



# Pollution inventory reporting – chemical treatment of waste, including oil guidance note

Environmental Permitting (England and Wales) Regulations 2010  
Regulation 60(1)

Version 4 December 2012

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# 1. Introduction

If we regulate your activity as an A(1) 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 2013 and the deadline for submitting is 28 February 2013.

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

In this guidance you will find helpful information specific to the chemical treatment of waste including oil.

You can find additional information on the website: [www.environment-agency.gov.uk/pi](http://www.environment-agency.gov.uk/pi)

The PI General Guidance explains how to complete the reporting form. Note that where there are no emissions you should report a substance as 'n/a' (not applicable), or where there are emissions below the specified reporting threshold you should report a substance as 'brt'. You need to report the total annual emissions of other substances emitted.

This document will help you to identify the PI substances relevant to your operation and estimate the annual mass of such substances released to air, sewer and controlled waters. The guidance is based around unit operations likely to take place at facilities falling under Section 5.3 - Part A(1)(a), Part A(1)(b), Part A(1)(c)(ii) or Section 5.4 - Part A(1)(a), Part A(1)(b), Part A(1)(c) of Schedule 1 of the EPR.

## 2. Description of chemical treatment operational activities

This guidance applies primarily to chemical treatment plants with a core neutralisation process. The major sources of potential emissions are listed below. Chemical treatment processes cover a wide range of unit operations and a wide range of wastes.

### 2.1. Composition of wastes

Treatment plants undertake analysis of incoming waste to check suitability for processing. The core waste streams are inorganic acids and alkalis and their rinse waters, together with cleaning, washing and interceptor wastes from a range of processes.

Inorganic species are neutralised and precipitated through the main process. Organic species may travel through the plant into the final sludge or effluent, or be evaporated during the exothermic reactions of neutralisation or during sludge pressing. Certain organic wastes contain 'hidden' species relevant to the PI. For example, lubricating oils contain naphthalene, benzene, toluene, ethylbenzene, xylene, phenols, copper and nitrogen and these can lead to ammonia and xylene emissions to atmosphere during separation from water, or increased levels in the final site effluent.

Sites need to undertake a scoping study to identify materials on the PI list that are not covered by their effluent monitoring programme, but are accepted at the site. The main areas to consider are:

- Aqueous wastes containing solvents that may be emitted owing to the heat of the process.
- High-nitrogen wastes with a potential for ammonia emissions to atmosphere.

- Phosphorus containing wastes: not all sites are required to monitor regularly for total phosphorus and in such cases it may be easier to make an estimate of emissions from intake of phosphoric acid.
- Occasional inorganic wastes: arsenic bearing wastes for example. Again, it is easier to calculate annual emissions from occasional waste intake data than to extend the monitoring programme.

The key sources of emissions you need to consider are listed below with more detailed methods of quantifying in the following sections.

## 2.2. Delivery, storage and transfer of materials

All plants accept waste by tanker, truck, pipeline or ship and generally store the waste prior to treatment either in small containers or tanks.

In many cases fugitive emissions can result from transfer operations between processes, (especially in non-pumped systems), leaks from containers and at pressure/vacuum relief valves.

Washing of containers and vehicles occurs at many sites.

Most liquid emissions are held on the site base and drain back into the process. Atmospheric emissions can occur as well, primarily from VOCs, acids or ammonia wastes.

## 2.3. pH adjustment/ neutralisation

In this process there can be a violent exothermic reaction with a rapid change in pH. Substances such as  $\text{CO}_2$ ,  $\text{HCl}$ ,  $\text{NO}_x$ , and  $\text{SO}_x$  are emitted from the reactor tank, together with any contaminant volatile materials, such as cleaning solvents in washwaters. The gases will carry liquors and particles with them. In general, these reaction tanks are fitted with alkaline scrubber units and most of the acid gases will be returned to the process along with some of the VOCs and almost all the particles and liquors.

Small adjustment of pH is a regular part of many chemical processes, or a tweak to the final effluent, and all intermediates should be retained in the solution with no significant discharges to atmosphere.

## 2.4. Pre-treatment

There is a huge range of processes available. Common ones are the oxidation of cyanides, the reduction of hexavalent chromium solutions, stripping of solvents from aqueous solutions and gravity separation of soluble oils and oil/water mixtures.

The aqueous fraction after pre-treatment goes into the main neutralisation process.

There may be atmospheric emissions as well. These operations may have their own atmospheric emission control systems, be covered by the main plant system or discharge to atmosphere. In general, pre-treatment systems for very hazardous wastes have their own abatement systems.

Areas that may have less stringent abatement systems and lead to emissions are ammonia emissions from acid cracking of oils, general VOCs from oil separation and problems with replacement of filters.

