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Proposal for a
COUNCIL DIRECTIVE
on the incineration of hazardous waste

(presented by the Commission)

EXPLANATORY MEMORANDUM

Introduction

In many Member States appropriate sites for safe disposal of waste are less and less available, so that other solutions must urgently be found. Incineration under stringent emission control requirements can strongly reduce the volume of waste which needs disposal. In its Resolution of 7 May 1990 on waste policy the Council of Ministers sets out that waste which cannot be recycled or reused has to be disposed of in the most environmentally safe manner. After adoption of two Directives on the incineration of municipal waste in 1989, the Council now invites the Commission to complete its proposals on incinerators for industrial waste, as a matter of urgency.

Although statistics on waste generation are difficult to compare due to the lack of a harmonised nomenclature, there is no doubt that hazardous waste is generated in all Member States and may account for approximately 2-20 % of the total waste generated in each Member State. The negative effects on the environment, in particular the air-pollution, caused by the incineration of "non-hazardous" waste being already dealt with by the Directives on the prevention and reduction of air pollution from new/existing municipal waste incineration plants (89/369/EEC and 89/429/EEC), this Directive proposal sets out the necessary provisions to prevent or minimize the negative impact on the environment resulting from the incineration of "hazardous wastes".

A more integrated approach towards the protection of the environment has been put forward by provisions of this Directive proposal covering not only the air pollution but also the protection of the soil, the surface and the groundwater, taking into account existing community legislation in these fields.

Following the Directive 78/319 (revised) wastes are considered hazardous due to their properties and constituents. Consequently the incineration of such wastes may cause harmful emissions if they contain polluting substances listed in Annex II of Council Directive 84/360/EEC, in particular organic compounds, HCl, HF and heavy metals or dioxins and furans which are considered highly dangerous. Given this harmful polluting potential, adequate measures based on the latest developments concerning prevention/reduction techniques must be taken to prevent or minimize emissions.

Abatement Techniques and Emissions Standards

However, referring only to BATNEEC (= Best Available Technologies Not Entailing Excessive Costs) for the purpose of preventing or minimizing emissions, which is the case in Council Directive 84/360/EEC, would in this case appear insufficient, in particular with respect to emissions resulting from dioxins, furans and mercury. If BATNEEC alone were applied, only those technologies used in plants authorized at least 5 years ago would be considered. At that time, however, the need to minimize dioxins and furans emissions was not so obvious, nor was the appropriate technical equipment to minimize them developed.

At the other hand, it appears not to be appropriate, for the time being to fix a legally binding emission limit value for dioxins and furans in the Directive proposal, since it is not possible to measure these emissions continuously with the measurement techniques currently available. Indeed, it takes some weeks to obtain the results of each spot check measurement, and strictly speaking, this result gives evidence for the operation of the plant during the sampling time only. Extrapolating from this result the emission behaviour of a plant burning waste of possibly different composition, would not be a reliable method to ensure the respect of a legally binding limit value. Neither would it be appropriate to close down a waste incineration plant on the basis of an analytical result obtained some weeks only after having taken the sample.

Therefore, and while awaiting the development of better monitoring methods, the Directive proposal provides for a specific obligation to minimize the emissions of dioxins and furans by the most progressive techniques and to make every effort not to exceed a guide value of 0,1 ng Toxic Equivalent/m³. It may be pointed out that Germany and the Netherlands have fixed this value as a legally binding emission limit value.

Most experts consider that, at the present time, only activated carbon filters would be able to reduce dioxin and furan emissions below this limit. Such filters are newly developed and the first one will most likely start operating in a hazardous waste incineration plant by early 1992; but experience with satisfactory results is already available from the treatment of smaller parts of the exhaust gas of waste incineration plants. Moreover, these filters are well suited to reduce the emissions of the other pollutants to a very small amount, in particular mercury. This efficiency, as well as the efficiency for dioxin reduction, is guaranteed by important manufacturers of exhaust gas treatment plants. In this respect the Land "Nordrhein-Westfalen", in Germany, has already stated in 1990 that activated carbon filters minimizing dioxin and furan emissions meet "state of the art" in the sense of the German Federal Immission Control Law. Other reduction techniques are already in operation (activated carbon in drifting stream processes with baghouse filters) or are still under development (e.g. catalysts).

To protect the environment against pollution resulting from the incineration of hazardous waste, very stringent emissions limit values are set in the Directive proposal. The Commission is wanting a sign to be set for its point of view on an effective environmental protection. As far as the limit values have not already been fixed by the progressive Dutch "Richtlijn Verbranden 89" and by the German "Verordnung über Verbrennungsanlagen für Abfälle und ähnliche brennbare Stoffe (17. BImSchVO), important equipment manufacturers guarantee the technical feasibility to meet values even below the limit values set out in the Directive proposal.

The tight limit value for "total organic carbon", which contains many known but also innumerable unknown and possibly harmful or even carcinogenic substances, can be met if progressive techniques are used to incinerate the wastes as completely as possible; also dioxins and furans are part of total organic carbon.

In order to respect the integrated approach towards environmental protection, the pollutants removed from the exhaust gas by wet treatment methods at new plants shall not be discharged with the waste water, but have to be recycled at the site. Heat energy necessary to evaporate such waste water can be obtained from the incineration process itself whilst the residues contained in the waste waters and the residues resulting from the incineration must be disposed of according to their nature. Existing plants may still discharge waste waters but only after appropriate treatment according to the provisions of Directive 76/464/EEC and its daughter directives.

Dynamic Evolution of Abatement Techniques

In the last few years, the developments of reduction techniques in the field of waste incineration have progressed so rapidly that more stringent emission limit values can and have to be fixed. For example, the emission limit values of the German TA Luft of 1986 have been outstripped by progressive techniques so that, already in 1990, a new regulation could enter into force with limit values considerably more stringent than the 1986 TA Luft-values. The limit for HCl, for example, was lowered to a fifth of its previous level. Further technical achievements in this area appear to be possible.

Therefore, this directive proposal intends to preserve and reward the dynamism of technical progress, not only by requiring that stringent emission limit values are respected, but also by requiring the use of "recently" developed techniques which are appropriate to prevent environmental pollution. For this reason, permits for hazardous waste incineration plants may only be issued if at that time all appropriate preventive measures against environmental pollution, in particular those recently developed, are taken, and if the relevant requirements of the Directive are met as a minimum. In this way, it is hoped that the development and improvement of environmental protection techniques becomes rewarding so that more progressive techniques with lower emissions to the environment will be used in new plants and some years later also in existing plants.

The modifications required to adapt the directive to the technical progress will be adopted in accordance with the procedure laid down in the directive.

Adaptation of existing Plants

In order to reduce substantially the environmental pollution caused by the incineration of hazardous wastes, it is important that all existing plants are brought to the standard of new plants within 3 years from the date of implementation of this Directive. In particular small plants may continue to operate without adaptation during a maximum of 5 years after that date before being shut down.

Specific Operating Conditions

In order to destroy as completely as possible the organic compounds appropriate measures have to be taken, particularly in the case of the incineration of barrels containing hazardous waste. Operation parameters (e.g. temperature, oxygen concentration in the exhaust gas) as well as CO and total organic carbon shall be measured continuously in order to ensure the optimization of the incineration conditions. In case of disturbances or breakdowns, additional measures have to be taken to prevent air pollution. Given the stringent emission limit values, correspondingly low concentrations of certain pollutants must be measured continuously by means of high quality measurement equipment and appropriate reference measurement methods for the calibration of this equipment. The maximum confidence intervals laid down shall guarantee comparable measurement results within the Community under realistic operating conditions.

In order to achieve as complete an incineration as possible, which is necessary to meet the emission limit value for total organic carbon, an appropriate design of the incinerator and/or appropriate pretreatment, including mixing of the wastes, is necessary, in particular for the incineration of barrels. This measure should not cause much higher costs for new plants; for existing plants, it will depend on the individual case. Also the addition of oxygen in the case of the incineration of unopened barrels may be financially rewarding because this measure may well allow the capacity of burning barrels to be raised.

Specific importance is to be given to the delivery and reception of the hazardous wastes at the site. The knowledge of the properties and constituents of the wastes makes it easier to control the incineration and the emissions therefrom, so that variable but no unexpected waste compositions nor unauthorized wastes are being burnt. Measures to avoid or minimize harmful emissions resulting from the intermediate storage and pretreatment, including mixing of the wastes, have to be taken.

Hazardous Waste Incineration in other Plants

As a matter of principle, one should not limit the incineration of hazardous waste to specifically designed installations, provided that appropriate precautions are taken in such a way that the same environmental protection is guaranteed.

Therefore, the incineration of hazardous waste as additional fuel in plants not solely destined to this purpose is only permitted if this does not cause higher emissions of polluting substances.

However, since the exhaust gas volume resulting from this incineration is only a part of the total exhaust gas volume, it is difficult to measure the diluted emissions which may contain dioxins and furans as well as many other dangerous or even cancerogenic substances. It may become impossible if the additional waste incinerated accounts for only a very small percentage of the total exhaust gas volume, although for that percentage the limit values may have been exceeded several times. In this case the plant would take the role formerly played by the North Sea for hazardous wastes burnt at sea. It is unlikely that it could fulfill all conditions laid down for exclusive hazardous waste incineration plants, in particular the obligations concerning the oxygen content after the last injection of combustion air and the limit values for CO.

For this reason, a minimum quantity of dangerous wastes being burnt as additional fuel has to be set so that variations in the exhaust gases become measurable and the respect of the main provisions of the directive proposal can be ensured. To this end, the amount of the heat released resulting from such additional incineration of waste is set to at least 10 % of the total heat released. Below this threshold all provisions of this directive proposal will apply, as well as in the case where the heat resulting from the incineration of additional hazardous waste amounts to more than 40 % of the total heat released, because then the main purpose of the plant is considered to be the incineration of hazardous wastes. For any incineration of dangerous wastes as additional fuel, appropriate emission limit and guide values must be evaluated on the ratio of the exhaust gas volumes resulting from the incineration of either the hazardous wastes or the authorised fuels only.

When issueing a permit for such an incineration, the competent authority may grant exemptions concerning the percentage requirements during a period not longer than 6 months after starting such an incineration

Information and Reporting

As this directive proposal requires the national competent authorities, when issueing or reviewing incineration permits, to check if all preventive measures - in line with technical progress - have been taken, it is of high interest to each Member State and the Commission that information on techniques concerning the incineration of hazardous wastes and the prevention or minimization of harmful emissions to the environment is generally available within the Community.

To this end, the Commission assisted by a Committee shall annually submit to the Member States a summary report on the progress in emission control techniques already implemented and any further major technical developments in this field. Member States shall ensure that the summary reports are disseminated to their competent authorities.

