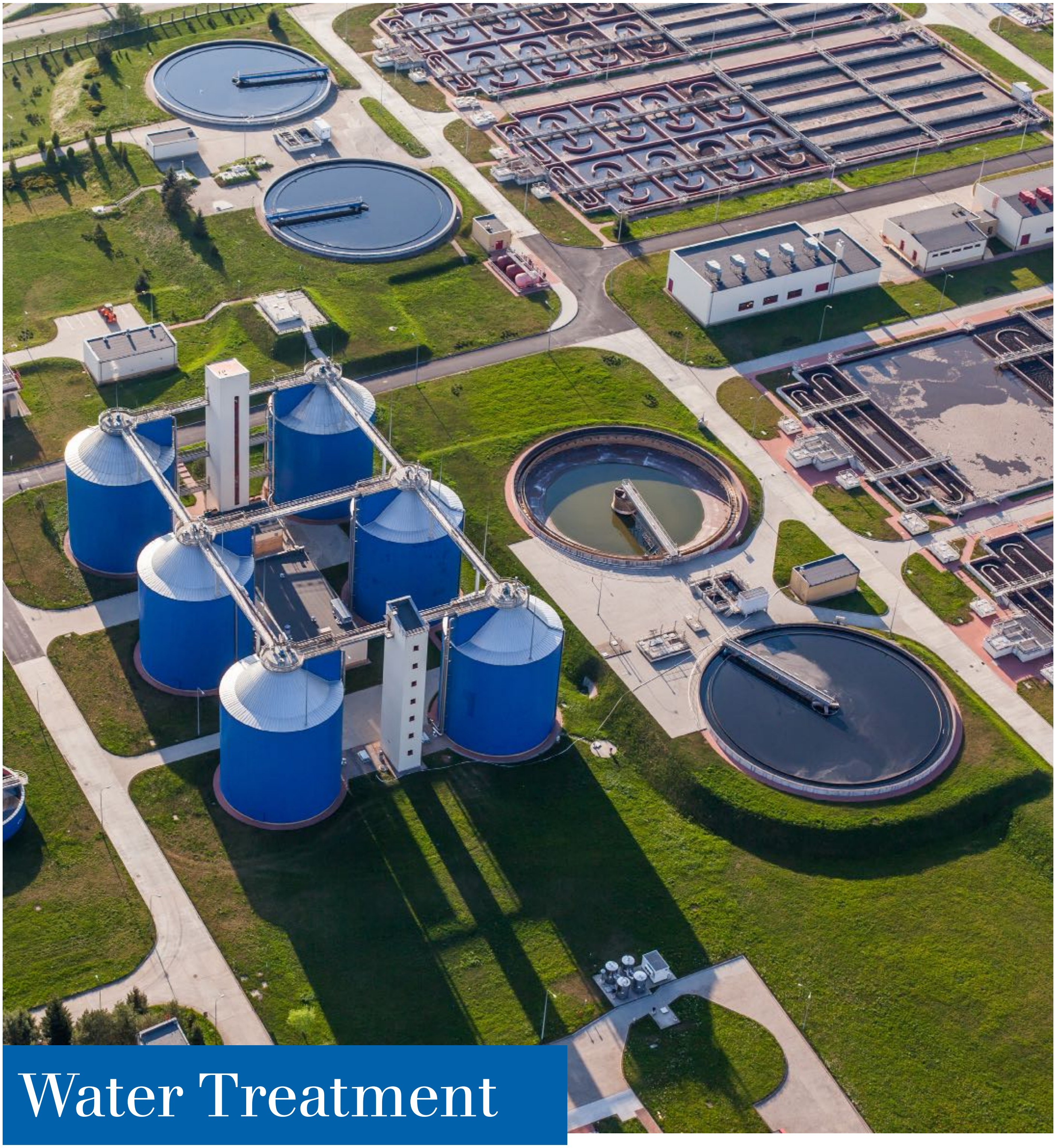


Water Treatment

Application Note

Introduction

Potable drinking water has always been a critical need for mankind. It comes from many sources, including rivers, lakes, wells and underground sources such as aquifers. Underground water is particularly good for the production of drinking water since much of it has been filtered through thick natural sand and gravel layers. Many undissolved materials are held back or reduced by this natural filter effect. Since natural filtration is not always sufficient, additional basins filled with sand and gravel are used at water treatment plants. Water runs into them and is collected as groundwater in catch basins. With both procedures, the impurities are separated by filtration. This raw water with reduced impurities simplifies the water treatment process.

