



National Pollutant Inventory

# **Emission Estimation Technique Manual**

**for**

**Defence Facilities**

**March 2000**

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**EMISSION ESTIMATION TECHNIQUES  
FOR  
DEFENCE FACILITIES**

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## DEFENCE FACILITIES

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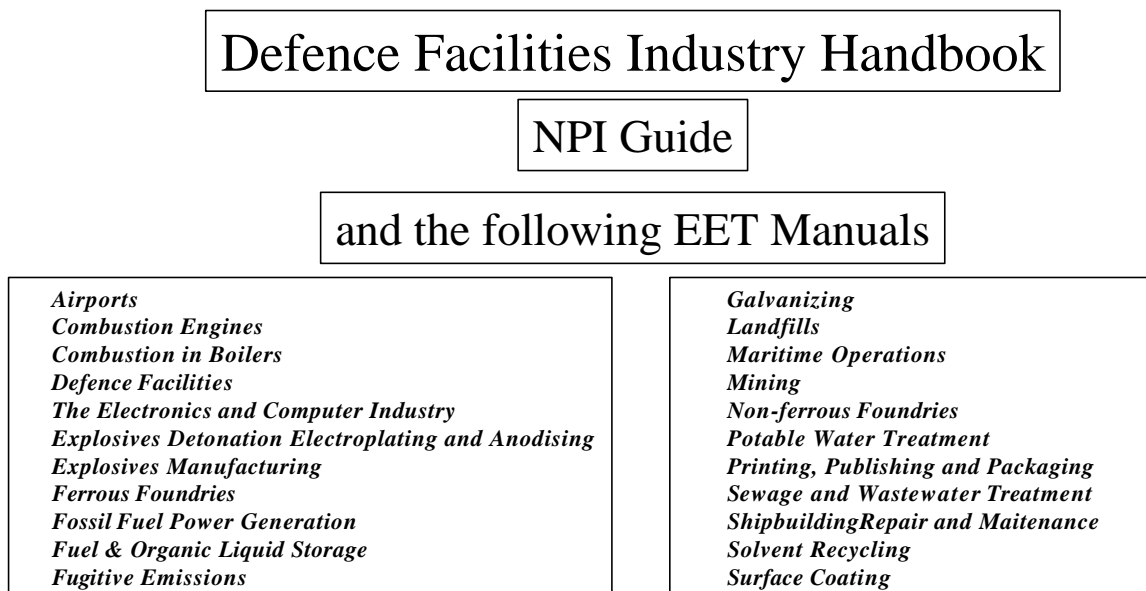
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## 1 Introduction

The purpose of all Emission Estimation Technique (EET) Manuals in this series is to assist Australian manufacturing, industrial, and service facilities to report emissions of listed substances to the National Pollutant Inventory (NPI).

This Manual is designed to assist Department of Defence (Defence) facilities to meet their NPI reporting obligations. It is one in a series of Manuals that form the Defence Facilities Handbook. Specific information on emission estimation techniques is contained in the other Manuals in the Handbook. The structure of the Handbook is displayed in Figure 1.

This Manual has been drafted by the NPI Unit of the Queensland Department of Environment and Heritage on behalf of the Commonwealth Government. It has been developed through a process of national consultation involving the Department of Defence, State and Territory environmental authorities and key stakeholders.



**Figure 1 - Structure of the Defence Facilities Handbook**

### 1.1 Australian and New Zealand Standard Industrial Classification (ANZSIC) Code

The correct four-digit ANZSIC code is part of the NPI reporting requirements. For defence facilities this is currently 8200. All four-digit ANZSIC codes within the 820 ANZSIC group are required to report to the NPI.

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## 2 Defence Reporting Obligations

Under the NPI, Defence is required to determine if any of its facilities trigger a reporting threshold for any of the NPI-listed substances (contained in *the NPI Guide*). If a facility triggers a threshold for an NPI-listed substance, Defence is required to estimate and report the facility's emissions of these substances to air, land and water.

Each Defence facility should be regarded as an individual facility and, as such, only those facilities that trigger a reporting threshold are required to report.

