LOTIC TECHNOLOGIES INC

EC-AOP

Electro-Catalytic
Advanced Oxidation Technology

Product Presentation

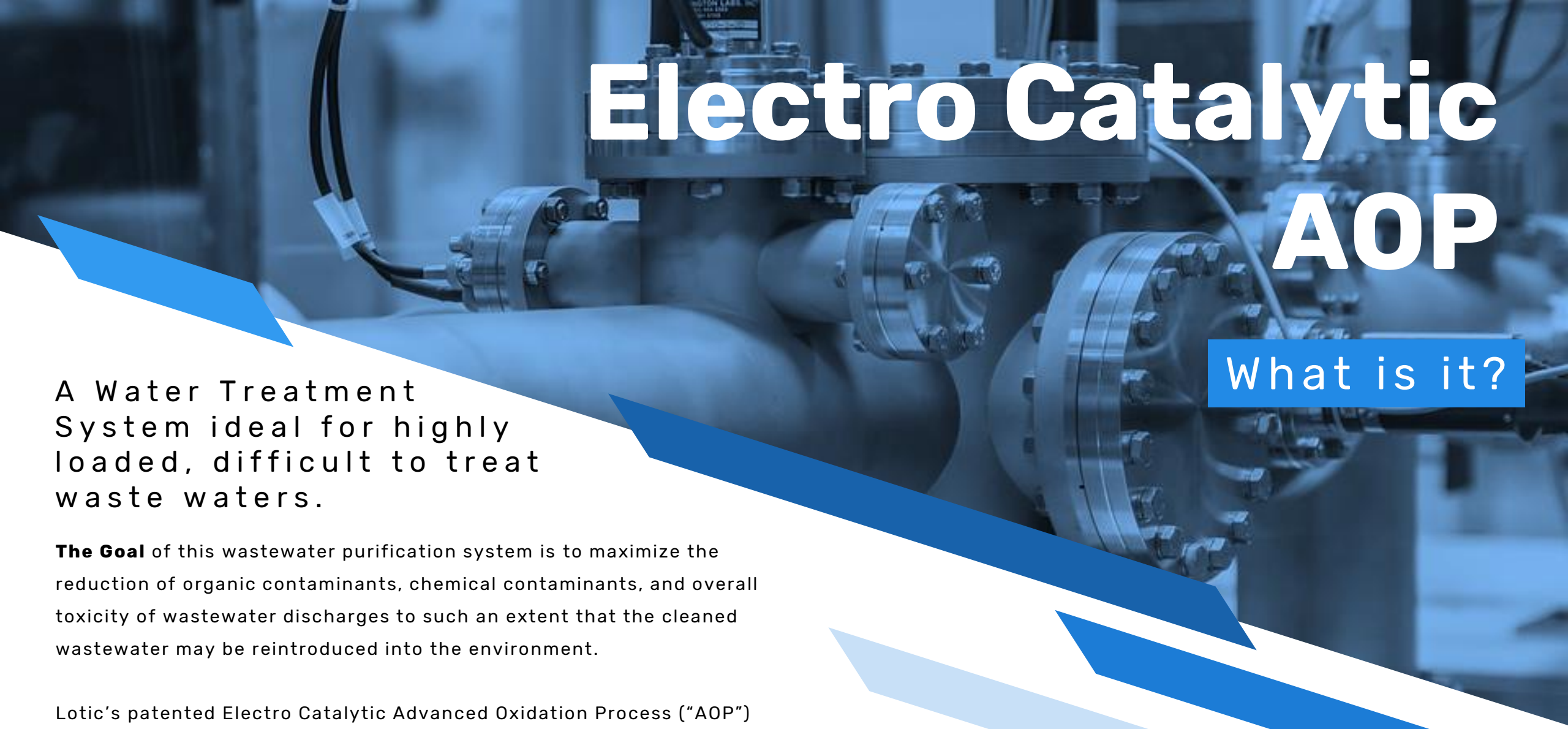
Lotic Technologies

Innovative Environmental Solutions

«Water is our most Precious Resource»

Lotic Technologies was incorporated in 2015, and provides its patented, innovative environmental technologies to multiple industries and sectors. We manufacture our own equipment to the particular custom specifications of each projects' certain requirements.

Lotic is an environmental leader in water management and provides cutting-edge technology, while delivering expert solutions to problems – meeting clientele needs in a cost effective way and providing a positive impact on the environment.



Electro Catalytic AOP

What is it?

A Water Treatment System ideal for highly loaded, difficult to treat waste waters.

The Goal of this wastewater purification system is to maximize the reduction of organic contaminants, chemical contaminants, and overall toxicity of wastewater discharges to such an extent that the cleaned wastewater may be reintroduced into the environment.

Lotic's patented Electro Catalytic Advanced Oxidation Process ("AOP") produces four powerful oxidizing agents, which combine to breakdown, reduce, and remove residual organic compounds in waste streams at an accelerated rate.

Electro Catalytic AOP

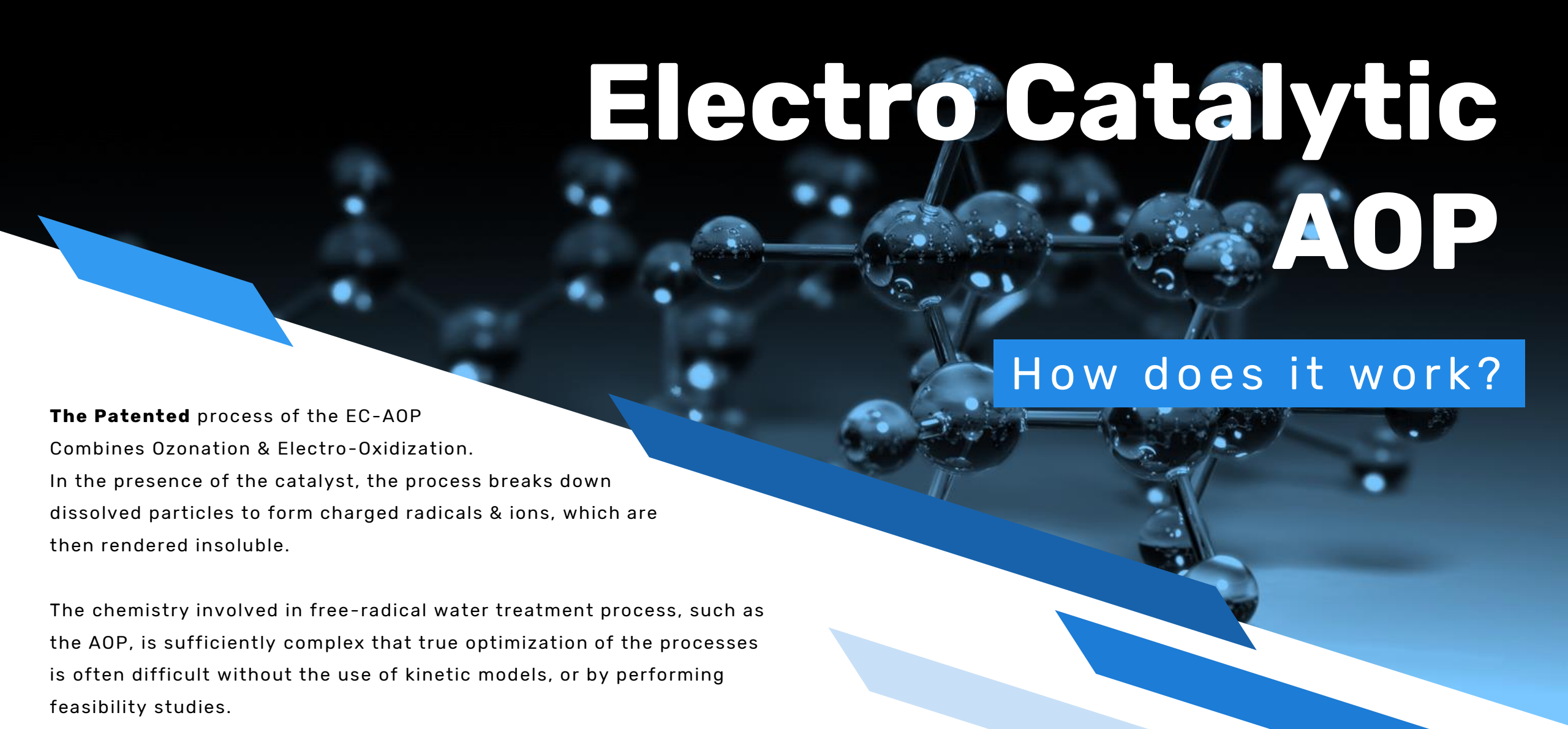
What are the advantages?

