



Environmental Protection Authority

Guidance for the Assessment of Environmental Factors

(in accordance with the
Environmental Protection
Act 1986)

Emissions of Oxides of Nitrogen from Gas Turbines

No. 15

Preliminary Guidance

March 1999

Western Australia

FOREWORD

The Environmental Protection Authority (EPA) is an independent statutory authority and is the key provider of independent environmental advice to Government.

The EPA's objectives are to protect the environment and to prevent, control and abate pollution. The EPA aims to achieve some of this through the development of environmental protection guidance statements for the environmental impact assessment (EIA) of proposals.

This document is one in a series being issued by the EPA to assist proponents, consultants and the public generally to gain additional information about the EPA's thinking in relation to aspects of the EIA process. The series provides the basis for EPA's evaluation of, and advice on, development proposals subject to EIA. The Guidance Statements are only a small part of assisting proponents in achieving an environmentally acceptable proposal. Consistent with the notion of continuous environmental improvement and adaptive environmental management, the EPA expects proponents to take all reasonable and practicable measures to protect the environment and to view the requirements of the Guidance as representing a minimum rather than maximum level of protection.

The Guidance and management criteria presented in section 3 of the document will be used by the EPA to assess new proposals for installation of gas turbines with specific regard to emissions of oxides of nitrogen to the atmosphere within the State.

This Guidance Statement has the status "Preliminary" which means that it has been reviewed by stakeholders and is sufficiently advanced in its development that it can be released for public comment.

I am pleased to release this document and encourage you to comment on it.

Bernard Bowen
CHAIRMAN
ENVIRONMENTAL PROTECTION AUTHORITY

3 March 1999

**ENVIRONMENTAL PROTECTION AUTHORITY
GUIDANCE FOR THE ASSESSMENT OF ENVIRONMENTAL
FACTORS**

**PRELIMINARY GUIDANCE STATEMENT No. 15:
EMISSIONS OF OXIDES OF NITROGEN FROM GAS TURBINES**

How to comment on this document

This document is released for public comment for a period of 4 weeks. Your comments are welcome.

Please send your comments by 6 April 1999 to:

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Guidance Statement No. 15

Guidance Statement for Emissions of Oxides of Nitrogen from Gas Turbines

Key Words: gas turbine, air quality, nitrogen dioxide, emission, oxides of nitrogen (NO_x)

1 PURPOSE

The purpose of this Guidance Statement is to provide a framework for the assessment of emissions of oxides of nitrogen (NO_x) from gas turbines.

This Guidance Statement addresses:

- (a) protection of the environment as defined by the *Environmental Protection Act 1986 (WA)* with a focus on human health and the environment;
- (b) the factor of NO_x emissions from gas turbines as an environmental pressure on air quality in the Perth metropolitan area and regional areas of Western Australia; and
- (c) the need to present to proponents who have proposals subject to environmental impact assessment (EIA) and to the general public, the Environmental Protection Authority's (EPA) contemporary views on NO_x emissions from gas turbines to ensure air quality impacts are acceptable.

2 INTRODUCTION

It is an objective of the EPA to prevent, control and abate pollution. To achieve this objective the EPA applies two complementary tests when assessing emissions of waste:

- (a) All reasonable and practicable measures should be taken to minimise the discharge of waste into the environment; and
- (b) Cumulative discharges of waste must not cause cumulative impacts beyond environmentally acceptable limits/standards/criteria.

With respect to (a) above, waste minimisation is central to ensuring the long-term protection of the environment while preventing individual emitters from unnecessarily utilising the environment's capacity to disperse waste, thereby limiting future opportunities which may be considered desirable by the community. This principle is provided for in Section 51 of the *Environmental Protection Act, 1986*. The Australian Environment Council/National Health and Medical Research Council (AEC/NHMRC), National Guidelines for the Control

of Emissions of Air Pollutants from New Stationary Sources (1985) are directly applicable.

With respect to (b) cumulative impacts can lead to unacceptable environmental impacts in the form of pollution. The EP Act was established for the prevention, control and abatement of pollution. Discharges of waste are regarded as causing pollution when their cumulative impacts on the surrounding environment exceed an acceptable limit. The limit may be defined as a concentration in the environment, by the progressive accumulation of contaminants to an unacceptable level or by causing undesirable change to the environment. This principle is provided for in Section 49 of the *Environmental Protection Act, 1986*. The National Environment Protection Measure and Final Impact Statement for Ambient Air Quality proposes standards for oxides of nitrogen appropriate for the assessment of ambient air quality impacts in populated areas.

