

## **PROCESS 39 WASTE INCINERATION PROCESSES**

Waste Incineration Processes: That is to say, Processes for the destruction by incineration of waste that contains chemically bonded halogens, nitrogen, phosphorus, sulphur or metal, or any waste which can give rise to noxious or offensive gases.

### **BASIC INFORMATION**

- (i) TLV Phosgene ( $\text{COCl}_2$ ) = 0,4 mg/m<sup>3</sup> = 0,1 ppm.
- (ii) TLV P = 0,1 mg/m<sup>3</sup>.
- (iii) TLV VCM = 5 ppm.

### **1. DEFINITIONS**

#### **1.1 WASTE INCINERATION**

Is process for the thermal destruction of any combustible waste. (Ref. Process 39, Second Schedule)

#### **1.2 INCINERATOR**

Is a fuel burning appliance that is used to dispose of any material by means of combustion. (Refer definition Sec 1.(vii) of the Act). This includes any technical equipment used for the incineration by oxidation of hazardous wastes including pre-treatment as well as pyrolyses or other thermal treatment processes. It also includes plants burning such wastes as a regular or additional fuel for any industrial process.

#### **1.3 HAZARDOUS WASTE**

Any material or substance, not included under 1.4 MEDICAL WASTE, that, if handled improperly, has the potential to harm people, property or the environment. For the purposes of these guidelines it includes waste that has the potential to generate noxious or offensive gases as defined in Sec 1.(xvii) of the Act when it is incinerated.

#### **1.4 MEDICAL WASTE**

Any waste which is generated during the diagnoses, treatment or immunisation of humans or animals; in research pertaining to this; in the manufacturing or testing of biological agents including blood; blood products and blood contaminated products; any body fluids or excretions; cultures; pathological wastes; sharps; human and animal wastes; isolation wastes; clinical wastes; pathogens; cytotoxic materials; toxic metals and low-grade radio-active materials. Any waste which unless rendered safe may prove hazardous or cause infection when anybody comes into contact with it.

## **2. CLASSIFICATION OF INCINERATORS**

### **2.1 CLASS 1**

Incinerators in which the waste serves as the fuel or supplementary fuel in an industrial process (e.g. the use of cement kilns or any other industrial boilers or furnaces for the disposal of noxious or hazardous materials).

### **2.2 CLASS 2**

Class 2A. Incinerators for the disposal of waste that contains hazardous or potentially hazardous waste

Class 2B-1. Incinerators for the disposal of waste that contains medical waste at a rate above 10 kg/day

.Class 2B-2 Incinerators for the disposal of waste that contains medical waste at a rate for less than 10 kg/day **in rural areas only.**

### **2.3 CLASS 3**

- Incinerators for the disposal of waste that contains "general waste" i.e. no toxic, hazardous, medical or organic halogen containing waste. These are suitable for incinerating waste from flats, offices and restaurants and which are designed to burn 100 kg/h or less.
- Incinerators burning more than 100 kg/h "general waste" will be treated in accordance with the guidelines for Class 2 incinerators.

#### **CLASS 3 <100 kg/h "GENERAL REFUSE"**

- Law enforcement is the responsibility of the local authority in terms of Part III of the Act and will be based on the above-mentioned guidelines.
- Prior approval of the local authority is to be obtained.

#### **CLASS 3 > 100 kg/h**

Law enforcement is the responsibility of the Chief Officer in terms of Part II of the Act and will be based on the above-mentioned guidelines.

## **3. MINIMUM DESIGN CRITERIA FOR INCINERATORS**

### **3.1 CLASS 1**

The standard for these incinerators will be in accordance with 'the best practicable means' as determined by the Chief Officer for each individual installation, taking into account the particular industrial process, combustion techniques and emissions.

A destruction and removal efficiency (DRE) = 99.99% should be attained on each principal organic hazardous constituent (POHC) in the feed waste where:

$$DRE = [(W_{in} - W_{out})/W_{in}] * 100$$

where:  $W_{in}$  = mass feed rate of the POHC in the waste stream fed to the incinerator, and

$W_{out}$  = mass emission rate of POHC in the stack prior to the release to the atmosphere.

Particulate emission Max. 120 mg/m<sup>3</sup>

Refer to Class 2A, 3.2.1 to 3.2.8, where applicable, for further guidelines in respect of feeding (stoking), primary and/or secondary combustion, chimney, instrumentation, siting, emission limits and operation for Class I incinerators.

**Points for the measurement of emissions should be provided.**

### **3.2 CLASS 2A. INCINERATORS FOR HAZARDOUS AND POTENTIALLY HAZARDOUS WASTES**

#### **3.2.1 FEEDING:**

Controlled hygienic, mechanical or automatic feeding methods have to be used which will not influence the air supply and temperature in the primary and secondary chambers of the incinerator negatively.

