



Environmental Protection Authority

# Guidance for the Assessment of Environmental Factors

(in accordance with the  
Environmental Protection  
Act 1986)

## **Management of Air Emissions from Biomedical Waste Incinerators**

No. 13

Final

March 2000

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 Guidance Statements to assist 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 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 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 use this Guidance as a minimum requirement rather than a maximum.

This document provides guidance with regard to emissions from biomedical waste incinerators.

The Department of Environmental Protection (DEP) is required to licence biomedical waste incinerators operating in Western Australia. Management of emissions from biomedical waste incinerators is required due to the potential for the release of dioxins, furans and acidic gases if medical waste is not burnt under controlled conditions.

Guidance is provided in this document for:

- (a) minimum standards for incineration design and operation;
- (b) incineration emission and monitoring requirements; and
- (c) flyash and incinerator residue disposal.

This Guidance Statement has the status of "**Final**" which means it has been reviewed by stakeholders and the public and has undergone a 12 month test period. The EPA has signed off the Guidance Statement and published it although it will be updated regularly as new information comes to hand.

I am pleased to release this document which now supercedes all previous versions.



**Bernard Bowen**  
CHAIRMAN  
ENVIRONMENTAL PROTECTION AUTHORITY

17 March 2000

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## Final Guidance Statement No. 13

### Guidance Statement for the Management of Air Emissions from Biomedical Waste Incinerators

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**Key Words: Incinerators, Biomedical Waste, Dioxins, Furans**

#### 1. Purpose

The purpose of this Guidance Statement is to assist in preventing air pollution from biomedical waste incinerators.

This Guidance Statement addresses:

- (a) protection of the environment as defined by the *Environmental Protection Act 1986 (WA)* (the Act) with a focus on emission standards and criteria for the operation of biomedical waste incinerators and design standards for biomedical waste incinerators;
- (b) the factor of air pollution from biomedical waste incinerators; and
- (c) the need to present to proponents, who have proposals subject to environmental impact assessment (EIA) and the general public, the Environmental Protection Authority's (EPA) position on Management of Emissions from Biomedical Waste Incinerators.

#### 2. Introduction

In 1990 the DEP foreshadowed the introduction of regulations for biomedical waste incinerators throughout WA. All biomedical waste incinerator operators were given notice that incinerators that were operated for the purposes of biomedical waste incineration after February 1996 would be required to be licensed.

The DEP licence required biomedical waste incinerators to comply with strict limits on emissions to reduce organic, acid and heavy metal emissions to an acceptable standard. All but one of the incinerators, the Stephenson & Ward incinerator, have closed down. Biomedical waste that may be incinerated is defined as infectious or potentially infectious waste produced by health care establishments, or by pathology, dental, or veterinary practises, or by laboratories.

The Stephenson & Ward Incinerator located in Welshpool provides an essential service to the State for the destruction of a range of biomedical waste including some which may be considered to be a hazard to human health. A significant portion of the biomedical waste stream has the potential to release dioxins, furans and acid gases to the atmosphere if burnt in uncontrolled conditions. The EPA guidance statement addresses the standards of operation and emissions of biomedical waste incinerators to ensure that emission levels are controlled.

### 3. Guidance

#### 3.1 The Environmental Objective

The EPA's environmental objective for the management of emissions from biomedical waste incinerators is to ensure that humans and other living things are not adversely affected by emissions either from incineration or from disposal of flyash.

#### 3.2 The development of operating and design requirements for biomedical waste incinerators

The standards required for the operation of the Stephenson & Ward incinerator should be the minimum standards required for the operation of biomedical waste incinerators throughout Western Australia. The Stephenson & Ward incinerator is licensed under the *Environmental Protection Act 1986 (WA)* and therefore must comply with a set of licence conditions. The licence conditions apply criteria to air emissions, specific operating conditions, and require regular testing and monitoring of emissions.

The emission limits for the Stephenson & Ward incinerator were adapted from the strict emission and control legislation applied to New South Wales municipal waste incinerators (*Clean Air (Plant and Equipment) Regulation 1997, Part 9, Dioxins and Furans*) by the NSW EPA. The dioxin/furan goal of  $0.1\text{ng}/\text{m}^3$  has also been adopted by the VicEPA.

