



Pollution inventory reporting - guidance for operators of waste transfer stations

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

Version 5 December 2012

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Contents

1. Introduction	4
2. Description of operational activities	4
2.1 Transfer stations without bulking or processing activities	4
2.2 Sites undertaking bulking and storage	4
2.3 Sites associated with adjacent treatment or recycling plant	5
2.4 Other activities	5
3. What emissions are relevant to your site?	6
Identifying the important waste streams	7
4. Quantifying emissions to air	9
Priority substances: VOCs, ammonia, strong acids, particulate matter	9
4.1 Filling of bulk storage tanks by road tanker	9
4.2 Gravity and vacuum emptying of drums, IBCs and other containers to bulk tanks	9
4.3 Storage and handling of empty IBCs, drums and smaller units	10
5. Quantifying emissions to water	11
Priority substances: TOC, N, P, Cl, Zn, xylene and possibly toluene, Cu and Ni	11
5.1 Emissions for washing containers and tanks	11
5.2 General emissions from fugitive leaks and spills	11
6. Emissions from other processes	11
7. Waste	12
Annex 1 - Worked example of air emissions from filling bulk storage tanks with no abatement equipment in place	13
Annex 2 - Worked example PI declaration from a waste transfer station	13

1. Introduction

If we regulate your activity as a Part 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 and the deadline for submitting is 28 February.

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 waste transfer stations.

You can find additional information on the website: 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 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) and Part A(1)(b) of Schedule 1 of the Environmental Permitting Regulations (EPR) and **primarily involving hazardous waste disposal**.

2. Description of operational activities

2.1 Transfer stations without bulking or processing activities

Site activities: Acceptance of mixed items, and repackaging of these into larger containers for onward shipment without decanting the waste.

Likely source of emission: Main emissions are restricted to accidental breakage of waste containers and emissions associated with any fuel used at the site.

2.2 Sites undertaking bulking and storage

Site activities: Acceptance of mixed items, transfer of material with similar properties into bulk containers for onward disposal, and disposal of original containers to landfill or recycling.

The bulk containers may be drums, intermediate bulk containers (IBCs) or tanks and there may be several types of bulking and storage activity: laboratory smalls to drums; drums to IBCs; tanker loads to storage tanks.

Likely source of emission: There is a large range of emissions from this type of site. In addition to accidental damage and emissions from fuel use at the site, each transfer of waste, and processing of the original

container, can generate liquid and vapour emissions.

All transfers of material give rise to small discharges. These may be small spills and splashes from manual decanting; releases from pipe couplings and valves; residues from washing tankers and containers or displacement of air rich in solvent vapours when filling and emptying tanks and tankers.

The wide range of possible emissions to air, sewer and controlled waters has to be estimated in relation to the range of activities and wastes handled at a particular site.

There are abatement systems available to control most of these emissions, but these are not used consistently across the UK. Individual plants need to assess the effectiveness of their own abatement systems.

2.3 Sites associated with adjacent treatment or recycling plant

Site activities: Sites adjacent to a treatment or recovery plant may separate and perhaps decant wastes suitable for treatment in that plant and bulk other wastes for disposal elsewhere.

Likely source of emission: The same range of emissions as previously described is possible, but it is common for the entire drainage system at the transfer station to be linked to the adjacent treatment plant. No emissions to sewer or controlled water take place from the transfer station itself under these circumstances, though emissions from any on-site treatment plant are reported as part of the total site emissions.

Similarly, some atmospheric emission control systems for the main treatment plant may be extended to cover storage units at the transfer station and the emissions from this element of the storage are reported as part of the total site emissions.

2.4 Other activities

Site activities: Some transfer stations undertake additional treatment operations, usually physical processes, on a portion of the waste stream. These might be solid/liquid separation, oil/water separation or waste conditioning processes.

Type of emission: Each of these will generate specific emissions and each needs to be assessed, but these are not covered in the following discussion. An independent assessment is required.

3. What emissions are relevant to your site?

The following substances are the most likely to be released in significant amounts from waste transfer stations. References to sampling methods are included in the PI general guidance mentioned earlier.