Market Segments

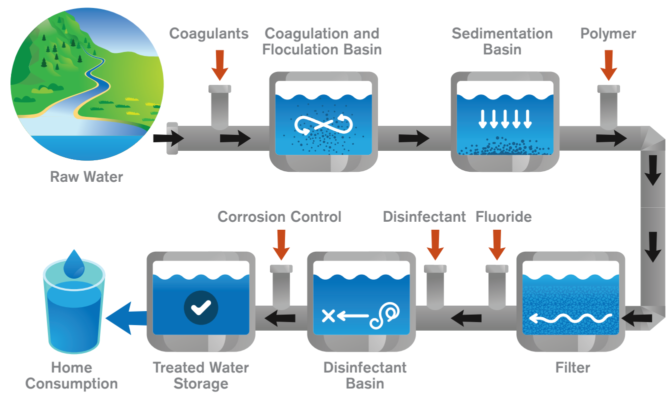
– Waterworks systems
– Water treatment plants
– Water plant installation contractors and control manufacturers

Challenges

The following chart summarizes the potential toxic substances at water treatment plants.

The Process

Generic layout of a drinking water treatment plant



The treatment process can vary from place to place depending on the water source and local preferences and requirements, but raw water is generally processed as follows. First, the raw water from the source is run through aeration/absorption systems. Oxygen from the air is dissolved into the water. In some water plants, air enriched with ozone is used for the treatment of the raw water. This process allows noxious gases to escape, reducing their levels. Iron and large particulate materials can precipitate out and be separated in sediment basins or sand and gravel filters. Activated charcoal then filters out

Substance	Chlorine	Chlorine dioxide	Hydrogen peroxide	Ozone
Formula	Cl_2	ClO_2	H_2O_2	O_3
PEL	1 ppm	0.1 ppm	1 ppm	0.1 ppm
IDLH	10 ppm	5 ppm	75 ppm	5 ppm
Traits	– Toxic gas, yellow-greenish – Pungent-smelling – Corrosive, oxidizing – Non-combustible	– Orange gas with pungent smell – Oxidizing – Heavier than air – Corrosive	– Colorless liquid – Non combustible – Oxidizing – Corrosive	– Toxic, colorless or bluish gas with distinctive smell – Oxidizing – Heavier than air
Substance	**Carbon dioxide**	**Ammonia**	**Sulphur dioxide**	**Carbon monoxide**
Formula	CO_2	NH_3	SO_2	CO
PEL	5,000 ppm	50 ppm	5 ppm	50 ppm
IDLH	40,000 ppm	300 ppm	100 ppm	1,200 ppm
LEL		15.4 % by vol.		12.5 % by vol.
UEL		30.2 % by vol.		74 % by vol.
Traits	– Toxic, colorless, odorless gas – Non-combustible	– Toxic, colorless, pungent-smelling gas – Corrosive – Lighter than air – Explosive when mixed with air	– Toxic, colorless, pungent-smelling gas – Non-combustible – Produces H_2SO_4 (acid rain)	– Toxic, colorless, odorless gas – Miscible with air

1. all values subject to change
2. TLV-values

substances that could discolor the water and influence its taste or smell. To destroy pathogens, ozone or chlorine is added. Sometimes H_2O_2 is used as part of the disinfecting process and in many plants the water is exposed to UV light as a final step.

Ozone, chlorine and/or hydrogen peroxide are used to remove organic contaminants. Depending on the condition of the raw water, more or less chlorine or ozone is added. Because potential leaks of these toxic gases can occur, local and/or personal gas monitoring is necessary. In addition, dangerous concentrations of these gases can occur in deposition basins and other areas.

The disadvantage of disinfecting with chlorine is a potential aftertaste in the water and the development of unwanted byproducts such as trihalogen methanes (THM) and trichlorine methane (chloroform), which is a carcinogen. To avoid the development of THMs, chlorine dioxide is usually used instead of chlorine.

At some plants, additional treatment operations may take place with the water, including addition of carbon dioxide to correct the pH (acidity) level and ammonia to extend the effectiveness of the chlorine. Both are applied in a gaseous form and their respective plant dosing/storage rooms would also warrant gas monitoring for accidental releases.

At some plants, diesel and gas-powered generators are used for electricity generation and pumping. Large generator packages are often containerized or housed in special machinery rooms. Fuel and/or exhaust leaks pose potential fire, explosive or toxic risks. In addition, most plants have other combustion processes that may generate dangerous toxic gases as products of combustion and have fuels that may present combustible/explosive hazards if they leak as gases or vapors.

