COMMISSION OF THE EUROPEAN COMMUNITIES

Brussels, 07.10.1998
COM(1998) 558 final

98/0289 (SYN)

Proposal for a
COUNCIL DIRECTIVE

on the incineration of waste

(presented by the Commission)

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EXPLANATORY MEMORANDUM

1. INTRODUCTION

The incineration of waste is a subject of considerable public concern. In the absence of effective controls, harmful pollutants may be emitted to air, land and water where they may contribute to human health and environmental impacts, acidification and damage to the environment on a local and regional level. It is widely recognised that whilst incineration of waste - preferably with heat recovery - can form an important part of an integrated waste management system, strict controls are required to prevent adverse environmental impacts.

In its Resolution of February 1997[1] the Council expressed the opinion "that appropriate emission standards should apply to the operation of facilities in which waste is incinerated in order to ensure a high level playing field in the waste sector".

In order to improve the protection of human health and the environment a number of key issues require Community attention

- EU legislation currently only covers the incineration of certain hazardous and municipal solid wastes, whereas many other types of waste which have a similar heterogeneous composition and may therefore pose similar potential hazards to the environment are being incinerated.

- There is no consistent approach to the regulation of co-incineration of wastes, for example in cement kilns or combustion plants. This has led to increasing amounts of waste going to co-incineration, for which environmental standards may be less stringent than those required for dedicated incinerators.

- There are no Community emission limit values set up for dioxins and furans[2] for incineration of non-hazardous waste, even though non-hazardous waste incineration has been estimated to contribute up to 40% of the overall emissions of dioxins and furans in the Community.

- The Fifth Environment Action Programme[3] established a number of targets for releases of heavy metals and dioxins and furans.

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1 Council Resolution of 24 February 1997 on a Community strategy for waste management (97/C76/01).

2 Dioxins (or dioxins and furans) is used as the general term for the family of related chlorinated compounds including the polychlorinated dibenzo-*p*-dioxins (PCDD) and polychlorinated dibenzofurans (PCDF).

3 Towards Sustainability, A European Community programme of policy and action in relation to the environment and sustainable development, 1993.

- The Protocol on Persistent Organic Pollutants signed in June 1998 by the Community within the framework of the UN-ECE Convention on Long-Range Transboundary Air Pollution sets legally binding limit values for the emission of dioxins and furans of 0.1 ng/m³ TE (Toxicity Equivalents) for installations burning more than 3 tonnes per hour of municipal solid waste.

- The Protocol on Heavy Metals signed in June 1998 by the Community within the framework of the UN-ECE Convention on Long-Range Transboundary Air Pollution sets legally binding limit values for the emission of particulate of 10 mg/m³ for hazardous and medical waste incineration and for the emission of mercury of 0.05 mg/m^3 for hazardous waste incineration and 0.08 mg/m^3 for municipal waste incineration.

- Control of air emissions for incineration plants can lead to the undesirable transfer of pollutants from air to water and there are no Community controls to address this for non-hazardous waste incineration.

- The latest technological advances make it possible to achieve improved standards of emissions abatement in a cost-effective manner and have yet to be integrated into Community legislation.

- It is expected that increasing amounts of waste will be incinerated over the coming years due to the forecast increase in the amount of waste generated and drop in waste going to landfills.

In order to address these issues adequately, it is necessary to extend the scope of Community legislation, to cover all waste not within the scope of Council Directive 94/67/EC and to strengthen the provisions contained in the existing legislation on municipal waste incineration.

1.1. Legislative background and scope of the proposed Directive

In June 1989 two Council Directives were adopted to control the emissions of certain pollutants from municipal waste incineration plants. Council Directive 89/369/EEC[4] provides specific controls for new municipal waste incineration plants and Council Directive 89/429/EEC[5] covers existing municipal waste incineration plants.

These Directives have made a considerable contribution to the reduction of emissions of pollutants in the Community. However, their scope is restricted to municipal waste while incineration is increasingly used as a means of treatment for other wastes, such as sewage sludge, clinical waste and tyres.

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4 OJ L 163, 14.6.1989, p. 32 – Council Directive on the prevention of air pollution from new municipal waste incineration plants.

5 OJ L 205, 15.7.1989, p. 50 – Council Directive on the reduction of air pollution from existing municipal waste-incineration plants.

In 1994 Council Directive 94/67/EC[6] was adopted. This Directive introduces conditions for the operation of plants for incinerating the most hazardous wastes. It imposes more stringent standards for emissions than the 1989 Directives for municipal waste incineration and introduces numerical emission limits for dioxins and furans.

In order to fill the existing gaps the proposed Directive seeks to establish controls on the incineration of most wastes that are not covered by the Directive on hazardous waste incineration (94/67/EC). It will thus address municipal wastes, hazardous wastes excluded from the scope of 94/67/EC, such as waste oil, solvents and clinical waste as well as other non-hazardous wastes. The distinction between hazardous and non-hazardous waste is primarily based on considerations of waste management and handling rather than on incineration characteristics. Non-hazardous wastes may contain components which give rise to hazardous air pollutants upon incineration and which can form many of the same pollutants as found in the incineration of hazardous wastes.

1.2 Co-incineration of wastes

Over recent years there has been a significant growth in the co-incineration of wastes in industrial plants. Co-incineration is the incineration of wastes as a regular or additional fuel in plants whose main purpose is the generation of energy or the production of material products. There has been considerable development of the use of certain wastes to provide some of the energy requirements of industrial processes. The most notable are the use of wastes such as tyres, solvent residues and waste oils in cement kilns and the combustion of wastes such as sewage sludge in conventional power plants.

Considerable public concern has been expressed about the control of emissions from co-incineration plants and provisions were included in Council Directive 94/67/EC on hazardous waste incineration to establish emission limits for plants co-incinerating hazardous wastes.

However, co-incineration of non-hazardous wastes is growing and is currently not covered by existing Community legislation. Inadequate controls on co-incineration can give rise to the problems that have been associated with poorly controlled dedicated incineration plants. The proposed Directive seeks to address the existing regulatory gap and to ensure that co-incineration does not represent a loophole allowing lower standards of environmental protection.

In addition, the lack of a coherent system for control of operational conditions or emissions from co-incineration of non-hazardous wastes in the Community can lead to the undesirable practice of transboundary shipments of wastes from areas with stringent controls to areas with lower standards of environmental protection. The proposed Directive establishes a comprehensive methodology to determine the emission limit values and operational parameters for co-incineration plants, which should ensure consistent high levels of environmental protection throughout the EU.

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6 OJ L 365, 31.12.1994, p. 34 – Council Directive on the incineration of hazardous waste.

1.3 Impacts of pollutants from waste incineration

Incineration of waste can give rise to emissions of pollutants to air, land and water. The pollutants that are emitted depend on both the technology employed and the waste that is treated. Air emissions can include acid gasses, particulate matter, heavy metals and highly toxic trace organic compounds.

The impetus for the proposed Directive arose originally from concern expressed about emissions of heavy metals, dioxins and furans and the measures proposed will have a major impact on these emissions. However, it has become clear that important reductions in other toxic pollutants can and should also be achieved.

Dioxins and furans

Concern has been expressed about the emission of certain organic compounds from incinerators. Although a wide range of compounds is emitted, most attention is focused on dioxins and furans. Dioxins and furans are a family of structurally related chemicals and most concern is expressed about the seventeen chlorinated dibenzodioxins and dibenzofurans that have chlorines in the 2,3,7 and 8 positions. The most toxic (2,3,7,8 – TCDD) is a known human carcinogen. The compounds are known to produce chloracne at high exposures and a wide range of non-cancer effects are thought to occur at extremely low levels of chronic exposure, including adverse effects on reproduction, impacts on the development of the unborn foetus and associations with impaired mental ability. Although there is uncertainty in the data, some effects have been reported at levels close to current background exposures and measures have been put in place in many countries to reduce exposure by identifying and controlling sources of dioxins and furans.

The Fifth Environment Action Programme contains the target for the reduction of emissions of dioxins and furans from known sources by 90% between 1985 and 2005 and requires numerical emission limits to be established for municipal waste incineration.

Whilst dioxins and furans are produced by a wide range of processes, the incineration of municipal waste in old plants has been identified as one of the major known sources[7]. Recent estimates suggest that incineration of non-hazardous waste may contribute as much as 40% of all emissions of dioxins and furans in Europe[8]. The improvement of combustion conditions can substantially reduce emissions of dioxins and furans and was a requirement of the 1989 Directives. These Directives did not set numerical emission limits for dioxins and furans, but several Member States have subsequently done so. Additional controls such as activated carbon systems and catalysts can reduce emissions to significantly low levels. The imposition of these limits will reduce emissions of dioxins and furans and will contribute to a reduction in population exposures.

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7 The European Atmospheric Emission Inventory of Heavy Metals and Persistent Organic Pollutants for 1990, Umweltbundesamt, Germany, 1997.

8 Identification of Relevant Industrial Sources of Dioxins and Furans in Europe, Landesumweltamt Nordrhein-Westfalen, 1997.

Other pollutants

The Fifth Environment Action Programme advocates a specific target for the reduction of releases of heavy metals in order to ensure no exceedances of critical loads. Since wastes may contain a wide range of heavy metals these can be emitted in the flue gases or in the waste waters and residues from incineration.

Recent estimates suggest that incineration in the EU may account for emissions of more than 16 tonnes per year of cadmium, 46 tonnes per year of chromium, 36 tonnes per year of mercury and over 300 tonnes per year of lead[9]. For cadmium and mercury in particular, incineration is a major contributor to overall emissions and is estimated to account for 8% of all cadmium emissions and 16% of all mercury emissions. Lead has been associated with learning impairment, especially in children. High levels of cadmium have been associated with lung cancer and a range of non-cancer effects. Mercury exposure has been found to affect behaviour and lead to renal damage even at low levels. Most heavy metals can be controlled by efficient particulate controls. The abatement of volatile metal emissions can be improved by using low temperatures in the flue gas cleaning system. Mercury emission abatement can be increased by the use of activated carbon.

In addition to emissions of heavy metals, dioxins and furans the incineration of waste also generates emissions of acid gases and particulate matter.

Exposure to high levels of acid gases can cause respiratory problems, while long range transport can lead to ecosystem damage by acidification. For municipal and similar wastes the uncontrolled emissions of hydrogen chloride usually exceed those of sulphur dioxide (due to the low levels of sulphur in the waste). Much lower levels of toxic hydrogen fluoride can also be emitted. Scrubbing controls all these gases.

Nitrogen oxides (NOx) are produced by incineration. In addition to the acidification of ecosystems and potential acute and chronic effects of high levels of nitrogen dioxide, oxides of nitrogen play a significant role in the production of low level ozone. In the study[10] carried out on the costs and benefits of the proposed Directive the contribution of NOx emissions to the health impacts caused by secondary particulates was calculated to be one of the most important adverse effects. At present emissions of NOx from incinerators are not subject to controls in the Community. The proposed Directive will address this deficiency. A number of measures to control the wastes being burned and the combustion process can minimise the production of NOx during incineration. If these measures alone are not sufficient to meet standards, additional controls such as catalytic reduction can be added.

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9 The European Atmospheric Emission Inventory of Heavy Metals and Persistent Organic Pollutants for 1990, Umweltbundesamt, Germany, 1997.

10 Economic Evaluation of the Draft Incineration Directive, Office for Official Publications of the European Communities, 1997.

Particulate matter in the atmosphere has been associated with large-scale chronic adverse effects on human health although the mechanisms by which it acts are not fully understood. Emissions of acid gases can lead to formation of secondary particulate matter and this may contribute to adverse health effects. The adverse effects are thought to be associated with the fine particulates in the atmosphere. Various classifications are used to describe the particulate in the atmosphere, the most common is PM10 although recently, studies have examined the possible effects of even finer PM2.5, it is thought that PM2.5 may have more of an adverse effect than PM10. Incineration gives rise to emissions of particulate matter. The nature of the particulates depends on the waste and the technology used for combustion and emissions control. Poorly controlled incineration plants can emit high levels of particulate matter and contribute to local environmental problems. With modern plants low levels of particulate emissions can be achieved but the emitted particulate can be very fine. In many cases the emissions would be classified as PM10 and limited data suggests that much of it may be classified as PM2.5. Thus, emissions may be contributing to adverse health impacts. In addition to particulate releases from the incineration process itself careful handling of wastes and residues may be required to ensure dust is not generated creating a local nuisance.

The potential importance of releases of pollutants to water from incineration was recognised in the hazardous waste incineration Directive (94/67/EC) and Article 8(3) requires the establishment of emission limit values for releases to water. There is a similar risk of such releases to water from non-hazardous waste incineration, generated mainly from the use of wet scrubbing systems. Therefore, in order to prevent environmental damage and transfer of pollutants to water, Community measures for releases to water are required. Most concern is related to releases of heavy metals. Where wet scrubbing is used, sophisticated water treatment facilities can be used to remove pollutants from the water discharges. In some cases liquid discharges can be prevented entirely by recycling the liquid into the process or by evaporation.