EC-AOP Units have a small footprint, are modular, and can be mobile.

This Product uses little-to-no-chemical, and requires zero hazardous clean-up or spill procedures. It can be used as a stand-alone system. Or can be used to enhance existing equipment, such as RO units and other filtration.

The EC-AOP system can decompose many hazardous chemical compounds found in waste water, without producing additional hazardous by-products or sludge, which requires additional handling. There are virtually no health, safety, spill or environmental concerns associated with the AOP.

Electro Catalytic AOP



How does it work?

The Patented process of the EC-AOP
Combines Ozonation & Electro-Oxidization.
In the presence of the catalyst, the process breaks down dissolved particles to form charged radicals & ions, which are then rendered insoluble.

The chemistry involved in free-radical water treatment process, such as the AOP, is sufficiently complex that true optimization of the processes is often difficult without the use of kinetic models, or by performing feasibility studies.

The extremely high level of catalytic activity is comparable to related methods, such as supercritical water oxidization and wet-air oxidization.

Electro Catalytic AOP

How can it help?

The EC-AOP can help customers meet government compliance standards, and/or further reduce discharge fees.

Smaller volumes of sludge are produced, which are more shear resistant and easily dewatered. This is in contrast to chemically coagulated sludge, which generally have a high bound water content, and larger volume.

The sludge produced by EC-AOP units generally pass the US EPA's guidelines for Toxic Characteristic Leaching Protocol (TCLP). This is in contrast to chemically coagulated sludge which are generally unstable metal hydroxides that are classified as hazardous and must be disposed of in secure land-fills.

The Lotic EC-AOP Unit is

CUSTOM DESIGNED

Meeting Your Requirements

Custom-designed skid-mounted systems are made to fit space limitations. Specifications are manufactured according to the precise fluid chemistry. Fully automatic systems ensure simple operation, and easy service & maintenance.

Superior Results

The Lotic EC-AOP utilizes the basis of Electro-Coagulation, which has been used for 100 years, but vastly improves the process with our patented hybrid process, which uses no chemicals, has a faster reaction rate, and treats inorganic pollutants while maintaining low energy consumption.

The Lotic AOP system can be customized for virtually any flow rate and volume of fluid.

HIGHLIGHTS

Of the EC-AOP Process

The Lotic EC-AOP requires minimal user manpower and service, since there is no moving parts. It also has the capability to treat fluid at a high volume & high rate capacity.

Recent tests have outperformed UV, chlorine dioxide, electrocoagulation and conventional biocides on cost vs. performance.

The Lotic EC-AOP unit allows a quick return on investment.

- Kills bacteria & pathogens by destroying cell walls
- Eliminates existing Hydrogen Sulfide (H2S)
- Treats out ammonia
- Oxidizes iron (Fe2) and heavy metals
- Reduces NORMS
- Eliminates or reduces BOD, COD & TOC
- Hydrocarbon & VOC removal
- Breaks down pharmaceuticals
- Breaks down pesticides
- Breaks down chlorocarbon, aromatics, phenolics, dyes, petroleum constituents
- Removal of suspended & colloidal solids
- Breaks oil/water emulsions – oxidizes and removes lower percentile oil constituents
- Removes fats, oils & greases
- Removes complex organics
- Reduces phosphates and nitrogen levels
- Achieves either total separation/precipitation of dissolved organics or achieve complete mineralization

The Main Objective of EC-AOP is to generate reactive Hydroxyl Radicals & Quasi Super-Critical conditions to enhance the oxidation and destruction of organic pollutants.

LET'S DIVE INTO SOME DETAIL

Electro Catalytic AOP

THE PROCESS

Electro Catalytic AOP

The Lotic EC-AOP unit manufactures its own ozone on-site. This is a necessity, since ozone has a half-life of 20 to 30 minutes.

Once created, the ozone is pumped into the AOP reactor, along with the fluid.

Inside the reactor, the ozone completes some very important tasks.

Ozone is a powerful oxidant

Oxidants can react with a variety of impurities such as metal salts, organic matter including micro organisms, hydrogen and hydroxide ions.

Creation of the key ingredient

Excess ozone is created in order to react with our electro catalyst in the reactor. The result of this reaction is the production of the main ingredient, hydroxyl radicals.

Oxidants break down

As reactions occur, the ozone and hydroxyl radicals naturally break down and produce hydrogen peroxide and atomic oxygen as by-products – two more oxidants. These components continue oxidation of the fluid.

