Pontic Technology

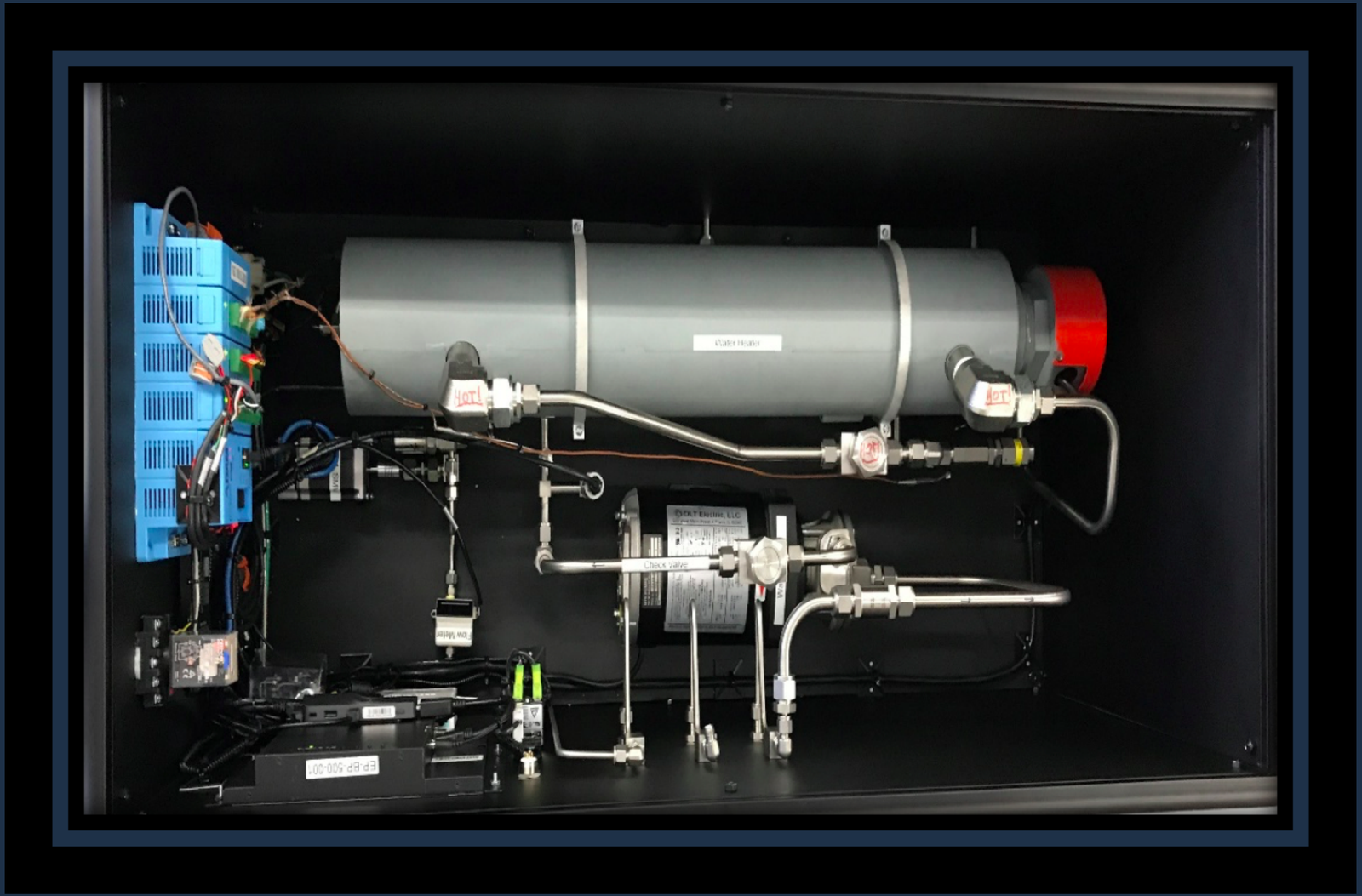
Germ-free, clean water from any source

TDSS TECHNOLOGY OVERVIEW

"As climate change and exponential population growth conspire to challenge human health, the importance of clean, affordable drinking water generated from reliable, low maintenance technology to communities drives at the heart of sustainable and healthy living."

