

NPI definition for Volatile Organic Compounds

Total Volatile Organic Compounds and the National Pollutant Inventory

Contents

Contents	1
Introduction.....	1
NPI VOC definition	1
TVOCs in fuel mixtures.....	1
TVOCs in solvents and other products	2
TVOCs thresholds.....	2
TVOCs emissions	2
TVOCs species.....	2
References.....	3
Abbreviations and definitions	4
Erratum	4

Introduction

For the purposes of the National Pollutant Inventory (NPI), total volatile organic compounds (TVOCs) is a substance to be reported by facilities if the TVOCs reporting threshold is exceeded. TVOCs is an NPI substance because it represents photochemical smog precursors. As such TVOCs can be generally defined as: any organic compound that participates in atmospheric photochemical reactions.

The intent of the inclusion of TVOCs is in recognition of the combined effect of compounds that contribute to smog formation that may not otherwise have been captured due to individual substances not meeting a usage threshold in their own right. The most common sources of TVOCs emissions are from the storage and use of liquid and gaseous fuels, the storage and use of solvents and the combustion of fuels.

A NPI definition of TVOCs is below.

NPI VOC definition

Any chemical compound based on carbon chains or rings with a vapour pressure greater than 2mm of mercury (0.27 kPa) at 25 °C. These compounds may contain hydrogen, oxygen, nitrogen and other elements. Substances that are specifically excluded are: carbon dioxide, carbon monoxide, carbonic acid, carbonate salts, metallic carbides and methane.

TVOCs in fuel mixtures

Most fossil fuels consist mainly of a mixture of a number of different carbon compounds. In many fuels, some of these carbon compounds will meet the above VOC definition, while others will not. There is a range of other substances in fuels which are not carbon compounds.

For more information about the composition of fuels see the NPI Emission Estimation Technique Manual Fuel and Organic Liquid Storage on the web (www.npi.gov.au/handbooks/approved_handbooks/fols.html).

NPI definition for Volatile Organic Compounds

TVOCs in solvents and other products

In a similar way to fuels, VOCs are often a component of products such as paints and solvents. The Material Safety Data Sheet is often the best means of identifying the TVOCs content of a certain product.

TVOCs thresholds

There are two NPI facility reporting thresholds relating to TVOCs:

Category 1a

This threshold is tripped if, at a facility, 25 tonnes or more of TVOCs is used in the reporting period.

For example, if a facility uses 300 tonnes per year of a fuel that consists of 10% TVOCs by weight, then it is said to use 30 tonnes (300 x 10/100) of VOCs and hence trips this threshold.

There is one exemption to this definition. For bulk storage facilities, the threshold is only exceeded if their design capacity also exceeds 25 kilotonnes (25,000 tonnes). It is important to note that this only applies to facilities solely engaged in bulk storage.

Category 2

This threshold is tripped if, at a facility, 400 tonnes or more of fuel or waste is burnt in the reporting period; or 1 tonne or more of fuel or waste is burnt in any hour (peak hourly usage) during the reporting period.

If this threshold is tripped, the facility is required to report emissions of a range of substances, including TVOCs.

TVOCs emissions

Industry handbooks for the NPI provide emission estimation techniques for estimating TVOCs from fuel burning, fuel storage and other solvent use.

For fuel storage, all losses from breathing and refilling are to be regarded as TVOCs emissions.

For use of solvents, paints and other such products, the TVOCs emissions often are equal to the TVOCs content of the product. These emissions may be reduced by techniques such as vapour recovery.

TVOCs species

There are 40 substances included on the NPI reporting list which fall under the TVOCs definition. This means these substances are VOCs. These substances are listed below. It is important to note that the reason for their inclusion as individual substances is on the basis of their toxicity to plant, animal and human health, not because of their activity as a precursor to the formation of smog.

NPI definition for Volatile Organic Compounds

Table 1: VOCS that are NPI substances

Substance	CASR Number	Substance	CASR Number
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
Acrylonitrile (2-propenenitrile)	107-13-1	Glutaraldehyde	111-30-8
Acrylic Acid	79-10-7	n- Hexane	110-54-3
Aniline (benzenamine)	62-53-3	Methanol	67-56-1
Benzene	71-43-2	2- Methoxyethanol	109-86-4
1,3 – Butadiene	106-99-0	2- Methoxyethanol acetate	110-49-6
Chloroethane (ethyl chloride)	75-00-3	Methyl ethyl ketone	78-93-3
Chloroform (trichloromethane)	67-66-3	Methyl isobutyl ketone	108-10-1
Cumene (1-methylethylbenzene)	98-82-8	Methyl methacrylate	80-62-6
Cyclohexane	110-82-7	Styrene (ethenylbenzene)	100-42-5
1,2- Dibromoethane	106-93-4	1,1,1,2- Tetrachloroethane	630-20-6
1,2- Dichloroethane	107-06-2	Tetrachloroethylene	127-18-4
Dichloromethane	75-09-2	Toluene (methylbenzene)	108-88-3
Ethanol	64-17-5	1,1,2- Trichloroethane	79-00-5
2- Ethoxyethanol	110-80-5	Trichloroethylene	79-01-6
2- Ethoxyethanol acetate	111-15-9	Vinyl Chloride Monomer	75-01-4
Ethyl acetate	141-78-6	Xylenes (individual or mixed isomers)	1330-20-7

References

1. USEPA, AP-42 1996.
2. "Measurement of Motor Vehicle Pollutants and Fleet Average Emission Factors in Melbourne," EPA Publication No. 652, June 1999.
3. "Volatile Organic Compounds in the Ambient Air of Greater Vancouver 1990 to 1996," Greater Vancouver District, Air Quality Department, 1999.
4. Report on the Kalgoorlie NPI Trial, 1999.
5. Correspondence from South Australian and Tasmanian NPI Teams
6. National Pollutant Inventory database: Contextual information on TVOCs (www.npi.gov.au/database/substance-info/profiles/88.html)
7. CRC Handbook of Chemistry & Physics.
8. Merck Index.
9. Ms Natalie Smrk, BP Australia Marketing and Technical Services.

NPI definition for Volatile Organic Compounds

Abbreviations and definitions

Term	Definition
NPI	National Pollutant Inventory
TVOCs	Total Volatile Organic Compounds
VOCs	Volatile Organic Compounds

Erratum

Page/details	Outline of alteration
Version 2.5 – updated from Version 2.4 – September 2006	
VOC definition	As tetrachloroethylene does not contain hydrogen, the reference to the compound containing hydrogen has been amended.
Version 2.4 – updated from version 2.3 – 23 March 2003	
General	Use the acronym TVOCs consistently and correctly. Added a section for abbreviations and definitions.
VOC definition	Combined the note into the actual definition. Will change this in other NPI documents as they are updated.
Fuel composition table	This was previously Table 1 in this document. The table has been removed and users referred to the NPI Fuel and Organic Liquid Storage manual.
Table 1: NPI substances which are VOCs	In previous versions this was Table 2. Methylenebis (CASR 101-68-8) was removed as it does not fit the definition of VOC. Glutaraldehyde was added as it is a VOC (vapour pressure is 16.4mmHg at 20°C). Reference to NPI table 1 and table 2 was removed as all substances are now required to be considered by reporting facilities.
References	Corrected web link for reference 6.
Version 2.3 – updated from version 2.2 – 21 October 2003	
Table 2 page 3	The substances do not fit the NPI definition of VOCs. The substances removed are: Di-(2-Ethylhexyl) phthalate (DEHP) and 4,4- Methylene bis 2,4 aniline (MOCA).

Electronic file name: voc_2-5

File: 2002/02607