Final Results

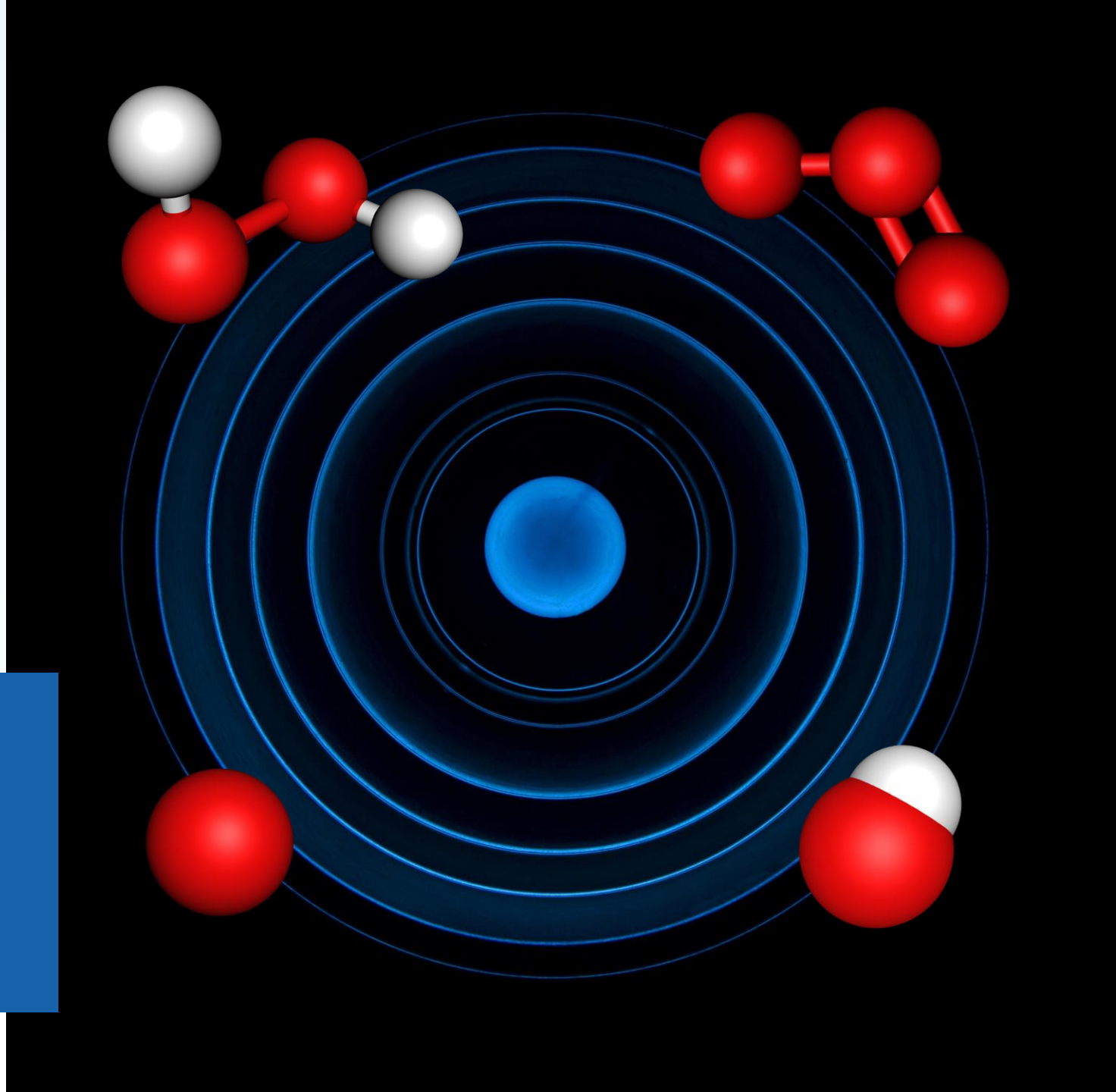
When reactions are complete, contaminants have been mineralized and oxidants have been degregated into H2O, O2 and CO2.

Electro Catalytic AOP

Oxidizing Agents

- **Atomic Oxygen**
- **Hydrogen Peroxide**
- **Ozone**
- **Hydroxyl Radicals**

These four powerful oxidizing agents are engaged in the EC-AOP reactor, breaking down contaminants in an environmentally friendly way, which results in a large decrease in organics, sludge, and other residual pollutants, toxins and chemicals.



WHY •OH RADICALS?

Electro Catalytic AOP

Oxidant	Redox (V)
•OH	2.80
O	2.42
O3	2.07
H2O2	0.87

The Hydroxyl Radical is one of nature's most powerful oxidizing agents. It easily & instantaneously reacts with surrounding dissolved chemicals, commencing a cascade of oxidation reactions which ultimately fully breaks down and mineralizes the molecule.

This reaction process can reduce the concentration of contaminants from hundreds of PPM to less than 5 PPB, which significantly lowers COD and TOC.

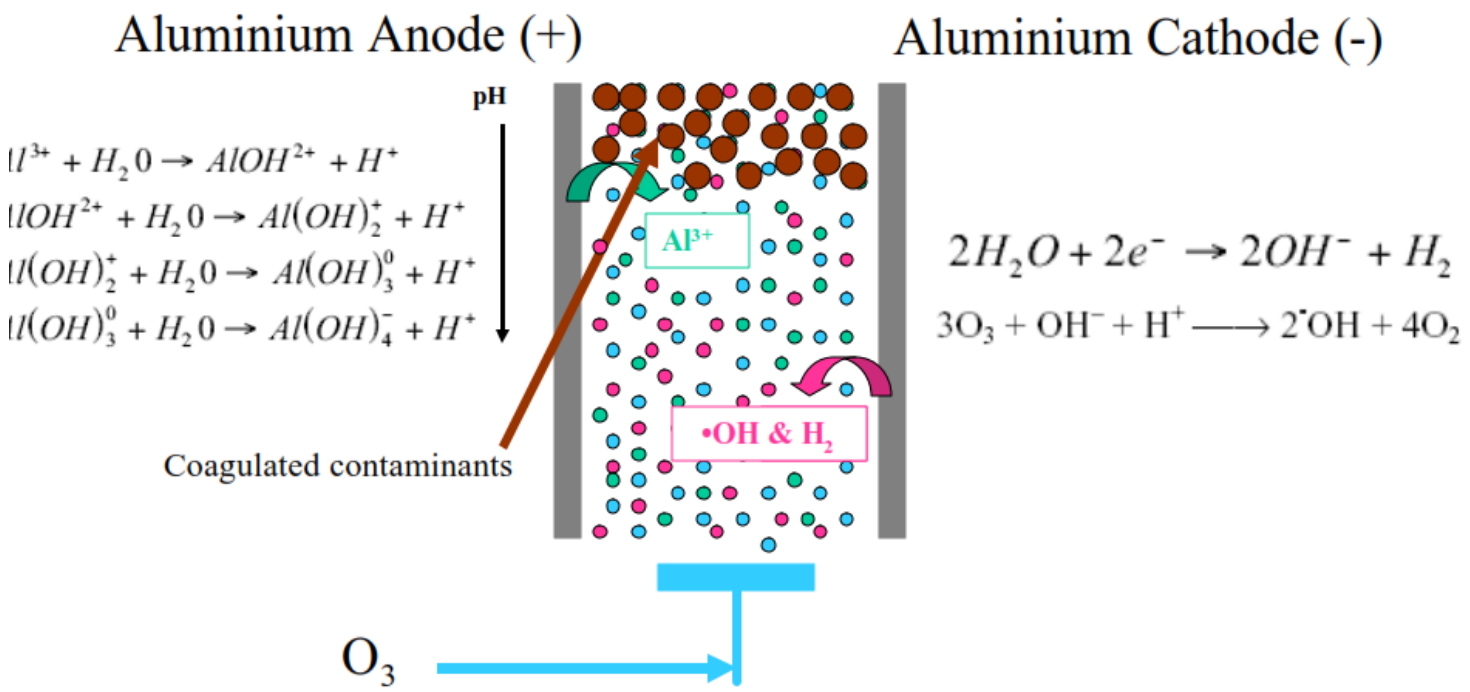
Hydroxyl Radicals are highly effective in the oxidative destruction of common organic pollutants, such as pesticides, pharmaceutical compounds, dyes, and petroleum based by-products.