Air	VOCs, ammonia, hydrogen chloride, particulate matter
Water	Total organic carbon (TOC), nitrogen, phosphorus, chlorides, zinc, xylene and possibly toluene, copper and nickel

Unless you are handling biocide contaminated wastes it is unlikely that the following substances will be emitted. You will report these substances 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	

The table below shows a range of activities at transfer stations that may give rise to substantial emissions. From the earlier descriptions and your own knowledge, consider which of these apply to your site, the type of waste stream associated with each and the abatement or mitigation systems in place.

Emissions to air, controlled waters or sewer (collectively referred to as 'water' in this guidance) are shown, as required by the PI reporting form. Accidental emissions are not covered and would require a separate assessment. You should report these as 'Notifiable emissions' and add into the 'Total emissions' figure.

Activity	Description of emissions	Emission type	Emissions to
Filling of bulk storage tanks by road tankers	Displaced air	VOCs	Air
	Losses from transfers	VOCs	Air
		Liquids	Water
Storage in bulk tanks	Vented material	VOCs	Air
Emissions from pipes and pumping systems	All losses	VOCs	Air
		Liquids	Water
Gravity and vacuum emptying of drums, IBCs and other containers to bulk tanks	Displaced air	VOCs	Air
	Losses from transfers	VOCs	Air
		Liquids	Water
Storage and handling of empty IBCs	Washing	Liquids	Water
	Storage	VOCs	Air
Storage and handling of empty drums and other similar containers	Crushing	VOCs	Air
		Liquids/solids	Water
	Washing	Liquids/solids	Water
	Storage	VOCs	Air
Washing of road tankers	Effluent	Liquids	Water
Maintenance of equipment	Tank cleaning/washing	Liquid/solid	Water
		VOCs	Air
Planned evaporation of volatile liquids	Evaporation	VOCs	Air

Identifying the important waste streams

Most sites will have a continuous, but small, discharge of waste to the site base from drips, splashes, crushing residues, pipe connections, oil leaks and so forth, and these will be washed to the surface waste collection points by rainwater and site cleaning.

Almost all hazardous waste transfer stations have a secure base laid to fall such that it drains rainwater and liquid/solid spills to one or more liquid tanks or interceptors. There may be separate drainage systems and sumps to isolate specific areas of the site where waste is handled and

bulked to contain possible spills and protect surface water drainage from contamination. These will reduce liquid emissions.

The surface water drainage may be discharged to sewer, to controlled waters, or to an adjacent treatment plant. Discharge consents to sewer or controlled waters will reflect some of the risks associated with the transfer station and specify monitoring requirements.

The most common materials to be bulked at transfer stations are dilute acids (often from metal treatment), caustic solutions, oils, non-halogenated solvents and aqueous organic wastes. The discharge to sewer is almost certain to contain total organic carbon, nitrogen, chloride, zinc and, if you are bulking non-halogenated solvents, xylene.

Most of the emissions to air are from the storage and bulking of organic wastes, primarily solvent wastes. Transfer activities of these wastes will result in VOC emissions to atmosphere unless there are substantial abatement control systems. Similar emissions are expected from the transfer of ammonia wastes and from strong acid wastes as well. Other emissions to atmosphere will occur at the same time, but the quantities will generally be minimal for most materials.

Sites handling powders and wastes giving rise to dusts (fly ash for example) will release particles to atmosphere and these may need to be considered where there are large quantities involved. Common abatement systems are fitted on venting systems for tanks and to reduce solvent losses to atmosphere due to displacement when filling tanks and tankers. Sites handling dusty wastes may have specific hoods, filters and extraction systems for these.

In principle, small quantities of every material handled at the site will be released. In practice, the risk of emission will be proportional to the amount of each material handled.

The following approach is reasonable for most sites and provides a simple basis for justifying your declaration to the Pollution Inventory.

- Make a list of the twenty most common waste types handled at your site that have been decanted into larger containers or bulked into tanks. Determine the average content (analysis) for these wastes and the annual tonnage (make sure that this includes your bulk solvent streams: larger sites may need to review more than twenty wastes, smaller sites may only need ten).
- Identify which of these contain substances that are relevant to the PI for emissions to water or air.
- Identify any other species relevant to the PI for which you have monitoring data.
- Consider the type of site activity that affects these waste types (decanting, washing containers and so forth).
- Where you do not have monitoring data to calculate the emission, undertake emission estimations on these activities (see below) and generate data to complete your declaration.
- Review the other species on the PI declaration form. If you are aware that there are significant emissions of other species, acknowledge these as 'brt' (below reporting threshold).

