



**Australian Government**

**Department of the Environment**



**NATIONAL POLLUTANT INVENTORY  
GUIDE**

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# NPI GUIDE

## TABLE OF CONTENTS

AUSTRALIAN GOVERNMENT, State and territory environment agencies .....	iii
WHO SHOULD USE THIS GUIDE? .....	6
Quick guide to NPI reporting .....	7
Key dates for NPI reporting .....	9
SECTION ONE Background .....	10
What is the National Pollutant Inventory? .....	10
Where does NPI data come from? .....	10
SECTION TWO Do You Need to Report to the NPI? .....	11
ANZSIC codes .....	11
NPI reporting thresholds .....	11
Facility process diagram .....	11
Category 1, 1a and 1b .....	12
Category 2a and 2b .....	15
Category 3 .....	18
SECTION THREE Estimating NPI Emissions .....	20
How are emissions defined? .....	20
Estimating emissions .....	21
Emission reduction activities .....	23
SECTION FOUR Estimating NPI substances in transfers of waste .....	24
What is a transfer? .....	24
Transfer destinations that require mandatory reporting .....	24
Transfer destinations for which reporting is voluntary .....	25
Estimating transfers .....	26
SECTION FIVE How to report NPI emissions and transfers .....	31
Using the NPI Online Reporting System .....	31
Using the NPI paper reporting form .....	32
Reporting emissions and transfers .....	32
FIGURE 2 Reporting checklist .....	33
Dictionary of NPI Terms and Acronyms .....	34
Appendix A Complete list of the 93 NPI substances .....	38
Notes on the NPI substance list .....	40
Appendix B Additional NPI substance data .....	43
Appendix C Additional information on Total Volatile Organic Compounds .....	47
Appendix D Unit conversion factors .....	49
SI and Customary units .....	49
Other useful equations .....	51
Appendix E TEF and (B[a]P) data .....	52
Appendix F Erratum for the NPI Guide .....	53
Version 6.1 – September 2015 .....	53
Version 6.0 – November 2014 .....	53
Version 5.3 – May 2012 .....	53

## LIST OF FIGURES

FIGURE 1 Determining whether you need to report to the NPI .....	8
FIGURE 2 Reporting checklist .....	33

## LIST OF EXAMPLES

EXAMPLE 1 Determining the usage of acetone (Category 1 substance).....	14
EXAMPLE 2 Estimating Category 2 thresholds for multiple fuels and waste .....	16
EXAMPLE 3 Estimating Category 3 thresholds .....	18
EXAMPLE 4 Determining transfers of substances in waste for a sewerage treatment facility .....	28
EXAMPLE 5 Determining transfers of substances in waste from a pig farm .....	29
EXAMPLE 6 Determining transfers of substances in waste from a timber product manufacturer.....	30

## LIST OF TABLES

TABLE 1 Minimum limits of fuel and/or waste burnt to trigger Categories 2a and 2b.....	15
TABLE 2 All NPI substances .....	38
TABLE 3 NPI substance reporting list (Category 2a).....	42
TABLE 4 NPI substance reporting list (Category 2b).....	42
TABLE 5 Additional data about the 93 substances .....	43
TABLE 6 NPI substances that are VOC.....	47
TABLE 7 Common SI NPI units .....	49
TABLE 8 SI Prefixes .....	50
TABLE 9 Common Units and Conversion Factors for NPI.....	50

## WHO SHOULD USE THIS GUIDE?

If you occupy a facility that can potentially release emissions or generate waste transfers that exceed the National Pollutant Inventory (NPI) reporting thresholds for the 93 listed substances in the *National Environment Protection (National Pollutant Inventory) Measure 1998*, you should read the NPI Guide.

The NPI Guide provides guidance on determining whether your facility will need to report to the NPI and provides general assistance on how to estimate and report emissions and transfers of listed NPI substances from your facility. The NPI Guide, however, does not provide information on how to estimate emissions and waste transfers for specific industry types. Industry-specific reporting materials, including Emission Estimation Technique (EET) manuals, have been developed for each reporting industry. Please visit the NPI website for a full list of manuals:

<http://www.npi.gov.au/reporting/industry-reporting-materials/emission-estimation-technique-manuals>

## Quick guide to NPI reporting

The following steps will help you to determine if your facility needs to report to the NPI and, if so, how to estimate emissions (see **Figure 1**)

**Step 1:** *Determine whether your facility\* is excluded from reporting to the NPI*

*\*Facility means any building or land together with any machinery, plant, appliance, equipment, implement, tool or other item used in connection with any activity carried out at the facility, and includes an offshore facility. The facility may be located on a single site or on adjacent or contiguous sites owned or operated by the same person.*

Some facilities and activities are specifically excluded from reporting, even if these exceed the reporting thresholds. The following facilities are not required to report to the NPI:

- a mobile emission source (for example, an aircraft in flight or a ship at sea) operating outside the boundaries of a facility;
- a petroleum retailing facility engaged in the retail sale of fuels;
- a dry cleaning facility employing less than 20 persons;
- a scrap metal handling facility trading in metal that is not engaged in the reprocessing of batteries or the smelting of metal;
- a facility, or those parts of a facility, solely engaged in agricultural production including the growing of trees, aquaculture, horticulture or livestock raising, unless it is engaged in the processing of agricultural produce or intensive livestock production (e.g., a piggery or a cattle feedlot); and
- a facility for which an ANZSIC code is not published on the NPI website  
<http://www.npi.gov.au/reporting/industry-reporting-materials/anzsic-code-list>

**Step 2:** *Determine whether your facility needs to report to the NPI*

**Section Two** of this NPI Guide will help you to assess whether you will need to report to the NPI.

**Step 3:** *Estimate emissions from your facility*

If your facility needs to report to the NPI, you are required to estimate emissions of all applicable NPI substances to air, land and water.

To assist with determining emissions from your facility, refer to your industry's Emission Estimation Technique (EET) manual on the NPI website.

**Section Three** has further information to assist in estimating emissions from your facility.

**Step 4:** *Estimate transfers from your facility*

If your facility needs to report transfers of NPI substances in waste, you need to estimate and report the amount contained within the waste.

To assist in determining your facility's transfers, refer to the Transfer Information Booklet as well as your industry's EET manual on the NPI website.

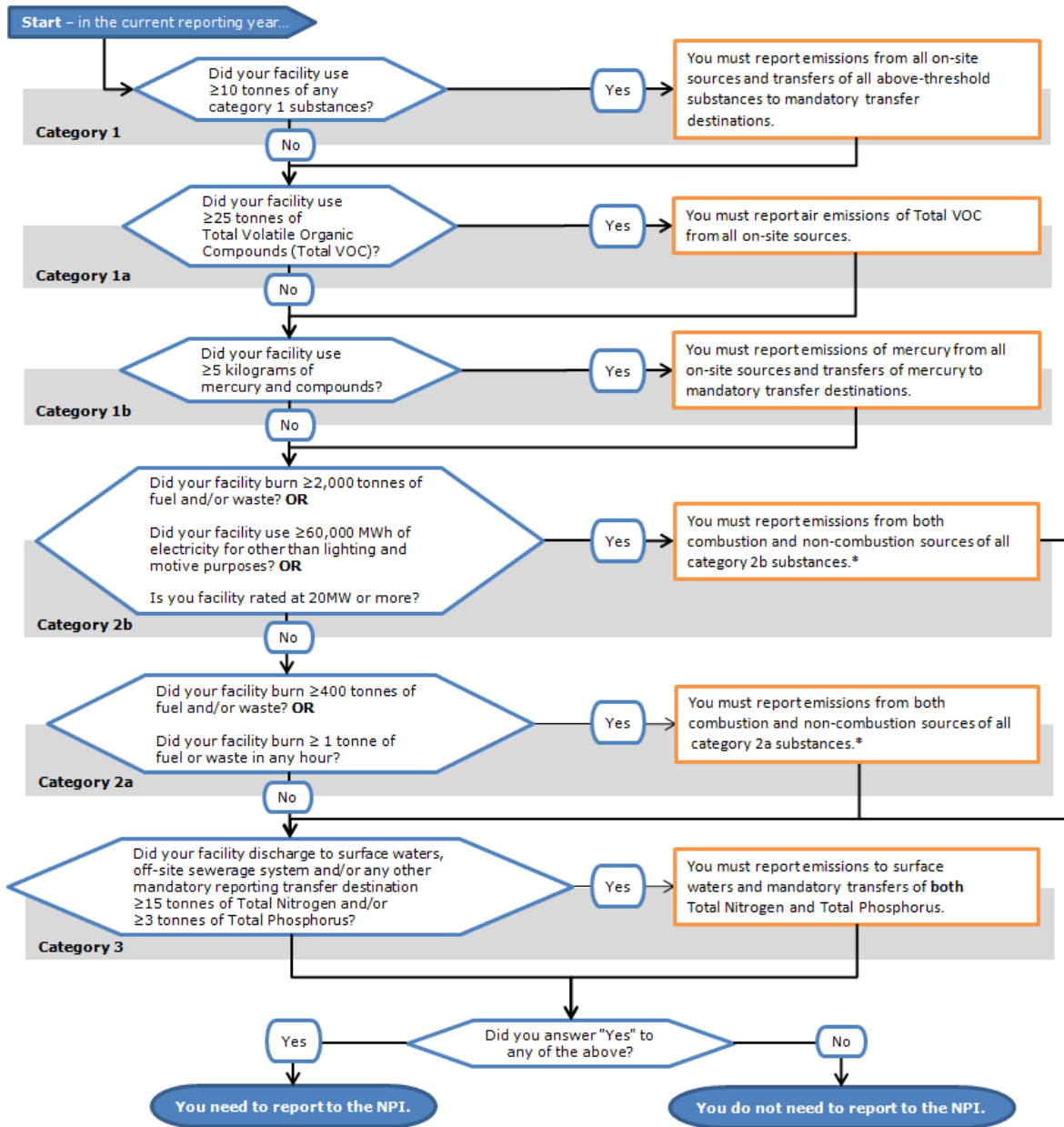
**Section Four** has further information on estimating transfers of NPI substances in waste.

**Step 5:** *Report your emissions and transfers*

Once you have estimated emissions and transfers from your facility, you can submit your reports of estimates to your state or territory environment agency via the NPI Online Reporting System (ORS), which is the preferred way. Alternatively, with approval from your environmental agency, you can manually complete a reporting form, which can be downloaded from the NPI website, and submit the completed form to your environment agency. Please note that simplified paper reporting forms for intensive agriculture are available and can be obtained from your environmental agency.

**Section Five** has further information on reporting estimated emissions and transfers.

**FIGURE 1 Determining whether you need to report to the NPI**



\*PM<sub>2.5</sub> emissions are only reportable from combustion sources



## Key dates for NPI reporting

1 January to 31 December	Reporting period for calendar year reporters
31 March	Calendar year reporters to provide emission and transfer estimates to state and territory agencies
1 July to 30 June	Reporting period for financial year reporters
30 September	Financial year reporters to provide emission and transfer estimates to state and territory agencies
31 March	Data released on the NPI website

## SECTION ONE BACKGROUND

### What is the National Pollutant Inventory?

The NPI is a publically accessible online database that presents information on:

- emissions of 93 specified substances to air, land and water from facilities (e.g. mining, manufacturing, waste management, etc);
- emissions of 93 specified substances from diffuse sources (e.g. motor vehicles, woodheaters etc); and
- transfers of 93 specified substances in waste from facilities.

The objectives of the NPI are to:

- help industry and government with environmental planning and management;
- provide the community with up-to-date information about substance emissions and transfers from industrial facilities; and
- promote waste minimisation, cleaner production, and energy and resource efficiency.

NPI substances are those that, when emitted at certain levels, have the potential to be harmful to human health or the environment. Australian state and territory governments have legislated that industry will report these emissions on an annual basis. Reportable NPI substances are listed in this Guide at **Appendix A** and are classified into six categories, each with their own reporting thresholds.

More information on the NPI can be found at [www.npi.gov.au](http://www.npi.gov.au).

### Where does NPI data come from?

Australian facilities that exceed the defined thresholds for the 93 NPI substances must estimate their emissions and transfers of the applicable NPI substances each year. The estimates must be reported to the relevant state or territory environment agency, either as a financial year, or calendar year report. The substances to be reported and the different threshold categories are listed in **Appendix A**.

The state and territory environment agencies review all NPI reports for accuracy and completeness, and forward the data to the Australian Government. The data is then published on the NPI website.

## SECTION TWO DO YOU NEED TO REPORT TO THE NPI?

### ANZSIC codes

The ANZSIC code is part of NPI reporting requirements. This NPI Guide contains an explanation of the ANZSIC classification system. Under Clause 14 of the *NPI National Environment Protection Measure 1998* (NPI NEPM), a facility is only required to report under the NPI if the ANZSIC code for one or more activities undertaken at the facility is included by the Commonwealth on a published list as an industry type required to report. The NPI publishes a list of participating ANZSIC codes under the NPI NEPM at <http://www.npi.gov.au/reporting/industry-reporting-materials/anzsic-code-list>.

### NPI reporting thresholds

This Section has further information and some examples to help you determine whether your facility exceeds any of the NPI reporting thresholds, and you are therefore required to report to the NPI.

The NPI has six different threshold categories with each of the 93 NPI substances listed in one or more of these categories. These are:

- Category 1 – based on substance usage;
- Category 1a – based on substance usage;
- Category 1b – based on substance usage;
- Category 2a – based on fuel and/or waste combusted;
- Category 2b – based on fuel and/or waste combusted; and
- Category 3 – based on substance emissions and transfers.

*Use of a substance means the handling, manufacture, import, processing, coincidental production or other use of the substance.*

*However, a substance is taken not to be used if:*

- (a) it is incorporated in an article in a way that does not lead to emission of the substance to the environment; or*
- (b) it is an article for sale or use that is handled in a way that does not lead to emission of the substance to the environment.*

If your facility exceeds the NPI reporting threshold during a reporting year for an NPI substance, all emissions of that substance from your facility must be reported. In addition, transfers of the substance (if Category 1, 1b or 3) to a mandatory reporting transfer destination must be reported.

The full list of NPI substances, together with substance data and technical notes, can be found in **Appendices A and B**. This information can also be accessed on the NPI website.

