



Halia[®] water and wastewater solutions for Europe

Modular water treatment solutions using pure oxygen,
bringing cost efficiency and environmental benefits

At Air Products,

we have a half-century of expertise in the most fundamental substance on earth—water. Our business is industrial gases. And we have put that knowledge to good use to make our water safe and pure. We understand the pressure companies are under to meet environmental legislation relating to water treatment.

In Europe, our dedicated team of technical experts is committed to provide customer-driven solutions to complex wastewater and water treatment problems, backed by our Water Laboratory (Matgas) in Barcelona, Spain, which serves customers in the whole of Europe.

Our robust modular solutions combine all the proven advantages of pure oxygen aeration, ozone and advanced oxidation with patented high mass transfer technology. Our waste-free advanced technology delivers highly effective, low-cost solutions, utilizing a modular approach to meet specific needs and specific treatment goals now and in the future.

Our Halia wastewater solutions, drinking water solutions, and aquaculture and river oxygenation solutions are capable of handling the following diverse requirements:



- To increase wastewater treatment capacity of an existing plant
- To reduce foams, odors and VOCs release of aeration tank
- To improve nitrification and settling efficiency
- To remove color for discharge or reuse
- To remove recalcitrant contaminants
- To raise the dissolved oxygen (DO) level and enlarge the aquaculture density



Air Products' Halia modular water solutions

have been successfully used in industrial and municipal water applications. Our solutions utilize the latest in gas generation technology and equipment flexibility to provide minimum overall cost and maximum performance.



Wastewater solutions

Our technical experts will work closely with you to provide the best oxygen injection solutions for optimum wastewater treatment and cost-efficiency. Our advanced oxidation technologies can help you treat municipal and industrial wastewater streams to meet the required standards for water reuse in various applications.

Drinking water solutions

Our modular oxidation solutions provide a range of robust treatment solutions for municipal drinking water customers. Our advanced oxidation technologies are designed to meet the driving needs of communities and increased regulatory requirements while reducing operating costs.

Aquaculture and river oxygenation solutions

Air Products supplies high-purity oxygen and Halia aeration solutions to the hatcheries and fish farms where oxygen is used instead of air to maintain adequate dissolved oxygen (DO) levels, so as to raise aquaculture density and quality, and improve productivity.

Advanced gas technologies help improve efficiency and lower operating costs

Halia aeration solutions— The ultimate benefits of pure oxygen

Pure oxygen, when used for aeration in aerobic biological processes, is widely recognized to be more effective than air-based technology for treating aqueous waste. It can offer cost savings either as a simple retrofit to extend the capacity of an existing treatment plant, or as part of a new installation.







Our proprietary injection technology is designed to provide maximum oxygen transfer into an activated sludge system utilizing pure oxygen.

Our Halia aeration solutions are designed taking the customer's process into consideration, to achieve the highest utilization possible of the delivered oxygen.

Benefits:

- Increase treatment capacity in existing system
- Reduce investment
- Smaller footprint
- Power saving
- Increase nitrification
- Reduce of foams, odors and VOC release
- Control filamentous bacteria
- Decrease sludge production

Halia aeration solution benefits a diversified range of application areas including wastewater biological aeration treatment, groundwater oxygenation and aquaculture.

Offering	Details
Halia mixer aeration solution 	Consists of a high-speed, surface floating mixer and a gas injection device. <ul style="list-style-type: none"> • Easy installation • Higher oxygen transfer efficiency
Halia propeller aeration solution 	Oxygen is injected into wastewater by propeller. <ul style="list-style-type: none"> • Wet install capability • Ideal for small basins
Ozone vent gas reuse 	Reuse up to 80% of the current wasted oxygen. <ul style="list-style-type: none"> • Aeration tank power saving and peak shaving • Reduction in operating cost
Halia venturi aeration system 	Oxygen is injected into wastewater by venturi. <ul style="list-style-type: none"> • Higher oxygen transfer efficiency • Significantly increase aeration capacity
Halia oxygen sludge digestion solution 	Use pure oxygen rather than air alone for sludge disposal. <ul style="list-style-type: none"> • Increase in oxygen delivery rates, enables faster digestion and higher pathogen kill • 30%–60% solid reduction
Aquaculture solution 	A pure oxygen injection system. <ul style="list-style-type: none"> • Raise the dissolved oxygen (DO) level in water • Increase the aquaculture productivity

* AquaDDM is a registered trademark of Aqua-Aerobic Systems, Inc.



Halia oxidation solutions— Powerful disinfectant and oxidation solution using ozone

Ozone is one of the most powerful oxidants commercially available today. Ozone effectively oxidizes color, various organic and inorganic compounds without leaving any harmful residue. These unique qualities of ozone make it a very attractive option for water treatment.

Our ozone-based oxidation technologies benefit a range of industries, such as pigment, textile and dyeing, pharmaceutical, pulp & paper, petrochemical and coal chemical.