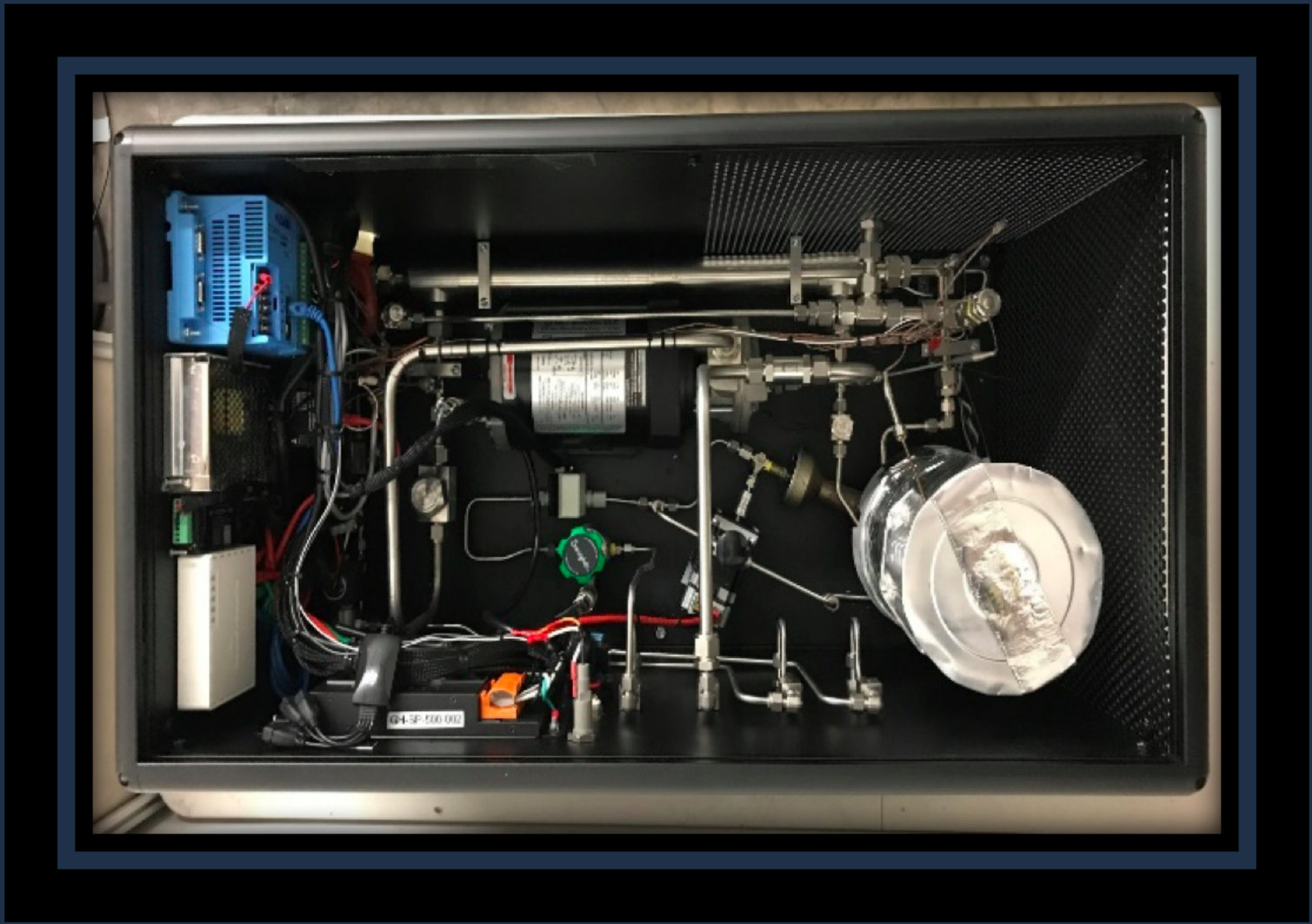
- Andrian Ponce

TDSSe (electric) Base Model



(TOP DOWN VIEW)