Dräger Solutions for Water Treatment Plants

Detection of toxic gases (ozone, chlorine, hydrogen peroxide, etc,) and oxygen deprivation in disinfection processes

Dräger Polytron® 7000, 5100 and 8100 are universal transmitters that accept any DrägerSensor® by downloading sensor-specific information from the embedded EEPROM sensor. The sensor has an internal temperature element which compensates for temperature variations between -40°F and 149°F. DrägerSensors for water plant applications include:

– EC Cl_2 sensor for measurement of chlorine or chlorine dioxide (measurement range 0-1 ppm min/50 ppm max)
– EC H_2O_2 sensor for measurement of hydrogen peroxide (measurement range 0-1 ppm min/300 ppm max)
– EC O_3 sensor for measurement of ozone (measurement range 0-0.5 ppm min/5 ppm max)
– EC NH_3 sensor for measurement of ammonia (measurement range 0-50 ppm min 300 ppm max)
– EC O_2 sensor for measurement of oxygen levels (measurement range 0-25% volume)

If carbon dioxide is used in the finishing process:

Dräger Polytron 5720 or 8720 IR Monitors provide a reliable method of detecting CO_2 rapidly and accurately at PEL levels. The PIR 7200 Infrared (IR) sensor provides years of service and has less frequent calibration requirements. It has a measurement range of 0-2000 ppm min/30% volume max.

Alternative solutions: Large CO_2 releases (% volume level) can also be monitored using a Polytron 7000, 5100 or 8100 with the EC O_2 sensor for measuring oxygen levels (measurement range 0-25% volume) by looking at O_2 displacement by CO_2 in an area.

Detection of fuel gases/vapors and combustible gases for combustion processes

Dräger Polytron 8700 or 5700 IR sensor monitor measure combustible hydrocarbon gas. Key features include long life (>10 years), fast response, IR gas detection and transmission, sophisticated double compensated optics that ensure low signal drift to minimize routine maintenance, wide temperature range (-40°F to +170°F) and beam block warning before potential failure, allowing preemptive action to prevent downtime.

Alternative solutions: Dräger Polytron 8200 or 5200 DD Catalytic sensor monitor for monitoring any combustible gas. The device has unique catalytic sensor technology with wire mesh flame arrestor for the fastest catalytic response in the industry. Low drift and poison-resistant design help reduce maintenance cost and provide reliability.

Dräger Polytron 7000 and Polytron 5100 or 8100 are universal transmitters that can accept any DrägerSensor by downloading sensor-specific information from the embedded EEPROM sensor. The sensor has an internal temperature element that compensates for variations in temperature from -40°F to 149°F. Sensors for combustion gas applications include:

– EC CO sensor for measurement of carbon monoxide levels (measurement range 0-50 ppm min/1000 ppm max)
– EC NO_2 sensor for measurement of nitrogen dioxide (measurement range 0-1 ppm min/20 ppm max)

Advantages of Various Dräger Solutions

Specific advantages of different Dräger technologies for water treatment plants include the following:

IR detectors

IR detectors have lower measuring ranges than catalytic bead sensors, provide higher sensitivities, require much less maintenance, have a much longer operating life (as much as 5 times longer), provide the best cost of ownership, and provide the fastest response to hydrocarbons and CO_2 gas. Other advantages include:
– Constant sensitivity over lifetime of the instrument
– Great stability and accuracy, low drift to minimize calibration frequency
– Submersible without damage (IP 66 & IP 67)

Catalytic bead detectors

Catalytic bead sensors are a low-cost solution that can measures any gas that will burn.

DrägerSensors®

Manufactured in Germany by Dräger, these electrochemical sensors are larger than the competition's to provide bigger electrodes and more electrolytes, which results in faster response, higher accuracy, more stability, and a longer sensor life. Other advantages include:
– Smart sensors with an internal temperature element and an embedded microchip with calibration info and all operating parameters to work with any Dräger Polytron EC transmitter
– Automatic sensor recognition, numerous self-test functions, remote calibration and signal compensation over the whole temperature range of -40°F to +149°F

Control systems

Dräger can provide safety-rated controllers to provide a complete central control solution for all of the plant's gas and fire concerns.

Expert Technical Support

Gas detection can be complicated and specific needs can vary from plant to plant. Dräger gas detection experts have extensive experience and can recommend the best solution for each facility. Dräger customers can take advantage of Dräger's unmatched technical support to discuss their application in detail and create an optimal gas detection solution.

CORPORATE HEADQUARTERS
Drägerwerk AG & Co. KGaA
Moislinger Allee 53–55
23558 Lübeck, Germany

www.draeger.com

USA
Draeger, Inc.
7256 S. Sam Houston Parkway W.,
Suite 100
Houston, TX 77085
1 800 4DRAGER
(1 800 437 2437)

Locate your Regional Sales Representative at: www.draeger.com/contact