Australian Government

Department of the Environment, Water, Heritage and the Arts

National Pollutant Inventory

Emission estimation technique manual
for

Railway yard operations
Version 2.0

June 2008

First published in July 1999

ISBN: 978 0 642 55424 6

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Disclaimer

The manual was prepared in conjunction with Australian states and territories according to the National Environment Protection (National Pollutant Inventory) Measure.

While reasonable efforts have been made to ensure the contents of this manual are factually correct, the Australian Government does not accept responsibility for the accuracy or completeness of the contents and shall not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance on, the contents of this manual.

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FOR
RAILWAY YARD OPERATIONS
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RAILWAY YARD OPERATIONS

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1 Introduction

The purpose of all emission estimation technique (EET) manuals is to assist Australian manufacturing, industrial and service facilities to report emissions of listed substances to the National Pollutant Inventory (NPI). This manual describes the procedures and recommended approaches for estimating emissions from the operation of railway yards (including servicing, loading and unloading of freight), maintenance operations and general upkeep of locomotives and rolling stock activities.

EET MANUAL		Railway yard operations
ANZSIC CODE	2006	2393, 4710 and 4720

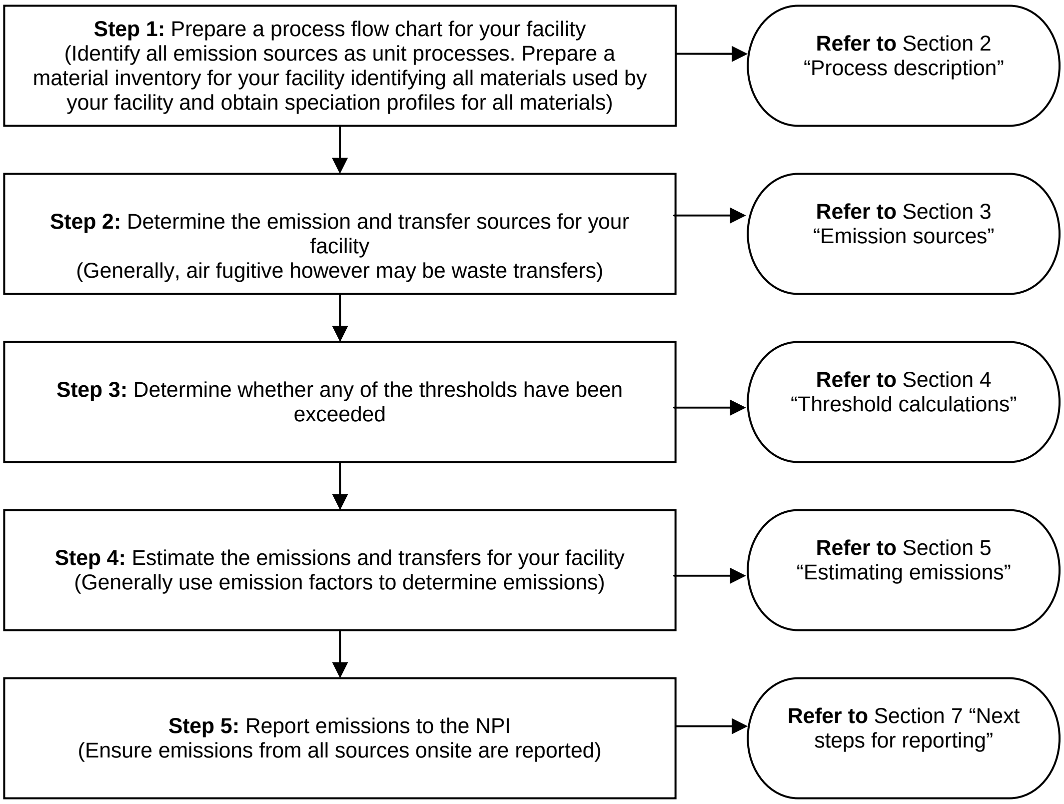
Note that the ANZSIC code is part of NPI reporting requirements. the *NPI Guide* contains an explanation of the ANZSIC code.

Pacific Air and Environment (PAE) drafted this manual on behalf of the Australian Government. This manual has been developed through a process of national consultation involving state and territory environmental authorities and key industry stakeholders. Particular thanks are due to the Queensland Rail and Pacific National for their assistance in developing this manual.

NPI substances are those that can potentially be harmful when emitted at certain levels. Australian, state and territory governments have agreed, in response to international requirements to provide information to the community, that industries will report these emissions annually. NPI substances are set out in the *NPI Guide* and are listed in categories which have a threshold; i.e. once annual ‘use’ of substances or fuels is above the threshold their emissions and transfers must be reported.

1.1 The process for NPI reporting

The process for NPI reporting can be seen in the following flow chart:



1.2 Information required to produce an annual NPI report

Typical data that will need to be collated for the reporting year is outlined in Table 1.

Table 1: Typical data required to produce an annual NPI report

Process	**Data to collect**
Materials inventory	The mass of all materials that are 'used' at your facility (e.g. diesel, petrol, crude oil, paints, solvents)
	Speciation profiles for all materials used at your facility Locations of default material speciation profiles is provided in Table 4
Operation of diesel powered locomotives	The total volume of diesel combusted in locomotives in the reporting year
Fuel storage	An inventory of fuel and organic liquid storage tanks at your facility showing the following: • tank type (e.g. horizontal fixed roof tank, vertical fixed roof tank) • material stored • tank capacity • throughput during the reporting year for each tank
Vehicle operation	The total amount of fuel combusted in vehicles used on-site
	The total vehicle kilometres travelled onsite by vehicles on unpaved roads
Abrasive blasting	The total amount of each type of abrasive material used in the reporting year
Surface coating	The total amount of each type of surface coating material used in the reporting year
Ancillary equipment operation	The total amount of fuel combusted in each boiler/space heater type
	The type of boiler/space heater (e.g. output capacity, low NO_x, wall or tangentially fired)
	The total amount of fuel combusted in each stationary internal combustion engine
	The type of internal combustion engine (e.g. rated capacity, low NO_x)
Water emissions	The total amount of water discharged during the reporting year
	The concentration of NPI substances in water discharged
Spills	The total amount of each material spilled
	The total amount of material removed after each spill

1.3 Additional reporting materials

This manual is written to reflect the common processes employed in the railway yard operation industry. In many cases it will be necessary to refer to other EET manuals to ensure a complete report of the emissions for the facility can be made. Other applicable EET manuals may include, but are not limited to:

- Combustion in Boilers,
- Combustion Engines,
- Mining,
- Fuel and Organic Liquid Storage,

- Surface Coating,
- Fugitive Emissions, and
- Other industry-specific emission estimation technique manuals.

2 Process description

The following section presents a brief description of the railway operations industry, and identifies the likely sources of emissions. This represents a typical facility in the industry, but you should develop a process flow diagram specific to your site.

Railway yard operations are designed primarily to cater for public transport, commercial transport and carrying. Within Australia, the use of railways is quite extensive and the types of locomotives and haulage equipment vary from state to state. Generally, the main locomotive types are electric or diesel fuel driven.

Within a railway yard and associated workshops, there are many possible emission sources. These operations include, but are not limited to, surface coating, machining of parts, surface refinishing, cleaning operations, maintenance and general transport operations. You should therefore try to identify all operations that are performed that may trigger reporting requirements, and not just those listed here.

The first step in working out emissions of NPI substances from your facility is creating a process flow diagram to highlight points in the process where emissions may occur including:

- general description of the process, and
- diagram, flowchart and or picture of the process(es).

Generally, the following emission sources potentially exist at facilities undertaking railway yard operations:

2.1 Operation of diesel locomotive in railway yard

The operation of diesel locomotives in railway yards leads to emissions to the atmosphere of combustion products (i.e. NO_x, CO, SO_2, TVOCs, PM_{10}, $PM_{2.5}$, and speciated VOCs (e.g. benzene, ethylbenzene, polychlorinated dioxins, toluene)).

