Pollution inventory reporting - chemicals guidance note

Environmental Permitting (England and Wales) Regulations 2010

Regulation 60(1)

LIT 7671 - 1217_10

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1. Introduction

If we regulate your activity as an A1 installation under the Environmental Permitting (England and Wales) Regulations 2010 (EPR) you will need to submit data to the Pollution Inventory.

You need to report each year. The system opens for reporting on 1 January and the deadline for submitting is 28 February.

Our general guidance sets out to report and provides information applicable to all business and industries.

In this guidance you will find helpful information specific to the chemical sector.

If your operations include waste incineration or combustion, please see also the specific guidance applicable to these sectors.

You can find additional information on the web:

Pollution Inventory Guidance and glossary: www.environment-agency.gov.uk/pi

REPI: http://www.environment-agency.gov.uk/business/topics/pollution/32272.aspx

2. Emissions to air

2.1. Relevant pollutants

Table 1 shows the main air emissions for the chemicals sector. Use this as a guide only and check for other pollutants emitted from your process.

Table 1 - Relevant air pollutants emitted by the chemicals sector

Ammonia	Ethylene dichloride (1,2-dichloroethane)	Nitrogen dioxide (Nitrogen oxides – NO & NO_2 as NO_2)
Anthracene	Ethylene oxide	Nitrous oxide
Arsenic	Fluorine & inorganic compounds as HF	Non-methane volatile organic compounds
Benzene	Formaldehyde	Particulate matter (including PM_{10})
1,3-Butadiene	Halons	Pentachlorobenzene
Cadmium	Hexabromobiphenyl	Pentachlorophenol
Carbon dioxide	Hexachlorobenzene	Perfluorocarbons
Carbon monoxide	Hydrochlorofluorocarbons	Polychlorinated biphenyls

Carbon tetrachloride	Hydrofluorocarbons	Polycyclic aromatic hydrocarbons
Chlorine & inorganic compounds as HCl	Hydrogen chloride	Sulphur hexafluoride
Chlorofluorocarbons	Hydrogen cyanide	Sulphur oxides -SO_2 & SO_3 as SO_2
Chloroform	Lead	Tetrachloroethane
Chromium	Mercury	Tetrachloroethylene
Copper	Methane	Trichlorobenzene
Dichloromethane (methylene chloride)	Methyl chloroform (trichloroethane)	Trichloroethylene
Di-(2-ethyl hexyl) phthalate	Naphthalene	Vinyl chloride
Dioxins & furans	Nickel	Zinc

2.2. Emission sources

2.2.1. Point source emissions

These emissions are exhausted via a stack or vent, that is, a single point source into the atmosphere. Abatement equipment, for example, scrubbing units, fabric filters (bag house) can be incorporated into the exhaust system prior to discharge to atmosphere.

2.2.2. Fugitive emissions

Fugitive emissions are those that are not released from a point source such as a stack.

In some chemical production activities fugitive, or diffuse, emissions may be more significant than point source emissions. Fugitive VOC emissions are often a very significant factor in emissions to air from large volume organic chemicals (LVOC) installations. Some examples of the potential sources of fugitive emissions to air are:

• the loading and unloading of materials into transport containers
• storage areas (for example, bays, stockpiles, and so forth)
• transferring material between vessels
• conveyor systems
• pipework and ductwork systems (for example, pumps, valves, flanges, equipment vents)
• accidental loss of containment from failed plant and equipment
• poor building containment and extraction

2.2.3. Emission factors, feedstock analysis and process stream data

The use of emission factors is described in the general guidance note. In some cases relevant to the chemical industry, and particularly in the case of SO_2, the emission factor is based on feedstock analysis data.

The use of feedstock analysis and process stream data to determine emissions is similar to the use of emission factors.