1.4 Technical progress in the incineration sector

Considerable technical progress has been made in the incineration sector. Substantially improved standards of emission control can be achieved more cost-effectively for incinerators in comparison to the 1980s. In addition considerable progress has been made in the monitoring of pollutants, both continuously and in periodic tests allowing demonstration of compliance with strict emission limits.

Stringent emission standards have been put in place in certain Member States, where existing legislation has required the installation of highly effective pollution controls which already allow compliance with the emission limit values contained in the proposed Directive.

A variety of designs of flue gas treatment technology have been developed and a high efficiency of control can be achieved for particulate matter, acid gases, heavy metals and organic compounds. Technologies for the control of dioxins and furans may be incorporated into the flue gas treatment or added as separate units. Recent rapid development has occurred in the technology for the control of nitrogen oxide

emissions (NOx) and a number of such systems are commercially available and in use in the Community and elsewhere.

The adoption of the proposed measures for the wastes that fall within the scope of the proposed Directive will mean that the contribution of waste incineration to emissions of heavy metals, dioxins and furans will be significantly reduced. This will help the EU to meet the target reduction for dioxins and make a substantial contribution to reducing adverse effects on human health and the environment.

1.5 Increases in waste incineration and the growth in co-incineration

The amount of waste incinerated in the Community is expected to grow over the coming years. Thus, the amount of municipal waste incinerated in the Community is expected to increase from 31 Mt/y in 1990 to 56.5 Mt/y in 2000[11]. This development is due to the forecast increase in the amount of waste generated and the decrease in waste going to landfills.

Large increases in the amounts of other wastes going to incineration are also anticipated. The banning of sea dumping of sewage sludge, coupled with increases in production of sludge due to the implementation of the Urban Waste Water Directive, will lead to substantial investment in new incineration capacity in the EU. In the absence of effective controls on polluting emissions, these increases will lead to increased environmental effects.

2. OBJECTIVES

The Proposed Directive will contribute to the protection of human health and the environment as required by Article 130r and Article 129 of the Treaty.

It seeks to integrate the technical progress that has been made in the control of incineration processes and to extend the scope of existing Community measures to combat the pollution of air, water and land caused by the incineration of municipal and other non-hazardous wastes. The aim is to prevent harmful effects on the environment and human health and where this is not possible to reduce these as far as possible. The key objectives therefore are to

- reduce substantially emissions of several key pollutants to air and control releases to water and land;

- provide a major contribution to the achievement of the target contained in the Fifth Environment Action Programme to reduce emissions of dioxins and furans from known sources by 90% between 1985 and 2005 with a specific objective to introduce standards for dioxin and furan emissions for municipal waste incineration;

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[11] Economic Evaluation of the Draft Incineration Directive, Office for Official Publications of the European Communities, 1997.

- contribute to a reduction in releases of heavy metals in accordance with the Fifth Environment Action Programme objective of eliminating exceedances of critical loads and levels;

- provide a coherent methodology for the regulation and operation of non-hazardous waste incineration and co-incineration.

3. LEGAL BASIS AND MAIN ELEMENTS OF THE PROPOSAL

Since the proposed Directive seeks to protect and improve the quality of the environment as well as human health, the legal basis for the Proposal is Article 130s(1) of the Treaty.

The central elements of this Directive include

- the extension of the scope of Community legislation to cover the incineration of non-hazardous non-municipal waste as well as hazardous wastes excluded from Council Directive 94/67/EC on hazardous waste incineration, in order to fill the existing gap in Community legislation;

- the introduction of emission limits for plants that co-incinerate waste;

- the updating of emission limits applicable to municipal waste incineration plants and the addition of limits on releases to water in order to reduce substantially the environmental impact of incineration and contribute emission reductions and air quality targets, while preventing a transfer of pollutants to water;

- the requirement that heat generated in the incineration process shall be recovered as far as possible and that residues shall be prevented, reduced or recycled as far as possible.

4. THE REGULATION OF CO-INCINERATION

Co-incineration is the incineration of wastes in industrial plants, whose main purpose is to generate energy or produce material products and which incinerate waste as regular or additional fuel. A wide range of combustible wastes may be used to derive part, or all, of the energy requirements of certain processes and can thus reduce the amount of primary fuel required.

Wastes may be used in a number of industrial processes, including heat and power plants, cement kilns, lime kilns, blast furnaces. In some cases there may be a combined effect of both an energy and material input, for example in cement kilns where mineral inputs can contribute to the product[12].

No measures are currently in place in the EU to control co-incineration except for some hazardous wastes.

The proposed Directive requires that all plants used for the co-incineration of waste should have detailed permits which specify the nature and mass of wastes that may be co-incinerated and ensure that the other requirements of the proposed Directive are met. To ensure genuine destruction of the wastes and to minimise the formation of products of incomplete combustion a minimum temperature of 850°C and residence time of 2 seconds must be maintained as in the case of dedicated incineration plants.

In order to secure a high level of environmental protection whilst recognising the benefits that may be achieved by the efficient use of energy in co-incineration plants a series of controls on emission limit values are proposed.

In the case of co-incineration of mixed municipal wastes co-incineration plants have to comply with the same standards as dedicated incinerators. For other wastes emission limit values are determined in accordance with the methodology described in Annex II of the proposed Directive.

In general the emission limit values for the specified pollutants and CO will be calculated according to the formula:

$$\frac{Vwaste*Cwaste+Vproc*Cproc}{Vwaste+Vproc} = C$$

Where ***Vwaste*** is the gas volume resulting from the incineration of waste only; ***Vproc*** gas volume from process without waste; ***Cwaste*** is the emission limit value for the pollutant for waste incineration alone and ***Cproc*** is the emission limit value as specified in the Proposed Directive for the process or the national standard where no value is specified. ***C*** is the resulting emission limit value for the co-incineration plant.

This formula is designed to prevent co-incineration plants from emitting higher amounts of pollutants per tonne of waste compared to dedicated incinerators.

For the most common co-incineration processes – cement kilns and large combustion plants - total emission limit values (C) are specified or specific limits are placed on the emissions from the process (Cproc).

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12 Waste Co-processing in Industry, Code of good practice for wastes valorisation in the Cement Industry, J P Degre, Ciments D'Obourg, 1996.

For cement kilns total emission limit values are established for all pollutants. The limits for HCl, HF, SO_2, total organic carbon, heavy metals, dioxins and furans are all identical to those required for dedicated incineration plants. By contrast the emission limit value for dust takes into account the special nature of the cement process in which the raw material enriched atmosphere in the kiln contributes to the dust emissions. The limit should act as a safeguard to guarantee that emissions of heavy metals are below the allowed limits. Exemptions granted by the competent authority are possible for SO_2 and total organic carbon, if higher emissions are due to the raw material.

The limit for NOx takes care of the special operational conditions of the cement process, since most of the NOx is generated by the high combustion temperatures - so called thermal NOx.

For combustion plants limits for Cproc reflect best practice in the sector based on plant scale and fuel type. Total emission limit values for heavy metals, dioxins and furans match those imposed on dedicated incineration plants.

For other industrial sectors total emission limit values for some heavy metals, dioxins and furans are the same as set for dedicated incineration plants in order to ensure the highest level of environmental protection.

If waste within the scope of Council Directive 94/67/EC is co-incinerated or incinerated in the same plant as waste within the scope of the proposed Directive, the requirements of the proposed Directive are applicable with respect to the total amount of waste, in order to ensure the highest level of environmental protection in all cases.

5. SUBSIDIARITY AND PROPORTIONALITY

The pollution caused by incineration and co-incineration plants is of a transboundary nature.

Acidifying pollutants and ozone precursors can be carried over distances of hundreds or thousands of kilometres before being deposited in the environment in the form of “acid rain” or leading to ground-level ozone episodes. Thus, emissions of acidifying pollutants and ozone precursors generated in one Member State can contribute to environmental degradation in other Member States. Other emissions, such as dioxins, mainly cause local contamination. However, this contamination affects meat and milk products which are traded throughout the Community. It is therefore necessary to introduce legislation setting the same minimum requirements for the whole of the Community.

Community legislation regulating emissions from incineration plants is already in place. This existing legislation is, however, incomplete for the following reasons.

Thus,

- Directive 94/67/EC includes up to date emission limit values corresponding to currently available techniques, but covers only the incineration of certain types of hazardous waste. Since both the environmental impact of the emissions and the available emission reduction techniques are independent of the type of waste incinerated, it is both necessary and appropriate for these limit values to apply to other types of waste.

- The existing legislation on municipal waste incineration covers only dedicated incineration plants, resulting in a diversion of waste to co-incineration plants where the regulatory controls may be less strict.

- Existing legislation covers only atmospheric emissions. This can lead to a transfer of pollution to the aquatic environment or to the waste residues.

Updated Community legislation is also necessary in the context of international obligations under the 1979 UN-ECE Convention on Long-Range Transboundary Air Pollution (CLRTAP).

In accordance with the principle of subsidiarity the proposed amendment leaves Member States the possibility to:

- introduce stricter standards than those set out in the measure;

- allow industry to use whichever techniques are most appropriate.

It is, however, essential that the measures adopted are sufficiently strict to ensure adequate protection of the environment and that they are the same throughout the Community.

The proposed measures are based on a careful consideration of the costs and the benefits of the actions and are equivalent to those proposed or in place in some Member States. There is, however, a wide disparity between existing legislation in different Member States and between the best performing plants and those with the lowest performance. Considerable benefit is therefore expected from improving the performance of these.

6. CONSISTENCY WITH OTHER COMMUNITY POLICIES

Waste Management

The effective management of waste is a complex and varied task. Thermal treatment represents only one waste management option amongst others in an integrated approach and the proposed Directive must be viewed as part of the wider legislative and policy framework covering waste management. The proposed Directive addresses only the thermal treatment of wastes, it does not address other treatment options for

wastes nor determines the wastes for which incineration is a suitable treatment. This is the role of other policy and legislative measures.

In its 1996 Review of the Community Strategy for Waste Management (COM(96) 399 final) the Commission confirms the hierarchy of principles established by the strategy document of 1989 that prevention of the generation of waste shall remain the first priority, followed by the recovery of waste and finally by the safe disposal of waste. The Strategy also clearly recognises the important role played by incineration with heat recovery in valorising waste and, as with incineration without heat recovery, meeting the need for efficient destruction of certain unavoidable wastes.

In keeping with the objective of the Waste Framework Directive 75/442/EEC as amended to ensure the highest level of environmental protection, the proposed Directive requires prior permitting of incineration and co-incineration plants in the Community. To minimise environmental impacts the Strategy also notes the need to minimise emissions of pollutants from waste incineration with or without heat recovery.

The Commission notes that particular attention should be paid to those installations which originally had not been designed to use waste as a fuel (co-incineration plants) and supports the principle that, where process and input are comparable, the same emission limits should be set for co-incineration plants as for dedicated incineration plants.

The proposed Directive directly addresses these concerns and proposes detailed operational requirements and emission limit values designed to minimise the impact of both dedicated incineration plants and co-incineration plants. The proposed Directive also widens the scope of existing legislation to control the performance of incineration operations of non-municipal wastes.

The emphasis of the 1996 Strategy Review on prevention and recovery is also reflected in the provisions which deal with residues from the incineration process.

Integrated Pollution Prevention and Control

The prevention and control of pollution from large industrial sources is governed by Council Directive 96/61/EC on Integrated Pollution Prevention and Control (IPPC). The scope of the Directive includes installations for the incineration of waste as defined in Council Directives 89/369/EEC on new municipal waste incineration plants and 89/429/EEC on existing municipal waste incineration plants with a capacity greater than 3 tonnes per hour.

The Directive contains provisions for the permitting of industrial installations based on an integrated assessment of their environmental performance. In addition to the permitting requirements, the Directive requires emission limit values to be set at Community level in cases where the need for such action has been identified. In the absence of such Community emission limit values, relevant emission limit values contained in existing Community legislation are to be applied as minimum emission limit values for IPPC installations.

The measures contained in the current Proposal are justified in view of the urgent need to update the existing emission values relating to incineration of municipal waste, to extend their application to other types of waste and co-incineration and to introduce a limit value for dioxin emissions. Full consistency between the IPPC approach and the current Proposal has been achieved by taking care that the proposed emission limit values do not hinder the overall environmental performance of the installations.

Combating Acidification

In March 1997 the Commission adopted a Communication to the Council and the European Parliament for a Community Strategy to combat acidification. This strategy aims ultimately to eliminate exceedances of critical loads. The reduction of acid gas emissions from incineration plants will assist in the achievement of this objective as well as contribute to the resolution of other problems such as ground-level ozone, human health effects associated with poor air quality, eutrophication and corrosion of buildings and monuments, to which long-range transport of NO_x and SO_2 contributes.

Ground water

The measures are consistent with the Groundwater Directive 80/68/EEC and require authorisation and monitoring of potentially harmful releases to water.