Public information on the incineration of hazardous waste and the emissions therefrom is ensured by procedures provided for in Community law (impact assessment to be carried out before granting the permit)

and the results of monitoring which have to be made available to the public.

Reporting on the general implementation of this directive shall be carried out according to the procedures laid down in article 5 of the Directive on standardisation and rationalisation of reports on the implementation of certain directives relating to the environment 91/692/EEC.

Cost Aspects

The very stringent provisions which must be fulfilled to build and operate a hazardous waste incineration plant implies an increase in the investment costs. The rise in costs, however, should not be valued on the basis of a comparison between the weakest techniques used in several existing plants and those techniques necessary to meet the provisions of this Directive proposal. Rather the existing plants with an acceptable standard of environmental protection should be taken as a reference. In this respect, one may refer to the equipment necessary to minimize emissions of dioxins and furans to 0,1 ng Toxic Equivalent/m³ and of mercury to 0,05 mg/m³ and which most plants do not possess yet. Besides an exhaust gas treatment train, at least consisting of a very efficient dust removal and scrubbing or equivalent measures, an activated carbon filter or an equivalent equipment is necessary as an additional measure to minimize in particular the emissions of mercury and dioxins.

A cost estimate (site excluded) is given below for the example of a combination of progressive techniques required as a minimum to meet the provisions of the Directive; combinations of other techniques can give comparable results. The estimate is mainly based on 1988 prices for a rated annual capacity of two times 55 000 tons (two incineration lines):

	MECU
2 rotary kilns with after-burner chamber	10
2 steam boilers	9
2 exhaust gas treatment trains consisting mainly of: dry electrostatic precipitator (dust concentration at outlet < 30 mg/m ³), two-stage wet scrubber, condensation of water vapour, wet electrostatic precipitator	24
Equipment to evaporate about 225 000 t/a waste water including rain water (contaminated) and cleaning water	37
Reception, laboratory, intermediate storage including transportation equipment at site	17
Service facilities with energy generation	7
Electrical equipment	10
Control equipment	10
	MECU
Buildings and infrastructure	37
2 activated carbon filters for an exhaust gas volume of about 50 000 m ³ /h each deduced from offers of important manufacturers in 1990	9
TOTAL	170
Contingencies (10%)	17
Interest during construction (10% averaged over 3 years)	28
	215 MECU
Specific investment	1950 ECU/t*y

The cost per ton of hazardous waste incinerated in this plant may be estimated under the following assumptions :

- depreciation period of the plant	10 years
- interest rate	10%
- instalment rate	16,28%/y
- personnel (40 000 ECU/y each on average)	220
- annual load factor	80%

- operating cost	190 ECU/t
- personnel	100 ECU/t
- capital cost	390 ECU/t

TOTAL	680 ECU/t
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If there were only one incineration line with the double capacity, the cost could be lowered considerably. Additional cost should be taken into account if a treatment of the residues would be necessary at the site.

To update existing plants, one or more of the above-mentioned measures or comparable measures must be taken. A cost estimate can be deduced from the amounts given above. The updating costs depend, however, on the effectiveness of the measures already taken to protect the environment from pollution resulting from the incineration of hazardous wastes.

Legal basis

The legal basis proposed for this Directive is Article 100A of the EEC Treaty.

Article 100A has as an/its objective the approximation of national legislation which might affect the establishment and functioning of the internal market.

Differing technical standards which apply to incineration plants for hazardous waste, seriously influence the incinerating activity, in particular with regard to the costs which arise from the nature of the technical standards imposed and the level of environmental protection herewith ensured.

The current differences in national provisions applicable to the incineration of hazardous waste, and in some cases the absence of such provisions, are consequently liable to distort competition, affect the free movement of goods in the internal market and give rise to differences in the protection of health and environment.

It is therefore the aim of this Directive proposal to provide for harmonized measures and procedures in order to prevent and minimize as far as possible the effects to human health and the environment resulting from the incineration of hazardous waste, ensuring a high level of environmental protection in all Member States, and at the same time impeding the risk of a flow of waste towards lower cost incineration plants due to less strict environmental standards.

The provisions of this Directive proposal, in particular those concerning the operating conditions and emission limit values, are considered necessary to ensure such a high level of environmental protection and need to be adopted and implemented by the Member States while respecting the principles of the internal market and free competition.

Finally, it is part of the Commission's view that, for an integrated implementation of its waste policy, its implications and likely effects on the internal market necessarily need to be taken into account.

For these reasons, it is considered necessary to adopt standards at a high level of environmental protection, that will be implemented in all Member States, as a measure to :

- a) prevent or minimize environmental damage which may be caused by the incineration of hazardous wastes, and
- b) impede the flow of waste towards lower cost incineration plants due to less strict environmental standards, as this would seriously affect the principle of free competition as well as to
- c) promote and ensure a reduction of waste movements within the Community, according to Council Directive 91/156/EEC of 18 March 1991 amending Directive 75/442/EEC on waste⁽¹⁾.

(1) OJ No L 78, 26.3.1991, p. 32.

Short Explanation to the Articles

Article 1

As indicated in the 4th Action Programme on the Environment, the aim of this Directive is to prevent or minimize emissions resulting from all incineration of hazardous wastes which may be harmful to the human health and all environmental media.

Article 2

The definition of hazardous wastes covers only those wastes which are considered hazardous by the Directive on hazardous waste (revised). This implies that, without spelling it out explicitly, this directive does not cover the cremation of human corpses. Also, the definition does not mean that the wastes must be burnt. Excluded from the scope of this article are municipal wastes and some combustible liquid wastes which cannot cause the specific harmful emissions resulting from the incineration of hazardous wastes due to their characteristics and constituents. Where waste oils as defined in Council Directive 75/439/EEC are incinerated, and if the waste oil treated is considered hazardous by the Council Directive on hazardous wastes, the incineration must take place in accordance with this Directive. If the waste oils are not considered hazardous, they may be incinerated in accordance with the provisions of Article 8 of Council Directive 75/439/EEC.

Not only specific technical equipment to incinerate hazardous wastes is considered to be an incineration plant, but in principal also any plant burning such wastes as a fuel. This comprehensive definition ensures that the aim of the Directive is respected by every plant whenever hazardous wastes are incinerated, without prejudice to the specific provisions laid down in Article 3, paragraph 4.

Article 3

The first 3 paragraphs contain the conditions under which a permit to operate an incineration plant may be granted. In order to take into account the dynamic technical development of reduction techniques, the permit may only be given if all appropriate measures against environmental pollution have been taken, and if the provisions of the Directive are met as a minimum. In this way, it is ensured that the recently developed technical measures shall apply as soon as possible to new incineration plants and, having regard to the period set by articles 14 and 15 also to existing plants.

The incineration of hazardous wastes as an additional fuel in plants not solely destined for incineration may cause additional emissions which cannot be measured due to the important dilution of the total exhaust gas volume, even if their concentrations are very much higher than allowed by the Directive. Moreover, some conditions of Article 7 destined to achieve as complete an incineration as possible cannot be fulfilled: e. g. the CO concentration as an indicator for such

an incineration is far exceeded by cement kilns. For these reasons, it must be ensured that any changes likely to occur in the emission concentrations of the regulated pollutants are so large that they can be measured. This is considered possible if the heat released resulting from the additional incineration of waste amounts to at least 10% of the total heat released; below this threshold, the whole Directive has to apply to the operation of such a plant. All provisions of the Directive shall also apply, if the percentage of the heat released resulting from the additional incineration of hazardous wastes amounts to more than 40% of the total heat released because then the main purpose of the plant is considered to be the incineration of hazardous wastes.

When issuing a permit for such an incineration, the competent authority may grant exemptions from the percentage requirement for a period not longer than 6 months after starting such an incineration. These provisions in combination with Article 8, paragraph 4 and Annex V are necessary to ensure that no higher emissions will be caused by the additional incineration of hazardous wastes than by the incineration of such wastes in plants built for this purpose only. Taking into account the usually required optimization procedures after start-up of such a plant burning additionally hazardous waste, it should be demonstrated at the latest six months after starting operation that the provisions above are met, otherwise the permit shall expire after that period.

Article 4

This article ensures, according to Council Directives 84/360/EEC, 89/369/EEC and 89/429/EEC, the public transparency of the authorization procedures and of the monitoring results.

Article 5

The requirements set in this article (regarding the delivery of wastes to the plant) are to ensure that characteristics and constituents of the hazardous wastes are known to the operator of the incineration plant with a view to control the incineration process and the raw gas concentrations, in particular if wastes are mixed at the plant. In this respect, Annex TN I provides detailed information concerning the practical organisation of the requirements laid down in this Article. The keeping of samples for at least 10 days after incineration enables the competent authority, in particular in the case of Article 13, paragraph 1, to control whether delivery and reception requirements have been complied with.

Article 6

During intermediate storage and pretreatment operations, there is also an obligation to avoid or minimize emissions. More information on the techniques currently in use at this end is indicated in TN II.

Article 7

This article sets general and specific requirements for the design and the operation of incineration plants. Annex TN III indicates currently available technologies. In order to ensure as complete an incineration as possible and to destroy dangerous halogenated organic wastes with a minimum of dioxin and furan formation, the temperature in the combustion chamber must be raised to 1200°C and the hot gases be kept at that temperature for at least two seconds in the presence of at least 6% oxygen. For non-halogenated organic wastes, the temperature may be lower but not less than 850°C. Requirements different from those may be authorized, provided that with the use of appropriate techniques, the levels of dioxin and furan emissions are not higher than those achieved with the regular requirements.

The hazardous waste feed is not permitted unless the main plant operating parameters are within the required limits. Feeding with hazardous wastes must also be prevented if emission limit values are exceeded due to disturbances or failures of the purification devices. (The case of technically unavoidable stoppages, disturbances or failures of the purification devices is dealt with specifically by Article 13.)

Some hazardous wastes are easier to incinerate completely, therefore they may be burnt with a lesser excess of oxygen of 3% at least.

Dioxins and furans formed during or after combustion are generally adsorbed at the fly-ash particles. To minimize the deposit of the particles before they enter the dust arrestment plant appropriate ducting of the exhaust gases and frequent cleaning of the ducts and heating surfaces is required.

Article 8

The emission limit values specified in this article correspond to those achievable by the application of the best available techniques for emission reduction, they are underpinned by guarantees of equipment manufacturers and limited operating experience at industrial scale.

Limit values of comparable severity for most of the substances to be monitored continuously have already been laid down in 2 Member States as far as daily average values are concerned. The short-term limit value averaged over half an hour are tighter than existing national legislation but reflect as well the current state of achieved technology and monitoring capabilities.