TDSSg (gas, fuel) Base Model



(TOP DOWN VIEW)

TDSSe or TDSSg

(FRONT OF EITHER SYSTEM)

PORTABLE BASE MODEL UNIT

TDSS ELECTRIC PORTABLE WATER STERILIZATION UNIT

General Specifications

	Model P100-110V	Model P100-220V	Model P100-INV
Source Voltage	110 VAC	220VAC	12-24 VDC (Vehicle Battery)
MAX Current Draw (Amps)	10	10	10
Sterile Water Produced Per Day (140°C Sterilization Temp -Gallons)	200	220	200
Dimensions (inches)	25 X 12 X 18	25 X 12 X 18	25 X 12 X 18
Weight (lbs)	55	55	55

TDSS ELECTRIC PORTABLE WATER STERILIZATION UNIT

- **Our portable base model unit is a lightweight solution for emergencies and drought-stricken areas.**

- **Our Portable Base Model can produce over 800 L per day, enough potable water for 250 people per day.**

- **Options:**
  - FM Health & Status Transmitter for remote monitoring (up to 50 miles)
  - WiFi connectivity for data monitoring and immediate status checks

- **<u>We can support any flow rate and temperature required up to 340 degrees Celsius.</u>**

THERMAL DISINFECTION STERILIZATION SYSTEM (TDSS) SUMMARY

Most clean water systems today use sterilization processes such as reverse osmosis, membrane (filter) technology, or UV light technology. These systems require regular maintenance, a large amount of energy, and routine replacement of major components, such as membranes, filters, or UV bulbs As such, they are expensive to operate and maintain, particularly for high volume applications. Other solutions involve the heating of the water to a high temperature as a means to sterilize, which typically requires large heat-sink apparatus to contain and cool the water after heating. Prior thermal approaches typically required heating water to a fixed temperature and fixed pressure, utilizing a batch approach, to achieve a minimum, desirable sterility assurance level (SAL). As such, requiring the apparatus to be structurally large and generally immobile.

TDSS is a significant improvement on prior approaches to water sterilization. TDSS utilizes a continuous thermal fluid flow process, to sterilize fluid to a high sterility assurance level (SAL). Sterilization is achieved by passing the fluid through a heating section to super heat the fluid to such a degree as to sterilize any living transmissible agents including fungi, bacteria, viruses (including COVID-19) and spore forms in an economical and environmentally responsible way, no matter the level of contamination of the source. **The system operates within prescribed ranges for pressure and temperature to achieve the desired level of sterilization without need of maintaining a fixed temperature or a fixed pressure within any portion of the system, including the heating section, no other water treatment system can make this claim.**

TDSS SUMMARY CONT.

Dirty water enters and sterile water exits in a continuous flow operation. TDSS uses a controller that implements proprietary software for controlling system operations, including controlled sequence of the valves and monitoring of sensors along the flow path. More specifically, TDSS includes a heating section to heat pressurized fluid above prescribed thresholds for temperature, pressure, and duration (e.g., dwell time) to achieve desired levels of sterilization, including a heat exchanger to both (a) preheat fluid prior to entering the heating section and (b) cool outflow of the heating apparatus, in which fluid travels through the apparatus by operating valves forward and aft of the heating section in a controlled sequence to facilitate flow through the system while maintaining prescribed pressure and temperature profiles.

As such, TDSS can be adapted for wide variety of uses such as household use, large-scale water treatment, industrial uses (such as in oil industry for fracking systems), ocean vessels for ballast water sanitation, portable water treatment, and others. Sterilization of all fluids including water can be accomplished.