2.2 Fuel storage

The storage of fuels and organic liquids leads to emissions of volatile organic compounds (VOCs). These emissions may contain a number of NPI substances, including benzene, toluene and xylenes.

VOC emissions from storage tanks occur as a result of both standing and working losses. Standing loss is the expulsion of vapour from a tank through vapour expansion and contraction, which are the results of changes in temperature and atmospheric pressure. This loss occurs without any liquid level change in the tank. The combined loss from filling and emptying is called working loss. Evaporation during filling operations is a result of an increase in the liquid level in the tank. As the liquid level increases, the pressure inside the tank exceeds the relief pressure and vapours are expelled from the tank. Evaporative loss during emptying occurs when air drawn into the tank during liquid removal becomes saturated with organic vapour and expands, thus exceeding the capacity of the vapour space (USEPA, 2006).

2.3 On-site vehicle operation

The operation of on-site vehicles leads to emissions to air of combustion products. Furthermore, particulate matter is generated from wheel generated dust caused by brake and tyre wear and disturbance of road material from vehicle movements.

2.4 Abrasive blasting

Abrasive blasting is the use of abrasive material to clean or texturize a material such as metal or masonry. Abrasive materials include sand, coal slag, smelter slags, mineral abrasives, metallic abrasives, and synthetic abrasives (e.g. garnet). Abrasive blasting of metals leads to emissions of particulates and speciated particulates (e.g. lead, copper) to the atmosphere.

2.5 Surface coating and solvent usage

Surface coating of materials and the usage of solvents at railway yard facilities leads to emissions of VOCs to the atmosphere from evaporation of the volatile component of the surface coating once applied. The use of solvents to clean graffiti from trains is expected to be a significant source of VOC emissions at railway yards where this activity takes place.

Spills of paints and solvents can lead to emissions to water of total volatile organic compounds (TVOCs) and speciated VOCs. Disposal of waste solvents and paints to hazardous waste facilities is considered a transfer of reportable NPI substances.

2.6 Maintenance operations

Maintenance operations encompass a variety of applications from surface coating or rail cars and locomotives, removal of graffiti from rail cars to the degreasing of bearings or other weathered components. Table 2 illustrates some of the inputs and possible emissions that can be expected from maintenance operations.

Table 2: Possible sources and emissions from maintenance operations

Process	**Material inputs**	**Possible emissions**
Oil and grease removal	Degreasers, solvents, other cleaning aids, acids	Spent solvents
Car and locomotive cleaning	Degreasers, solvents, acids	Spent solvents, VOCs, waste acids
Rust removal	Acids, abrasive blasting materials	Waste acids, PM_{10} and NPI listed metals
Paint preparation	Solvents (thinners), white spirits, enamel reducers	Spent solvents, VOCs
Surface coating and finishing	Enamels, paints, electroplating substances, galvanising metals, acids	Spent solvents, VOCs, NPI listed metals, waste acids
Spray booths and cleaning operations	Solvents, thinners, white spirits.	Spent solvents, VOCs

2.7 Volatile material loading

Loading of volatile liquids to plating and storage tanks results in emissions to air as organic vapours in ‘empty’ tanks are displaced by the liquid being loaded into the tanks.

3 Emission sources

Emissions from railway yard operations are released to the environment via various routes. These can be summarised as emissions to air, water and land, and are detailed in Sections 3.1, 3.2 and 3.3 respectively. Table 3 details possible emissions sources from railway yards.

General information regarding emission sources can be located in the *NPI Guide.*

3.1 Emissions to air

Air emissions may be categorised as point-source or fugitive emissions.

3.1.1 Point source emissions

Point source emissions are directed into a vent or stack and emitted through a single stationary point source into the atmosphere. Examples of point source emissions include emissions from on-site power generation (e.g. stationary diesel generator).

Air emission control technologies such as electrostatic precipitators, fabric filters or baghouses and wet scrubbers are commonly installed to reduce the concentration of particulates in processing off-gases before emission through a stack. The collection efficiency of such abatement equipment needs to be considered when installed, and where emission factors from uncontrolled sources have been used in emission estimations. Guidance on applying collection efficiencies to emission factor equations is provided in Section 5.5.

3.1.2 Fugitive emissions

These are emissions not released through a vent or stack. Examples of fugitive emissions include:

- emissions from diesel locomotives, vehicles, surface coating,
- dust from stockpiles,
- volatilisation of vapour from vats, open vessels and spills,
- emissions from materials handling,
- emissions emanating from ridgeline roof-vents, louvres and open doors of buildings, and
- equipment leaks such as from valves and flanges.

Estimating emissions using emission factors is the usual method for determining losses from fugitive emission sources.

3.2 Emissions to water

Emissions of substances to water can be categorised as discharges to:

- surface waters (lakes, rivers, dams, estuaries),
- costal or marine waters, and
- stormwater runoff.

Emissions of toxic substances to waterways may pose environmental hazards. Most facilities emitting NPI listed substances are required by their state or territory environment agency to closely monitor and measure these emissions. These existing sampling data can be used to calculate annual emissions to the NPI.

If no wastewater monitoring data exists, emissions to process water can be calculated based on a mass balance or using emission factors.

Discharge of listed substances to a sewer or tailings dam is not regarded as an emission but is reportable as a transfer to the NPI. Further guidance on reporting transfers is provided in Section 6 and the *NPI Guide*.

3.3 Emissions to land

Emissions of substances to land include solid wastes, slurries, sediments, spills and leaks, and storage and distribution of liquids. Such emissions may contain NPI listed substances. Emission sources can be categorised as:

- surface impoundments of liquids and slurries, or
- unintentional leaks and spills.

Some facilities may use treated wastewater for irrigation. This wastewater need only be considered for NPI reporting if it contains an NPI listed substance. For NPI purposes this is categorised as an emission to land.

Table 3: List of possible emission sources at railway yards

Operation	**Unit process**	**NPI substances potentially emitted**	**Destination and emission estimation technique**		
			Air	**Land**	**Water**
Diesel powered locomotives	Diesel powered locomotives	Combustion products	Section 5.2.1 of this manual	NA	NA
Fuel storage	Fuel storage	Total VOCs and speciated VOCs	EETs are outlined in the *NPI EET Manual for Fuel and Organic Liquid Storage*	Potential for spills. See Section 5.3.1	Potential for spills. See Section 5.3.1
Vehicle operation	Exhaust emissions from vehicles	Combustion products	EETs are outlined in the *NPI EET Manual for Combustion Engines*	NA	NA
Abrasive blasting	Abrasive blasting	Particulates and speciated particulates	Section 5.2.4 of this manual	NA	NA
Surface coating	Surface coating	Total VOCs and speciated VOCs	EETs are outlined in the *NPI EET Manual for Surface Coating*	Potential for spills. See Section 5.3.1	Potential for spills. See Section 5.3.1
Bulk volatile material loading	Bulk volatile material loading	Total VOCs and speciated VOCs	EETs are outlined in the *NPI EET Manual for Surface Coating*	Potential for spills. See Section 5.3.1	Potential for spills. See Section 5.3.1
Ancillary equipment operation	Boilers and space heaters	Combustion products	EETs are outlined in the *NPI EET Manual for Boilers*	Potential for fuel leakage and spills. See Section 5.3.1	Potential for fuel leakage and spills. See Section 5.3.1
	Emergency generators	Combustion products	EETs are outlined in the *NPI EET Manual for Combustion Engines*	Potential for fuel leakage and spills See Section 5.3.1	Potential for fuel leakage and spills. See Section 5.3.1

4 Threshold calculations

The NPI has six different threshold categories and each NPI substance has at least one reporting threshold. If an NPI substance exceeds a threshold all emissions of that substance from the facility must be reported. In the case of railway yard operations, the tripping of substance thresholds is likely to result from:

- the storage and handling of fuel, and
- combustion of fuel in locomotives, stationary engines and on-site vehicles.