No waste is to be fed into the incinerator:

- at start up and until the minimum combustion temperatures have been reached.
- whenever the minimum combustion temperatures are not maintained.
- whenever the previous charge has not been completely combusted in the case of a batch loader.
- until such time as the addition of more waste will not cause the design parameters of the incinerator to be exceeded.

### 3.2.2 PRIMARY COMBUSTION:

The primary combustion chamber shall be accepted as the primary combustion zone and should be equipped with a burner/s burning gas or low sulphur liquid fuel. Other combustion methods will be judged on merits. Primary air supply is to be controlled efficiently.

### 3.2.3 SECONDARY COMBUSTION:

- The secondary combustion chamber shall be accepted as the secondary combustion zone and should be fitted with a secondary burner/s burning gas or low sulphur liquid fuel or any suitable fuel. Secondary air supply is to be controlled efficiently. Flame contact with all the gases should be achieved.
- The residence time in the secondary chamber should be not less than two (2) seconds.
- The gas temperature as measured against the inside wall in the secondary chamber, not in the flame zone, should be not less than 1100°C.
- The oxygen contents of the emitted gases should be not less than 11%.
- Both the primary and the secondary temperatures should be maintained until all the waste has been completely combusted.

### 3.2.4 CHIMNEY:

- The chimney should have a minimum height of nine (9) metres above ground level and clear the highest point of the building by not less than six (6) metres for flat roofs or 3 metres for pitched roofs. (Refer to Circular 7 of 1994 Department of Health). The topography and height of adjacent buildings (i.e. closer than 5 times chimney height) should be taken into account.
- If possible the chimney should be visible to the operator from the stoking floor.
- The addition of dilution air after combustion in order to achieve the requirements of these guidelines is unacceptable.
- The minimum exit velocity should be 10 metres/second.
- The stack shall be insulated to maintain the maximum outlet temperature.
- **Point for the measurement of emissions shall be provided.**

### 3.2.5 INSTRUMENTATION:

#### TEMPERATURE:

- The temperature should be determined against the inside wall of both the primary and secondary combustion chambers. Care should be taken not to measure the burner flame temperature.
- An audible and visible alarm should be installed to warn the operator when the secondary temperature drops to below the required temperature.

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In addition to the above the following instruments **may** also be required: !

A carbon monoxide and/or oxygen meter/recorder

A smoke density meter/recorder

A gas flow meter/recorder

A solid particulate meter/recorder

Any other instrument or measurement that the Chief Officer considers necessary.

### 3.2.6 SITING:

- Should be sited in accordance with the relevant town planning scheme, the topography and be compatible with premises in the neighbourhood.
- It should be housed in a suitably ventilated room.

### 3.2.7 EMISSION LIMITS:

The total particulate emission should not exceed  $180 \text{ mg/m}^3 @ 11\% \text{ O}_2$ , for Class 2 and  $120 \text{ mg/m}^3$  for Class 1 incinerators, as measured at 0% moisture.

Opacity of the smoke should not exceed 20%.

All the emissions to air other than steam or water vapour should be odourless and free from mist, fume and droplets.

The Chief Officer may require that the certificate holder have tests carried out by an accredited person or body to determine stack and/or ground level concentrations of the following substances:

All pollutant concentrations should be expressed at  $0^\circ\text{C}$  and  $101,3\text{kPa}$ , dry gas and 11% oxygen.

Emission concentrations for Class 1 and Class 2A incinerators:

Max. of  $0,05 \text{ mg/m}^3$  (as measured in the chimney) for:

Cadmium and compounds as	Cd
Mercury	Hg
Thallium	Tl

Max. of 0,5 mg/m<sup>3</sup> (as measured in the chimney) for:

Chromium	Cr
Beryllium	Be
Arsenic	As
Antimony	Sb
Barium	Ba
Lead	Pb
Silver	Ag
Cobalt	Co
Copper	Cu
Manganese	Mn
Tin	Sn
Vanadium	V
Nickel	Ni

(Refer Official Journal of the European Communities No.C130/121/5/92)

Chloride	as	HCl <30 mg/m <sup>3</sup>
Hydrofluoric acid	as	HF <30 mg/m <sup>3</sup>
Sulphur dioxide	as	SO <sub>2</sub> <25 mg/m <sup>3</sup>

Any substance that the Chief Officer may consider necessary e.g. polycyclic hydrocarbons, benzene etc.

A Class 2A incinerator should attain the following performance level:

A 99.99% destruction and removal efficiency (DRE) for each principal organic hazardous constituent (POHC) in the waste feed where:

$$DRE = [(W_{in} - W_{out})/W_{in}] * 100$$

where:  $W_{in}$  = mass feed rate of the POHC in the waste stream fed to the incinerator, and

$W_{out}$  = mass emission rate of POHC in the stack prior to the release to the atmosphere.