Hydroxyl Radicals do not discriminate, which allows it to react with almost every aqueous pollutant.

The final product of the reduction process of •OH is H20, which reduces by-product sludge and does not introduce new hazardous elements into the fluid.

Why we call it

Electro Catalytic



Our Facility

Proudly Canadian

Lotic Technologies is located in the manufacturing heartland of Nisku, Alberta, Canada.

Lotic Technologies designs, engineers and manufactures its equipment on-site. This ensures that the highest of quality is upheld, and that each customer receives a superior product that is developed specifically to their requirements.

Manufacturing

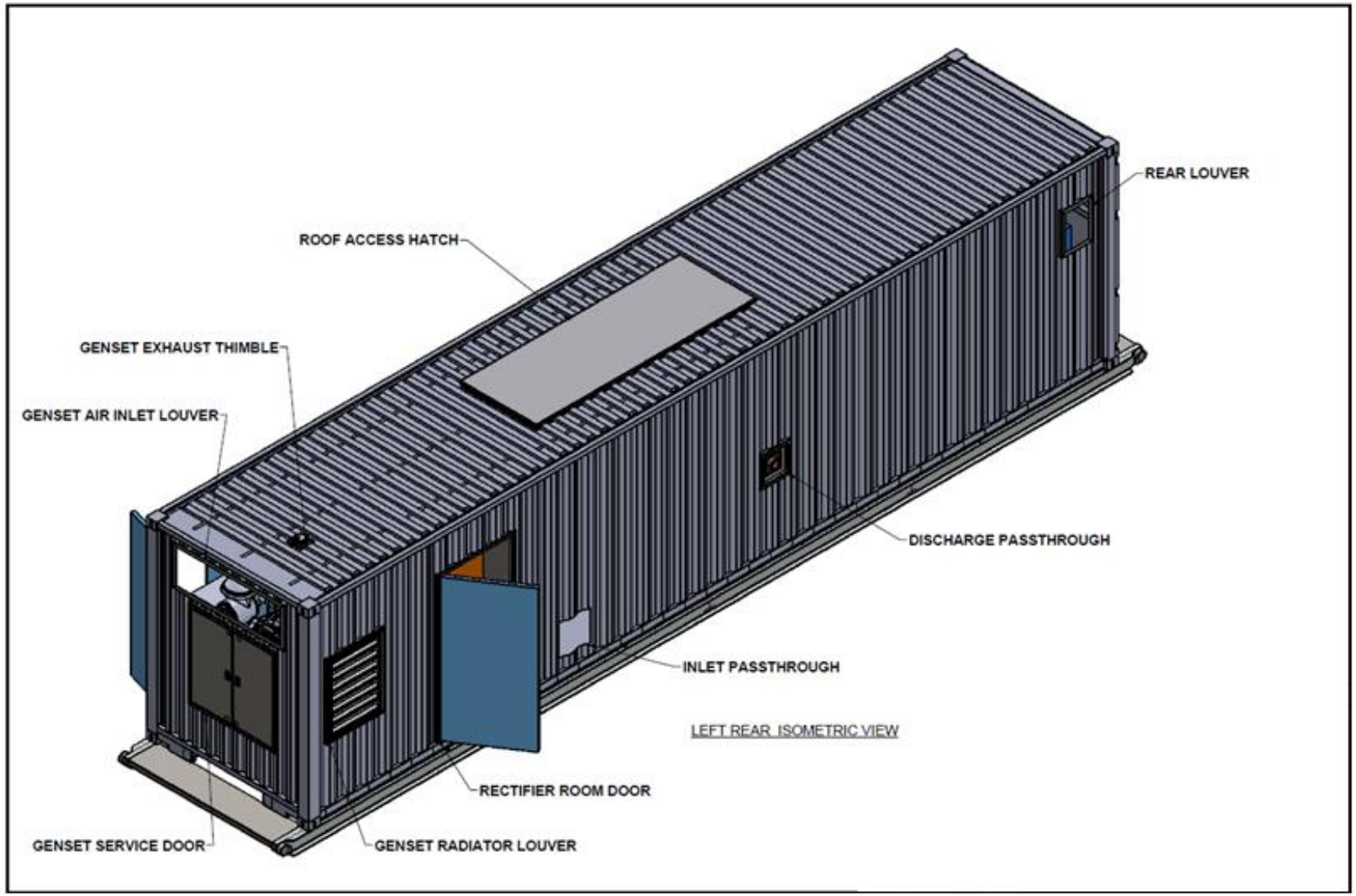
Our Products

All products we engineer and manufacture are designed to the highest specifications, codes & industry standards. This allows our units to be safely operated in any industry and regulatory climate.

Commercial Units can be custom- designed for virtually any site – with small footprints if required – and can be either mobile or permanent facilities.

A typical set-up

Electro Catalytic AOP



A typical set-up

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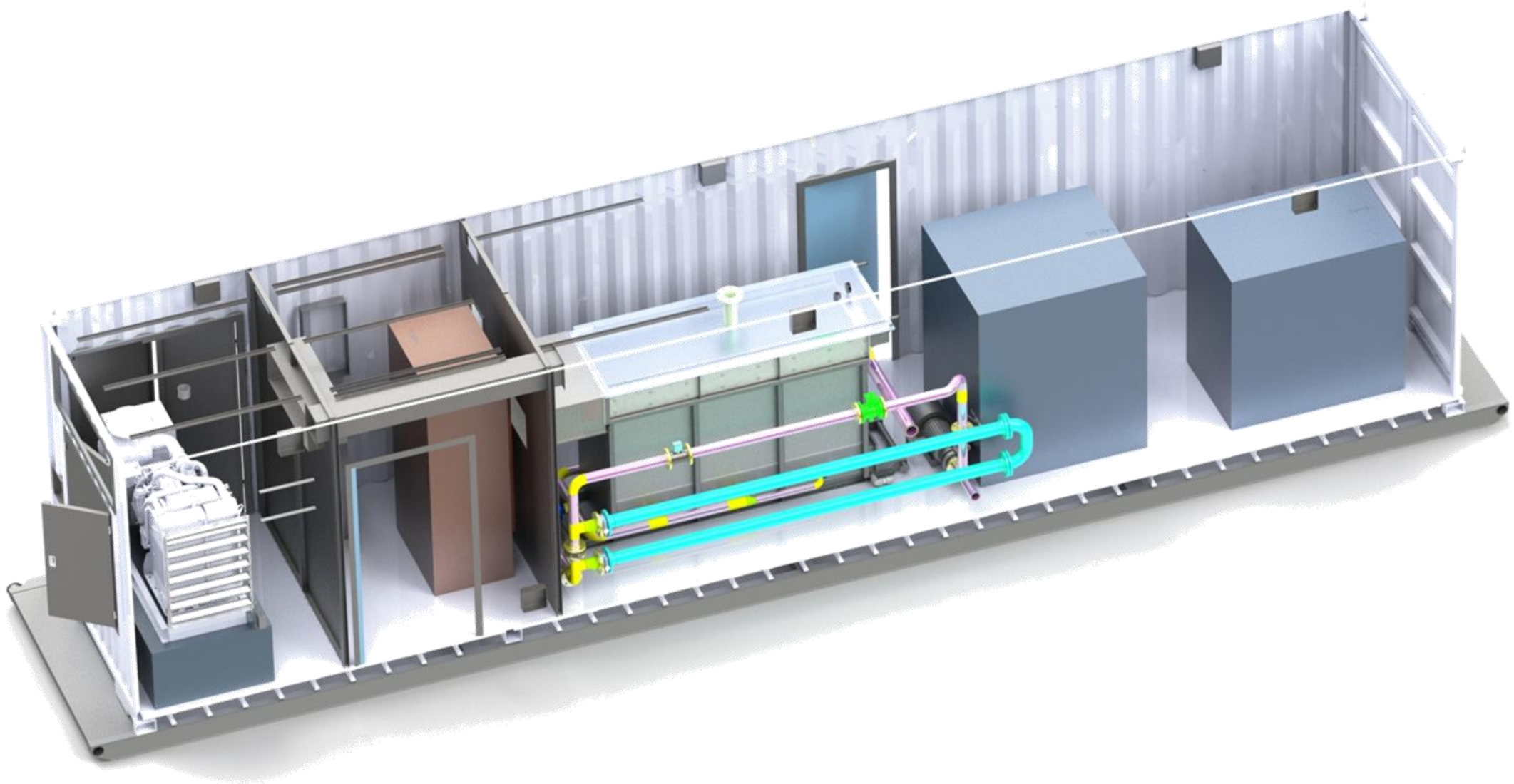