Other on-site operations may also result in threshold exceedences, including the transfer of NPI substances in waste.

The NPI Guide provides detailed information on thresholds and methods for identifying emission sources. The method involves identifying any NPI substances that may be used or produced by your facility, or are components of materials used by your facility, and then calculating whether the quantity used exceeds the NPI threshold.

The NPI thresholds that apply to facilities within the railway yard operations industry include Categories 1, 1a, 1b, 2a and 2b substances. In the case of Category 1,1a and 1b substances, they must be reported if they exceed the threshold. In the case of Category 2 substances, if fuel use exceeds the Category 2a threshold then all Category 2a substances must be reported. If the Category 2b threshold is exceeded then emissions of all Category 2b substances must be reported.

The thresholds for substances that are expected to be tripped for railway yard operations are:

- Category 1, 1a and 1b from the receipt of materials containing NPI substances, and
- Category 2a or 2b from the combustion of fuel.

The following flowchart (Figure 1) outlines the process the user should work through to determine whether the facility has tripped a threshold for reporting Category 1, Category 1a and Category 1b substances.

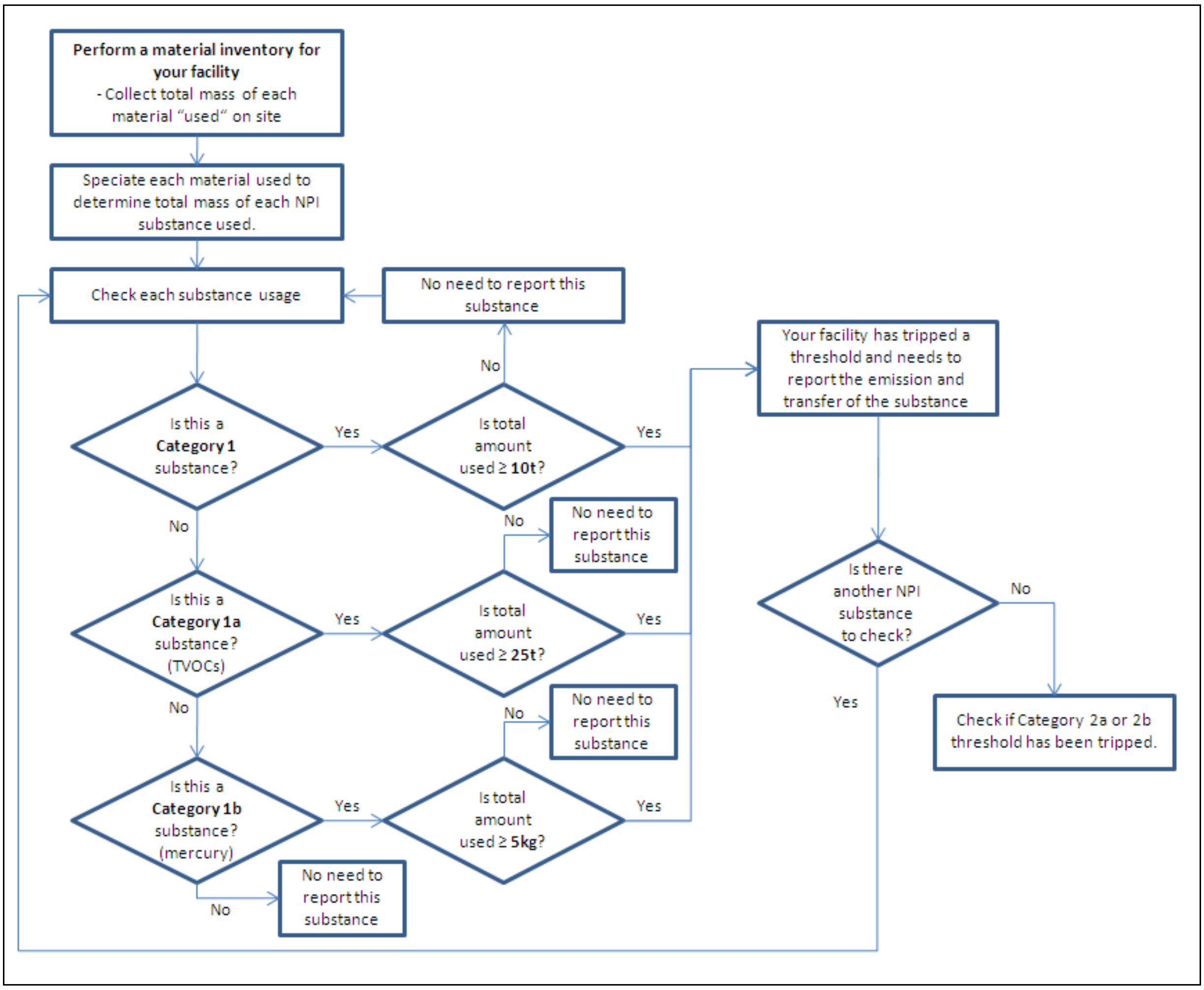


Figure 1: Determining whether the Category 1, Category 1a or Category 1b reporting thresholds have been tripped

The first step in determining whether Category 1, 1a or 1b reporting thresholds have been tripped is preparing a materials inventory for your facility.

When preparing a materials inventory, you should collect the mass of all materials that have been used at your site. This includes materials that are unloaded at your facility and loaded onto locomotives at your facility. For example, the mass of

- coal,
- iron ore,
- bauxite, and
- other mineral ores.

Also, the mass of fuels that cross your site boundary needs to be collected. This includes:

- diesel,
- petrol,
- residual oil, and
- LPG/CNG/biodiesel.

Furthermore, the mass of substances used for ancillary activities such as maintenance works and equipment cleaning is required to be included to determine the mass of each NPI substance used. These materials could include paints and solvents.

The next step is to determine the amount of each NPI substance in each material used during the reporting year. This process is called **material speciation**. Material speciation profiles are profiles that detail the concentration of each substance (or species) within each material. Material speciation profiles can be obtained from Material Safety Data Sheets (MSDSs) or from the supplier of the material. If site specific material speciation profiles are not available, use the speciation profiles detailed in Table 4.

Table 4: Location of useful material speciation profiles to determine substance usage

Material	**Location of material speciation profile**
Coal	*NPI EET Manual for Mining* *NPI EET Manual for Fossil Fuel Electric Power Generation*
Bauxite	*NPI EET Manual for Alumina Refining*
Petrol	*NPI EET Manual for Fuel and Organic Liquid Storage*
Diesel	
Residual oil	
Fuel oil	
Crude oil	
Naphtha	
Paints	*NPI EET Manual for Surface Coating*
Solvents	

Example 1 – Calculating the total mass of Category 1 substances used
This example shows how the usage of manganese and compounds (Mn) is calculated from a facility that handles coal and bauxite. The following data are available:

Mass of coal used = 100,000 t/y
Mass of bauxite used = 2,540,000 t/y
Concentration of Mn in coal used = 41 g/t
Concentration of Mn in bauxite used = 70 g/t

Mass of Mn used in reporting period
= (100,000 x 41/1000 + 2,540,000 x 70/1000)/1000
= 182 t

In this example, the total mass of manganese and compounds used by the facility is 182 tonnes. Therefore, the Category 1 threshold for manganese has been tripped and all emissions and transfers of manganese and compounds must be reported to the NPI.

The following flowchart (Figure 2) outlines the process the user should work through to determine whether the facility has tripped a threshold for reporting Category 2 substances.

