



Environmental Newsletter

Prepared by WG-5 Environment

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Water Management

Summary

EIGA Working Group 5 – Environment has compiled this environmental newsletter to give information to EIGA members, specifically to site managers, Directors, technical managers, company environmental specialists and National Trade Associations on best practice for managing water and wastewater and minimising usage and discharges.

Introduction

Water use is receiving increased attention with pressure on availability of drinking and other water and in Europe on achieving the European Union targets for water quality. Water is becoming an increasingly scarce and expensive resource with mains water, sewerage and trade effluent charges rising. Unlike greenhouse gas emissions (GHG) which is a global environmental issue, water use is a local environmental issue with water use assessed at the level of river basins or catchment areas. In addition to which the impacts of climate change are being felt across Europe. Over the past thirty years, droughts have dramatically increased in number and intensity in the EU.

As a result of this assessment the Commission presented an initial set of policy options to increase water efficiency and water savings in a Communication published in July 2007. In addition to which, in October 2000 the 'Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for the Community action in the field of water policy' (EU Water Framework Directive or WFD) was adopted. The purpose of the Directive was to establish a framework for the protection of inland surface waters (rivers and lakes), transitional waters (estuaries), coastal waters and groundwater.

The European Commission is looking at river basin management under the EU Water Framework Directive 2000/60/EC [1], resulting in a number of initiatives to collect data and to improve water management [2]. The chemical industry is also working on initiatives to improve its Water Footprint [3].

The Carbon Disclosure Project (CDP) [4] requires water reporting and the use of World Resources Institute (WRI) water risk tools [5] to assess any business risk associated with surface or underground water scarcity.

New regulations, such as the European taxonomy will also increase the pressure on companies to accurately manage the environmental impacts of their activity.

The protection of all natural resources is an integral part of EIGA's commitment to sustainable development. Water is essential for life on earth and is also a highly important resource for many industry sectors of the global economy. In the face of the risks linked to water (water stress in terms of both quantity and quality, risks associated with conflicts of use, etc.), EIGA aims to continuously improve guidelines on water management.

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EUROPEAN INDUSTRIAL GASES ASSOCIATION AISBL
AVENUE DE L'ASTRONOMIE 30 • B-1210 BRUSSELS
PHONE +32 2 217 70 98 • E-mail: info@eiga.eu - www.eiga.eu

In this context, the main significant water use data becomes a strategic information to allow industrial gases Companies to manage and anticipate potential issues and concerns in the management of water within their activities.

To be able to analyse the data, EIGA's members need accurate data to estimate the potential for improvement in a dedicated geography, for a dedicated use or for anticipating future design standards. In addition, the data is necessary to determine the impact of the activity on the availability of the resource and on the natural water cycle.

Against this background EIGA has written a newsletter to bring together advice to members to help them focus on water usage and minimisation. Many of the processes used in industrial gas operations use water such as water in the cooling towers for air separation plants, water for cleaning vehicles and equipment, process water for manufacturing dissolved acetylene.

