

# EPA Guidelines

## Air quality impact assessment using design ground level pollutant concentrations (DGLCs)

Updated January 2006\*□

*EPA 386/06: This guideline provides advice and criteria for proponents of new developments that may emit pollutants to the atmosphere. The information is also relevant to established facilities seeking to determine the ground level impact caused by their emissions. It replaces the previous version, EPA 386/03.*

### Legislation relating to air pollution from stationary sources

The principal legislation addressing pollution in South Australia is the *Environment Protection Act 1993* (the Act). In particular, section 25 imposes a general environmental duty on all persons undertaking an activity that pollutes or might pollute the environment, requiring them to take all reasonable and practicable measures to prevent or minimise any resulting environmental harm.

Regulation of air pollution is primarily governed through the *Environment Protection (Air Quality) Policy 1994* (Air Policy). The Schedule to the Air Policy specifies the maximum pollution levels that may be discharged from chimneys (stacks).

### Design ground level concentrations (DGLCs)

To demonstrate that no adverse effects will occur at ground level due to emissions from a proposed or existing facility, proponents are required to use computerised pollutant dispersion modelling techniques to predict the maximum ground level pollutant concentrations which will result. Proponents are required to show that these maximum concentrations are less than the design ground level concentrations specified in Table 1, at all locations at all times.

The design ground level concentrations (DGLCs) adopted by the Environment Protection Authority (EPA) are based on protecting public health and amenity, or other environmental factors if they are more sensitive than human health. For example, certain types of vegetation, such as vineyards, require more stringent controls on fluoride compounds than have been found necessary for the protection of human health.

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\* Extensive changes made to previous version.

Safety factors are built into the DGLCs to provide an added level of protection for sensitive members of the community, such as children and the elderly.

## Pollutant classes

The pollutants listed in Table 1 are classified as Class 1, Class 2, or Class 3 air pollutants.

Class 1 lists the common air pollutants—nitrogen dioxide, sulfur dioxide and carbon monoxide—covered in the *National Environment Protection (Ambient Air Quality) Measure* (Air NEPM). These pollutants are emitted from many sources and are widely spread in the air environment.

Class 2 and 3 pollutants are generally emitted from fewer point sources and hence are not so widely spread in the air environment. The distinction between Class 2 and 3 pollutants is based on the level of toxicity, with those listed in Class 3 considered to be of higher environmental risk.

Table 1 is by no means an exhaustive list of pollutants. For analytes other than those in Table 1, the proponent is required to:

- carry out a search of peer reviewed literature to determine an appropriate DGLC

*or*

- estimate the DGLC using the formula time weighted average (TWA)/30

*or*

- demonstrate to the satisfaction of the EPA that their analyte has no health, environmental or amenity impacts.

## Simplified approach for relatively small emission rates

In some situations the concentration of a pollutant from an emission source may be sufficiently small that the EPA, based on its experience, would be satisfied that DGLCs would be met without the need for verification through pollutant dispersion modelling.

In general, the need for pollutant dispersion modelling may be waived at the discretion of the EPA if it can be shown that:

- the emission is released from a single point source and contains a concentration of no more than 100 times the DGLC when measured at the top of the stack
- the emission will be discharged from a stack that is:
  - at least three metres above the highest point within a 30-m radius
  - has a discharge velocity no less than 10 metres per second
  - does not have a conical or similar rain protector that interferes with the upward exit flow.
- the proposed facility exists within flat terrain with no unusual meteorological factors. Note: a flat cut made into the side of a hill is not 'flat terrain'.

## Processes where odour is expected to be of concern

It may be difficult to identify all the compounds, and their relative proportions, in emissions from some processes. In addition, such emissions may contain compounds that have both odorous and toxic properties.

In new developments, the proponents should draw on data from similar developments. In established developments, the emissions should be sampled and analysed for:

- the compounds present (to the limit of available gas chromatograph mass spectrometer (GCMS) techniques)
- odour (using appropriate Australian Standards to obtain representative samples and testing using an odour panel).

