Information sheet

Waste Management

Clinical or related waste treatment and disposal

This information sheet provides clarification on the various treatment and disposal mechanisms available for managing clinical or related wastes as required under the Environmental Protection (Waste Management) Regulation 2000.

Definitions

Clinical waste means waste that has the potential to cause disease, including, for example, the following:
- animal waste;
- discarded sharps;
- human tissue waste; and
- laboratory waste.

$\log_{10}$kill=4 means a 4 decade reduction or a 0.0001 survival probability in a microbial population.

$\log_{10}$kill=6 means a 6 decade reduction or a 0.000001 survival probability in a microbial population.

Non-infectious, for waste, means the waste:
- has a $\log_{10}$kill=4 for bacterial spores; and
- has a $\log_{10}$kill=6 for vegetative bacteria.

Pharmaceutical product means a restricted drug under the *Health (Drugs and Poisons) Regulation 1996*.

Pharmaceutical waste means waste arising from:
- pharmaceutical products that have passed their recommended shelf life;
- pharmaceutical products discarded due to off-specification batches or contaminated packaging;
- pharmaceutical products returned by patients or discarded by the public;
- pharmaceutical products no longer required by the public; and
- waste generated during the manufacture of pharmaceutical products.

Radioactive substance means radioactive material (whether or not it is sealed):
- containing more than the concentration or activity of a radionuclide prescribed under a regulation; or
- prescribed under a regulation to be a radioactive substance.

Radioactive waste means waste that is contaminated with a radioactive substance.

Related waste means waste that constitutes, or is contaminated with, chemicals, cytotoxic drugs, human body parts, pharmaceutical products or radioactive substances.

Segregation (for the purpose of this guideline) means the practice of categorising and separating wastes, at the point of generation, into various waste streams to allow appropriate storage, transport, treatment or disposal.

Treated waste (for the purpose of this guideline) means waste that has undergone processing through one of the methods listed in schedule 5 of the Regulation (excluding compaction and landfill, which are not treatment methods).

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Unrecognisable (for the purpose of this guideline) means that the form of the waste has been changed through a mechanical or chemical process so that its original form cannot be determined. A process such as double-bagging does not render the waste unrecognisable as the waste is still in its original form.

Untreated clinical waste includes clinical waste that has only been partly treated.

Clinical or related waste treatment and disposal

All clinical or related waste must be treated prior to disposal to landfill, except clinical waste that has been generated in a scheduled area.

Untreated clinical waste generated in a scheduled area may be disposed of to landfill in a scheduled area, under supervised burial conditions.

Clinical or related waste can be treated by one of the following methods:
- incineration;
- autoclaving and shredding;
- chemical disinfection using hypochlorite, and shredding;
- chemical disinfection using peroxide and lime, and shredding; or
- microwave disinfection and shredding.

Compaction is not a treatment mechanism. Compaction may be used to reduce the volume of waste held in storage prior to treatment or disposal.

Landfill is a disposal mechanism.

Cytotoxic waste must be incinerated before disposal to landfill.

Human body parts must be incinerated or treated by chemical disinfection processes using peroxide and lime, and shredded before disposal to landfill.

Radioactive waste must be managed under the requirements of the *Radiation Safety Act 1999*. A person must not dispose of radioactive material unless:
- the concentration or activity of a radionuclide in the material is not more than the maximum concentration or activity prescribed under a regulation; or
- the person holds an approval to dispose of the material, and disposes of it as required under the approval.

Pharmaceutical waste must be incinerated before disposal to landfill.

Compaction of human body parts, animal carcasses, cytotoxic waste, chemical waste, radioactive waste, pharmaceutical waste and sharps is not considered appropriate.

Treatment and disposal methods

Schedule 5 of the *Environmental Protection (Waste Management) Regulation 2000* outlines the treatment and disposal methods that must be used for the various categories of clinical or related wastes (see table on page 7). This schedule can be amended as new treatment options become available and are proven effective. Each method is described in greater detail to provide clinical or related waste generators with the necessary information to accurately assess the suitability of the treatment mechanisms available to them.

Any method used for the treatment of clinical or related waste in Queensland:
- should render the waste non-infectious;
- should render the waste unrecognisable;
- should ideally achieve a significant volume and mass reduction;
- should not result in unacceptable levels of hazardous or toxic by-products;
- must be generally environmentally acceptable;

• must be verifiable for the treated wastes;
• must have automatic controls and fail-safe mechanisms built in; and
• must ensure the waste cannot bypass the treatment process.

Incineration

Incineration **must** be used for cytotoxic wastes and pharmaceutical wastes. This process is also suitable for the treatment of human body parts and clinical waste and, in some circumstances, may also be suitable for the destruction of chemical wastes. Incineration must not be used for the destruction of radioactive wastes.

Incineration involves the high temperature (thermal) destruction of wastes. Strict controls are placed on the operation of clinical or related waste incinerators to ensure that there is minimal environmental impact from their use. The process renders the waste unrecognisable. However, the resultant ash requires disposal at a regulated waste disposal facility.