Defence airports are not required to estimate emissions from aircraft moving or in flight. The Airports Handbook can be used for assistance in estimating emissions from other airport activities (excluding aircraft in flight or taxiing, ie the LTO cycle). State and Territory EPAs will estimate emissions for all aircraft taxiing, landing or taking off from airports and report these aggregated emissions to a particular airshed. There will be a need to obtain information on the aircraft movements at the defence facilities, type of aircraft using the facility, and the type of engines in the aircraft. Emissions from these mobile activities on a dedicated defence airbase will only be estimated by EPAs if the airbase is within an airshed for which emissions are being estimated.

Operations on defence airports such as aircraft maintenance or servicing activities or vehicle activities, will need to examine whether they trip an NPI threshold for any listed NPI substances or fuel/energy related activity. If they do collectively trip any threshold, the facility will then need to report their emissions of the relevant NPI substances to the State or Territory EPA.

Emissions from Defence ships in ports managed by a Port Authority will be estimated as aggregated emissions. If the port is a facility where only Defence ships are permitted, emissions from ships in that port should be estimated by the facility occupier i.e. Defence.

The reporting period is the 1 July - 30 June. The facility should report the emissions to the relevant State or Territory environment authority by the 30 September each year. The relevant State or Territory is that in which the facility is physically located. The contact details for these authorities are contained in the *NPI Guide*.

### 2.1 Determining if a Facility Needs to Report to the NPI.

Section Three of *the NPI Guide* provides guidance on how to determine if a facility trips a NPI reporting threshold. The basic steps in determining if a report is required can be summarised as follows:

- for Category 1 and 1a substances identify whether listed NPI substances are used (or handled by way of their incidental presence in materials) in quantities

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- at or above the threshold values, and whether the facility has a bulk storage design capacity exceeding 25 kilotonnes;
- for Category 2a and 2b substances determine the amount and rate of fuel (or waste) burnt each year, the annual energy consumption and the maximum potential power consumption, and assess whether the threshold limits are exceeded; and
  - for Category 3 substances determine the annual emissions to water and assess whether the threshold limits are exceeded.

For those substances above the threshold values, the facility's emissions must be reported.

## **2.2 Estimating Emissions from the Defence Facility**

If a facility has tripped a threshold for one or more NPI-listed substances, the facility is required to report emissions of these substances from all sources at the site. Section 3.0 of this Manual refers to the most appropriate EET Manuals to use when estimating the facility's emissions.

EETs that are not outlined in the Manuals may be used with the consent of the relevant environmental authority. Therefore, if it is thought that an alternative EET will provide more accurate information than those provided in the manual, approval must be sought from the relevant environmental authority.

## **2.3 National Security Issues**

There are provisions within the NPI to exempt some reporting if issues of national security exist. Claims for exemptions on national security grounds will be resolved between the Commonwealth Defence and Environment Ministers, or their delegates. In such situations, aggregation of the data may overcome the security issue.

### 3 Common Activities and Relevant EET Manuals

This section describes some of the activities at Defence facilities that may lead to emission of substances on the NPI reporting list. This discussion does not replace the NPI Manuals dedicated specifically to these activities but provides a perspective on them that is relevant to Defence. Table 1 lists possible activities at Defence facilities and the EET Manuals that you should use to estimate emissions from these activities.

**Table 1 - Activities Common to Defence Facilities and the Relevant EET Manuals**

<b>Defence Activities</b>	<b>EET Manual</b>
Maintenance of vehicles, vessels, and aircraft (painting and cleaning)	Surface Coating; Electroplating and Anodising; Galvanizing; Solvent Recycling; Non-ferrous Foundries; and Ferrous Foundries
Fuel storage and refuelling	Fuel and Organic Liquid Storage
Power generation	Fossil Fuel Power Generation Combustion Engines
Printing	Printing, Publishing and Services to Printing
Waste disposal	Landfills Sewage sludge and biomedical waste incineration
Sewage and wastewater treatment	Sewage and Wastewater Treatment
Solvent and organic chemical storage	Fuel and Organic Liquid Storage
Explosives and ordnance manufacture and storage	Explosives Manufacturing
Explosives detonation and firing ranges	Explosives Detonation and Firing Ranges
Quarrying operations	Mining
Airfield operations	Airports
Potable water provision	Potable Water Treatment
Boiler, space heater operation and other furnaces	Combustion in Boilers
Fuel combustion in cooking (messes)	Combustion in Boilers
Laundries	Combustion in Boilers
Computer and electronic equipment manufacturing/maintenance	The Electronics & Computer Industry
Ground support equipment	Combustion Engines
Ship building	Shipbuilding, Repair and Maintenance
Dock and shipyard operations	Maritime Operations
Testing or evaluation laboratories	No EET Manual available.

