



ENVIRONMENTAL ISSUES GUIDE

Doc 106/20

Revision of Doc 106/03

EUROPEAN INDUSTRIAL GASES ASSOCIATION AISBL



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ENVIRONMENTAL ISSUES GUIDE

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Amendments to 106/03

Section	Change
	Editorial to align style with IHC associations
3	Definitions added
4.3	New section
4.4.2	New data relating to Industrial Emission Directive
4.4.3	Updated for regulation
4.4.5	New section on F gases
4.5	Update for regulation
4.6	Update for regulation
4.7	Update groundwater section for regulation
4.7.6	New section on spillages
4.7.7	New section on storage of hazardous substances
4.8.2	New section
4.9	Updates for regulation
4.10	New section on waste electronic and electrical equipment
4.11	New section on landfill

NOTE Technical changes from the previous edition are underlined

1 Introduction

This publication provides general guidance on environmental issues common across all industrial gases activities.

2 Scope and purpose

2.1 Scope

This publication provides guidance for operating and technical managers on the European legislation concerning the main environmental issues relevant to the industrial gases Industry. It also provides recommendations on the good practices used to control the impacts and to comply with the legislation. In all cases the relevant national legislation should be consulted for the specific implementation in each country or region.

3 Definitions

For the purpose of this publication, the following definitions apply.

3.1 Publication terminology

3.1.1 Shall

Indicates that the procedure is mandatory. It is used wherever the criterion for conformance to specific recommendations allows no deviation.

3.1.2 Should

Indicates that a procedure is recommended.

3.1.3 May

Indicates that the procedure is optional.

3.1.4 Will

Is used only to indicate the future, not a degree of requirement.

3.1.5 Can

Indicates a possibility or ability.

3.2 Technical definitions

3.2.1 Best Available Technique (BAT)

The most effective and advanced stage in the development of activities and their methods of operation which indicates the practical suitability of particular techniques for providing the basis for emission limit values and other permit conditions designed to prevent and, where that is not practicable, to reduce emissions and the impact on the environment as a whole:

a) 'Techniques' includes both the technology used and the way in which the installation is designed, built, maintained, operated and decommissioned.

b) 'Available techniques' means those developed on a scale which allows implementation in the relevant industrial sector, under economically and technically viable conditions, taking into consideration the costs and advantages, whether or not the techniques are used or produced inside the Member State in question, as long as they are reasonably accessible to the operator.

c) 'Best' means most effective in achieving a high general level of protection of the environment as a whole.

3.2.2 Best Available Technique Reference document (BREF)

A document resulting from the exchange of information organised pursuant to Article 13 of Directive 2010/75/EU, *Industrial Emissions Directive (IED)*, drawn up for defined activities and describing applied techniques, present emissions and consumption levels, techniques considered for the determination of best available techniques as well as BAT conclusions and any emerging techniques, giving special consideration to the criteria listed in Annex III of 2010/75/EU [1].¹

3.2.3 Environmental aspect

Elements of an organisation's activities, products or services that can interact with the environment. For example, use of energy or transportation of products.

3.2.4 Environmental impact

Any change to the environment, whether adverse or beneficial, wholly or partially resulting from an organisation's environmental aspects as per ISO 14001, *Environmental Management Systems – Requirements with Guidance for Use*, [2]. For example, the contamination of water with hazardous substances or the reduction of air emissions.

3.2.5 Electric and Electronic Equipment

Equipment falling under the categories set out in Annex I and further detailed in Annex II and is designed for use with a voltage rating not exceeding 1000 volts for alternating current and 1500 volts for direct current.

3.2.6 Installation

A stationary technical unit within which one or more activities listed in Annex I or in Part 1 of Annex VII of Directive 2012/19/EU on *Waste Electrical and Electronic Equipment (WEEE)*, are carried out, and any other directly associated activities on the same site which have a technical connection with the activities listed in those Annexes and which could have an effect on emissions and pollution [3].