### Facility process diagram

A facility process diagram will help you to determine if any NPI thresholds have been exceeded. The diagram should identify:

- raw inputs into the facility (either as part of the process, or handled on-site);
- products and by-products manufactured onsite;
- emission sources;
- transfer sources and destinations; or
- where Category 1, 1a, 1b, 2a, 2b or 3 substances are present in any of the streams mentioned above.

### ***Proprietary mixtures and articles***

In some instances, an NPI substance may be contained in a proprietary mixture or article. The following information provides some guidance about when reporting is necessary.

- Proprietary mixtures – you are not required to include any NPI substance unless it is specified in the Safety Data Sheet (SDS) describing the properties and use of the material, or the manufacturer's advice. You can contact the material supplier for this information, as they must provide an SDS on request.
- Articles (emissions) – a substance is not considered used if:
  - it is already permanently incorporated in an article in a way that does not lead to emission of the substance to the environment (for example, metals on the NPI list that form part of a motor car), or
  - it is an article for sale or use that is handled in a way that does not lead to emission of the substance to the environment (for example, paint sold by a hardware store).
- Articles (transfers) – an article ceases to be an article, when:
  - it is transferred (i.e. transported or moved to a mandatory reporting transfer destination or a voluntary reporting transfer destination), in a way that is likely to affect its integrity, or
  - if conditions, handling or treatment, at the mandatory reporting transfer destination or the voluntary reporting transfer destination, are likely to affect its integrity.
- Examples include:
  - a compact fluorescent light ceases to be an article as soon as it is placed in a bin or skip, or
  - a steel beam remains an article if it is discarded or disposed of, unless it is likely to be exposed to substances or conditions that affect its integrity.

### **Category 1, 1a and 1b**

#### ***Category 1 threshold***

Category 1 includes a broad range of NPI substances that are typically used for production. Most of the NPI substances fall into this category.

The threshold for this category is the 'use', as defined earlier, of 10 tonnes or more per year of a Category 1 substance.

#### ***Category 1a Total Volatile Organic Compounds threshold***

Category 1a contains only Total Volatile Organic Compounds (TVOC). The threshold for this category is the use of 25 tonnes or more per year of TVOC.

The NPI defines total TVOC as the sum, by mass, of individual VOC, including non-NPI VOC. The inclusion of TVOC in the NPI recognises the combined effect of individual volatile organic compounds that contribute to smog formation. The individual VOC may not otherwise be captured due to the usage threshold for individual VOC not being exceeded.

The NPI definition for volatile organic compounds (VOC) is set out in **Appendix C**.

The NPI substance list includes VOC which are also Category 1 substances (10 tonnes usage threshold). To help identify these, you can use **Appendices B and C** and/or the NPI website.

#### ***Category 1b mercury and compounds threshold***

Category 1b contains only mercury and compounds. The threshold for mercury and compounds is the use of 5 kg or more in the reporting year. The extremely low threshold for Category 1b, in comparison with Category 1 substances, reflects the high toxicity of mercury.

### **Determining the use of Category 1, 1a and 1b substances**

A simple way to determine the 'usage' of an NPI substance by your facility is described in the following steps:

**Step 1:**     *Determine whether NPI substances are produced*

The first step is to determine if your facility manufactures or coincidentally produces any NPI substances. For example, if a facility produces five tonnes of acetone (a Category 1 substance) in its processes, the acetone produced is included as part of the facility's total use of acetone.

Once identified, the amount of each NPI substance manufactured or coincidentally produced must be determined. To assist you with these calculations, substance properties and unit conversions are located in **Appendices B and C** respectively.

**Step 2:**     *Calculate the quantities of NPI substances purchased/handled*

The next step is to determine if any NPI substances are handled at your facility and, if so, the quantities involved. An example of this is a quarry where rock from the site is moved from one part of the site to another. Any NPI substance within the rock must be included as part of the facility's total use of that substance.

**Step 3:**     *Step 3: Determining the total amount of NPI substances used*

For each Category 1, 1a and 1b NPI substance, add the components of use from the two previous steps to calculate the total amount that has been 'used' at your facility (in tonnes per year). If the facility has 'used' a total of 10 tonnes or more of a Category 1 substance, 25 tonnes or more of a Category 1a substance and/or 5 kg or more of Category 1b substance in a reporting year you must report the emissions of each substance that has exceeded the threshold.

When determining the 'used' amount you must ensure that the substance is not counted more than once. For example, purchased material that is counted as part of Step 1 should not be counted as part of material the site handles in Step 2.

**Example 1** below shows the method of calculating the use of a Category 1 substance. Acetone is used in this example, but the same principles apply to other NPI substances.

### EXAMPLE 1 Determining the usage of acetone (Category 1 substance)

#### The facility has purchased:

- 10,000 litres of acetone, and
- 100,000 litres of a mixture containing 12% by volume (vol%) acetone, and
- 2.5 tonnes of acetone are produced as a by-product during production of its main product.

Does the use of acetone in this facility exceed the Category 1 reporting threshold?

**Step 1:** *Determine the amount of acetone the facility produces*

From the information provided, 2.5 tonnes of acetone is produced by the facility as a by-product.

**Step 2:** *Determine how much acetone the facility purchases/handles*

In this example the facility has purchased 10,000 litres (L) of pure (100%) acetone.

Specific gravity of acetone:

= 0.792 kilograms per litre (kg/L) (from the NPI substance profile for acetone or the MSDS for acetone, which can be obtained from the acetone supplier).

Convert the volume (L) of acetone to mass (kg):

= volume of acetone (L) x specific gravity of acetone (kg/L)  
= 10,000 L x 0.792 kg/L  
= 7,920 kg

Convert the final mass of acetone from kg to tonnes (t):

= mass of acetone (kg) x conversion factor to tonnes (tonnes per kilogram (t/kg))  
= 7,920 kg x 0.001 t/kg  
= 7.9 t

The facility has also purchased 100 000 litres of a mixture containing 12 vol% acetone.

Find the acetone volume in the mixture that contains 12 vol% acetone:

= volume of total mixture (L) x [percentage of acetone in mixture (vol%)]  
= 100,000 L x [12÷100]  
= 12,000 L of acetone present in material

Specific gravity of acetone:

= 0.792 kg/L

Convert the volume of acetone to tonnes of acetone:

= Volume of acetone (L) x specific gravity of acetone (kg/L) x conversion factor to t (t/kg)  
= 12,000 L x 0.792 kg/L x 0.001 t/kg  
= 9.5 t

The total amount of acetone purchased in the reporting year is 7.9 plus 9.5 tonnes

⇒ a total of 17.4 tonnes

**Step 3:** Add the 'use' of acetone from Steps 1 and 2

= 2.5 t + 17.4 t  
= 19.9 t

The total acetone use is more than 10 t, thus exceeding the Category 1 substance threshold. This means that the acetone emissions and any transfer of acetone to a mandatory reporting transfer destination must be reported. Note: unit conversion factors are listed in **Table 8** in **Appendix C**.

## Category 2a and 2b

### Category 2a substances and thresholds

This category contains a group of substances that are common products of combustion or other thermal processes. A full list of Category 2a substances can be found in **Table 1** at **Appendix A**. The NPI reporting thresholds for this category are:

- burning of 400 tonnes or more of fuel and/or waste in the reporting year, or
- burning of 1 tonne or more of fuel and/or waste in an hour at any time during the reporting year.

### Category 2b substances and thresholds

This category also contains substances that are products of combustion or other thermal processes and includes all Category 2a substances. It also includes metals and compounds emitted when fuels (especially coal and oil) or waste liquids and/or solids are burnt.

The NPI thresholds for this category of substances are:

- burning 2,000 tonnes and/or more of fuel or waste in the reporting year
- consuming 60,000 megawatt hours or more of electrical energy for other than lighting, computing or motive purposes (e.g. an electric motor) in the reporting year, or
- having maximum potential power consumption of 20 megawatts or more for other than lighting or motive purposes in the reporting year.

A full list of Category 2b substances can be found in **Table 2** at **Appendix A**.

If your facility exceeds any of the Category 2a or 2b thresholds you must estimate and report any emissions of all substances listed under these categories. Note that, apart from PM<sub>2.5</sub> which is reportable only from combustion sources, emissions from all sources need to be estimated.

Transfers of Category 2a or 2b substances are not reportable. However, many Category 2a or 2b substances are also Category 1, Category 1a or Category 1b substances. If the Category 1, 1a or 1b threshold has been exceeded in its own right then transfers to mandatory reporting transfer destinations must be reported. See **Section Four**, for further information on transfers.

### Calculating how much fuel is burnt

A facility is required to determine how much fuel and/or waste is burnt within the facility boundary. One or more different fuel and/or waste types may be burnt.

**TABLE 1** provides a quick guide for facilities that burn only one fuel and /or waste type to calculate whether a fuel combustion threshold has been exceeded.

**TABLE 1 Minimum limits of fuel and/or waste burnt to trigger Categories 2a and 2b**

Fuel/waste type	Category 2a (minimum limit)	Category 2b (minimum limit)	Conversion factor
Biogas	367,000 cubic metres (m <sup>3</sup> ) per reporting year, OR 917 m <sup>3</sup> in any one hour during the reporting year	1,830,000 m <sup>3</sup> per reporting year	1.09 kilograms per cubic metre (kg/m <sup>3</sup> )
Diesel	478,000 litres per reporting year, OR 1,200 litres in any one hour during the reporting year	2,390,000 litres per reporting year	0.836 kg/L
Fuel oil	444,000 litres per reporting year, OR 1,110 litres in any one hour during the reporting year	2,220,000 litres per reporting year	0.9 kg/L
LPG	784,000 litres per reporting year, OR 1,960 litres in any one hour during the reporting year	3,920,000 litres per reporting year	0.51 kg/L
Natural gas	17,800,000 MJ per reporting year, OR 44,400 MJ in any one hour during the reporting year	88,800,000 MJ per reporting year	0.0225 kg/MJ

**TABLE 1 Minimum limits of fuel and/or waste burnt to trigger Categories 2a and 2b**

Fuel/waste type	Category 2a (minimum limit)	Category 2b (minimum limit)	Conversion factor
Petrol	541,000 litres per reporting year, OR 1,350 litres in any one hour during the reporting year	2,710,000 litres per reporting year	0.739 kg/L
Solid fuel (e.g. coal or wood)	400 tonnes per reporting year, OR 1 tonne in any one hour during the reporting year	2,000 tonnes per reporting year	Not required
Explosives (e.g. ANFO)	400 tonnes per reporting year, OR 1 tonne in any one hour during the reporting year	2,000 tonnes per reporting year	Not required
Solid, liquid or gas waste	400 tonnes per reporting year, OR 1 tonne in any one hour during the reporting year	2,000 tonnes per reporting year	Not required

**NOTE:**

- Conversion factor values are average values from fuel suppliers as of August 2000. Accurate data can be obtained from your fuel supplier.
- To convert from kilograms to tonnes use the conversion factor 1 tonne = 1,000 kilograms.
- Further conversion factors are listed in Table 3 in Appendix D

**How to calculate burning multiple fuel and/or waste types**

If your facility burns more than one fuel type or waste, you need to convert the fuels and/or wastes into units of mass. The different fuels and/or wastes can then be added and compared against the Category 2a and 2b thresholds. **EXAMPLE 2** outlines the steps to determine your total fuel use.

**EXAMPLE 2 Estimating Category 2 thresholds for multiple fuels and waste**

A small sized plant manufactures specialty trucks and, according to invoices, used the following amounts of natural gas, diesel and LPG during the reporting year:

- 17,500,000 MJ of natural gas burnt in the boilers and a thermal oxidiser (afterburner);
- 18 kilolitres (kL) of diesel used by on-site front-end loaders; and
- 15 kL of LPG used by forklifts.

30 tonnes (t) of waste solvents were burnt in the thermal oxidiser.

To determine whether this manufacturing plant reached any Category 2a or 2b thresholds during the reporting year, the combined weight of the various fuels and waste burnt at this site needs to be determined.

**Step 1: Determine the weight of natural gas burnt**

Known data: a) 17,500,000 MJ/yr of natural gas burnt, and  
b) calorific value of natural gas is 0.0225 kg/MJ (Table 1)

Convert the yearly amount of natural gas from energy (MJ/yr) to mass (t/yr):

$$\begin{aligned}
 &= \frac{\text{Energy Used (MJ/yr)} \times \text{calorific value (kg/MJ)}}{\text{tonne conversion factor (kg/t)}} \\
 &= \frac{17,500,000 \text{ (MJ/yr)} \times 0.0225 \text{ (kg/MJ)}}{1,000 \text{ (kg/t)}} \\
 &= 394 \text{ t/yr of natural gas burnt in the reporting period.}
 \end{aligned}$$

**Step 2: Determine the weight of distillate oil (diesel) burnt**

Known data: a) 18 kL/yr of diesel burnt, and  
b) specific gravity of automotive diesel is 0.836 kg/L (Table 1).

Convert the volume of diesel burnt in the reporting year (kL/yr) to mass (t/yr):



**EXAMPLE 2 Estimating Category 2 thresholds for multiple fuels and waste**

$$= \frac{\text{volume (kL/yr)} \times \text{specific gravity (kg/L)} \times \text{kilolitre conversion factor (L/kL)}}{\text{tonne conversion factor (kg/t)}}$$

$$= \frac{18 \text{ (kL/yr)} \times 0.836 \text{ (kg/L)} \times 1,000 \text{ (L/kL)}}{1,000 \text{ (kg/t)}}$$

= 15 t/yr of diesel burnt in the reporting period.

**Step 3:** Determine the weight of LPG burnt

Known data: a) 15 kL/yr of LPG burnt, and  
b) specific gravity of LPG is 0.51 kg/L (Table 1).

Convert the volume of LPG burnt in the reporting year (kL/yr) to mass (t/yr):

$$= \frac{\text{volume (kL/yr)} \times \text{specific gravity (kg/L)} \times \text{kilolitre conversion factor (L/kL)}}{\text{tonne conversion factor (kg/t)}}$$

$$= \frac{15 \text{ (kL/yr)} \times 0.51 \text{ (kg/L)} \times 1,000 \text{ (L/kL)}}{1,000 \text{ (kg/t)}}$$

= 8 t/yr of LPG burnt in the reporting year.