Water Footprint definition

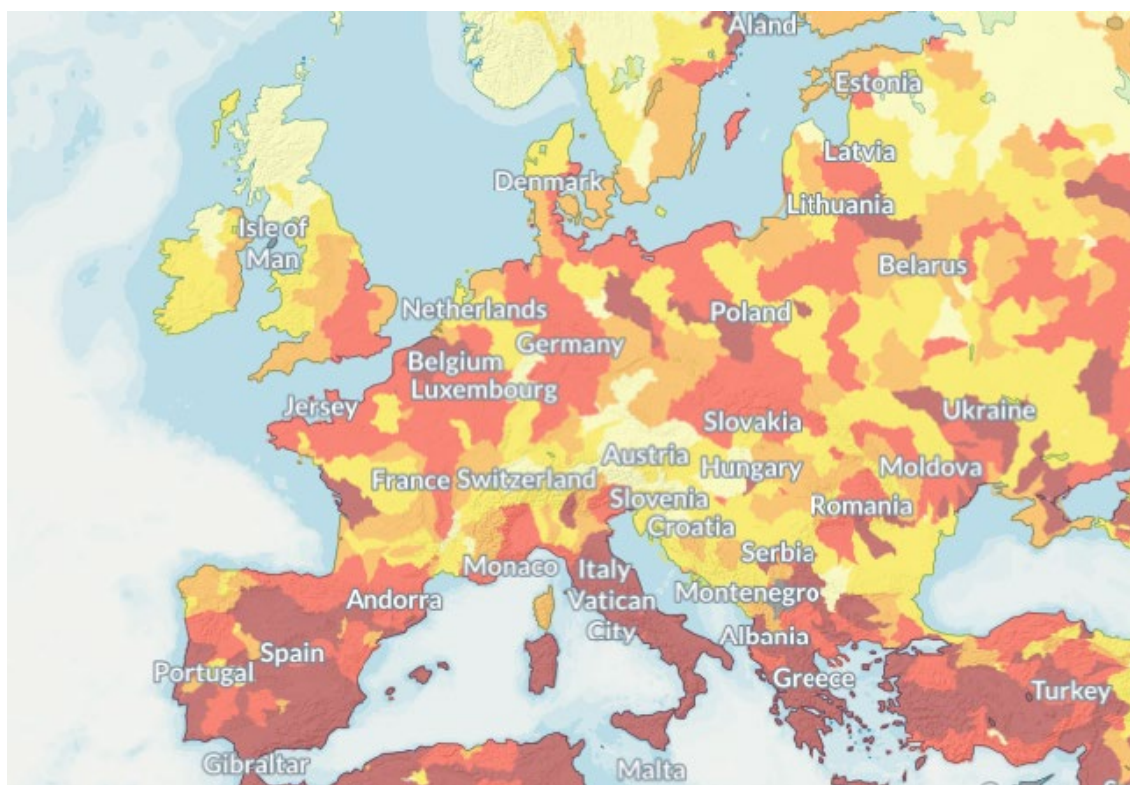
The Water Footprint of a product is the volume of freshwater consumed to produce the product, taking into account the volumes of water consumed and polluted in the different steps of the supply chain. This does not specifically include other ecological impacts. This is not so relevant for industrial gases products (e.g. a cylinder of oxygen etc.) as the products do not contain water.

Water Footprint can also be calculated for organisations, products or sites.

Water abstraction risk assessment is concerned with the local impact of the total volume of water removed from a catchment area. The Carbon Disclosure Project has developed a set of questions as part of their annual water information request which can be used in the development of a Water Footprint and risk assessment.

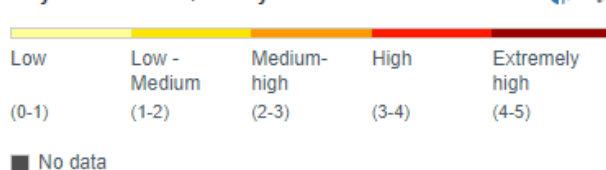
Water stress areas

Many data are now available in order to raise awareness of people on water stress / depletion over the world. The following map is extracted from the Aqueduct project ([Aqueduct | World Resources Institute \(wri.org\)](https://www.wri.org/aqueduct)) in which entities can map water risks such as floods, droughts and stress.

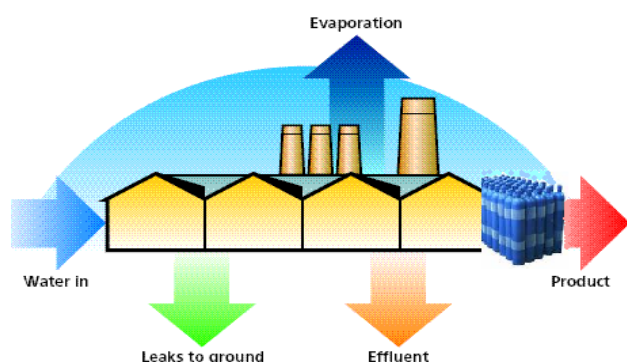


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Physical Risks Quantity

**Water balance:**

In addition to employing good environmental practice sites that use water should also consider developing a water balance for the site to work out how much you use. Such an approach accounts for where water enters and leaves a site, and where it is used within the business. It typically contains information about the amount of water used by each main process and, for some processes, can be very detailed. Presenting a water balance as a diagram makes it easy to understand and use as a management tool. The type of water used on-site and the type of wastewater generated by site operations/activities will determine how much a company pays for water supply and wastewater disposal. Typically water can come from a number of sources and be discharged as waste water in a number of ways.