3.2.7 Making available on the market

Supply of a product for distribution, consumption or use on the market of an EU member state in the course of a commercial activity, whether in return for payment or free of charge.

3.2.8 Placing on the market

The first making available of a product on the market within the territory of an EU member state on a professional basis.

3.2.9 Polluting substances

Substances which could cause harm to human health or the environment or nuisance, including noise and heat.

3.2.10 Waste Electrical and Electronic Equipment

Electrical and Electronic Equipment (EEE), which is waste within the meaning of Article 3 of Directive 2012/19/EU including all components, subassemblies and consumables, which are part of the product at the time of discarding [3].

¹ References are shown by bracketed numbers and are listed in order of appearance in the reference section.

4 Environmental impacts relevant to the industrial gases industry

4.1 General environment aspects and impacts and the links to EIGA document

This publication covers the general common environmental issues impacting all industrial gases processes, with the relevant legislation. There are several linked EIGA publications that provide more details on general environmental issues, legislation for the gas industry and operational good environmental practices. A list of these linked publications and their links to ISO 14001 is provided in Appendix 1 [2].

4.2 Background

ISO 14001 clause 4.3.1 states [2]:

The organization needs to establish and maintain a procedure to identify the environmental aspects of its activities, products or services that it can control or over which it can be expected to have an influence, in order to determine those that have or can have significant impacts on the environment.

Section 4 aims to set out the main environmental impacts of the gases industry and look at the broad European legal and best practice requirements for these issues.

There are items of general environmental legislation that impact gas companies. An example includes the voluntary Eco Management and Audit Scheme (EMAS) that stipulates companies put in place an environmental management system and make an environmental statement. The impact of this general legislation is communicated to EIGA members through publications such as the EIGAZette and newsletters.

The main topics of the legislation are:

- emissions to air;
- emissions to water;
- soil and groundwater protection;
- energy and water use;
- noise, see EIGA Doc 85, *Noise Management* [4];
- use of chemicals and hazardous substances;
- waste; and
- use of suppliers and contractors

The regulations apply to both new and existing plant. New plant should be designed to minimise the environmental impact to reduce the use of hazardous substances and to facilitate the de commissioning.

4.3 Environmental liability

On 21st April 2004, the EU adopted Directive 2004/35/CE on environmental liability with regard to the prevention and remediation of environmental damage [5]. Far-ranging provisions on the definition of environmental damage, on the prevention and remediation as well as on the associated expenses and the necessary precautions have been incorporated.

EIGA members are affected by these provisions when producing and transporting products.

The directive required implementation into national law by the EU member states by April 30th April 2007. As on other occasions a locally adapted implementation into national laws is in place and EIGA will continue to monitor developments on the EU level.

4.3.1 Background

This directive applies to damage to protected species and natural habitats, and contamination of water and soil by a list of activities, including the emission, manufacturing, use, storage, filling, disposal and transport of dangerous substances (as defined by Regulation (EC) No 1272/2008 on classification, labelling and packaging of substances and mixtures) [6].

Furthermore, it covers the damage to protected species and natural habitats by any kind of activities.

The directive does not contain any retroactive liability for environmental damage caused before 30th April 2007 nor does it deal with personal injury, damage to private property or financial losses.

The liability stays with the operator. The operator can be prompted by the authorities to avoid imminent damage and is liable to contain damage incurred, and to remedy any damage in order to avoid further damage.

If remedial actions are necessary, they will be decided by the authorities after evaluation of the operator, and in principle, the operator has to bear their cost.

Currently there is no requirement to take out mandatory insurance coverage, but the member states are asked to create appropriate incentives for the development of this type of insurance.

4.3.2 Effects on the industrial gases industry

Gas producers may be affected by the directive on environmental liability as a result of the fact that these activities are under the scope of the directive in the following areas:

- production, storage, filling and in-plant transport of gases underlying regulation (EC) No 1272/2008 – for all gases that are classified as “dangerous” in accordance with this regulation [6]; and
- transport and delivery of gases.