TDSS TECHNOLOGY OVERVIEW

All of the innovative high heat/pressure TDSS systems are continuous flow systems requiring no moving parts, no filters/membranes and minimal maintenance. They can operate for years using either electricity (grid power, generators or solar panels) or natural gas/other hydrocarbon fuels, solar concentration and waste heat.

All systems are energy efficient and their operating performance can be operated and monitored remotely using a smartphone app or from a nearby station. If multiple systems are operating in a larger region, they can all be operated and monitored online or by wireless FM using regional radio systems (aircraft monitoring).

Each system purifies and sterilizes water by heating fluids above thresholds utilizing:

- Temperature – set at high-temperature values that are adjustable during operations
- Pressure – more than the saturated water table values for the fixed temperature employed
- Time/Duration or Dwell Time – determined by the flow rate of the water/GPD for the desired Sterilization Assurance Level (SAL)
- Aeration (i.e. aerification) for VOC reduction and elimination

TDSS TECHNOLOGY OVERVIEW CONT.

Water and other Fluids sterilization levels are achieved by varying pressure, temperature, and dwell time using a proprietary control technology. Under these conditions and adding nothing to the water or other fluids, all microorganism/biological contaminants are eliminated.

In addition, only our technology/systems offer continuous flow with the ability to vary temperature,
pressure and dwell time during operations in real-time, while achieving the high level of sterilization assurance and validation of a 6 log reduction in bacterial spore population, exceeding established WHO, EPA, and state standards.

Our revolutionary systems significantly outperform current market water treatment systems, including reverse osmosis and UV lighting, because our systems utilize thermal inactivation, a process that is far more effective in eliminating all microorganism/biological contaminants (fungi, bacteria, viruses (including COVID-19), spore forms, parasites).

TDSS TECHNOLOGY OVERVIEW CONT.

Most clean water systems in the market today use methods such as reverse osmosis, membrane (filter) technology, or UV light technology. Our systems have significant and competitive differentiators from these other sterilization processes.

These differentiators include:

- continuous flow capabilities with the ability in real-time to vary pressure, temperature and dwell time during operations – no other water treatment system can make this claim
- achieving a sterilization assurance and validation of 10^{-6} which greatly exceeds established WHO, EPA and state standards. A SAL of 10^{-6} is equal to a 6-log reduction in the population in bacterial spores.
- portable, scalable and customizable whether the need is 50 gallons per day (GPD) or 50 million+ GPD
- cost-effective, energy efficient water and other fluids recycling and recovery solutions
- small footprint
- leaving minerals in the water
- no waste (unlike reverse osmosis technology that wastes up to 50% of the water treated as brine
- having no filters and no moving parts
- requiring only minimal maintenance
- operating for years using either electricity, solar electric, solar concentration or natural gas
- operations of systems can be monitored/controlled remotely, via monitoring stations or smart phones.
- ability to operate at a competitive cost
- ability to operate in remote areas

STERILIZATION MADE SIMPLE

HEAT IT UP

- Simple application to moderate heat
- Heating process takes place under pressure
- Multiple sources of heat can be used to achieve necessary combination of heat and pressure

COOL IT DOWN

- Reduce the heated water temperature through a simple heat recovery operation (recuperative heat exchanger)
- Complete process integrated into an uninterruptible operation - **'non potable water in, potable water out'**