Pollutant dispersion modelling should be carried out to determine the ground level concentrations of individual compounds present in the emissions (in accordance with this guideline), as well as ground level odour concentrations. The requirements for ground level odour determination are set out in EPA Guideline 373/03 *Odour Assessment Using Odour Source Modelling*.

## Pollutant dispersion modelling

If the simplified approach does not apply, computer modelling must be carried out to design a stack (or stacks) that adequately disperses the pollutants.

The EPA generally specifies requirements for pollutant dispersion modelling on a case-by-case basis; however, the following points should be considered:

- The modelling should be carried out by a person/persons having appropriate training and experience in pollutant dispersion modelling.
- The model generally used by consultants is Ausplume version 5, in conjunction with at least 12 months of representative hourly meteorological data. Ausplume may not be suitable for dispersion modelling in certain cases—for example, where complex terrain may cause wind channelling, or where there is the potential for slope flows, recirculation, or sea breezes to affect dispersion. In these cases, other models, such as the diagnostic model Calpuff and prognostic model TAPM, may help in making a valid assessment of likely pollutant dispersion.
- While the EPA has some meteorological data sets in the Ausplume format that may be suitable, proponents of major developments may need to generate their own on-site meteorological data over a representative time period to use in the modelling program.
- Emissions should be estimated as accurately as possible for the proposed development, using sources such as known emission rates from similar facilities. Other methods for estimating or predicting emissions include the use of standard emission factors and theoretical mass balance calculations.
- The DGLCs given in this guideline must be met at all times; no ground level concentrations calculated through pollutant dispersion modelling can exceed the DGLC. In other words, the 100<sup>th</sup> percentile of results should be equal to or less than the DGLC.

Model results should be presented as maximum ground level concentration contour plots superimposed on site layout plans. The plans should show pertinent physical features and the location of sensitive environmental receptors, such as residential dwellings and commercial premises.

## Presentation of dispersion modelling

All dispersion modelling shall be presented in accordance with the EPA Guideline 578/05 *Presentation of air pollution modelling reports*.

## Currency of these guidelines

These guidelines offer advice to assist with compliance with the general environmental duty and specific environmental policies. They are subject to amendment and persons relying on the information should check with the EPA to ensure that it is current at any given time.

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## FURTHER INFORMATION

### *Legislation*

Legislation may be viewed on the Internet at: [www.parliament.sa.gov.au/dbsearch/legsearch.htm](http://www.parliament.sa.gov.au/dbsearch/legsearch.htm)

Copies of legislation are available for purchase from:

Government Legislation<sup>+</sup> Outlet  
101 Grenfell Street  
Adelaide SA 5000

Telephone: 13 23 24  
Internet: [www.shop.service.sa.gov.au](http://www.shop.service.sa.gov.au)

### *For general information please contact:*

Environment Protection Authority  
GPO Box 2607  
Adelaide SA 5001

Telephone: (08) 8204 2004  
Facsimile: (08) 8204 9393  
Freecall (country): 1800 623 445  
Internet: [www.epa.sa.gov.au/](http://www.epa.sa.gov.au/)

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Table 1 Design ground level concentrations (DGLCs) for Class 1, 2 and 3 indicators. The values adopted in this table are based on the Victorian State Environment Protection Policy (Air Quality Management) and the experience of the South Australian EPA.

SUBSTANCE	REASON FOR CLASSIFICATION	AVERAGING TIME	DESIGN CRITERIA mg/m <sup>3</sup> <sup>1</sup>	DESIGN CRITERIA ppm <sup>2</sup>
<b>Class 1</b>				
Carbon monoxide	Toxicity	1-hour	29	25
Nitrogen dioxide (in Adelaide metro area)	Toxicity	1-hour	0.113	0.0625
Nitrogen dioxide (outside Adelaide metro area)	Toxicity	1-hour	0.158	0.075
Sulfur dioxide	Toxicity	1-hour	0.45	0.17
<b>Class 2 (toxicity-based)</b>				
Acetone	Toxicity	3-minute	40	16.7
Acrylic acid	Toxicity	3-minute	0.2	0.067
Ammonia	Toxicity	3-minute	0.6	0.83
Aniline	Toxicity	3-minute	0.25	0.067
Antimony and compounds	Toxicity	3-minute	0.017	-
Asphalt (petroleum) fumes	Toxicity	3-minute	0.17	-
Barium (soluble compound)	Toxicity	3-minute	0.017	-
Biphenyl	Toxicity	3-minute	0.043	0.0067
Bromochloromethane	Toxicity	3-minute	35	6.7
Bromoform (tribromomethane)	Toxicity	3-minute	0.17	0.017