The type of waste incinerator most suited to the destruction of clinical or related wastes is one that consists of both a primary and a secondary chamber, with appropriate air emission controls.

In order to achieve destruction of cytotoxic wastes, the incineration process must be capable of reaching a temperature of at least 1100°C in the secondary chamber, with a retention time of at least one second.

Incinerators that accept cytotoxic waste and pharmaceutical wastes must hold a development approval for environmentally relevant activity — ERA 76(e) and be registered[1] with the administering authority. A facility that holds a development approval for ERA 76(e) is also able to accept clinical waste.

Incineration processes that are capable of reaching 900°C in the primary chamber are suitable for the treatment of clinical wastes, but must not be used for cytotoxic wastes. These incinerators may also be referred to as Class 3 incinerators. Incinerators that accept clinical wastes only (not cytotoxic, human body parts or pharmaceutical waste) must hold a development approval for an environmentally relevant activity — ERA 76(d) and be registered with the administering authority.

Autoclave (steam sterilisation)

The autoclave process is suitable for the treatment of clinical wastes (excluding animal carcasses). It is currently not an acceptable practice for the treatment of cytotoxic wastes, chemical wastes, radioactive wastes, pharmaceutical wastes or human body parts.

In order to treat clinical waste effectively, the autoclave process relies on the time/temperature/pressure relationship. Full penetration of the waste load is required to achieve effective treatment. Autoclaves for the treatment of clinical wastes differ from those used for sterilising equipment.

Autoclaves suitable for the treatment of clinical wastes must be capable of reaching a minimum temperature of 140°C for a minimum period of 30 minutes. The minimum temperature **must** be achieved throughout the entire waste load in the chamber for treatment, prior to the commencement of the 30 minute period. Due to difficulty in the steam penetrating sharps and to promote effective treatment, sharps must be treated for 40 minutes in order for the process to be effective.

As the autoclave process does not render the waste totally unrecognisable, it must be used in conjunction with a shredding process. Shredding may be undertaken before or after autoclaving. If the waste is shredded prior to treatment, the system should be fully enclosed to ensure worker exposure to aerosols and waste is minimised. Integrity of sharps containers is not maintained during the autoclave process, so shredding should be used to render the sharps unable to puncture or penetrate the skin.

A development approval is required for environmentally relevant activity (ERA 85) for autoclaves receiving and treating regulated wastes.

[1] To carry out any environmentally relevant activity mentioned in this Information Sheet, you are also required to become a registered operator with the relevant administering authority. Please refer to EPA Information Sheet *Requirement to become a registered operator to carry out certain ERAs* – which can be viewed online.

Chemical disinfection (hydrogen peroxide and lime, grinding/shredding)

This chemical disinfection system is suitable for the treatment of clinical wastes and human body parts. It must not be used for the treatment of cytotoxic wastes, pharmaceutical wastes, radioactive wastes or chemical wastes.

This system is a fully automated process involving simultaneous shredding and hydrogen peroxide spraying of the waste. The spraying of disinfectant while shredding serves to destroy any airborne pathogens that may be released during shredding. After passing through a screen, the shredded waste is mixed with burnt lime. Bentonite is added at the end of the treatment process to absorb excess liquid from the waste. Immediately prior to discharge onto a conveyor belt, sodium silicate is added to the waste. This reacts with the free lime to form calcium silicate (cement).

The treated material, resembling paper maché, must then be stored for at least 48 hours in order for the temperature of the waste to rise to at least 70°C to complete the waste treatment process. The waste can then be disposed of to landfill as limited regulated waste (meaning it can be disposed of to a general waste landfill without the landfill requiring approval as a regulated waste disposal facility).

A development approval is required for environmentally relevant activity (ERA 85) for any chemical disinfection system receiving and treating regulated wastes.

Chemical disinfection (sodium hypochlorite, grinding/shredding)

Another form of chemical disinfection process uses hypochlorite and shredding. Currently, this chemical disinfection process is only suitable to treat clinical waste (excluding animal carcasses). The process must not be used for the treatment of cytotoxic wastes, pharmaceutical wastes, radioactive wastes, human body parts or chemical wastes.

The process is fully automated and sensors prevent the operation of the equipment if parameters fall outside the predetermined limits of operation (e.g. chemical dosage, contact time, etc.).

The waste is loaded into a hopper using an automated process. As the waste passes through the first grinder, the bags are cut open and any fibrous materials or lengths of tubing are cut into short pieces.

The material is then drawn into a second grinder that cuts and grinds the waste, in the presence of a fine mist of disinfectant fluid, until it is able to pass through a sieve into a third grinder, which further reduces the size of the waste. This process also ensures that any sharps are rendered unable to puncture the skin. The ground waste is then soaked with disinfectant fluid as it passes into an air classifier. The solid particles and the fluid are then mixed with disinfectant fluid for a period of not less than 15 minutes.

The material is then de-watered and removed for disposal. The waste can then be disposed of to landfill as limited regulated waste (meaning it can be disposed of to a general waste landfill without the landfill requiring a regulated waste disposal facility approval).