Control procedures already exist in EIGA member companies to prevent pollution from these activities. Plans for an insurance against liability could lead to changes in the insurance field.

Since the directive expressly states that more rigorous local provisions are possible, the implementation in the EU member states can vary considerably.

4.3.3 Actions

When performing the activities mentioned in 4.3.2, EIGA member companies should ensure that:

- all respective legal requirements and relevant directives are complied with during operation of the plant;
- there are any possible negative effects on water, protected species or natural habitats are likely, given the location of the activity; and
- insurance coverage for possible damage is sufficient.

4.4 Emissions to air

4.4.1 Integrated media permits

Emissions to air water or land are usually regulated by specific permit. Some industrial gases installations come under the Industrial emissions directive (IED). This covers the permitting of industrial installations to offer a high level of protection to the environment as a whole. This considers the emissions to all media, air, water and land together as well as the use of energy, water and waste and decommissioning.

4.4.2 Industrial Emissions Directive

4.4.2.1 Overview

On 17th December 2010, the European Commission published Directive 2010/75/EU concerning integrated pollution prevention and control (IPPC), as the basis of a common system of environmental operating permits and supervision by the competent authorities for industrial installations where environmental impacts are considered in an integrated, holistic manner [7].

The IED came into force on 6th January 2011 This new directive replaced the IPPC directive and tightens controls over emissions. It also creates one integrated regime for pollution control by consolidating and replacing the directives on large combustion plants, titanium dioxide, waste incineration and solvent emissions.

All industrial installations, as defined in the chapters of the directive, shall have a permit to operate issued by the relevant competent authorities.

These permits cover emissions to all media (air, land, water) of any polluting substances as well as soil pollution, energy efficiency, waste minimisation, use of raw materials, water use and transportation impacts.

Industry must use Best Available Techniques (BAT) to prevent or minimise pollution and ensure that any emissions are restricted to the environmental medium where they are least damaging. These BATs include economic considerations. The European IPPC bureau in Spain coordinates the production of BAT reference documents (BREFs) that provide a framework for the setting of emission limit values and permit conditions in permits by the member states' competent authorities.

Guidance Emission Limit Values (ELVs) are to be set on the basis of the BATs, but these shall also take into account environmental quality standards in accordance with established European or international standards, depending on the environmental sensitivity of a region.

The first two chapters of the IED apply to all types of installation and therefore include common provisions, for example in areas such as the application of BAT, the processes of permitting and inspections, the primacy and obligations of the regulators, applying general binding rules, monitoring, and links to other laws such as those for waste management and emissions trading schemes. For example, the application of the waste hierarchy prescribed in the Waste Framework Directive 2008/98/EC is now included within the IED [8].

4.4.2.2 Impact of IED on EIGA members

The IED applies to industrial activities giving rise to pollution as referred to in Chapters II to VI [1]. For the industrial gases industry this means that the relevant processes are the manufacture of:

- hydrogen, syngas and carbon monoxide;
- acetylene;
- specialty gases and organometallics;

- nitrous oxide; and
- carbon dioxide.

The directive sets thresholds for some processes, but there is no threshold in the directive for any of the above processes. This means that even small plants (for example hydrogen electrolyzers or small steam methane reformers for fuelling applications) may be included depending on the interpretation of the local authorities.

During the review of the directive, EIGA requested an additional threshold for hydrogen plants, based on the one that exists in the Directive 2003/87/EC *establishing a system for greenhouse gas emission allowance trading* (EU Emissions Trading Directive) [9]. However, this was not included in the revised IED.

A listing of the gas industry processes, the relevant chapters of the IED, BREFs and EIGA documents is shown in Appendix 1.

Air Separation Units (ASUs) are not considered in the scope of the IED, even though inorganic chemicals production is mentioned in the directive chapters, this is because air separation is a physical separation process rather than a chemical process.

The directive defines an installation rather than a process to be permitted. This may be misinterpreted in some member states to include on site utilities such as ASUs.