The basic equation used in feedstock analysis emission calculations is:

(1) $E = Q_f$ x [Op hours] x [PC_f/100] x (MM_p / EM_f)

Where:

E	= emission of pollutant, kg/yr
Q_f	= feedstock use (kg/hr)
PC_f	= pollutant concentration in the feedstock (%)
Op hrs	= operating hours per year, hr/yr
MM_p	= molar mass of pollutant as emitted after combustion
EM_f	= relative atomic mass of polluting element as present in feedstock

Equation 1 is the method usually used for calculating SO_2 emissions where it is normally assumed that all of the sulphur in the feedstock is converted to SO_2.

Where the pollutant concentration in the feedstock is consistent over the averaging period (that is, one year), equation 1 can be written as:

(2) $E = M$ x [PC_f/100] x (MM_p / EM_f)

Where:

E	= emission rate of pollutant in kg/yr
M	= mass of feedstock burnt in one year (kg/yr)
PC_f	= pollutant concentration in the feedstock (%)
MM_p	= molar mass of pollutant as emitted after combustion
EM_f	= relative atomic mass of polluting element as present in feedstock

Example: SO_2 emissions calculated from oil combustion, based on fuel analysis results and fuel flow information. It is assumed that the facility operates burning waste oil for 1500 hours per year and that abatement of SO_2 does not occur.

Q_f = 2000 kg/hr

PC_f = 1.17%

MM_p = 64

EM_f = 32

Op hours   = 1500 hr/yr

E $= Q_f \times PC_f \times (MW_p / EW_f) \times$ [Op hours]

$= [(2000) \times (1.17 / 100) \times (64/32) \times 1500]$ kg/yr

$= \textbf{7.0 x 104 kg/year}$

You can also use equation 1 for volatile elements such as fluorine and chlorine as well as trace metallic pollutants, although some of these latter species are retained in the plant, either in the ash or in abatement equipment. You should apply appropriate retention factors.

When using equation 1 or equation 2, you should be aware that the amounts of pollutants present in the feedstock or process stream can vary significantly.

3. Emissions to water

Emissions of substances to water can be either direct to controlled waters or indirect, following transfer to off-site effluent treatment plant. Find guidance on what constitutes an emission or a transfer in the general PI guidance document.

3.1. Relevant pollutants and emission sources

Water discharges from chemical processes arise from the air abatement equipment (for example, wet scrubbers), storm water, cooling water, boiler blow-down, raw material handling areas, accidental emissions of raw materials, products or waste materials, fire fighting and from on-site effluent treatment. See table 2 for a list of key water emissions for the chemicals sector. Use these as a guide only and check for other pollutants emitted from your process.

Table 2 - Water pollutants emitted by the chemicals sector

Alachlor	Diuron	Phenols
Anthracene	Ethyl benzene	Phosphorus (total)
Arsenic	Ethylene oxide	Polychlorinated biphenyls
Asbestos	Fluorides as total F	Polycyclic aromatic hydrocarbons
Atrazine	Halogenated organic compounds	Simazine
Benzene	Hexabromobiphenyl	Tetrachloroethylene
Benzo(g,h,i)perylene	Hexachlorobenzene	Tetrachloromethane
Brominated diphenylethers	Hexachlorobutadiene	Toluene
Cadmium	Lead	Tributyltin
Chlorides as total Cl	Mercury	Trichlorobenzenes
Chloropyrifos	Naphthalene	Trichloroethylene
Chromium	Nickel	Trichloromethane (Chloroform)
Copper	Nitrogen (total)	Trifluralin
Cyanides as total CN	Nonylphenols & ethoxylates	Triphenyltin

Dichloromethane	Octylphenols & ethoxylates	Vinyl chloride
Ethylene dichloride (1,2-dichloroethane)	Organotin compounds	Xylenes
Di-(2-ethyl hexyl) phthalate	Pentachlorobenzene	Zinc
Dioxins and furans	Pentachlorophenol	

The resulting discharge of the above substances depends on the 'in process' preventative measures (good housekeeping, re-use) and the presence and technical standards of waste water treatment facilities.

4. Off-site waste transfers

Wastes must be classified by the European Waste Catalogue (EWC) 6-digit code(s) and by the relevant Waste Framework Directive disposal or recovery code(s) (D&R).

There is no reporting threshold for hazardous wastes, which are indicated by an asterisk in the EWC. For all other EWC/D&R code combinations, a reporting threshold of 5 tonnes applies.