Waste Oils

Council Directive 75/439/EEC requires that a harmonised system of waste oil collection, treatment and disposal is put in place and high standards are maintained in the incineration of waste oils as required by the proposed Directive.

Energy Efficiency

The European Union has set as a policy objective the achievement of a minimum penetration of 12% of Renewable Energy sources by 2010. This represents a doubling of the current contribution made by renewable energy sources to gross inland energy consumption in the Community.

Renewable Energy sources are expected to contribute to reduced dependence on energy imports, increase security of supply and to reduce emissions of carbon dioxide, thus reducing the potential for global warming. In addition to the environmental benefits, the establishment of a healthy renewable energy industry should create employment and export opportunities.

The achievement of the target market penetration will require significant investment in several sources of renewable energy, active promotional actions along with the removal of barriers such as restrictions on access to electricity markets.

In order to meet the targets a large contribution will be required from biomass based energy generation both heat and power. The Community Strategy on Renewable Energy[13] details measures needed to develop the markets for solid biomass. These measures include the promotion of co-firing biomass in coal power plants and for district heating and clean energy generation from municipal and other wastes where this does not conflict with waste prevention and recycling.

The Strategy recognises the important part that can be played by the organic fraction of municipal waste, separated household waste and sewage sludge in meeting Community targets. Currently two of the best established and most efficient technologies for generating energy from such wastes are by incineration with energy recovery and by co-firing in industrial plants. In future other thermal treatment technologies, such as gasification, may be expected to make a positive contribution.

In accordance with the Strategy the proposed Directive has been developed to support the generation of energy from biomass in a clean and environmentally sound way. Biomass fuels are generally unpolluted in comparison to wastes. To avoid burdensome restrictions on the exploitation of biomass resources, the major attractive sources of biomass have been specifically excluded from the scope of the proposed Directive. The specific exclusions cover wood and wood residues.

For other wastes the proposed Directive requires that heat is recovered wherever possible in order to ensure that maximum use is made of the renewable energy available in the wastes. Since it is not possible to exclude the possibility of contamination being present in other wastes and therefore the risk of harmful emissions from their combustion, incineration and co-incineration plants using other wastes must meet the minimum standards contained in the proposed Directive. In recognition of the fact that some wastes will be less contaminated than others, specific derogations have been allowed in order to reduce the costs of compliance for wastes that can be shown to have low emissions. The reduced monitoring requirements will reduce the costs to plant operators and further improve the economic advantages of exploitation of these wastes.

7. POSITION OF STAKEHOLDERS

Extensive consultation has taken place with the principal stakeholders concerned by the proposed Directive, namely the Member States, industry and environmental NGOs.

[13] Energy for the Future: Renewable Sources of Energy, White Paper for a Community Strategy and Action Plan, COM(97) 599 final.

Member States

Several meetings were convened by the Commission and attended by national experts from the Member States. In general all Member States have been supportive of the proposed Directive given the need to improve Community-wide regulation for waste incineration and co-incineration processes.

The Scandinavian countries, Germany and Austria emphasised the need to exclude from the scope clean biomass fuels. To that effect the Commission excluded wood and agriculture and forest residues which have not been subject to treatment containing heavy metals or halogenic organic compounds.

Finland and Sweden suggested that certain waste streams should be excluded from the scope, such as separately collected paper and cardboard wastes, on the grounds that they were "clean". After consideration the Commission decided that by their nature it was not possible to exclude, with sufficient confidence the possibility of contamination of these materials. They should therefore remain within the scope of the proposed Directive in order to ensure adequate environmental protection. However, additional derogations are added to the proposed Directive, which will significantly reduce the burden of monitoring of wastes for which the operator can prove that the emissions do not exceed the emission limits values in the proposed Directive.

In order to meet the concern expressed by France that the requirements for NOx control would be excessively burdensome for small scale plants and would not prove cost-effective, plants with a capacity under three tonnes per hour are allowed a higher emission limit value for NOx.

Industry

Industrial interests were, *inter alia*, represented by

– CEPI – for the paper and pulp industry;

– CEI Bois - for the woodworking industry;

– EURELECTRIC and UNIPEDE for the power generation industry;

– FEAD and EURITS for the waste industry; and

– Cembureau for the cement industry.

The consultations focused on the scope of the proposed Directive and the exclusion of biomass materials as well as the possibility of reduced monitoring for "clean" wastes. As described above, some untreated biomass has been excluded and reduced monitoring requirements are allowed for wastes where emissions can be proved not to exceed the emission limit values in the proposed Directive.

The other main areas for discussion concerned the treatment of co-incineration with the waste industry pressing for equal standards to apply to all waste treatment. Although the cement industry agrees to high standards they underlined the need to take account of the special features of the cement process that lead to releases of certain pollutants – in particular NOx and dust and the particular difficulties in controlling these. While account has been taken of the technical circumstances, stringent controls have been maintained for the pollutants and a cost-benefit assessment of additional NOx controls was carried out[14].

The plastics and power generation industries argued for derogations for the combustion of "clean" waste streams. After consideration reduced monitoring requirements were agreed for wastes proven not to give rise to emissions greater than the emission limit values in the proposed Directive.

Environmental NGOs

NGOs were represented by the EEB and Greenpeace. Both were supportive of the need for the proposed Directive and welcomed the inclusion of co-incineration. There were specific concerns raised over the exact emission limit values to be applied. They ask for more stringent emission limit values. According to the cost-benefit analyses carried out tighter standards are not justified. Furthermore all Member States apart from the Netherlands and Austria do not see a justification for and therefore do not support more stringent requirements.

Another issue raised by the NGOs is related to waste management, namely the question of banning certain substances, especially PVC from incineration. EEB and Greenpeace claim that as a result of PVC-incineration flue gas cleaning residues will increase due to the neutralisation of hydrochloric acid.

A ban on PVC incineration would not fall within the scope of the proposed Directive, since it seeks to ensure that the incineration process will not cause environmental damage irrespective of what is incinerated, by imposing strict standards on incineration emissions. A ban on PVC incineration is more efficiently dealt within the management of the specific waste stream.

14 Economic evaluation of NOx abatement techniques in the European cement industry, Ökopol 1998.

8. ECONOMIC ASSESSMENT

8.1 General aspects

Detailed studies have been carried out on the costs and benefits of applying the proposed Directive to the incineration of municipal waste[15], other non-hazardous wastes[16] and to the co-incineration of waste in cement kilns[17]. These cost-benefit studies are based on an analysis of the additional costs that would be incurred in order to implement the proposed Directive across the Community and of the benefits to society as a whole due to the improved control of emissions.

The first study considered incineration of municipal solid waste in dedicated incineration plants, as this represents the largest flow of waste incinerated in the Community. The analysis was then extended to cover sewage sludge and clinical waste because significant amounts of each are incinerated and for each waste the handling and combustion equipment are significantly different compared to municipal waste incineration. An additional study was then performed to examine the costs and benefits of extending the emission limit values to co-incineration of waste. Cement kilns were taken as the focus of this study as they burn most of the waste co-incinerated. The study is therefore relevant to the majority of installations affected.

The benefits of the Directive will be a reduction in adverse effects on human and ecological health as well as a reduction in other effects of pollution, such as crop or building damage. The costs will include additional capital expenditure to install or upgrade pollution control equipment, and additional running costs due to increased environmental monitoring or increased chemical usage in the flue gas treatment system. In the first instance these additional costs will be borne by plant operators. However, over time these costs will be passed on to those making use of such facilities, directly or indirectly, such as municipalities and the local taxpayers.

It is not simple to evaluate the additional costs and benefits of proposed regulations in an industry as diverse and complex as the incineration of waste. Cost estimates may be too high, as the costs of technologies may fall over time with technical advances or due to economies of scale. Simplifying assumptions must be made in order to estimate costs for the entire stock of incineration plants across Europe. On the benefit side, there have been great improvements in the assessment methodology in recent years. Nevertheless, there remain considerable uncertainties surrounding the health effects of air pollution, particularly the chronic effects. The valuation of these effects is also not straightforward.

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15 Economic Evaluation of the Draft Incineration Directive, Office for Official Publications of the European Communities, 1997.

16 Economic evaluation on waste incineration, ERM 1998.

17 Economic Evaluation of NOx abatement techniques in the European Cement Industry; Ökopol 1998.

There are also limits to the scope of a cost-benefit analysis where it is confined to a particular regulation. Implementing policy proposals requires the use of valuable resources that could be used to produce other things. Therefore, even if the estimated benefits of the strategy appear to exceed the costs this does not necessarily imply that the policy should be implemented. The money spent on abatement costs could perhaps be spent on another policy with higher net benefits. That is, there are always opportunity costs of implementing a regulation. Even so, the cost-benefit analysis does provide an estimate of the effects on overall welfare of adopting a particular policy or target.

Valuation of benefits

The value in monetary terms that should be attached to the benefits of reducing effects on health is a subject of considerable debate. The benefit estimates reported here, for all studies, make use of the Value of Statistical Life (VOSL) approach. This is a well established approach that assesses benefits by using an estimate of what people are willing to pay to reduce risks of mortality. A VOSL of ECU 3 million was used. This figure is in line with work done to synthesise research on benefit estimation under the DG XII EXTERNE programme.

There has been some debate about the appropriateness of using the VOSL for cases where the reduction in life expectancy attributable to exposure to pollution is small. This will often be the case for example, where pre-existing chronic respiratory or cardiac disease is a factor in death. For this reason, some analysts have advocated the use of an alternative measure, the value of a statistical life year lost (VOLY). This measure attaches a value to each life year that is lost as a result of premature mortality. It therefore takes into account that those who are affected by such pollution often have a short life expectancy.

However, there is little empirical evidence that the willingness to pay to avoid risk declines with age, as would be predicted by the VOLY approach. The estimates reported here are therefore based on the VOSL approach. Nevertheless, it should be noted that measuring benefits using the VOLY approach would reduce the estimated monetary benefits of this Directive.

Uniform Limit Values

This Proposal applies uniform limit values to all plants, in all sectors covered. This approach has the advantage of being easily understood and relatively straightforward to monitor. There is a good case for setting high minimum standards for incinerators, given that most are located in or near densely populated areas. Setting uniform minimum requirements will also discourages waste tourism, where waste is shipped from member states with high abatement standards to those with lower standards in order to take advantages of differences in disposal costs.

However, uniform emission limit values do have disadvantages. It may be the case that within a given area it would be cheaper to achieve a given reduction in emissions more cheaply by setting differentiated standards for the plants located in that area. That is, the same environmental improvement could be achieved at lower cost. It can also be argued from an economic point of view that standards ought to be lower in

areas where population is less dense or less exposed, and the damage costs of emissions consequently lower.

For reasons of simplicity, and in the absence of more refined data on how damage costs vary with location, it has been decided to propose uniform emission limit values. Member States do in any case have flexibility to go beyond these minimum standards should they so desire. However, were the limit values in this Directive to be revised in the future there would be a case for assessing the feasibility of differentiating limit values for certain pollutants to take into account variations in damage costs.

8.2 Environmental benefits

The implementation of the proposed Directive will lead to significant reductions in emissions of several key pollutants across the EU, despite the projected increases in the amounts of waste incinerated. In addition, the requirements to control releases to water from non-hazardous waste incineration for the first time will reduce pollutant burdens on marine and freshwater eco-systems. These effects should ensure an overall reduction in the environmental impact from waste incineration.

Recent studies estimate that emissions from waste incineration account for 36 t/y of mercury and 16 t/y of cadmium in the Community[18]. The full implementation of the proposed Directive should reduce the total estimated emissions of mercury and cadmium from the incineration of municipal waste, clinical waste and sewage sludge to 7,1 t/y and 1,1 t/y respectively. If the output of all other sources remains unchanged the contribution from waste incineration to the total output of mercury and cadmium emissions would be reduced from 16% to 3% for mercury and from 8% to 0,6% for cadmium.

The incineration of non-hazardous wastes has been identified as the largest known source of emissions of dioxins and furans to air in Europe[19]. Emissions to air from the incineration of clinical and municipal wastes are put at approximately 2300 g I-TE/y (based on 1993-1995). Some reductions in emissions of dioxins and furans from non-hazardous waste incineration in the Community have already been achieved through the implementation of the 1989 Directives on municipal waste incineration and national measures. These measures are expected to lead to reduced emissions of dioxins and furans for a few more years and emissions from all non-hazardous waste incineration can be projected to amount approximately to 1200 g I-TE/y by the year 2000.

However, after 2000 the increases in the amounts of waste incinerated are expected to lead to an overall increase in emissions if additional controls are not introduced. The proposed Directive will impose an emission limit value of 0.1 ng/Nm3 for the incineration or co-incineration of waste. Full implementation of this requirement

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18 The European Atmospheric Emission Inventory of Heavy Metals and Persistent Organic Pollutants for 1990, Umweltbundesamt, Germany, 1997.

