AUSTRALASIAN
CEMETERIES & CREMATORIA
ASSOCIATION

ENVIRONMENTAL GUIDELINES FOR CREMATORIA AND CREMATORS

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ENVIRONMENTAL GUIDELINES FOR CREMATORIA AND CREMATORS 1

1 Introduction

The process of disposing of human remains by cremation can give rise to the emission of various pollutants to the atmosphere. The **Australian Cemeteries & Crematoria Association** has initiated this ***Code of Practice*** to encourage both management and staff to develop a commitment to being environmentally conscious by taking measures to control emission of pollutants to air and to lessen the visible impact of their industry.

The responsibility for pollution control is to be shared between Local Government, State Government and the individual crematorium operators.

Operators must ensure that they take all practical measures, in accordance with all applicable Acts or Ordinances, to prevent, control, or reduce pollution site and to control and regulate the disposal of wastes off the site in a manner which complies with statutory regulations.

2 Purpose of Guideline

This guideline aims to set standards of excellence for crematoria operators and to provide decision making authorities and industry with the knowledge to reduce water and air pollution and noise nuisance. It can be used by control authorities as a guide in the review of development and building applications and for assessing complaints.

This guideline identifies environmental considerations associated with crematoria. It is intended for industry, local government and community use, and is designed to:

- highlight potential pollution matters such as emissions to air of combusted materials, odour and noise:
- lessen visible impact (especially smoke and furnace stacks);
- help control authorities include environment management and site considerations in planning decisions;
- identify any environmental health issues connected with crematoria processes;
- help occupiers develop management strategies for preventing and controlling pollution; and
- assist crematoria operators to manage waste streams

3 Scope of guideline

This guideline applies to crematoria and cremators used for the disposition of human remains. It covers design criteria and operation of these facilities and also recommends environmental control measures for the process of cremation and the disposal of cremated remains within crematorium grounds.

It should be noted that if cremators are proposed to be used for purposes other than thecremation of human remains such as the incineration of biomedical or cytotoxic wastes, operation considerations may require maintenance of higher chamber temperatures, increased buffer zones and implementation of specialised pollution control mechanisms.

4 Definitions

Air Impurities: Smoke, soot, dust, ash (including fly ash) cinders, solid particles of any kind, gases. fumes, mists and odours of an offensive nature.

Air pollution:	The emission into the air of any air impurity.
Cadaver:	The body of a human being after death.
Casket/Coffin:	The container designed to transport a corpse. Usually constructed of timber products and lined with suitable impervious material to prevent the leakage of body fluids.
Cemetery:	Means any land used or intended for use for the interment of human remains after death. In the same way, the burial of cremated remains within the grounds of a crematorium makes that land a recognisable cemetery by definition.
Combustion Efficiency:	Percentage of combustible material which is completely oxidised in the incinerator. Calculating the following formula: Combustion efficiency = 100 x {[CO2] - [CO]} / {CO2] where [CO2] and [CO] are the concentrations of carbon dioxide and carbon monoxide respectively in the final exhaust from the furnace.
Control Authorities:	State Government departments, local authorities, or other bodies with legislative responsibility for pollution control.
Cremated Remains:	The residue of a corpse after the cremation process.
Cremation:	The process of reduction of a corpse by incineration.
Crematorium:	Means any premises furnished with a cremator used to or intended for use to reduce corpses to ashes after death, together with any chapel, funeral parlour or columbarium located on the same land, and used in connection with that place.
Cremator:	The actual furnace used to reduce corpses to ashes.
Cremator Room:	The actual room containing the cremator.
Effective Stack Height:	Used to calculate stack configurations to mitigate the eddy or wake effects of incinerated emission dispersal. ESH may be calculated as follows: *Building height (metres) plus stack height (metre) above building.*
Flue:	Smoke-duct in a chimney, channel for conveying heat.
Local Authority:	Local government, Council or Shire as the case may be.
Main Chamber:	Primary or ignition chamber of the cremation furnace.
Occupier:	In relation to the premises or any part of the premises, the person in occupation or control, the person entitled to possession of the premises or that part of the premises.
Particulates:	Small, impure, solid air-borne particles.