**Table 1 - Activities Common to Defence Facilities and the Relevant EET Manuals (cont.)**

<b>Defence Activities</b>	<b>EET Manual</b>
Firefighting and firefighting training	No EET Manual available. An emission estimation technique is contained in Section 3.7.1.
Activities resulting in losses from pipelines etc.	Fugitive Emissions

Emissions of a specific NPI substance from all the activities listed in Table 2 should be added together and reported in the facility report i.e. all emissions of an NPI substance from all sources/activities must be reported.

### **3.1 Aircraft, Vessel, and Vehicle Maintenance**

Aircraft, vessel, and vehicle maintenance includes the simple routine procedures such as engine degreasing and cleaning with NPI-listed solvents and acids to the complete reworking of airframes, engines, and avionics. Many Defence facilities have vehicle pools that manage all aspects of truck and motor vehicle maintenance including vehicle workshops and paint booths. Other Defence establishments maintain facilities for the reworking of aircraft and motorised watercraft.

The EET Manuals that may be of relevance to these activities include the *Surface Coating, Electroplating and Anodising, Galvanizing, Solvent Recycling, Non-ferrous Foundries* and *Ferrous Foundries EET Manuals*.

### **3.2 Painting Operations**

Paint shops are among the most common activities at mid-size and large Defence facilities. Painting operations generate hazardous emissions and wastes including waste solvent, waste thinners, paint, sandblasting particulates, and clean-up rags containing liquid chemicals. All of the chemicals used are likely to contain NPI-listed substances. Painting operations can range from spot painting with a spray can to spray painting large vehicles, aircraft, and boats. Paint shops are also responsible for painting houses and buildings, preparing signage, and providing other miscellaneous functions.

The *Surface Coating EET Manual* provides guidance on how to estimate emissions from painting operations.

### **3.3 Electroplating**

A key component of metal finishing operations at Defence facilities is electroplating. Operations in which electroplating is used can vary widely from electronic circuit board manufacturing to application of surface finishes to a wide variety of fabricated metal parts from handguns to fieldguns and aircraft parts.



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The *Electroplating and Anodising EET Manual* provides guidance on how to estimate emissions from electroplating and anodising operations.

### **3.4 Sewage and Wastewater Treatment Plant Operations**

Defence facilities can generate large quantities of process and sanitary wastewater from many of the operations described above. Aircraft and vehicle maintenance and electroplating operations are just two of the operations that generate large quantities of wastewater.

The *Sewage and Wastewater Treatment EET Manual* provides guidance on how to estimate emissions from these activities.

### **3.5 Testing or Evaluation Laboratories**

Activities conducted at Defence laboratories include the provision of analytical services. These laboratories also conduct bench and pilot-scale testing. Chemistry and material science laboratories generally generate the most hazardous waste and emissions of NPI-listed substances, followed by chemical engineering and physics laboratories.

Laboratory emissions differ from those of typical generators of NPI-listed substances in that laboratories use small amounts of a wide range of chemicals. The volume of emissions generated at laboratories ranges from a few grams to hundreds of litres depending on the experiments and research being undertaken. Typical emission streams associated with laboratory operations include inorganic acids, bases and organic solvents containing NPI-listed substances; listed metals and compounds; unused chemicals; and reaction products from experiments.

While there is no manual covering these activities, facilities which trip thresholds for particular substances are required to report all emissions of those substances from all activities at the facility.

### **3.6 Combustion in Boilers, Space Heaters and Other Furnaces**

Defence facilities commonly operate boilers and space heaters to fulfil much of their heating and power generation requirements. These stationary combustion sources burn several different types of fuel, most commonly fuel oil, diesel, natural gas, or occasionally jet fuel. Coal combustion is limited to large heating and power plants.

The *Combustion in Boilers EET Manual* provides guidance on how to estimate emissions from boilers at the facility. For the purposes of the NPI, it can be assumed that the emission factors and emission estimation techniques provided for boilers are applicable to space heaters of a comparable size and fuel type.