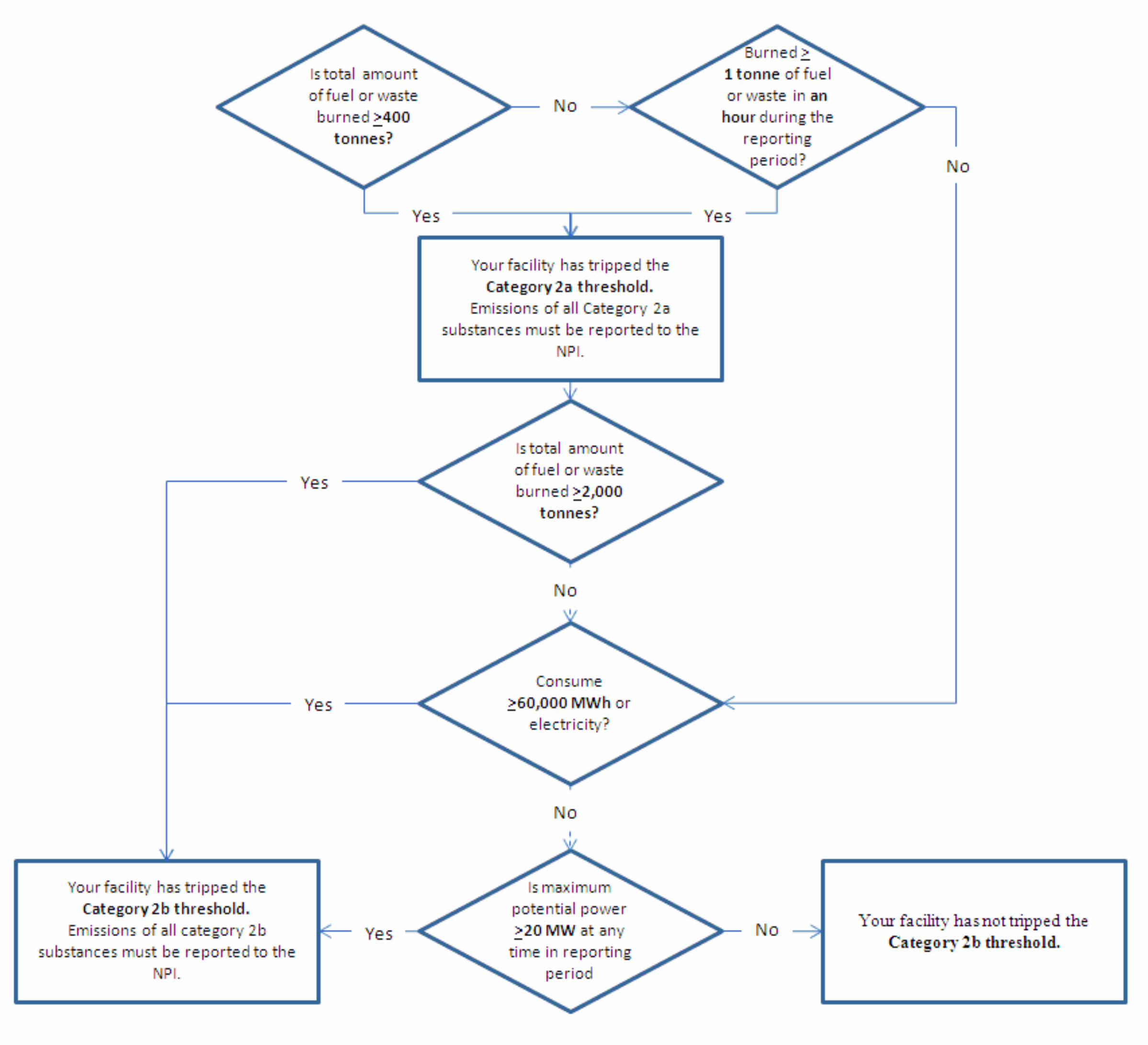


Figure 2: Determining whether the Category 2a and Category 2b reporting thresholds have been tripped

Category 2a substances and thresholds

This category contains a group of substances that are common products of combustion or other thermal processes. The NPI reporting thresholds for this category are:

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

Category 2a NPI substances

- Carbon monoxide
- Fluoride compounds
- Hydrochloric acid
- Oxides of nitrogen
- Particulate matter (2.5 micrometres or less in diameter)
- Particulate matter (10 micrometres or less in diameter)
- Polycyclic aromatic hydrocarbons (as B[a]Peq)
- Sulfur dioxide
- Total Volatile Organic Compounds (VOCs)

Category 2b substances and thresholds

This category also contains substances that are common 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) are burnt. The NPI thresholds for this category of substances are:

- burning 2,000 tonnes or more of fuel or waste in the reporting year,
- consuming 60,000 megawatt hours or more of electrical energy for other than lighting or motive purposes in the reporting year, and
- a facility that has maximum potential power consumption of 20 megawatts or more for other than lighting or motive purposes in the reporting year.

Category 2b substances

- Arsenic and compounds
- Beryllium and compounds
- Cadmium and compounds
- Carbon monoxide
- Chromium (III) compounds
- Chromium (VI) compounds
- Copper and compounds
- Hydrochloric acid
- Lead and compounds
- Magnesium oxide fume
- Mercury and compounds
- Nickel and compounds
- Oxides of nitrogen
- Particulate matter (2.5 micrometres or less in diameter)
- Particulate matter (10 micrometres or less in diameter)
- Polychlorinated dioxins and furans (as TEQs)
- Polycyclic aromatic hydrocarbons (as B[a]Peq)
- Sulfur dioxide
- Total Volatile Organic Compounds (VOCs)

If your facility trips any of the Category 2 thresholds you must estimate and report any emissions of the substances listed under these categories. Note that, apart from $PM_{2.5}$, emissions from all sources, not just combustion sources, need to be estimated.

Transfers of Category 2 substances are not reportable. However, many Category 2 substances are also Category 1 or Category 1b substances. If the Category 1 or 1b threshold has been exceeded in its own right then transfers to mandatory transfer destinations must be reported.

5 Emission estimation techniques

If you have established under Section 4 that your facility exceeds NPI thresholds, you will need to estimate the total mass of NPI substances emitted.

There are five types of emission estimation techniques (EETs) that may be used to calculate emissions from your facility. These are:

- sampling data or direct measurement,
- mass balance,
- emission factors,
- fuel analysis or engineering calculations, and
- an approved alternative.

Generally, railway yard operation activities report emissions using the direct measurement, mass balance or emission factors techniques. These techniques are described in this section, but the other emission estimation techniques can be found in the *NPI Guide.*

Select the EET (or mix of EETs) that is most appropriate for your purposes. For example, you might choose a mass balance to estimate fugitive losses from pumps and vents, 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 these EETs, your data will be displayed on the NPI database as being of 'acceptable reliability'. Similarly, if the relevant environmental agency has approved the use of EETs that are not outlined in this manual (i.e. 'approved alternative'), your data will also be displayed as being of acceptable reliability.

This manual seeks to provide the most effective EETs for the NPI substances relevant to the railway yard operations industry. However, the absence of an EET for a substance in the manual does not imply that an emission should not be reported to the NPI. The obligation to report on all relevant emissions remains if reporting thresholds have been exceeded.

You should note that the EETs presented in this manual relate principally to average process emissions. Emissions resulting from non-routine events are rarely discussed in the literature, and there is a general lack of EETs for such events. However, it is important to recognise that emissions resulting from significant operating excursions and/or accidental situations (e.g. spills) will also need to be estimated. Emissions to land, air and water from spills must be estimated and added to process emissions when calculating total emissions for reporting purposes. The emission resulting from a spill is the net emission, i.e. the quantity of the NPI reportable substance spilled, less the quantity recovered immediately (within 24 hours) during clean up operations.

5.1 Direct measurement

You may wish to use direct measurement in order to report to the NPI, particularly if you already do so in order to meet other regulatory requirements. If this is the case, the NPI does not require you to undertake additional sampling and measurement, rather simply reporting the emissions will be adequate.

Discharges to waterways through licensed discharge points are a common source of emissions to water. Direct measurement is typically the only way to estimate emissions to water. In order to estimate emissions to water, you need to know the volume of water discharged and the concentration of NPI pollutants within the water discharged.