**Step 4:** Determine the combined weight (CW) of all fuels and waste burnt

$$\text{CW} = \text{natural gas (t/yr)} + \text{diesel (t/yr)} + \text{LPG (t/yr)} + \text{waste solvents (t/yr)}$$

$$= 394 \text{ t/yr} + 15 \text{ t/yr} + 8 \text{ t/yr} + 30 \text{ t/yr}$$

$$= 447 \text{ t/yr of fuels and waste burnt in the reporting year.}$$

Since more than 400 t of fuels and waste were burnt during the reporting period, this manufacturing plant must report all Category 2a substances. A full list of Category 2a substances can be found in Table 1 at Appendix A.

**How to determine a facility's electricity use or power rating (fuel and energy)**

The Category 2b thresholds for electricity usage and power rating are for facilities that use large amounts of electricity, for reasons other than lighting or motive purposes, but might not burn 2,000 tonnes of fuel and/or waste on-site. Examples of facilities with high electricity usage are large aluminium smelters or electrolytic refining operations.

To determine whether your facility has exceeded the Category 2b threshold for electricity usage at your facility, firstly check the electricity bill over the reporting year for the facility to see if electricity use is greater than 60,000 MWh for this period. If not, your facility has not tripped the electricity usage threshold. If so you will now need to determine what proportion of the electricity usage is for lighting or motive purposes – this usage should be deducted from the total usage. If the remaining usage is higher than 60,000 MWh, you will need to report all Category 2b substances.

To determine whether your facility trips the Category 2b threshold for power rating, check the maximum power rating of relevant electrical equipment (i.e. any equipment not used for lighting or motive purposes) at your facility. If the combined power rating of relevant equipment exceeds 20 MW, you will need to report all Category 2b substances.

If your facility exceeds the electricity use threshold, but the facility does not emit NPI substances, you should contact your environmental agency for advice, as you might not be required to report.

*Motive means producing physical or mechanical motion. Electrical motive equipment includes pumps, fans compressors, conveyor belts etc. Electrical non-motive equipment includes arcing furnaces, heaters, ovens etc.*

## Category 3

### Category 3 substance thresholds

The threshold for Category 3 is based on the actual amount of total nitrogen and/or total phosphorus:

- emitted to water (excluding groundwater);
- transferred to a mandatory reporting transfer destination; or
- emitted to water and transferred to a mandatory reporting transfer destination.

You must report emissions and transfers to mandatory destinations of **both**<sup>1</sup> total nitrogen and total phosphorus if any of the above are at, or above:

- 15 tonnes per year for total nitrogen, and/or
- 3 tonnes per year for total phosphorus.

*Total nitrogen is defined as the sum of nitrate and nitrite expressed as nitrogen equivalent.*

*Total phosphorus is defined as phosphate expressed as phosphorus equivalent.*

### EXAMPLE 3 Estimating Category 3 thresholds

A small wastewater treatment plant treats a domestic wastewater influent and has the following effluent streams containing total nitrogen (TN) and total phosphorus (TP):

- 1.5 tonnes per day (t/d) of dewatered waste sludge to landfill with 75% moisture content and 3% of total solids (TS) as TN and 1.2% as TP
- 3.2 million litres per day (ML/d) of treated wastewater to a natural surface stream with 10 milligrams per litre (mg/L) TN and 1.1 mg/L TP, and
- 2.1 ML/d of treated wastewater to irrigated land with 6mg/L TN and 1.2mg/L TP.

#### Step 1: Recognise the following

- The TN and TP in the waste sludge to landfill are transfers to a mandatory reporting transfer destination and therefore contribute to the threshold determination
- The TN and TP in the effluent to natural surface stream are emissions to water and therefore contribute to the threshold determination, and
- The TN and TP in the effluent to irrigated land are transfers to a voluntary reporting transfer destination and therefore do not contribute to the threshold determination.

#### Step 2: Determine the amount of TN and TP in the sludge sent to landfill (mandatory transfer)

Known data: a) 1.5 t/d of dewatered waste sludge to landfill, and  
b) 75% moisture content, or 25% TS, and  
c) 3% of TS as TN and 1.2% of TS as TP

$$\text{TN}_{\text{transfer(mandatory)}} = 1.5\text{t/d} \times 365\text{d/yr} \times \frac{25}{100}(\text{TS}) \times \frac{3(\text{TN})}{100(\text{TS})} = 4.1\text{t/yr}(\text{TN})$$

$$\text{TP}_{\text{transfer(mandatory)}} = 1.5\text{t/d} \times 365\text{d/yr} \times \frac{25}{100}(\text{TS}) \times \frac{1.2(\text{TP})}{100(\text{TS})} = 1.6\text{t/yr}(\text{TP})$$

<sup>1</sup> If the threshold for **any** Category 3 substance is exceeded, then **both** Category 3 substances must be reported.

### EXAMPLE 3 Estimating Category 3 thresholds

**Step 3:** Determine the amount of TN and TP discharged to the natural surface stream (emission)

Known data: a) 3.2 ML/d of treated wastewater to a natural surface stream, and  
b) nutrient loading of 10 mg/L TN and 1.1 mg/L TP

$$TN_{\text{emission}} = 3.2 \text{ML/d} \times 365 \text{d/yr} \times 10 \text{mg/L} \times \frac{1 \text{t}}{1,000,000,000 \text{mg}} \times \frac{1,000,000 \text{L}}{1 \text{ML}} = 11.7 \text{t/yr}$$

$$TP_{\text{emission}} = 3.2 \text{ML/d} \times 365 \text{d/yr} \times 1.1 \text{mg/L} \times \frac{1 \text{t}}{1,000,000,000 \text{mg}} \times \frac{1,000,000 \text{L}}{1 \text{ML}} = 1.3 \text{t/yr}$$

**Step 4:** Add the respective amounts of TN and TP transferred to landfill and emitted to water

$$TN_{\text{transfer(mandatory)}} + TN_{\text{emission}} = 4.1 \text{t/yr} + 11.7 \text{t/yr} = 15.8 \text{t/yr}$$

$$TP_{\text{transfer(mandatory)}} + TP_{\text{emission}} = 1.6 \text{t/yr} + 1.3 \text{t/yr} = 2.9 \text{t/yr}$$

The sum of TN above is 15.8 t/yr which exceeds the 15 t/yr threshold, so this facility has exceeded Category 3 and must report. The sum of TP above is 2.9 t/yr, which is below the 3 t/yr threshold, however this facility must still report both TN and TP emissions and transfers to mandatory reporting transfer destinations because at least one Category 3 threshold has been exceeded. Emissions and transfers are to be reported in kg/yr.

**Step 5:** (optional): The facility may also choose to report the TN and TP voluntary transfers in the water sent to irrigate land

Known data: a) 2.1 ML/d of treated wastewater to a natural surface stream, and  
b) nutrient loading of 6 mg/L TN and 1.2 mg/L TP

$$TN_{\text{transfer(irrigation)}} = 2.1 \text{ML/d} \times 365 \text{d/yr} \times 6 \text{mg/L} \times \frac{1 \text{t}}{1,000,000,000 \text{mg}} \times \frac{1,000,000 \text{L}}{1 \text{ML}} = 4.6 \text{t/yr}$$

$$TP_{\text{transfer(irrigation)}} = 2.1 \text{ML/d} \times 365 \text{d/yr} \times 1.2 \text{mg/L} \times \frac{1 \text{t}}{1,000,000,000 \text{mg}} \times \frac{1,000,000 \text{L}}{1 \text{ML}} = 0.9 \text{t/yr}$$

Again, these voluntary transfers are to be reported in kg/yr.

*In the case of Category 3 substances, the amount that exceeds the reporting threshold will be the same amount reported as emissions to water or transfer to mandatory reporting transfer destinations. However, the amount emitted and transferred is reported in kilograms per year, not in tonnes per year. See Section Four for more information.*

#### Identify which NPI substances to report and next steps

- Now that you have an understanding of how to determine reporting thresholds for NPI substances, as outlined in the beginning of this Section, you should be able to identify the NPI substance(s) for which the relevant threshold(s) are exceeded as a result of activities at your facility.
- You must now estimate emissions and transfers of these substances, and report your estimates to the NPI. **Section Three** provides information on how to estimate emissions of NPI substances to air, land and water. **Section Four** provides information on how to estimate transfers of NPI substances within waste.

## SECTION THREE ESTIMATING NPI EMISSIONS

**Section Two** helped to identify the list of NPI substances used and their associated NPI reporting thresholds. This section provides guidance on how to estimate emissions. You will need to estimate facility emissions for all substances for which the NPI reporting threshold is triggered and report these, along with transfers of NPI substances in waste (described in **Section Four**). **Section Five** provides more information on how to report using the NPI Online Reporting System and paper reporting form.

If you require further information and guidance on how to estimate emissions from specific industry processes, you should consult the relevant industry sector EET manual(s). The manuals have been specifically developed for each industry type identified through their ANZSIC 2006 code. Manuals can be viewed/downloaded from the NPI website. If you do not have internet access, call your state or territory environment agency to obtain a copy of the relevant manual(s).

### How are emissions defined?

For NPI reporting purposes “emissions” are defined as:

*“the release of an NPI substance to the environment, whether in pure form, or contained in other matter, and/or in solid, liquid or gaseous form.”*

Under the NPI reporting rules, emissions include the release of substances to the environment, including from landfill, sewage treatment plants and tailings dams. The reporting of emissions of NPI substances must specify whether the emissions are to air, land or water. Emissions must be reported separately from transfers (see **Section Four** on how to report transfers).

### Are there any exclusions?

NPI substances incorporated into products should not be reported if the products are for sale or use and they are handled so they do not lead to emissions of the substances into the environment. See the definition for ‘use’ on page 11 of this guide.

### Emissions to air

The NPI categorises emissions to air as either point source or fugitive emissions.

Point source emissions flow into a vent or stack and are emitted through a single point source into the atmosphere. Point source emissions include, for example, emissions from the exhaust system of a boiler, or stationary combustion engine powered equipment.

Fugitive emissions are emissions that are not released via a vent or stack. Examples of fugitive emissions include exhaust emissions from vehicles, evaporative emissions from vehicle fuel tanks, volatilisation of vapour from vats or fuel and other volatile organic liquid storage tanks, open vessels, spills and materials handling. Emissions from ridgeline roof vents, louvers and open doors of a building, equipment leaks, valve leaks and flanges are also examples of fugitive emissions.

### Emissions to water

The NPI defines emissions to water as discharges to surface waters such as lakes, rivers, dams and estuaries, coastal or marine waters and stormwater runoff. Groundwater emissions are not classified as emissions to water and should be reported as emissions to land.

As emissions of toxic substances to waterways pose an environmental risk, most state and territory environment agencies require facilities to closely monitor and measure these emissions. If you collect such information for other purposes you can use the existing data to estimate emissions.

## ***Emissions to land***

The NPI defines emissions to land as substance emissions that occur on a site within a facility. Emissions to land can include solid wastes, slurries and sediments. Emissions to land may also result from spills, leaks, storage and redistribution of materials containing NPI substances. These emissions sources are broadly classified as surface impoundments of liquids and slurries. Emissions to groundwater should be reported as emissions to land.

## **Estimating emissions**

A process flow diagram of your facility's operations may be helpful in estimating emissions from your facility. This will help you to identify all the possible emission sources for NPI substances, such as output and emission streams.

Stack emissions, wastewaters, and solid wastes containing NPI substances are all potential emission sources, which can be identified in a process diagram. If wastewater is treated on-site, sludges or other wastes containing NPI substances may be created and emitted. Other emissions may result from, for example, vessel washing, or volatilisation to air for certain substances. All sources of NPI substance emissions should be clearly identified.

## ***Industry reporting materials***

EET manuals can be downloaded from the NPI website:

<http://www.npi.gov.au/reporting/industry-reporting-materials/emission-estimation-technique-manuals>.

You should select the manual(s) that are relevant to your facility from the NPI website. You will need to report emissions for each NPI substance for which the threshold is exceeded. You must include both point and fugitive sources and identify whether emissions are to air, land and/or water.

There are four types of emission estimation techniques that you can use to calculate emissions. The use of alternative methods requires written approval from your state or territory environment agency.

### *Mass balance*

This technique is based on estimating the quantity of the NPI substance going into a facility, process or piece of equipment and comparing against the quantity leaving the facility. Emissions are calculated as the difference between input and output for each listed substance. Accumulation or depletion of the substance within equipment should be accounted for in your calculation.

### *Fuel analysis or engineering calculations*

This method uses physical/chemical properties, such as vapour pressure, for a listed substance and incorporates information on such properties into mathematical relationships, such as the ideal gas law. Theoretical models for specific processes can also be used, although these can be complex.

### *Sampling or direct measurement*

Sampling methods can be periodic or continuous and are based on measured concentrations of the substance in a process or waste stream, and volume or flow rate of that stream. You may wish to report direct measurement data to the NPI, particularly if you have already collected such data to meet other regulatory requirements. Additional sampling or measurement is not required by the NPI.

One commonly used method is the Continuous Emission Monitoring System (CEMS) which provides a continuous record of emissions over time, usually through measuring pollutant concentrations. Once the pollutant concentration is known, emission rates can be calculated by multiplying the pollutant concentration by the volumetric gas or liquid flow rate for that stream.

It is important to note that, prior to using stack testing to measure emissions, you should develop a protocol for collecting and averaging the data in order to ensure that the estimate is representative and satisfies your environmental authority's requirements for NPI emission estimates.

## *Emission factors*

Emission factors specify the quantity of an NPI substance(s) emitted from a source as a result of a specified activity and take into account any pollution control measures employed in carrying out the activity. Emission factors are usually expressed as the mass of the substance emitted multiplied by the unit mass, volume, distance, or duration of the activity emitting the substance (for example, kilograms of xylene per cubic metre of paint or ink produced).

When using emission factors, you should be aware of the associated Emission Factor Rating code and what the rating implies. An A or B rating indicates a greater degree of certainty than a D or E rating. A rating of U indicates that the emission factor uncertainty has not been rated, such as for emission factors generated by modelling rather than actual test results.

NPI Emission Factor Ratings are as follows:

<b>A</b>	Excellent
<b>B</b>	Above average
<b>C</b>	Average
<b>D</b>	Below average
<b>E</b>	Poor
<b>U</b>	Unrated

## *Other estimation techniques*

Under certain circumstances, you may be able to use emissions estimation techniques other than the four techniques above, which are described in NPI industry reporting materials. The use of alternative techniques requires the written approval of your state or territory environment agency. Approval is subject to the provision of robust and traceable data that validates the alternative technique(s). Written approval must be obtained before you submit your emissions report.