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### 3.7 Fire Drills and Emergency Simulations

Most large defence facilities around Australia operate on-site rescue and fire fighting training facilities. In these facilities, fuel is burned in a pit, ship, building, or aircraft mock-up to simulate emergency situations. The amounts of fuel burnt and time of burning depend on the particular training exercise being performed and the type of equipment in use. An emission estimation technique for this activity is contained in the following section.

#### 3.7.1 Fire Training and Emergency Simulation

Fire training facilities are distinguished by the type of fuel burned in the simulations. Australian defence facilities most commonly use propane, jet fuel (avtur), diesel, or petrol. There has been a move in Australia in recent years to increasingly burn propane due to concerns over the air emissions derived from the burning of diesel and other fuels. The burning of diesel and other fuels tends to produce a column of smoke (particulate matter) that can extend for kilometres downwind, whereas burning of propane produces fewer particulate emissions.

Air pollutants emitted from the burning of training fires include PM<sub>10</sub> (particulate matter with an equivalent aerodynamic diameter of 10 micrometres or less ie.  $\leq 10\mu\text{m}$ ), NO<sub>x</sub> (oxides of nitrogen), SO<sub>2</sub> (sulfur dioxide), CO (carbon monoxide), and VOCs (volatile organic compounds). Emission factors for these pollutants depend on the type of fuel burned, and have been estimated based on measured emissions from uncontrolled burning of each fuel. Using these emission factors, total pollutant emissions from a training fire can be calculated.

The methodology for calculating emissions from training fires is provided below. The quantity of fuel burnt in each fire is determined, and this is multiplied by the emission factors to calculate the total pollutant emissions to the atmosphere for each fire. Emissions from one training fire are calculated using Equation 1.

#### Equation 1

$$E_i = Q_f * EF_i$$

where:

$E_i$	=	emissions of pollutant i in kg
$Q_f$	=	quantity of fuel burned in training fire in 10 <sup>3</sup> L
$EF_i$	=	emission factor in kg/10 <sup>3</sup> L
i	=	pollutant

Total emissions of pollutant i in a reporting year are calculated by summing emissions of pollutants i from the individual training fires.

Table 2 provides emission factors for PM<sub>10</sub>, NO<sub>x</sub>, SO<sub>2</sub>, CO, and VOCs arising from commonly combusted fuels. Emission factors are given in terms of kilograms of pollutant emitted per 1 000 litres of fuel burned.

**Table 2 - Emission Factors for Uncontrolled Fuel Burning in Training Fires**

Fuel	Emission Factors (kg/10 <sup>3</sup> litres of fuel)				
	CO	PM <sub>10</sub>	NO <sub>x</sub>	SO <sub>2</sub>	VOCs
Propane (Liquified Petroleum Gas)	4.2	14.1	0.77	0.0024	3.8
Avtur JP-4	430	115	3.23	0.46	15.4
Avtur JP-8	538	121.7	4.04	0.82	16.2

Adapted from: Energy and Environmental Analysis Inc., September 1995.

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## 4 References

ANZSIC: Australian and New Zealand Standard Industrial Classification  
Australian Bureau of Statistics & NZ Dept of Statistics 1993  
ABS Catalogue No 1292.0

The following EET Manuals are available through the NPI Homepage ( [www.npi.ea.gov.au](http://www.npi.ea.gov.au) ), or from your local Environmental Protection Authority (See the *NPI Guide* for contact details):

- Fugitive Emissions;
- Surface Coating;
- Electroplating and Anodising;
- Galvanizing;
- Solvent Recycling;
- Non-ferrous Foundries;
- Ferrous Foundries;
- Fuel and Organic Liquid Storage;
- Fossil Fuel Electric Power Generation;
- Printing, Publishing and Packaging;
- The Electronics & Computer Industry;
- Municipal Solid Waste Landfills;
- Sewage and Wastewater Treatment;
- Mining;
- Explosives Manufacturing;
- Explosives Detonation and Firing Ranges;
- Airports;
- Potable Water Treatment;
- Combustion in Boilers;
- Combustion Engines; and
- Shipbuilding Repair and Maintenance.