## 2.5. Evaporation

Evaporation is usually carried out in fully enclosed systems but various vent valves can result in fugitive emissions. Plant should be well regulated and should be in satisfactory condition.

Evaporation also occurs in an uncontrolled manner, such as the evaporation of solvents from mixing solids and liquids or the stirring of sludges in open tanks.

## 2.6. Solvent extraction

There is a significant potential for emissions on transfer and in the case of emergency releases. Again this should normally be well operated and regulated and many systems return the extraction solvent for reuse in a closed loop. Once the streams are separated, consider how the supernatant is decanted/separated for subsequent transfer and the discharge of contaminated product.

## 2.7. Settlement

There are no significant issues with settlement or sedimentation. Emissions to atmosphere are possible but unlikely owing to the quiescence necessary for effective performance. This is a concentration process so the design of the tanks and residence time will affect the particle size distribution of the final sludge and hence the distribution of PI substances between sludge and the supernatant.

## 2.8. Filtration/pressing

This is a common area for emissions from a chemical plant. The air space above some presses is attached to the main abatement system at the plant, but not in all sites. The need to maintain the presses and remove cake/sludge means that the doors are open on a regular basis, making it hard to avoid emissions. Ammonia is the most likely species to be emitted to the atmosphere, together with residual VOCs if there is a high organic content in the waste streams.

### 3. Emissions relevant to your site

The emissions listed below are expected to occur from most treatment plants but the scale of the emission depends on waste throughput and abatement systems. These are the key substances you need to consider for reporting to the PI.

#### Priority substances from chemical treatment works to be reported to the PI

Activity	Air emissions	Water and sewer emissions
Neutralisation	HCl, chlorine, NO <sub>x</sub> , SO <sub>x</sub> , ammonia	chloride, phosphorus, nitrogen, metals
Air stripping (designed or in association with general agitation and heating at the plant)	ammonia, VOCs including organic solvents such as methylene chloride	
Sludge pressing	ammonia, VOCs	
Sludge blending	particles, VOCs (particularly if this is an exothermic system)	
Other materials passing through the plant		TOC, methylene chloride, phenol, benzene, toluene, xylene, ethylbenzene, naphthalene

Unless you are handling biocide contaminated wastes it is unlikely that the following substances will be emitted so these substances will be reported as 'n/a' for all relevant media unless you know better for your site.

Aldrin	Endosulfan	Pentachlorophenol
Atrazine	Endrin	Simazine
Brominated diphenylethers	Hexachlorobenzene	Tributyltin compounds
DDT	Hexachlorocyclohexanes	Trifluralin
Dichlorvos	Nonylphenols	
Dieldrin	PCBs	

## 4. Quantifying emissions to air

**Priority substances: VOCs, ammonia, strong acids, particles, NO<sub>x</sub>, SO<sub>x</sub>**

Most sites have some abatement equipment to control atmospheric emissions. This varies from extensive systems covering all reaction tanks, storage tanks and sludge pressing areas, to more limited systems covering the main reaction tank alone. The actual atmospheric emissions from individual plants will depend on the abatement system. Very few plants have monitoring programmes in place that can quantify their emissions.

Most of the atmospheric emissions are associated with the transfer and bulking of VOCs and these are the key emissions to quantify. Other waste streams that are known to contribute to emissions are ammonia wastes, strong acid wastes and powders or dusty wastes. There are a number of equations available to calculate emissions from different processes. You can find these in the 'Pollution inventory reporting – guidance for operators of waste transfer stations' document on the [sector specific guidance webpage](#). It covers the following operations:

- filling of bulk storage tanks by road tanker
- gravity and vacuum emptying of drums, IBCs and other containers to bulk tanks
- storage and handling of empty IBCs, drums and smaller units

## 5. Quantifying emissions to water

**Priority substances: chloride, phosphorus, nitrogen, metals**

Most sites are on a totally enclosed base with all liquids entering or generated on the site (including rainfall) returned to the process. Liquid effluent generally goes to sewer. Almost all sites have a complex set of conditions relating to this discharge that regulate sampling and monitoring frequency and both the maximum concentration allowed for different species in the effluent and a maximum daily, weekly or monthly quantity of different species. This requires flow proportional monitoring, or the monitoring of each batch before discharge of a set volume. Either system provides the data to calculate annual emissions to the PI for a number of the main species. The problems in scoping emissions to water are restricted to those species that are known to exist, but for which there is no monitoring data, and unexpected species that arrive with particular waste streams. Refer to section 2.1 – composition of wastes.

## 6. Emissions from other processes

Guidance in this document relates to a 'standard' waste management facility undertaking a single operation with limited waste streams. Many sites undertake a range of activities, and process a wide variety of wastes.