Any transfer of waste off-site to a third party is covered by the Duty of Care provisions of the Environmental Protection Act 1990. This includes the requirement to describe the waste and record the quantity. You should use data generated in compliance with Duty of Care requirements to complete the PI return.

4.1. Relevant wastes

In general the waste streams from chemical facilities can be classified into types as follows:

- By-products for which no internal use or external sale is available
- Residues from separation processes such as distillation
- Catalysts which have declined in performance and require replacement
- Filter cake, activated carbon, ion exchange resins, molecular sieves and other treatment materials
- Sludges from waste water treatment
- Emptied containers and packaging
- Maintenance and construction materials

The key substances likely to be present can be derived from knowledge of the process, materials of construction, corrosion/erosion mechanisms and materials related to maintenance. The presence of substances created by abnormal operation should be identified.

4.2. Quantification of emissions

You should not report wastes that are temporarily stored on site by yourself, as these are not classed as off-site waste transfers for the PI return. However, waste transferred to third parties (even if stored on your site), should be reported.

Appendix A Normalisation of emission concentrations

In many cases, pollutant emission concentrations to air are reported as normalised concentrations, the actual measured emission concentration having been adjusted to a normalised temperature (273K), oxygen, pressure and/or water vapour concentration. In calculating mass emissions to air, it is important that either the actual release concentration is multiplied by the actual volumetric flowrate, or the normalised concentration is multiplied by the normalised volumetric flowrate

The following equations can be used to correct measured concentrations and flowrates for temperature, oxygen, pressure and water vapour content.

Concentrations

To correct for moisture concentration to dry (0% oxygen)

$$C_d = C_m \times (100/(100 - \%H_2O))$$

Where: C_d is the dry concentration
C_m is the measured concentration
$\%H_2O$ is the measured water vapour percentage

To correct the % oxygen to dry basis (if required – may already be measured dry)

$$O_{2(dry)} = O_2m \times (100/(100 - \%H_2O))$$

Where: $O_2(dry)$ is the dry oxygen percentage
O_{2m} is the measured oxygen percentage

To correct to normalised oxygen concentration

$$C_{corr} = C_d \times (20.9 - O2_{norm})/(20.9 - O_{2(dry)})$$

Where: C_{corr} is the corrected concentration for oxygen concentration
O_{2norm} is the stated normalised oxygen percentage

To correct for temperature

$$C_{normT} = C_{corr} \times ((273 + T_m)/273)$$

Where: C_{normT} is the normalised concentration for temperature
T_m is the measured temperature in degrees centigrade
To correct for pressure

$$C_{norm} = C_{normT} \times (101.3/P_m)$$

Where: C_{norm} is the normalised concentration
P_m is the measured pressure in kPa

Volumetric flowrates

To correct for moisture concentration to dry (0% oxygen)

$$Q_d = Q_m \times ((100 - \%H_2O))/100)$$

Where: Q_d is the dry volumetric flowrate
Q_m is the measured volumetric flowrate
$\%H_2O$ is the measured water vapour percentage

To correct the % oxygen to dry basis (if required – may already be measured dry)

$$O_2(dry) = O_{2m} \times (100/(100 - \%H_2O))$$

Where: $O_2(dry)$ is the dry oxygen percentage

O_{2m} is the measured oxygen percentage

To correct to normalised oxygen concentration

$$Q_{corr} = Q_d \times (20.9 - O_{2(dry)})/(20.9 - O_{2norm})$$

Where: Q_{corr} is the corrected volumetric flowrate for oxygen concentration
O_{2norm} is the stated normalised oxygen percentage

To correct for temperature

$$Q_{normT} = Q_{corr} \times (273/(273 + T_m))$$

Where: Q_{normT} is the normalised volumetric flowrate for temperature
T_m is the measured temperature in degrees centigrade

To correct for pressure

$$C_{norm} = C_{normT} \times (P_m /101.3)$$

Where: C_{norm} is the normalised volumetric flowrate
P_m is the measured pressure in kPa

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