Pollution:	Direct or indirect alteration of the environment causing contamination or degradation.
Prosthetics:	Artificial parts to rectify or overcome a defect of the body. Includes artificial limbs and dental accessories.
Residence time:	Average time (minimum residence) required for gases in residence combustion chamber to travel from the ignition source and secondary air introduction to the point of exit from the residence combustion chamber when the incinerator is operating at its maximum design flow. Residents time is determined by calculation taking into consideration the temperature, chamber size and maximum flow rates.
Secondary Chamber:	A second, separate chamber designed to assist with the final destruction of combustibles that may remain after the initial combustion process occurs in the main chamber.
Stack:	Includes any structure or opening from or through which air impurities are released to the atmosphere.

5 Process description

Cremators are designed to reduce corpses and the caskets that contain them to ash. To ensure the dignified and environmentally sound reduction of remains during the cremation process, a high standard of incineration is required.

In most cases a funeral service is held in an adjoining room or building. At the conclusion of the funeral service the casket (usually sealed) is removed from the chapel and placed in the cremator room until a cremator is available. At the appropriate time and temperature the cremator door is opened and the sealed casket is either manually pushed or mechanically inserted into the furnace. The cremation process begins the instant the casket is placed inside the main chamber of the cremator.

Cremators may be either manually or automatically operated. Conditions inside computer monitored cremators are automatically adjusted to suit the conditions of each individual cremation. Conditions inside manually operated furnaces are monitored by an attendant. Cremators vary in design and construction and many older designs do not necessarily have burners in secondary chambers. Generally each cremator has an opening in the floor to allow cremated remains to be collected at the end of the process. Unburnt particles travel into a secondary chamber. If combustion is complete within the secondary chamber there will be no visible emissions from the stack.

Unburnt gases and particulates pass from the main chamber into an adjoining secondary chamber. Gases and particulates are incinerated in the secondary

chamber by the controlled introduction of additional secondary combustion air and a burner.

On completion of the cremation process in both furnace types, the still hot remains are raked into a collection tray and allowed to cool. When cooled, metallic contents (such as prosthesis, coffin nails etc) are removed, usually with the aid of a magnet. The cremated remains are then mechanically ground into a powder and placed inside either a bronze, copper or impervious plastic box or urn for safe keeping. At some later time the cremated remains are either interred in a memorial wall or garden, or collected by the person who authorised the cremation. Unclaimed cremated remains are eventually buried in an unmarked common grave within the grounds of the crematorium.

6 By product assessment : generation, handling and disposal

To fulfill the anticipated requirements of government policy on waste minimisation, a detailed account of sources and quantities of waste should be prepared. This information can be used by management or to provide appropriate authorities with accurate information.

6.1 Airborne wastes

Visible emissions emanating from the stack may be attributed to the following:

- casket composition and content;
- incorrect operation of cremators;
- composition of the cadaver;
- type of fuel used to fire the cremator;
- equipment condition.

Caskets may contain a wide variety of unknown objects such as:

- personal mementos and artifacts of varying composition:
- clothing ; and
- alcohol.

The types of materials used in the manufacture of caskets which produce airborne wastes may include:

- paints, lacquer finishes and adhesives;
- metal and/or plastic fittings;
- solid wood, particleboard or paper;
- petroleum based (DAP) paper pressed over particleboard;
- synthetic fibre or polyvinyl chloride (PVC) shrouds;

- plastic inner linings made from PVC and other plastics;
- fabric inner linings usually made from satins; crepes and plisse; and
- pillows stuffed with feather down or foam products.

Factors involving the composition of the cadaver such as:
- lifestyle previously led:
- pharmaceutical and non-prescription drugs ingested; and
- cause of death;

all contribute to airborne emissions and have a considerable effect on the rate of combustion.

6.2 Liquid wastes

The primary sources of liquid wastes from crematoria are:
- fluids released from the cadaver: and
- spent scrubber liquor from pollution control equipment (where fitted).

Other minor sources are associated with the maintenance of memorial gardens such as pesticides, herbicides and fertilisers.