In the context of assessing airborne emissions from a proposed industry, it is necessary to estimate the overall air quality that will result for each of the air quality issues to which the industry's emissions relate. In doing this it is necessary to take account of the existing state of the surrounding environment in the area determined to be appropriate for each issue. For example, a developer wishing to site a "significant source" of oxides of nitrogen in or near the Perth metropolitan area would need to address:

- local concentrations of nitrogen dioxide (within approximately 10 to 15 km of the site), accounting for the existing sources of oxides of nitrogen within that radius and the regional background concentration of nitrogen dioxide;
- concentrations of photochemical smog products (characterised by ozone and nitrogen dioxide) over a broad region (100x100 km), accounting for all significant existing sources of oxides of nitrogen and reactive organic compounds (the precursors of photochemical smog). The Perth Photochemical Smog Study (1996) is a comprehensive source of information for such an assessment; and
- the contribution to greenhouse gas emissions associated with emissions of oxides of nitrogen (and other emissions). The EPA's Interim Guidance No. 12 - Guidance for Minimising Greenhouse Gas Emissions (1998) provides guidance on the estimation and assessment of greenhouse gas contributions.

Note: The term "significant source" is used here in a similar context to the term "significant industrial source" defined within the Environmental Protection (Kwinana) (Atmospheric Wastes) Policy (Western Australian Government, 1992), viz: "an industrial source from which the discharge of an atmospheric waste is, in the opinion of the Chief Executive Officer, such as to affect or to be likely to affect the relevant portion of the environment".

In simple terms, the assessment must determine, for each potential air quality impact, whether the surrounding environment can accommodate the emissions from the new industry. While the EPA reviews the proposal in the light of existing emissions (which affect the existing surrounding environment) in the course of assessing a specific proposal it appreciates that a new proposal has limited opportunity to improve existing air quality. Emissions from existing sources are generally managed via means such as licences, regulations and Environmental Protection Policies. In circumstances where acceptable limits are already being exceeded rejection of a new source of emissions may occur. However, the EPA may recommend approval of a new industry with tight emissions controls

provided there are other strategies in place or under development to manage the overall air quality issue.

Air quality impacts of an industry are normally assessed via computer models which require:

- data on gaseous and/or particle emissions from the industry;
- data on emissions from other sources in the region of potential impact, plus (if appropriate) information on the background concentration of the air contaminants being assessed; and
- meteorological data, used by the model to simulate the dispersion of emissions.

Unless the modelled maximum ground level concentrations of waste gases and/or particles are small relative to the National Environment Protection Measure criteria (NEPC, 1998), conditions requiring measurements at representative locations around the industry will be recommended, both before and after commencement of operation, in order to confirm model predictions. The scale of the monitoring program would be dictated by the scale of the potential impact.

This Guidance Statement does not provide specific guidance on the assessment of ambient and cumulative impacts of these emissions or their contribution to Greenhouse gas inventories, which also require consideration.

2.1 The Environmental Protection Authority's Previous Statements on the Emissions of Oxides of Nitrogen from Gas Turbines

The EPA has consistently endorsed the use of best practicable emission control for gas turbines (EPA, 1991, 1995a, 1995b, 1995c, 1996).

The EPA has also recommended that "future gas turbine installations should be required to meet the ANZEC/NH&MRC guidelines for emissions from stationary sources. These emission levels are currently applied in Sydney and Melbourne and are achievable using currently available NO_x reduction techniques." (EPA, 1991)

The EPA considers that for NO_x emissions, the current AEC/NHMRC guidelines should be used as an upper limit for assessing the performance of gas turbine installations and is of the view that "current technology can easily achieve lower emission levels than the limits in the (AEC)/NHMRC guidelines" (EPA, 1996).

3 GUIDANCE

3.1 The Environmental Objective

It is an objective of the EPA to prevent the degradation of Western Australia's air quality by controlling excessive emissions of oxides of nitrogen from new gas turbine installations.

To achieve this objective, this Guidance Statement provides assessment guidance and guidelines for the management of source emissions of oxides of nitrogen from gas turbines. Specifically, this Guidance recommends the use of the AEC/NHMRC national guidelines for emissions of oxides of nitrogen from gas turbines as being appropriate for assessing new gas turbine installations. These guidelines are reproduced as Table 1.

This Statement does not provide specific guidance on the assessment of ambient and cumulative impacts of these emissions or their contribution to Greenhouse gas inventories, which also require consideration.

Table 1. National Guidelines for Emissions of Oxides of Nitrogen from Gas Turbines.

	Rated Electrical Output	Oxides of Nitrogen* g.m ⁻³
Gaseous fuels	less than 10 MW	0.09
	greater than 10 MW	0.07
Other fuels	less than 10 MW	0.09
	greater than 10 MW	0.15

* Calculated as NO₂ at a 15 per cent oxygen reference level, dry, at STP

Source: AEC/NHMRC, National Guidelines for the Control of Emissions of Air Pollutants from New Stationary Sources (1985).

