
Diamox™

An on-site electro-oxidation solution
for the toughest of wastewaters

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elementsix™
DE BEERS GROUP

Diamox™ is a compact and easy-to-implement electrochemical advanced oxidation reactor that enables on-site wastewater treatment systems with game-changing simplicity and efficiency



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Perfecting a technology that transforms wastewater treatment

Diamox™ diamond electrode cells use proprietary solid boron doped diamond (BDD) to give small to medium volume wastewater treatment systems a transformative increase in efficiency and capability.

Diamox™ electrochemical cells enable manufacturers of on-site wastewater treatment systems to design solutions that:

- Effectively treat effluents that are otherwise difficult or impossible to tackle with conventional means, by fully mineralising dissolved organic compounds
- Allow discharge of treated water directly from site
- Are cost effective, and simple to operate and maintain
- Avoid the need to use UV and chemicals
- Meet the diverse requirements of key industries such as chemical, pharmaceuticals, oil and gas, textiles and environmental water management

Delivered ready to install

Diamox™ is a complete 'bolt-in' unit comprising a Diamox™ cell with solid BDD electrodes, housing and all electrical and pipework connections – ready to install into electrochemical advanced oxidation systems.



Diamox™ has proven reliability and is easy to integrate into your water treatment technology.

Diamox™ contains a stack of bipolar BDD electrodes to maximise the effluent's exposure to oxidising species generated at the electrode's surface.

Diamox™: The breakthrough that makes electrochemical advanced oxidation systems effective, reliable and economical

Conventional treatments use aerobic biological processes to digest contaminants dissolved in wastewater. Highly contaminated effluent streams pose a challenge for these processes since the dissolved species can be resistant to oxidation (recalcitrant), and can be toxic to the microbial colonies in a bio-digesting plant.

Advanced oxidation processes (AOPs) provide an on-site solution for these challenging waste streams. They function by mineralising dissolved effluents through oxidation reactions with hydroxyl radicals.

The power of the hydroxyl radical

The hydroxyl radical ($\cdot\text{OH}$) is the neutral form of the hydroxide ion (OH^-). Hydroxyl radicals are highly reactive, able to oxidise even the most recalcitrant and toxic dissolved effluent species.

Extending electrode life for years

Conventional electrodes dissolve in the presence of hydroxyl radicals, giving them a limited field life. Element Six's electrochemical processing (EP) grade BDD electrodes are resistant to the hydroxyl radical and have a field life measured in years – enabling AOP systems that are efficient and reliable.

Complete treatment with a single electrochemical process

AOP systems usually require additional UV and chemical processes to generate the hydroxyl radical and that makes them more complicated to operate, more hazardous and less sustainable. Electrochemical AOP systems with long life Diamox™ electrodes can generate the hydroxyl radical solely by electrochemical means to treat highly contaminated water; for a system that is less complicated, safer and easier to operate.

A proven technology for better sustainability in key industries

Enabling efficient electrochemical advanced oxidation processes

Diamox™ is a game-changing cell for electrochemical advanced oxidation water treatment technology since it is able to operate at extremely high current density, with 100% of the hydroxyl radicals generated available for useful oxidation work.

Effective - capable of full mineralisation of dissolved organic compounds

Reliable - using Element Six's BDD electrodes that have a field life measurable in years

Flexible - effective with most types of effluent streams with dissolved contaminants

Compact footprint

Safe - operates at low temperature and pressure without the addition of hazardous chemicals

Proven performance in a variety of waste streams

Successful results have been achieved in complex waste streams, including:

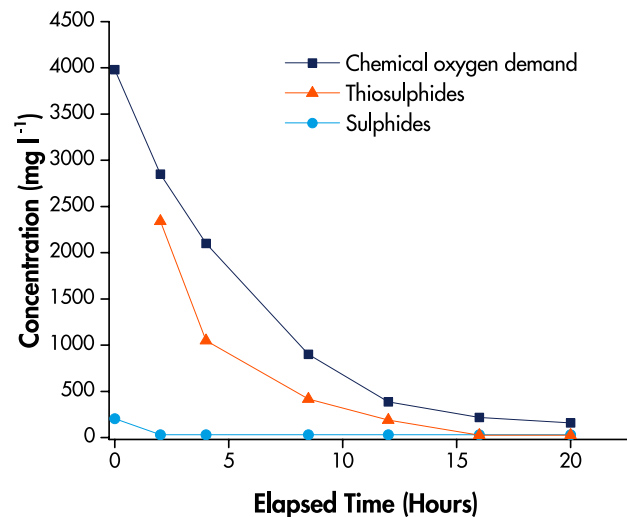
- High Chemical Oxygen Demand (COD) streams of >100,000 mg l⁻¹ to <200 mg l⁻¹ landfill leachate
- Phenolic compounds
- Mercaptans
- Dyes