Benefits:

- Reduce halogenated disinfection by-products, like trihalomethanes and bromate
- Taste and odor control
- Improve coagulation, flocculation and filtration
- Flexible configurations, fully tested for easy installation
- Low-cost alternative



Offering

Halia venturi mixing system

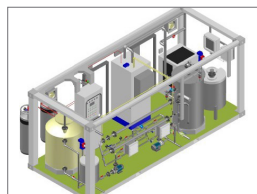


Details

Ozone is injected into wastewater by venturi.

- Higher ozone transfer efficiency
- No annoyance of fouling formation and corrosion

Halia micro-channel solution



A self-contained system, minimizing on-site assembly.

- High strength organic contaminants removal
- Industrial wastewater treatment for reuse/ recycle or discharge after treatment to meet the requirements

Ozone is used today in a range of municipal and industrial water applications, including:

- Wastewater treatment
- Drinking water
- Cooling water biocide
- Sanitization
- Clean-in-place systems for process
- Inorganic pollutant oxidation, including iron, manganese and sulfide
- Oxidation of organic contaminants in groundwater and industrial systems

Count on our dedication to safety and sustainability

Our Halia water treatment solutions use oxygen instead of air for aeration, which increases the oxygen dissolution driving force and minimizes the energy cost. Halia oxidation solution utilizes ozone as a water treatment disinfectant and oxidant in a very environmental friendly way. Ozone decomposes naturally in a matter of hours to normal molecular oxygen, leaving no residual compounds or toxins unlike other disinfectants.

Globally, we are a safety leader in our industry and stand among the top performers of the Responsible Care® program from the Association of International Chemical Manufacturers (AICM).



Halia CO₂ solutions — pH neutralisation process

At Air Products we understand the difficulties of neutralising alkaline waste water. Conventional treatment often uses sulphuric or hydrochloric acid to correct pH.

The aggressive nature of these acids means that neutralising waste water with dissolved carbon dioxide has many operational and environmental advantages:

- **Better working conditions.** No more burns, poisonous fumes and other risks resulting from the handling of mineral acids.
- **Accurate pH control.** The risks of excessive acidification using strong acids are prevented.
- **Low initial investment.** There are various application systems, but all involve simple, safe and compact equipment.
- **Automated process.** The automation means that staff do not handle corrosive acids or transport them inside the plant.
- **Continuous operation.** The pH is controlled automatically, without need for significant maintenance.
- **Economy.** The use of carbon dioxide is very economical and cuts down on indirect operating costs. The chemical characteristics of the gas mean that the treatment plants do not require such expensive equipment.

Air Products MATGAS water laboratory

The Air Products European Water Laboratory is located in Barcelona, Spain, providing technical advice and support to customers in the whole of Europe.



This state-of-the-art facility comes with:

- Laboratory reactors and analysis equipment for customer water sample testing and identification of the appropriate water treatment solutions
- Research and development capability that enables customers to improve existing and develop new advanced oxidation technologies, as well as the local development of equipment to suit the needs of European water treatment plants

Air Products is a recognized leader in the safe operation and application of industrial gases and works with customers to review their systems and provide ozone and oxygen safety training. Oxygen and ozone solutions offered by Air Products incorporate all required safety features as standard.

A complete range of supply options to meet your needs

To meet your expectations, it is crucial that industrial gas supply is available when and where you need it. Air Products offers a wide variety of industrial gas supply options, from on-site to merchant-delivered liquid or gas, to meet your purity, volume and flow rate needs economically and effectively. With any of our supply options, Air Products is committed to providing on-time delivery of products that meet your specifications.



Industrial gas supply options

- **Cylinders, dewars and microbulk** for small or medium sized users.
- **Merchant liquid**—Products are delivered in insulated tanks and stored on-site for use as liquid or gas after vaporization.
- **On-site plant**—Gas generation systems and oxygen vacuum swing adsorption (VSA) generators.
- **Pipeline supply**—A facility is usually built adjacent to or nearby our customer's facility, and product is delivered through a pipeline.



Support services

- Pilot trials
- Biological treatment systems
- Oxidation treatment systems
- Safety and operability reviews and training
- Ongoing technical support and equipment service



Air Products is a leading global supplier of industrial gases, performance materials, and equipment and services. We serve customers in industrial, energy, technology and healthcare markets worldwide. With fiscal 2013 revenues over \$10 billion and operations in over 50 countries, more than 21,000 Air Products employees are working to build lasting relationships with our customers and communities based on understanding needs and delivering on them with integrity and passion. Through this understanding, we continually find innovative ways to help our customers win markets around the world whilst maintaining our focus on being an industry leader in safety, health and preservation of the environment.



Halia (Hā´•lēă)

A name from Greek legend

Since the 1960s, Air Products has provided customer-driven solutions to increase and improve treatment of both wastewater and drinking water, for industrial and municipal customers. Our name has long been linked with oxygen and ozone applications that return a precious resource to its pure state. We bring tradition, knowledge, and understanding to the technologies of water. So when we extended our exciting line of water treatment products, we borrowed a name from Greek mythology.

Halia was a goddess of the sea. Her name is a fitting association for our products. It represents the application of modern science and technology to restoring a basic building block of life to the purity of the past.

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