Example 2 illustrates the method you should use to estimate emissions of NPI pollutants to water from monitored licence discharge points.

Example 2 – Emissions determined by direct measurement: estimating emissions to water

A facility monitors a water discharge point for total volume discharged and the concentration of lead and compounds in the discharge once a fortnight.

The monitoring data for the year is presented below:

Week	Measured flow (kL/day)	Lead concentration (mg/L)	Emission (kg/day)
2	350	0.918	0.32
4	394	0.7	0.28
6	417	0.815	0.34
8	440	0.683	0.30
10	364	0.787	0.29
12	340	0.84	0.29
14	457	0.865	0.40
16	424	0.643	0.27
18	463	0.958	0.44
20	414	0.681	0.28
22	476	0.68	0.32
24	431	0.628	0.27
26	369	0.807	0.30
28	392	0.729	0.29
30	323	0.964	0.31
32	302	0.722	0.22
34	358	0.566	0.20
36	322	0.51	0.16
38	330	0.63	0.21
40	322	0.63	0.20
42	408	0.652	0.27
44	442	0.649	0.29
46	356	0.695	0.25
48	390	0.758	0.30
50	423	0.658	0.28
52	487	0.97	0.47
Average discharge			**0.29**

In this example, the daily discharge needs to be calculated for every discrete monitoring point by multiplying the measured flow rate by the measured concentration of lead in the outfall. From these calculated data the average lead discharge can be determined.

To estimate the annual emission to water, you must multiply the average daily emission by the number of days water was discharged to the environment.

5.2 Emission factors

An emission factor is a tool that is used to estimate emissions to the environment. In this manual, it relates to the quantity of substances emitted from a source to some common activity associated with those emissions. Emission factors are usually expressed as the weight of a substance emitted multiplied by the unit weight, volume, distance or duration of the activity emitting the substance (e.g. kilograms of substance per kilolitre of diesel combusted).

When using emission factors, you should be aware of the associated emission factor rating (EFR) code and what the rating implies. An A or B rating indicates a greater degree of certainty than a D or E rating. The main criterion affecting the uncertainty of an emission factor remains the degree of similarity between the equipment/process selected in applying the factor and the target equipment/process from which the factor was derived

The EFR system is:

A	Excellent
B	Above average
C	Average
D	Below average
E	Poor
U	Unrated

Emission factors applicable to this manual are listed in Appendix B. You must ensure that you estimate emissions for all substances relevant to your process.

Emission factors developed from measurements for a specific process may sometimes be used to estimate emissions at other sites. For example, a company may have several units of similar model and size, if emissions were measured from one facility, an emission factor could be developed and applied to similar sources. If you wish to use a site-specific emission factor such as this, you should first seek approval from your state or territory environment agency.

5.2.1 Operation of diesel powered locomotives

Emissions from the operation of diesel powered locomotives within a railway yard can be estimated using Equation 1 and emission factors presented in Appendix B.

Equation 1

$$E_i = A \times EF_i$$

where:

E_i = Emissions from diesel powered locomotives (kg/y)
A = Amount of diesel fuel consumed in diesel locomotives in the reporting year (kL/y)
EF_i = Emission factor for NPI substance i from diesel locomotives (kg/kL)

Emission factors to estimate emissions from diesel locomotives are presented in Table 7 in Appendix B.

Example 3 illustrates how to estimate emissions from diesel powered locomotives.

Example 3 – Estimating emissions from diesel powered locomotives

This example illustrates the steps for estimating pollutant emissions from diesel locomotives used at a railway yard. 7,350 kL of diesel fuel is used in on-site shunting locomotives in the reporting period.

Step 1
Determine the volume of diesel fuel used in shunting locomotives in the reporting period. The volume of diesel used is 7,350 kL.

Step 2
Select the appropriate emission factor values for diesel powered locomotives. The appropriate emission factor values are presented in Table 7 in Appendix B.

Step 3
Calculate pollutant emissions using Equation 1.

Pollutant (i)	Volume of diesel used (kL/y)		Emission factor (kg/kL)	=	Emissions (kg/y)
	A	x	EF_i	=	E_i
1,3-Butadiene	7,350	x	0.31	=	2,283
Arsenic and compounds	7,350	x	0.036	=	266
Ammonia	7,350	x	0.0066	=	48
Benzene	7,350	x	0.35	=	2,577
Cadmium and compounds	7,350	x	0.0034	=	25
Carbon monoxide	7,350	x	25.82	=	189,779
Chromium (III) compounds	7,350	x	0.025	=	187
Chromium (VI) compounds	7,350	x	0.0109	=	80
Lead and compounds	7,350	x	0.038	=	277
Nickel and compounds	7,350	x	0.0034	=	25
Oxides of nitrogen	7,350	x	44.37	=	326,112
Particulate matter 10.0 µm	7,350	x	3.53	=	25,941
Particulate matter 2.5 µm	7,350	x	3.39	=	24,887
Polychlorinated dioxins and furans	7,350	x	8.35×10^{-11}	=	6.1×10^{-07}
Polycyclic aromatic hydrocarbons	7,350	x	0.0017	=	12
Selenium and compounds	7,350	x	0.0034	=	25
Sulfur dioxide	7,350	x	0.0167	=	123
Total volatile organic compounds	7,350	x	4.27	=	31,411
Zinc and compounds	7,350	x	0.038	=	277

5.2.2 Fuel storage

EETs for the storage of organic liquids (e.g. fuels) can be found in the *EET Manual for Fuel and Organic Liquid Storage.*

5.2.3 Vehicle operation

EETs for exhaust emissions from vehicle operation can be found in the *EET Manual for Combustion Engines*.

If vehicles operate on unpaved roads at your facility, emissions are required to be estimated for wheel generated dust (PM_{10} and speciated metals only). EETs for estimating emissions from wheel generated dust can be found in the *EET Manual for Mining.*

5.2.4 Abrasive blasting

Emissions from abrasive blasting can be estimated using Equation 2 and emission factors presented in Appendix B.

Equation 2:

$$E_i = A \times EF_i$$

where:

E_i	=	Emissions from abrasive blasting	(kg/y)
A	=	Amount of abrasive material used in the reporting period	(t/y)
EF_i	=	Emission factor for NPI substance i for abrasive blasting	(kg/t)

Example 4 illustrates how to estimate emissions from abrasive blasting.

Example 4 – Estimating emissions from abrasive blasting
This example illustrates the steps for estimating pollutant emissions from abrasive blasting. 2,450 kg of abrasive material (garnet) are used in the reporting period. Abrasive blasting occurs in an uncontrolled environment to clean steel rail containers.

Step 1
Determine the amount of abrasive material used in the reporting period. The amount of garnet used is 2,450 kg.

Step 2
Select the appropriate emission factor values for abrasive blasting using garnet in an uncontrolled environment. The appropriate emission factor values are presented in Table 8 in Appendix B.

Step 3
Calculate pollutant emissions using Equation 2.

Pollutant (i)	Amount of abrasive material used (t/y)		Emission factor (kg/t)	=	Emissions (kg/y)
	A	x	EF_i	=	E_i
Particulate matter 10.0 µm	2.45	x	13	=	32
Arsenic and compounds	2.45	x	0.01	=	0.025
Chromium (III) compounds	2.45	x	0.003	=	0.0074
Cobalt and compounds	2.45	x	0.004	=	0.0098
Copper and compounds	2.45	x	0.002	=	0.0049
Lead and compounds	2.45	x	0.006	=	0.015
Nickel and compounds	2.45	x	0.002	=	0.0049
Zinc and compounds	2.45	x	0.005	=	0.012

5.2.5 Surface coating

EETs for painting and surface coating operations can be found in the *EET Manual for Surface Coating*.

5.2.6 Volatile material loading

EETs for volatile material loading can be found in the *EET Manual for Surface Coating*.