Consider whether you are undertaking additional operations or processing waste types that will add to emissions. Some of these might be:

- Biological treatment system prior to discharge to controlled waters to reduce COD, but which emits carbon dioxide to atmosphere.
- Sludge mixing operations without abatement equipment leading to high VOC emissions. Can a mass balance be used to estimate this loss?
- Emissions associated with an ancillary transfer station operation see 'Pollution inventory reporting – guidance for operators of waste transfer stations' document on the [sector specific guidance webpage](#) for help with these.
- On-site combustion processes resulting in emissions of CO<sub>2</sub>, SO<sub>2</sub>, NO<sub>x</sub>, VOC, CO, PM<sub>10</sub> and PAHs. Emissions can be estimated by multiplying annual fuel use by appropriate emission factors such as those in the table below:

### Combustion emission factors (kg/tonne fuel, unless otherwise specified)

	CO <sub>2</sub>	SO <sub>x</sub>	NO <sub>x</sub>	NMVOC	CO	PM <sub>10</sub>	PAH
<b>Residual fuel oil</b>	3112	47.4	7.54	0.125	0.5	2.85	0.15 (g/te fuel)
<b>Distillate (gas) oils</b>	3142	3.6	3.46	0.0875	0.06	0.2	0.15 (g/te fuel)
<b>Diesel</b>	3142	0.8	48.8	7.075	15.8	2.83	4.07 (g/te fuel)

## 7. Waste

Report off-site waste transfers as set out in the PI general guidance document available on our PI web pages ([www.environment-agency.gov.uk/pi](http://www.environment-agency.gov.uk/pi)).

## 8. Special issues for oil recovery operations

The emissions listed in the table below are expected to occur in any plant processing waste lubricating oils or oil/water mixtures by physical processes such as filtering, settlement and heat treatment to separate oil, water and solids. The species come from three main sources: original components of the oil, products from the breakdown of the oil in use and residues from oil additives.

**Expected emissions from oil processing to be reported to the Pollution Inventory**

<b>Species</b>	<b>Likely to be emitted to air?</b>	<b>Likely to be emitted to sewer?</b>
Benzene	Yes	Yes
Ethylbenzene	Not explicitly required	Yes
Toluene	Not explicitly required	Yes
Xylenes	Yes	Yes
Other NMVOCs	Yes	Not required
Phenols	Not expected in atmospheric emission: too soluble in oil and water	Yes
PAHs	Not generally expected in atmospheric emissions, but possible from processing operations producing a fine mist of oil	Yes
Arsenic	No	Yes
Cadmium	No	Yes
Chromium	No	Yes
Copper	No	Yes
Lead	No	Yes
Nickel	No	Yes
Zinc	No	Yes
Total nitrogen	Not required	Yes
Total phosphorus	Not required	Yes
TOC	Not required	Yes
Chloride	Not required	Yes

**Quantifying emissions to air and water**

Plants processing only soluble oils or heating oils will also have a different range of emissions, but most sites take a proportion of lubricating oils.

Plants undertaking acid treatment of soluble oils to break the emulsion may produce ammonia discharges to atmosphere as well, but almost certainly below reporting threshold (brt).

Plants undertaking distillation processes of specific oils for reuse, such as transformer oils, will not produce this range of emissions and will need to make an estimation based on their specific operation.

Many sites will have monitoring data for discharges of some of the metal species, COD, nitrogen, chloride and phenol to sewer. Fewer sites undertake a wider range of water monitoring or atmospheric emission monitoring.

You can use our Excel computer model to estimate these emissions from basic information about intake tonnage of different types of oil waste, and the quantity and oil content of discharges to sewer and landfill. Download from the [sector specific guidance webpage](#) under 'Waste treatment, transfer and storage'. You may use the model in the absence of site-specific data to help you make your PI declaration. We know this model is crude and that it will overestimate VOC emissions for sites with atmospheric control systems in place.

### **Other emissions**

This guidance relates to a 'standard' oil recovery operation with limited waste streams. Many sites undertake a range of activities and process a wide variety of wastes. You need to check if you are doing additional operations or processing waste types that will add to emissions such as:

- Biological treatment system prior to discharge to controlled waters to reduce COD, but which emits carbon dioxide to atmosphere.
- Use of separation facilities for physical treatment or blending with other wastes with, for example, a high COD, metal or nitrogen content. These will provide additional discharges of reportable substances to sewer. This could be estimated from intake concentrations and volumes, or by analysis of the sewer discharge.
- Air stripping columns for high ammonia waste: discharge of ammonia to atmosphere to be calculated by mass balance.
- Processing of ancillary garage wastes such as degreasing wipes, giving additional VOC emissions to atmosphere.
- Industrial oils with a known solvent content, or chemical contamination. Is it on the PI list? Estimate the likely emissions from processing.
- Combustion derived emissions: see Section 6

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