6.3 Solid wastes

After the corpse and casket have been cremated, the remains are in the form of an ash residue. This residue consists of:
- char;
- slag from glass or metal mementos or artifacts;
- chemical compounds (formed during the cremation process);
- metal prosthetics;
- screws, staples and other metal casket accessories; and
- particulate matter which may contain heavy metals.

The furnace itself yields the following solid wastes as a result of the cremation process:
- ash from the main combustion chamber;
- flyash collected in dry particulate collection devices;
- precipitate collected in dry acid gas scrubbers (where fitted); and
- sludge collected in wet scrubbers (where fitted).

Both memorialised and unclaimed cremated remains are disposed of within the grounds of the crematoria. (Note: the burial of cremated remains within the grounds of a crematorium classifies that land as a cemetery).

7 Noise sources and current practices

To determine noise limits and to assess noise levels, refer to the appropriate legislation in each state.

Sources of noise from crematoria include:

- music from memorial chapel services
- electric fans and blowers
- pumps
- air compressors
- mechanical grinding
- vehicular traffic
- combustion noise
- maintenance of memorial gardens
- other activity involving maintenance of cremation equipment

Clearly audible noise should not be detectable beyond crematoria site boundaries.

8 Environmental management practice

Compliance with applicable legislation and efficient production are best achieved when sound environmental management practice is in place. There are many elements of environmental management practice; the most important ones should be included in the guideline.

8.1 Planning issues

The planning stage of any industrial activity is the best time to design the operation in a way, which conforms to the legislative requirements, and to examine all waste prevention options

8.1.1 Waste prevention

A full examination of the process by-products and wastes should be carried out to identify options for waste prevention. In some cases, raw material substitution may lead to changes in the process. Often, reuse or recycling of by-products results in reduction of wastes. The following is a list of some waste prevention and reduction options for consideration during the planning stage:

- change processes or equipment;
- change composition of caskets and casket accessories used;
- improve controls of cremation processes;
- improve materials handling and cleaning operations;

- improve maintenance and repair of equipment;
- improve methods by which unclaimed cremated remains are disposed of; and
- internally recycle waste;
- modify internal design of cremator to achieve high turbulence & greater residence times;
- change fuel to either LPG or natural gas;
- foam and feather down used for stuffing pillows and padding caskets may be effectively replaced by shredded scrap paper.

Plastic and/or metal casket accessories may be removed before the cremation process takes place as a means of eliminating unnecessary emissions.

8.1.2 Site selection

Careful site selection can lead to substantial reduction in environmental nuisance. Relevant site information should include:

- proximity to housing developments and to land zoned to permit housing or other land uses not compatible with the proposed development;
- site hydrology - flood liability, site drainage and proximity to watercourses and ground water resources used for domestic, agricultural or town water supply;
- prevailing wind conditions;
- landform and the likely direction of drift in the event of odour or noise;
- adequate land area to house furnaces, chapels and internment of cremated remains;
- erosion hazard;
- local road network; and
- power, water supply, sewerage infrastructure.

As with cemetery site selection, the selection of crematoria sites must be undertaken with care as they may be intended to be the final resting place for deceased persons.

In areas likely to be disturbed by the proposed development and infrastructure, the site description should include data on flora and fauna, such as:

- major plant communities
- the status and conservation significance of vegetation
- the occurrence of any rare or threatened species
- the presence of any exotic and introduced species.

8.1.3 Buffer zones

Buffers zones are particularly important as measures to separate conflicting land uses and to minimise the impact of new developments in environmentally sensitive areas. Even if other control measures are used, odour, dust and noise emissions may still occur. Adequate buffer distances from adjacent land uses are the best way of avoiding noise nuisance from and noise pollution. Occupiers should include them in management strategies and local authorities should include them in town planning approvals. New buffer zones should be created as part of the proposed development.

Planning and design must allow for changing conditions. The use of buffers needs to be balanced against possible future changes to the surrounding land use. For example, future development may bring neighbours closer to the development/land use, and the other control measures may become necessary. Providing a buffer zone will also reduce the potential for distress caused by encroaching land development on memorial gardens.

Sufficient land must be set aside for the sole purpose of the internment of unclaimed cremated remains.