5.3 Mass balance

Mass balances involve examining a process to determine whether emissions can be characterised based on an analysis of operating parameters, material composition, and total material usage. Mass balance involves the quantification of total materials into and out of a process with the difference between inputs and outputs being accounted for as an emission to the environment (to air, water, land), or as part of the facility's waste. Mass balance is particularly useful when the input and output streams can be readily characterised, and this is most often the case for small processes and operations.

Mass balances can be undertaken for a whole facility or the individual process steps that make up the facility.

Information about mass balances in relation to the NPI is in the *NPI Guide*.

5.3.1 Spills

A mass balance approach is an ideal method to estimate emissions to land or water from spills.

For many facilities the primary source of emissions to land and water will be because of spills, including intentional spillage due to vessel wash down. Accidental spills can contribute to emissions to land directly, to water through runoff, and to air.

Unless spilled material is routed to a secure containment facility, the quantity of material spilled, less any material that is collected, must be reported to the NPI. In practical terms, a log of spillages could be maintained detailing quantities spilled and the composition of the spill (in particular the quantities of NPI substances spilled). This log could then provide the basic information for NPI reporting.

You should note that if the spill is a volatile liquid, it is reasonable to assume that the entire light end fraction is volatilised and the remaining liquid is released into the ground (if the spill occurs on land). However, if the liquid is not volatile and no material is collected, it is reasonable to assume that all material is released into the ground (i.e. emission to land).

If the spill occurs in the water, it is the facility's responsibility to report the total mass of the spill and the quantities of NPI substances within the spill as an emission to water.

To estimate emissions to land from spills of volatile liquids that occur on land, you should use Equation 3.

To estimate emissions from spills of non volatile liquids on land and spills of volatile and non-volatile liquids over water you should use Equation 4.

Equation 3:

$$E_i = ((Q_{SPILL} - mf_{VOC} \times Q_{SPILL}) - Q_{REMOVED}) \times mf_i$$

Equation 4

$$E_i = (Q_{SPILL} - Q_{REMOVED}) \times mf_i$$

where:

E_i	=	Emissions to land or water of NPI substance i	(kg)
Q_{SPILL}	=	Quantity of material spilled	(kg)
$Q_{REMOVED}$	=	Quantity of material cleaned up	(kg)
mf_{VOC}	=	Mass fraction of volatile compounds in material spilled (see Table 4)	(kg VOC/kg material)
mf_i	=	Mass fraction of NPI substance i in material spilled (refer to site specific speciation profiles or speciation profiles detailed in Table 4).	(kg i/kg material)

To estimate emissions to atmosphere from spills on land of volatile materials, you should use Equation 5.

Equation 5

$$E_i = (Q_{SPILL} \times mf_{VOC}) \times mf_i$$

where:

E_i	=	Emissions to land or water of NPI substance i	(kg)
Q_{SPILL}	=	Quantity of material spilled	(kg)
$Q_{REMOVED}$	=	Quantity of material cleaned up	(kg)
mf_{VOC}	=	Mass fraction of volatile compounds in material spilled (see Table 4)	(kg VOC/kg material)
mf_i	=	Mass fraction of NPI substance i in material spilled (refer to site specific speciation profiles or speciation profiles detailed in Table 4).	(kg i/kg material)

Table 5 shows some typical fractions of VOCs in Australian fuels, which can be used in equations 3 to 5.

Table 5: Typical fraction of volatile compounds in Australian fuels [a]

Volatile liquid	**Mass fraction of volatile compounds (kg VOC/kg material)**
Diesel	0.076
Fuel oil	0.03
Heating oil	0.12
Petrol	1.0

[a] Source: *NPI EET Manual for Fuel and Organic Liquid Storage*

Example 5 illustrates how to estimate emissions to atmosphere of total VOCs and to land of lead from a diesel spill.

Example 5 – Estimating emissions from spills
This example illustrates the steps for estimating pollutant emissions from heating oil spills in an uncontained location at a railway operations facility. 1,200 kg of heating oil was spilt at the port facility during the reporting period. 500 kg of heating oil was removed from the site and disposed. It is estimated that heating oil contains 0.0042 kg lead per kilogram heating oil.

Step 1
Determine the amount of heating oil spilt during the reporting period. 1,200 kg of heating oil was spilt.

Step 2
Determine the amount of heating oil cleaned up after the spill. 500 kg of heating oil was removed from the spill site and transferred to a secure containment facility.

Step 3
Determine the volatile fraction of heating oil. From Table 5, the volatile fraction of heating oil is 0.12 kg VOCs/kg heating oil.

Step 4
Estimate the emission to atmosphere of total VOCs from the spill using Equation 5.

Total VOC emissions to atmosphere = 1,200 kg heating oil x 0.12 kg VOCs/kg
= 144 kg VOCs

Step 5
Estimate the emission to land of lead from the heating oil spill using Equation 3.

Lead emission to land = ((1,200 kg heating oil – 0.12 kg VOCs/kg heating oil x 1,200 kg heating oil) – 500 kg heating oil) x 0.0042 kg lead/kg heating oil
= 2.3 kg lead

5.4 Approved alternative

You are able to use emission estimation techniques that are not outlined in this document. You must, however, seek the consent of your state or territory environmental agency. For example, if your company has developed site-specific emission factors, you may use these if they have been approved by your local environmental agency.

5.5 Control technologies

Abatement equipment and emission control technologies include baghouses, cyclones and afterburners on industrial equipment and oxidation catalysts, diesel particulate filters (DPFs) and selective catalytic reduction (SCR) on locomotives. These can be used to reduce emissions. If you have installed these or other abatement equipment at your facility or on locomotives or if you have implemented work practices at your facility that reduce emissions, you should multiply the control efficiency of the technology or the work practice by the appropriate emission factors that reflect uncontrolled emissions.

6 Transfers of NPI substances in waste

The NPI requires the mandatory reporting of NPI substances that are transferred as waste to a final destination. Transfers are required to be reported if a Category 1, Category 1b or Category 3 reporting threshold is exceeded. For example, if the threshold has been exceeded for the Category 1 substance - lead and compounds - as a result of use of this substance on site, transfers to final destination of lead as well as the emissions are reportable. Both emissions and transfers are reportable in kilograms.

There is no requirement to report transfers of:

- substances that are exclusively Category 2a or Category 2b,
- substances which are both Category 2a or Category 2b and Category 1 or Category 1b (e.g. copper and compounds), in the event that the substance has tripped the Category 2 threshold only, or
- TVOC (Category 1a and Category 2a).

Transfers are also not reportable if they are contained in overburden, waste rock, uncontaminated soil or rock removed in construction or road building, or soil used in capping of landfills.

Transfers are, however, required if they are transported to a destination for containment or destruction which includes:

- 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, and
- 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 substances contained in waste to a sewerage system is also included.

In the specific context of railway yard operations, the quantities of NPI substances contained in wastewater such as arsenic, cadmium, boron and fluoride would be reportable as transfers. Also, NPI substances contained in waste oil that are transferred to a hazardous waste facility would need to be reported to the NPI.

The transfer of NPI substances to a destination for reuse, recycling, reprocessing, purification, partial purification, immobilisation, remediation or energy recovery can be reported voluntarily. This is an opportune way for facilities to promote good news to their local community.

Further information regarding transfers of waste, including how to estimate and report, can be found in the *NPI Guide*.

7 Next steps for reporting

This manual has been written to reflect the common processes employed in the railway yard operations industry. To ensure a complete report of the emissions for your facility, it may be necessary to refer to other EET manuals. These are listed in Section 1.3.

When you have a complete report of substance emissions from your facility, report these emissions according to the instructions in the *NPI Guide*.

8 References

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USEPA (2006) *Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources, AP-42, Chapter 7.1, Organic Liquid Storage Tanks*, United States Environmental Protection Agency, Office of Air Quality Planning and Standards.