Cylinder filling and redistribution centres are also not manufacturing processes and are out of the scope of the IED, though in some cases they can lead to emissions and may handle gases that are hazardous to the environment.

These activities are regulated within the member states and subject to local planning and operating licence requirements from the standpoint of safety and community considerations.

The IED now covers cylinder painting or cleaning activities using more than 1 kg/h or 2 tonnes per year of high volatile organic compound (VOC) paints or solvents. Some larger facilities for example tank painting shops and vapour degreasing, may be affected.

4.4.2.3 Suggested actions by EIGA members

EIGA members should:

- monitor the implementation in each country via national gases associations and ensure relevant EIGA documents are also referenced in local legislation and
- ensure relevant site operations have the correct permits in place and are complying consistently with BAT.

For cleaning and painting operations it is advisable to undertake a review to see whether the VOC producing compounds can be eliminated or substituted (for example water-based paints) without compromising safety or health. It is also best practice to control inventories of these compounds to a minimum and have written handling and control procedures. Advice on good practices for these operations can be found in EIGA Doc 88, *Good Environmental Practices for the Industrial Gases Industry* [10].

4.4.3 Use of ozone depleting substances

Several man-made substances have been identified which contribute to the depletion of the earth's ozone layer. These are principally halogenated hydrocarbons and halocarbons and include chlorofluorocarbons (CFCs), hydrochlorofluorocarbons (HCFCs), brominated halocarbons (Halon) and certain chlorinated solvents.

Regulation (EC) No 1005/2009 on substances that deplete the ozone layer implements the Montreal Protocol in Europe [11].

4.4.3.1 The ozone layer

Ozone is present in varying concentrations throughout the atmosphere, but most ozone exists in the stratosphere in a layer a few dozen kilometres above the earth. The low-level ozone, troposphere ozone, affects human health causing headache, respiratory ailments and eye irritations as well as damaging the farm crops. One main cause is the vehicle emissions.

The stratospheric ozone is beneficial since it acts as a filter to harmful ultraviolet radiation (UV-B) from the sun. In 1985 scientists identified a thinning of the ozone layer over Antarctic that nowadays also applies for the major part of the earth.

The cause was identified as Ozone Depleting Substances (ODSs) that are broken down by sunlight producing halogen atoms (chlorine, bromine, etc.) that destroy ozone. The consequences are that UV-B level increases, causing damage to human health, including skin cancer and cataracts as well as biologically affecting the aquatic and terrestrial ecosystems.

4.4.3.2 Scope and effect on EIGA members

The intention is to restrict and phase out the production and use in the EU of the ozone depleting substances and most of the member states and the industry have adopted to this situation. For example, has EIGA issued EIGA Doc 33, *Cleaning of Equipment for Oxygen Service* [12].

The impact on the gas industry is:

- the replacing of fixed fire protection systems and fire extinguishers containing halon;
- from 1st January 2015, the use of all HCFC as refrigerants prohibited;
- used controlled substances shall be recycled or recovered to minimise atmospheric release; and
- servicing of equipment containing controlled substances shall be done by authorised personnel with specific qualifications.

Furthermore, in some European countries there is national legislation using the released amount of ODS as a base for taxation, but this is not included in the directive.

4.4.3.3 Phase out schedule – Production

The production of CFCs, Halons, carbon tetrachloride, 1,1,1-tetrachloride and hydrobromofluorocarbons were prohibited under Regulation (EC) No 3093/94 *on substances that deplete the ozone layer* [13]. The phase out of the HCFC production started in 2000 with a complete production stop due in 2025.

4.4.3.4 Phase out schedule – Placing on the market and use

The placing on the market and use of CFCs, Halons, carbon tetrachloride, 1,1,1-trichloroethane and hydrobromofluorocarbons are prohibited.

At the end of 2009, the use of virgin HCFCs to service and maintain existing equipment was banned. From 1st January 2015, it has been illegal to use any HCFCs to service and maintain refrigeration and air conditioning equipment. Alternative gases should be used to retrofit or replace equipment.