**Sources:**

“Source” refers to the provider of water for the Facility and “destination” refers to the place where the industrial water that can no longer be used by the Facility is discharged. The source and destination of water identified can be the following one:

- Fresh surface water as a source or a destination: all surface water systems containing low concentration of dissolved salts and other dissolved solids, such as ice sheets, ice caps, glaciers, icebergs, bogs, ponds, lakes, rivers and streams.
- Brackish water as a source or a destination: the surface water in which the concentration of salts is high and far exceeds normally acceptable standards for municipal, domestic or irrigation use (at least higher than 10,000 mg/l TDS). Seawater has a typical concentration of salts above 35,000 mg/l TDS.
- Groundwater as a source or a destination: it is where the water is accumulated beneath the earth's surface in rock and soil pore spaces and in the fractures of rock formations. Groundwater is usually recharged from the surface.
- Municipality water system, as a source or a destination: the source is water coming from an outside network also used to provide water for citizens' uses and the destination is when water is discharged in the sewer used for the discharge of citizens' wastewater as well.
- Third party source or destination: the water coming from an outside network and provided by a third party company (e.g. customer, facilities company) or discharged in a third party company sewer, dedicated to industrial wastewater.
- Rainwater source: the water that has fallen as rain and has been directly collected inside or outside the Facility to be used for an industrial purpose.

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- Water to be reused as:
 - a source: it is when the water has already been used by another Facility or company for its own usage and is then withdrawn instead of being directly discharged into a wastewater treatment station or into the environment;
 - a destination: the water is discharged outside the borders of the Facility to be reused by another facility or company for an industrial or farming purpose (it can be reused by another Facility in the same site).
- Air condensation source: the water obtained by the condensation of air (most of the time during the compression of air), collected and reused for an industrial purpose. This source provides a small amount of water that is most of the time used to fill a closed cooling circuit or other small use.
- Other source or destination: all water sources and water destinations that are not mentioned in the above definitions. The objective is to define all the kinds of sources and destinations, that is why, each situation where this “other” source or destination is completed will be investigated to determine the right family or to create a new one.

Water use:

The water use shall be split in two types because of the means to manage the consumption are not the same:

Water used for cooling

The water is withdrawn outside the Facility, heated, and discharged outside the Facility. several kinds of cooling circuits can be used in industrial operations:

- **Open cooling circuit:** It is also called a “one through” circuit because the withdrawn water circulates once through into the cooling water network and is returned to a destination outside the Facility boundaries. Different cases could be:
 - The Facility uses the water obtained from the "supplier" in a single circuit and returns it to the "supplier". This makes the Facility a "once-through system" with respect to the "supplier".
 - Water is pumped from the environment and used in a single circuit by the Facility before being returned to the environment. This makes the Facility a "once-through system" with respect to the environment.
 - Water is pumped from the environment and is used in a single circuit by the Facility before being returned to the storm water or other system.
 - The Facility uses the water obtained from the "supplier" in a single circuit and returns it to the environment or to the storm water or other system.
- **Semi-open cooling circuit:** This is a cooling circuit where the majority of the cooling is achieved through the evaporation of recirculating cooling water. Also known as an “open evaporative cooling circuit”. This definition also includes “evaporative condensers”.
 - The water circulates permanently through the cooling water network. To keep the capacity to absorb the heat of the process, the water is cooled down again through a cooling tower. To maintain the physico-chemical balance of the water, a blow-down water is discharged.
 - Make-up water compensates for losses caused by evaporation, vesicular entrainment, blowdown discharge and leakages.
- **Closed cooling circuit:** The water circulates permanently through the cooling water network. As it is closed, no losses due to evaporation occur.
 - This kind of circuit does not consume water during normal operation, except in case of leakage. The water is renewed periodically (generally every 2 - 3 years). In that last case, there is a spot high water consumption due to the system filling.
- **Adiabatic cooling circuit:** It is a process of reducing heat through a change in air pressure caused by volume expansion. Adiabatic cooling systems use less water than evaporative cooling systems, they can be one of three types: direct adiabatic cooling, indirect adiabatic cooling or two stage adiabatic cooling.

Water used for a processes

For this usage, the water is withdrawn outside the Facility. Then, the water is used in a process. It can be:

- partially or totally incorporated or transformed as a part of the product. Finally, the part not included in the product is discharged outside the boundaries of the Facility. Thus, a significant part of the water withdrawn for this usage is not discharged and the blowdown generally needs a water treatment before the release into the environment.
- used to heat or cool the process itself.
- used to clean the process installations (to allow production of other products, for maintenance as well).

The following process uses can be defined:

- **Steam generation:** The water is used to generate steam used by the Facility for its own usage (e.g. steam methane reformer, cleaning of process) or to be exported to another Facility.

Even if the steam can be condensed and reused to generate steam again, it is often necessary to discharge some condensates that are the blowdown of the water generation.