19 Identification of Relevant Industrial Sources of Dioxins and Furans in Europe, Landesumweltamt Nordrhein-Westfalen, 1997.

should reduce total emissions of dioxins and furans from the incineration of municipal waste, clinical waste and sewage sludge to approximately 11 g I-TE/y – even with the expected increase in the amount of waste incinerated. This would mean a reduction in excess of 99% relative to 1993/95 levels, ensuring that the 90% reduction target of the Fifth Environmental Action programme is achieved. Should the output of other sources of dioxins and furans remain unchanged the contribution of municipal and clinical waste incineration to overall emissions would be reduced from 40% to a mere 0.3%.

The proposed Directive should also ensure that substantial reductions are achieved in emissions of acid gases, especially HCl, NO_x and SO_2. These emission controls will help to meet air quality targets and ensure that the incineration of non-hazardous waste does not contribute significantly to the global and regional problems of acidification and ground level ozone. Stringent controls on the emissions of particulate matter will reduce the potential adverse impact on human health thought to be caused by exposure to fine particulates in the atmosphere. The biggest reductions in the overall mass of particulates will be for large-scale municipal waste incineration plants. However, the most noticeable effects can be expected for small incineration plants for other non-hazardous wastes where controls may be poor or non-existent – emissions from such plants can give rise to a local nuisance as well as contributing to general population exposure.

8.3 Monetary estimates of costs and benefits

Municipal Solid Waste Incineration

An economic evaluation[20] was undertaken to estimate the costs of implementing the draft Directive for the incineration of municipal waste in mass burn incinerators. A matrix of plant sizes and pollution control options was developed. The number and capacity of incineration plants and the pollution controls used across the Member States in the year 2000 was forecast. This was designed to be representative of the situation when the existing Directives on municipal waste incineration (89/369/EEC, 89/429/EEC) were fully implemented.

Additional costs for the flue gas treatment required to achieve the emission limits values in the draft Directive were estimated. It was assumed that existing plants would be upgraded rather than being replaced. The analysis used data for France, Germany and the UK which represent the bulk of EU incineration capacity. The estimated cost of complying with the emission limit values for air releases in the proposed Directive across the whole of the EU was ECU 423 million/y. Discounting these costs over 20 years at a rate of 8% gives a total cost (in net present value terms) of approximately ECU 4.2 billion.

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[20] Economic Evaluation of the Draft Incineration Directive, Office for Official Publications of the European Communities, 1997.

The benefits due to the introduction of the proposed Directive were estimated to be ECU 663 million/y, for a reference case based on a hypothetical incinerator at Stuttgart in Germany. Discounting these benefits over 20 years using a rate of 8% gives a total benefit (net present value) of approximately ECU 6.5 billion. Therefore the net benefit of implementing the draft Directive standards for air emissions for municipal waste incineration was estimated at ECU 240 million/y or a total net benefit (net present value) of ECU 2.3 billion.

For the benefits assessment the study also took as the baseline full compliance with the 1989 Directives to ensure that only the additional benefits of the proposed Directive were included. The major impacts found in the study were identified as effects of air pollutants on human health. The largest contributions to these impacts were judged to come from primary and secondary particulates (the secondary particulates being derived from SO2, NOx and NH3). Secondary particulates had a greater impact than primary particulates.

However, there remains also considerable scientific uncertainty over the impact of particulates on chronic mortality. Thus the overall potential benefits were calculated both including and excluding the effects on chronic mortality. The benefits estimates above exclude the effects on chronic mortality. Clearly if these effects are significant, then the benefit figures would be a significant underestimate. The benefit estimates also do not include ecological damage caused by acid gases, which was not quantified.

The health impacts from heavy metals, dioxins and furans were found to be relatively small. Despite the high toxicity of these compounds the low emissions were found to make little impact on health. There is, however, considerable scientific debate on the effects of long term exposures to low doses of these chemicals. Further recent work on the potential impacts of dioxins and furans suggest that there are a number of additional effects that were not quantified in the study. The major additional impacts that had not been included in the original assessment were identified as:

- non-cancer human health impacts;
- damage to ecosystems and wildlife;
- potential costs associated with clean-up of land impacted by deposition of dioxins and furans;
- costs associated with adverse impacts on the production of milk where additional dioxin and furan input could cause the milk to exceed tolerable contamination levels;
- the potential damage due to other pollutants that are controlled by the techniques used to control dioxin and furan emissions.

It is not possible at this stage to place a monetary value on these effects. To the extent that these effects are significant, they would result in an increased in estimated damage due to emissions of dioxins and furans and thus increase the benefit of tighter controls relative to the figures reported above.

Sewage Sludge and Clinical Waste Incineration

The study on these wastes[21] collected statistics on the total arisings and amounts incinerated at present and projections for the year 2020. Existing plant capacity was divided into three generic groups to capture differences in current standards of emission abatement and resulting emissions. The capital and operating costs of upgrading or replacing the emissions controls for plants not currently meeting the standards in the proposed Directive were assessed, and the benefit in terms of reduced damage from air pollution was estimated.

The net cost of implementing the proposed Directive was calculated taking the difference between the total cost (capital cost and operating cost) for full implementation and the business as usual (i.e. no change) scenario. Costs of implementation were estimated at ECU 514 million for sewage sludge and ECU 787 million for clinical waste, in net present value terms (equivalent to 52 and ECU 80 million/y respectively over 20 years using an 8% discount rate).

For consistency the benefits were derived from the monetary values used in the study on municipal waste incineration , but based on damage costs for a plant near Paris and using a 50m stack (the conditions judged to be most representative of situations for incineration of sewage sludge and clinical waste). Total damage costs were calculated for each Member State using the two scenarios: business as usual and full implementation of the Proposed Directive. The difference between damage costs in the two scenarios was then calculated to give an estimate of the benefits of the Directive.

The total benefit of the proposed Directive was estimated to be ECU 383 million for sewage sludge incineration and ECU 1 076 million for clinical waste incineration, if the chronic mortality effects are excluded. Taking costs and benefits together we have a net disbenefit of ECU 131 million for sewage sludge and a net benefit of ECU 290 million for clinical waste. Including chronic effects on mortality would change the results markedly. Including chronic effects gives a net benefit of ECU 950 million for sewage sludge and a net benefit ECU 3 420 million for clinical waste.

Co-incineration in cement kilns

This study[22] examined the costs and benefits of various technical options for reducing NOx emissions from cement kilns. The study focussed on this sector and only this pollutant because cement kilns burn most of the waste co-incinerated, and because NOx is the only pollutant for which cement kilns are likely to incur significant costs in order to comply with the proposed limit values.

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21 Economic evaluation on waste incineration, ERM 1998.

22 Economic Evaluation of NOx abatement techniques in the European Cement Industry; Okopol 1998.

The net costs and benefits of achieving the specified limit value depend for a kiln depend very much on current emission levels and the technologies employed to achieve the limit value. Rather than assessing total costs of the Directive based on an assessment of the stock of cement kilns in Europe, this study assessed the benefit/cost ratio of achieving the NOx limit for a range of kilns sizes and technologies.

The study found that for every kiln type there is at least one technology that exists that would allow the operator to achieve the proposed emission limit value. Moreover, the avoided damage significantly outweighs the cost of achieving the emission limit values in all cases. The benefit/cost ratio ranges from 3 to 33, depending mainly on the assumptions made about the population affected, existing emission levels and the size of kiln. The benefit/cost ratio would be higher if chronic effects were included.

8.4 Impacts of the proposed Directive on business

The largest sector affected by the proposed Directive is the incineration of municipal solid waste, the majority of which is derived from domestic and commercial sources. Additional costs therefore are divided amongst a large number of beneficiaries of the disposal of the wastes. Additional costs for implementation of the draft Directive for air emissions are estimated to add approximately ECU 7.6 per tonne of municipal waste incinerated.

The increased costs of meeting the proposed standards will fall in the first instance on the operators of incinerators. The operators of incineration plants are expected to pass on such additional costs to the individuals and enterprises that generate the waste. The costs therefore will therefore be spread widely and to a large extent will be met by increases in charges to households for waste disposal. This means that in a broad sense the costs are met by society in general and it is society that gains the benefit of reduced health damage.

There will be additional costs to cement kilns of meeting the proposed NOx limit. However, the study reported above shows that the benefits to society outweigh these costs by a considerable margin. Moreover, the study also shows that savings in operating costs that cement kilns achieve in burning waste rather than other fuels are significant. In most cases the savings in operating costs from burning waste are sufficient to cover the additional expense of NOx reduction even if the waste is only 5 to 10 percent of the kiln’s energy demand.

9. CONCLUSIONS

The proposed Directive will make a significant contribution to improving the regulation of waste incineration in the Community both in dedicated plants and for the increasingly common practice of co-incineration in other industrial plants. Emission limits values for release of pollutants to air and water will ensure that the necessary high standards of environmental and human health protection are achieved. The requirement to recover the heat will ensure that best use is made of unavoidable

wastes that are not re-used or recycled in accordance with the Waste Management Strategy.

The main elements of the proposed Directive include

- the extension of the scope of existing legislation to cover the incineration of wastes that are not hazardous and are not defined as municipal wastes as well as to address hazardous wastes excluded from the Directive on hazardous waste incineration (94/67/EC);

- the updating of emission limits applicable to municipal incineration plants and the addition of limits on releases to water;

- detailed provisions for the operation of plants for co-incineration of wastes.

The economic evaluation for municipal waste has aggregate benefits higher than costs in the central case, though the cost/benefit ratio will vary with location and may be negative in some areas. For clinical waste and sewage sludge the analysis is more marginal, with net costs for sewage sludge and net benefits for clinical waste when chronic mortality effects are excluded. If chronic effects are included then costs are lower than benefits in all cases. For cement kilns the costs are significantly lower than benefits in all cases.

It should be noted though that there are significant uncertainties involved in the economic assessment. This is partly because costs and benefits vary with location and over time, but also because the science underpinning the analysis of benefits is still uncertain. The importance or otherwise of chronic health effects remains to be definitively established. The possible magnitude of the chronic effects suggests though that there is a strong case for further controls on emissions from incinerators on precautionary grounds.

Further work should be done on both the extent of chronic health effects, and the way in which they are treated within cost-benefit analysis. Therefore, it is the aim of the Commission to promote more work in this area. In addition the Commission has forwarded to the Council and the European Parliament a Communication on pollution related diseases. Its intention is to promote action towards a better understanding of the role of pollutants in the causation and aggravation of diseases in the Community and thus the prevention thereof.

Significant reductions in emissions of certain pollutants will be achieved, including important reductions in the emissions of dioxins and furans, which will contribute to the EU policy commitment of a 90% reduction in dioxin emissions from known sources between 1985 and 2005.

Annex 1

The Current Situation in the EU

Comprehensive data are not available on the incineration capacity in the EU. There is such a wide variety of incineration plants burning a range of waste materials that it has not been possible to identify them all. In addition it should be noted that the management of waste is undergoing a period of rapid development and incinerators are being built in many countries at the same time as a large number of older plants are being upgraded or closed down.

The study on the evaluation of the draft Directive[23] assessed the information available on the stock of incinerators for municipal waste (the most commonly combusted waste) in the European Union. The best information for the situation in the early 1990s comes from a study carried out for the European Commission by TNO[24]. This study indicates a total incinerator stock of 485 units with a capacity of 43 140 kt per year, including Switzerland and Norway. The TNO survey showes that the incineration of municipal waste is not evenly distributed across the EU. The information in Table 2 is derived from the data in the TNO survey and is representative of the situation in the late 1980s/early 1990s.

Since compliance with the two Directives on the incineration of municipal waste is not yet complete, it is important to consider the situation when full compliance has been achieved. In the economic evaluation projections were made of the incinerator stock that could be expected in the EU in the year 2000 after all necessary upgrades and plant closures have been completed. With the imposition of stringent emissions standards EU capacity is expected to move towards larger more cost-effective plants. A total of 363 plants with a throughput of 56 512 kt per year is forecast.

There is some difficulty in identifying the full number of other incineration plants which will be affected by the proposed Directive given the wide range of wastes that may be combusted in dedicated plants or in co-incineration plants. Further analysis has been carried out on the costs and benefits of the proposed Directive in the fields of sewage sludge and clinical waste incineration[25]. In the area of health care waste incineration particularly there have been significant changes in the number of incinerators as small-scale hospital based plants have closed down and have been replaced by centralised capacity. The study estimates that approximately 2 Mt of sewage sludge and 1.3 Mt of clinical wastes are incinerated each year in the European Union.

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23 Economic Evaluation of the Draft Incineration Directive, Office for Official Publications of the European Communities, 1997.