The characteristics of the individual cremation may not be known until after the combustion process is complete because most cremation authorities maintain policies which prevent employees from opening coffins to examine the contents. These factors, coupled to the possibility of either power failure and/or mechanical breakdown, indicate the need for a minimum buffer zone for cremation furnace equipment.

In line with other state environmental protection authority guidelines, a buffer zone of the order of **200 metres** (depending on the nature of prevailing winds and the natural topography of the site) between the emission stack and neighbouring residences is desirable. In any case a buffer zone of not less than 100 metres is recommended.

8.1.4 Visual environment

The choice of aesthetically pleasing colours and finishes will enhance the look of premises. Features such as trees, shrubs, rock walls and grassed slopes incorporated into the landscaping not only help with the visual impact, but also diminish the effect of operation sighting beyond the boundaries of crematoria. Planting may also assist in dust control. Endemic species are recommended for planting as they will provide a habitat for birds and animals native to the area. Early planting should be organised at new sites.

Noise will not be reduced by planting. However, the perception of noise is reduced by visual screenings. Creating earth banks, on the other hand, may reduce noise if the source is close to the banks and the banks are high enough.

8.2 Management strategies

The occupier should develop management strategies for both proposed and existing premises.
The aims of the strategies should be to:

- minimise emissions of pollutants to the atmosphere;
- prevent odour and smoke emissions;
- prevent soil and ground water contamination arising from the disposal of unwanted cremated remains;
- minimise environmental health risks;
- minimise discomfort to neighbours adjacent to crematoria and/or cremation furnaces;
- lessen visible impact of crematoria; and
- improve efficiency of cremation processes through energy savings.

The management strategy for the control of emissions to air is most appropriately founded in the design of caskets and equipment used in their reduction to ash.

It is suggested that crematorium operators maintain close liaison with funeral directors with a view to encouraging use of casket materials that minimise environmental risks in the combustion process. It may be appropriate for cremation authorities to require funeral director's to supply a written log of the casket contents.

8.3 Compliance with environmental statutory requirements

It is important for crematorium operators to identify clearly their obligations in relation to environmental legislation.

8.3.1 Air emissions

Crematorium operators need to be familiar with environmental standards required and know the allowable emission levels.

The quality of emissions from crematoria will be dependent on:

- type (s) of air pollution control equipment fitted;
- casket composition and contents;
- cremation furnace design;
- combustion temperature;
- residence times;
- type of fuel;
- cremation furnace operating practices;
- turbulence characteristics; and
- air and fuel feed rates.

Emissions from cremators should comply with the criteria set out in Table 1 below.

Table 1. Emission Standards for Crematorium Furnace Facilities.

AIRBORNE EMISSION	CURRENT CLEAN AIR REGULATIONS CONCENTRATION g/m3	FUTURE POLICY OBJECTIVES * CONCENTRATION g/m3
Combustion Particles	0.450	0.250
Carbon Monoxide +	-	0.150 +
Nitrogen Oxides	2.500	0.500
Chlorine & Compounds except HCl	0.200	0.200
Acid gases as HCl	0.400	0.200
Fluorine & Compounds as HF	0.100	0.050
Total Organic Compounds	-	0.226
Heavy Metals	0.020	0.010
Mercury	-	0.003
Lead	-	0.010
Cadmium	-	0.003

* Based on National Guidelines recommended by NHMRC, ANZECC and + Victorian EPA

Note: Gas volumes are expressed dry at zero degrees celsius at an absolute pressure of 1 atmosphere (101.325 kPa) and calculated at 7% oxygen and 12% CO2 for particulates
Nitrogen oxides are expressed as nitrogen dioxide. Heavy metals are expressed as a total which includes cadmium, chromium, nickel, cobalt, arsenic and mercury. All the above values must be from measurements taken over the complete cremation cycle. Total organic compounds are expressed as Hexane.

Where crematoria furnaces do not meet air emission standards one or more of the following devices may be fitted;

- gas conditioning devices to reduce flue gas temperatures;
- wet or dry scrubbers to remove acid gases;
- fabric filters or electrostatic precipitators to remove fine particulates; and
- mechanical collectors.
- addition of secondary chamber afterburners where none are fitted.