The following sections give some guidance and equations for quantifying different types of emissions, and an example set of calculations from a transfer station.

4. Quantifying emissions to air

Priority substances: VOCs, ammonia, strong acids, particulate matter.

Most of the atmospheric emissions will be associated with the transfer and bulking of volatile organic compounds (VOCs), and these are the key emissions to quantify. Other waste streams that are known to contribute to atmospheric emissions at transfer stations are ammonia wastes, strong acid wastes and powders or dusty wastes.

4.1 Filling of bulk storage tanks by road tanker

It will be necessary to calculate the atmospheric VOC emissions due to the venting of vapour contained in the receiving vessel. Where the receiving tanks are fitted with emission abatement equipment, for example carbon adsorption, the emissions from this activity are likely to be minimal and can be ignored.

The assumption is that the air displaced from the storage tank is saturated with vapours associated with the organic liquid mixture in the tank. The mole fraction of each vapour in the displaced air is given by the following equation.

$$y = x (VP / P)$$

where:

y = vapour mole fraction of substance in displaced air

x = liquid mole fraction of substance (x = 1 for waste solvent containing one component).

VP = vapour pressure of component in the tank (kPa). This can be obtained from material safety data sheets or standard chemical engineering reference books such as Perry's Chemical Engineers Handbook (7th Edition, Ch 2).

P = system pressure (kPa). In most cases, for example, for open reactors, this will be ambient pressure (101.3kPa).

(Ref: EETM Organic Chemical Processes Industries, pg. 9)

Having determined y for each vapour present, divide the volume of waste solvent added in litres (equals volume of air displaced) by 24.436 (assuming a liquid temperature of 25°C) to give the number of moles of displaced saturated air. Multiply this figure by each value of y to determine the number of moles of each waste solvent vapour emitted. Multiply the resulting figure by the appropriate molecular weight to determine the mass of each substance emitted.

4.2 Gravity and vacuum emptying of drums, IBCs and other containers to bulk tanks

There are two elements to this emission:

- the displacement of vapour saturated air in the container
- fugitive losses during transfer

The equation above can be used for the displacement calculation, but there is no simple method available for the fugitive losses due to transfer. At present, these are covered by estimating the losses associated with the reject container, see below.

4.3 Storage and handling of empty IBCs, drums and smaller units

Most IBCs are reused and will go through a process of evaporation of residual solvents and washing of the container prior to reuse on site or onward sale.

Drums are typically crushed and sold for recycling, although a proportion is reused or sent to landfill. Smaller containers usually go to landfill.

Aqueous wastes and residues are considered in Section 5. This section is about emissions to atmosphere from solvent residues in containers.

A few transfer stations have drainage areas where 'emptied' drums are left upside down to drain over a grid and sump. The tonnage of solvent collected in this, or similar, manner should be deducted from the calculation below (sites with a liquid collection sump beneath the drum crushing unit will tend to evaporate solvents from the drum before crushing to avoid explosion).

After decanting, 'empty' solvent containers are left to vent to atmosphere. This may be in a separate area of the site, or simply in the skip of waste for landfill.

It is assumed that 1% of the container volume is left as liquid residue in 205 litre drums and smaller containers, and 0.5% in IBCs (there may be sludge as well).

The simple equation for emissions of each type of waste is:

Total annual emissions from IBCs will be:

5 x N litres

Where N = number of 1000 litre IBCs handled per annum

The mass of emissions can be calculated from the specific gravity of the liquid.

Total annual emissions from smaller containers will be:

(V x 0.01) x N litres

Where V = volume of container (litres) and N = number of containers per annum. Again, the specific gravity of the liquid can be used to calculate the mass of emissions.

Transfer stations that bulk small volumes of organic solvents may find it hard to quantify the number of containers and the wide range of incoming solvents. It may be easier to consider emissions related to the average concentration of the mixed wastes leaving the site (this is likely to be one of the 'top twenty' waste streams at the site).

Consider the outgoing solvent waste stream of Z kg per annum created by bulking from IBCs or smaller containers.