Predictive Emission Monitoring (PEM) is an alternative technique that could be used. PEM is based on developing a correlation between pollutant emission rates and process parameters. A PEM allows facilities to develop site-specific emission factors, or emission factors with greater relevance to their particular process. Based on test data, a mathematical correlation can be developed that predicts emissions using various parameters.

You should select the EET that is most appropriate for your purposes. For example, you might choose to use; a mass balance technique to estimate fugitive emissions of solvents from printing or surface coating; direct measurement for stack and pipe emissions; and emission factors when estimating losses from storage tanks and stockpiles.

If you estimate your emission by using any of EETs published in the NPI industry guidance materials, your data will be described on the NPI database as being of 'acceptable reliability'. Similarly, if your state or territory environment agency has approved the use of EET's that are not outlined in this guide, your data will also be described as being of 'acceptable reliability'.

## **Calculation tools**

Calculation tools for different industries and industrial processes have been developed by the NPI to assist you in estimating emissions from your facility. Each calculation tool uses emission factors, published in the corresponding EET manual. The calculation tools can be used 'stand alone' or in conjunction with up to ten other calculation tools, thereby allowing for a comprehensive estimation of emissions from your facility. Emissions data can be uploaded from these calculation tools to your facility report through the NPI Online Reporting System.

The calculation tools and instructions for use are only accessible through the NPI Online Reporting System. Further information about the NPI Online Reporting System, including how to register as a user, can be found in **Section Five**. Users should note that if a calculation tool has been modified by a user, any resulting data calculated with the modified tool may not be accepted by your environment agency.

NPI calculation tools have been designed to work only in Microsoft Excel 2003, Microsoft Excel 2007 and Microsoft Excel 2010. You will need to set the macro security to 'medium'. Further information is available in the User Guide for the NPI Online Reporting System on the NPI website:

<http://www.npi.gov.au/resource/user-guide-npi-online-reporting-system>.

Some individual facilities and organisations have developed computer spreadsheets, databases and/or other software tools to assist with estimating emissions. Such tools are acceptable, provided the tools are identical to the estimation methods contained in the NPI EET manuals they are fully referenced, and their appropriateness can be easily verified. If the software tool contains alternative techniques not presented in the EET manuals, you must obtain written approval from your state or territory environment agency before using these tools.

### **Emission reduction activities**

One of the main goals of the NPI is to encourage facilities to use cleaner production techniques to reduce substance emissions and decrease waste. Facilities that implement emission reduction initiatives aim to reduce their substance emissions, decrease waste, save resources and become more efficient.

Implementing cleaner production includes activities such as regular maintenance scheduling, improved record keeping and procedures, optimising production schedules, installing vapour recovery systems or using cleaner raw materials. Facilities can also install pollution control equipment such as electrostatic precipitators, baghouses, scrubbers or biofilters.

All reporting facilities have the opportunity to voluntarily report their emission reduction activities. This information is published on the NPI website and provides context to facility data.

### ***Other technical information***

The NPI website has a technical guidance for industry reporters section. Refer to this section of the website ([www.npi.gov.au/reporting/industry-reporting-materials/industry-reporting-frequently-asked-questions](http://www.npi.gov.au/reporting/industry-reporting-materials/industry-reporting-frequently-asked-questions)) for further information on specific issues about reporting to the NPI.

## SECTION FOUR ESTIMATING NPI SUBSTANCES IN TRANSFERS OF WASTE

**Section Two** provided guidance the substances your facility will be required to report. **Section Three** helped you to estimate emissions to air, land and water of the substances identified in **Section Two**. The next step is to determine if your facility is required to report transfers of NPI substances contained in waste.

For each substance triggered in Category 1, Category 1b or Category 3 you are required to report any transfer of that substance within waste. Your facility will need to determine if those substances are contained in any waste transferred within and from your facility. You will then need to determine if the waste is transferred to a mandatory or voluntary reporting transfer destination and estimate transfer quantities. This section provides guidance on how to compile this information for your facility.

Transfers need to be reported, along with emissions of all triggered substances, to your state or territory environment agency within the statutory timeframes. **Section Five** provides more information on how to report emissions and transfers.

### What is a transfer?

A transfer is the transport or movement, on-site or off-site, of NPI substances contained in waste for the purposes of:

- containment
- destruction
- treatment that leads to:
  - reuse, recycling or reprocessing
  - purification or partial purification
  - remediation, or
  - immobilisation
- energy recovery.

The transfer of waste needs to be reported only if the waste contains an NPI substance that your facility has triggered in Category 1, Category 1b or Category 3. Wastes containing Category 1a, Category 2a or Category 2b substances do not need to be reported, unless the substances are also Category 1 or Category 1b substances.

Transfer destinations for NPI reporting purposes are designated as either **mandatory**, or **voluntary**. Any transfers of triggered substances within waste to mandatory reporting transfer destinations must be reported. Any transfers of triggered substances within waste to voluntary reporting transfer destinations can be reported at the discretion of the facility.

You should note that some transfers are specifically excluded from the requirement to report to the NPI. These are identified below.

### Transfer destinations that require mandatory reporting

You must report transfers of waste to the NPI if the waste is moved to a destination for final disposal. Mandatory reporting transfer destinations include:

- a destination for containment including landfill, tailings storage facility, underground injection or other long term purpose-built waste storage facility
- an off-site destination for destruction
- an off-site sewerage system, or
- an off-site treatment facility which leads solely to one or more of the above.

A containment destination may be on-site, for example a tailings storage facility on a mine site, or off-site, for example waste going to landfill. The transport or movement of NPI substances contained in waste to a sewerage system is also included.



Examples of the types of transfers that are mandatory to report include the:

- collection of waste by a hazardous waste contractor for disposal or destruction;
- transfer of waste to a landfill;
- transfer of sewage to an off-site treatment facility;
- transfer of tailings from a mine processing plant to a purpose built tailings storage facility; and
- transfer of waste for incineration.

A facility must report a mandatory transfer of material stored on-site for the duration of a reporting year, even if the material will be reused at a later date. For example, from May 2013 to October 2014, waste was stored in a containment facility on-site. Reporting of transfers will be required for the 2013-14 NPI reporting year. If the facility then sought to reuse that waste in some capacity in November 2014, a voluntary report can be lodged for the transfer of this waste for the 2014-15 reporting year. Contextual information can be used to provide further explanation when lodging your NPI report.

### **Transfer destinations for which reporting is voluntary**

Your facility may choose to voluntarily report on transfers to a destination where the NPI substance will be used for any of the following purposes:

- reuse;
- recycling;
- reprocessing;
- purification;
- partial purification;
- immobilisation;
- remediation; or
- energy recovery

Transfer reporting destinations are designated as voluntary only where the NPI substances in the waste are to be used for the purposes listed above. If the NPI substance is removed from the waste and disposed of without further use, this is a transfer to a final destination and reporting is mandatory.

Transfers of waste to voluntary reporting transfer destinations may be either on-site or off-site. A facility may choose to report on such transfers as it highlights their efforts to reduce its waste footprint.

Examples of voluntary reporting transfers include:

- transfer of cow manure to a composting facility for the production of soil conditioner;
- transfer of waste oil off-site for recycling; and
- transfer of ash from a coal fired power station to a cement manufacturer for reuse.

### ***What is excluded from transfers reporting?***

Your facility does not have to report on the transport or movement of NPI substances contained in:

- overburden;
- waste rock;
- uncontaminated soil;
- gas, water or rock removed in construction or road building;
- soil used for capping landfills;
- domestic sewage from on-site amenities; or
- general waste (refuse).

Waste rock means the sub-grade rock displaced during underground or surface mining operations. Please note however, these substances still need to be considered when calculating 'use' to determine

if the Category 1 thresholds are triggered.

## Estimating transfers

The methodology to identify the transfers that your facility needs to report is described below:

### **Step 1:** *Identify the waste streams on your facility*

A facility can have a number of process waste streams going to a number of destinations, both on and off-site. It may be useful to draw a process flow diagram of your facility's operations to identify the streams. If you already have a flow diagram prepared, for when you determined whether your facility exceeded any NPI reporting thresholds, this diagram can be used.

### **Step 2:** *Identify the destination of the waste stream*

If the waste is transported to a destination for containment or destruction then this transfer must be reported. Potential mandatory reporting transfer destinations could include:

- landfills
- tailings storage facilities
- other purpose built waste storage facilities
- underground injection points
- incineration or other destruction methods
- off-site sewerage systems

If the waste is transported to a destination for any of the following uses, then reporting of this transfer is voluntary:

- reuse;
- recycling;
- reprocessing;
- purification;
- partial purification;
- immobilisation;
- remediation; or
- energy recovery.

### **Step 3:** *Determine if the materials in each waste stream contain NPI substances for which the relevant threshold is exceeded*

You are only required to report transfers of waste containing Category 1, 1b and/or 3 NPI substances for which your facility triggered and reported emissions.

If you do not know the composition of the waste, you may need to verify the composition through chemical and/or physical analysis. Chemical or physical analysis should only be required for the first year of reporting unless your waste streams are highly variable.

### **Step 4:** *Estimate quantities of substances transferred in waste*

You will need to estimate the quantities of the triggered NPI substances in waste being transferred to any mandatory reporting transfer destinations and, if you choose, any voluntary reporting transfer destinations.

Transfers can be estimated using the Transfer Estimation Techniques (TET) contained within the relevant NPI guidance materials (please see note below). Information relating to quantities of triggered NPI substances within the waste material and quantities of waste being produced will be required. This information may be gathered from waste tracking certificates, but may require some additional data collection systems to be put in place.

**Examples 4, 5 and 6** illustrate how to apply TETs to three different facility types, each with a number of different waste streams.

### ***Industry reporting materials***

Once you have identified the NPI substances that your facility is required to report, you can estimate transfer quantities. The relevant EET manual for your industry may contain more information about reporting transfers.

Note: NPI industry reporting materials are periodically updated, with the aim being to include the latest information on facility processes and estimation techniques. However, some manuals are yet to incorporate the latest information, including guidance on estimating transfers.

### ***Reporting format***

Transfers are reported in a separate table to emissions, and require the following information:

- substance
- transfer amount (kg/year)
- whether the transfer is on-site or off-site
- the transfer estimation technique used, and
- the transfer destination, for example, if transferred for containment, destruction, reuse, recycling, reprocessing, purification, remediation, or immobilisation.

### ***Other technical information***

Further information on transfers can be found in the [Transfers Information Booklet](#).

#### EXAMPLE 4 Determining transfers of substances in waste for a sewerage treatment facility

The facility is a sewerage treatment plant managed by a local council. The installed treatment equipment and associated delivery infrastructure represent a range of technologies and processes.

The facility has identified that it triggers the NPI reporting thresholds for:

- the Category 3 substances total nitrogen and total phosphorous
- the Category 1 substances, ammonia (total), boron and compounds, chlorine and hydrogen sulfide
- Categories 2a and 2b, due to combustion activities
- The facility is required to report transfers of the Category 1 and Category 3 substances, but not the Category 2a and 2b substances.

**Step 1:** *Identify the waste streams in your facility*

The facility process diagram identifies an input stream (transfers from outside industry) and four waste streams, one for biosolids and three for treated effluent. Substances in the output waste streams must be considered for reporting as transfers.

**Step 2:** *Identify the destination of the waste streams*

Four distinct waste streams have been identified:

Material	Description of transfer and destination	Transfer reporting requirements
Biosolids	(1) Biosolids are unsuitable for composting due to chemical contamination and are disposed of to landfill	Landfill for containment, therefore mandatory reporting of Category 1 and Category 3 substances.
Treated effluent	(2) Treated effluent is generally provided to a third party for irrigation.	Reuse, therefore voluntary reporting.
	(3) Some treated effluent is pumped via a sewerage system to another sewerage treatment plant for further treatment.	Off-site sewerage system, therefore mandatory reporting of Category 1 and Category 3 substances.
	(4) Some treated effluent is transported via a dedicated pipeline to a facility for purification to produce high quality water.	To a destination for purification and reuse, therefore voluntary reporting.

**Step 3:** *Determine if the materials in each waste stream contain NPI triggered substances*

Routine analytical tests have already been conducted on biosolids and treated effluent. The tests show that that these materials contain boron and compounds, total nitrogen and total phosphorus. Additional tests show that they also contain ammonia, chlorine compounds and hydrogen sulfide.

The facility has identified that it must report transfers of: boron and compounds; total nitrogen, total phosphorus, ammonia, chlorine and hydrogen sulfide within the biosolids sent to landfill, and the effluent sent to another sewerage treatment plan via a sewerage system. It can choose to voluntarily report on biosolids and treated effluent being sent to third parties for reuse and/or further purification.

**Step 4:** *Estimate quantities of substances transferred in waste*

The facility can use results of chemical analysis and total throughput volumes/mass to calculate the mass of NPI substances transferred in waste.

### EXAMPLE 5 Determining transfers of substances in waste from a pig farm

There are two main types of pig housing structures used in the industry. These are conventional housing with slatted floors where wastes are flushed to a central system, or deep litter sheds with a straw type bedding. This facility has conventional housing and has found that it triggers the requirement to report Category 3 due to the quantities of total nitrogen derived from pig urine and faeces.

**Step 1:** *Identify the waste streams at the facility*

The flushing of the waste in the conventional housing structure produces large volumes of effluent. The facility screens the effluent for solids and sends the wastewater to evaporation ponds.

The screened solids are composted on-site and applied to land. The effluent in the final pond is left to evaporate and sometimes used for irrigation purposes on crops used for livestock grazing. The sludge is also applied as a fertiliser. The disposal of carcasses usually occurs by burying to compost on-site.

**Step 2:** *Identify the destination of the waste streams*

The facility examines its waste streams and identifies four destinations:

Material	Description of transfer	Destination and reporting requirements
Carcasses	(1) Buried on-site to decompose.	On-site burial of carcasses is not considered to be a transfer and therefore does not need to be reported.
Effluent	(2) Screened solids are composted and applied to the land.	On-site application of solids for reuse is considered a voluntary reporting transfer destination and therefore can be reported if the facility chooses.
	(3) Waste water is sent to evaporation ponds.	Waste water sent to evaporation ponds is not regarded as a transfer.
	(4) Sludge is applied to the land as a fertiliser.	As with the screened solids, application of the sludge for reuse is considered a voluntary reporting destination and therefore can be reported if the facility chooses.