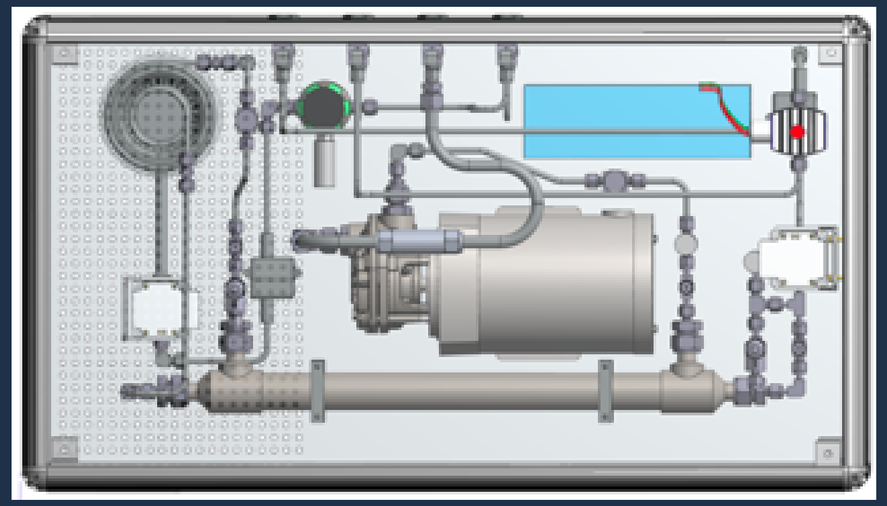
SAFE TO DRINK

- All the water that goes into the system is recovered in the output and is 100% drinkable, leaving zero waste to contaminate the environment (no RO Brine)

TDSSe - Electric Base Model Specifications

Dimensions

- 86cm x 45cm x 45cm
- Mass: 25kg
- Production: 2000 liters/day at a 6 log reduction SAL
- Energy Consumption:
- 0.023 KWhr per liter of water sterilized at a cost of ~$0.002/liter



TDSSe (electric)

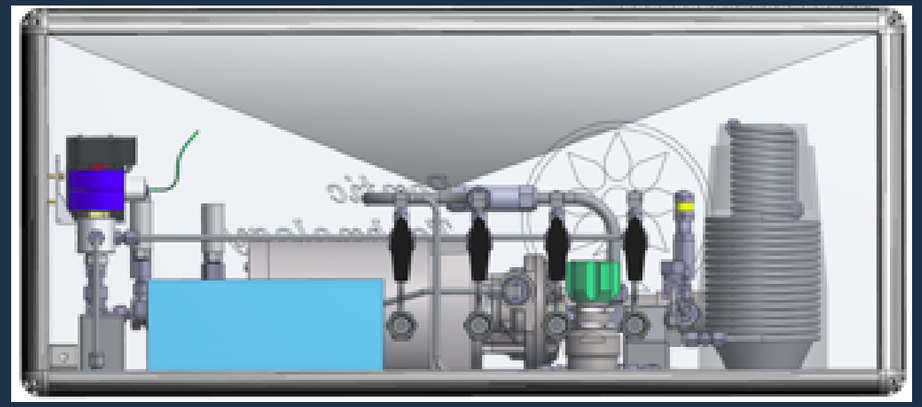
Options include:

- Remote System Control - Fixed, Vehicle or Airplane

TDSSg - Fuel Base Model Specifications

Dimensions

- 86cm x 45cm x 45cm
- Mass: 25kg
- Production: 2000 liters/day at a 6 log reduction SAL
- Energy Consumption:
- 0.0017 Liters of fuel used per liter of water sterilized at a cost of ~$0.0004/liter
- TDSSg operating system has 15 Watts max electrical power consumption and produces 500 GPD
- Lithium batteries are charged using (3) Thermal Electric Generators with optional 110/220 VAC
- Boost Pump for low-pressure inlet operations and heating power - up to 80,000 BTU (Propane/Butane fuel).



TDSSg (fuel)

Options include:

- Remote System Control - Fixed, Vehicle or Airplane

GENERAL SPECS & PERFORMANCE OF BASE MODEL

For data connectivity, the “base model” systems operate using:

- Optional TCP/IP Ethernet (wireless) connectivity for monitoring (up to 100 max remote user interface connections)
- Optional Email/SMS text notification built-in to each system allowing for status and operational reports

The operating characteristics of the “base model” systems:

- Require inlet water temp < 40°C
- Output water temperature < 50°C
- Are fully autonomous with a host of pre-programed safety features
- Are easily adaptable for reservoir operations

The TDSSe requires de-scaling after 720 hours of calcified (hard) water sterilization. Note: All systems require pre-treatment cleaning before initial use.