24 The Impact of a change in the EC legislation on the combustion of municipal solid waste, TNO report 93-312.

25 Economic evaluation on waste incineration, ERM 1998.

Table 2: Incineration of MSW in Europe

Country	Incineration capacity kt/y	% of MSW incinerated	Number of MSW incinerators
Austria	340	11	2
Belgium	2 240	54	24
Denmark	2 310	74	31
Finland	70	2	1
France	11 330	42	225
Greece	0	0	0
Germany	12 020	36	49
Ireland	0	0	0
Italy	1 900	16	28
Luxembourg	170	75	1
Netherlands	3 150	35	10
Norway	500	22	18
Portugal	0	0	0
Spain	740	6	14
Sweden	1 860	47	21
Switzerland	2 840	59	30
UK	3 670	8	31
Total	43 140		485
Total EU	39 800		437

Contents of the Proposal

Article 1 explains the aim of the proposed Directive as to prevent or reduce as far as possible the adverse impacts on the environment arising from the incineration of waste.

Article 2(1) covers the scope of the proposed Directive. The proposed Directive shall apply to plants for the incineration of waste and also to plants in which waste may be co-incinerated with conventional fuels.

Article 2(2) gives details of the installations excluded from the proposed Directive. Installations incinerating or co-incinerating wood and agriculture and forest residues unless they contain halogenated organic compounds or heavy metals as a result of treatment, waste mentioned in Article 2(1) of Council Directive 75/442/EEC as amended, wastes from the exploration and exploitation of oil and gas resources from offshore installations that is incinerated on board and radioactive waste. In addition installations incinerating or co-incinerating less than 10 tonnes per year of non-municipal waste are excluded.

Article 3(1) defines waste based on Article 1(a) of Council Directive 75/442/EEC as amended.

Article 3(2) defines the term "incineration plant" and takes care to ensure that pyrolysis, gasification and other thermal treatment plants are included where the products are subsequently incinerated in the same process.

Article 3(3) defines the term "co-incineration plant" such that a plant whose main purpose is to produce energy or material products but incinerates waste as a regular or additional fuel is included.

Article 3(4) defines "existing" incineration and co-incineration plants. A plant is to be considered existing if it is either in operation and complying with the relevant national and Community legislation before this proposed Directive has to be brought into effect or is subject to a full application for authorisation at that time and is then brought into operation within one year of the proposed Directive being brought into effect.

Article 3(5) and ***3(6)*** define "emission" and "emission limit values" (ELV) to include the direct or indirect release of substances, vibrations, heat or noise from any part of the installation to all environmental media and the ELV shall set a limit to the emission during specified periods of time.

Article 3(7) defines "dioxins and furans" to include the 17 compounds listed in Annex I.

Article 3(8) and ***(9)*** define the "operator" as the natural or legal person controlling the installation and the "permit" as the written decision granting authorisation to operate the plant.

Article 3(10) defines “residue” to include all liquid and solid materials arising from the operation which are defined as waste according to Article 1(a) of Council Directive 75/442/EEC as amended. These will include slags and ashes from the incineration and materials arising from the flue gas treatment.

Article 4(1) ensures that all installations have a permit (the provisions of the proposed Directive may be included in a permit required by other measures).

Article 4(2) requires that the permit includes the description of measures to ensure the plant is designed and operated to meet the requirements of the proposed Directive, and meets the aims of recovering heat and prevents or recovers as far as possible the generation of wastes and where they are disposed of that this is in accordance with the relevant legislation.

Article 4(3) and ***(4)*** ensure that the measurement techniques for the emissions are satisfactory and that the specific wastes incinerated are detailed according to the European Waste Catalogue (EWC). For co-incineration plants the total waste incineration capacity should be specified.

Article 4(5) requires that Member States define a procedure for permitting of mobile plants.

Article 5 concerns the delivery and reception of waste. The provisions are designed to ensure that all steps necessary to ensure waste handling does not cause harm to the environment. In addition operators must determine the mass and category of wastes according to the EWC prior to accepting it.

Article 6 concerns operating conditions. These requirements are more stringent than in existing Directives and are designed to ensure optimum operation to minimise environmental emissions.

Article 6(1) requires that complete combustion is achieved. To demonstrate this ashes and slags arising from incineration must have a content of total organic carbon of less than 3%. In addition gas resulting from incineration is raised to a minimum of 850°C for at least 2 seconds. This should be maintained even under the most unfavourable conditions, all plants shall be equipped with auxiliary burners to maintain the temperature as long as there is waste in the chamber.

Article 6(2) requires that co-incineration plants ensure a temperature of 850°C for at least 2 seconds.

Article 6(3) requires that waste is automatically prevented from being fed to the combustion process should the minimum temperature not be reached in start up or continuous operation and in the event of emissions exceeding the emission limit values. This ensures that waste is only incinerated under controlled conditions.

Article 6(4) requires that, whilst derogations to the operational conditions may be authorised by competent authorities, the levels of dioxins and furans emitted shall not be increased compared to those obtained by applying the conditions in Article 6(1). Any change shall neither increase the amount of residues produced nor the content of pollutants in them.

Article 6(5) requires that emissions do not give rise to significant ground level pollution and discharges are in accordance with relevant legislation. Furthermore any heat should be recovered as far as is possible.

Article 7(1) and (2) refer to the emission limit values for releases to air (described in Annex V).

Article 7(3) to ***(6)*** present the provisions for setting ELVs for plants co-incinerating waste. ELVs shall be calculated as described in Annex II except where untreated municipal waste is co-incinerated. Where a mixture of hazardous and non-hazardous wastes are co-incinerated the requirements of the proposed Directive shall be applied.

Article 8(1) to ***(7)*** establish the requirements for controls on discharges to water. Any waste water discharged must be subject to a permit. This permit shall ensure that relevant national and Community legislation is respected and in addition that the emission limit values specified in the proposed Directive for heavy metals, dioxins and furans are met.

Where waste water is treated with water from other processes a mass balance shall be carried out to ensure that the conditions are met. Dilution shall not be used unless it is allowed under waste management licensing arrangements.

Provision is required to ensure that no polluting substances shall be released to soil or groundwater according to the Council Directive 80/68/EEC. Water arising from rain or from fire-fighting operations shall be stored and tested prior to release.

Article 9 requires that Member States ensure that to the extent possible residues are prevented or minimised in terms of their quantity and harmfulness and recycled as far as possible in accordance with national and Community legislation. Residues should be transported and stored in closed containers and tests on the soluble metal and heavy metal fractions carried out to determine the most appropriate disposal route.

Article 10 requires that suitable systems are installed at the plant for control and monitoring of the parameters and emissions that show compliance with the Directive. Requirements are laid out to ensure that the equipment used is functioning correctly and that the sampling meets the approval of the competent authority.

Article 11 specifies detailed requirements for monitoring.

Article 11 (2-13) specify requirements for monitoring emissions to air. Continuous measurement is required for CO, dust, TOC, HCl, HF, SO2, NOx as well as of combustion chamber temperature, oxygen concentration, pressure, temperature and moisture content of the exhaust gases.

A minimum of two measurements per year of heavy metals and dioxins and furans are required with measurements every three months in the first 12 months of operation.

Less stringent requirements are allowed in certain circumstances. Continuous measurement of HF may not be required if controls on HCl ensure that limits will not be exceeded. Periodic measurements of HCl, HF, and SO2 may be allowed if the plant operator can prove that emissions of these pollutants will not exceed the emission limit values.

The methods of expressing emissions at standard conditions are laid out as are the definitions of demonstrating compliance and recording this information.

If emission limit values are exceeded then the competent authorities shall be informed without delay.

When continuous measurement methods become available for heavy metals, dioxins and furans the Commission shall decide when they shall be required.

Article 11 (14-17) specify requirements for monitoring emissions to water. Continuous measurement of temperature and flow are required. Daily measurement of suspended solids and heavy metals as specified in annex IV (items 5-13) of the proposed Directive.

Two measurements per year are required for dioxins and furans (one measurement each three months in the first year of operation).

Article 12 ensures that the necessary steps are taken to present information to the public during the permit procedure and operation of a plant in accordance with Council Directive 90/313/EEC and Council Directive 96/61/EC.

Article 13 addresses abnormal operating conditions. This article requires Member States to minimise the impacts of unavoidable technical failures and breakdowns. As a minimum plants shall not be permitted to incinerate waste while exceeding emissions limit values for a single period of more than four hours or for a cumulative total of 60 hours in a year.

Articles 14 and 15 allow for periodical reviews of the permit and reports on the implementation of the proposed Directive.

Articles 16 and 17 describe the Committee Procedure used to adopt amendments to the proposed Directive in response to technical progress.

Article 18 repeals Council Directives 89/369/EEC and 89/429/EEC, that deal with new and existing municipal incineration plants, five years after the proposed Directive enters into force.

Article 19 requires that effective sanctions are put in place by Member States for violations of the provisions made in the proposed Directive.

Article 20 covers the transition conditions. The proposed Directive shall apply to existing plants five years after the Directive entered into force.

Article 21 requires that the proposed Directive is incorporated into national laws not more than two years after it enters into force and that the Commission is informed. The proposed Directive shall be referenced in national provisions.

Article 22 notes that the proposed Directive shall enter into force on the twentieth day following its publication.

Article 23 addresses the proposed Directive to the Member States.

Annex I provides the toxic equivalence factors to be used for the determination of emissions of dioxins and furans.

Annex II provides the detailed method for determining emission limit values for installations where waste is co-incinerated.

An equation is provided to calculate the permitted emission limit values based on the volumes of flue gases generated by the waste and by the process. As the proportion of the flue gas from waste incineration increases the emission limit values approach those required for waste incineration plants. Reference emission limits for the processes are given in the annex.

For the special cases of cement kilns and combustion plants used for co-incineration emission limit values for releases to air are detailed.

Other industrial sectors will have to meet the standards for dedicated waste incineration plants for emissions of dioxins and furans as well as cadmium, thallium and mercury.

Annex III defines the measurement techniques to be used. CEN standards shall be used where available and national standards where the CEN standards are not available. The minimum performance of the measurement techniques is defined in terms of confidence intervals at the emission limit.

Annex IV contains the emission limit values for releases to water from the cleaning of exhaust gases. Concentration limits are set for suspended solids, dioxins and furans as well as the following heavy metals and their compounds: mercury, cadmium and thallium (taken together) and the sum of antimony, arsenic, lead, chromium, cobalt, copper, manganese, nickel, vanadium.

Annex V contains the emission limit values for air. Emission limit values are given for dust, organic substances, hydrogen chloride, hydrogen fluoride, sulphur dioxide, oxides of nitrogen, dioxins and furans as well as the following heavy metals and their compounds: mercury, cadmium and thallium (taken together) and the sum of antimony, arsenic, lead, chromium, cobalt, copper, manganese, nickel and vanadium.

Emission limit values for the metals are expressed as averages over the sample period (minimum of 30 minutes and maximum of 8 hours) whilst for other pollutants emission limits are expressed as daily averages and half hourly averages. The half hourly averages are higher than the daily averages to reflect variability in the emissions.

V e) specifies limits for the emission of carbon monoxide (used as an indicator of good combustion). A daily average of 50 mg/m3 shall be maintained and limits are placed on short term excursions.

Proposal for a
COUNCIL DIRECTIVE

on the incineration of waste

THE COUNCIL OF THE EUROPEAN UNION,

Having regard to the Treaty establishing the European Community, and in particular Article 130s(1) thereof,

Having regard to the proposal from the Commission[26],

Having regard to the Opinion of the Economic and Social Committee[27],

Having regard to the Opinion of the Committee of the Regions[28],

Acting in accordance with the procedure laid down in Article 189c of the Treaty, in cooperation with the European Parliament[29],

(1) Whereas the fifth Environment Action Programme: Towards sustainability - A European Community programme of policy and action in relation to the environment and sustainable development[30] sets as an objective "no exceedance ever of critical loads and levels" of certain pollutants such as nitrogen oxides (NO_x), sulphur dioxide (SO_2), heavy metals and dioxins while in terms of air quality the objective is that "all people should be effectively protected against recognised health risks from Air Pollution"; whereas that Programme further sets as an objective a "90% reduction of dioxin emissions of identified sources by 2005 (1985 level)" and "at least 70% reduction from all pathways of cadmium (Cd), mercury (Hg) and lead (Pb) emissions in 1995";

(2) Whereas the Protocol on persistent organic pollutants signed by the Community within the framework of the United Nations Economic Commission for Europe (UN-ECE) Convention on long-range transboundary air pollution sets legally binding limit values for the emission of dioxins and furans of 0.1 ng/m³ TE (Toxicity Equivalents) for installations burning more than 3 tonnes per hour of municipal solid waste, 0.5 ng/m³ TE for installations burning more than 1 tonne per hour of medical solid waste, and 0.2 ng/m³ TE burning more than 1 tonne per hour of hazardous waste;

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26 OJ C

27 OJ C

28 OJ C

29 OJ L

30 OJ C 138, 17.5.1993, p. 5.

(3) Whereas the Protocol on Heavy Metals signed by the Community within the framework of the United Nations Economic Commission for Europe (UN-ECE) Convention on Long-Range Transboundary Air Pollution sets legally binding limit values for the emission of particulate of 10 mg/m³ for hazardous and medical waste incineration and for the emission of mercury of 0.05 mg/m^3 for hazardous waste incineration and 0.08 mg/m^3 for municipal waste incineration;

(4) Whereas Council Directives 89/369/EEC[31] and 89/429/EEC[32] on the prevention and reduction of air pollution from municipal waste incineration plants contributed to the reduction and control of atmospheric emissions from incineration plants; whereas more stringent rules should now be adopted and those Directives should accordingly be repealed;

(5) Whereas, in accordance with the principle of subsidiarity and the principle of proportionality as set out in Article 3b of the Treaty, the objective of reducing emissions from incineration and co-incineration plants cannot be achieved effectively by Member States acting individually; whereas unconcerted action offers no guarantee of achieving the desired objective; whereas, in view of the need to reduce emissions across the Community, it is more effective to take action at the level of the Community; whereas this Directive confines itself to minimum requirements for incineration and co-incineration plants;

(6) Whereas Council Resolution 97/C76/01 of 24 February 1997[33] on a Community strategy for waste management underlines the importance of Community criteria concerning the use of waste, the need for appropriate emission standards to apply to incineration facilities, the need for monitoring measures to be envisaged for existing incineration plants, and the need for the Commission to consider amending Community legislation in relation to the incineration of waste with energy recovery in order to avoid large-scale movements of waste in the Community;

(7) Whereas the rules of the Internal Market apply for wastes for recovery and therefore the same strict rules are necessary for all plants incinerating waste in order to avoid transboundary movements to plants operating at lower costs due to less stringent environmental standards;

(8) Whereas Council Directive 96/61/EC of 24 September 1996[34] sets out an integrated approach to pollution prevention and control in which all the aspects of an installation's environmental performance are considered in an integrated manner; whereas installations for the incineration of municipal waste with a capacity exceeding 3 tonnes per hour and installations for the disposal and recovery of hazardous waste with a capacity exceeding 10 tonnes per day are included within the scope of the Directive 96/61/EC;

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31 OJ L 163, 14.6.1989, p. 32.