3.2 Application of the Guidance to Assessment

As mentioned in the Introduction, when assessing proposals with the potential to release emissions of oxides of nitrogen from gas turbines, the EPA will apply the following complementary tests:

- (a) All reasonable and practicable measures should be taken to minimise the discharge of waste into the environment; and
- (b) Cumulative discharges of waste must not cause cumulative impacts beyond environmentally acceptable limits/standards/criteria.

To achieve the above environmental objective, this Guidance Statement relates solely to minimising the discharge of NO_x from proposed new turbine(s). (Test (a) above applies.)

Advice on assessing the environmental acceptability of the cumulative impact of NO_x discharges (ie. proposed discharge and existing discharges) may be obtained on request from the Environmental Protection Authority (test (b) above). In general this could require demonstrating that ambient areas and sensitive land uses are not subjected to ambient concentrations of oxides of nitrogen (and in many

cases ozone) in excess of the National Environment Protection Measure for Ambient Air Quality standards.

The EPA considers that, for NO_x emissions from gas turbines, the AEC/NHMRC guidelines (referred to in Section 2 of this document and reproduced in Table 1) should be used as an upper limit for assessing the performance of proposed new gas turbine installations. The EPA's view is that, at least for large gas turbines burning natural gas, current technology can easily achieve emission levels lower than the limits in the AEC/NHMRC guidelines and considers that the proponent should use best engineering design and best practice management to better these limits. This is consistent with the EPA's view that proponents should use all reasonable and practicable measures to minimise the discharge of wastes, including gases. It is also appropriate that no single project use all the available 'space' in an airshed for any given emission. In relation to large gas turbines burning natural gas, the EPA notes that most new industries are now, as a matter of course, adopting dry low NO_x burner technology as best practice. Alternatively, where gas turbines are installed as a part of combined cycle or cogeneration plant, injection of steam into the gas turbine combustion chambers does represent, in certain circumstances, best practice. These technologies can achieve NO_x emissions at base load of 25 parts per million volume dry at a 15 percent oxygen reference level. The corresponding AEC/NHMRC guideline (Table 1) for large gas turbines burning natural gas is 34 parts per million volume dry at a 15 percent oxygen reference level at base load (which is 0.07 grams per cubic metre at standard temperature and pressure).

The assessment of proposals involving emissions from proposed gas turbine installations which comply with this Guidance Statement is likely to be straightforward and rapid (except where the installation is proposed for a region with existing or potential air quality problems, in which case the incremental air quality impact will also be assessed). Requests from proponents for a relaxation of the Guidance for gas turbines in areas remote from human habitation and sensitive environmental systems, or for projects where NO_x reduction systems capable of achieving the AEC/NHMRC guidelines would be unsuitable for reasons of operational performance or reliability, will be considered on a case by case basis.

3.3 Management System

An Environmental Management System (EMS) is an essential requirement for the successful management of emissions of oxides of nitrogen from gas turbines.

Where appropriate, the proponent should demonstrate that there is in place an environmental management system which includes the following elements:

1. An environmental policy and corporate commitment to it;
2. Mechanisms and processes to ensure:
 - 2.1 planning to meet environmental requirements;
 - 2.2 implementation and operation of actions to meet environmental requirements;
 - 2.3 measurement and evaluation of environmental performance; and
3. Review and improvement of environmental outcomes.

4 APPLICATION

4.1 Area

This Guidance Statement applies to all applications for the installation of gas turbines at all sites throughout the state of Western Australia.

4.2 Duration and Review

(To be inserted when the final Guidance is released)

5 RESPONSIBILITIES

5.1 Environmental Protection Authority Responsibilities

The EPA will apply this Guidance Statement when assessing any proposals for installation of new gas turbines at all sites within Western Australia.

5.2 Department of Environmental Protection Responsibilities

The DEP will assist the EPA in applying this Guidance Statement in environmental impact assessment and in conducting its functions under Part V of the *Environmental Protection Act 1986*.

5.3 Proponent Responsibilities

Where proponents demonstrate to the EPA that the requirements of this Guidance Statement are accountably and enforceably incorporated into proposals, the assessment of such proposals is likely to be assisted.

6 DEFINITIONS AND/OR ABBREVIATIONS

AEC - Australian Environment Council (as it existed in 1985).

DEP - Department of Environmental Protection.

EIA - environmental impact assessment.

EPA - Environmental Protection Authority.

EP Act 1986 - Environmental Protection Act 1986 as amended.

g.m⁻³ - grams per cubic metre expressed dry at 0 degrees Celsius and 1 atmosphere pressure (101.325 kilopascals) unless otherwise indicated.

MW - net electrical energy output from the gas turbine measured in megawatts.

NEPC - National Environment Protection Council.

NHMRC - National Health and Medical Research Council.

NO_x - Oxides of nitrogen.

STP - standard temperature (0 degrees Celsius) and pressure (1 atmosphere or 101.325 kilopascals).