The internal operating pressure of the "base model” systems:

- Require a minimum of 100psig inlet water pressure which is produced by an optional internal pump or an external source
- Operates up to a maximum 500psig internal pressure using an internal pump for reservoir operations

TDSS BASE MODEL

Each “base model” system provides other benefits including, a prominent leadership role in environmental sustainability and risk mitigation, especially in drought-stricken areas and dry, desert environments; a strategic humanitarian aid capability, and a joint operating venture/strategic alliance with government. In addition, each system can be utilized in a rapid response/FEMA emergency - i.e. storm damage, etc.

COST CALCULATIONS PER LITER

Electricity

- Assuming the price is $ 0.10 per kWh, the cost of electricity is $ 0.001/liter
- Example: 120 liters of water a day will cost $ 0.13/day

Fuel (gas)

- Assuming the price is $ 0.55/m(3), the cost of gas is $ 0.00055/liter
- Example: 120 liters of water a day will cost $ 0.066/day

HOW IS TDSS DIFFERENT?

BETTER THAN CURRENT FORMS OF WATER CLEANUP

Significantly outperforms current water treatments including:

- Reverse Osmosis
- UV Lighting
- Ozone, chlorine & chloramine processes

as shown in sterility assurance level results achieved via bacterial spore inactivation.

- 6 log bacterial reduction or better

SIMPLE & EFFECTIVE METHODOLOGY

- Pressure, temperature & dwell time is the primary method for sterilization
- Rapid start up
- Thermal inactivation is the most optimal method of micro-destruction
- No added chemicals
- No filters
- No consumables
- Smaller footprint
- Operating performance by app or smart phones

MULTIPLE SOURCES OF POWER

- Models use natural gas/hydrocarbon fuel or electricity. Options include solar power and solar concentration heating methods
- Designs include using waste heat from existing sources (generators, engines etc.) to reduce operating costs

TDSS TECHNOLOGY TESTING

Our TDSSe, TDSSg systems performance have passed rigorous, multiple validation and assurance testing by independent laboratories. In all three cases, the findings and conclusions of the tests achieved all goals and validated technology objectives and performance.

Test #1 focused on eliminating Geobacillus Stearothermophilus spore suspensions, which are the most heat resistant organisms known.

Test #2 focused on eliminating E-Coli bacterial suspensions.

Test #3 focused on water bottling test. FDA issued comprehensive bottled water Standards of Identity- 21C.F.R. 165.110 (b)

TEST RESULTS

The water output of our thermal inactivation system was tested and validated by an independent 3rd party, VERRIX Technology, utilizing Geobacillus Stearothermophilus spore suspensions, which are the most heat resistant organisms.

“We conclude with a high degree of certainty that the Company’s systems are effective at achieving spore inactivation at sterility assurance levels greater than 6-log reduction (>>10^{-6} SAL) while operating in continuous flow water purification…” -VERRIX

TEST RESULTS

Test #1

Results showed "No other water purification and sterilization systems can claim the continuous flow capabilities that Pontic Technology's systems (electric, gas) achieve or the high level of sterilization assurance and validation of a 6 log bacterial reduction or better, which greatly exceeds established WHO, EPA and state standards."

Test #2

Results showed 1,553 MPN/100mL for total coliform, and 79 CFU/mL for the source water (input), and below detection limit results for all effluent (output) samples.

Test #3

Results showed that all treated water samples yielded non detected and less than detection limit for E-coli, total coliform and plate counts.

DEVELOPING NEW TECHNOLOGIES

Our company creates new technologies to improve and solve scientific problems in our lives.

Pontic Technology offers several patented iterations of high temperature water purification and sterilization systems. Each system is able to produce safe, germ-free water no matter the level of microorganism/biological contaminants.