The average dioxin and furan concentration in the emissions of Class 1 and 2A should not exceed 80 ng/m<sup>3</sup> total dioxins and furans if measured for a period of 6 to 16 hours or 0,2 ng International Toxic Equivalent (I-TEQ/m<sup>3</sup>) or result in an excess cancer risk of 1:100000 on the basis of annual average exposure.(ng = nanograms)

### **3.2.8 OPERATION:**

Materials destined for incineration should be of known origin and composition and may only be incinerated in a furnace that is registered for the incineration of that particular type of waste.

Record should be kept of the mass and/or volume, the type and origin of the waste to be incinerated.

The incinerator should be preheated to working temperature before charging any waste.

**Overloading of the incinerator should be avoided at all times.**

The incinerator should be kept in good working order at all times and should not be used if any component fails. Any malfunction should be recorded in a log book and reported to the relevant control authority.

It should be supplied complete with full operating instructions. The incinerator operator and all relevant staff should be trained to the satisfaction of the relevant control authority.

A list should be displayed at or near the control panel which identifies all trained operators.

**The incinerator and its surrounds should be kept in a clean and neat condition at all times.**

In cases where noxious or offensive gases are emitted that cannot be destroyed by secondary combustion, additional control equipment e.g. scrubbers, bag filters or electrostatic precipitators will be required.

### **3.3 CLASS 2B-1: MEDICAL WASTE INCINERATORS - MORE THAN 10KG/DAY**

**3.3.1 FEEDING:** See 3.2.1

**3.3.2 PRIMARY COMBUSTION:** See 3.2.2

#### **3.3.3 SECONDARY COMBUSTION:**

The secondary combustion chamber shall be accepted as the secondary combustion zone and should be fitted with a secondary burner/s burning gas or low sulphur liquid fuel or any suitable fuel. Secondary air supply is to be controlled efficiently. Flame contact with all the gases should be achieved. The residence time in the secondary chamber should be not less than one (1) seconds.

The gas temperature as measured against the inside wall in the secondary chamber, not in the flame zone, should not be less than 1 100 °C if materials containing 1% or more halogenated hydrocarbons are combusted. In cases where there is less than 1% halogenated hydrocarbons present, the temperature in the secondary chamber can be reduced to 850 °C. No cytotoxic materials shall be combusted with a temperature in the secondary combustion chamber of less than 1 000 °C. The oxygen contents of the emitted gases should be not less than 11%.

Both the primary and the secondary temperatures should be maintained until all the waste has been completely combusted. In cases where there is any likelihood of the presence of halogens, acceptance tests may have to be performed in respect of dioxins and furans. Periodic tests may be required on the incinerator while burning the normal, regular waste.

**3.3.4 CHIMNEY:** See 3.2.4.

**3.3.5 INSTRUMENTATION:** See 3.2.5

**3.3.6 SITING:** See 3.2.6

#### **3.3.7 EMISSION LIMITS:**

The combustion of more than 1000kg/hour of medical waste on one site will require suitable air cleaning equipment, for example a scrubber, in order to control emissions.

The total particulate emission should not exceed 180 mg/m<sup>3</sup> (@ 11% O<sub>2</sub>), as measured at 0% moisture. The opacity of the smoke should not exceed 20%.



If the emission limits for air pollutants are exceeded in incinerators with a combined capacity (on a premises) of less than 1000kg/hr , the following shall be required:

- a) Calculate the maximum ground level concentrations using an acceptable dispersion model and if the results indicate a level below TLV<sub>/100</sub> submit the report to the Chief Officer for evaluation.
- b) If the dispersion model results indicate a level above TLV<sub>/100</sub> a complete health risk assessment shall be done and the report submitted to the Chief Officer for evaluation.

All the emissions to air other than steam or water vapour should be odourless and free from mist, fume and droplets.

The Chief Officer may require that the certificate holder have tests carried out by an accredited person or body to determine stack and/or ground level concentrations of the substances mentioned in **section 3.2.7**

All pollutant concentrations should be expressed at 0°C and 101,3kPa, dry gas and 11% oxygen.

#### **3.4 CLASS 2B-2: MEDICAL WASTE INCINERATORS - LESS THAN 10KG/DAY**

Approval may be granted on a basis of merit to operate incinerators, not complying with all the conditions for Class 2B-1 units, **in rural areas only**, provided that incineration is considered the “best environmental option” in the particular instance and that

- a) the local authority approves of the operation
- b) the unit is located on an suitable, well ventilated site
- c) the ash is disposed of to the satisfaction of the Department of Water Affairs.
- d) the unit is operated in such a manner that no nuisance is caused to residents in the vicinity.