Appendix A: Definitions and abbreviations

Table 6: Glossary of technical terms and abbreviations used in this manual

Term	Definition
°C	Degrees Celsius
ANZSIC	Australian and New Zealand Standard Industrial Classification
CARB	California Air Resources Board
CO	Carbon monoxide
Combustion products	CO, NO_x, SO_2, PM_{10}, $PM_{2.5}$, VOCs, speciated VOCs (e.g. benzene, toluene, xylenes, ethylbenzene, formaldehyde), speciated particulates (e.g. antimony, arsenic, chromium, copper, selenium)
DEH	Department of the Environment and Heritage
DEWHA	Department of the Environment, Water, Heritage and the Arts
EET	Emission estimation technique
EF	Emission factor
EFR	Emission Factor Rating
E_i	Emission of pollutant i per year
i	Pollutant component whose emission level is being determined
K	Kelvin
kg	Kilograms
kL	Kilolitre (i.e. 1,000 litres)
L	Litre
mf_i	Mass fraction of NPI substance in material spilled
mf_{VOV}	Mass fraction of volatile compounds in material spilled
Mn	Manganese and compounds
MSDS	Material safety data sheets
NO_x	Oxides of nitrogen
NPI	National Pollutant Inventory
PAHs	Polycyclic aromatic hydrocarbons
$PM_{2.5}$	Particulate matter with an aerodynamic diameter of less than 2.5 µm
PM_{10}	Particulate matter with an aerodynamic diameter of less than 10 µm
Q_{SPILL}	Quantity of material spilled
$Q_{REMOVED}$	Quantity of material cleaned up
SO_2	Sulfur dioxide
t	Tonnes
TOC	Total organic compounds
TSP	Total suspended particulate
TVOCs	Total volatile organic compounds
UNEP	United Nations Environment Programme

Term	**Definition**
USEPA	United States Environmental Protection Agency
VOCs	Volatile organic compounds
y	Year

Appendix B: Emission factors

B.1 Diesel powered locomotives

Table 7: Emission factors (kg/kL) for diesel locomotives (uncontrolled)

Substance	Emission factor (kg/kL)	Emission factor scientific notation (kg/kL)	Rating
1,3-Butadiene[a]	0.31	$3.11x10^{-01}$	U
Arsenic & compounds[b]	0.036	$3.63x10^{-02}$	U
Ammonia[d]	0.0066	$6.57x10^{-03}$	U
Benzene[a]	0.35	$3.51x10^{-01}$	U
Cadmium & compounds[b]	0.0034	$3.42x10^{-03}$	U
Carbon monoxide[d]	25.82	$2.58x10^{+01}$	U
Chromium (III) compounds[c]	0.025	$2.54x10^{-02}$	U
Chromium (VI) compounds[c]	0.0109	$1.09x10^{-02}$	U
Lead & compounds[b]	0.038	$3.76x10^{-02}$	U
Nickel & compounds[b]	0.0034	$3.42x10^{-03}$	U
Oxides of nitrogen[d]	44.37	$4.44x10^{+01}$	U
Particulate matter 10.0 µm[d,e]	3.53	$3.53x10^{+00}$	U
Particulate matter 2.5 µm[d]	3.39	$3.39x10^{+00}$	U
Polychlorinated dioxins and furans (TEQ)[h]	0.000000000084	$8.35x10^{-11}$	U
Polycyclic aromatic hydrocarbons (B[a]Peq)[g]	0.0017	$1.67x10^{-03}$	U
Selenium & compounds[b]	0.0034	$3.42x10^{-03}$	U
Sulfur dioxide[f]	0.0167	$1.67x10^{-02}$	U
Total volatile organic compounds[d]	4.27	$4.27x10^{+00}$	U
Zinc & compounds[b]	0.038	$3.76x10^{-02}$	U

[a] Derived based on hydrocarbon emission factor presented in EEA (2007) - Table 8-3: Baseline emission factors for uncontrolled diesel engines and organic speciation profile presented in USEPA SPECIATE, profile ID 0008 Reciprocating Diesel Fuel Engine.

[b] Derived based on particulate matter emission factor presented in EEA (2007) - Table 8-3: Baseline emission factors for uncontrolled diesel engines and particulate matter speciation profile presented in CARB (2003), profile ID 112 Diesel Fuel Combustion

[c] Derived based on particulate matter emission factor presented in EEA (2007) - Table 8-3: Baseline emission factors for uncontrolled diesel engines and particulate matter speciation profile presented in CARB (2003), profile ID 112 Diesel Fuel Combustion assuming that 70% of total chromium is emitted as chromium (III) compounds and 30% of total chromium is emitted as chromium (VI) compounds (DEH, 2005)

[d] Derived based on emission factors presented in EEA (2007) - Table 8-3: Baseline emission factors for uncontrolled diesel engines (assuming power range of between 500 – 1000 kW)

[e] Assuming that 97.6% of total particulate is in the PM_{10} size range (CARB, 2003)

[f] Derived based on the fuel consumption figures reported in EEA (2007) and a maximum diesel sulphur content of 10 ppm as per the Australian Diesel Fuel Standard.

[g] Emission factor was derived from total hydrocarbon emission factor presented in EEA (2007), and organic speciation profile for diesel exhaust (assuming heavy goods vehicle) sourced from *South East Queensland motor vehicle fleet air emissions inventory 2000, 2005, 2011* (Pekol et al., 2003)

[h] Sourced from *Standardized Toolkit for Identification and Quantification of Dioxin and Furan Releases* (UNEP, 2005)

B.2 Abrasive blasting

Table 8: Emission factors (kg/t) for abrasive blasting: uncontrolled abrasive blasting of mild steel panels using Garnet

Substance	Emission factor (kg/t)	Emission factor scientific notation (kg/t)	Rating
Particulate matter 10.0 µm[a]	13	$1.30 \times 10^{+01}$	E
Arsenic & compounds[b]	0.01	1.00×10^{-02}	E
Chromium (III) compounds[b]	0.003	3.00×10^{-03}	E
Cobalt & compounds[b]	0.004	4.00×10^{-03}	E
Copper & compounds[b]	0.002	2.00×10^{-03}	E
Lead & compounds[b]	0.006	6.00×10^{-03}	E
Nickel & compounds[b]	0.002	2.00×10^{-03}	E
Zinc & compounds[b]	0.005	5.00×10^{-03}	E

[a] Source: AP42 Chapter 13.2.6-1 Abrasive Blasting (USEPA, 1997)

[b] Speciated emission factors derived based on abrasive material speciation profile provided in Morris and Salome, 1996. Speciated metal emissions are assumed to be uncontrolled. If it is assumed that a percentage of TSP is controlled multiply the emission factor by the assumed percentage emitted. For example, if 20% of TSP is controlled, multiply the emission factor by 0.8.

Table 9: Emission factors (kg/t) for abrasive blasting: uncontrolled abrasive blasting of mild steel panels using steel grit

Substance	Emission factor (kg/t)	Emission factor scientific notation (kg/t)	Rating
Particulate matter 10.0 µm[a]	13	$1.30 \times 10^{+01}$	E
Arsenic & compounds[b]	0.062	6.20×10^{-02}	E
Chromium (III) compounds[b]	1.315	$1.32 \times 10^{+00}$	E
Cobalt & compounds[b]	0.051	5.10×10^{-02}	E
Copper & compounds[b]	2.75	$2.75 \times 10^{+00}$	E
Lead & compounds[b]	0.068	6.80×10^{-02}	E
Nickel & compounds[b]	0.83	8.30×10^{-01}	E
Zinc & compounds[b]	0.11	1.10×10^{-01}	E

[a] Source: AP42 Chapter 13.2.6-1 Abrasive Blasting (USEPA, 1997)

[b] Speciated emission factors derived based on abrasive material speciation profile provided in Morris and Salome, 1996. Speciated metal emissions are assumed to be uncontrolled. If it is assumed that a percentage of TSP is controlled multiply the emission factor by the assumed percentage emitted. For example, if 20% of TSP is controlled, multiply the emission factor by 0.8.