The critical or essential use of controlled substances may continue under a special permit (licence) issued by the competent authority with the conditions that the:

- import of controlled substances requires a licensee; and
- import of controlled substances or products containing them from a state not party to the Montreal protocol is prohibited.

4.4.3.5 Emission control

Used controlled substances shall be recovered for recycling or destruction with approved technology. Controlled substances shall not be sold in disposal containers. All reasonable precautionary measures shall be taken to prevent leakage of controlled substances and users, service technicians, etc. shall meet qualification criteria.

NOTE When phasing out the CFC and HCFC use in refrigeration equipment there are two alternatives, to replace the whole machine or to change the cooling media only. Usually, it is economically feasible to replace the small air conditioning units and cooling machines with new ones not using any controlled substances. In bigger units the media could be changed but be aware of that this also entails rebuilding the machine. The refrigeration equipment and refrigerant suppliers should be consulted. In all cases the work should be risk assessed and carried out to ensure that there is no release of controlled substances.

4.4.3.6 Reporting

Each producer, importer and exporter shall annually report the quantities of controlled substances handled.

4.4.3.7 Minimising emissions

In addition to the European regulation the EIGA recommends minimising of the emissions as set out in this section.

Several substances have been developed as replacements for almost all uses of ODS. For example, CFCs and HCFCs previously used as refrigerants in ASUs can be replaced by other freons (HFCs) with no ozone depleting potential and low global warming potential (GWP), or with propane, ammonia or water.

All users should actively investigate the availability and suitability of these substances and technologies. The following general principles should apply:

- When choosing refrigerant consider the environmental impact including ODS and GWP, the cost, the cooling efficiency, safety and use products with no ODS when appropriate.
- Ensure that technicians repairing and maintaining refrigeration units and air conditioning units are qualified and properly trained to ensure that the ODS emission is minimised and the ODS recovered, recycled or disposed of.
- Make an inventory of all equipment containing ODS, including vehicle air conditioners and establish a leak testing and maintenance program.
- Monitor the consumption and emission of ODS.
- Consider replacing refrigeration and air conditioning units containing CFC or HCFC, alternatively to convert to a substitute refrigerant, especially if the present system requires repair (see above).
- Remove the ODS for proper recycling or disposal before the equipment is scrapped.

NOTE Advice on alternative systems can be found from United Nations Environment Programme (UNEP) [14].

4.4.4 Global warming gases

In July 2002 the EU formally ratified the Kyoto Protocol on reduction of greenhouse gas emissions [15]. This gave further legal impetus to various legal initiatives the EU on the control and reduction of greenhouse gases emissions. The EU has set itself targets for reducing its greenhouse gas emissions progressively up to 2050 and implementing measures include restrictions on the emissions of greenhouse gases, emissions permit trading, and tax incentives / disincentives.

At the Paris climate conference (COP21) in December 2015, 195 countries adopted the first ever universal, legally binding global climate deal, to which the EU is a signatory.

The European initiatives on energy taxation, fluorinated gases and emissions trading have not been agreed by all member states, but several member states have acted to introduce greenhouse gas reductions measures such as taxes, covenants, trading and schemes to encourage alternative energy and energy efficiency measures.

4.4.4.1 Scope and effect on EIGA members

EIGA members are potentially impacted by all these initiatives due to the energy intensity of the air separation process, direct carbon dioxide emissions from steam reforming plants, as well as the filling, distribution and use of carbon dioxide, methane, nitrous oxide, hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), HCFCs and sulphur hexafluoride.

4.4.5 Use of fluorinated gases regulation

Fluorinated gases and gas mixtures are used for many common applications and in a wide variety of products. As part of the first phase of the European Climate Change Programme (ECCP) the EU commission proposed a regulation on fluorinated gases which was adopted in 2006 as Regulation (EC) No 842/2006 on certain fluorinated greenhouse gases [16]. As this is a regulation not a directive, the requirements are directly applicable to member states. The aim of the regulation was to contain, prevent and thereby reduce emissions of fluorinated greenhouse gases covered by the Kyoto Protocol [15].