A treatment solution for many industries

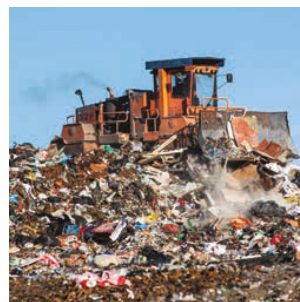
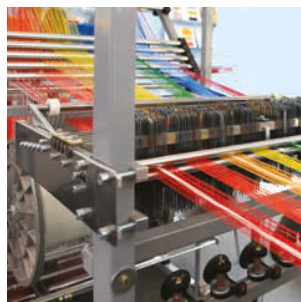
Diamox™ is suitable for use in low to medium volume wastewater treatment systems in a wide range of industries, such as:

- Spent caustic wastewater
- Textile wastewater – dye de-colourisation
- Pharmaceutical wastewater
- Reverse osmosis brines
- Landfill leachate, including ammonia reduction

Example of COD reduction in a batch process



Removal of recalcitrant dissolved contaminants from spent caustic industrial wastewater.



Diamox™ enables on-site processing in multiple industries including pharmaceutical, textiles, landfill leachate and oil & gas.

A turnkey reactor ready for implementation

Technical support

Element Six has more than 20 years' experience in the research, development and manufacture of CVD diamond solutions for applications that range from electrochemistry to optics.

Element Six is able to provide:

- Expert assistance to ensure our clients maximise their technological potential
- Co-development capability to solve application problems
- Mapping of the oxidation capacity of Diamox™ over a range of effluent contamination concentrations

Technical specifications for Diamox™ 20C

Electrodes	Element Six EP Grade BDD
COD oxidation capacity	2 kg per hour
Water connections	4 inch Van Stone flange
Power connections	175 mm ² flexible cable with terminal connector

Recommended power supply

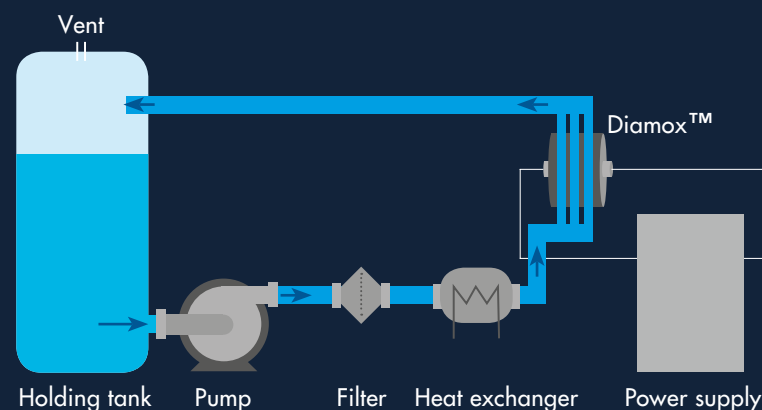
Bipolar DC power supply	120 to 250 kW
Polarity switching	60 seconds
Operating current	250 - 375 A
Voltage range	120 to 660 V DC

Recommended operating conditions

Effluent conductivity	>20 mS cm ⁻¹
Operating pressure	1 to 3 bar
Recirculation flow rate	>25,000 litres per hour
Water exit temperature	50 °C

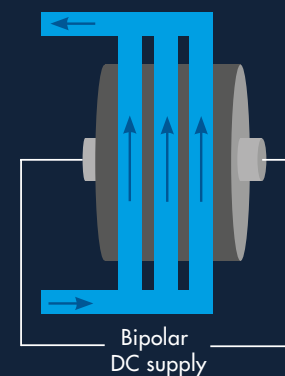
How Diamox™ fits into AOP treatment plants

Diamox™ enables simple compact advanced oxidation treatment systems on-site. The effluent is held in a tank and then pumped through the Diamox™ cell. The oxidation occurs in a batch process with the dissolved effluents mineralised at the surface of the anode electrode, controlled by the power applied.



Bipolar electrochemical cells

Diamox™ uses BDD for the anode and the cathode. Its design allows for switching the polarity of electrodes to prevent fouling, enabling operation in highly contaminated environments.



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