The dioxin and furan limit of  $0.1\text{ng}/\text{m}^3$  has been internationally accepted as a "goal" and not as a strict emission standard for a number of years because there is still incinerator technology in use that cannot achieve such low emission limits. The German Federal Environmental Agency (Umweltbundesamt) has implemented the dioxin and furan limit of  $0.1\text{ng}/\text{m}^3$  as a strict emission control limit for incinerators and industry operating near populated areas. Testing on the Stephenson & Ward incinerator following the upgrading of the pollution control equipment has indicated that the dioxin and furan goal of  $0.1\text{ng}/\text{m}^3$  can be readily achieved.

The EPA has adopted a standard of  $0.1\text{ng}/\text{m}^3$  criteria for dioxins and furans.

#### 3.3 Biomedical Waste Incinerator Design, Operation and Emission Requirements

##### (a) Minimum Requirements for Incinerator Design and Operation

- Biomedical waste incinerators shall be sited on appropriately zoned land away from residential areas.
- The secondary chamber is to be sized to achieve a 1 second minimum gas residence time within the secondary combustion chamber at a temperature of at least  $1100^\circ\text{C}$ , or a 2 second minimum at a temperature of at least  $1000^\circ\text{C}$ , under maximum operating conditions. The residence time is measured from the flame front to where the secondary chamber temperature sensor is positioned. The primary and secondary chamber temperature sensors are to be located so they do not receive direct radiation from the chamber's burner or flame.

- The primary chamber must operate at a temperature of between 650°C and 900°C. Temperatures below 650°C have been shown to produce incomplete physical destruction. Avoiding temperatures in excess of 900°C minimises excessive gas velocities and thus prevents carryover of particles and ash.
- Gases entering the particulate control device must be below 230°C, avoiding temperatures between 250°C and 400°C prevents the formation of dioxins and furans.
- Gas exiting the secondary chamber should have an excess oxygen content of at least 6%.
- The incinerator shall go into “interlock mode” within 120 seconds if the secondary chamber exhaust gas temperature falls below 1000°C. The interlock shall prevent waste from being loaded into the primary chamber until the secondary chamber temperature reaches 1000°C.

(b) Incinerator Emission and Monitoring Requirements

- An essential ingredient for any incinerator is regular on-stream monitoring of certain air quality parameters. The exhaust gases of biomedical waste incinerators are normally required to be analysed for the contaminants specified in Table 1.
- Gas volumes are to be expressed dry, at 0°C, and at absolute pressure 101.325 kPa and 7% O<sub>2</sub>.
- The oxygen content of the exhaust gases leaving the secondary combustion chamber must be accurately measured and recorded daily whenever the incinerator is operating.
- Carbon monoxide (CO) and carbon dioxide (CO<sub>2</sub>) content of exhaust gases must be accurately measured and recorded daily whenever the incinerator is operating. Combustion efficiency (CE%) is to be calculated and recorded. The incinerator is to operate with a combustion efficiency of better than 99.8%.

$$\text{CE\%} = \frac{\text{concentration of CO}_2 \times 100\%}{(\text{concentration of CO}_2 + \text{concentration of CO})}$$

- Chlorinated dibenzodioxins and dibenzofurans must be reported in the following groups together with the specified congeners. This allows computation of toxic equivalents and gives an indication of the classes of compound present. The two major groups, chlorinated dibenzodioxins and the corresponding furans must be reported separately. Each level of chlorination from tetra to octa substitution must be reported separately.

Within each level of chlorination:

- (i) All those compounds including chlorine substitution at the 2,3,7,8 positions must be reported individually;

- (ii) Those compounds not substituted at the 2,3,7,8 positions must be reported as a composite group (for each level of chlorination), for example "non-2,3,7,8 hexachlorinated dibenzodioxins".
- Operator training is essential for the efficient and effective operation of the incinerator. Operator training should be designed to ensure correct incinerator operation in all circumstances, including during emergency situations or unexpected power supply problems. Adequate training will assist in preventing unacceptable environmental impacts.