Operational Suggestion
Cremation furnaces are designed for the cremation of corpses and the caskets or coffins that contain them. Where emissions standards are not met, the following **operational suggestions** *may* **assist** in meeting those standards and help to prevent smouldering, odour, high quantities of particulate emissions, acid gases and dark smoke as well as a variety of potentially noxious emissions.

- efficient cremation furnace operation and monitoring;
- the correct furnace temperature (a suitably temperature in the secondary chamber throughout the combustion process with adequate excess air will optimise reduction of potentially noxious compounds);
- an appropriate residence time, 1.5 seconds at 850 degrees centigrade is sufficient;
- automated chamber loading mechanisms interlocked to temperature;
- main chamber temperature between 650 - 900 degrees centigrade;
- main chamber optimum insertion and operation temperature at 760 degrees centigrade. Other insertion temperatures below 760 degrees centigrade can also produce satisfactory results.
- automatic control of additional air to the main chamber;
- automatic control of secondary air (this may also be lined with oxygen monitoring at the base of each individual cremation stack);

- two or more cremations feeding into one stack are difficult to control and generally unadvisable;
- an initial insertion and throughout the cremation the secondary chamber should be maintained at a minimum temperature of 850 degrees centigrade and have the ability to withstand in excess of 1200 degrees centigrade for sustained periods.
- the burner in the secondary chamber must have modulating fire rate control (rather than high-low control);
- a turbulent path of well mixed gases in the secondary chamber with the addition of excess oxygen as needed to ensure proper combustion of volatiles;
- air supplied at the inlet or into the secondary (and/or tertiary) chamber to provide a level of oxygen at the outlet of the cremator of not less than 6% to ensure oxidising conditions are maintained throughout the process.;
- oxygen levels or smoke obscuration levels (measured by a device located in the flue stack);
- wet scrubber devices should only be used when absolutely necessary due to the additional problems they cause and their cost. Modern well-maintained cremators do not require wet scrubbers.

Crematorium facilities must be designed to cope with present and future environmental requirements and must be able to cope with expected demand as overloading can result in incomplete reduction, unwanted emissions and greater maintenance problems.

By adopting the following suggestions air emissions may be significantly reduced:

- removal of PVC plastics (these materials produce hazardous end products such as PCDDDs, PCDFs and PCBs);
- Water based adhesive products used wherever possible.
- reduce unnecessary use of synthetic fibres for lining and/or trimming caskets;
- reduce the use of (DAP) paper, paint and/or lacquer finishes and be replaced by water based products wherever possible.
- Caskets be constructed of wood or wood by-products which, when subjected to the cremation process, are easily combustible and do not emit smoke, give off toxic gas or leave any retardant smears or drips after final combustion.
- Use of metal fittings should be limited unless these are removed prior to the cremation process.
- Use of polyurethane paints should be avoided wherever possible.
- Products containing polystyrene foams should not be used.

- Pitch, bitumen or similar products should not be used as a sealing material.
- Mementos or artifacts likely to explode, such as sealed containers, batteries or similar objects.

During periods of volitisation there is the potential for unbent gases and vapours to be issued from the stack in the form of dense, black smoke. It must be noted however, that if crematoria equipment is operating efficiently there should be neither visible stack emissions, nor any odours. Operation of cremation furnaces needs to take the following into account if air emissions are to be minimised. Appropriate consideration of the following will also assist the cremation process and reduce fuel consumption.

- hearth loading;
- hearth area;
- average arch height and chamber volume:
- maximum heat release rate;
- cremation and initial heat up rates;
- optimised sequencing of the cremation process control;
- maximum charge weights; and
- location of the gas burner in the main chamber.

Stack/Flue Design

Cremation furnace stack design and construction must be capable of withstanding the temperature of gases leaving the secondary chamber. Stack design must be based on the maximum gas temperatures expected and the maximum rate of operation.

When stack fans are used, the system design must enable the continued discharge of a lower than normal flow during system failures (eg. power). Stack dilution inlets must be designed and placed so as not to create a hazard inside or outside the building. Thus, a flue system using a fan must be designed in such a way that combustion gases are discharged safely during power failure, without damaging the stack fan.