SUBSTANCE	REASON FOR CLASSIFICATION	AVERAGING TIME	DESIGN CRITERIA mg/m <sup>3</sup> <sup>1</sup>	DESIGN CRITERIA ppm <sup>2</sup>
Bromotrifluoromethane	Toxicity	3-minute	203	33
Carbon black	Toxicity	3-minute	0.1	-
Carbon tetrachloride (tetrachloromethane)	Toxicity	3-minute	0.021	0.0033
Chlorine	Toxicity	3-minute	0.1	0.033
Chlorine dioxide	Toxicity	3-minute	0.0093	0.0033
Chloroform (trichloromethane)	Toxicity	3-minute	1.6	0.33
Chloromethane (methyl chloride)	Toxicity	3-minute	3.4	1.7
Chromium (III) compounds	Toxicity	3-minute	0.017	-
Copper fume	Toxicity	3-minute	0.0067	-
Copper dusts and mists	Toxicity	3-minute	0.033	-
Cotton dust (raw)	Toxicity	3-minute	0.0067	-
Crotonaldehyde	Toxicity	3-minute	0.2	0.067
Cyanide (as CN)	Toxicity	3-minute	0.17	-
Cyclohexane	Toxicity	3-minute	35	10
Cyclohexanol	Toxicity	3-minute	6.9	1.7
o-Dichlorobenzene	Toxicity	3-minute	10	1.7
1,2-Dichloroethylene	Toxicity	3-minute	26.3	6.7
Dichlorvos	Toxicity	3-minute	0.033	0.0033
Dinitrobenzene (all isomers)	Toxicity	3-minute	0.033	0.005

SUBSTANCE	REASON FOR CLASSIFICATION	AVERAGING TIME	DESIGN CRITERIA mg/m <sup>3</sup> <sup>1</sup>	DESIGN CRITERIA ppm <sup>2</sup>
Dinitrotoluene	Toxicity	3-minute	0.05	-
Ethanolamine	Toxicity	3-minute	0.25	0.1
Ethylbenzene	Toxicity	3-minute	14.5	3.3
Ethyl butyl ketone	Toxicity	3-minute	7.7	1.7
Ethyl chloride (chloroethane)	Toxicity	3-minute	86.6	33.3
Ethylene glycol (vapour)	Toxicity	3-minute	2.0	-
<sup>3</sup> Fluoride	Bioaccumulation	24-hour 7 days 90 days	0.0029 0.0017 0.0005	0.0034 0.002 0.00059
Fluorine	Toxicity	3-minute	0.053	0.033
Formaldehyde	IARC Group 2A carcinogen	3-minute	0.04	0.033
n-Hexane	Toxicity	3-minute	5.9	1.7
2-Hexanone	Toxicity	3-minute	3.3	0.83
Hydrogen chloride	Toxicity	3-minute	0.25	0.17
Iron oxide fume	Toxicity	3-minute	0.17	-
Magnesium oxide fume	Toxicity	3-minute	0.33	-
Maleic anhydride	Toxicity	3-minute	0.033	0.0083
Manganese and compounds	Toxicity	3-minute	0.033	-
<i>Mercury</i>				
- organic	Bioaccumulation	3-minute	0.00033	-