**Step 3:** *Determine if the materials in each waste stream contain triggered NPI substances*

The facility has identified that it can voluntarily report the transfer of NPI substances in the screened solids and sludge. These materials are known to contain total nitrogen and total phosphorus.

**Step 4:** *Estimate quantities of substances transferred in waste*

The facility can use results of chemical analysis and total throughput volumes/mass to calculate the mass of NPI substances transferred in waste.

### EXAMPLE 6 Determining transfers of substances in waste from a timber product manufacturer

The facility manufactures timber products of various lengths and thicknesses, with both laminated and un-laminated coatings. The facility also collects wood waste to make a reconstructed timber product.

The facility has identified that it triggers the requirement to report through combustion (Category 2b) as well as formaldehyde emissions (Category 1).

**Step 1:** *Identify the waste streams on your facility*

The facility identifies that there are two main waste streams: general waste and prescribed industrial waste. The general waste is mostly generated by the staff canteen and administration areas.

The manufacture of particle board results in liquid prescribed industrial waste, containing formaldehyde based resins and dyes. This waste is sent to concrete lined pits, over time it solidifies and is removed by excavator and taken to a local landfill.

**Step 2:** *Identify the destination of the waste streams*

The facility examines its waste streams and identifies a number of destinations.

Material	Description of transfer	Destination and reporting requirements
General solid waste	Collected by contractor for disposal in a landfill facility.	No reporting is required as general waste is excluded from transfers.
Liquid waste from particle board manufacture	Sent to on-site concrete lined pits to solidify.	This is not the final destination for the waste and therefore does not have to be reported.
	Solidified product is excavated and taken to local landfill for disposal	Off-site containment (i.e. landfill) is a mandatory reporting destination.

**Step 3:** *Determine if the materials in each waste stream contain triggered NPI substances*

The facility identified that the only Category 1 substance triggering the requirement to report was formaldehyde. The facility knows that 20% of the solid waste taken from the concrete lined pits is formaldehyde and so it will need to report the transfer of this substance.

**Step 4:** *Estimate quantities of substances transferred in waste*

Because the facility is charged on a per weight basis for the disposal to landfill of its solid waste and is aware that this waste is 20% formaldehyde, the quantities transferred can be calculated.

## SECTION FIVE

### HOW TO REPORT NPI EMISSIONS AND TRANSFERS

After you have estimated your facility's emissions and transfers you need to report your estimates to your state or territory environment agency within the statutory timeframes. If you own and/or operate more than one facility, a separate report must be lodged for each facility.

Estimates can be reported in two ways – either through the NPI Online Reporting System, which is the preferred way **or** by completing the NPI paper reporting form. Access to both the NPI Online Reporting System and the paper reporting form are available on the NPI website. Both reporting formats have similar data reporting fields.

#### Using the NPI Online Reporting System

The NPI Online Reporting System allows you to enter, validate and submit your NPI report. The system can be accessed anywhere using all modern web browsers, via the Internet.

Two types of user levels apply to the NPI Online Reporting System:

- **Reporters** can enter the basics of an NPI report, but cannot submit and certify the report. Reporters can **release** the report to a coordinator.
- **Coordinators** have the same privileges as reporters, and can also maintain details of the facility, and **submit and certify** NPI reports. Most users will be coordinators.

Each facility can have any number of reporters and coordinators, thus allowing for the greatest flexibility.

Access to the NPI Online Reporting System can be obtained by contacting your state or territory NPI representative. Please note access is only granted on the certification of a registration form by an authorised company officer.

Upon logging in, the user can select the facility and the reporting year, and then follow a step by step path to compile the report. Data from the previous year will pre-populate many fields, thereby reducing the amount of data entry required. Emissions data will be partly validated by the system, comparing the current year against previous years. Where necessary, the user will be asked to explain variance, thus assisting review and quality assessment of data by NPI personnel.

The NPI calculation tools can be used in conjunction with the NPI Online Reporting System to upload your substance emissions. As the calculation tools work **off-line**, on your own computer, none of the facility's production data is reported to the NPI; only the emissions are reported.

All data and calculations should be checked before submitting your report to your state or territory environment agency. You should note that submitting a report via the system is considered by most states and territories as certifying a report. Please contact your local NPI representative to confirm the procedure within your jurisdiction.

If required, you can print your emissions reports and facility details for your records. For users with more advanced skills and in-house environmental management systems, it is possible to upload your emissions reports directly into the NPI Online Reporting System.

For more information, as well as training materials, please visit the NPI website at <http://www.npi.gov.au/>.

## Using the NPI paper reporting form

The paper reporting form is split into five different sections that must be completed before your report is considered finished and acceptable under the NEPM statutory requirements. Once complete, the form must be forwarded to your state or territory environment agency.

Word and PDF copies of the form are available on the NPI website at <http://www.npi.gov.au/>.

## Reporting emissions and transfers

### Reporting significant figures

Emissions and transfer estimates must be reported to the highest level of precision that is justified by the data, in accordance with Australian Standard 2706-2003. However, emissions and transfer estimates will be displayed on the NPI website to two significant figures only. For example:

- A reported value of 52,366,968 kg will be displayed as 52,000,000 kg
- A reported value of 0.000523 kg will be displayed as 0.00052 kg

### Reporting emissions

If an NPI threshold for a substance is exceeded (see **Section 2**), emission of the substance must be estimated, where possible. If an emission cannot be estimated for that substance (e.g., no relevant emission factors are available) but usage data for the substance exists, or if the emission is estimated to be zero, the emissions field should be left blank and an explanation must be provided in the emission validation section of the report.

If there is no usage data for the NPI substance and emissions are unable to be estimated, or are estimated to be zero, then the relevant substance entry should be removed from the report.

### Reporting transfers

If a transfer threshold for a substance is exceeded (see **Section 2**), then transfers for the substance must be estimated, where possible. If a transfer cannot be estimated for that substance but usage data for the substance exists, or if the transfer is estimated to be zero, the transfers field should be left blank and an explanation must be provided in the transfer validation section of the report.

If there is no usage data for the NPI substance and transfers are unable to be estimated, or are estimated to be zero, then the relevant substance entry should be removed from the report.

It should be noted that usage data for the purposes of estimating transfers is not reported.



**FIGURE 2 Reporting checklist**

Visit the NPI website: <ul style="list-style-type: none"><li>• Check for the latest reporting information</li><li>• See if your facility has reported previously</li></ul>	→	<input type="checkbox"/>
Contact your state or territory environment agency to register your facility	→	<input type="checkbox"/>
Report all of your facility's administrative data such as your ABN and location coordinates	→	<input type="checkbox"/>
Record all Category 1, 1a and 1b substances that have tripped the reporting threshold	→	<input type="checkbox"/>
Report emissions to air, land and water for the Category 1, 1a and 1b substances your facility has tripped	→	<input type="checkbox"/>
Calculate and report the amount of fuel or waste burnt at the facility	→	<input type="checkbox"/>
Determine whether the Category 2a or Category 2b threshold has been tripped	→	<input type="checkbox"/>
Report emissions of all Category 2a substances if your facility has tripped the reporting threshold	→	<input type="checkbox"/>
Report emissions of all Category 2a and Category 2b substances if your facility has tripped the Category 2b threshold	→	<input type="checkbox"/>
Report emissions of Category 3 substances if your facility has tripped the reporting threshold	→	<input type="checkbox"/>
Report any transfer in waste for each substance triggered in Category 1, Category 1b and Category 3	→	<input type="checkbox"/>
Report any emission reduction activities from your facility	→	<input type="checkbox"/>
Enter details into the NPI online reporting system or the reporting form	→	<input type="checkbox"/>
Contact your state or territory environment agency if you need assistance	→	<input type="checkbox"/>

## DICTIONARY OF NPI TERMS AND ACRONYMS

<b>A</b>	Activity Rate
<b>ABN</b>	Australian Business Number
<b>ACN</b>	Australian Company Number
<b>Anthropogenic</b>	Caused by of human activity
<b>ANZSIC code</b>	Australian and New Zealand Standard Industrial Classification code. In the NPI, this is used to classify facilities into industry types.
<b>AP-42</b>	AP-42, Fifth Edition, Compilation of Air Pollutant Emission Factors
<hr/>	
<b>(B[a]P<sub>eq</sub>)</b>	TEF scaled according to Benzo[a]Pyrene as a reference value of 1
<b>Biogenic</b>	Caused by living organisms
<b>BIPM</b>	International Bureau of Weights and Measures / <i>Bureau International des Poids et Mesures</i>
<hr/>	
<b>CAS No.</b>	Chemical Abstract Series number
<hr/>	
<b>E</b>	Emission(s)
<b>EET</b>	Emission Estimation Technique
<b>EF</b>	Emission factor
<b>EFR</b>	Emission Factor Rating
<b>Emission</b>	For the purposes of NPI reporting means the release of a substance to the environment, whether in pure form or contained in other matter, and whether in solid, liquid or gaseous form. It does not include the transfer of a substance; however, it does include the release of a substance to the environment, during transfer and from a transfer destination.
<b>ER</b>	Overall emission reduction efficiency (%)
<hr/>	

**Facility** Any building, land or offshore site from which an NPI substance may be emitted, together with any machinery, plant, appliance, equipment, implement, tool or other item used in connection with any activity carried out.

**Facility boundary** For the purposes of NPI reporting if two or more sites\* are less than 2km apart they should be regarded as one facility unless residential areas are situated between the sites. For sites between 2km and 10 km apart the occupier can choose to report as one or two facilities unless residential areas are situated between the sites. Sites more than 10km apart should be treated as separate facilities. In determining the distance between sites, the shortest distance between site boundaries should be used rather than the geographical centres of the sites.

\*Exclusion:

- A tailings storage facility (TSF) is deemed to be part of the facility from which the waste emanates, irrespective of the distance between the TSF and the waste source ('Sites' can refer to main open pits, satellite pits, concentrators etc).

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**Industry reporting materials** Industry specific guides for Australian manufacturing, industrial and service facilities to assist with the estimation and reporting of emissions and transfers of NPI listed substances.

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**kg** Kilogram(s)

**kPa** Kilopascal(s)

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**L** Litre(s)

**Mandatory reporting transfer destination** For the purposes of NPI reporting, mandatory reporting transfer destination means destination for containment, including landfill, tailings storage facility, underground injection or other long term purpose-built waste storage structure; an off-site destination for destruction; an off-site sewerage system; or an off-site treatment facility which leads solely to one or more of the above.

**MJ** Mega joule(s)

**MW** Megawatt(s)

**MWh** Megawatt hr(s) = 3600 MW

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**NEPM** National Environment Protection Measure

**NPI** National Pollutant Inventory  
A publicly available Internet database of emissions and transfers of 93 substances from industrial facilities and diffuse sources in Australia.

<b>OECD</b>	Organisation for Economic Cooperation and Development
<b>ORS</b>	Online Reporting System An online data entry portal allowing reporters to enter, validate and submit their NPI reports and update facility information
<hr/>	
<b>PFD</b>	Process Flow Diagram
<b>PRTR</b>	Pollutant Release and Transfer Register
<hr/>	
<b>Reporting Period</b>	One year, usually a financial year beginning 1 July and ending 30 June.
<hr/>	
<b>Scientific notation</b>	used to express numbers e.g. 7.38E-02 represents 0.0738 or $7.38 \times 10^{-2}$
<b>SDS</b>	Safety Data Sheet
<b>SI</b>	<i>Le Système International d'Unités</i> (International System of units) System of defining standard units of measurement maintained by the Bureau International des Poids et Mesures (BIPM), based on seven base units (metre, kilogram, second, ampere, kelvin, mole and candela). All other units of measurement are derived from the seven base units.
<b>SME</b>	Small and Medium Enterprises Small enterprises employ fewer than 20 people and up to 200 for medium. (unless they have zero employment and sales over \$10 million). Excludes non-employing unincorporated businesses.
<hr/>	
<b>t</b>	Tonne(s)
<b>TEF</b>	Toxicity Equivalency Factor A factor that provides a relative value for a toxic chemical in terms of its comparable toxicity to another chemical of the same group, based on a consensus when considering biological and toxicological endpoints. For polycyclic aromatic hydrocarbons, the baseline chemical used is benzo[a]pyrene.
<b>TEQ</b>	Toxicity Equivalency Quantity. A means of scaling the emissions of each species of a particular group of chemical compounds according to their relative toxicity. Each species is multiplied by the relevant TEF and then the values are added to produce an overall TEQ.
<b>TET</b>	Transfer Estimation Technique
<b>TF</b>	Transfer Factor
<b>TFR</b>	Transfer Factor Rating
<b>TSF</b>	Tailings storage facility

<b>Total VOC</b>	Total Volatile Organic Compounds (TVOC) TVOC are defined as the sum, by mass, of all Volatile Organic Compound constituents, as defined in Appendix C. TVOC constituents can include non-NPI substances
<b>Transfer</b>	A transfer is the transport or movement, on-site or off-site, of substances contained in waste for: <ul style="list-style-type: none"> <li>• containment,</li> <li>• destruction,</li> <li>• treatment that leads to: <ul style="list-style-type: none"> <li>• reuse, recycling or reprocessing,</li> <li>• purification or partial purifications,</li> <li>• remediation, or</li> <li>• immobilisation</li> </ul> </li> <li>• energy recovery</li> </ul>
<hr/> <b>UNCED</b>	United Nations Conference on Environment and Development
<b>Usage</b>	The handling, manufacture, import, processing, coincidental production or other use of the substance.
<b>USEPA</b>	The United States Environmental Protection Agency
<hr/> <b>Voluntary reporting transfer destination</b>	Means a destination for reuse, recycling, reprocessing, purification, partial purification, immobilisation, remediation or energy recovery.
<b>Vol%</b>	Percentage of a substance in a solution by volume.
<hr/> <b>Waste rock</b>	The sub-grade rock displaced during underground or surface mining operations.