A typical set-up

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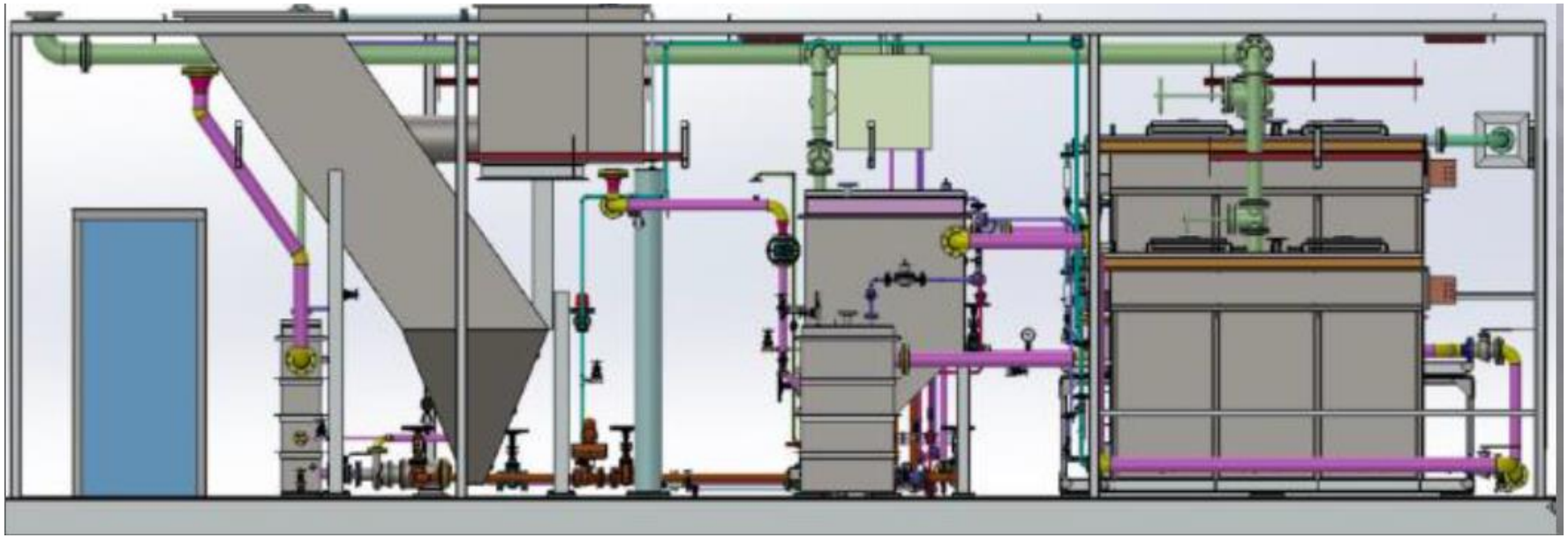