Any chemical disinfection system must hold a development approval for an environmentally relevant activity (ERA 85) for receiving and treating regulated wastes. Other chemical treatment processes are available. One treatment system involves shredding and the use of a chemical known as Stericid. The process involves the simultaneous shredding and chemical (cold process) disinfection of clinical waste to render it suitable for disposal as limited regulated waste. The process is suitable for the treatment of clinical waste (excluding animal carcasses). It must not be used to treat human body parts, cytotoxic wastes, pharmaceutical wastes, radioactive wastes or chemical wastes.

Microwave disinfection and shredding

The microwave disinfection process uses a combination of pre-heated steam and microwave radiation to treat the waste. Clinical waste is then shredded within a conveyor system, with the treated waste resembling saturated paper maché.

Microwave disinfection is suitable for the treatment of clinical waste (excluding animal carcasses). It must not be used for the treatment of cytotoxic waste, pharmaceutical waste, radioactive wastes, chemical waste or human body parts.

A development approval is required for an environmentally relevant activity (ERA 85) for any microwave disinfection system receiving and treating regulated wastes.

Compaction

Compaction is a process that uses pressure to reduce the volume of the waste. The intention of allowing treated and untreated clinical waste to be compacted is to facilitate the storage of waste prior to treatment or disposal.

A compaction unit must have appropriate environmental controls such as HEPA (high efficiency performance apparatus) filters and leachate collection devices. Compaction must be undertaken as an automated, enclosed process, which does not allow waste to escape from the unit.

Compaction must not be used for sharps; human and animal body parts; or chemical, cytotoxic or radioactive wastes. A compaction unit that is used for compacting general wastes is not suitable for use with untreated clinical waste.

A compaction unit may only be used on-site at a registered treatment facility in order to facilitate the storage of wastes prior to treatment, or after treatment has been completed. A generating premise should not use compaction unless the appropriate controls are in place. Some premises that generate clinical waste use “compression” devices to remove air from the waste bags without compacting the waste in the bags. This is an acceptable practice, provided it is undertaken within a purpose-made unit and air is not forced out of the bags using manual compression.

This practice is only acceptable for clinical waste bags and must not be used for cytotoxic, chemical or radioactive waste.

Landfill

Landfill disposal of chemical wastes, cytotoxic wastes, human body parts, pharmaceutical wastes and radioactive wastes is not permitted.
Clinical wastes that have been treated through a registered treatment process to render them safe and unrecognisable may be landfilled as limited regulated waste.

Supervised burial of untreated clinical waste

Untreated clinical waste can be disposed of to landfill in scheduled areas. These are local government areas listed in schedule 8B of the *Environmental Protection Regulation 1998*. A general waste disposal facility located within a scheduled area is able to accept up to five tonnes of untreated clinical waste per year. Existing landfills located in scheduled areas that have a development approval under ERA 75(a) are deemed to be able to accept untreated clinical waste.

The following conditions apply to the supervised burial of untreated clinical wastes:

- clinical waste should be deposited at the lowest edge of the landfill working face or excavation;
- a local government representative should supervise the immediate burial of the waste;
- the waste should be covered immediately with at least one metre of solid general waste or clean fill;
- any compaction should only be on the cover material — not on the clinical waste;
- the clinical waste disposal area should be at least two metres from the proposed or design edge of the landfill;
- the location of the deposited waste should be marked on the landfill site map;
- clinical waste should be at least two metres below the final surface of the landfill or excavation — it should not be disposed of in the final lift of the landfill;
- the name and address of the generating premise(s), and the amount and type of waste deposited should be recorded; and
- a copy of this information should be given to the person depositing the waste for their records.

Further information

Other information sheets in this series include:

Clinical or related waste management
Clinical or related waste storage
Defining clinical waste
Determining whether waste is “clinical waste”
Managing sanitary hygiene waste
Pharmaceutical and cytotoxic waste management
Waste management laws
Requirement to become a registered operator to carry out certain ERAs

For copies of EPA supporting information, visit the website at www.epa.qld.gov.au.
Advice and support are available through a statewide network of regional and district EPA offices. Contact details are available on the website and in the White Pages.

Treatment and disposal methods
(based on Schedule 5 of the Environmental Protection (Waste Management) Regulation 2000)

Waste type as segregated	Incineration	Autoclaving and Shredding	Chemical disinfection using hypochlorite and grinding/shredding	Chemical disinfecion using peroxide, lime and grinding/shredding	Microwave disinfection and shredding	Compaction	Landfill
Chemical	✔ (if registered)	✘	✘	✘	✘	✘	✘
Cytotoxic	✔	✘	✘	✘	✘	✘	✔
Human body parts	✔ (1)	✘	✘	✔ (1)	✘	✘	✔
Pharmaceutical	✔	✘	✘	✘	✘	✘	✔
Radioactive	✘	✘	✘	✘	✘	✘	✘
Clinical	✔ (1)	✔ (1)	✔ (1)	✔ (1)	✔ (1)	+/- ✔ other than animal carcasses and sharps	✔ if treated by one of the listed processes OR in a scheduled area

(1) Alternative treatment methods

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