For the specific heavy metals emitted by the plant, a somewhat longer sampling time is required to collect enough material. The gaseous and the vapour forms of these substances must be sampled as well by appropriate methods because the tight limit values stipulated cover all forms of heavy metal emissions. Such an approach is necessary to render environmentally acceptable the incineration of hazardous waste. By using sophisticated (although expensive) analytical equipment, the samples taken can in principle be analysed within a few hours so that the plant operator is rapidly aware of any transgression of the limit values and may take corrective action. Within this analytical limitation, the monitoring of heavy metal emissions can be assimilated to the true continuous monitoring imposed by paragraph 1a and b for daily average and half-hourly average values for a number of pollutants.

As already stated in the general remarks, the monitoring of dioxins and furans is currently only possible by spot checks, requiring long sampling times for collecting enough material to carry out the very difficult analysis of the various congeners which are toxicologically the most relevant ones.

Experts suggest that a delay of up to two months is necessary before a sample can be analysed in terms of quality and quantity. Moreover, there are as yet only few laboratories qualified for this task in the Member States.

For these reasons, it is not appropriate to lay down already now a legally binding limit value which can not be properly controlled. It is therefore stipulated that the emissions of dioxins and furans shall be minimized as far as possible by progressive techniques and that every effort must be made to respect for all spot checks a guide value of 0.1 ng/m^3 . This value is defined as the sum of the concentrations of the most relevant congeners of dioxins and furans evaluated in accordance with Annex IV (by using the concept of toxic equivalence).

The incineration of hazardous waste as additional fuel in other than incineration plants requires the respect of the same limit values as required for specific incineration plants, but the limit values apply only to that part of the volume of the exhaust gas resulting from the incineration of wastes. The relevant emission limit and guide values shall be determined in accordance to Annex V.

Article 9

The necessary licence to discharge waste waters shall set appropriate conditions and limit values to meet the aim of the Directive set out in Article 1.

If pollutants removed from the exhaust gas by wet treatment plants were to be discharged with the waste waters, this would be contradictory to the aim of the Directive to prevent or minimize emissions to all environmental media. For this reason in new plants the discharge of waste waters resulting from the cleaning of exhaust gases must be

prohibited. Appropriate technical measures are available, for example evaporation techniques which can make use of the energy released by the incineration of hazardous wastes itself. As an additional advantage, this measure would also allow to reuse the condensate at the site and to save fresh water.

Insofar as the waste water from existing plants contains dangerous substances covered by Council Directive 76/464/EEC and its daughter directives, the licence will be issued and the relevant limit values must be fixed according to these directives.

Preventive measures must also be taken to avoid the discharge of contaminated rainwater runoff or contaminated waters resulting from accidents (e.g. spillage, fire-fighting).

Article 10

The unavoidable residues from the incineration and also the residues from the exhaust gas treatment which contain the pollutants often in a more concentrated form must be disposed of in accordance with the Directives on waste and on hazardous waste if there is no recovery possible. Their final disposal should be facilitated by keeping the residues separate and by lowering the potential risk of residues containing particularly harmful substances through the use of appropriate technologies (e.g. recycling of filter dust into the incinerator, thermal treatment, separation of the harmful substances). Closed containers are required in particular to prevent scattering at transport and intermediate storage of pollutants occurring in the form of fine dust.

In line with the policy goals of rational utilization of energy and resource management, the heat generated by the incineration of hazardous wastes should not be wasted (as it is still done at several plants) but as far as possible used e.g. for the possible evaporation of waste waters at the plant or for power generation.

Article 11

To ensure that the parameters, conditions, limit and guide values imposed can be verified, the measurement equipment and techniques must fulfill high technical standards. To this end they must be subject to the permit issued by the competent authority. Some guidance is given in Annex TN IV.

The requirements for the measurement equipments and techniques are set out in Annex VI. In particular CEN-standards must be used to guarantee uniform measurement results within the Community. As long as such CEN-standards are not available, national standards may apply.

To ensure that measurement equipments and techniques for continuous measurements meet a high quality, confidence intervals are introduced and, for the first time, used as quality standards for the measurement of the emissions into the air. To render more comparable the quality of measurement results obtained with the continuous monitoring

equipments used, these confidence intervals must be defined as a function of the relevant emission limit values. Subtracting the confidence interval from the measured values is necessary because a technically and statistically not avoidable uncertainty of the measurements cannot be held up against the operator of the incineration plant. Only on the basis of such corrected values can an appropriate comparison with the emission limit values be established in order to determine if these limit values are exceeded or not.

To ensure that the measurements will be taken correctly an approval of the competent authority of the installation and its functioning is required. To maintain the correct functioning requires an annual surveillance test as well.

The requirements for periodical (monthly) measurements must also be subject to the permit due to the importance of the results relating to the stringent emission limit values, in particular for heavy metals and the guide value for dioxins and furans which are a high potential risk to the environment and the human health. Because of the present lack of CEN-standards national requirements may be fixed by the competent authorities while awaiting the elaboration of CEN-standards in this field.

Article 12

In order to ensure that the pollution of the environment is prevented as laid down in the Directive, it is necessary to carry out continuous measurements of the quantitatively important emissions as well as of the conditions necessary to ensure the appropriate operation of the plant and the parameters to standardize the measurement results. However, since continuous measurement techniques may not (yet) be available for certain substances, periodical measurements shall be carried out. This is the case in particular for emissions of heavy metals, as well as for dioxins and furans. Due to their high potential risk to the environment and the human health, periodical measurements of these emissions must be carried out monthly in order to verify compliance with the limit values imposed and the guide value to be achieved.

To verify compliance with the limit and guide values and to compare the measurement results within the Community the results must be standardized at uniform conditions except in the particular case of a pure oxygen atmosphere where specific oxygen conditions must apply. To prevent that, as a result of calculations, exhaust gas would be diluted it is not allowed to standardize the measurement results at the imposed oxygen levels if the measured oxygen content is lower.

The 95 % confidence interval of Annex VI.4 implies that, due to statistical reasons, there is a probability that the limit values are exceeded by a very small percentage of the short-term values (half-hourly averages) over the year and the 10-minute averages over any 24-hour period (after having subtracted the confidence intervals from the measured average values). Therefore, only 97 % of the short-term average values (95 % in the case of CO) must meet the limit values. The true short-term values measured will follow a log-normal distribution.

As the daily averages are determined from a large number of short-term values, there will be an equal number of those values which is outside (above or below the 95% confidence interval of the limit value) and upon averaging the values above will be levelled off. Therefore it can be stipulated safely that all long-term limit values shall not exceed the corresponding limit values.

Article 13

Provisions are required for the actions to be taken in case that measured limit values are exceeded. The competent authorities must be informed as soon as possible and the plants shall not continue to operate until such time as corrective measures have restored the compliance with the Directive's requirements.

Plants incinerating waste as additional fuel must stop the feeding of waste when the limit values are exceeded due to disturbances or failures of the purification devices, but can continue on their regular fuel.

The maximum permissible period for an abnormal operation causing exceedances of the emission limit values of air pollutants is reduced to a fourth of the period permitted in the directives concerning the incineration of domestic waste due to the high potential risk to the environment and human health resulting from such pollutants. For the same reason the emission limit value for total dust containing in particular heavy metals and dioxins and furans is also lowered to a fourth and the limit value for total organic carbon (as given in Article 8) containing also dioxins and furans and numerous unknown substances, possibly carcinogenic ones, shall not be exceeded at all. During such periods the additional incineration of hazardous wastes in plants under Article 3, paragraph 4, must be stopped but the plant can continue to operate while being fed with the authorized fuels only.

Article 14

A delay of 3 years after the date specified in Article 19 paragraph 1 of the directive is stipulated for the adaptation of all existing plants to the provisions of this directive.

However, the operator is given the option, within a specified time span, to notify the competent authority of his decision to continue the operation of the plant for a limited time only, as specified in this article, before its definitive shut-down. In this case, no adaptation will be required.

Article 15

To protect the environment from avoidable pollution by dangerous substances, in particular highly toxic and carcinogenic ones, it is necessary to adapt all plants to the progress in emission control techniques. To this purpose, the permit has to be reviewed every five years by the competent authorities.

The Commission assisted by a Committee shall annually submit to the Member States a summary report, based on the information described in paragraph 2, in order to inform on the progress in emission control techniques already implemented and any further major technical developments in this field. These summary reports are intended to provide the Member States with the basic information concerning appropriate preventive measures against environmental pollution in the sense of Article 3, paragraph 2 of this Directive and which is necessary for the competent authorities when they issue or review permits for hazardous waste incineration plants.

Similar provisions were laid down in Council Directive 84/360/EEC where it is set out that Member States shall exchange information among themselves and with the Commission regarding their experience and knowledge of measures for prevention and reduction of air pollution as well as technical processes and equipments and air quality and emission limit values.

Article 16

In the last few years, the developments of reduction techniques in the field of waste incineration have progressed so rapidly that more stringent emission limit values can and have to be fixed.

The modifications required to adapt the directive to the technical progress will be adopted in accordance with the procedure laid down in Article 17.

Article 17

Powers for the implementation of the directive are conferred on the Commission in conformity with Article 2 procedure III variant a, of Council decision 87/373/EEC of 13 July 1987.

Article 18

Reporting on the general implementation of this directive will be carried out according to the procedures laid down in Article 5 of Council Directive on the standardisation and rationalisation of reports on the implementation of certain directives relating to the environment (91/692/EEC).

Annex I

Listed are the polychlorinated dioxins and furans where the positions 2,3,7,8 are substituted by chlorine. The sum of the concentrations of these dioxins and furans is determined using the concept of toxic equivalents in accordance with Nato-CCMS-Code (report 176 of August 1988).

Annex II

The determination of the total emission limit and guide values and the total oxygen content must be carried out in order to ensure that the additional incineration of hazardous waste in other plants does not cause higher emissions than in plants solely destined to incinerate such wastes. To avoid in particular additional burning of hazardous waste in plants which already cause high environmental pollution due to poor emission control techniques, the determination must be based on a C_{fuel} representing the real mass concentration of the relevant pollutants in the flue gas of plants which comply with the national laws, regulations and administrative provisions while burning the regular authorized fuels (hazardous wastes excluded).

Annex III

The provisions ensure that the measurements are carried out representatively and respecting progressive measurement techniques, in particular CEN-standards. These standards shall also apply, as soon as they are available, to the measurement of dioxins and furans. To achieve comparable measurement results within the Community 95 % confidence intervals are set up for the pollutants to be measured continuously. Due to the measurement uncertainty resulting from the characteristics of the pollutants and the lack of appropriate measurement methods to calibrate the automated measurement systems the stipulated confidence intervals differ and are still relatively high compared with the stringent emission limit values. But they can be met as proven by the available calibration results.