**APPENDIX A  
COMPLETE LIST OF THE 93 NPI SUBSTANCES**

**TABLE 2 All NPI substances**

	SUBSTANCE	CAS No.	THRESHOLD CATEGORY
	Acetaldehyde	75-07-0	1
	Acetic acid (ethanoic acid)	64-19-7	1
	Acetone	67-64-1	1
	Acetonitrile	75-05-8	1
	Acrolein	107-02-8	1
	Acrylamide	79-06-1	1
	Acrylic acid	79-10-7	1
	Acrylonitrile (2-propenenitrile)	107-13-1	1
	Ammonia (total)	N/A	1
	Aniline (benzenamine)	62-53-3	1
	Antimony and compounds	7440-36-0	1
	Arsenic and compounds	7440-38-2	1 & 2b
	Benzene	71-43-2	1
	Benzene hexachloro- (HCB)	118-74-1	1
	Beryllium and compounds	7440-41-7	1 & 2b
	Biphenyl (1,1-biphenyl)	92-52-4	1
	Boron and compounds	7440-42-8	1
1,3-	Butadiene (vinyl ethylene)	106-99-0	1
	Cadmium and compounds	7440-43-9	1 & 2b
	Carbon disulfide	75-15-0	1
	Carbon monoxide	630-08-0	1, 2a & 2b
	Chlorine and compounds	N/A	1
	Chlorine dioxide	10049-04-4	1
	Chloroethane (ethyl chloride)	75-00-3	1
	Chloroform (trichloromethane)	67-66-3	1
	Chlorophenols (di, tri, tetra)	N/A	1
	Chromium (III) compounds	7440-47-3	1 & 2b
	Chromium (VI) compounds	7440-47-3	1 & 2b
	Cobalt and compounds	7440-48-4	1
	Copper and compounds	7440-50-8	1 & 2b
	Cumene (1-methylethylbenzene)	98-82-8	1
	Cyanide (inorganic) compounds	N/A	1
	Cyclohexane	110-82-7	1
1,2-	Dibromoethane	106-93-4	1
	Dibutyl phthalate	84-74-2	1
1,2-	Dichloroethane	107-06-2	1
	Dichloromethane	75-09-2	1
	Ethanol	64-17-5	1
2-	Ethoxyethanol	110-80-5	1
2-	Ethoxyethanol acetate	111-15-9	1
	Ethyl acetate	141-78-6	1
	Ethyl butyl ketone	106-35-4	1
	Ethylbenzene	100-41-4	1
	Ethylene glycol (1,2-ethanediol)	107-21-1	1
	Ethylene oxide	75-21-8	1
	Di-(2-Ethylhexyl) phthalate (DEHP)	117-81-7	1
	Fluoride compounds	N/A	1, 2a & 2b

	SUBSTANCE	CAS No.	THRESHOLD CATEGORY
	Formaldehyde (methyl aldehyde)	50-00-0	1
	Glutaraldehyde	111-30-8	1
n-	Hexane	110-54-3	1
	Hydrochloric acid	7647-01-0	1, 2a & 2b
	Hydrogen sulfide	7783-06-4	1
	Lead and compounds	7439-92-1	1 & 2b
	Magnesium oxide fume	1309-48-4	1 & 2b
	Manganese and compounds	7439-96-5	1
	Mercury and compounds	7439-97-6	1b & 2b
	Methanol	67-56-1	1
2-	Methoxyethanol	109-86-4	1
2-	Methoxyethanol acetate	110-49-6	1
	Methyl ethyl ketone	78-93-3	1
	Methyl isobutyl ketone	108-10-1	1
	Methyl methacrylate	80-62-6	1
4,4'	Methylene-bis(2-chloroaniline) (MOCA)	101-14-4	1
	Methylene bis (phenylisocyanate)	101-68-8	1
	Nickel and compounds	7440-02-0	1 & 2b
	Nickel carbonyl	13463-39-3	1
	Nickel subsulfide	12035-72-2	1
	Nitric acid	7697-37-2	1
	Organo-tin compounds	N/A	1
	Oxides of Nitrogen	N/A	2a & 2b
	Particulate Matter $\leq 2.5$ $\mu\text{m}$ (particulate matter 2.5 microns or less, also know as PM <sub>2.5</sub> )	N/A	2a & 2b
	Particulate Matter $\leq 10.0$ $\mu\text{m}$ (particulate matter 10 microns or less, also know as PM <sub>10</sub> )	N/A	2a & 2b
	Phenol	108-95-2	1
	Phosphoric acid	7664-38-2	1
	Polychlorinated biphenyls	N/A	1
	Polychlorinated dioxins and furans (TEQ)	N/A	2b
	Polycyclic aromatic hydrocarbons (B[a]P <sub>eq</sub> )	N/A	2a & 2b
	Selenium and compounds	7782-49-2	1
	Styrene (ethenylbenzene)	100-42-5	1
	Sulfur dioxide	7446-09-5	1, 2a & 2b
	Sulfuric acid	7664-93-9	1
1,1,2,2-	Tetrachloroethane	79-34-5	1
	Tetrachloroethylene	127-18-4	1
	Toluene (methylbenzene)	108-88-3	1
	Toluene-2,4-diisocyanate	584-84-9	1
	Total Nitrogen	N/A	3
	Total Phosphorus	N/A	3
	Total Volatile Organic Compounds	N/A	1a, 2a & 2b
1,1,2-	Trichloroethane	79-00-5	1
	Trichloroethylene	79-01-6	1
	Vinyl Chloride Monomer	75-01-4	1
	Xylenes (individual or mixed isomers)	1330-20-7	1
	Zinc and compounds	7440-66-6	1

## Notes on the NPI substance list

Information on substance definitions and thresholds is reproduced here. More information is available on the website [www.npi.gov.au](http://www.npi.gov.au) or from the *National Environment (National Pollutant Inventory) Protection Measure 1998 (as varied)* (available from [www.scew.gov.au](http://www.scew.gov.au)).

In this Schedule:

- a) Category 1 involves the use of 10 tonnes or more of the substance in the reporting period.
- b) Category 1a involves the use of 25 tonnes or more of the substance in the reporting period.
- c) Category 1b involves the use of 5 kilograms or more of the substance in the reporting period.  
use' of a substance means the handling, manufacture, import, processing, coincidental production or other use of the substance.
- d) Category 2a involves the burning of:
  - (a) 400 tonnes or more of fuel or waste in the reporting period; or
  - (b) 1 tonne or more of fuel or waste in any hour in the reporting period.
- e) Category 2b substance involves:
  - (a) the burning of 2,000 tonnes or more of fuel or waste in the reporting period; or
  - (b) the consumption of 60,000 megawatt hours or more of electrical energy in the reporting period for other than lighting or motive purposes in the reporting period; or
  - (c) the maximum potential power consumption of the facility being rated at 20 megawatts or more for other than lighting or motive purposes in the reporting period.
- f) Category 3 involves the emission to water or transfer to a mandatory reporting transfer destination of 15 tonnes or more of total Nitrogen or 3 tonnes or more of Total Phosphorus in the reporting period.
- g) The threshold for Category 1 acids refers to the amount of the acid compound used (for example, in the case of "hydrochloric acid", the threshold refers to the amount of hydrogen chloride used) in the reporting period. This amount can be calculated as a factor of volume and concentration.
- h) the thresholds for 'total nitrogen' and 'total phosphorus' refer only to the amounts of those nitrogen and phosphorus compounds that give rise to nitrate/nitrite and phosphate ions respectively and, for transfers, the thresholds of 'total nitrogen' and 'total phosphorus' refer only to the amounts of soluble compounds of nitrogen and phosphorus that are in materials that readily permit the dissolution of these substances.
- i) the threshold for "ammonia (total)" refers to the total amount of both ammonia (NH<sub>3</sub> CAS number 7664-41-7) and the ammonium ion (NH<sub>4</sub><sup>+</sup>) in solution.
- j) the threshold for 'chlorine and compounds' includes the amount of chlorine compounds used that may produce emissions of chlorine gas (Cl<sub>2</sub>), free residual chlorine, hypochlorite ion (OCl<sup>-</sup>), hypochlorous acid (HOCl) or chloramines.
- k) the threshold for Category 1 substances or Category 1b substances that are listed as "(a metal) and compounds" refers to the total amount of the metal and its compounds used (for example, "lead and compounds" refers to lead and all compounds that incorporate lead).

For the purposes of estimating emission data and mandatory transfer data to be reported under clause 9 of the Measure:

- l) the amount of a Category 1 acid emitted refers to the amount of the actual acid compound emitted or transferred in the reporting period (for example, in the case of "hydrochloric acid", the amount emitted or transferred refers to the amount of hydrogen chloride emitted or transferred). It does not include any amounts of the acid that have been neutralised before release as the acid no longer exists.



- m) the amounts of “total nitrogen” and “total phosphorus” emitted or transferred refer to the amounts of those nitrogen and phosphorus compounds emitted or transferred in the reporting period that give rise to nitrate/nitrite and phosphate ions respectively and, for transfers, the amounts of ‘total nitrogen’ and ‘total phosphorus’ transferred refer only to the amounts of soluble compounds of nitrogen and phosphorus that are in materials that readily permit the dissolution of these substances.
- n) the amount of “ammonia (total)” emitted or transferred refers to the total amount of both ammonia (NH<sub>3</sub> CAS number 7664-41-7) and the ammonium ion (NH<sub>4</sub><sup>+</sup>) emitted or transferred in solution in the reporting period.
- o) the amount of ‘chlorine and compounds’ emitted or transferred refers to the total amount of chlorine gas (Cl<sub>2</sub>), free residual chlorine, hypochlorite ion (OCl<sup>-</sup>), hypochlorous acid (HOCl) and chloramines emitted or transferred in the reporting period, expressed as the equivalent weight of chlorine (Cl).
- p) the amount emitted or transferred in relation to a substance listed as “(a metal) and compounds” refers only to the amount of the metal emitted or transferred in the reporting period (for example, the amount of “lead and compounds” emitted refers only to the amount of lead emitted).
- q) the amount of ‘polychlorinated dioxins and furans (TEQ)’ emitted or transferred refers to the sum of the toxic equivalent amounts of the individual congeners emitted in the reporting period. Toxic equivalent amounts are obtained by multiplying the mass of the congener by the Toxicity Equivalency Factor published in industry reporting materials.
- r) the amount of ‘polycyclic aromatic hydrocarbons (benzo[a]pyrene equivalent) (PAHs B[a]P<sub>eq</sub>)’ emitted refers to the sum of the toxic equivalent amounts of the individual congeners emitted or transferred in the reporting period. Toxic equivalent amounts are obtained by multiplying the mass of the congener by the Toxicity Equivalency Factor published in industry reporting materials.
- s) the amount of ‘oxides of nitrogen’ emitted refers to the mass of nitrogen oxide (NO) and nitrogen dioxide (NO<sub>2</sub>) expressed as the equivalent mass of nitrogen dioxide according to the protocol published in industry reporting materials.
- t) the amount of ‘particulate matter ≤2.5 μm (PM<sub>2.5</sub>)’ emitted refers only to the amount emitted from the burning of fuel or waste.

**TABLE 3 NPI substance reporting list (Category 2a)**

prefix	SUBSTANCE	CAS No.	THRESHOLD CATEGORY	THRESHOLD
	Carbon monoxide	630-08-0	2a	400 tonnes per year, or 1 tonne per hour
	Fluoride compounds	N/A		
	Hydrochloric acid	7647-01-0		
	Oxides of Nitrogen	N/A		
	Particulate Matter 2.5 um (particulate matter 2.5 microns or less, also known as PM <sub>2.5</sub> )	N/A		
	Particulate Matter 10.0 um (particulate matter 10 microns or less, also known as PM <sub>10</sub> )	N/A		
	Polycyclic aromatic hydrocarbons (B[a]P <sub>eq</sub> )	N/A		
	Sulfur dioxide	7446-09-5		
	Total Volatile Organic Compounds	N/A		

**TABLE 4 NPI substance reporting list (Category 2b)**

prefix	SUBSTANCE	CAS No.	THRESHOLD CATEGORY	THRESHOLD
	Arsenic and compounds	7440-38-2	2b	2,000 tonnes per year, or 60,000 megawatt hours, or rated at 20 megawatts
	Beryllium and compounds	7440-41-7		
	Cadmium and compounds	7440-43-9		
	Carbon monoxide	630-08-0		
	Chromium (III) compounds	7440-47-3		
	Chromium (VI) compounds	7440-47-3		
	Copper and compounds	7440-50-8		
	Fluoride compounds	N/A		
	Hydrochloric acid	7647-01-0		
	Lead and compounds	7439-92-1		
	Magnesium oxide fume	1309-48-4		
	Mercury and compounds	7439-97-6		
	Nickel and compounds	7440-02-0		
	Oxides of Nitrogen	N/A		
	Particulate Matter 2.5 um (particulate matter 2.5 microns or less, also known as PM <sub>2.5</sub> )	N/A		
	Particulate Matter 10.0 um (particulate matter 10 microns or less, also known as PM <sub>10</sub> )	N/A		
	Polychlorinated dioxins and furans (TEQ)	N/A		
	Polycyclic aromatic hydrocarbons (B[a]P <sub>eq</sub> )	N/A		
	Sulfur dioxide	7446-09-5		
	Total Volatile Organic Compounds	N/A		