If dilution inlets are not designed and placed correctly, on flue fan power failure hot (eg. 850 degrees centigrade) flue gases could be discharged inside the building for dilution inlets inside the building.

Provision for weather protection should not interfere with free upward vertical discharge of gases and vapours. The stack outlet should be designed to allow for flows of at least **8 metres/second.**

The stack must be no less than **3 metres above the peak of the roof.** The visual aspect of the furnace must be taken into consideration due

to the nature of the combustible material. Eddy or wake effects will not generally occur if the effective stack height is greater than 2.5 times the building height or width (whichever is the lesser), or if the stack is 10 times the building height or width (again, whichever is the lesser), away from the building. Stacks should be modelled prior to installation to assess the dispersion characteristics if required by the authority. (**Note:** in some circumstances greater stack heights may be required to meet the criteria for design ground level concentrations). As crematoria are used infrequently and many of the ambient standards are expressed as long term averages, it is unlikely that these will be limiting factors in stack design.

8.3.2 Water discharges

Crematorium operators must operate equipment in ways which avoid waste discharges to surface waters and ground waters.

- If wash down is necessary for either hygiene or housekeeping reasons, contaminated water should be collected in sumps and stored in leak-proof containers for removal by a commercial liquid waste collection service.
- Spent scrubber liquor recycling and reuse will minimise the quantity requiring disposal.
- Where necessary, use a commercial liquid waste collection service.
- Install solid hearth rather than grates in the main chamber.
- Ensure efficient auxiliary heat sources are in place to initiate the dehydration process.
- Maintenance of an appropriate furnace temperature is essential to mitigate spillage from the sudden release of body fluids from the cadaver.

8.3.3 Solid waste disposal

Cremation Authorities must be aware of the implications of the state land contamination legislation and are encouraged to investigate and implement the best solid waste disposal practice.

Where installed, sludge from wet scrubbers should:

- be stored in tankers or water-tight containers as it is removed from the scrubber;
- be immediately taken to an approved disposal site;
- be stored so that drainage is prevented from entering surface waters and leachate is prevented from contaminating ground water if immediate disposal is not practical;
- be stores in areas that are roofed;
- be diverted from upstream stormwater run off to prevent contamination;
- not be allowed to dry out sufficiently to become a dust nuisance;

- not be allowed to build up on-site in large quantities; and
- be taken to a disposal site as soon as practicable.

To avoid potential pollution hazards when disposing of unclaimed cremated remains on-site:

- provide soil bunding to divert stormwater run off for burial pits; and
- do not excavate below the watertable.

It is recommended that a study of the underground soil characteristics be undertaken prior to the approval of a new crematorium facility to eliminate the potential for soil or ground water contamination as a result of porous soils and/or high water table levels. The recommendation for existing crematoria is to take regular samples from disposal pits and surrounding soil to ensure that underground seepage of potentially hazardous leachate is not occurring.

8.3.4 Noise emissions

8.3.4.1 Operating hours

Noise complaints may result from early or late operations or from weekend activities.

8.3.4.2 Existing premises

The following noise control measures should be considered:

- acoustic barriers such as screens around noisy equipment and operations
- where possible, visual signals and portable beeper telephones to replace hooters and telephone bells
- vehicle movement, especially trucks, limited to normal working hours
- diesel forklift engines, other noisy vehicles and air-powered tools fitted with efficient exhaust mufflers
- maintenance of equipment and prompt attention to loose or rattling covers, worn bearings and broken equipment
- mechanical equipment located on mounts designed to isolate structure-borne vibration and noise.

8.3.4.3 New premises

The noise control measures mentioned above for existing premises can be incorporated more cheaply and efficiently into proposed developments during the design stage. Other measures to consider are:

- installation of noisy equipment into one or more plant rooms or specially designed acoustic enclosures
- positioning of noisy operations as far away as possible from current or future noise-sensitive area.
- use of building layout and the natural topography as acoustic barriers where possible.

8.4 Training employees

Training employees is a vital part of any environmental management practice. Staff should be aware of the environmental management program depending on their duties. Training programs should contain common elements such as familiarisation with the company environmental policy, commitment to waste prevention, and raw materials conservation. Employees should be encouraged to bring forward fresh ideas.