Annexes TN I - IV

These Annexes are added for information only. They represent the Best Available Technology Not Entailing Excessive Cost (BATNEEC) of the time at which existing plants started operation many years ago. At that time the harmful effects to the environment in particular from dioxins and furans and mercury were not yet so obvious and the corresponding emission control techniques were not developed. Progressive techniques already being used in new and substantially altered plants which achieve the stringent provisions including the emission limit and guide values are listed in Annex TN III.3

Actual legal situation in the Member States concerning Hazardous Waste Incineration Plants, in particular relating to authorisations and emission limit values(*)

1. Installations for which authorisation is required in Member States

According to Article 3 of Council Directive 84/360/EEC of 28 June 1984 on the combating of air pollution from industrial plants, Member States have to ensure that prior authorisation is required by their competent authorities for the operation of industrial plants, particularly those belonging to listed categories among which are the waste incineration plants.

Member States should have brought into force the laws, regulations and administrative provisions necessary to comply with the provisions of the Directive not later than 30 June 1987 and should have communicated them to the Commission according to Article 16 of the Directive.

On this basis, the situation in the Member States can be resumed as follows: all countries but Greece claim that their national legislation covers all aspects of the Directive. With regard to Greece, however, the actual legal situation is unknown to the Commission since it failed to communicate its internal measures.

In more detail, all Member States but Greece have laid down in their legislation a detailed list of installations or activities which are subject to an authorisation procedure prior to operation.

2. Emission limit values applied in Member States for hazardous waste incineration plants

An analysis of the indicated emission limit values (or guide values) as recorded in the different regulations of the Member States put forward the following summary conclusions:

- legally binding emission limit values for hazardous waste incineration plants are laid down in the regulations of four Member States: France, F.R.G., the Netherlands and Spain.
- More or less exhaustive emission guide values are provided in the regulations of Denmark, Ireland and the United Kingdom.
- In the remaining Member States (Belgium, Italy, Luxembourg and Portugal), no emission limit values or guide values are fixed whilst for Greece information is not available.

The competent authorities of Belgium and Luxembourg, in their negotiations with operators, however, do take into account emission limit values applied in Dutch and German law.

(*) Ref.: Technical Note on Best Available Technologies Not Entailing Excessive Cost for hazardous waste incineration; Report EUR 13007 EN, 1990

In more detail, the situation is as follows:

In Belgium, no legally binding emission limits are laid down for hazardous waste plants. The emission limits are defined for each individual plant in the operating permit. When defining these limits, the licensing authorities take into account limit and guideline values applied in other countries, in particular in F. R. Germany and the Netherlands. It should be mentioned that legally binding emission limit values are laid down in the "Arrêté Royal" of 8/8/1975 for industrial combustion installations which, in principle, also apply for waste incinerators. In practice these values are so high that they are of little relevance for hazardous waste incineration plants.

In Denmark, no legally binding emission limits are laid down. However, new air pollution guideline values are laid down in "Guidelines for Limiting Pollution from Incineration Plants", published in 1986 by the National Agency of environmental Protection. These guidelines do not apply specifically for the destruction of chemical wastes, sludges and special waste from hospitals. However, they are supplemented by individually specified operating conditions and emission limits for incinerators for chemical wastes, sludges and special hospital wastes. Moreover, supplementary individual operating conditions for such waste incinerators are laid down in the permit for operation. The National Agency of Environmental Protection, the Ministry of Environment, is the authority granting the permit and carrying out the supervision.

In the F. R. Germany, legally binding emission limits are laid down in section 3.3.8.1.1 (incineration facilities) and additionally in sections 2.3, 3.1.4, 3.1.6 and 3.1.7 (general requirements) of the Technical Instruction on Clean Air. The limits are applicable to all forms of combustible waste products (household waste, industrial waste and waste water treatment sludges). In strict terms, the Instruction is just an administrative regulation and only binds administrative authorities. However, indirectly it has a certain binding effect on the operators of plants as well via the approval procedure. (*)

In France, guidelines to establish prefectoral decrees containing legally binding limit values for each industrial waste incineration plant are laid down in the "circulaire" and "instruction technique" dated 21 March 1983. Prefectoral decrees could be more stringent, considering conditions, specific type of wastes, and best available technologies. In addition, a specific agreement is required for plants in which PCBs and PCTs are collected or burned. Agreement is given by specific ministerial decree (Arrêté Ministeriel) for such plants. In the case of incineration, a minimum destruction efficiency is required.

No information about emission limits for hazardous waste incinerators in Greece has been made available to the Commission.

(*) The Technical Instruction on Clean Air (TA Luft) relating to waste incineration has been replaced by the "17. Verordnung zum Bundes-Immissionsschutzgesetz" of 23. November 1990 which sets i. a. more stringent emission limit values.

In Ireland, no national legally binding limit values, relevant for the sectors concerned, are laid down, but legally binding emission limit values are applied at the local level by the relevant licensing authorities. The Air Pollution Act of 1987 requires the application of "best practicable means". It is necessary for local authorities to make themselves familiar with the current state of technical knowledge, performance standards achieved by various emission control technologies, processes, operating methods and other alternatives which have been developed for various plants, so that they are in a position to attach effective and realistic emission limits to licences. Directions specifying the "best practicable means" in relation to particular classes of industrial plants are in preparation to assist in implementing the licensing regulations (account is taken of T.A. Luft and other international standards).

In Italy, according to Article 20 of Law 615, all industrial plants must have installations and devices for the abatement of air pollutants to the lowest technically feasible levels, i.e. adopt the "best technical means" available. Moreover, according to Article 3 of the technical regulation (DPR number 322 of 15/04/1971), all sections of an industrial factory which can contribute to air pollution must have an abatement plan. Legally binding emission limits are not laid down in the Italian legislation for hazardous waste incinerators. However, the decree of 20/11/1985 stipulates the use of a secondary combustion chamber. The approval document to be issued by local authorities may contain more detailed emission limits to be met by the individual plant.

In Luxembourg, no legally binding emission limits for hazardous waste incinerators are laid down. Those of the German Technical Instruction are officially applied as guideline values.

In the Netherlands, the government has recently (21/08/1989) laid down emission limits for the incineration of all types of waste. Before that date, the permit to be obtained by all industrial plants causing air pollution (either under the Air Pollution Act for large installations or under the Nuisance Act for small ones) set limits to permissible emissions for individual plants.

In Portugal, no legally binding emission limits are laid down for hazardous waste plants. The emission limits are defined for each individual plant during the licensing procedure. When defining these limits, the licensing authorities take into account limit and guideline values applied in other countries. A new law concerning air quality protection, which will establish legally binding emission limit values for several industrial processes as well as emission limit values of general application, is under discussion.

In the Spanish legislation, especially in Decreto 833, point 3, emission values and legal procedures for solid waste incineration, but not specifically for hazardous waste incineration, are laid down. At present, the Spanish government is elaborating a guide to fix values for air pollutants emitted by hazardous waste incineration.

In the United Kingdom, no legally binding emission limit values for hazardous waste incinerators are laid down. However, the emission limits established by the national pollution inspectorate, published in the "Notes on Best Practicable Means" are operational. They are called "presumptive emission limits" because it is presumed that if industry exceed those limits, they do not meet the requirements of best practicable means. The intention is not that industry should pollute up to these limits; they are under a statutory duty to do whatever is practicable to prevent emissions and to assure that those which cannot be prevented are reduced below these limits. Therefore, the values given in the "Notes of Best Practicable Means" can be considered as guideline values with the practical character of maximum emission limit values. The duty to use best practicable means does also require control over those emissions which are not capable of being measured and for which therefore no emission limits can be set (fugitive or uncontained emissions).

Also under this duty, industry is required not only to provide equipment and systems for the prevention of emissions, but also to ensure proper and effective use and supervision of all operations where harmful or offensive substances may be involved. The Pollution Inspectorate is presently updating an existing "Note on Best Practicable Means" for chemical waste incineration which will contain "presumptive emission limits".

WASTE INCINERATION - EMISSION LIMIT VALUES

N°	POLLUTANTS	<u>EEC</u> - Proposal -	<u>Germany</u>	<u>Netherlands</u>	
		Hazardous waste (Milligram/m ³)	Hazardous/ municipal waste (Milligram/m ³)	Hazardous/ municipal waste (Milligram/m ³)	
1	Total dust	5	10	5	
2	Total organic carbon	5	10	10	
3	Inorganic chlorine compounds	5	10	10	
4	Inorganic fluorine compounds	1	1	1	
5	Sulphuroxides	25	50	40	
6	Carbon monoxide	50	50	50	
7	Cadmium	0,05	0,05	0,05	
8	Thallium			-	
9	Mercury	0,05	0,05	0,05	
10	Other heavy metals (total)	0,5	0,5	1	
		(Nanogram/m ³)	(Nanogram/m ³)	(Nanogram/m ³)	
11	Dioxins + furans (as toxic equivalents)	*	0,1	0,1	
	Averaging time	N° 1- 6 N° 7-10 N° 11	24 h 0,5 - 2 h 6 -16 h	24 h 0,5 - 2 h 6 -16 h	1 h (with some exceptions)

* : Guide value of 0,1 ng/m³

Proposal for a
COUNCIL DIRECTIVE
on the Incineration of hazardous waste

THE COUNCIL OF THE EUROPEAN COMMUNITIES,

Having regard to the Treaty establishing the European Economic Community, and in particular Article 100a thereof,

Having regard to the proposal of the Commission⁽¹⁾,

In cooperation with the European Parliament⁽²⁾,

Having regard to the opinion of the Economic and Social Committee⁽³⁾,

Whereas the 1973⁽⁴⁾, 1977⁽⁵⁾, 1983⁽⁶⁾ and 1987⁽⁷⁾ European Community Action Programmes on the Environment stress the importance of the prevention and reduction of air pollution;

Whereas in their resolution concerning the action programme on the environment 1987 to 1992, the Council and the Representatives of the Governments of the Member States meeting within the Council, emphasize the importance for Community action to concentrate, inter alia, on implementation of appropriate standards in order to ensure a high level of public health and environmental protection;

(1) OJ No

(2) OJ No

(3) OJ No

(4) OJ No C 112, 20.12.1973, p. 1.

(5) OJ No C 139, 13.6.1977, p. 1.

(6) OJ No C 46, 17.2.1983, p. 1.

(7) OJ No C 328, 7.2.1987, p. 1.