- **Water for back-up vaporizer:** The use of water depends on the type of back-up vaporizer. The withdrawn water amount includes hot water circuit systems used to vaporize cryogenic liquids in gases.

The discharged water amount will depend on the kind of vaporizer installed in the plant. Some are in a closed circuit while others are in a one-through configuration.

- **Water used for other productions:**
 - **Hot water production:** This kind of use includes all the use of hot water for an industrial process, excepting the hot water produced for back-up vaporizer.
The discharged water amount will depend on the usage. The water can be completely recovered and recycled within the Facility, completely integrated in the product or discharged after use.
 - **Acetylene production:** Water can be used to produce acetylene by the reaction of calcium carbide with water in special generators (wet hydrolysis). After reaction, the carbide lime is separated from the excess water by decantation and the water recovered should be reused into the production process.
The discharged water amount will depend on the application of this good practice. If the water is discharged, it requires treatments and permission of the local sewage water authorities.
 - **Carbon dioxide (CO₂) production:** Water is mainly used in the concentration phase, if at all. During this process phase, withdrawn water is necessary for the cooling of the process and for scrubbing (a typical concentration process consists of an absorption system that uses any type of amine in water). The water amount used for cooling equipment is reported in the cooling water category.
The process discharged water amount includes the water moisture condensation drained by the compressor and the potential discharge of the scrubber if not managed as a waste. If one of these amounts of water is not specifically measured, it is acceptable to report as cooling water the whole amount discharged from the facility, so that the discharge for the process will be considered at 0. A specific comment is added in the report to explain that the amount has not been split.
 - **Cylinder testing:** The water is used to perform the pressure test of the cylinders in the maintenance shops. This water can be totally or partially recycled before discharging.

How to minimise water use

EIGA has published a number of documents that are a good basis from which to focus on issues related to water use and water minimisation.

- *Guidelines on environmental management systems* [6] includes checklist in the Appendix 4 on how to conduct an initial environmental assessment on the use of water and waste water.

- *Environmental issues guide* [7] section 4.4 Energy and water use covers some of the basic issues on water use.
- The EIGA publication series on environmental impacts for different process and operations (e.g. *Environmental impacts of air separation units* [8]) also covers specific environmental issues related to processes.
- There is also some good guidance in *EIGA publication Good environmental management practices for industrial gas industry* [9]

The table below provides some ideas for best practice for activities that use significant quantities of water by EIGA member companies.

Activity using water	Examples of best practice solutions to minimise water usage and waste water
Boiler Make up water	<ul style="list-style-type: none"> • Avoid excessive chemical feed through tight control of water chemistry. • Run boiler at optimum concentration cycles to minimize chemical loss, wastewater discharges, and makeup water consumption. • Consider using automatic blow down equipment (changing from manual to automatic can reduce boiler energy use by 2 – 5% and reduce blow down losses by up to 20%). • Consider improvements to water quality for feed water to reduce blow down rates.
Cooling tower and systems make up water	<ul style="list-style-type: none"> • Minimize leaks through preventive maintenance (check for excessive drift and splash). • Reduce controlled losses (e.g. look at bleed losses, concentration cycles). • Maintain proper level of corrosion inhibitors to extend life of equipment. • Ensure all float valves are set within operating ranges. • Investigate fitting Variable Speed drive motors to cooling tower fans so that cooling system is better matched to system heat load.
Cooling tower and process boiler -blow down	<ul style="list-style-type: none"> • Run cooling tower/boiler at optimum concentration cycles to minimize chemical loss, wastewater discharges, and makeup water consumption. • Purchase water treatment chemicals in bulk or returnable containers instead of drums, where practical.
Cylinder testing	<ul style="list-style-type: none"> • Recycle cylinder test water to the extent practical. • Discharge through a permitted outfall or sewer connection. • Use of other methodology using less water (Ultrasonic for example)
Vehicle washing	<ul style="list-style-type: none"> • Recycle water to the extent practical. • Use non potable water where practical. • Wash vehicles in wash bays or other designated areas. • Discharge through a permitted outfall or sewer connection. • Other dry way to washing

Action plan for water minimisation

Sites should consider developing a site action plan for water minimisation and would consider the following key points in such a plan.

Step 1: Obtaining commitment and resources

As with any environmental improvement programme, commitment from senior management is vital for success. This should be obtained at an early stage - particularly if you do not have the necessary authority to commit resources to produce a detailed water balance or to investigate and implement water saving opportunities. It may be easier to obtain top-level commitment once you have started to collect information and develop your water balance (step 2) and are in a position to highlight current costs and usage, identify the need for more information and suggest the scope for potential savings; and highlight some 'quick win' opportunities.