Operators should be aware of their obligations to employees under *Workplace Health and Safety* legislation in each state. Management should ensure that staff supervising the cremation process are properly trained.

8.5 Internal auditing and reporting

An environmental management program may contain more elements than those outlined in this guideline. Each company should design and fully describe a detailed program pertinent to their operation.

Internal auditing and reporting are the control tools of program implementation. Internal auditing usually consists of an assessment of current practice and base numerical data relevant to environmental management. Monitoring of progress can be achieved through annual auditing. Internal reports based on audits will assist operators to assess the effectiveness of the environmental management plan.

The following parameters require continuous monitoring:

- opacity
- temperature of the primary and secondary chambers

To facilitate operations and maintaining equipment in a good condition the following parameters be continuously monitored:

- carbon monoxide (CO)
- oxygen (O_2)
- carbon dioxide (CO_2)

Monitoring of stack emissions for compliance annually for the following:

- total solid particulates
- carbon monoxide
- nitrogen oxides as nitrogen dioxide
- total organic compounds as hexane

Oxygen and carbon dioxide will also be required to interpret the results.

At the time of commissioning and later if there are any concerns about the emissions, or a change in coffin or packing materials, the following tests should also be done:

- chlorine and compounds except HCl
- acid gases as HCl
- fluorine and compounds as HCl
- heavy metals
- mercury
- lead
- cadmium

The reference gas condition chosen for the emission limits is 7% O_2 by volume. Oxygen is used world-wide as a reference gas for many pollutants. It enables measured values to be standardised for comparative purposes and ensure that diluted air cannot be used as a means of achieving emission limits.

The measurement of CO, CO_2 and O_2 levels allow determination of the combustion efficiency of cadaver, casket and burner on the day of stack emission sampling. The monitoring of cremation furnaces may include:

- temperature controllers for both chambers. This controls excessive increases in temperature so that both plant and personnel are protected.
- constant monitoring of flue gas O_2 levels via positive feedback and correctional control of air to the cremation furnace.
- two co-planer sampling ports located on the stack for the taking of flue gases for analysis. A new Australian Standard in this area is currently being developed. Until this document is available, the sampling plane locations must be in accordance with the criteria contained within existing *Clean Air Regulations.* Reference should also be made to the British Standard 3405:1983 *Measurement of Particulate Emission Including Grit and Dust (Simplified Method).*
- A smoke obscuration monitoring device fitted to give operators warning of emissions so that corrective if action may be taken. Alarm systems should be of low noise levels and/or visual.

Monitoring program results may be reported to National Association of Testing Authorities (NATA) endorsed test sheets in a form for submission to the applicable local authority. All results taken are to be performed by NATA approved and registered bodies and in accordance with NATA methods.

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Contributors:

The Australian Cemeteries & Crematoria Association gratefully acknowledges contributions from the following individuals: J. Gilbertson - Cheltenham Public Cemetery Trust; M. Vincent - Environmental Planning Branch, QLD; J. Browne - Parsons Tabo; P. MacLean - Metropolitan Cemeteries Board; J. Waters, Amdel Limited Industrial Services, R. George, Austeng Pty Ltd; K. Crowden - Enfield General Cemetery Trust; B. Hall - Centennial Park Cemetery Trust; Steven Pearce - Major Furnace & Engineering Pty Ltd.

10 Further Information

Cemetery and crematoria authorities who are members of ACCA are able to provide further information on these guidelines and associated matters. Similarly, the Head office of ACCA is available to assist organisations and individuals seeking further detail or contacts.

The Environmental Guidelines for Cemeteries & Crematoria will be reviewed regularly, to reflect changes in practices and legislation. Please direct comments in relation to the Guideline to the Head office of ACCA.

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CEMETERIES & CREMATORIA ASSOCIATION of NSW

Response to the stakeholder discussion paper:

BURIAL SPACE

in the

SYDNEY GREATER METROPOLITAN AREA

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About our Association

The Cemeteries & Crematoria Association of NSW (CCANSW) was established in 1965 as a trade association. The Association continues to represent the interests of cemeteries and crematoria in NSW. The membership comprises representation from trust, local government and private cemeteries and crematoria, with excess of 70 member organisations.