SUBSTANCE	REASON FOR CLASSIFICATION	AVERAGING TIME	DESIGN CRITERIA mg/m <sup>3</sup> <sup>1</sup>	DESIGN CRITERIA ppm <sup>2</sup>
- inorganic	Bioaccumulation	3-minute	0.0033	-
Methyl acrylate	Toxicity	3-minute	1.2	0.33
Methyl bromide (bromomethane)	Toxicity	3-minute	0.63	0.17
Methylene chloride (dichloromethane)	Toxicity	3-minute	5.8	1.7
Nitric acid	Toxicity	3-minute	0.17	0.067
n-Pentane	Toxicity	3-minute	60	20
2-Pentanone	Toxicity	3-minute	23.3	6.7
Phthalic anhydride	Toxicity	3-minute	0.2	0.033
Propylene glycol monomethyl ether	Toxicity	3-minute	12	3.3
Silver metal	Toxicity	3-minute	0.0033	-
Silver, soluble compounds (as Ag)	Toxicity	3-minute	0.00033	-
Sulfuric acid	Toxicity	3-minute	0.033	-
1,1,1-trichloroethane (methyl chloroform)	Toxicity	3-minute	22.7	4.2
1,1,2-trichloroethane	Toxicity	3-minute	1.8	0.33
Trichlorofluoromethane	Toxicity	3-minute	187	33.3
Trimethylbenzene (mixed isomers)	Toxicity	3-minute	4.0	0.83
Vinyl toluene	Toxicity	3-minute	8.1	1.7
Welding fume (total particulate)	Toxicity	3-minute	0.17	-

SUBSTANCE	REASON FOR CLASSIFICATION	AVERAGING TIME	DESIGN CRITERIA		DESIGN CRITERIA	
			mg/m <sup>3</sup> <sup>1</sup>		ppm <sup>2</sup>	
<i>Wood dust</i>						
- hardwoods	IARC Group 1 carcinogen	3-minute	0.0033		-	
- softwoods	IARC Group 1 carcinogen	3-minute	0.017		-	
Zinc chloride fume	Toxicity	3-minute	0.033		-	
Zinc oxide fume	Toxicity	3-minute	0.17		-	
<b>Class 2 (odour-based)</b>			<b>Odour</b>	<b>Toxicity</b>	<b>Odour</b>	<b>Toxicity</b>
Acetaldehyde	Odour	3-minute	0.076	5.9	0.042	3.2
Acetic acid	Odour	3-minute	0.50	0.82	0.20	0.32
n-Butanol	Odour	3-minute	0.9	5.1	0.3	1.7
n-Butyl acetate	Odour	3-minute	1.85	23.8	0.39	5.0
Butyl acrylate	Odour	3-minute	0.18		0.035	
Butyl mercaptan	Odour	3-minute	0.012	0.06	0.004	0.017
Carbon disulphide	Odour	3-minute	0.13	1.01	0.042	0.32
Chlorobenzene	Odour	3-minute	0.20	1.5	0.042	0.32
Cumene (isopropyl benzene)	Odour	3-minute	0.039	8.1	0.008	1.6
Cyclohexanone	Odour	3-minute	0.48	3.2	0.12	0.82
Diacetone alcohol	Odour	3-minute	1.3		0.28	
Diethylamine	Odour	3-minute	0.06	0.97	0.02	0.32
Dimethylamine	Odour	3-minute	0.017	0.59	0.0094	0.32
Diphenyl ether	Odour	3-minute	0.14		0.02	

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			mg/m <sup>3</sup> <sup>1</sup>		ppm <sup>2</sup>	
Ethanol	Odour	3-minute	3.8	62.7	2.0	33.3
Ethyl acetate	Odour	3-minute	22.1	23.6	6.3	6.6
Ethyl acrylate	Odour	3-minute	0.0008	0.66	0.0002	0.16
Hydrogen sulfide	Odour	3-minute	0.00014	0.47	0.0001	0.32
Methanol	Odour	3-minute	5.5	8.7	4.3	6.7
Methylamine	Odour	3-minute	0.005	0.43	0.0042	0.32
Methyl ethyl ketone	Odour	3-minute	5.9	16	2.0	4.9
Methyl mercaptan	Odour	3-minute	0.00084	0.032	0.00042	0.016
Methyl methacrylate	Odour	3-minute	0.21	13.4	0.05	3.2
Methyl styrene	Odour	3-minute	0.25	8.1	0.052	1.7
Methyl isobutyl ketone	Odour	3-minute	0.41	6.7	0.1	1.6
Nitrobenzene	Odour	3-minute	0.0047	0.16	0.00094	0.032
Perchloroethylene (tetrachloroethylene)	odour	3-minute	6.3	11.2	0.94	1.7
Phenol	Odour	3-minute	0.036	0.13	0.0094	0.032
Phosphine	Odour	3-minute	0.0056	0.014	0.0042	0.01
n-propanol	Odour	3-minute	0.075	16.4	0.03	6.2
Pyridine	Odour	3-minute	0.013	0.52	0.0042	0.16
Styrene (monomer)	Odour	3-minute	0.21	6.97	0.05	1.64
Toluene	Odour	3-minute	0.65	12.3	0.17	3.2