Whereas the Council Resolution of 7 May 1990 on waste policy⁽¹⁾ invites the Commission to complete its proposals on incinerators for industrial waste, as a matter of urgency;

Whereas the incineration of hazardous waste, due to its characteristics and constituents, gives rise to emissions particularly dangerous for the environmental media of air, soil, surface and groundwater, thereby endangering public health; whereas in some cases this pollution may have transboundary features;

Whereas therefore preventive action is required to protect the environment against particularly dangerous emissions from the incineration of hazardous waste and to guarantee citizens the right to a clean and healthy environment;

Whereas the differences between technical standards and control and operating procedures relating to installations for the incineration of hazardous waste have an influence on incineration activity, in particular as a result of the costs arising from the nature of the technical standards imposed and the level of environmental protection thus ensured;

Whereas the current differences in national provisions applicable to the incineration of hazardous waste, and in some cases the absence of such provisions, may distort competition, affect the free movement of goods in the single market, and give rise to differences in the protection of health and the environment;

Whereas it is necessary, for the smooth functioning of the internal market, to harmonize the national provisions relating to the incineration of hazardous waste in such a way as to ensure a high level of protection of health and the environment in all Member States;

Whereas Article 4 of Council Directive 84/360/EEC of 28 June 1984 on the combating of air pollution from industrial plants⁽²⁾ provides that prior authorization shall be required for the operation of industrial plants, particularly those belonging to listed categories among which

(1) OJ No C 122, 18.5.1990, p. 2.

(2) OJ No L 188, 16.7.1984, p. 20.

are waste incineration plants; whereas this authorization may be issued only when all appropriate preventive measures against air pollution have been taken, including the application of the best available technology not entailing excessive costs;

Whereas Council Directive 75/442/EEC of 15 July 1975 on waste⁽¹⁾, as amended by Directive 91/156/EEC⁽²⁾, provides that waste must be disposed of without endangering human health and without harming the environment; whereas, to this end, the same Directive stipulates that any installation or undertaking treating waste must obtain a permit from the competent authority relating, inter alia, to the precautions to be taken;

Whereas a high level of environmental protection requires the setting and maintaining of appropriate operating conditions and emission limit values for hazardous waste incineration plants within the Community; whereas hereby and in the first place the competent authorities have to take into account the latest development of effective emission control techniques when issuing or reviewing the permit;

Whereas high standard measurement techniques are required to monitor the mass concentrations of the pollutants permitted to be released into the environment and to compare the results of the measurements within the Community taking into account maximum confidence intervals;

Whereas the normal operation as well as technically unavoidable stoppages, disturbances or failures of the purification devices have to be regulated; whereas, the provisions to prevent and minimize the risks and consequences of major accidents as set by Council Directive 82/501/EEC of 24 June 1982 on the major-accident hazards of certain industrial activities⁽³⁾, as last amended by Directive 90/656/EEC⁽⁴⁾, apply to incineration plants for hazardous waste;

(1) OJ No L 194, 25.7.1975, p. 47.

(2) OJ No L 78, 26.3.1991, p. 32.

(3) OJ No L 230, 5.8.1982, p. 1.

(4) OJ No L 353, 17.12.1990, p. 59.

Whereas, for the emissions of dioxins and furans, a guide value only should be set due to the lack of existing appropriate measurement methods; whereas, nonetheless, it is decisive to minimize such emissions by using progressive techniques and to make all efforts to meet the fixed guide values;

Whereas the environment requires an integrated protection against emissions resulting from the incineration of hazardous wastes; whereas, therefore, waste water resulting from the cleaning of exhaust gases of new plants shall not be discharged, in order to prevent a pollution shift from one environmental medium to another;

Whereas the incineration of hazardous waste as additional fuel in plants not solely destined for this purpose may not cause higher mass concentrations of polluting substances in that part of the exhaust gas volume resulting from such incineration and should therefore be subject to appropriate limitations;

Whereas the Commission and each Member State shall collaborate in order to ensure that information on the progress on emission control techniques and the results of the measurements of the pollutants released into the environment will be made available;

Whereas a committee should be set up to assist the Commission in implementing this Directive and adapting it to scientific and technical progress,

HAS ADOPTED THIS DIRECTIVE:

Article 1

1. The aim of this Directive is to provide for measures and procedures to prevent or at least to minimize the effects on the environment, in particular the pollution of air, soil, surface and groundwater, and the resulting risks to human health, from the incineration of hazardous waste and, to this end, to set up and maintain appropriate operating conditions and emission limit values for hazardous waste incineration plants within the Community.

2. This Directive applies without prejudice to other Community legislation relating to hazardous waste and the protection of the health and safety of the workers at the incineration plant, in particular Council Directives 80/1107/EEC⁽¹⁾ and 89/391/EEC⁽²⁾.

Article 2

For the purpose of this Directive:

1. "Hazardous waste" shall mean any solid or liquid waste as laid down by Article 1 of Council Directive 91/689/EEC⁽³⁾.

The following wastes shall be excluded from the scope of this Directive:

- municipal wastes as defined in Article 1(3) of Council Directive 89/369/EEC⁽⁴⁾ and Article 1(3) of Council Directive 89/429/EEC⁽⁵⁾;
- combustible liquid wastes including waste oils as defined in Council Directive 75/439/EEC⁽⁶⁾ if

the mass content of polychlorinated aromatic hydrocarbons, e.g. polychlorinated biphenyls (PCB) or pentachlorinated phenol (PCP), amounts to not more than 10 ppm,

the net calorific value amounts to at least 30 MJ per kilogramme, and

these wastes are not rendered hazardous due to other constituents.

(1) OJ No L 327, 3.12.1980, p. 8.
(2) OJ No L 393, 29.6.1989, p. 1.
(3) OJ No L 377, 31.12.1991, p. 20.
(4) OJ No L 163, 14.6.1989, p. 32.
(5) OJ No L 203, 15.7.1989, p. 50.
(6) OJ No L 194, 25.7.1975, p. 31.

- any combustible liquid wastes which cannot cause, in the flue gas directly resulting from their combustion, other emissions than those from gas oil as defined in Article 1(1) of Council Directive 75/716/EEC⁽¹⁾ or a higher concentration of emissions than those resulting from the combustion of gas oil as so defined.

2. "Incineration plant" shall mean any technical equipment used for the incineration by oxidation of hazardous wastes including pretreatment as well as pyrolysis or other thermal treatment processes, e.g. plasma process, insofar as their products are subsequently incinerated with or without recovery of the combustion heat generated. This includes plants burning such wastes as a regular or additional fuel for any industrial process.

This definition covers the site and the entire installation comprising the waste reception, storage, pretreatment facilities, the incinerator, its wastes, fuel and air-supply systems, exhaust gas and waste water treatment facilities, and devices and systems for controlling incineration operations and continuously recording and monitoring incineration conditions.

3. "New incineration plant" shall mean a plant for which the permit to operate is granted as from the date specified in Article 19(1).
4. "Existing incineration plant" shall mean a plant for which the first permit to operate is granted before the date specified in Article 19(1).
5. "Emission limit value" shall mean the concentration and/or mass of polluting substances which is not to be exceeded in emissions from plants during a specified period.

(1) OJ No L 307, 27.11.1975, p. 22.

6. "Operator" shall mean any natural or legal person who operates the incineration plant, or who has or has been delegated decisive economic power over it.

Article 3

Member States shall ensure that:

1. Permits for installations, establishments or undertakings which operate incineration plants must be obtained from the competent authorities, pursuant to Articles 9, 10 and 11 of Directive 75/442/EEC and Article 3 of Council Directive 84/360/EEC.
2. The permit shall be given only if the application shows that the incineration plant is designed, equipped and will be operated in such a manner that all appropriate preventive measures against environmental pollution, in particular measures to prevent or minimize emissions, have been taken. As a minimum, those measures provided for by Articles 5 to 13 must be met.
3. The permit given by the competent authorities must explicitly list the categories and/or the generic types of those hazardous wastes which may be treated in the incineration plant as well as the total capacity of the incinerator.
4. In the case of a plant not intended primarily to incinerate hazardous wastes, and where such a plant is being fed with hazardous wastes the resulting heat release from which is between 10% and 40% inclusive of the total heat released in the plant at each moment of the operation, the following Articles only of the Directive shall apply:

Articles 1 to 6

Article 7 points 2 and 6

Article 8 including its measuring provisions

Article 10

Articles 13, 14 and 15.

5. The permit for additional incineration as described in paragraph 4 shall be issued only if it is demonstrated in the application:

- that the hazardous waste burners shall be positioned and the waste added in such a way as to achieve complete incineration and
- with calculations as laid down in Annex II that the provisions of Article 8 shall be met.

The permit for additional incineration shall explicitly list the categories and/or the generic types of those hazardous wastes which may be incinerated additionally in the plant. It shall, moreover, specify the minimum and maximum mass flows of those hazardous wastes, their lowest and maximum calorific values and their maximum contents of pollutants, e.g. PCB, PCP, chlorine, fluorine, sulphur, heavy metals.

The permit shall expire six months after starting such incineration, if a comparison of the results of measurements carried out under the most unfavourable conditions show that the provisions of Article 8 are not met. For this period of six months the competent authority may grant exemptions from the percentage requirement stipulated in point 4.

Article 4

Member States shall take measures in order that:

1. The applications for a permit and the decisions of the competent authorities are made available to the public in accordance with procedures provided for in Community and national law.
2. The results of the monitoring provided for in Article 12 are made available to the public in a form decided upon by the competent authorities and in accordance with procedures provided for in Community and national law.

Article 5

Member States shall ensure that:

1. The operator of the incineration plant takes all necessary measures concerning the delivery and reception in order to prevent or minimize as far as possible the effects to the environment, in particular the pollution of air, soil, surface and groundwater, and the risks to human health. These measures have to cover at least the requirements set out in points 2 and 3.
2. Prior to accepting the waste at the incineration plant, the operator shall receive a description of the waste covering:
 - the physical and chemical composition of the waste and all information necessary to evaluate its suitability for the intended incineration process;
 - the hazard characteristics of the waste, the substances with which it cannot be mixed, precautions to be taken in handling the waste.
3. Prior to accepting the waste at the incineration plant, at least the following reception procedures have to be respected:
 - the mass of the waste has to be determined;
 - the checking of those documents required by Directive 91/689/EEC and, where they apply, those required by Council Directive 84/631/EEC⁽¹⁾ and dangerous goods transport regulations;
 - representative samples have to be taken where appropriate and as far as possible before unloading, to verify the conformity with the description provided under point 2 by carrying out

(1) OJ No L 326, 13.12.1984, p. 31.

controls like those indicated in Annex TN I and to enable the competent authorities to identify the nature of the wastes treated. These samples have to be kept for at least 10 days after the incineration.

Article 6

Member States shall take measures in order that the equipment used for the intermediate storage and the pretreatment of hazardous wastes necessary prior to the incineration shall be designed and operated so as to avoid or minimize emissions of dust, volatile substances and odours⁽¹⁾.