32 OJ L 203, 15.7.1989, p. 50.

33 OJ C 76, 11.3.1997, p. 1.

34 OJ L 257, 10.10.1996, p. 26.

(9) Whereas this Directive sets emission limit values according to Article 18 of Directive 96/61/EC as well as operating conditions and emission limits for all plants incinerating waste in order to ensure a high level of environmental protection;

(10) Whereas compliance with the emission limit values laid down by this Directive should be regarded as a necessary but not sufficient condition for compliance with the requirements of Directive 96/61/EC regarding the use of best available techniques; whereas such compliance may involve more stringent emissions limit values, emission limit values for other substances and other media, and other appropriate conditions;

(11) Whereas industrial experience in the implementation of techniques for the reduction of polluting emissions from incineration plants has been acquired over a period of ten years;

(12) Whereas Article 4 of Council Directive 75/442/EEC of 15 July 1975 on waste[35], as last amended by Commission Decision 96/350/EC[36], requires Member States to take the necessary measures to ensure that waste is recovered or disposed of without endangering human health and without harming the environment; whereas, to this end, Article 9 of that Directive provides that any plant or undertaking treating waste must obtain a permit from the competent authorities relating, inter alia, to the precautions to be taken;

(13) Whereas the purpose of the incineration plants established and operated in accordance with this Directive is to reduce the pollution-related risks of waste through a process of thermal treatment, especially oxidation, to reduce the quantity and volume of the waste and to produce residues that can be recycled or disposed of safely;

(14) Whereas Article 129 of the Treaty requires that human health requirements should form a constituent part of other Community policies; whereas, further, Article 130r provides that Community policy on the environment is to contribute to protecting human health;

(15) Whereas, therefore, a high level of environmental protection and human health protection requires the setting and maintaining of appropriate operating conditions and emission limit values for waste incineration plants within the Community; whereas the limit values set should contribute to reducing negative effects on the environment and to minimising adverse effects on human health;

(16) Whereas high-standard measurement techniques are required to monitor emissions to ensure compliance with the emission limit values for the pollutants;

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35 OJ L 194, 25.7.1975, p. 39.

36 OJ L 135, 6.6.1996, p. 32.

(17) Whereas integrated protection of the environment against emissions resulting from the thermal treatment of waste is required; whereas, aqueous waste resulting from the cleaning of exhaust gases should therefore be discharged only after separate treatment, in order to limit a transfer of pollution from one environmental medium to another;

(18) Whereas provisions should be laid down for cases where the emission limit values are exceeded as well as for technically unavoidable stoppages, disturbances or failures of the purification devices;

(19) Whereas the co-incineration of waste in plants not primarily intended to incinerate waste should not be allowed to cause higher emissions of polluting substances in that part of the exhaust gas volume resulting from such co-incineration and should therefore be subject to appropriate limitations;

(20) Whereas the Member States should lay down rules on penalties applicable to infringements of the provisions of this Directive and ensure that they are implemented; whereas those penalties must be effective, proportionate and dissuasive,

HAS ADOPTED THIS DIRECTIVE:

Article 1

Objectives

The aim of this Directive is to prevent or, where that is not practicable, to reduce as far as possible negative effects on the environment, in particular the pollution of air, soil, surfacewater and groundwater, and the resulting risks to human health, from the incineration and co-incineration of waste and, to that end, to set up and maintain appropriate operating conditions and emission limit values for waste incineration and co-incineration plants within the Community.

Article 2

Scope

1. This Directive covers incineration and co-incineration plants.

2. The following plants shall however be excluded from the scope of this Directive:

   (a) Plants only treating the following wastes:

      (i) waste falling within the scope of Council Directive 94/67/EC[37],

[37] OJ L 365, 31.12.1994, p. 34.

(ii) agriculture and forest residues and wood with the exception of those that may contain halogenic organic compounds or heavy metals as a result of treatment,

(iii) waste excluded from the scope of Directive 75/442/EEC pursuant to Article 2(1) of that Directive,

(iv) waste resulting from the exploration for and the exploitation of oil and gas resources from off-shore installations and incinerated on board;

(b) Plants which treat less than 10 tonnes per year of non-municipal waste only.

Article 3

Definitions

For the purposes of this Directive:

1. "waste" means any solid or liquid waste as defined in Article 1(a) of Directive 75/442/EEC;

2. "incineration plant" means any stationary or mobile technical unit and equipment dedicated to the thermal treatment of wastes with or without recovery of the combustion heat generated. This includes the incineration by oxidation of wastes as well as pyrolysis, gasification or other thermal treatment processes, such as plasma process in so far as the products of the treatment are subsequently incinerated;

   This definition covers the site and the entire plant including all incineration lines, waste reception, storage, on site pre-treatment facilities; its waste-, fuel-and air-supply systems; the boiler; facilities for treatment or storage of the residues, exhaust gas and waste water; the stack; devices and systems for controlling incineration operations, recording and monitoring incineration conditions;

3. "co-incineration plant" means a plant whose main purpose is the generation of energy or production of material products and which uses wastes as a regular or additional fuel;

   This definition covers the site and the entire plant including all incineration lines, waste reception, storage, on site pre-treatment facilities; its waste-, fuel- and air-supply systems; the boiler; facilities for treatment or storage of the residues, exhaust gas and waste water; the stack; devices and systems for controlling incineration operations, recording and monitoring incineration conditions;

4. "existing incineration or co-incineration plant" means a plant in operation and complying with relevant existing national and Community legislation or, in accordance with legislation existing before the date specified in Article 21, a plant which is authorised or registered or in the view of the competent authority the subject of a full request for authorisation, provided that the plant is put into operation no later than one year after the date specified in Article 21;

5. "emission" means the direct or indirect release of substances, vibrations, heat or noise from individual or diffuse sources in the plant into the air, water or soil;

6. "emission limit values" means the mass, expressed in terms of certain specific parameters, concentration and/or level of an emission, which may not be exceeded during one or more periods of time;

7. "dioxins and furans" means all polychlorinated dibenzo-p-dioxins and dibenzofurans listed in Annex I;

8. "operator" means any natural or legal person who operates or controls the plant or, where this is provided for in national legislation, to whom decisive economic power over the technical functioning of the plant has been delegated;

9. "permit" means a written decision (or several such decisions) granting authorisation to operate all or part of a plant;

10. "residue" means any liquid or solid material (including bottom ash and slag; fly ash and boiler dust; solid reaction products from gas treatment; sewage sludge from the treatment of waste waters; spent catalysts and spent activated carbon) defined as waste in Article 1(a) of Directive 75/442/EEC, which is generated by the incineration or co-incineration process, the exhaust gas or waste water treatment or other processes within the incineration or co-incineration plant.

Article 4

Application and Permit

1. No incineration or co-incineration plant shall operate without a permit.

2. Without prejudice to Directive 96/61/EC, the application for a permit by an incineration or co-incineration plant to the competent authority shall include a description of the measures which are envisaged to guarantee that:

   (a) the plant is designed, equipped and will be operated in such a manner that the requirements of this Directive are met;

   (b) the heat generated during the incineration process is recovered as far as possible;

   (c) the residues will be prevented, reduced or recycled as far as possible;

(d) the disposal of the residues which cannot be prevented, reduced or recycled will be carried out in conformity with national and Community legislation.

3. The permit shall be granted only if the application shows that the proposed measurement techniques for emissions into the air comply with Annex III.

4. The permit granted by the competent authority to an incineration or co-incineration plant shall:

(a) list explicitly the categories of wastes, according to the European Waste Catalogue (EWC) which may be treated;

(b) include the total waste incinerating capacity of the plant;

(c) specify the sampling and measurement procedures used to satisfy the obligations imposed for periodic measurements of each air and water pollutants.

5. The procedure for granting permits for mobile plants shall be determined by Member States.

Article 5

Delivery and Reception of Waste

The operator of the incineration or co-incineration plant shall take all necessary precautions concerning the delivery and reception of waste in order to prevent or, where not practicable, to reduce as far as possible negative effects to the environment, in particular the pollution of air, soil, surfacewater and groundwater as well as odours and noise, and direct risks to human health.

The operator shall determine the mass of each category of the waste, according to the EWC-catalogue, prior to accepting the waste at the incineration or co-incineration plant. The competent authorities may grant exemptions for industrial plants and undertakings incinerating or co-incinerating only their own waste at the place of production of the waste provided that the same level of protection is met and that the values are not needed for the calculations pursuant to Annex II.

Article 6

Operating Conditions

1. Incineration plants shall be operated in order to achieve a level of incineration such that the Total Organic Carbon (TOC) of the slag and bottom ashes is less than 3 % of the dry weight of the material. If necessary appropriate techniques of waste pre-treatment shall be used.

All incineration plants shall be designed, equipped, built and operated in such a way that the gas resulting from the process is raised, after the last injection of combustion air, in a controlled and homogeneous fashion and even under the most unfavourable conditions, to a temperature of at least 850°C, as measured near the inner wall of the combustion chamber, for at least two seconds.

All incineration plants shall be equipped with auxiliary burners. These burners must be switched on automatically when the temperature of the combustion gases after the last injection of combustion air falls below 850°C. They shall also be used during plant start-up and shut-down operations in order to ensure that the temperature of 850°C is maintained at all times during these operations and as long as unburned waste is in the combustion chamber.

During start-up and shut-down or when the temperature of the combustion gas falls below 850°C, the auxiliary burners shall not be fed with fuels which can cause higher emissions than those resulting from the burning of gasoil, as defined in Article 1(1) of Council Directive 75/716/EEC[38], liquefied gas or natural gas.

2. All co-incineration plants shall be designed, equipped, built and operated in such a way that the gas resulting from the co-incineration of waste is raised in a controlled and homogeneous fashion and even under the most unfavourable conditions, to a temperature of at least 850°C for at least two seconds.

3. Incineration and co-incineration plants shall have and operate an automatic system to prevent waste feed:

   (a) at start-up, until the temperature of 850°C has been reached;

   (b) whenever the temperature of 850°C is not maintained;

   (c) whenever the continuous measurements required by this Directive show that any emission limit value is exceeded due to disturbances or failures of the purification devices.

4. Conditions different from those laid down in paragraph 1 and specified in the permit for certain categories of waste or for certain thermal processes may be authorised by the competent authority. The change of the operational conditions shall not cause more residues or residues with a higher content of organic pollutants compared to those, which could be expected under the conditions laid down in paragraph 1.

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[38] OJ L 307, 27.11.1975, p. 22.

Conditions different from those laid down in paragraph 2 and specified in the permit for certain categories of waste or for certain thermal processes may be authorised by the competent authority. Such authorisation shall be conditional upon at least the provisions for emission limit values set out in Annex V for total organic carbon and CO being complied with.

All operating conditions determined under this paragraph and the results of verifications made shall be communicated to the Commission as part of the information provided in accordance with the reporting requirements.

5. All incineration and co-incineration plants shall be designed, equipped, built and operated in such a way as to prevent emissions into the air giving rise to significant ground-level air pollution; in particular, exhaust gases shall be discharged in a controlled fashion and in conformity with Community and other relevant air quality standards by means of a stack the height of which is calculated in such a way as to safeguard human health and the environment.