A typical set-up

Electro Catalytic AOP

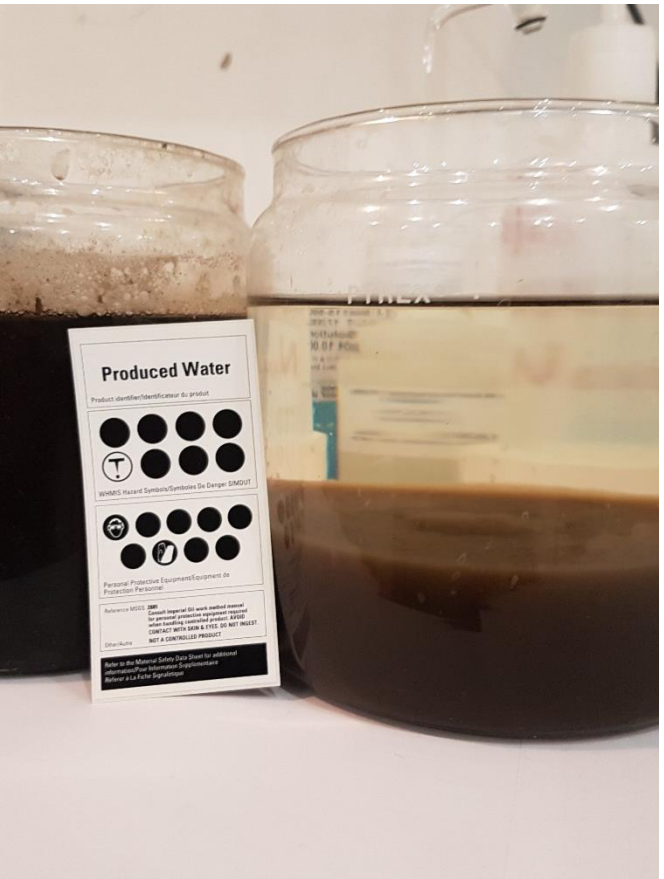
Basic Specifications

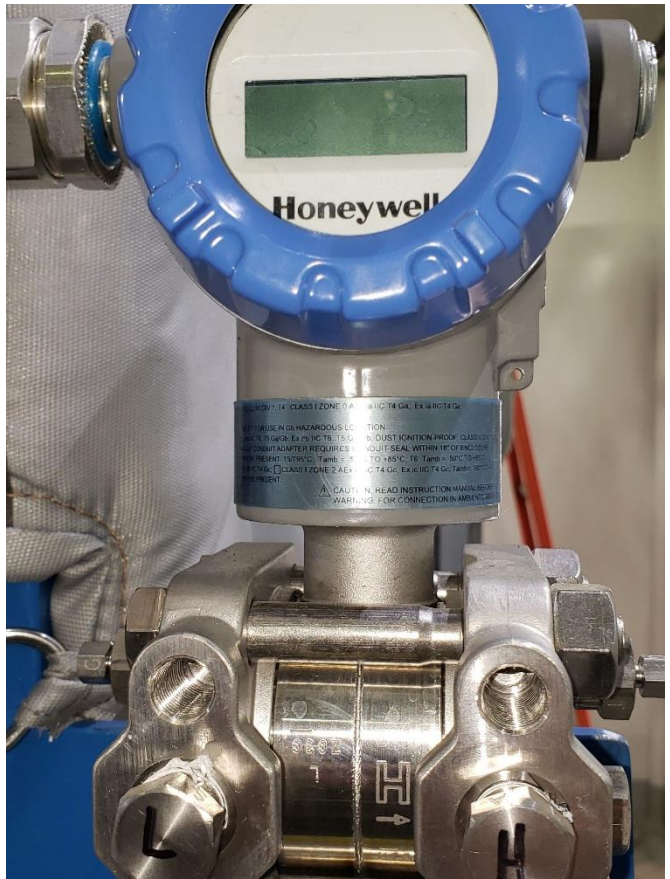
Portable Skid or Seacan mounted systems are typically 8'x40'x9.6', 100gpm (22.71m3/hr), and 36,000lbs dry weight. Portable units can be daisy-chained together for increased flow rates, or large units can be built to achieve large flow rates.

Standard Product Line is 50gpm, 100gpm, and 650gpm. Custom Reactor tanks can be customized to tailor required flow rates. There are no limits to what custom flow rate equipment can be designed.

Product Cost is not outlined or estimated for a unit until a thorough pre-project scope is completed, including attaining a fluid pre-treatment report, and confirmation of desired flow rates. Lotic typically tests all water prior to determining a cost due to Reactor calculations and requirements.

- Reactor Tank sizes vary – a 650gpm reactor is generally 96" x 186", and multiple tanks can work in tandem to achieve very large process volumes per day.
- The standard 40ft process center comes in 100gpm flow rate. This can also be customized to larger flow rates.
- EXXON produced treating cost are $0.25 per.m3 op-cost, and consumables are included in this price. (Highly dependent on power cost.)


Produced Water
Product identifier/Identificateur du produit
WHMIS Hazard Symbols/Symboles De Danger SIMDUT
Personal Protective Equipment/Equipment de Protection Personnel
Refer to the Material Safety Data Sheet for additional information/Pour Information Supplémentaire Référer a La Fiche Signalétique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Client List

Current Testing & Pilots

Bench-Phase

Energy Industry

- Chevron Energy
- Murphy Oil
- Artis Exploration
- CNRL
- Lai Pulo - Nigeria

Bench-Phase

Civil Industry

- Municipality of Camrose
- Northwest Regional Waste Management Authority
- Cleantech Systems

Pilot-Phase

- Imperial Oil / ExxonMobil
- PMI Environmental / Shell Deepwater Exploration & Production

Imperial Oil

EC-Pilot Project

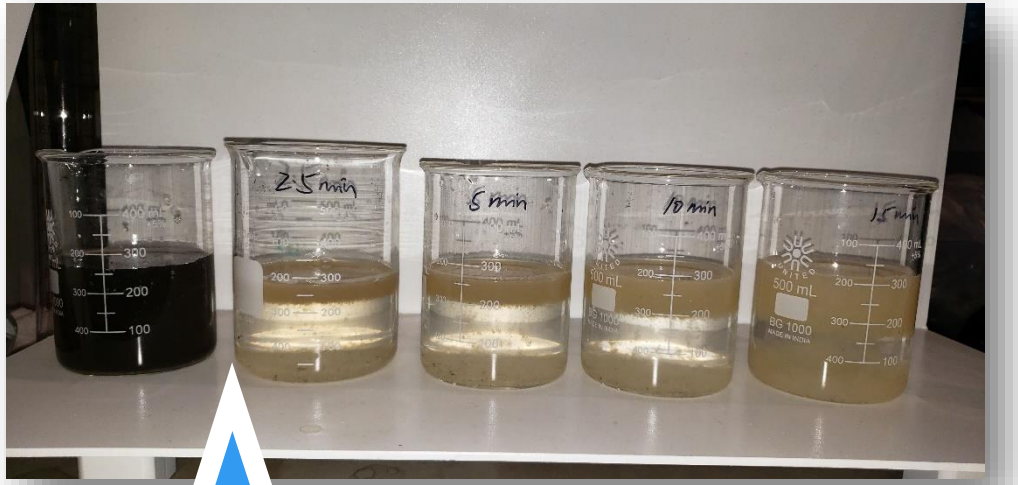
Lotic Technologies is currently piloting it's technology at the Imperial Oil Leming CSS facility. The Pilot Project will determine if the technology is commercially feasible for clarifying produced fluid for re-injection.