The company is developing several other new technologies at our Technology Development Center in Los Angeles. Among them is our patented organic chemical contaminate elimination system and a volatile organic compound (VOC) elimination system utilizing a new material never patented and exploited before. The company is developing a simple hand held chemical and bacterial elimination device.

TDSS PATENT STATUS AS OF JAN 4, 2021

Jurisdiction	Application No.	Pat. No.	Title	Current Owner	Status	Our Matter No.
US	15/249,097	9,757,485	SYSTEM AND METHOD FOR FLUID STERILIZATION	PAPADOPOULOS, MICHAEL	Granted	MPA-00658
US	15/664,868	10,213,517	(Con) SYSTEM AND METHOD FOR FLUID STERILIZATION	PAPADOPOULOS, MICHAEL	Granted	MPA-00803
US	15/950,980	10,512,701	SYSTEM FOR FLUID STERILIZATION FOR A VESSEL	PAPADOPOULOS, MICHAEL	Granted	MPA-00879
PCT	PCT/US2016/049081		SYSTEM AND METHOD FOR FLUID STERILIZATION	PAPADOPOULOS, MICHAEL	Granted	MPA-00658
Australia	AU2016316834	2016316834	SYSTEM AND METHOD FOR FLUID STERILIZATION	PAPADOPOULOS, MICHAEL	Granted	MPA-00658
Bahrain	20180038		SYSTEM AND METHOD FOR FLUID STERILIZATION	PAPADOPOULOS, MICHAEL	Pending	MPA-00658

Brazil	BR 11 2018 003875 0		SYSTEM AND METHOD FOR FLUID STERILIZATION	PAPADOPOULOS, MICHAEL	Pending	MPA-00658
Canada	2996624		SYSTEM AND METHOD FOR FLUID STERILIZATION	PAPADOPOULOS, MICHAEL	Pending	MPA-00658
China	201680062049.7		SYSTEM AND METHOD FOR FLUID STERILIZATION	PAPADOPOULOS, MICHAEL	Pending	MPA-00658
Eurasia	201890508	034907	SYSTEM AND METHOD FOR FLUID STERILIZATION	PAPADOPOULOS, MICHAEL	Granted	MPA-00658
Europe	16 842 707.8		SYSTEM AND METHOD FOR FLUID STERILIZATION	PAPADOPOULOS, MICHAEL	Pending	MPA-00658
India	201837007422		SYSTEM AND METHOD FOR FLUID STERILIZATION	PAPADOPOULOS, MICHAEL	Pending	MPA-00658
Israel	257738		SYSTEM AND METHOD FOR FLUID STERILIZATION	PAPADOPOULOS, MICHAEL	Pending	MPA-00658

Japan	2018-529521		SYSTEM AND METHOD FOR FLUID STERILIZATION	PAPADOPOULOS, MICHAEL	Pending	MPA-00658
Malaysia	PI 2018000282		SYSTEM AND METHOD FOR FLUID STERILIZATION	PAPADOPOULOS, MICHAEL	Pending	MPA-00658
Mexico	MX/a/2018/002471		SYSTEM AND METHOD FOR FLUID STERILIZATION	PAPADOPOULOS, MICHAEL	Pending	MPA-00658
New Zealand	740103	740103	SYSTEM AND METHOD FOR FLUID STERILIZATION	PAPADOPOULOS, MICHAEL	Granted	MPA-00658
Panama	92016-01		SYSTEM AND METHOD FOR FLUID STERILIZATION	PAPADOPOULOS, MICHAEL	Pending	MPA-00658
Qatar	2016/049081		SYSTEM AND METHOD FOR FLUID STERILIZATION	PAPADOPOULOS, MICHAEL	Pending	MPA-00658