Article 7

Member States shall ensure that:

1. Incineration plants for hazardous wastes shall be designed, equipped and operated to prevent or at least minimize the effects to the environment in particular the pollution of air, soil and water, and the risks to human health. To this end, the most appropriate technological means⁽²⁾ and requirements shall be applied to fulfil the prescriptions laid down in the subsequent points.
2. Plants for the incineration of hazardous wastes shall be operated in order to achieve a complete incineration. This may require the use of appropriate techniques of waste pretreatment.
3. All waste 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 the relevant temperature stated in points 4 and 5. They shall also be used during plant start-up and shut-down operations in order to ensure that the above mentioned minimum temperature is maintained at all times during these operations and as long as the waste is in the combustion chamber.

(1) Information on equipment and operational practice is provided by TN II.

(2) Currently available technology is indicated briefly in Annex TN III.

During start-up and shut-down or when the temperature of the combustion gas falls below the temperatures stated in points 4 and 5, the auxiliary burners must 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 Directive 75/716/EEC, liquefied gas or natural gas.

It is mandatory to have an automatic system to prevent hazardous waste feed:

- at start-up, until the required minimum incineration temperature has been reached;
 - whenever the required minimum incineration temperature is not maintained;
 - whenever the continuous measurements required by Article 12(1)(a) show that any emission limit value is exceeded due to disturbances or failures of the purification devices.
4. All incineration plants shall be designed, equipped and operated in such a way that the gas resulting from the combustion of the hazardous waste, 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 at the inner wall of the combustion chamber, for at least two seconds in the presence of at least 6% oxygen; if halogenated organic substances are incinerated, the temperature has to be raised to at least 1200°C.

When the furnace is fueled with liquid hazardous waste only or with a mixture of gaseous substances and powdered solids from a thermal pretreatment of hazardous waste under oxygen deficiency, and when the gaseous part provides for more than 50% of the entire heat released, the oxygen content after the last injection of combustion air shall amount to at least 3%.

5. Requirements different from those laid down in point 4 and specified in the permit for certain hazardous wastes may be authorized by the competent authorities if appropriate techniques are used in the incineration furnaces or exhaust gas treatment equipment. This authorization shall be conditional upon at least the emission limit values given in point 1 of Article 8 being met and the levels of dioxins and furans emitted being lower or equivalent to those obtained with the requirements laid down in point 4 of this Article.

All operating conditions determined under the provisions of this paragraph and the results of verifications made shall be communicated to the Commission.

6. During the operation of the incineration plant the following limit values of carbon monoxide (CO) concentrations shall not be exceeded in the combustion gases:
 - a) 50 milligrams/m³ of combustion gas determined as daily average value;
 - b) 150 milligrams/m³ of combustion gas of at least 95% of all measurements determined as 10-minute average values taken in any 24-hour period.
7. The deposit of fly ash shall be minimized before the dust arrestment plant, e.g. by appropriate ducting for exhaust gas as well as by frequent cleaning of boilers, heating surfaces, economizers and exhaust gas ducts.
8. All incineration plants shall be designed, equipped 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 by means of a stack.

The stack height is calculated in such a way as to safeguard human health and the environment.

Article 8

Member States shall ensure that:

1. Incineration plants have to be designed, equipped and operated in such a way that at least the following emission limit values are not exceeded in the exhaust gas:

(a) daily average values

(1) Total dust	5 mg/m ³
(2) Gaseous and vapourous organic substances, expressed as total organic carbon	5 mg/m ³
(3) Hydrogen chloride (HCl)	5 mg/m ³
(4) Hydrogen fluoride (HF)	1 mg/m ³
(5) Sulphur dioxide (SO ₂)	25 mg/m ³

(b) half-hourly average values

(1) Total dust	10 mg/m ³
(2) Gaseous and vapourous organic substances, expressed as total organic carbon	10 mg/m ³
(3) Hydrogen chloride (HCl)	10 mg/m ³
(4) Hydrogen fluoride (HF)	2 mg/m ³
(5) Sulphur dioxide (SO ₂)	50 mg/m ³

(c) all average values over the sample period of a minimum of 0.5 and a maximum of 4 hours

(1) Cadmium and its compounds, expressed as cadmium (Cd)	}	total	0.05 mg/m ³
(2) Thallium and its compounds, expressed as thallium (Tl)			
(3) Mercury and its compounds, expressed as mercury (Hg)	} J		0.05 mg/m ³
(4) Antimony and its compounds, expressed as antimony (Sb)	}	>	total
(5) Arsenic and its compounds, expressed as arsenic (As)			
(6) Lead and its compounds, expressed as lead (Pb)			
(7) Chromium and its compounds, expressed as chromium (Cr)			
(8) Cobalt and its compounds, expressed as cobalt (Co)			
(9) Copper and its compounds, expressed as copper (Cu)			
(10) Manganese and its compounds, expressed as manganese (Mn)			
(11) Nickel and its compounds, expressed as nickel (Ni);			
(12) Vanadium and its compounds, expressed as vanadium (V)			
(13) Tin and its compounds, expressed as tin (Sn)			
			0.5 mg/m ³

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

2. The emission of dioxins and furans shall be minimized by the most progressive techniques. To this end every effort must be made to ensure that all average values measured over the sample period of a minimum of 6 hours and a maximum of 16 hours do not exceed a guide value of 0.1 ng/m³.

- This guide value is defined as the sum of the concentrations of the individual dioxins and furans evaluated in accordance with Annex I.
3. The results of the measurements made to verify compliance with the limit and guide values set out in Articles 7 and 8 shall be standardized under the conditions laid down in point 2 of Article 12.
 4. Where hazardous wastes are additionally incinerated in plants which are not solely destined for the incineration of such wastes, the provisions of point 6 of Article 7 and points 1, 2 and 3 of this Article shall only apply to that part of the volume of exhaust gas resulting from the incineration of the wastes.

Appropriate emission limit and guide values for the relevant pollutants emitted in the exhaust gas of such plants as set out in Annex II shall be laid down.

Article 9

Member States shall ensure that:

1. Any waste water discharged from an incineration plant must be subject to a licence issued by the competent authority. This licence shall state that it is only valid under the condition that the waters are treated, as necessary, in order to minimize the effects on the environment and to prevent risks to human health and that the limit values imposed therein are respected.
2. In so far as the waste water contains dangerous substances covered by Council Directive 76/464/EEC⁽¹⁾ and its daughter Directives⁽²⁾, any licence which is issued and the relevant limit values must be fixed according to these Directives.

(1) OJ No L 129, 18.5.1976, p. 23.

(2) OJ No L 81, 27.3.1982, p. 29.

OJ No L 291, 24.10.1983, p. 1.

OJ No L 74, 17.3.1984, p. 49.

OJ No L 274, 17.10.1984, p. 11.

OJ No L 181, 4.7.1986, p. 16.

OJ No L 158, 25.6.1988, p. 35.

OJ No L 219, 14.8.1990, p. 49.

3. Discharge to the aquatic environment of waste waters resulting from the cleaning of exhaust gases shall be prohibited for new plants.
4. Incineration plant sites including associated storage areas for hazardous wastes shall be designed and operated in such a way, as to prevent the release of any polluting substance into soil and groundwater following the provisions of Council Directive 80/68/EEC⁽¹⁾. Moreover, storage capacity shall be provided for rainwater run-off from the incineration plant site or for contaminated water arising from spillages or fire-fighting operations. This storage capacity shall be adequate to ensure that such waters can be tested and treated before discharge where necessary.

Article 10

Member States shall ensure that:

1. Wastes resulting from the operation of the incineration plant shall be recovered or disposed of in accordance with Directives 75/442/EEC and 91/689/EEC. This may require a pretreatment of such wastes according to the technical development.

Such wastes should be kept separate from each other and, in order to further facilitate their recovery or disposal, the appropriate technologies should be applied.

2. Transport and intermediate storage of dry residues e.g. filter and boiler dust and dry residues from the treatment of exhaust gases shall take place in closed containers.
3. The heat recovered from the incineration processes should be used as far as possible on-site, by third parties or for power generation.

(1) OJ No L 20, 26.1.1980, p. 43.

Article 11

Member States shall ensure that:

1. Measurement equipments shall be installed and techniques shall be used in order to monitor in accordance with Article 12 the parameters, conditions and mass concentrations of the pollutants relevant to the incineration process. They shall be subject to the permit issued by the competent authorities. (For monitoring information, see Annex TN IV).
2. The permit shall only be issued if the measurement techniques comply with Annex VI. The values of the 95% confidence interval at the emission limit values in point 6(a) of Article 7 and Article 8, point 1(b), Nos. (1), (2), (3) and (5), shall not exceed the values given by point 4 of Annex III.

The competent authorities shall give approval of the appropriate installation and the functioning of the automated monitoring equipment and shall require an annual surveillance test with respect to this equipment.

3. The sampling and measurement procedures used to satisfy the obligations imposed for periodical measurements of each air pollutant and the location of the sampling or measurement points shall be subject to the permit issued by the competent authority.

The requirements for periodical measurements shall be fixed by the competent authority according to Annex III.

Article 12

1. Member States shall ensure that:

The following measurements shall be carried out in compliance with Annex III at the incineration plant:

- (a) continuous measurements of the substances mentioned in point 6 of Article 7 and Article 8, points 1(a) and (b);
- (b) continuous measurements of the following process operation parameters:
 - temperature as mentioned in Article 7, points 4 and 5,
 - concentration of oxygen, pressure, temperature and water vapour content of the exhaust gas;
- (c) periodical, i.e. monthly measurements of the substances mentioned in Article 8, points 1(c) and 2;
- (d) the residence time, the minimum temperature and the oxygen content of the exhaust gases as specified in Article 7, points 4 and 5 shall be subject to appropriate verification, at least once when the incineration plant is first brought into service and under the most unfavourable operating conditions envisageable.

The continuous measurement of HF may be omitted if treatment stages for HCl are used which make sure that the emission limit value under Article 8, points 1(a)(3) and 1(b)(3) is not being exceeded. In this case the emissions of HF are subject to periodical measurements as laid down in point (c) above.

The continuous measurement of the water vapour content shall not be necessary provided that the exhaust gas is dried before the emissions are analysed.

Measurements of the pollutants listed in point 1 of Article 8 may not be necessary, provided that the permit allows the incineration of only those hazardous wastes which cannot cause average values of those pollutants higher than 10% of the emission limit values set out in point 1.

The competent authorities shall require continuous measurements of the substances mentioned in Article 8, points 1(c) and 2, being carried out in compliance with Annex III as soon as appropriate measurement techniques are available within the Community.

2. The results of the measurements made to verify compliance with the limit and guide values set out in Articles 7 and 8 shall be standardized under the following conditions:

- Temperature 273 K, pressure 101.3 kPa, 11% oxygen, dry gas;

- Temperature 273 K, pressure 101.3 kPa, 3% oxygen, dry gas, in case of incineration of waste oil only as defined in Directive 75/439/EEC.