EC- AOP
Testing Results

<Bench Testing Results>
3rd Party Lab Analyzed

EC-AOP Bench Testing

Lotic Technologies

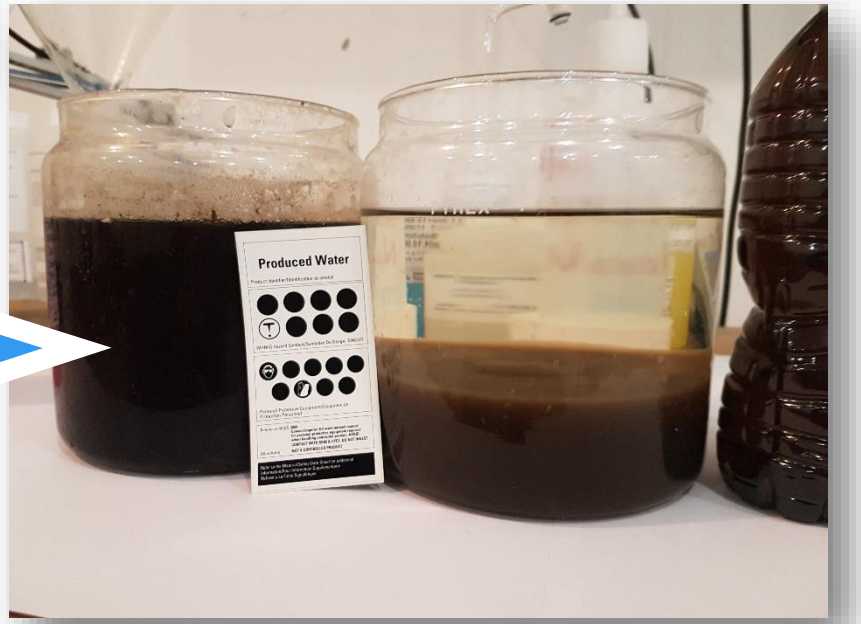


Landfill Leachate

- High Bacteria Removal
- High Organic Removal

Produced Water

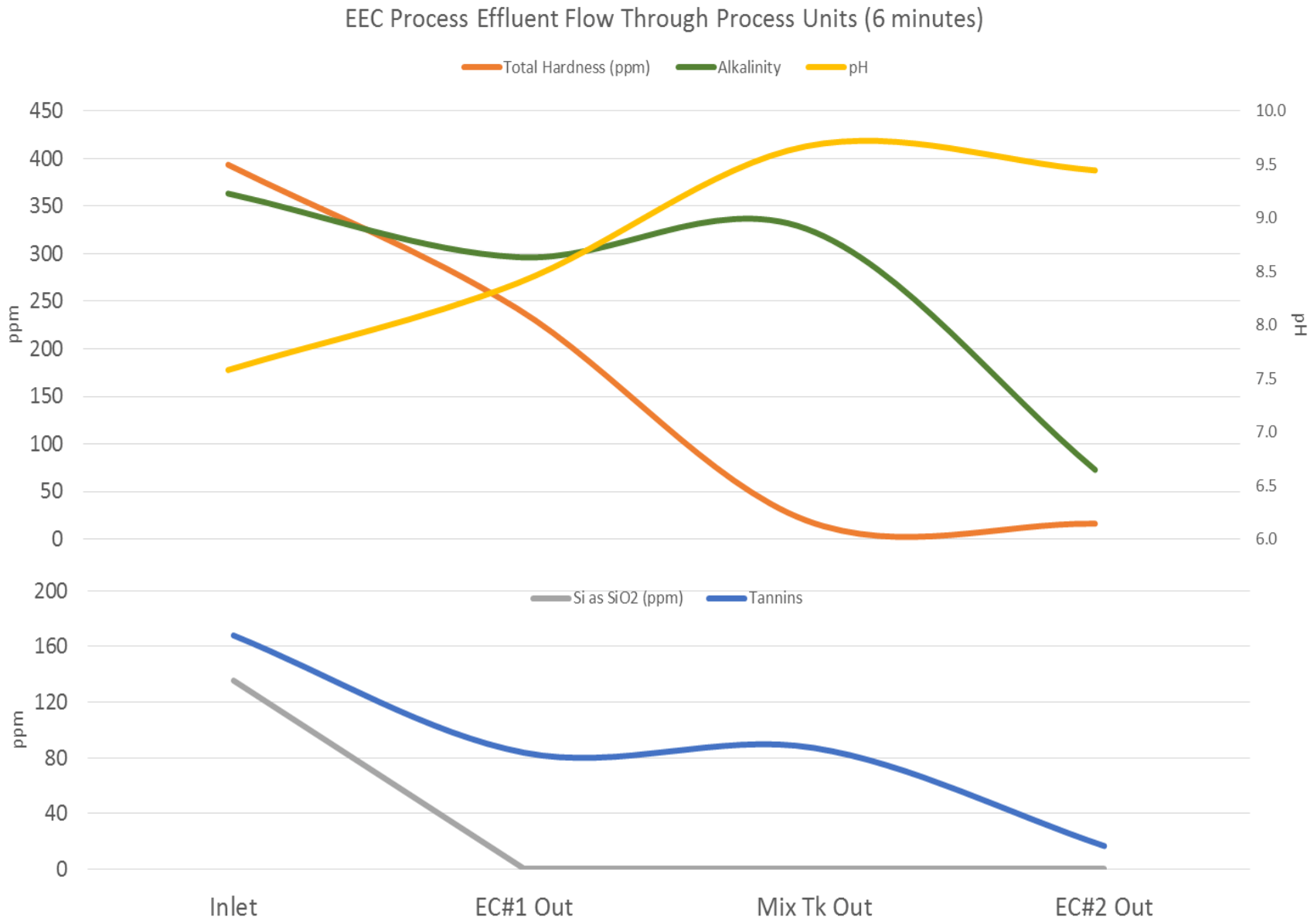
- High Silica Removal
- Hardness Reduction
- Immediate Sludge Flocculation



Oilsands Tailings Pond Fluid

- TSS Reduction of 96.3%
- High Metal Removal Efficiencies
- Immediate Sludge Flocculation

EEC Bench Pilot Results



Parameters	Influent (mg/L)	Effluent (mg/L)	Removal efficiency (%)
pH	8.01	8.34	NA
Conductivity	1790	1680	6.1
Alkalinity	343	342	0.3
Hardness	86	63	26.7
TSS	821	30	96.3
TDS	1130	1030	8.8
Chloride	140	122	12.9
Sulfate	362	304	16.0
Metals-Total Trace			
Al	24	2.1	91.0
Ca	25.4	13.0	49.0
Fe	12.7	0.07	99.0
Mg	10.6	7.3	31.0
Mn	0.613	0.01	98.0
K	17.6	13.9	21.0
Si	18.4	0.33	98.0
Na	362	345	5.0
S	122	98.7	19.0
Metals-Total ICP-MS			
Ar	0.0066	0.0011	83.0
Ba	0.461	0.036	92.0
Cd	0.00016	0.00002	88.0
Co	0.0133	0.0009	93.0
Cu	0.091	0.01	89.0
Pb	0.008	0.00003	96.0

Bench-Test Results

Oilsands Tailings Fluid

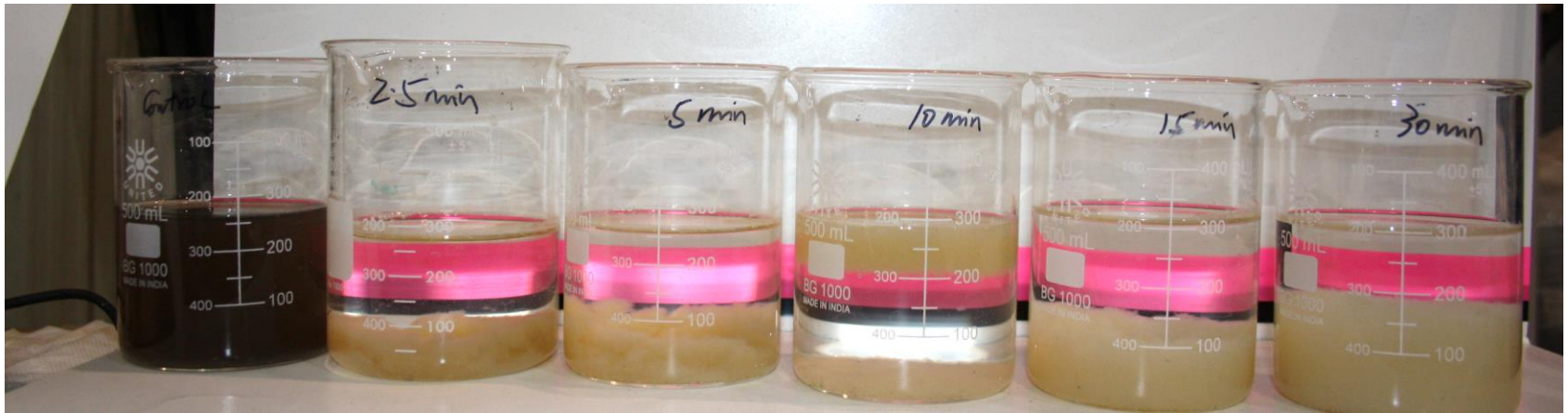
- **Very small sample size**
- **Further sampling and optimization required**
- **Preliminary estimated OPEX:**
  - **1.3kW/m3 power requirement**
  - **$0.06/m3 consumable cost**