**Table 1 Western Australian Environmental Protection Authority  
 Emission  
 Levels for Biomedical Waste Incinerators**

<b>Emission</b>	<b>Measure as</b>	<b>Levels</b>
Smoke	Ringelmann scale	1
Soot	Bacharach scale	3
Solid particles	adjusted to 12% CO <sub>2</sub>	0.070 g/m <sup>3</sup>
Hydrogen sulphide	H <sub>2</sub> S	0.005 g/m <sup>3</sup>
Nitrogen oxides	NO <sub>2</sub>	0.500 g/m <sup>3</sup>
Carbon monoxide	CO	0.150 g/m <sup>3</sup>
Sulphur trioxide or H <sub>2</sub> SO <sub>4</sub> mist	SO <sub>3</sub>	0.100 g/m <sup>3</sup>
Chlorine and chlorine compounds	HCl	0.050 g/m <sup>3</sup>
Fluorine and fluorine compounds	HF	0.005 g/m <sup>3</sup>
Organic compounds	C	0.030g/m <sup>3</sup>
Antimony, arsenic, cadmium, lead, mercury	Total as element or in compounds	0.010 g/m <sup>3</sup>
Cadmium and compounds	Maximum concentrations of each as elements or compounds	0.003 g/m <sup>3</sup>
Mercury and compounds		0.003g/m <sup>3</sup>
Dioxins and furans	Total toxic equivalents	0.100 ng/m <sup>3</sup>

(c) Flyash and Incinerator Residue Disposal

- Ash and particulate residue are to be disposed of at a landfill site licensed for the purpose under the Environmental Protection Act (WA) 1986. Prior to disposal, chemical analysis of the waste is required to ensure that the content of substances which are environmentally hazardous, including Hg, Cd and Pb, is maintained below an acceptable level.
- When analysing flyash the following must be assessed:  
  
 Total PAH, benzo (A) pyrene, chlorine compounds expressed as HCl, chlorinated dibenzodioxins and chlorinated dibenzofurans, mutagenicity by Ames test.

- When analysing bottom ash the following must be assessed:  
  
Total PAH, leachable metal species (Cd,Co, Cr, Cu Hg, Ni Pb, Sn, Zn) by Toxicity Characteristic Leaching Procedure Method 1311 (EPA/SW - 846, 1986)
- Flyash and incinerator residues may be disposed of at a landfill as determined by the maximum leachable fraction (Refer to current Department of Environmental Protection *Landfill Waste Classification and Waste Definitions*).

### **3.4 Approach**

The proponent should identify how this Guidance Statement will be complied with.

### **3.5 Management system**

An Environmental Management System (EMS) is an essential requirement for an incinerator and any incinerator proposal is likely to be assessed.

The proponent should demonstrate that an EMS is in place which includes the following elements:

1. An environmental policy and a corporate commitment to it;
2. Mechanisms or 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**

The Guidance Statement applies to all applications for Biomedical Waste Incinerators throughout the state of Western Australia.

### **4.2 Duration and review**

The duration of this Guidance Statement is for five years unless some unforeseen circumstances require it to be revised.

## 5. Responsibilities

### 5.1 Environmental Protection Authority Responsibilities

The EPA will apply this Guidance Statement when assessing any proposals for biomedical waste incinerators.

### 5.2 Department of Environmental Protection Responsibilities

The Department of Environmental Protection 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 abbreviations

**C** - carbon

**Cd** - cadmium

**Co** - cobalt

**CO** - carbon monoxide

**CO<sub>2</sub>** - carbon dioxide

**Cr** - chromium

**Congener** - a substance of the same category or kind as another

**Cu** - copper

**DEP** - the Department of Environmental Protection

**EIA** - environmental impact assessment

**EPA** - Environmental Protection Authority

**Guideline** - a document that gives guidance on possible means for achieving desired environmental outcomes.

**HCl** - hydrogen chloride

**HF** - hydrogen fluoride

**Hg** - mercury

**H<sub>2</sub>S** - hydrogen sulphide

**H<sub>2</sub>SO<sub>4</sub>** - sulfuric acid

**NO<sub>2</sub>** - nitrogen dioxide

**NSWEPA** - New South Wales Environment Protection Authority

**Pb** - lead

**Sn** - tin

**SO<sub>3</sub>** - sulphur trioxide

**TEQ** - total toxic equivalents

**TCLP** - Toxicity Characteristic Leaching Procedure Method 1311

**VicEPA** - Victorian Environment Protection Authority

**Zn** - zinc

## 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 Statement should therefore provide robust justification for the proposed departure.

## 8. References

Department of Environmental Protection. 1996, Landfill Waste Classification and Waste Definitions. Perth.

Umweltbundesamt , Determination of Requirements to Limit the Emissions of Dioxins and Furans. Texte 58/95. ZAD. Germany.

EPA/SW- 846, Test Methods for Evaluating Solid Waste - Physical/Chemical Methods, 3rd Edition, 1986, Revision 1, dated December, 1987, and 1990 updates.