In December 2013, the EU reached an agreement on a new F-gas Regulation to replace to existing Regulation (EC) No 842/2006 on certain fluorinated greenhouse gases, introducing wider control and a phase down of F gas use [17]. The revised F-gas Regulation (EU) No 517/2014 on fluorinated greenhouse gases, was published in May 2014 [18]. The regulation applies from 1st January 2015, repealing the existing regulation. The regulation sets minimum EU wide standards and is directly applicable to member states. However, member states are free to adopt more ambitious measures going beyond the regulation, for example introduce taxes at the member state level.

The revised regulation includes:

- a reduction in the amount of F-gas in the EU by 79% by 2030;
- further restrictions on the use of F-gas in refrigeration equipment including the recharging during service and maintenance of existing refrigeration equipment with a charge size of over 40 tonnes of CO₂ equivalent and with an HFC GWP of 2500 or more will not be permitted from 2020 onwards; and
- bans certain products based on agreed GWP thresholds. There are no specific bans for industrial refrigeration other than a ban on the use of F-gas with a GWP of 2500 or more from 2020 as outlined in 11a of Annex III. It should be noted, however, that this ban does not apply to equipment designed to cool products to temperatures below –50 °C.

More details are found in EIGA Doc 192, *Fluorinated Gases Management* [19].

4.5 Energy use

Energy efficiency is one of the main targets of the emissions trading schemes such as the Kyoto Protocol and the European Union Emission Trading Scheme for reducing Greenhouse Gas (GHG) emissions.

The burning of fossil fuels to release energy is the major anthropogenic source of GHG. Improvement in energy efficiency can reduce greenhouse gas emissions in two ways:

- energy efficiency measures for combustion systems (for example boilers, furnaces and ovens) to reduce emissions in direct proportion to reduced amount of fuel consumed; and
- reductions in consumption of electricity, lower demand for electricity and, consequently, reduction in emissions from thermal electrical power generating stations.

Reducing energy intensity, not only improves the competitiveness of the economy, it is a very effective way for ensuring reliable energy supplies, reducing greenhouse gas emissions and promoting market development of highly energy efficient technologies. Therefore, energy is a priority issue within the European Union which has developed a common energy and climate policy.

Directive 2012/27/EU on energy efficiency requires [20]:

- member states set an indicative national energy efficiency target in the form they prefer (for example primary / final savings, intensity, consumption) and, from 30th April 2013, notify together with its translation in terms of an absolute level of primary energy consumption and final energy consumption in 2020;
- member states achieve a certain amount of final energy savings over the obligation period January 2014 to December 2020 by using energy efficiency obligations schemes or other targeted policy measures to drive energy efficiency improvements in households, industries and transport sectors;
- large enterprises carry out an energy audit at least every four years, with a first energy audit in 5 December 2015; and
- incentives for Small and Medium Enterprises (SMEs) to undergo energy audits to help them identify the potential for reduced energy consumption.

4.5.1 Scope and impact on the EIGA members

Some aspects to keep in mind about energy optimisation in the gas industry are to operate the plants at optimum efficiency with minimum start up and shutdowns.

4.5.1.1 Energy utilisation

Energy should be viewed as any other valuable raw material resource required for running a business. Energy has costs and environmental impacts and shall to be managed well, in order to increase the business profitability and competitiveness. By enacting energy efficiency measures organisations simultaneously save costs and reduce environmental impacts and risks.

Basis of an energy management system:

One of the most commonly used models for energy management is a plan-do-check-act (PDCA) cycle, which is often known by company management from other contexts but energy. This approach is also in line with the most commonly used management approaches and standards that are relevant to industry. Usually good energy management practices are based on a standard or a specification, for example ISO 9001, *Quality Management Systems – Requirements*, and the related environmental management standard ISO 14001, the EU Eco-Management and Audit Scheme (EMAS) and ISO 50001, *Energy Management* [2, 21, 22]. Features of a successful energy management system to comply with the IED are included in Appendix A.