Any heat generated by the incineration or co-incineration process shall be recovered as far as possible.

Article 7

Air Emission Limit Values

1. Incineration plants shall be designed, equipped, built and operated in such a way that the emission limit values set out in Annex V are not exceeded in the exhaust gas:

2. The results of the measurements made to verify compliance with the emission limit values shall be standardised with respect to the conditions laid down in Article 11.

3. Where wastes are co-incinerated, the emission limit values as determined pursuant to Annex II shall apply.

4. In the case of co-incineration of untreated, mixed municipal waste, paragraph 3 shall not apply.

5. If waste falling within the scope of Directive 94/67/EC is co-incinerated or incinerated in the same plant as waste falling within the scope of this Directive, the emission limit values set out in Annexes II, IV and V to this Directive, respectively, shall apply with respect to the total amount of waste. As regards other requirements, the stricter of the provisions of Directive 94/67/EC or this Directive shall apply.

6. Notwithstanding paragraphs 3 and 5, if more than 40% of the resulting heat release in a plant referred to in paragraph 5 comes from waste falling within the scope of Directive 94/67/EC, the emission limit values set out in Annex V to this Directive shall apply.

Article 8

Water Discharges

1. Any waste water discharged from an incineration or co-incineration plant shall be subject to a permit.

2. Discharges to the aquatic environment of waste water resulting from the cleaning of exhaust gases shall be limited as far as possible.

3. Subject to a specific provision in the permit, the waste water from the cleaning of exhaust gases may be discharged after separate treatment on condition that:

   (a) the requirements of relevant Community, national and local provisions are complied with in the form of emission limit values; and

   (b) the mass concentrations of the polluting substances referred to in Annex IV do not exceed the emission limit values laid down therein.

4. The emission limit values shall apply at the point where the polluting substances referred to in Annex IV are discharged from the incineration or co-incineration plant.

   Where the waste water from the cleaning of exhaust gases is treated collectively with other on-site sources of similar waste water, the operator shall take the measurements referred to in Article 11:

   (a) on the waste water stream from the exhaust gas cleaning processes prior to its input into the collective waste water treatment plant;

   (b) on the other waste water stream or streams prior to its or their input into the collective waste water treatment plant;

   (c) at the point of final waste water discharge, after the treatment, from the incineration plant.

   The operator shall take appropriate mass balance calculations in order to determine the emission levels in the final waste water discharge that can be attributed to the waste water arising from the cleaning of exhaust gases in order to check compliance with the emission limit values set out in Annex IV.

5. The competent authorities shall ensure that in no instance does dilution of waste waters occur by mixing different waste water streams or otherwise, except where such mixing is part of a process duly licensed under the waste management licensing regulations.

6. The permit shall:

   (a) establish emission limit values for organic or inorganic polluting substances in accordance with paragraph 2 and in order to meet the requirements referred to in paragraph 3(a);

   (b) set operational control parameters at least for temperature and flow.

7. Incineration and co-incineration plant sites, including associated storage areas for wastes, shall be designed and operated in such a way as to prevent the release of any polluting substances into soil and groundwater in accordance with the provisions of Council Directive 80/68/EEC[39]. Moreover, storage capacity shall be provided for rainwater run-off from the incineration plant site or for contaminated water arising from spillage or fire-fighting operations.

   The storage capacity shall be adequate to ensure that such waters can be tested and treated before discharge where necessary.

Article 9

Residues

Residues resulting from the operation of the incineration or co-incineration plant shall be prevented or at least minimised in their amount and harmfulness. Residues shall be recycled as far as possible directly in the plant or outside in accordance with relevant Community legislation and national provisions.

Transport and intermediate storage of dry residues in the form of dust, such as boiler dust and dry residues from the treatment of combustion gases, shall take place in the form of e.g. closed containers.

Prior to determining the routes for the disposal or recycling of the residues from incineration and co-incineration plants, appropriate tests shall be carried out to establish the physical and chemical characteristics and the polluting potential of the different incineration residues. The analysis shall concern in particular the total soluble fraction and heavy metals soluble fraction.

[39] OJ L 20, 26.1.1980, p. 43.

Article 10

Control and Monitoring

Measurement equipment shall be installed and techniques used in order to monitor the parameters, conditions, mass concentrations and flows of the pollutants relevant to the incineration or co-incineration process.

The measurement requirements shall be laid down in the permit or in the conditions attached to the permit issued by the competent authorities.

The appropriate installation and the functioning of the automated monitoring equipment for emissions into air and water shall be subject to control and to an annual surveillance test by means of parallel measurements with the reference methods once a year.

The location of the sampling or measurement points shall be agreed with the competent authority.

Periodic measurements of the emissions into the air and water shall be carried out in accordance with Annex III, point 1.

Article 11

Measurement Requirements

1. Member States shall, either by specification in the conditions of the permit or by general binding rules, ensure that paragraphs 2 to 12, as regards air, and paragraphs 14 to 17, as regards water, are complied with.

2. The following measurements of air pollutants shall be carried out in accordance with Annex III at the incineration and co-incineration plant:

   (a) continuous measurements of the following substances: CO, total dust, TOC, HCl, HF, SO_2, Nox;

   (b) continuous measurements of the following process operation parameters: temperature near the inner wall of the combustion chamber, concentration of oxygen, pressure, temperature and water vapour content of the exhaust gas;

   (c) at least two measurements per year of heavy metals, dioxins and furans; one measurement every three months shall however be carried out for the first 12 months of operation.

3. The residence time as well as the minimum temperature and the oxygen content of the exhaust gases shall be subject to appropriate verification, at least once when the incineration or co-incineration plant is brought into service and under the most unfavourable operating conditions anticipated.

4. The continuous measurement of HF may be omitted if treatment stages for HCl are used which ensure that the emission limit value for HCl is not being exceeded. In this case the emissions of HF shall be subject to periodic measurements as laid down in paragraph 2(c).

5. The continuous measurement of the water vapour content shall not be required if the sampled exhaust gas is dried before the emissions are analysed.

6. Periodic measurements as laid down in paragraph 2(c) of HCl, HF and SO_2 instead of continuous measuring may be authorised by the competent authority in incineration or co-incineration plants, if the operator can prove that the emissions of those pollutants can under no circumstances be higher than the prescribed emission limit values.

7. The results of the measurements made to verify compliance with the emission limit values shall be standardised at the following conditions:

   (a) Temperature 273 K, pressure 101.3 kPa, 11% oxygen, dry gas;

   (b) Temperature 273 K, pressure 101.3 kPa, 3% oxygen, dry gas, in case of incineration of waste oil only as defined in Council Directive 75/439/EEC[40];

   (c) when the wastes are incinerated or co-incinerated in an oxygen-enriched atmosphere, the results of the measurements can be standardised at an oxygen content laid down by the competent authority reflecting the special circumstances of the individual case;

   (d) in the case of co-incineration, the results of the measurements shall be standardised at a total oxygen content as calculated in Annex II.

8. All measurement results shall be recorded, processed and presented in an appropriate fashion in order to enable the competent authorities to verify compliance with the permitted operating conditions and emission limit values laid down in this Directive in accordance with procedures to be decided upon by those authorities.

9. The emission limit values for air shall be regarded as being complied with if:

   (a) none of the daily average values exceeds any of the emission limit values set out in Annex V(e) first indent, and Annex V(a);

   (b) none of the half-hourly average values exceeds any of the emission limit values set out in Annex V(b);

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[40] OJ L 194, 25.7.1975, p. 23.

(c) none of the average values over the sample period set out for heavy metals and dioxins and furans exceeds the emission limit values set out in Annex V(c) and (d);

(d) the provisions of Annex V(e), second indent, are met.

10. The half-hourly average values and the 10-minute averages shall be determined within the effective operating time (excluding the start-up and shut-off periods if no waste is being incinerated) from the measured values after having subtracted the value of the confidence interval specified in point 2 of Annex III. The daily average values shall be determined from those validated average values.

To obtain a valid daily average value no more than five half-hourly average values in any day shall be discarded due to malfunction or maintenance of the continuous measurement system. No more than ten daily average values per year shall be discarded due to malfunction or maintenance of the continuous measurement system.

11. The average values over the sample period and, in the case of periodical measurements of HF, the average values for HF shall be determined in accordance with the requirements of Article 10.

12. Should the measurements taken show that the emission limit values laid down in this Directive have been exceeded, the competent authorities shall be informed without delay.

13. The Commission, acting in accordance with the procedure laid down in Article 17, shall decide, as soon as appropriate measurement techniques are available within the Community, the date from which continuous measurements of the air emission limit values for dioxins and heavy metals shall be carried out in accordance with Annex III.

14. The following measurements shall be carried out at the point of waste water discharge

(a) continuous measurements of the parameters referred to in Article 8(6)(b);

(b) instantaneous daily measurements of total suspended solids;

(c) monthly measurements of a representative 24-hour sampling of the polluting substances referred to in Article 8(3) with items 2 to 13 in Annex IV;

(d) at least two measurements per year of dioxins and furans; however one measurement every three months shall be carried out for the first 12 months of operation.

15. The measurements for the determination of concentrations of water polluting substances in the discharge shall be carried out representatively.

16. The monitoring of the mass of pollutants in the treated waste water shall be done in conformity with Community and national law and laid down in the permit as well as the frequency of the measurements. The measurements shall be carried out according to CEN standards and, if not available, to national standards.

17. The emission limit values for water shall be regarded as being complied with if:

(a) no representative 24-hour sampling exceeds the emission limit value set out in Annex IV for total suspended solids, polluting substance number 1; for heavy metals, polluting substances numbers 5 to 13, cadmium and thallium, substance number 3 and 4 and for mercury, substance number 2;

(b) the twice-yearly measurements of dioxins and furans do not exceed the emission limit value set out in Annex IV, polluting substance number 14.

Article 12

Access to Information and Public Participation in the Permit Procedure

Without prejudice to Council Directive 90/313/EEC[41] and Directive 96/61/EC, applications for new permits shall be made available to the public for an appropriate period to enable it to comment on them before the competent authority reaches a decision. That decision, including at least a copy of the permit, and any subsequent updates, shall also be made available to the public.

Article 13

Abnormal Operating Conditions

The competent authority shall lay down in the permit the maximum permissible period of any technically unavoidable stoppages, disturbances, or failures of the purification devices or the measurement devices, during which the concentrations in the discharges into the air and the purified waste water of the regulated substances may exceed the prescribed emission limit values.

In case of a breakdown, the operator shall reduce or close down operations as soon as practicable until normal operations can be restored.

The incineration plant or co-incineration plant or incineration line shall under no circumstances continue to incinerate waste for a period of more than four hours uninterrupted where emission limit values are exceeded; moreover, the cumulative duration of operation in such conditions over one year shall be less than 60 hours.

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41 OJ L 158, 23.6.1990, p. 56.

The total dust content of the emissions into the air of an incineration plant shall under no circumstances exceed 150 mg/m3 expressed as a half-hourly average; moreover the air emission limit values for CO and TOC shall not be exceeded. All other conditions referred to in Article 6 shall be complied with.

Article 14

Permit Review

Without prejudice to Directive 96/61/EC, the competent authority shall periodically reconsider and, where necessary, update permit conditions.

Article 15

Reporting

The reports on the implementation of this Directive shall be established in accordance with the procedure laid down in Article 5 of Council Directive 91/692/EEC[42]. The first report shall cover the first full three-year period after the date specified in Article 21.

Article 16

Future Adaptation of the Directive

The Commission, in accordance with the procedure laid down in Article 17, shall amend Articles 10, 11 and 12 and Annexes I to V in order to adapt them to technical progress or new findings concerning the health benefits of emission reductions.

Article 17

Committee

1. For the purposes of the application of this Directive, the Commission shall be assisted by the Committee established under Article 16 of Directive 94/67/EC.

2. The representative of the Commission shall submit to the committee a draft of the measures to be taken. The committee shall deliver its opinion on the draft within a time limit which the chairman may lay down according to the urgency of the matter. The opinion shall be delivered by the majority laid down in Article 148(2) of the Treaty in the case of decisions which the Council is required to adopt on a proposal from the Commission. The votes of the representatives of the Member States within the committee shall be weighted in the manner set out in that Article. The Chairman shall not vote.

   The Commission shall adopt the measures envisaged if they are in accordance with the opinion of the Committee.

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[42] OJ L 377, 31.12.1991, p, 48.

If the measures envisaged are not in accordance with the opinion of the committee, or if no opinion is delivered, the Commission shall, without delay, submit to the Council a proposal relating to the measures to be taken. The Council shall act by a qualified majority.

If, on the expiry of a period of three months from the date of referral to the Council, the Council has not acted, the proposed measures shall be adopted by the Commission.

Article 18

Repeal

Directives 89/369/EEC and 89/429/EEC shall be repealed five years after the entry into force of this Directive.