**APPENDIX B  
ADDITIONAL NPI SUBSTANCE DATA**

**TABLE 5 Additional data about the 93 substances**

Prefix	SUBSTANCE (CAS No.2)	ALTERNATIVE NAME4	MOLECULAR FORMULA	MOLECULAR WEIGHT	SPECIFIC GRAVITY1	VOC?
	Acetaldehyde (75-07-0)		C <sub>2</sub> H <sub>4</sub> O	44.05	0.788 (l)	Yes
	Acetic acid (64-19-7)	Ethanoic acid	C <sub>2</sub> H <sub>4</sub> O <sub>2</sub>	60.05	1.053 (l)	Yes
	Acetone (67-64-1)		C <sub>3</sub> H <sub>6</sub> O	58.09	0.791 (l)	Yes
	Acetonitrile (75-05-8)		C <sub>2</sub> H <sub>3</sub> N	41.05	0.787 (l)	Yes
	Acrolein (107-02-8)		C <sub>3</sub> H <sub>4</sub> O	56.06	0.839 (l)	Yes
	Acrylamide (79-06-1)		C <sub>3</sub> H <sub>5</sub> NO	71.08	1.122 (l)	
	Acrylic acid (79-10-7)		C <sub>3</sub> H <sub>4</sub> O <sub>2</sub>	72.06	1.062 (l)	Yes
	Acrylonitrile (107-13-1)	2-propenenitrile	C <sub>3</sub> H <sub>3</sub> N	53.06	0.806 (l)	Yes
	Ammonia (total)		NH <sub>3</sub>	17.03	0.597 (g)	
	Aniline (62-53-3)		C <sub>6</sub> H <sub>7</sub> N	93.13	1.022 (l)	Yes
	Antimony (7440-36-0) and compounds		Sb Various compounds	171.75 Varies	6.68 (s) Varies	
	Arsenic (7440-38-2) and compounds		As Various compounds	74.92 Varies	4.70 (s) Varies	
	Benzene (71-43-2)		C <sub>6</sub> H <sub>6</sub>	78.11	0.879 (l)	Yes
	Benzene hexachloro (118-74-1)	Hexachlorobenzene (HCB)	C <sub>6</sub> Cl <sub>6</sub>	284.78	2.044	
	Beryllium (7440-41-7) and compounds		Be Various compounds	9.01 Varies	1.848 (s) Varies	
	Biphenyl (92-52-4 )	1,1-biphenyl	C <sub>12</sub> H <sub>10</sub>	154.21	1.041 (s)	
	Boron (7440-42-8) and compounds		B Various compounds	10.81 Varies	2.46 (g) Varies	
	1,3- Butadiene(106-99-0)	Vinyl ethylene	C <sub>4</sub> H <sub>6</sub>	54.09	0.621 (l)	Yes
	Cadmium (7440-43-9) and compounds		Cd Various compounds	112.41 Varies	8.65 (s) Varies	
	Carbon disulfide (75-15-0)		CS <sub>2</sub>	44.01	1.26 (l)	
	Carbon monoxide (630-08-0)		CO	28.01	0.814 (l) 0.968 (g)	
	Chlorine (7782-50-5) and compounds		Cl <sub>2</sub>	70.9	2.46 (g)	
	Chlorine dioxide (10049-04-4)		ClO <sub>2</sub>	67.45	2.34 (g)	
	Chloroethane (75-00-3)	Ethyl chloride	C <sub>2</sub> H <sub>5</sub> Cl	64.51	2.22 (g)	Yes
	Chloroform (67-66-3)	trichloromethane	CHCl <sub>3</sub>	119.38	1.484	Yes
	Chlorophenols (di, tri, tetra)		e.g. C <sub>6</sub> H <sub>4</sub> Cl <sub>2</sub> O	N/A	N/A	
	Chromium (III) (7440-47-3) Compounds		Cr (III) compounds	Varies	Varies	
	Chromium (VI) (7440-47-3) Compounds		Cr (VI) compounds	Varies	Varies	
	Cobalt (7440-48-4) and compounds		Co Various compounds	58.94 Varies	8.9 (s) Varies	
	Copper (7440-50-8) and compounds		Cu Various	63.55 Varies	8.94 (s) Varies	

**TABLE 5 Additional data about the 93 substances**

Prefix	SUBSTANCE (CAS No.2)	ALTERNATIVE NAME4	MOLECULAR FORMULA	MOLECULAR WEIGHT	SPECIFIC GRAVITY1	VOC?
			compounds			
	Cumene (98-82-8)	1-methylethylbenzene	C <sub>9</sub> H <sub>12</sub>	120.19	0.862 (l)	Yes
	Cyanide Inorganic compounds		CN <sup>-</sup>	26.023	N/A	
	Cyclohexane (110-82-7)		C <sub>6</sub> H <sub>12</sub>	84.16	0.778 (l)	Yes
1,2-	Dibromoethane (106-93-4)		C <sub>2</sub> H <sub>4</sub> Br <sub>2</sub>	187.6	2.172 (l)	Yes
n-	Dibutyl phthalate (84-74-2)		C <sub>16</sub> H <sub>22</sub> O <sub>4</sub>	278.35	1.046 (l)	
1,2-	Dichloroethane (107-06-2)		C <sub>2</sub> H <sub>4</sub> Cl <sub>2</sub>	98.96	1.257 (l)	Yes
	Dichloromethane (75-09-2)	Methylene Chloride	CH <sub>2</sub> Cl <sub>2</sub>	84.9	1.316 (l)	Yes
	Ethanol (64-17-5)		C <sub>2</sub> H <sub>5</sub> OH	46.07	0.789 (l)	Yes
2-	Ethoxyethanol (110-80-5)		C <sub>4</sub> H <sub>10</sub> O <sub>2</sub>	90.12	0.931 (l)	Yes
2-	Ethoxyethanol Acetate (111-15-9)		C <sub>6</sub> H <sub>12</sub> O <sub>3</sub>	132.16	0.975 (l)	Yes
	Ethyl acetate (141-78-6)		C <sub>4</sub> H <sub>8</sub> O <sub>2</sub>	88.11	0.902 (l)	Yes
	Ethyl n-butyl ketone (106-35-4)		C <sub>7</sub> H <sub>14</sub> O	114.2	0.820 (l)	Yes
	Ethylbenzene (100-41-4)		C <sub>2</sub> H <sub>5</sub> C <sub>6</sub> H <sub>5</sub>	106	0.870 (l)	Yes
	Ethylene glycol (107-21-1)	1,2-ethanediol	C <sub>2</sub> H <sub>6</sub> O <sub>2</sub>	62.07	1.1135 (l)	
	Ethylene oxide (75-21-8)		C <sub>2</sub> H <sub>4</sub> O			Yes
	Di-(2-Ethylhexyl) phthalate (117-81-7)	DEHP	C <sub>24</sub> H <sub>38</sub> O <sub>4</sub>	390.56	(s)	
	Fluoride compounds		Various compounds			
	Formaldehyde (50-00-0)	Methyl aldehyde	CH <sub>2</sub> O	30.03	1.067 (g)	Yes
	Glutaraldehyde (111-30-8)		C <sub>5</sub> H <sub>8</sub> O <sub>2</sub>	100.12		Yes
	Hexachlorobenzene (118-74-1)		C <sub>6</sub> Cl <sub>6</sub>	284.78	2.044 (s)	
n-	Hexane (110-54-3)		C <sub>6</sub> H <sub>14</sub>	86.18	0.660 (l)	Yes
	Hydrochloric acid (7647-01-0)		HCl	36.5	1.055 (l)	
	Hydrogen sulfide (7783-06-4)		H <sub>2</sub> S	34.08	1.19 (g)	
	Lead (7439-92-1) and compounds		Pb Various compounds	207.2 Varies	11.34 (s) Varies	
	Magnesium oxide fume (1309-48-4)		MgO	40.30		
	Manganese (7439-96-5) and compounds		Mn Various compounds	54.94 Varies	7.47 (s) Varies	
	Mercury (7439-97-6) and compounds		Hg Various compounds	200.59 Varies	13.53 (l) Varies	
	Methanol (67-56-1)		CH <sub>3</sub> OH	32.04	0.79 (l)	Yes
2-	Methoxyethanol (109-86-4)		C <sub>3</sub> H <sub>6</sub> O <sub>2</sub>	76.10	0.966 (l)	Yes
2-	Methoxyethanol acetate (110-49-6)		CH <sub>2</sub> OOCCH <sub>3</sub>	118.13	1.01 (l)	Yes
	Methyl ethyl ketone (78-93-3)		C <sub>4</sub> H <sub>8</sub> O	72.11	0.805 (l)	Yes
	Methyl isobutyl ketone (108-10-1)		C <sub>6</sub> H <sub>12</sub> O	100.16	0.801 (l)	Yes

**TABLE 5 Additional data about the 93 substances**

Prefix	SUBSTANCE (CAS No.2)	ALTERNATIVE NAME4	MOLECULAR FORMULA	MOLECULAR WEIGHT	SPECIFIC GRAVITY1	VOC?
	Methyl methacrylate (80-62-6)		C <sub>4</sub> H <sub>6</sub> O <sub>2</sub>	86.09	1.015 (l)	Yes
4,4'-	Methylene-bis (2-chloroaniline) (MOCA) (101-14-4)		C <sub>13</sub> H <sub>12</sub> Cl <sub>2</sub> N <sub>2</sub>	267.16	(s)	
	Methylenebis (101-68-8)	Phenylisocyanate	C <sub>15</sub> H <sub>10</sub> N <sub>2</sub> O <sub>2</sub>	250.26	1.180 (s)	
	Nickel (7440-02-0) and compounds		Ni Various compounds	58.69 Varies	8.908 (s) Varies	
	Nickel carbonyl (13463-39-3)		C <sub>4</sub> -NiO <sub>4</sub>	170.74	1.318 (l)	
	Nickel subsulfide (12035-72-2)		Ni <sub>3</sub> S <sub>2</sub>	240.25	(s)	
	Nitric acid (7697-37-2)		HNO <sub>3</sub>	63.01	1.503 (l)	
	Organo-tin compounds			Varies	Varies	
	Oxides of Nitrogen		e.g. NO and NO <sub>2</sub>	Varies	Varies	
	Particulate Matter < 2.5 µm	PM <sub>2.5</sub>		Varies	Varies	
	Particulate Matter < 10.0 µm	PM <sub>10</sub>		Varies	Varies	
	Phenol (108-95-2)		C <sub>6</sub> H <sub>6</sub> O	94.11	1.071 (s)	
	Phosphoric acid (7664-38-2)		H <sub>3</sub> PO <sub>4</sub>	98.00	(s)	
	Polychlorinated biphenyls	PCBs		Varies	Varies	
	Polychlorinated dioxins and furans (TEQ)			Varies	Varies	
	Polycyclic aromatic hydrocarbons (B[a]P <sub>eq</sub> )			Varies	Varies	
	Selenium (7782-49-2) and compounds		Se Various compounds	78.96 Varies	3.00 (s) Varies	
	Styrene (100-42-5)	ethenylbenzene	C <sub>8</sub> H <sub>8</sub>	104.15	0.906 (l)	Yes
	Sulfur dioxide (7446-09-5)		SO <sub>2</sub>	64.06	2.22 (g)	
	Sulfuric acid (7664-93-9)		H <sub>2</sub> SO <sub>4</sub>	98.08	1.84 (l)	
1,1,2- 2-	Tetrachloroethane (79-34-5)		Cl <sub>2</sub> (CH) <sub>2</sub> Cl <sub>2</sub>	167.85	1.587 (l)	Yes
	Tetrachloroethylene (127-18-4)		C <sub>2</sub> Cl <sub>4</sub>	165.83	1.62 (l)	Yes
	Toluene (108-88-3)	methylbenzene	C <sub>7</sub> H <sub>8</sub>	92.14	0.866 (l)	Yes
	Toluene-2,4-diisocyanate (584-84-9)		C <sub>9</sub> H <sub>6</sub> N <sub>2</sub> O <sub>2</sub>	174.16	1.224 (l)	
	Total Nitrogen					
	Total Phosphorus					
	Total Volatile Organic Compounds		N/A	Varies	Varies	
1,1,2-	Trichloroethane (79-00-5)		C <sub>2</sub> H <sub>3</sub> Cl <sub>3</sub>	133.4	1.442 (l)	Yes
	Trichloroethylene (79-01-6)		C <sub>2</sub> HCl <sub>3</sub>	131.39	1.46 (l)	Yes
	Vinyl Chloride Monomer (75-01-4)		C <sub>2</sub> H <sub>3</sub> Cl	62.5	0.911 (g)	Yes
	Xylenes (1330-20-7) (individual or mixed isomers)		e.g. C <sub>8</sub> H <sub>10</sub>	e.g. 106.17	e.g. 0.86 (l)	Yes
	Zinc (7440-66-6) and compounds		Zn Various compounds	65.38 Varies	7.14 (s) Varies	

Notes:

Specific gravity is relative to water at 20°C for solids (s) and liquids (l), and air at 20°C and 1atm (101.3 kPa) for gases (g). Some specific gravity data provided were determined at temperatures other than 20°C.

CAS No. is the Chemical Abstract Series Number.

Further information about these substances can be attained from various sources:

The NPI Publication – Contextual Information Dec. 1999

The Merck Index from Merck and Co., Inc

[www.sigma-aldrich.com](http://www.sigma-aldrich.com)

Substance Data Sheets (SDS) for NPI substances should be available from suppliers of any substance.

There are usually a number of alternative names – only one is provided here.

Where an element and its compounds are listed (e.g. lead and compounds), the Molecular Weight and Specific Gravity provided are for the element itself (e.g. lead). The properties of the various compounds will vary considerably, depending on the type of compound. For example lead oxide (PbO) and lead sulfide (PbS) have a specific gravity of 9.5 and 7.5 respectively.

More information about the NPI substances is available on the NPI website at

<http://www.npi.gov.au/substances/fact-sheets> where a profile for each NPI substance is provided.

## APPENDIX C ADDITIONAL INFORMATION ON TOTAL VOLATILE ORGANIC COMPOUNDS

### NPI definition of volatile organic compounds

The NPI defines volatile organic compounds (VOC) as any compound containing carbon that:

- Has a vapour pressure greater than 0.01 kPa at 293.15 K (i.e. 20°C), i.e., readily vapourises under normal indoor atmospheric conditions of temperature and pressure; and
- Is photochemically reactive, i.e., can contribute to photochemical smog formation.

VOC comprises of a very large range of compounds, including some NPI substances. Specific substances for which the above definition of VOC does not apply for NPI reporting purposes are:

- Carbon monoxide;
- Methane;
- Acrylamide;
- Benzene hexachloro;
- Biphenyl;
- Chlorophenols;
- n- Butyl phthalate;
- Ethylene glycol;
- di- (2-Ethylhexyl) phthalate (DEHP);
- 4,4- Methylene bis 2,4 aniline (MOCA);
- Methylenebis;
- Phenol; and
- Toluene- 2,4-diisocyanate

VOC that are also NPI substances are set out in **Table 6**.