Successful implementation of energy management requires commitment by company management, conducting an energy audit, analysis and target setting, setting up a monitoring / measuring system, motivating staff and having management reviews. Finally, it is necessary to implement the energy

management system with a corresponding structure throughout the company on a permanent basis to ensure the continuous follow up and improvement of energy efficiency.

Integrating energy management with nearby facilities is another way to improve energy efficiency.

Energy management can be used in all companies because it provides a general approach and structure that offers flexibility to accommodate any specific branch of business. With respect to corporate management, this may be understood as being either the management of the holding company, or of a business unit of a site.

Energy efficiency management:

A key element to deliver energy efficiency at an installation level is a formal management approach. The techniques to achieve management of energy efficiency are applicable to all installations.

Energy management is a useful instrument to improve the efficiency of energy systems both at company and site level. Energy management does not only focus on technical possibilities but also takes into consideration the organisation, the motivation of employees, good practices, cooperation of different departments, and costs. It means structured attention to energy with objectives of continuously reducing energy consumption and improving efficiency in production and utilities and sustaining the achieved improvements. Very often energy management (for example use of renewable or non-renewable resources) is an integral part of an environmental management system or other management system.

Organisations can save energy by applying the same management principles and techniques they use elsewhere in the business for key resources such as raw materials as well as for environment and health and safety. These management practices must include full managerial accountability for energy use. The management of energy consumption and costs eliminates waste and brings in cumulative savings.

4.5.1.2 Suggested actions for EIGA members

The EIGA member companies shall make sure that they:

- comply with all regulatory demands on energy efficiency; and
- consider best practice techniques for improve and manage energy efficiency.

4.6 Water use and minimisation

In October 2000 the Directive 2000/60/EC establishing a framework for the Community action in the field of water policy (Water Framework Directive or WFD) was adopted [23]. 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. There is huge potential for water saving across Europe. Europe continues to waste at least 20% of its water due to inefficiency [24].

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 acetylene.

Most companies and organisations know how much water they use but may not always use this knowledge to help them reduce the amount of water consumed. By using less water, companies save money on both water supply and wastewater disposal and minimise their impact on the environment. Taking action to save water may also allow companies to recover raw materials or product previously lost in effluent streams.

4.6.1 How to minimise water

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:

- EIGA Doc 107, *Guidelines on Environmental Management Systems*, includes checklist in the Appendix 4 on how to conduct an initial environmental assessment on the use of water and wastewater [25];
- EIGA Doc 106, *Environmental issues guide*, Section 4.4, Energy and water use covers some of the basic issues on water use [26];
- EIGA publication series on environmental impacts for different processes and operations, for example EIGA Doc 94, *Environmental Impacts of Air Separation Units*, covers specific environmental issues related to processes [27]; and
- EIGA Doc 88, *Good Environmental Management Practices for Industrial Gas Industry* [10].

The Table 1 provides some ideas for best practice for activities that use significant quantities of water by EIGA member companies.

Table 1 Example best practices to minimise water usage

Activity using water	Examples of best practice solutions to minimise water usage and wastewater
Boiler make-up water	• Avoid excessive chemical feed through tight control of water chemistry • Run boiler at optimum concentration cycles to minimise 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	• Minimise leaks through preventive maintenance (check for excessive drift and splash) • Reduce controlled losses (for example 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	• Run cooling tower / boiler at optimum concentration cycles to minimise chemical loss, wastewater discharges, and make-up water consumption • Purchase water treatment chemicals in bulk or returnable containers instead of drums, where practical
Cylinder testing	• Recycle cylinder test water to the extent practical • Discharge through a permitted outfall or sewer connection
Vehicle washing	• 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

4.6.2 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.