Guesstimate 'Y', the percentage received in IBCs (for most sites, Y will be 0% or 100% for given waste streams).

Total annual emission is Z * (0.01 – 0.00005Y) kg

Using the average concentration of the outgoing solvent stream, calculate the emissions for specific species as a proportion of Z.

5. Quantifying emissions to water

Priority substances: TOC, N, P, Cl, Zn, xylene and possibly toluene, Cu and Ni

For transfer stations where all surface water drainage and liquid waste from sumps, crushers and washing areas goes to an on-site treatment plant prior to discharge to controlled waters or sewer, you do not need to declare water emissions for this part of the licensed activity. You do need to report any emissions to controlled waters or sewer from the treatment plant.

Other transfer stations could use the water emissions estimation approach outlined below.

5.1 Emissions for washing containers and tanks

Liquid emissions may arise from the washing and processing of containers prior to their recycling, landfill or reuse, or from the washing of road tankers.

One approach to estimating these emissions is to assume that the residual material in each type of container after emptying is 0.5% of the volume, and that all of this material is washed to sewer.

The emission in kg is then $V * 5$, where V is the volume of the container/tanker (m^3), taking a uniform density of 1 tonne/cubic metre on the assumption that this process will occur with aqueous waste streams. In general, volatile residues from containers of solvent waste are evaporated directly to atmosphere rather than washed to sewer.

If the relevant species are covered by your site monitoring programme, this will provide an alternative source of data to estimate the annual mass of emissions.

5.2 General emissions from fugitive leaks and spills

The following approach gives an estimate of emissions to water for sites with contamination of surface water caused by small fugitive emissions.

- Review your list of the twenty most common wastes and which species are relevant to the PI for emissions to water.
- Identify the substances on the PI list for which monitoring data are available, and calculate annual emissions for these based on discharge volumes and analytical results.
- Assume that emissions of the remaining substances from your top twenty will be below the reporting threshold and enter these as brt on the emission declaration form.
- Consider whether you are decanting wastes containing nitrogen, phosphorus, chloride or organic carbon (the answer is almost certainly 'Yes') and, if so, ensure that the boxes for TOC, total nitrogen, total phosphorus and chloride are recorded as brt as well.

6. Emissions from other processes

We have indicated the species most likely to be emitted from these types of waste management site and this will help you complete your declaration.

Please remember it is your responsibility to use the best data and techniques available to you to work out emissions from your operation. This guidance 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 doing additional operations at your site or processing unusual waste types that will add to emissions. Some of these might be:

- Transfer and bulking of powders or the separation/grinding/crushing/trommelling of mixed non-hazardous wastes with potentially high discharges of particles to atmosphere.
- Crushing oil filters and separation into a solid metal fraction and a liquid oil fraction. If not undertaken in controlled conditions, there will be an oil mist discharge to atmosphere including PAHs and VOCs.
- The use of waste solvent to clean other equipment resulting in high discharges of the solvent to atmosphere
- Turning, grinding or other exposure to atmosphere of solvent sludges or solvent contaminated wiping cloths prior to landfill resulting in solvent emissions to atmosphere
- On-site combustion processes resulting in emissions of CO₂, SO₂, NO_x, VOC, CO, PM₁₀ and PAH. 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 ₂	SO _x	NO _x	NMVOC	CO	PM ₁₀	PAH
Residual fuel oil	3112	47.4	7.54	0.125	0.5	2.85	0.15 (g/te fuel)
Distillate (gas) oils	3142	3.6	3.46	0.0875	0.06	0.2	0.15 (g/te fuel)
Diesel	3142	0.8	48.8	7.075	15.8	2.83	4.07 (g/te fuel)

7. Waste

You need to report any off-site waste transfers as set out in the general guidance document on completing the PI reporting form.

Annex 1 - Worked example of air emissions from filling bulk storage tanks with no abatement equipment in place

This calculation could be carried out using the annual tonnage of waste solvents received if the composition of the waste solvent in the bulk container stays reasonably constant throughout the year. Alternatively the emissions from each addition of waste solvent can be calculated as shown here and summed for the whole year.