**TABLE 6 NPI substances that are VOC**

Substance	CASR #	Substance	CASR #
Acetaldehyde	75-07-0	Ethyl butyl ketone	106-35-4
Acetic acid (ethanoic acid)	64-19-7	Ethylbenzene	100-41-4
Acetone	67-64-1	Ethylene oxide	72-21-8
Acetonitrile	75-05-8	Formaldehyde (methyl aldehyde)	50-00-0
Acrolein	107-02-8	Glutaraldehyde	111-30-8
Acrylonitrile (2- propenenitrile)	107-13-1	n- Hexane	110-54-3
Acrylic Acid	79-10-7	Methanol	67-56-1
Aniline (benzenamine)	62-53-3	2- Methoxyethanol	109-86-4
Benzene	71-43-2	2- Methoxyethanol acetate	110-49-6
1,3- Butadiene	106-99-0	Methyl ethyl ketone	78-93-3
Chloroethane (ethyl chloride)	75-00-3	Methyl isobutyl ketone	108-10-1
Chloroform (trichloromethane)	67-66-3	Methyl methacrylate	80-62-6
Cumene (1- methylethylbenzene)	98-82-8	Styrene (ethenylbenzene)	100-42-5
Cyclohexane	110-82-7	Tetrachloroethylene	127-18-4
1,2- Dibromoethane	106-93-4	1,1,2,2- Tetrachloroethane	79-34-5
1,2- Dichloroethane	107-06-2	Toluene (methylbenzene)	108-88-3
Dichloromethane	75-09-2	1,1,2- Trichloroethane	79-00-5
Ethanol	64-17-5	Trichloroethylene	79-01-6
2- Ethoxyethanol	110-80-5	Vinyl chloride monomer	75-01-4
2- Ethoxyethanol acetate	111-15-9	Xylenes (individual or mixed isomers)	1330-20-7
Ethyl acetate	141-78-6		

It is important to note that the reason for the inclusion of the above VOC in the NPI is their potential toxicity to human health and the environment, not because of their smog forming potential.

### NPI definition of total volatile organic compounds

The NPI defines total volatile organic compounds (TVOC) as the sum, by mass, of individual VOC, including non-NPI VOC. The inclusion of TVOC in the NPI recognises the combined effect of individual volatile organic compounds that contribute to smog formation. The individual VOC may not otherwise be captured due to the usage threshold for individual VOC not being exceeded. The main sources of VOC emissions are the storage and use of liquid and gaseous fuels, the storage and use of solvents, and the combustion of fuels.

#### ***Estimating TVOC emissions***

TVOC emissions from fuel burning, fuel storage and other solvent use can be estimated using the relevant NPI emission estimation technique manual(s). For fuel storage, all losses from breathing and refilling are to be regarded as TVOC emissions. For use of solvents, paints and other such products, the TVOC emissions often are equal to the total VOC content of the product. These emissions may be reduced by techniques such as vapour recovery.



## APPENDIX D UNIT CONVERSION FACTORS

### SI and Customary units

The concept of quantity is usually expressed as the product of a number and a unit of reference, for example, distance is the product of a number and its unit of reference the metre.

NPI emission factors are sourced from around the world. Whilst there is an emphasis on the development of Australian factors, emission factors from international sources will always be present. This means that in some cases, emission factors will need to be converted to the units which are representative of Australian industry.

There are two common systems of units used in emissions estimation: one is the SI or the International System of Units and Customary units.

### SI units

SI units which is an abbreviation of the French *Système International d'Unités* is the common unit used in Australia. There are 7 base units from which other units of measurement are derived. The seven units are;

- Length (in metre(s), m)
- Mass (kilogram(s), kg)
- Time, duration (second(s), s)
- Electric current (ampere(s), A)
- Thermodynamic temperature (kelvin, K)
- Amount of substance (mole(s), mol)
- Luminous intensity (candela, cd)

Whilst some of these units are not commonly used for NPI reporting, they are often used in the derivation of common units which are used for NPI reporting. Some common NPI units are listed in **TABLE 7**, with their derived SI unit and expressed in terms of base SI Units.

**TABLE 7 Common SI NPI units**

Name	Unit	Symbol	SI coherent derived unit		Notes
			Expressed in terms of other SI units	Expressed in terms of SI base units	
Energy	joule	J	N/m <sup>2</sup>	m <sup>2</sup> kg s <sup>-2</sup>	
Power	watt	W	J/s	m <sup>2</sup> kg s <sup>-3</sup>	
Celsius temperature	Degree Celsius	°C		K	
Volume	cubic metre	m <sup>3</sup>		m <sup>3</sup>	
	litre	L, l		1 L = 1 dm <sup>3</sup> = 10 <sup>-3</sup> m <sup>3</sup>	a
Density	kilogram per cubic metre	ρ	kg/m <sup>3</sup>	kg m <sup>-3</sup>	
time	minute(s)	min		1 min = 60 s	a
	hour(s)	h		1 h = 3600 s	a
	day(s)	d		1 d = 86,400 s	a
Mass	tonne	t		1 t = 103 kg	a
Pressure	pascal	Pa	N/m <sup>2</sup>	m <sup>-1</sup> kg s <sup>-2</sup>	

a) common units

### SI Prefixes

SI also defines a series of prefix names and symbols to form the names of decimal multiples and submultiples of SI units. These prefixes range from 10<sup>24</sup> to 10<sup>-24</sup>, for NPI reporting the common range of SI units ranges from peta (10<sup>15</sup>) down to nano (10<sup>-9</sup>), a full list is in **TABLE 8**.

**TABLE 8 SI Prefixes**

Factor	Name	Symbol	Factor	Name	Symbol
10 <sup>1</sup>	deca	da	10 <sup>-1</sup>	deci	d
10 <sup>2</sup>	hecto	h	10 <sup>-2</sup>	centi	c
10 <sup>3</sup>	kilo	k	10 <sup>-3</sup>	mili	m
10 <sup>6</sup>	mega	M	10 <sup>-6</sup>	micro	μ
10 <sup>9</sup>	giga	G	10 <sup>-9</sup>	nano	n
10 <sup>12</sup>	tera	T	10 <sup>-12</sup>	pico	p
10 <sup>15</sup>	peta	P	10 <sup>-15</sup>	femto	f
10 <sup>18</sup>	exa	E	10 <sup>-18</sup>	atto	a
10 <sup>21</sup>	zetta	Z	10 <sup>-21</sup>	zepto	z
10 <sup>24</sup>	yotta	Y	10 <sup>-24</sup>	yocto	y

Using these prefixes it is possible to convert tonnes (t) to kilograms

$$1(\text{tonne}) = 1 (\text{Mg}) = 1 \times (10^3) (\text{kg}) = 1,000 (\text{kg})$$

The kilogram as a base SI unit is unique in that it includes a prefix as part of its name and symbol. When attaching decimal multiples and submultiples to a unit of mass other than the kilogram, the prefix is attached to the unit name “gram”, which has the unit symbol “g”

For example

$$10^{-6} (\text{kg}) = 1 (\text{mg}), \text{ but not } 1 (\mu\text{kg}) (\text{microkilogram})$$

### ***The Imperial (UK) and US Customary System units***

As a significant portion of the NPI emission factors are sourced from the USEPA AP-42, it is important to have an understanding of the units used in these documents when estimating NPI emissions. The Imperial unit of measure, which was used in Britain, has for the most part been replaced by the SI system. However some units still exist, such as the British Thermal Unit (BTU).

It needs to be noted that the Imperial gallon is different to the US gallon. In general, published NPI emission factors have been converted from these units into Litres to avoid confusion. However, when using emission factors from other sources, it is important to note the differences between the UK and US customary system units.

Some of the Common conversions used are listed in **TABLE 9**.

**TABLE 9 Common Units and Conversion Factors for NPI**

US Customary System unit	SI unit		
Unit	Sub-unit	Conversion Factor	Note(s)
Mass	1 pound	= 455.592 grams	SI Unit (g)
	1 ton (short)	= 907.185 kilograms	SI Unit (kg)
	1 ton (long)	= 1016.047 kilograms	SI Unit (kg)
Length	1 inch	= 2.54 centimetres	SI Unit (cm)
	1 foot	= 30.480 centimetres	SI Unit (cm)
	1 yard	= 91.44 centimetres	SI Unit (cm)
	1 mile	= 1.60935 kilometres	SI Unit (km)
Volume	1 cubic foot	= 28.317 Litres	SI Unit (L)
	1 gallon (US)	= 3.7853 Litres	SI Unit (L)
	1 gallon (Imperial)	= 4.5461 Litres	SI Unit (L)
Temperature	1 Farenheit degree	= 5/9 Centigrade degree	
	degrees Farenheit	= 5/9 (T°F-32) degrees centigrade	SI Unit (°C)
Pressure	1 atm	= 760 mm of mercury	at 0°C density of 13.5951 g/cm <sup>3</sup>
	Pounds per square inch	= 101.325 kiloPascals = 6.895 kiloPascals	SI Unit (kPa) SI Unit (kPa)

**TABLE 9 Common Units and Conversion Factors for NPI**

US Customary System unit	SI unit		
Unit	Sub-unit (psi)	Conversion Factor	Note(s)
Density	1 pound mass per cubic foot	= 16.01846 kilograms/cubic metre	SI Unit (kg/m <sup>3</sup> )
Energy	1 British Thermal Unit (BTU)	= 1054.4 joules	SI Unit (J)
		= 0.2930 watt-hour	SI Unit (Wh)

Using these conversions, it is possible to convert US emission factors for use in SI units.

An example can be found in “Table 1.1-3 Emission Factors for SO<sub>x</sub>, NO<sub>x</sub>, and CO from Bituminous and sub-bituminous coal combustion” in USEPA AP-42 Fifth Edition, Volume 1, Chapter 1: External Combustion Sources. A pulverised bituminous coal, dry bottom, wall fired boiler (built before 1971) has an emission factor of 0.5 pounds per ton. As no suffix is present after the ton, it can be assumed that the ton is equal to a metric ton or 1000 kg.

Using the conversion value in **TABLE 9**

$$\begin{aligned} \text{Emission Factor} &= \frac{0.5 \text{ (lb / t)} \times 455.592}{1000 \text{ (g / kg)}} \\ &= 0.228 \text{ (kg / t)} \end{aligned}$$

This value is based on US bituminous coal, which has slightly different properties to black coal in Australia and is to be used as an example only. It is recommend that the emission factors found in the NPI EET manual for combustion in boilers be used when estimating the emissions from black coal wall fired boilers instead.

#### Other useful equations

Volume to mass:

$$\text{Mass (tonnes)} = \frac{\text{volume (L)} \times \text{specific gravity (kg/L)}}{1000 \text{ (kg/t)}}$$

Energy use to mass:

$$\text{Mass (tonnes)} = \frac{\text{energy use (MJ)} \times \text{specific gravity (kg/m}^3\text{)}}{\text{calorific value (MJ/m}^3\text{)} \times 1000 \text{ (kg/t)}}$$

Proprietary mixtures:

$$\text{Volume (L)} = \frac{\text{volume mixture (L)} \times \% \text{ substance}}{100}$$

**APPENDIX E**  
**TEF AND (B[A]P) DATA**

<b>Polychlorinated dioxins and furans</b>	<b>WHO 2005 TEF</b>
chlorinated dibenzo-p-dioxins	
2,3,7,8-TCDD	1
1,2,3,7,8-PeCDD	1
1,2,3,4,7,8-HxCDD	0.1
1,2,3,6,7,8-HxCDD	0.1
1,2,3,7,8,9-HxCDD	0.1
1,2,3,4,6,7,8-HpCDD	0.01
OCDD	0.0003
chlorinated dibenzofurans	
2,3,7,8-TCDF	0.1
1,2,3,7,8-PeCDF	0.03
2,3,4,7,8-PeCDF	0.3
1,2,3,4,7,8-HxCDF	0.1
1,2,3,6,7,8-HxCDF	0.1
1,2,3,7,8,9-HxCDF	0.1
2,3,4,6,7,8-HxCDF	0.1
1,2,3,4,6,7,8-HpCDF	0.01
1,2,3,4,7,8,9-HpCDF	0.01
OCDF	0.0003
<b>Polycyclic aromatic hydrocarbons</b>	<b>WHO 1998 relative potencies (B[a]P)</b>
Anthanthrene	0.3
Anthracene	0.0005
Benz[a]anthracene	0.005
Benzo[a]pyrene	1.0
Benzo[b]fluoranthene	0.1
Benzo[e]pyrene	0.002
Benzo[g,h,i]perylene	0.02
Benzo[j]fluoranthene	0.05
Benzo[k]fluoranthene	0.05
Chrysene	0.03
Cyclopenta[c,d]pyrene	0.02
Dibenzo[a,e]pyrene	0.2
Dibenz[a,h]anthracene	1.1
Dibenzo[a,l]pyrene	1.0
Dibenzo[a,h]pyrene	1.0
Dibenzo[a,i]pyrene	0.1
Fluoranthene	0.05
Indeno[1,2,3-c,d]pyrene	0.1
Phenanthrene	0.0005
Pyrene	0.001

*For NPI reporting the amount of 'Polycyclic Aromatic Hydrocarbons (Benzo[a]pyrene equivalent) (PAHs B[a]Peq)' emitted refers to the sum of the toxic equivalent amounts of the individual congeners emitted or transferred. Toxic equivalent amounts are obtained by multiplying the mass of the congener by the Toxicity Equivalency Factor published in the NPI Guide.*

## APPENDIX F ERRATUM FOR THE NPI GUIDE

### Version 6.1 – September 2015

Page	Outline of alteration
Front cover	Date, version number
Footer	Date, version number
23	Updated link for other technical information

### Version 6.0 – November 2014

Page	Outline of alteration
Front cover	Date, version number, Departmental logo
Footer	Date, version number
iii	Updated contact details for states and territories
10	Updated contextual information on NPI
11	New information on ANZSIC codes
12-14	Updated information on Total Volatile Organic Compounds
26	New information on exclusions for transfers reporting
28	Updated example 4
30	Updated example 6
31	Update guidance on how to report emissions and transfers
32	Updated text on reporting significant figures and zero values
34	Updated definition for EF
35	Remove NEPC definition
36	Updated definition for ORS
36	Updated definition for PRTR
37	Updated definition for Total Volatile Organic Compounds
38	Updated table 2 title
47-48	Updated Additional Information on Total Volatile Organic Compounds
52	New information on PAH's included
53	Remove erratum list for changes up to and including June 2011
Multiple	Changed the term "trigger" to "exceed" in reference to NPI thresholds
Multiple	Editorial amendments
Overall	Update template

Earlier changes to the NPI Guide can be obtained from the Australian Government NPI team by emailing [npi@environment.gov.au](mailto:npi@environment.gov.au).

### Version 5.3 – May 2012

Page	Outline of alteration
Front cover	Date, version number
Footer	Date, version number
iii	Updated contact details for states and territories
6	Updated definition of facility
7	Updated threshold flowchart (Figure 1)
16	Updated guidance on total nitrogen
28	Updated example 5
29	Updated example 6
31	Updated guidance on the reporting of zero and blank emissions