SUBSTANCE	REASON FOR CLASSIFICATION	AVERAGING TIME	DESIGN CRITERIA		DESIGN CRITERIA	
			mg/m <sup>3</sup> <sup>1</sup>		ppm <sup>2</sup>	
Triethylamine	Odour	3-minute	0.36	0.39	0.09	0.1
Xylenes	Odour	3-minute	0.35	11.4	0.08	2.7
<b>Class 3</b>						
Acrolein	USEPA extremely toxic	3-minute	0.00077		0.00033	
Acrylonitrile	USEPA Group B1 carcinogen	3-minute	0.014		0.0067	
Alpha chlorinated toluenes and benzoyl chloride	IARC Group 2A carcinogen	3-minute	0.017		0.0033	
Arsenic and compounds	IARC Group 1 carcinogen	3-minute	0.00017		-	
Asbestos	IARC Group 1 carcinogen	3-minute	0.33 fibres/litre		-	
Benzene	IARC Group 1 carcinogen	3-minute	0.053		0.017	
Beryllium and beryllium compounds	IARC Group 1 carcinogen	3-minute	0.000007		-	
1,3-butadiene	IARC Group 2A carcinogen	3-minute	0.073		0.033	
Cadmium and cadmium compounds	IARC Group 1 carcinogen	3-minute	0.000033		-	
Chromium VI compounds	IARC Group 1 carcinogen	3-minute	0.00017		-	
1,2-dichloroethane (ethylene dichloride)	Mutagen (USEPA)	3-minute	0.13		0.033	
Epichlorohydrin	IARC Group 2A carcinogen	3-minute	0.025		0.0067	
Ethylene oxide	IARC Group 1 carcinogen	3-minute	0.006		0.0033	
Hydrogen cyanide	USEPA extremely toxic	3-minute	0.37		0.33	

SUBSTANCE	REASON FOR CLASSIFICATION	AVERAGING TIME	DESIGN CRITERIA mg/m <sup>3</sup> <sup>1</sup>	DESIGN CRITERIA ppm <sup>2</sup>
MDI (Diphenylmethane diisocyanate)	USEPA extremely toxic	3-minute	0.000073	-
Nickel and nickel compounds	IARC Group 1 carcinogen	3-minute	0.00033	0.00017
PAH (as BaP)	IARC Group 2A carcinogen	3-minute	0.00073	-
Pentachlorophenol	USEPA extremely toxic	3-minute	0.0017	-
Phosgene	USEPA extremely toxic	3-minute	0.013	0.0033
Propylene oxide	USEPA Group B1 carcinogen	3-minute	0.16	0.067
Respirable crystalline silica— inhaled in the form of quartz or cristobalite (measured as PM <sub>2.5</sub> )	IARC Group 1 carcinogen	3-minute	0.00033	-
TDI (toluene-2,4-diisocyanate and toluene-2,6-diisocyanate)	USEPA extremely toxic	3-minute	0.00007	-
Trichloroethylene	IARC Group 2A carcinogen	3-minute	0.9	0.17
Vinyl chloride	IARC Group 1 carcinogen	3-minute	0.043	0.017

<sup>1</sup> gas volumes are expressed at 25° C and at an absolute pressure of one atmosphere (101.325 kPa).

<sup>2</sup> parts per million (volume/volume)

<sup>3</sup> the fluoride content is calculated by dry weight and expressed as fluoride (F<sup>-</sup>) ppm