Assume that 1000 kg of predominantly waste benzene are received and added to a waste solvent storage tank containing a two component mixture of benzene and toluene in a % mole fraction ratio of 95:5.

$$VP_{\text{benzene}} = 12.46 \text{ kPa at } 25^{\circ} \text{ (from Perry's)}$$

$$VP_{\text{toluene}} = 4.97 \text{ kPa at } 25^{\circ} \text{ (from Perry's)}$$

So mole fractions in displaced vapour are:

$$\begin{aligned} y_{\text{benzene}} &= X_{\text{benzene}} * VP_{\text{benzene}} / P \\ &= 0.95 * 12.46 \text{ kPa} / 101.3 \text{ kPa} \\ &= 0.117 \end{aligned}$$

$$\begin{aligned} y_{\text{toluene}} &= X_{\text{toluene}} * VP_{\text{toluene}} / P \\ &= 0.05 * 4.97 \text{ kPa} / 101.3 \text{ kPa} \\ &= 0.0025 \end{aligned}$$

Volume of vapour displaced equals volume of liquid added.

The 1000 kg of waste benzene added (density at 25°C = 0.872 kg/l), gives an added volume of 1000/0.872 = 1147 litres.

$$\text{Number of moles of saturated vapour released} = 1147 / 24.436 = 46.9$$

So, number of moles of toluene = 46.9 x 0.0025 = 0.12, giving a mass of toluene emitted of 0.12 x 92 = 11 g

Number of moles of benzene = 46.9 x 0.117 = 5.48, giving a mass of benzene emitted of 5.48 x 78 = 427 g

The sum of all such emissions from each waste solvent addition gives the annual mass estimate for air emissions from this part of the operation. Ideally, allowance should be made for any changes with time in the composition of the stored bulk waste solvent mixture.

Annex 2 - Worked example PI declaration from a waste transfer station

Assumptions

This is a hazardous waste transfer station with impermeable base. It has bulking areas with blind sumps and roof. Solvent storage tanks are in a separately bunded area with activated carbon filters on vents. Thermal outbreathings and head space displacement losses due to charging the storage tanks are scrubbed prior to atmospheric discharge.

Loading, unloading and drum storage areas of the site are in the open and drain to interceptor, hence to sewer. There is continual monitoring of pH and flowrate, weekly monitoring of COD, metals, oil, ammoniacal nitrogen and suspended solids on the sewer discharge.

Packing materials and old contaminated containers are sent to landfill.

The site handles a very wide range of materials, but there are six major solvent streams (all percentages are by mass):

Halogenated solvents comprise an average 80% solvent; 20% solids. The solvent fraction consists of 10% trichloroethylene; 10% methyl chloroform (1,1,1-trichloroethane); 60% methylene chloride (dichloromethane).

Non-halogenated solvents average 70% solvent, 30% solids and water and solvents comprise 10% toluene; 30% xylenes; 10% acetone, 20% others, mainly MEK, ethanol, acetaldehyde (ethanal), methanol and aliphatic C10-C12 hydrocarbons.

The other major waste streams are dilute hydrochloric acid and zinc, sulphuric acid and phosphoric acid from metal processing, soluble oils, dilute caustic soda, dilute ammonia solutions from photographic processes, aqueous paint residues, aqueous adhesive residues and ethylene glycol. All of these are bulked prior to onward transfer or storage.

Emission scoping

Operation 1: Repacking and labelling of laboratory chemicals

Potential emissions: None: no incidences of damage to containers noted in site diary.

Operation 2: Decanting into IBCs

Potential emissions: 5 streams handled: halogenated solvents, non-halogenated cempfuel, aqueous organic, caustic, dilute acids. Drums shredded prior to landfill or recycling.

The key streams are cempfuel (120 te produced per year and then stored at the site for tankering - see Operation 3 below) and halogenated materials (60 te produced per year) that leave the site in IBCs. Emissions are due to the venting of residues in the emptied containers after bulking. Using equations described in the guidance, this is about 1% of the solvent output.

Total atmospheric emissions are:

$0.01 * 60 * 0.8 \text{ te} = 480 \text{ kg}$ halogenated solvents

$0.01 * 120 * 0.7 \text{ te}$ (70% of the solvent waste is solvent) = 840 kg non-halogenated solvents

This gives an initial assessment of the VOC emissions. These are then broken down into species.