The Association is recognised as the peak body for cemeteries and crematoria in NSW and has strong ties to the Australian Funeral Directors Association, Funeral Directors Association of NSW and the Australasian Cemeteries and Crematoria Association.

5.1 Family graves

Re-use of family graves is an excellent way to extend the life and use of a cemetery.

Ownership of the site needs to be clear-cut, with the definition of ownership of the Burial Right set in legislation and covering all cemeteries in NSW. 'Lift and deepen' is an option appropriate for family graves as well as new graves with limited tenure.

Family graves can be used for multiple ash placements.

Another positive factor regarding the re-use of family graves is the obligation of the owner to maintain the safety and amenity of any existing monument.

5.2 Renewable tenure of gravesites

Renewable tenure and the practice of 'lift and deepen' should be introduced for new gravesites. Legislation to allow renewable tenure must be uniform and apply to all cemeteries - trust, local government and those that are privately owned.

5.3 Renewable tenure for community mausolea

Appropriate only if embalming is no longer a requirement and new mausolea are built with proper drainage and ventilation. The Public Health Act would require amendment and building codes altered to include requirements for the elimination of odours and body leachate. Similar principles to 'lift and deepen' would apply and an ossuary box used. In Victoria, where there are a large number of community mausolea, embalming is not a requirement.

5.4 Unused burial rights

The existing legislation (Cemeteries Legislation Amendment (Unused Burial Rights) Act, 2001) that applies to Trust cemeteries should be extended to cover all cemeteries as soon as possible.

5.5 Land use planning

Our ancestors had the foresight to provide burial space in any planned settlement, town or village. This no longer occurs. The Government should now take the lead in providing additional public land for burial. The principle of developers providing Section 94 funding could also be expanded to include purchase, establishment and maintenance of cemeteries in new developments.

5.6 Provision of additional public cemeteries

The Government should identify potential public lands and make them available at no cost. These lands to be administered by a Trust or Trustee.

5.7 Encouraging the adoption of alternative interment practices

There is no existing NSW legislation that limits the capacity of a grave. The only requirement is that there be 900mm earth cover above the last burial (unless otherwise approved by the NSW Director of Health). Most cemeteries bury double depth. Capacity is only limited to the type of machinery available and whether or not hand digging is required.

It is questionable that 'green' or 'woodland' burials would provide more space. More space may be provided if burials are set out in a grid system with no pathways and no individual memorialisation. This may also apply to vertical burial. These concepts need not be restricted to 'green' or 'woodland' burials.

There is a high incidence of some cultural groups pre-purchasing graves to accommodate whole families (including small children who may live for another eighty or so years). Limiting this practice will extend the life of a cemetery.

5.8 Other actions to address the immediate shortage of burial land for some groups

To maximise land use, the life of a cemetery and to encourage systematic use, it may be necessary to discourage the establishment of denominational sections. It is an inefficient use of land to develop small, specific group or denominational cemeteries where overall burial demands are not met.

It is not unreasonable to expect that land be purchased by a group or community with specific cultural needs.

6 Maintenance of Cemeteries

Closed, inactive cemeteries require maintenance (usually from a local government source). If a cemetery remains operational it should have a guaranteed future. The introduction of 'lift and deepen', revocation of burial rights, the re-use of family graves and ash placements will assist financially in supporting the ongoing maintenance of a cemetery.

Legislation is necessary to ensure public and private cemeteries set aside adequate funds to provide for future maintenance.

Other

Currently cemeteries operate under various Acts and Regulations – primarily the Public Health (Disposal of Bodies) Regulation 2002. The Local Government Act 1993 does not include anything specific to cemeteries.

All the legislation currently relating to cemetery and crematoria operations should be aggregated into a Cemeteries Act and be administered by a single government department.

It must be remembered that cremation is a good alternative. Promotion of this practice should be encouraged.

Conclusion

The Cemeteries and Crematoria Association of NSW endorses the initiative of the Government and the Cemeteries Interdepartmental Committee and the publication of the discussion paper 'Burial Space in the Sydney Greater Metropolitan Area'.

As a major stakeholder, representing cemeteries and crematoria in NSW, we would be happy to assist in your determinations.