Step 2: Preliminary review

A preliminary site review typically consists of:

- 1) Gathering existing data, e.g. annual water use and costs,
- 2) Conducting a brief assessment of the major gaps in information, and,
- 3) Deciding how detailed a water balance is appropriate for your company.

The preliminary review may also involve: estimating potential cost savings from water saving measures; deciding if additional budget is required for obtaining missing information and/or constructing a water balance e.g. installing temporary water meters.

A preliminary review can be conducted relatively quickly by and may involve a walk round your site or building. During the walk round you may take a note pad to make sketches and notes on activities and operations that use water. You may also wish to inform other people what you are doing and ask them for their views on water use and current practices. Your tour of the site and the information you obtain may highlight some 'fast start' projects that will help you to secure top-level commitment.

You may also consider developing a checklist and using the checklist in *Guidelines on environmental management systems* [6]

Step 3: Drawing the water balance picture to identify improvements

In order to start pulling together a detailed picture for the site collect information that already exists within the company. Check whether the information appears accurate and consistent. For example, check the meter readings on your latest water bill and find out when your water meter(s) was last calibrated. Type of data that should be considered is shown in the table below.

Type of data/information	Description
Water supply and treatment costs	Water supply bills, water licence fees, pumping, chemicals, operating and labour costs
Water treatment	System type and capacity
Water and effluent quantities	Meter readings in and out of site, on individual machines/process areas Data on rainfall or groundwater inputs From water treatment reports
Water and effluent quality	Analysis of on-site water treatment and effluent samples (either in-house, by external laboratories or by water company) Equipment specifications from suppliers
Effluent treatment costs	Pumping, chemicals, operating, maintenance and labour costs
Effluent discharge costs	Industrial waste water and sewage bills Charges for discharge to controlled waters
Effluent removed off-site in tankers	Waste disposal contractor's bills for transport, treatment and disposal Quantities and quality off tankered liquids
Site plans	Water distribution and drainage plans, including water sources and location of meters
Details of process or unit or operation	Process flow and pipe/process technical drawings, including manufacturers' specifications

Conclusions

Use of water in stressed catchment areas and water footprint is receiving increasing attention from stakeholders and regulators. Industrial and medical gases companies are large consumers and make use of large quantities of cooling water, which is mainly recycled and reused, with a part of it evaporating. Alternatively, it is returned to the source. The use of water in the products themselves is negligible and not considered in the water footprint.

Nevertheless, we can expect this to be a topic that stakeholders are showing an interest in and EIGA members should be aware of the potential for these issues to impact permits for operations or new plants, especially where plants or operations are in water stressed areas.

References and further information

- [1] Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for the Community action in the field of water policy. <http://eur-lex.europa.eu>. a
- [2] Water for Europe Website; CEFIC / SusChem / A.Spire Innovation for Growth Portal. <http://www.water-europe.eu/Home.aspx>
- [3] CEFIC - Water Quality. <http://www.cefic.org/Policy-Centre/Environment--health/Water/>
CEFIC - Water Innovation Partnership. <http://www.cefic.org/Policy-Centre/Environment--health/Water-Innovation-Partnership/>
- [4] The Carbon Disclosure Project (CDP) has developed a set of questions as part of their annual water information request which can be used in the development of a Water Footprint and risk assessment Carbon Disclosure Project (CDP) website. <https://www.cdp.net>
- [5] World Resources Institute (WRI) website. <http://www.wri.org/>
- [6] Doc 107, *Guidelines on Environmental Management Systems*. European Industrial Gases Association. www.eiga.eu
- [7] Doc 106, *Environmental Issues Guide*. European Industrial Gases Association. www.eiga.eu
- [8] Doc 094, *Environmental Impacts of Air Separation Units*. European Industrial Gases Association. www.eiga.eu
- [9] Doc 088, *Good Environmental Management Practices*. European Industrial Gases Association. www.eiga.eu

Various EIGA documents on environmental impact (ASU, acetylene, CO₂,...)

http://ec.europa.eu/environment/water/pdf/1st_report.pdf

http://ec.europa.eu/environment/water/water-framework/newsletter/index_en.html

Communication for the Commission to the European Parliament and the Council, Addressing the challenge of water scarcity and droughts in the European Union, {SEC(2007) 993}, {SEC(2007) 996}.

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