When the hazardous wastes are burnt in a pure oxygen atmosphere, the results of the measurements can be standardized at an oxygen content laid down by the competent authority reflecting the special circumstances of the individual case. In a case covered by point 4 of Article 3, the results of the measurements shall be standardized at a total oxygen content as calculated in Annex II.

When the emissions of pollutants are reduced by exhaust gas treatment, the standardization with respect to the oxygen contents foreseen above shall be done only if the measured oxygen content over the same period exceeds the relevant standard oxygen content.

3. Member States shall ensure that 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 and guide values laid down in this Directive in accordance with procedures to be decided upon by those authorities.

4. The emission limit values are complied with if 97% of the half-hourly average values over the year and all of the daily average values of Article 7, point 6(a) and Article 8, point 1(a) and (b) and all average values over the sample period of Article 8, point 1(c) do not exceed the emission limit values and if the provision of Article 7, point 6(b) (10-minute average) is met.

The half-hourly average values and the 10-minute averages shall be determined within the effective operating time (including the start-up and shut-off periods when hazardous waste is being incinerated) from the measured values after having subtracted the value of the confidence interval given by point 4 of Annex III. The daily average values are determined from those validated average values.

The average values over the sample period and, in the case of periodical measurements of HF, the average values for HF are determined as given by the requirements imposed under point 3 of Article 11.

5. For the periodic measurements, the competent authorities shall lay down appropriate measurement programmes to ensure that the results are representative for the level of emissions of the substances concerned resulting from the incineration of the categories and/or the generic types of wastes permitted to the plant.

The results obtained must be suitable for verifying that the limit values have been observed.

Article 13

Member States shall take measures in order to ensure that:

1. Should the valid measurements taken show that the limit values laid down in this Directive have been exceeded, the competent authorities shall be informed as soon as possible. The plant concerned shall not continue to operate while failing to comply with emission standards.

In the case of point 4 of Article 3, additional feeding of hazardous wastes shall be stopped when the limit values are exceeded due to disturbances or failures of the purification devices.

2. The competent authorities shall lay down the maximum permissible period of any technically unavoidable stoppages or disturbances, or failures of the purification devices, during which the concentrations in the discharges into the air of the regulated substances may exceed the limit values laid down. Under no circumstances shall the plant continue to incinerate hazardous waste for a time period of more than two hours uninterrupted; moreover, the cumulative duration of operation in such conditions over one year shall be less than 24 hours.

In case of a breakdown, the operator shall reduce or close down operations as soon as practicable until normal operations can be restored. In plants falling within Article 3, point 4, additional feeding of hazardous wastes shall be stopped.

The total dust content of the discharges shall under no circumstances exceed 150 mg/m^3 expressed as half-hourly average; moreover, the emission limit value laid down in Article 8, points 1(a)(2) and 1(b)(2) must not be exceeded. All other conditions, in particular the combustion conditions mentioned in this Directive, shall be complied with.

Article 14

1. The provisions of this Directive shall apply to existing incineration plants within 3 years after the date specified by Article 19(1).

2. However, the plant operator may notify the competent authority within six months after the date specified by Article 19(1) that the existing plant will not be operated for more than 20 000 hours within a period of five years at maximum starting with the operators' notification before being definitely shut down. In this case the provisions of paragraph 1 do not apply.

Article 15

1. Member States shall require their competent authorities to review the permit for each incineration plant for hazardous wastes at least every five years and to ensure that the plants are updated, where necessary, consistent with the progress in emission control techniques.

For new plants, the date for the first review shall be within five years of the first operation of the plant at the latest. For existing plants the date of the first review shall be within five years of the date specified in Article 14(1).

2. Member States shall provide annually the following information to the Commission.

For each new incineration plant or substantial modification, which is newly authorized:

- the date of authorization;
- the most important measures and/or techniques incorporated for the minimization of emissions;
- the imposed operating conditions;
- the maximum emission limits imposed.

The information shall also include for each new or substantially modified incineration plant:

- the date at which it was put into operation;

- the results of the continuously measured emissions, in accordance with Article 12, for an unbroken period of 12 months within the first two years after the notified date of the first operation;
 - the results of the periodically measured emissions, in accordance with Article 12, carried out in the first two years after the notified date of the first operation.
3. The Commission, assisted by the committee as described in Article 17, shall annually submit to the Member States a summary report, based on the information described in paragraph 2, in order to inform on the progress in emission control techniques already implemented and any further major technical developments in this field.

Member States shall ensure that the summary reports are disseminated to their competent authorities.

Article 16

The modifications required to adapt the Directive to technical progress will be adopted in accordance with the procedure laid down in Article 17.

Article 17

1. The Commission shall be assisted by a committee composed of the representatives of the Member States and chaired by the representative of the Commission.

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.

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, the Council has not acted, the proposed measures shall be adopted by the Commission.

Article 18

The reports on the implementation of this Directive shall be established according to the procedure laid down in Article 5 of Council Directive 91/692/EEC⁽¹⁾. The first report covers the period 1995-1997.

Article 19

1. Member States shall bring into force the laws, regulations and administrative provisions necessary to comply with this Directive not later than 30 June 1994. They shall forthwith inform the Commission thereof.

When Member States adopt these provisions, these shall contain a reference to this Directive or shall be accompanied by such reference at the time of their official publication. The procedure for such reference shall be adopted by Member States.

(1) OJ No L 377, 31.12.1991, p. 48.

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 20

This Directive is addressed to the Member States.

Done at Brussels,

For the Council
The President

ANNEX I

Equivalence factors for dioxins and dibenzofurans

For the determination of the summed value as stated in Article 8 point 2 the mass concentrations of the following dioxins and dibenzofurans have to be multiplied with the following equivalence factors before summing up (using the concept of toxic equivalents).

		toxic equivalence factor
2,3,7,8	- Tetrachlordibenzodioxin (TCDD)	1
1,2,3,7,8	- Pentachlordibenzodioxin (PeCDD)	0.5
1,2,3,4,7,8	- Hexachlordibenzodioxin (HxCDD)	0.1
1,2,3,7,8,9	- Hexachlordibenzodioxin (HxCdd)	0.1
1,2,3,6,7,8	- Hexachlordibenzodioxin (HxCDD)	0.1
1,2,3,4,6,7,8	- Heptachlordibenzodioxin (HpCDD)	0.01
	- Octachlordibenzodioxin (OCDD)	0.001
2,3,7,8	- Tetrachlordibenzofuran (TCDF)	0.1
2,3,4,7,8	- Pentachlordibenzofuran (PeCDF)	0.5
1,2,3,7,8	- Pentachlordibenzofuran (PeCDF)	0.05
1,2,3,4,7,8	- Hexachlordibenzofuran (HxCDF)	0.1

1,2,3,7,8,9	- Hexachlordibenzofuran (HxCDF)	0.1
1,2,3,6,7,8	- Hexachlordibenzofuran (HxCDF)	0.1
2,3,4,6,7,8	- Hexachlordibenzofuran (HxCDF)	0.1
1,2,3,4,6,7,8	- Heptachlordibenzofuran (HpCDF)	0.01
1,2,3,4,7,8,9	- Heptachlordibenzofuran (HpCDF)	0.01
	- Octachlordibenzofuran (OCDF)	0.001

ANNEX II

Determination of emission limit and guide values for the
additional incineration of hazardous waste

The limit or guide value for each relevant pollutant and carbon monoxide in the exhaust gas resulting from the additional incineration of hazardous waste must be calculated as follows:

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

V_{waste}: exhaust gas volume resulting from the incineration of hazardous waste only determined from the waste with the lowest calorific value specified in the permit and standardized at the conditions given by Article 12, point 2.

C_{waste}: emission limit values set for plants destined to incinerate hazardous wastes only (at least the emission limit values and guide value for the pollutants and carbon monoxide as laid down in Article 8, points 1 and 2, and Article 7, point 6).

V_{fuel}: exhaust gas volume resulting from the combustion of the authorized fuels normally used in the plant (hazardous wastes excluded) determined on the basis of oxygen contents at which the emissions must be standardized 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 combustion process must be used. The standardization at the other conditions is given by Article 12, point 2.

C_{fuel}: real mass concentrations 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 authorized fuels (hazardous wastes excluded).

C : total emission limit value or guide value for CO and the relevant pollutants replacing the emission limit values and the guide value as laid down in Article 7, point 6 and in Article 8, points 1 and 2. The total oxygen content to replace the oxygen content for the standardization in Articles 7 and 8 is calculated on the basis of the content above respecting the volume ratio.

Pollutants and CO not resulting directly from the incineration of hazardous wastes or from the combustion of fuels (e. g. from materials necessary for the production or from products) as well as CO resulting from such incineration directly if

- the higher CO concentrations in the combustion gas are required by the production process and
- C_{waste} (as defined above) for total organic carbon, dioxins and furans is met

should not be taken into account.

In any case, given the authorized hazardous wastes which can be additionally incinerated, the total emission limit value (C) must be calculated under conditions which would minimize the emissions into the environment. Such conditions may be materialized for each relevant pollutant in the case of additional incineration of hazardous wastes in plants not solely destined for the incineration of the wastes:

$C_{waste} < C_{fuel}$: the pollution of the surroundings will be less as a result of the additional incineration of hazardous wastes

$C_{waste} = C_{fuel}$: indifferent

$C_{waste} > C_{fuel}$: the surroundings would suffer from the additional incineration of hazardous wastes

ANNEX III

Measurement Techniques

1. Measurements for the determination of concentrations of air pollutants in gas-carrying ducts have to be carried out representatively.
2. 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. While awaiting the elaboration of the CEN-standards, national standards shall apply.
3. The procedure to monitor dioxins and furans can only be authorized if the detection limit for the sampling and analysis of the individual dioxins and furans is sufficiently low to allow the determination of a meaningful result in terms of toxicity equivalents.
4. The values of the 95% confidence intervals determined at the emission limit values shall not exceed the following percentages of the emission limit values:

Carbon monoxide (Article 7, point 6a)	:	10%
Sulphur dioxide (Article 8, point 1b(5))	:	10%
Total dust (Article 8, point 1b(1))	:	20%
Total organic carbon (Article 8, point 1b(2))	:	30%
Hydrogen chloride (Article 8, point 1b(3))	:	30%

ANNEX TN I

for information

Waste Delivery and Reception

Before the waste material can be allowed into the plant, it has to pass the entrance and control area. Here it has to undergo the following control and supervising activities: besides weighing and administrative control also a laboratory control.

The laboratory control consists of inspecting the waste material to get a visual impression, the sampling of the material, characterization of the material by general qualitative or semi-quantitative screening tests. Due to the lack of time, a comprehensive analysis is often not possible. The following parameters need to be tested:

- nonflammability,
- chlorine and sulphur content,
- pH-value,
- content of heavy metals (e.g. by test strips, Atomic Absorption Spectrometry or Atomic Emission Spectrometry with Inductively Coupled Plasma).