Testing Results

Electro Catalytic AOP

Landfill Leachate – Meadow Lake – Stagnant Unit

Parameter	Control	Treated sample	Removal
COD (mg/L)	626	315	49.7%
TSS (mg/L)	505	8	98.4%
EC (µs/cm)	3130	1600	48.9%
TDS (mg/L)	1700	747	56.1%
Hardness (mg/L)	812	212	73.9%
Alkalinity (mg/L)	1110	253	77.2%

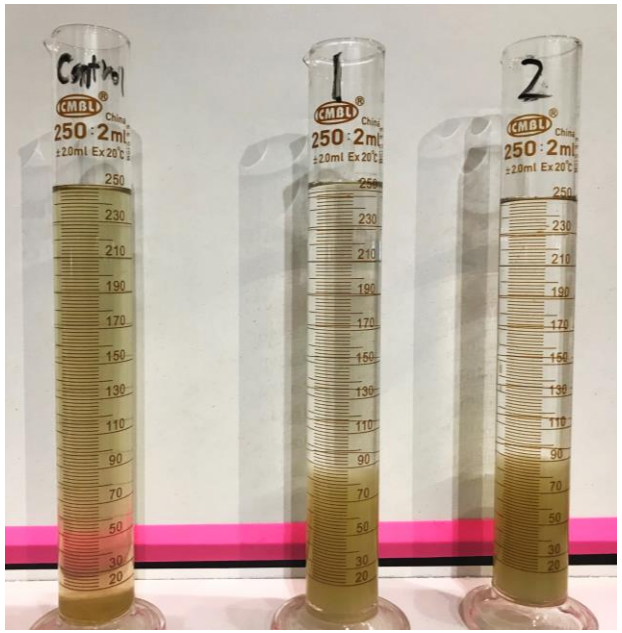


Testing Results

Electro Catalytic AOP

Municipal Wastewater - Camrose

Parameter	Control	Treated sample	Removal
COD (mg/L)	149	35	76.5%
BOD (mg/L)	13	6	53.8%
TSS (mg/L)	41	9	78.0%
Ammonia (mg/L)	12.8	12.4	3.1%
TKN (mg/L)	17.3	13.5	22.0%
Phosphorus (mg/L)	2.37	<0.05	>97.9%
Calcium (mg/L)	77.2	34.5	55.3%
Magnesium (mg/L)	44.2	21.7	50.9%
Hardness (mg/L)	375	176	53.1%
Alkalinity (mg/L)	300	178	40.7%
Total Coliform (CFU/100mL)	20	1	95.0%
E.Coli (CFU/100mL)	10	1	90.0%



Testing Results

Electro Catalytic AOP

SAGD Production Water

Parameter	Control	Treated sample	Removal
Hardness (mg/L)	351	87	75%
Alkalinity (mg/L)	634	350	45%
Calcium (mg/L)	307	80	74%
Magnesium (mg/L)	48	5	89%
Silica (mg/L)	142	1	99%
Tannin (mg/L)	158	0	100%

Testing Results

Electro Catalytic AOP

SAGD Production Water – 2nd Client

Parameter	Control	Treated sample	Removal %
Hardness (mg/L)	393	36	90.9%
Alkalinity (mg/L)	363	97	73.3%
Calcium (mg/L)	349	17	95.2%
Magnesium (mg/L)	45	19	58.1%
Silica (mg/L)	136	2	98.5%
Tannin (mg/L)	168	32	80.9%

Data Collected from several case studies under different conditions

Parameter	Before AOP	After AOP	% remove
Aldrin (Pesticide)	0.0630	0.0010	98.40
Aluminum	224.00	0.69	99.69
Ammonia	49.00	19.40	60.41
Arsenic	0.076	< 0.0022	97.12
Barium	0.0145	<0.0010	93.10
Benzene	90.10	0.359	99.60
BOD	1050	14.0	98.67
Boron	4.86	1.41	70.98
Cadmium	0.1252	<0.0040	96.81
Calcium	1321	21.4	98.40
Chlorieviphos (pesticide)	5.87	0.03	99.50
Chromium	139.0	<0.010	99.92
Cobalt	0.1238	0.0214	82.71
Copper	0.7984	<0.0020	99.75
Cyanide (free)	723.0	<0.020	99.99
Cypermethrin (pesticide)	1.30	0.070	94.60
DDT (pesticide)	0.2610	0.0020	99.20
Diazinon (pesticide)	34.00	0.210	99.40
Ethyl Benzene	428.00	0.3720	99.91
Flouride	1.10	0.4150	62.27
Gold	5.72	1.380	75.87
Iron	68.34	0.1939	99.72
Lead	0.590	0.0032	99.46
Lindane (pesticide)	0.1430	0.0010	99.30
Magnesium	13.15	0.0444	99.66
Manganese	1.0610	0.0184	98.27
Mercury	0.720	<0.0031	98.45
Molybdenum	0.350	0.0290	91.71
MP-Xylene	41.60	0.0570	99.86
MTBE	21.58	0.0462	99.79
Nickel	183.0	0.070	99.9
Nitrate	11.7	2.6	77.78
Nitrite	21.0	12.0	42.86
Nitrogen TKN	1118.88	59.08	94.72
NTU	35.38	0.320	99.10
O-Xylene	191.0	0.416	99.78
PCB (Arochlor 1248)	0.0007	<0.0001	85.71
Petroleum Hydrocarbons	72.50	<0.20	99.72
Phosphate	28.00	0.20	99.28
Platinum	4.40	0.680	84.55
Potassium	200.00	110.00	45.00
Peoptamphos (pesticide)	80.87	0.360	99.60
Selenium	68.00	38.00	44.00

EC-AOP efficiency in common contaminant removal.

Testing Results

A few case studies include:

1 Boiler Water Test

The EC-AOP unit reduced Silica, Silicon and Iron levels (dissolved & total) from water samples by over 99%.

2 Slaughterhouse Effluent

The EC-AOP unit reduced TDS, Organic Carbon, Turbidity, E.Coli, Fecal Coliform, & Heterotrophic Plate Count by over 99%.

3 Landfill Leachate Test

The EC-AOP unit reduced levels of Ammonia by 72%, Arsenic by 93%, Barium by 83% and Chromium by 93%.

CONTACT US

For More Information

Head Office - 1.780.639.1259

www.lotictech.ca

3902 - 82Ave
Leduc, AB
T9E 0H4

David Mahowich
dmahowich@lotictech.ca

Mike Schreiber
mschreiber@lotictech.ca

Brett Erickson
berickson@lotictech.ca

Graham Klenner
graham@klennerconsulting.co.nz
NZ mob 0272413955