7 LIMITATIONS

This Guidance Statement has been prepared by the Environmental Protection Authority to assist proponents and the public. While it represents the contemporary views of the Environmental Protection Authority, each proposal which comes before the Environmental Protection Authority for environmental impact assessment will be judged on its merits. Proponents who wish to deviate from the Guidance provided in this document should provide robust justification for the proposed departure.

8 REFERENCES/BIBLIOGRAPHY

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Status

Signed-off by the EPA at this stage for public review

Citation

This document can be cited as a Preliminary Guidance Statement for Emissions of Oxides of Nitrogen from Gas Turbines.

Acknowledgments

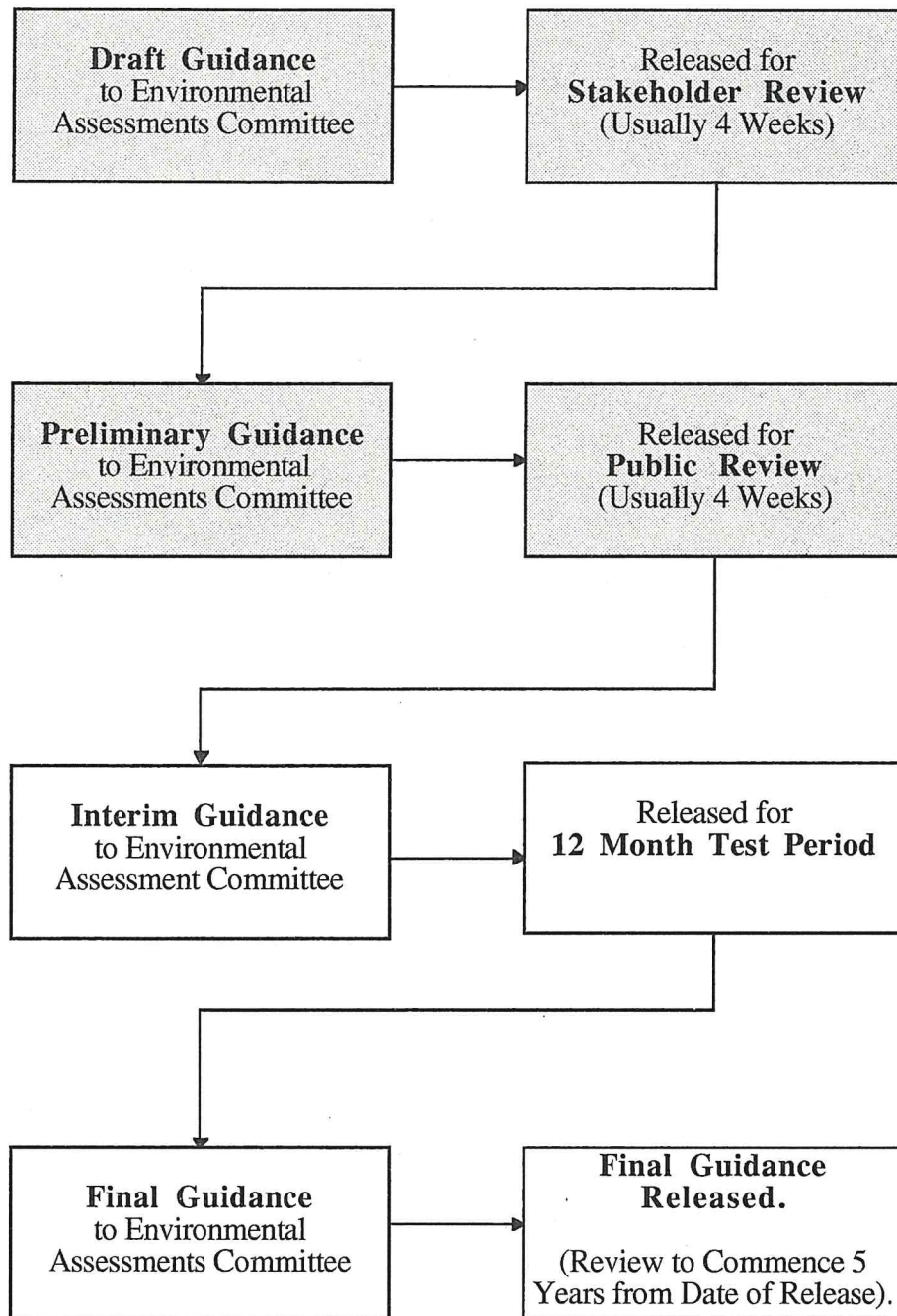
The EPA acknowledges the assistance of the Department of Environmental Protection in preparing this Guidance Statement.

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Appendix 1

Guidance for the Assessment of Environmental Factors Flow Diagram



Note: Shaded areas denotes those parts of the process completed