Halogenated solvents: total 480 kg

60% methylene chloride; $0.6 * 0.01 * 60 \text{ te} = 360 \text{ kg}$

10% trichloroethylene; $0.1 * 0.01 * 60 \text{ te} = 60 \text{ kg}$

10% methyl chloroform; $0.1 * 0.01 * 60 \text{ te} = 60 \text{ kg}$

Non-halogenated solvents: total 840 kg

30% xylenes; $0.3 * 0.01 * 120 \text{ te} = 360 \text{ kg}$

10% toluene; $0.1 * 0.01 * 120 \text{ te} = 120 \text{ kg}$

Emissions of acetone, acetaldehyde, ethanol, methanol, MEK, and aliphatic hydrocarbons to air are not reportable **except** as part of the total NMVOC emission.

Total NMVOC emissions are 1320 kg

Operation 3: Charging storage tanks

Potential emissions: the tanks are connected to scrubber units to control outbreathings due to thermal change or tank filling. There is a balancing system in place for filling tankers. There will be

discharges of all solvent mixtures in store, but these will be small. IBCs are emptied using a pump. Residual volatile liquids discharge to atmosphere. The calculations of emissions are the same as Operation 2 above but the discharge is only 0.5% of output.

The tanks handle 120 te of waste from the IBCs filled at the site and a further 260 te of waste that arrives at the site in IBCs.

Total emissions

30% xylenes; $380 * 0.3 * 0.005 \text{ te} = 570 \text{ kg}$

10% toluene; $380 * 0.1 * 0.005 \text{ te} = 190 \text{ kg}$

Total NMVOC emissions are $380 * 0.7 * 0.005 \text{ te} = 1330 \text{ kg}$

Monitored emissions from the site: to sewer

Potential emissions: monitoring for COD, metals, oil, ammoniacal nitrogen, suspended solids and flowrate. Weekly samples, but not flow proportional samples. Essentially 52 spot samples, nearly all showing low values and sometimes below the level of determination. One 'high' ammoniacal nitrogen reading, but no obvious correlation with any incident on the site. Multiply weekly results by weekly flowrate for an estimated weekly load and sum to give annual emissions to sewer.

Week No	Flow (m ³)	COD (mg/l)	COD discharged (g)	TOC = COD/3 (g)	NH3-N (mg/l)	NH3-N discharged (g)
1	2.1	190	399	133	<0.1	0.1
2	1.6	460	736	245	0.3	0.48
3	0.2	610	122	41	1.9	0.38
and so on						
Annual total				5980		14

Other relevant species (from the main list of wastes at the plant) are xylene, toluene, chloride and phosphorus. These are declared as emissions below reporting threshold (brt).

Summary of total emissions from operations undertaken on site

Operation	Emissions to air	Emissions to sewer
Repacking and labelling of laboratory chemicals	nil	nil
Decanting into IBCs	60 kg methyl chloroform 360 kg methylene chloride 120 kg toluene 60 kg trichlorethylene 360 kg xylenes 1320 kg NMVOCs	several species likely to be BRT: solvent species metals total chloride total nitrogen total phosphorus TOC
Transfer from IBCs to solvent storage tanks	190 kg toluene 570 kg xylenes 1330 kg NMVOCs	xylenes TOC
Totals Species in bold are above the reporting threshold. The rest are reported as BRT.	60 kg methyl chloroform 360 kg methylene chloride 310 kg toluene 60 kg trichloroethylene 930 kg xylenes 2650 kg NMVOCs	150 kg oil 0.5 kg Cu 0.5 kg Ni 0.5 kg Zn 5.98 kg TOC 14 g NH3-N traces of xylene, toluene, Cl and P

For this example, in the PI reporting form you would put 'n/a' against all in entries in parts 2 and 3, with the following exceptions:

Air

Methyl chloroform	60 kg
Methylene chloride	BRT
Toluene	310 kg
Trichloroethylene	BRT
Xylene – all isomers	BRT
NMVOCs	BRT

Sewer (and/or controlled waters as appropriate)

Toluene	BRT
Xylene – all isomers	BRT
Copper	BRT
Nickel	BRT
Zinc	BRT
Chlorides – total as Cl	BRT
Nitrogen – total as N	BRT
Phosphorus – total as P	BRT
Total organic carbon (TOC)	BRT

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