Article 19

Penalties

The Member States shall lay down the rules on penalties applicable to infringements of the national provisions adopted pursuant to this Directive and shall take all measures necessary to ensure that they are implemented. The penalties provided for must be effective, proportionate and dissuasive. The Member States shall notify those provisions to the Commission by the date specified in Article 21 at the latest and shall notify it without delay of any subsequent amendment affecting them.

Article 20

Transitional Provisions

The provisions of this Directive shall apply to existing plants five years after the date of entry into force of this Directive.

Article 21

Bringing into Effect

1. Member States shall bring into force the laws, regulations and administrative provisions necessary to comply with this Directive no later than two years after its entry into force. They shall forthwith inform the Commission thereof.

   When Member States adopt those measures, they shall contain a reference to this Directive or be accompanied by such a reference on the occasion of their official publication. Member States shall determine how such reference is to be made.

2. Member States shall communicate to the Commission the texts of the provisions of national law which they adopt in the field covered by this Directive.

Article 22

Entry into Force

This Directive shall enter into force on the twentieth day following that of its publication in the *Official Journal of the European Communities.*

Article 23

Addressees

This Directive is addressed to the Member States.

Done at Brussels,

For the Council
The President

ANNEX I

Equivalence factors for dibenzo-p-dioxins and dibenzofurans

For the determination of the total concentration (TE) of dioxins and furans the mass concentrations of the following dioxins and dibenzofurans shall be multiplied by the following equivalence factors before summing:

		Toxic equivalence factor
2,3,7,8	- Tetrachlorodibenzodioxin (TCDD)	1
1,2,3,7,8	- Pentachlorodibenzodioxin (PeCDD)	0.5
1,2,3,4,7,8	- Hexachlorodibenzodioxin (HxCDD)	0.1
1,2,3,6,7,8	- Hexachlorodibenzodioxin (HxCDD)	0.1
1,2,3,7,8,9	- Hexachlorodibenzodioxin (HxCDD)	0.1
1,2,3,4,6,7,8	- Heptachlorodibenzodioxin (HpCDD)	0.01
	- Octachlorodibenzodioxin (OCDD)	0.001
2,3,7,8	- Tetrachlorodibenzofuran (TCDF)	0.1
2,3,4,7,8	- Pentachlorodibenzofuran (PeCDF)	0.5
1,2,3,7,8	- Pentachlorodibenzofuran (PeCDF)	0.05
1,2,3,4,7,8	- Hexachlorodibenzofuran (HxCDF)	0.1
1,2,3,6,7,8	- Hexachlorodibenzofuran (HxCDF)	0.1
1,2,3,7,8,9	- Hexachlorodibenzofuran (HxCDF)	0.1
2,3,4,6,7,8	- Hexachlorodibenzofuran (HxCDF)	0.1
1,2,3,4,6,7,8	- Heptachlorodibenzofuran (HpCDF)	0.01
1,2,3,4,7,8,9	- Heptachlorodibenzofuran (HpCDF)	0.01
	- Octachlorodibenzofuran (OCDF)	0.001

ANNEX II

Determination of emission limit values for the co-incineration of waste

The limit value for each relevant pollutant and carbon monoxide in the exhaust gas resulting from the co-incineration of waste shall be calculated as follows:

$$\frac{V_{waste} * C_{waste} + V_{proc} * C_{proc}}{V_{waste} + V_{proc}} = C$$

V_{waste}: exhaust gas volume resulting from the incineration of waste only determined from the waste with the lowest calorific value specified in the permit and standardised at the conditions given by this Directive.

C_{waste}: emission limit values set for plants intended to incinerate wastes only (at least the emission limit values for the pollutants and carbon monoxide).

V_{proc}: exhaust gas volume resulting from the plant process including the combustion of the authorised fuels normally used in the plant (wastes excluded) determined on the basis of oxygen contents at which the emissions must be standardised as laid down in Community or national regulations. In the absence of regulations for this kind of plants, the real oxygen content in the exhaust gas without being thinned by addition of air unnecessary for the process must be used. The standardisation at the other conditions is given in this Directive.

C_{proc}: emission limit values as laid down in the tables of this annex for certain industrial sectors or in case of the absence of such a table or such values, emission limit values of the relevant pollutants and carbon monoxide in the flue gas of plants which comply with the national laws, regulations and administrative provisions for such plants while burning the normally authorised fuels (wastes excluded). In the absence of these measures the emission limit values laid down in the permit are used. In the absence of such permit values the real mass concentrations are used.

C : total emission limit values as laid down in the tables of this annex for certain industrial sectors and certain pollutants or in case of the absence of such a table or such values total emission limit values for CO and the relevant pollutants replacing the emission limit values as laid down in specific Articles of this Directive. The total oxygen content to replace the oxygen content for the standardisation is calculated on the basis of the content above respecting the partial volumes.

II.1 Special provisions for cement kilns

Daily average values (for continuous measurements) Sample periods and other measurement requirements as in Article 7. All values in mg/m^3 (Dioxins ng/m^3).

The results of the measurements made to verify compliance with the emission limit values shall be standardised at the following conditions: Temperature 273 K, pressure 101.3 kPa, 10 % oxygen, dry gas,

II.1.1 C - total emission limit values

Pollutant	C
Total Dust	**30**
HCl	**10**
HF	**1**
NO_X	**800**
Cd + Tl	**0.05**
Hg	**0.05**
Sb, As, Pb, Cr, Co, Cu, Mn, Ni, V	**0.5**
Dioxins and furans	**0.1**

II.1.2 C – total emission limit values for SO_2 and TOC:

Pollutant	C
SO_2	**50**
TOC	**10**

Exemptions may be authorised by the competent authority in cases where TOC and SO_2 do not result from the incineration of waste.

II.1.3 Emission limit value for CO:

Emission limit values for CO can be set by the competent authority.

II.2 Special provisions for large combustion plants

II.2.1 C_{proc}:

C_{proc} for solid fuels expressed in mg/Nm^3 (O_2 content 6%):

Pollutants	50 to 100 MWth	100 to 300 MWth	> 300 MWth
SO_2 general case	**850**	**850 to 200 (linear decrease from 100 to 300 MWth)**	**200**
indigenous fuels	**or rate of desulphurisation ≥90%**	**or rate of desulphurisation ≥92%**	**or rate of desulphurisation ≥95%**
NOx	**400**	**300**	**200**
Dust	**50**	**30**	**30**

C_{proc} for biomass (as defined in Council Directive 88/609/EEC as amended) expressed in mg/Nm^3 (O_2 content 6%):

Pollutants	50 -100 MWth	100 - 300 MWth	> 300 MWth
SO_2	**200**	**200**	**200**
NOx	**350**	**300**	**300**
Dust	**50**	**30**	**30**

C_{proc} for liquid fuels expressed in mg/Nm^3 (O_2 content 3%):

Pollutants	50 to 100 MWth	100 to 300 MWth	> 300 MWth
SO_2	**850**	**850 to 200 (linear decrease from 100 to 300 MWth)**	**200**
NOx	**400**	**300**	**200**
Dust	**50**	**30**	**30**

II.2.2 C - total emission limit values:

C expressed in mg/Nm^3 (O_2 content 6%). All average values over the sample period of a minimum of 30 minutes and a maximum of 8 hours:

Pollutant	**C**
Cd + Tl	0.05
Hg	0.05
Sb + As + Pb + Cr + Co + Cu + Mn + Ni + V	0.5

C expressed in ng/Nm^3 (O_2 content 6%). All average values measured over the sample period of a minimum of 6 hours and a maximum of 8 hours:

Pollutant	C
Dioxins and furans	0.1

II.3 Special provisions for other industrial sectors

II.3.1 C - total emission limit values:

C expressed in ng/Nm^3. All average values measured over the sample period of a minimum of 6 hours and a maximum of 8 hours:

Pollutant	C
Dioxins and furans	0.1

C expressed in mg/Nm^3.All average values over the sample period of a minimum of 30 minutes and a maximum of 8 hours:

Pollutant	C
Cd + Tl	0.05
Hg	0.05

ANNEX III

Measurement Techniques

1. Sampling and analysis of all pollutants including dioxins and furans as well as reference measurement methods to calibrate automated measurement systems shall be carried out as given by CEN-standards elaborated on the basis of mandates by the Commission. While awaiting the elaboration of the CEN-standards, national standards shall apply.

2. At the daily emission limit value level, the values of the 95% confidence intervals of a single measured result shall not exceed the following percentages of the emission limit values:

Carbon monoxide	:	10%
Sulphur dioxide	:	20%
Nitrogen dioxide	:	20%
Total dust	:	40%
Total organic carbon	:	30%
Hydrogen chloride	:	40%

ANNEX IV

Emission Limit Values
for discharges of waste water
from the cleaning of exhaust gases

Polluting substances	Emission limit values expressed in mass concentrations
1- Total suspended solids as defined by Directive 91/271/EEC[43]	20 mg/l
2- Mercury and its compounds, expressed as mercury (Hg)	0.02 mg/l
3- Cadmium and its compounds, expressed as cadmium (Cd)	0.05 mg/l
4- Thallium and its compounds, expressed as thallium (Tl)	
5- Antimony and its compounds, expressed as antimony (Sb)	5 mg/l
6- Arsenic and its compounds, expressed as arsenic (As)	
7- Lead and its compounds, expressed as lead (Pb)	
8- Chromium and its compounds, expressed as chromium (Cr)	
9- Cobalt and its compounds, expressed as cobalt (Co)	
10- Copper and its compounds, expressed as copper (Cu)	
11- Manganese and its compounds, expressed as manganese (Mn)	
12- Nickel and its compounds, expressed as nickel (Ni)	
13- Vanadium and its compounds, expressed as vanadium (V)	

14 - Dioxins and furans, defined as the sum of the individual dioxins and furans evaluated in accordance with Annex I	0.5 ng/l

[43] OJ L 135, 30.5.1991, p. 40.

ANNEX V

AIR EMISSION LIMIT VALUES

(a) Daily Average Values

Total dust	10 mg/m^3
Gaseous and vaporous organic substances, expressed as total organic carbon	10 mg/m^3
Hydrogen chloride (HCl)	10 mg/m^3
Hydrogen fluoride (HF)	1 mg/m^3
Sulphur dioxide (SO_2)	50 mg/m^3
Nitrogen monoxide (NO) and nitrogen dioxide (NO_2), expressed as nitrogen dioxide for existing incineration plants with a capacity exceeding 3 tonnes per hour or new incineration plants	200 mg/m^3
Nitrogen monoxide (NO) and nitrogen dioxide (NO_2), expressed as nitrogen dioxide for existing incineration plants with a capacity of 3 tonnes per hour or less	400 mg/m^3

(b) Half-hourly Average Values

Total dust	30 mg/m^3
Gaseous and vaporous organic substances, expressed as total organic carbon	20 mg/m^3
Hydrogen chloride (HCl)	60 mg/m^3
Hydrogen fluoride (HF)	4 mg/m^3
Sulphur dioxide (SO_2)	200 mg/m^3
Nitrogen monoxide (NO) and nitrogen dioxide (NO_2), expressed as nitrogen dioxide for existing incineration plants with a capacity exceeding 3 tonnes per hour or new incineration plants	400 mg/m^3

(c) All average values over the sample period of a minimum of 30 minutes and a maximum of 8 hours

Cadmium and its compounds, expressed as cadmium (Cd)	
Thallium and its compounds, expressed as thallium (Tl)	total 0.05 mg/m^3
Mercury and its compounds, expressed as mercury (Hg)	0.05 mg/m^3
Antimony and its compounds, expressed as antimony (Sb)	
Arsenic and its compounds, expressed as arsenic (As)	
Lead and its compounds, expressed as lead (Pb)	
Chromium and its compounds, expressed as chromium (Cr)	
Cobalt and its compounds, expressed as cobalt (Co)	total 0.5 mg/m^3
Copper and its compounds, expressed as copper (Cu)	
Manganese and its compounds, expressed as manganese (Mn)	
Nickel and its compounds, expressed as nickel (Ni)	
Vanadium and its compounds, expressed as vanadium (V)	

These average values cover also gaseous and the vapour forms of the relevant heavy metal emissions as well as their compounds.

(d) Average values shall be measured over a sample period of a minimum of 6 hours and a maximum of 8 hours. The emission limit value refers to the total concentration of dioxins and furans calculated using the concept of toxic equivalence in accordance with Annex I.

Dioxins and furans	0.1 ng/m^3

(e) The following emission limit values of carbon monoxide (CO) concentrations shall not be exceeded in the combustion gases(excluding the start-up and shut-down phase):

- 50 milligrams/m^3 of combustion gas determined as daily average value;

- 150 milligrams/m^3 of combustion gas of at least 95 % of all measurements determined as 10-minute average values or 100 mg/m3 of combustion gas of all measurements determined as half-hourly average values taken in any 24-hour period.

Exemptions may be authorised by the competent authority for incineration plants using fluidised bed technology, provided that the authorisation foresees an emission limit value for carbon monoxide (CO) of not more than 100 mg/m^3 as a hourly average value.