New South Wales Environmental Protection Authority (NSWEPA), Clean Air (Plant and Equipment) Regulation 1997

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**Index**

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**Status**

Signed off by the EPA

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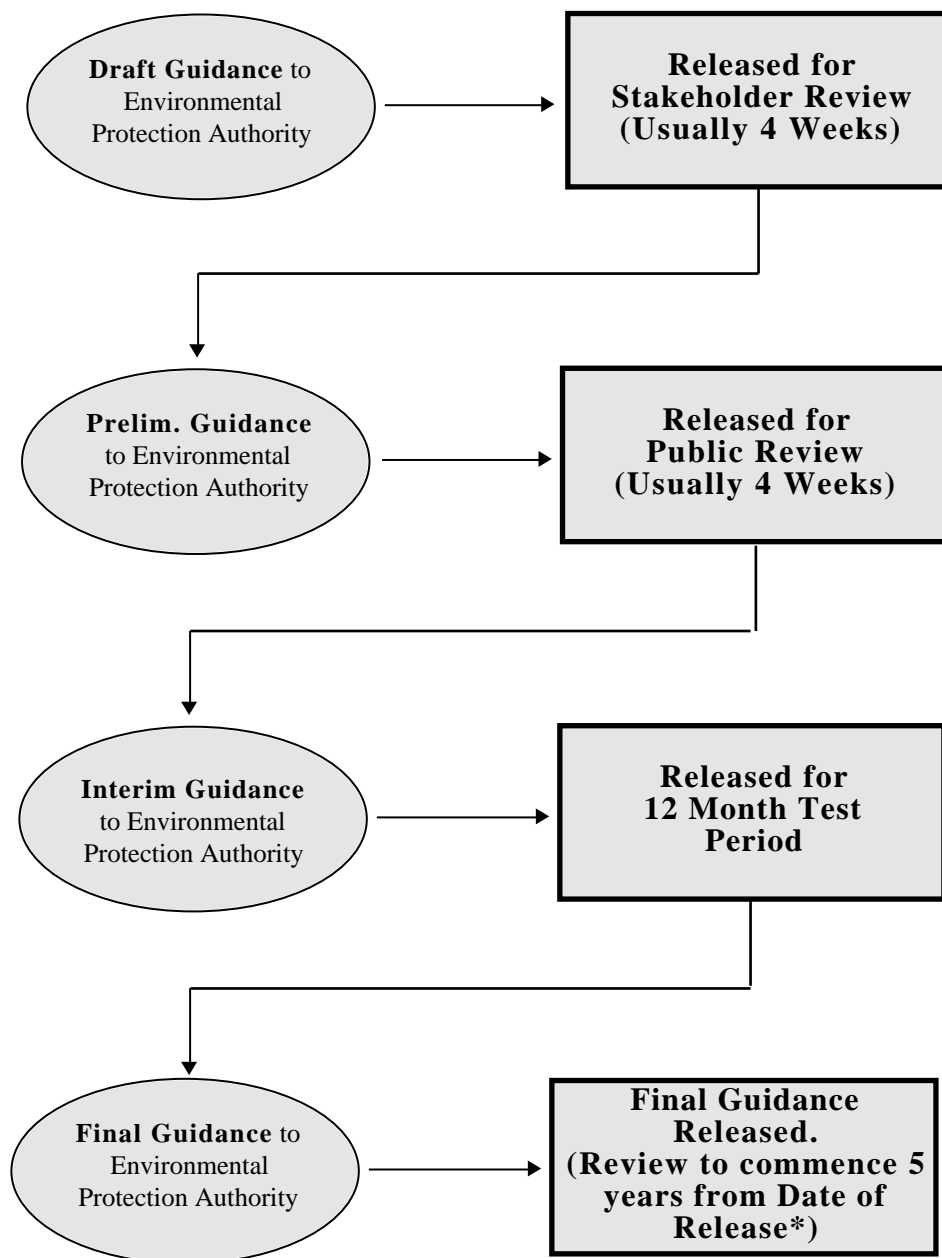
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## Appendix 1

### Generic Flow Diagram for the Guidance Statement Process

(Note: Guidance Statements will usually progress through the stages shown below. The number of stages required for each Guidance Statement will be determined by the EPA on a case by case basis. The EPA will take stakeholder and public views into account when making this decision.)



\* Guidance may be reviewed earlier if circumstances require it.

Note: Shaded areas denotes those parts of the process completed