An alternative control system consists of a comprehensive analysis of the waste material before actual delivery at the plant. When the waste is delivered, it is only checked for conformity with the original sample and on specific relevant parameters. In general, it depends on the nature and the chemical and physical characteristics of the waste, e.g. if it is liquid or solid as to which parameters have to be tested and by which analytical methods. Therefore it is impossible to define a list of tests that can be applied to each type of waste.

Normally further checks are carried out on the sample later on, e.g. calorific value, water content, concentration of PCB or other toxic and/or thermoresistant contaminants.

At the end of the laboratory tests, the identity of the waste is known and the material can be directed to the proper discharge station within the plant.

ANNEX TN II

for information

Before finally discharging the waste either into a bunker or into one of the tanks, it has to be confirmed that no reactions between bunker or tank contents and the newly delivered material may occur. Such reactions, e.g. polymerization, may lead to uncontrolled temperature increases, ultimately causing a fire or even an explosion. Therefore, the behaviour of the waste has to be checked before unloading by some kind of small scale test.

The discharge areas are an integral part of the storage facilities. This plant section is normally designed in such a manner that emissions caused by the handling of hazardous waste materials, especially contamination of soils and groundwater by spills and leakages and diffuse emissions into the air are avoided. Therefore, where necessary, the areas where the waste is handled need to be isolated by materials that are among other things resistant to chlorinated hydrocarbons; all stations where volatile substances are unloaded, discharged or taken in have to be equipped with suction units.

Apart from the abovementioned general criteria for the technical equipment, the following types of storage facilities for combustible, toxic waste can be distinguished:

- storage of solid waste (bunker),
- storage of slurry material (tanks or specially equipped bunker compartments),
- storage of liquid waste oil, solvents, toxic waste water (tanks),
- storage of waste drums and other containers (drum storage area).

Where solid waste is stored other than in closed containers, it may be kept under less than atmospheric pressure by exhausting air out of the bunker or the sluice area. The exhaust gas may be used either as combustion air to the incinerator or, if the incinerator is out of order, it must be treated under the provisions of the authorization or discharged by the stack.

By discharging liquid or wet material into a tank, a gas volume (volume saturated with volatile organic matter) equivalent to the discharged waste is displaced. This gas stream has to be handled in such a manner that it causes neither odour nor pollution. State of the art is to discharge the displaced gas volume within a closed system, e.g. tubes with the necessary safety equipment either into the combustion chamber or in the case of plant shut down to an activated carbon filter or nitrogen cooled condensing plant.

Due to the highly variable characteristics of wastes as far as their level of contamination with pollutants is concerned, water content, calorific value etc., great attention is necessary to equalize and homogenize the waste fractions before feeding them to the kiln. To this end, the solid waste may be mixed and the different liquid materials should be mixed to a fuel that finally differs little in its physical and chemical characteristics.

ANNEX TN III

for information

1. Combustion

General Considerations

There is no single 'best' technology for achieving combustion. Whilst certain basic requirements will always apply, selection of the most suitable type of combustion chamber and of the operating conditions required in any particular case will depend upon the chemical and physical nature of the waste.

1.1 Combustion Conditions

Effective combustion will always depend upon at least four key parameters:

- temperature,
- residence time,
- oxygen availability,
- turbulence.

2. Combustion Gas Treatment

2.1 Gas Conditioning - Some Aspects

Care should be taken when gas cooling is used that recombination dioxins and furans which may occur under some circumstances after the combustion process is not enhanced.

Reformation of PCDDs and PCDFs is now often considered as occurring mainly in the range of temperature between 400 and 200°C.

When heat recovery is used, gas can still be quenched to achieve a temperature lower than 200°C very rapidly.

In addition, quenching has an important removal efficiency for HCl and outlet gas, when it is water saturated, and in proper conditioning for wet scrubbing.

2.2 Dust Separation

Proven separation processes such as those using electrostatic precipitators, filter separators and wet collectors of various types are available for separating dust from fluegases in special waste incinerators. Inertial separators, e.g; cyclones, are incapable of meeting current requirements, at least when installed as final collectors in a series.

The requirements with regard to the dust content of the scrubbed gas obtained by means of dust collectors fitted downstream of special waste incineration plants will depend largely on where the collectors are placed within the fluegas treatment units. In the case of primary separators, the requirements will mainly depend on what demands are placed on the downstream fluegas treatment installations. On the other hand, in the case of final separators, existing laws must be complied with.

In addition to the widely used dry electrostatic filters, wet filters of both the horizontal plate type and the vertical tube type are particularly recommended for humid fluegases as, in addition to the dust, aerosols and droplets can effectively be separated out at a low pressure loss.

Wet electrostatic filters are suitable for the removal of residual dust and the separation of aerosols downstream of the noxious gas treatment stage.

The main type of filter collector is the bag filter which can be subdivided into the reverse air flow bag filter and the pulse jet bag filter, depending on the filter cleaning method used.

In reverse air flow filters the dust is deposited on the inside of the bag which is made of light textiles or felts. The flow of contaminated gas keeps the bags inflated.

In a wet collector dust particles are deposited on droplets of liquid which is finely dispersed in the contaminated gas. A special feature of wet collectors is that the degree of separation depends very largely on particle size. Large particles are much more efficiently eliminated than fine ones.

2.3 Acid Gas Removal and Demister

Depending on the waste burned, the contaminated fluegases arising in special waste incineration plants may contain noxious gases such as HCl, HF and SO_x in the following concentrations (actual conditions):

HCl	1 000 - 15 000 mg/m ³
HF	10 - 500 mg/m ³
SO _x (in the form of SO ₂)	100 - 1 000 mg/m ³

the fluegases may also contain considerable amounts of vapourized mercury. The following processes are available for eliminating these noxious substances adequately:

- wet scrubbing,
- spray absorption.

* Wet Gas-Cleaning: As the residues are re-used separately, there is an increasing tendency not to separate the dust and gaseous pollutants simultaneously, although this possibility does exist. The dust tends to be removed, e.g. by means of a dry electrofilter, before the pollutant treatment stage.

For pure separation of gaseous pollutants, the scrubbers can then be operated with a much lower energy input.

In view of the different physico-chemical properties of HCl and HF on the one hand and SO₂ on the other, it has proved advantageous to wash the waste gas in two stages. The first stage in the washing process is to separate out HCl, HF and heavy metal vapours (e.g. mercury) with a very low pH value (0 - 3). In the second stage, SO₂ is separated out using dilute caustic soda (pH = 6 - 8).

- * **Spray Absorption Methods:** With these methods the absorbent is injected as a solution (e.g. NaOH) or as a suspension (e.g. lime milk) into a reactor where it reacts with the acidic HCl, HF and SO₂ gases. As a result of heat exchange with the waste gas, the absorbent droplets are dried as they pass through the reactor, with the result that the acidic pollutant components are transported in a dry particulate state.

Apart from jets, rotating disk sprays are the preferred spraying devices used. A filtering separator is generally installed after the reactor in order to collect the particulate reaction products leaving the reactor.

3. Available Technologies

For the time being, especially the following measures are known for an incineration as complete as possible and minimizing the emissions of air pollutants:

- adequate pretreatment (e.g. mechanical, thermal),
- incineration including after-burning with additional use of oxygen to lower the emissions of carbonmonoxide and organic substances and to improve the burnout especially in connection with the input of drums,
- quench or spray absorber,
- dry electrostatic precipitator or baghouse filter for dust removal,

- wet scrubber,
- flue gas cooling,
- wet electrostatic precipitator,
- activated carbon filter / activated carbon in drifting stream processes,
- SCR reactor.

ANNEX TN IV

for information

Monitoring of Emissions

1. Introduction

To ensure proper plant operation, it is essential that key combustion and gas cleaning parameters are monitored and recorded.

Emissions from hazardous waste incineration plants can be monitored and analysed continuously by the plant's own instruments, supplemented by regular check measurements. Other emissions like solid residuals require supplementary laboratory tests.

2. Plant Instruments

2.1 Parameters

The plant instruments are used for ongoing plant control and the automatic control of the incineration process, including flue gas cleaning. The following are typical control parameters:

- Flue gas temperatures
 - . in the kiln room,
 - . in the secondary combustion chamber,
 - . in the boiler, and
 - . before/after the filter.

- The concentration of
 - . oxygen (O₂),
 - . carbon monoxide (CO),
 - . hydrogen chloride (HCl),
 - . suspended matter/dust in the flue gas.

Other instrumentation is used for monitoring the plant's combustion efficiency and emissions. The following are typical monitoring parameters:

- nitric oxides (NO_x),
- sulphur dioxide (SO₂),
- suspended particles/dust,
- total organic carbon (TOC).

2.2 Monitoring of Emissions

In the literature there are many accounts of monitors for emission measurements, but the lists are incomplete because of the rapid developments in the area.

The bibliography refers to the German Umweltbundesamt: Bericht 1/1986 (Umweltbundesamt 1986). The basic principles are in situ and extractive measurements.

3. Check Measurement

Check measurements can be subdivided into three types:

- random sample measurements,
- calibration measurements,
- performance measurements.

3.1 Periodic Sample Measurements

To check the plant's particulate matter emissions and emissions of heavy metals and acid gases in particular, it is recommended to regularly measure emissions of the following:

- particulate matter,
- mercury and cadmium,
- arsenic, nickel and lead,

- chromium, copper and vanadium,
- hydrogen chloride, hydrogen fluoride and hydrogen bromide,
- sulphur dioxide and sulphur trioxide,
- total organic carbon,
- polychlorinated biphenyls and polychlorinated triphenyls,
- halogens and hydrogen sulphide,
- dioxins and dibenzofurans,
- phosphorus compounds,
- odourous substances.

Sampling of dust particles and metals contained therein should be carried out isokinetically as described in ISO/DIS9096.

Isokinetic sampling means that the velocity of suction in the sampling equipment's nozzle is equal to the flue gas velocity in the duct or stack from which the partial gas stream is sucked out.

3.2 Calibration Measurements

Validation of plant performance including calibration of the plant's instruments can be carried out in conjunction with the random sample measurements. There has proved to be a need for this since emission monitors are complicated systems which become unreliable after lengthy periods without expert inspection.

3.3 Plant Performance Measurements

After entry into service of a new furnace line and/or a new flue gas cleaning equipment, there is a need for performance testing, so that plant-specific characteristics are demonstrated. The test programme is a matter for agreement both in terms of content and frequency. Among the typical parameters are:

- Emission of TOC,
- Hydrogen chloride (HCl),
- Hydrogen fluoride (HF),
- Oxides of sulphur (SO₂, SO₃),
- Emission of PCDDs and PCDFs,
- Oxides of nitrogen (NO_x),
- Mercury (Hg).

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