Saudi Arabia	518391031		SYSTEM AND METHOD FOR FLUID STERILIZATION	PAPADOPOULOS, MICHAEL	Pending	MPA-00658
Singapore	11201801498X		SYSTEM AND METHOD FOR FLUID STERILIZATION	PAPADOPOULOS, MICHAEL	Pending	MPA-00658
South Africa	518391031	2018/01998	SYSTEM AND METHOD FOR FLUID STERILIZATION	PAPADOPOULOS, MICHAEL	Granted	MPA-00658
S. Korea	2018-7008116		SYSTEM AND METHOD FOR FLUID STERILIZATION	PAPADOPOULOS, MICHAEL	Pending	MPA-00658
UAE	6000307/18		SYSTEM AND METHOD FOR FLUID STERILIZATION	PAPADOPOULOS, MICHAEL	Pending	MPA-00658

Pontic Technology Team

DR. MICHAEL PAPADOPOULOS
FOUNDER & CEO

The driving force behind Pontic Technology and the development of its first technology – an innovative, competitive cost, zero waste, patented thermal disinfection water sterilization system. He has self-funded all technology development and company operations to-date.
A practicing Dentist for more than 30 years, whose business acumen is highly respected, as is his knowledge and expertise in clinical training and advanced oral health care.
Education: DDS, University of Southern California (USC) Herman Ostrow School of Dentistry.

JIM LEWIS
CTO, CHIEF TECHNOLOGY OFFICER

In charge of overseeing the design, development and implementation of all company technology systems. Senior Test Engineer at NASA's Jet Propulsion Laboratory (JPL) and their lead for chemical propulsion and process automation. Lead integration engineer for Mars In-Situ Resource Utilization (Air & Water) Experiment (MOXIE). Past duties include Space Shuttle Systems Engineer and Test Director for Mechanical Truss systems on the International Space Station. Veteran: U.S. Special Forces officer (27 years active and reserves), including multiple Middle East combat tours as a Special Forces team, company and battalion commander. Recipient of 30+ military awards including Bronze Star and U.S. State Department Meritorious Honor award for work with Afghan District Governors in Afghanistan. Education: B.S. in Physics/Computer Applications, University of Alabama; Masters in Aerospace Engineering; Masters in Space Systems Engineering, both from Florida Institute of Technology.

DR. GERALD VOECKS
HEAD OF PR
CSO, CHIEF SCIENCE OFFICER

In charge of technology advancements and use of maximum science applications. Senior Scientist at NASA's Jet Propulsion Laboratory (JPL) and their lead for development of in situ sensors for NASA's life support systems and in advancing technologies of NASA's space program for In Situ Resource Utilization for future human missions. Past duties include development of heterogeneous catalysts, designed for hydrogen production/hydrocarbon combustion. His work has pioneered catalyst systems designs and reactor designs that have been incorporated into operations on aircraft, vehicles and stationary powerplants and been active in fuel cell systems development. Currently holds 20 patents, is co-author 20+publications, and is a Visiting Scientist at Caltech. Education: BSE, MA, PhD in chemistry, covering areas of inorganic synthesis, photo catalysis and reaction mechanisms. Postdoctoral work was in inorganic/organic surface chemistry.

DR. JOHN SOLOMON
CONSULTANT AND SCIENTIST

Dr. John Solomon is one of the consultants and scientists that advises on research and development of flow systems and water sterilization experiments. He is a tenured Associate Professor of Mechanical Engineering at Tuskegee University, Alabama. His research interest is experimental fluid mechanics and he holds two US patents for developing actuators for high-speed flow control.

DR. ADRIAN PONCE
TSO, TEST AND STERILITY OFFICER

In charge of ensuring the development and testing of company technology in meeting highest water sterilization assurance and validation standards. Senior Scientist at NASA's Jet Propulsion Laboratory (JPL) and chemistry faculty at Caltech. Research interest investigating microbial survival and growth have taken him to extreme environments, including the Atacama Desert, Chile, and the Kilimanjaro glaciers. A list of published articles is available online at http://ponce.caltech.edu. Education: Ph.D. Chemistry, Caltech for research on electron transfer in proteins and water.

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