Table 10: Emission factors (kg/t) for abrasive blasting: uncontrolled abrasive blasting of mild steel panels using copper slag ex Mt Isa

Substance	Emission factor (kg/t)	Emission factor scientific notation (kg/t)	Rating
Particulate matter 10.0 µm[a]	13	$1.30x10^{+01}$	E
Arsenic & compounds[b]	0.69	$6.90x10^{-01}$	E
Chromium (III) compounds[b]	0.066	$6.60x10^{-02}$	E
Cobalt & compounds[b]	0.715	$7.15x10^{-01}$	E
Copper & compounds[b]	6.63	$6.63x10^{+00}$	E
Lead & compounds[b]	0.263	$2.63x10^{-01}$	E
Nickel & compounds[b]	0.001	$1.00x10^{-03}$	E
Zinc & compounds[b]	1.48	$1.48x10^{+00}$	E

[a] Source: AP42 Chapter 13.2.6-1 Abrasive Blasting (USEPA, 1997)

[b] Speciated emission factors derived based on abrasive material speciation profile provided in Morris and Salome, 1996. Speciated metal emissions are assumed to be uncontrolled. If it is assumed that a percentage of TSP is controlled multiply the emission factor by the assumed percentage emitted. For example, if 20% of TSP is controlled, multiply the emission factor by 0.8.

Table 11: Emission factors (kg/t) for abrasive blasting: uncontrolled abrasive blasting of mild steel panels using copper slag ex Whyalla

Substance	Emission factor (kg/t)	Emission factor scientific notation (kg/t)	Rating
Particulate matter 10.0 µm[a]	13	$1.30x10^{+01}$	E
Arsenic & compounds[b]	0.01	$1.00x10^{-02}$	E
Chromium (III) compounds[b]	0.026	$2.60x10^{-02}$	E
Cobalt & compounds[b]	0.635	$6.35x10^{-01}$	E
Copper & compounds[b]	5.31	$5.31x10^{+00}$	E
Lead & compounds[b]	0.286	$2.86x10^{-01}$	E
Nickel & compounds[b]	0.21	$2.10x10^{-01}$	E
Zinc & compounds[b]	3.6	$3.60x10^{+00}$	E

[a] Source: AP42 Chapter 13.2.6-1 Abrasive Blasting (USEPA, 1997)

[b] Speciated emission factors derived based on abrasive material speciation profile provided in Morris and Salome, 1996. Speciated metal emissions are assumed to be uncontrolled. If it is assumed that a percentage of TSP is controlled multiply the emission factor by the assumed percentage emitted. For example, if 20% of TSP is controlled, multiply the emission factor by 0.8.

Table 12: Emission factors (kg/t) for abrasive blasting: uncontrolled abrasive blasting of mild steel panels using copper slag ex Port Kembla

Substance	Emission factor (kg/t)	Emission factor scientific notation (kg/t)	Rating
Particulate matter 10.0 µm[a]	13	1.30x10^{+01}	E
Arsenic & compounds[b]	0.095	9.50x10^{-02}	E
Chromium (III) compounds[b]	0.315	3.15x10^{-01}	E
Cobalt & compounds[b]	0.14	1.40x10^{-01}	E
Copper & compounds[b]	4.88	4.88x10^{+00}	E
Lead & compounds[b]	2.69	2.69x10^{+00}	E
Nickel & compounds[b]	0.074	7.40x10^{-02}	E
Zinc & compounds[b]	12.4	1.24x10^{+01}	E

[a] Source: AP42 Chapter 13.2.6-1 Abrasive Blasting (USEPA, 1997)

[b] Speciated emission factors derived based on abrasive material speciation profile provided in Morris and Salome, 1996. Speciated metal emissions are assumed to be uncontrolled. If it is assumed that a percentage of TSP is controlled multiply the emission factor by the assumed percentage emitted. For example, if 20% of TSP is controlled, multiply the emission factor by 0.8.

Table 13: Emission factors (kg/t) for abrasive blasting: uncontrolled abrasive blasting of mild steel panels using copper slag ex Newcastle

Substance	Emission factor (kg/t)	Emission factor scientific notation (kg/t)	Rating
Particulate matter 10.0 µm[a]	13	1.30x10^{+01}	E
Arsenic & compounds[b]	1.23	1.23x10^{+00}	E
Chromium (III) compounds[b]	0.225	2.25x10^{-01}	E
Cobalt & compounds[b]	0.14	1.40x10^{-01}	E
Copper & compounds[b]	4.07	4.07x10^{+00}	E
Lead & compounds[b]	3.68	3.68x10^{+00}	E
Nickel & compounds[b]	0.03	3.00x10^{-02}	E
Zinc & compounds[b]	15.5	1.55x10^{+01}	E

[a] Source: AP42 Chapter 13.2.6-1 Abrasive Blasting (USEPA, 1997)

[b] Speciated emission factors derived based on abrasive material speciation profile provided in Morris and Salome, 1996. Speciated metal emissions are assumed to be uncontrolled. If it is assumed that a percentage of TSP is controlled multiply the emission factor by the assumed percentage emitted. For example, if 20% of TSP is controlled, multiply the emission factor by 0.8.

Appendix C: Modifications to the railway yard operations emission estimation technique (EET) manual (Version 2.0 June 2008)

Page	**Outline of alteration**
Throughout	Manual structure has been updated to reflect the latest NPI manual templates
1	ANZSIC codes were updated to reflect changes between ANZSIC 93 and ANZSIC 06.
2	New report section added 'The process for NPI reporting'
3	Added a table outlining typical data required to estimate emissions from all emission sources likely to exist at a facility conducting railway yard operations.
5-7	Modified the typical emission sources described in the Process description and typical emissions section so that emission sources, match source names where there are available emission estimation technique published in NPI manuals.
10	Included Table 2 which shows all likely emission sources, the likely emission destination (air, water or land) and where a user can find published emission estimation techniques in NPI manuals (either within the manual or in other manuals).
11 - 16	Included a new section, 'Threshold calculations' which guides the user on how to determine whether the Category 1, 1a, 1b 2a and 2b thresholds have been tripped in a reporting year.
17 – 18	Included an example showing how to calculate water emissions from fortnightly grab samples of concentration and flow rate.
17	Removed discussion on sampling data and CEMS data within the direct measurement section as this is unlikely to apply to many railway yard operators. The user is directed towards the *NPI Guide* for guidance for this method.
20	Included equation for estimating emissions from diesel powered locomotives
21	Included an example to show users how to estimate emissions from diesel powered locomotives
22	Removed emission factors for vehicles from the manual and referred the user to emission estimation techniques in the *NPI EET Manual for Combustion Engines*
22	Included equation for estimating emissions from abrasive blasting.
23	Included an example to show users how to estimate emissions from abrasive blasting
23	Removed information about surface coating and referred to user to the *NPI EET Manual for Surface Coating.*
24-25	Included the spills section under mass balance. This section details how users could estimate emissions to air, water and land from spills.
25	Included the table on typical fraction of volatile compounds in Australian fuels
26	Included an example showing users how to calculate emissions to land and to air from a diesel spill.
27	Included the section on transfers
31-32	Included a glossary
33	Updated emission factors for diesel powered locomotives – updated all emission factors and included emission factors for NPI listed metals, speciated VOCs, PCDD/Fs, PAHs and $PM_{2.5}$
34-36	Updated PM_{10} emission factor for PM_{10} from abrasive blasting. The previous manual incorrectly referenced the TSP emission factor from USEPA and reported the factor as the emission factor for PM_{10} emissions.

Page	Outline of alteration
34-36	Included emission factors for NPI listed metals based on the speciation profiles for different abrasive materials reported in the *NPI EET Manual for Surface Coating.*