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COMMISSION OF THE EUROPEAN COMMUNITIES

COM(79) 296 final

Brussels, 14 June 1979

Proposal for a COUNCIL DIRECTIVE

on the limit values applicable to discharges of mercury
into the aquatic environment by the chlor-alkali electro-
lysis industry

Proposal for a COUNCIL DIRECTIVE

on the quality objectives for the aquatic environment
into which mercury is discharged by the chlor-alkali
electrolysis industry

(submitted to the Council by the Commission)

COM(79) 296 final

EXPLANATORY MEMORANDUM

1. Introduction

In their concern to combat the pollution of fresh and sea water by the discharge of dangerous substances, the European Economic Community and its Member States have become Contracting Parties to international conventions whose purpose is to reduce and eventually eliminate this type of pollution (the Convention for the Prevention of Marine Pollution from Land-based Sources and the Convention on the Protection of the Rhine against Chemical Pollution), and are taking part in negotiations for other conventions with the same purpose. To ensure the harmonized implementation of these conventions and to launch a general and simultaneous effort by the Member States, the Council on 4 May 1976 approved Directive 76/464/EEC on pollution caused by certain dangerous substances discharged into the aquatic environment of the Community. This Directive stipulates, among other things, that pollution caused by the discharge of certain individual substances which belong to eight families and groups (known as List I substances) must be eradicated in accordance with provisions laid down by the Directive.

In particular, every discharge into the waters covered by the Directive which is liable to contain one of these substances requires prior authorization by the competent authority of the Member State concerned, which sets the emission standards. These standards must not exceed the limit values adopted by the Council upon a proposal from the Commission, with the exception of those cases where quality objectives fixed by the Council are complied with.

For the preparation of its initial proposals, the Commission convened a meeting of national experts on 14 June 1976 at which it was decided that priority should be given to the study of five substances; they include mercury and its compounds. This substance was chosen in view of its properties and the large quantities of discharges containing it.

At a second meeting held on 4 July 1977, it was agreed, for limit values, that the Commission would first prepare a proposal concerning chlor-alkali electrolysis plants, in view of the volume of discharges in this sector, and that it would continue its work with a view to presenting, as soon as possible, proposals for all mercury discharges covered by Directive 76/464/EEC. At its meetings of 5 and 6 December 1977, 20 and 21 June and 13 and 14 November 1978, the group of national experts advised the Commission on the preparation of this proposal.

2. Aim of the first proposal for a Directive

The purpose of the Directive is to eliminate pollution caused by discharges of mercury by chlor-alkali electrolysis plant into inland surface waters, territorial waters and internal coastal waters¹. It accordingly contains provisions for the application of Directive 76/464/EEC.

Direct discharges will have to meet the emission standards complying with limit values which are adopted primarily on the basis of toxicity, persistence and bioaccumulation of mercury and which take into account the best available technical methods. The result will be a significant reduction in these discharges. Additional stipulations aim at bringing about a gradual reduction in pollution caused by discharges from electrolysis plants which indirectly introduce mercury into the aquatic environment.

¹ To protect groundwater against this type of pollution (as well as others), the Commission has presented to the Council a proposal for a Directive on the protection of groundwater against pollution caused by certain dangerous substance (O J No C 37, 14 February 1978 p.3).

The Member States will have to take the appropriate administrative measures and carry out inspections which will enable the Commission, the Council and Parliament to be adequately informed of the application of the Directive.

If it transpires that the elimination of pollution of this type demands further measures as regards chlor-alkali electrolysis, the Commission will present appropriate proposals to the Council.

3. Comments on the first proposal for a Directive

3.1. Limit values

Chlor-alkali electrolysis may be carried out in an isolated plant or on a site where there are several industrial activities. The operation of older plant causes much more complex pollution problems than that of new facilities. The diversity of situations has made it necessary to define different limit values for different types of plant. Differentiation as regards the maximum allowable concentration in discharges is arrived at by means of variables whose value must be laid down for each plant. The limit values proposed for maximum quantities vary with the date of entry into service of the plant and the production process.

3.1.1. Maximum concentration

The limit value expressed as a concentration relates to the point of discharge into the receiving environment of the effluent discharged wholly or in part by electrolysis plant. It is defined according to a formula whose significance for standard cases may be inferred from the following examples.

In an isolated plant all the mercury-contaminated water has been in contact with the electrolysis installations. These are the process waters, used, for example, in condensation operations, equipment and site washing water, and rainwater. Contamination of these waters may be increased by the leaching of mercury deposited on the ground or in the drainage system after previous electrolysis operations¹.

When a plant has been designed to use a minimum quantity of water, its consumption may approximate to 700 l/t chlorine production capacity for manufacturing and equipment washing operations.

If these waters make up the total effluent of a plant, the application of the formula of the maximum allowable concentration given in paragraph 1.1 of Annex I would require that this concentration should not exceed 700 µg mercury/l; this would correspond to 0.49 g mercury/t chlorine production capacity, a value which is seldom complied with in existing plant. New plants to be built may need less process and washing water than 700 l/t chlorine, and mercury discharges authorized in this instance will therefore be less than 0.49 g/t chlorine.

To these discharges of mercury, however, there must be added those in rainwater run-off from roofs and the ground which has picked up particles of mercury emanating from chimney stacks or which have permeated the roof or walls of the electrolysis rooms. In a standard unit of recent construction, the total amount of water contaminated by mercury could be estimated at 2 m³/t chlorine production capacity. The concentration of 700 µg/l in the discharges then corresponds to a quantity of 1.4 g mercury/t chlorine.

¹ Leaching may even affect other waters. No special provisions are laid down for this case in the proposal for a Directive. Leaching of this kind therefore cannot be adduced as a reason for permitting a higher concentration of mercury in the discharges nor the emission of greater quantities of mercury by plant of a given capacity.

Besides contaminated water, an electrolysis plant discharges other water, in particular that used for cooling operations. In a standard plant, the requirements for process, washing and cooling water are of the order of $20 \text{ m}^3/\text{t}$ chlorine production capacity. By applying the formula given in paragraph 1.1 of Annex I,

$$C = 700 \frac{V}{V} = \frac{2}{20} = 70 \text{ } \mu\text{g mercury/l} = 70 \text{ mg mercury/m}^3$$

This concentration corresponds to 1.4 g mercury/t chlorine production capacity, since the water requirements of the plant are $20 \text{ m}^3/\text{t}$ chlorine, and $70 \text{ mg mercury/m}^3 \times 20 \text{ m}^3/\text{t chlorine} = 1.4 \text{ g mercury/t chlorine}^1$.

Water consumption figures of the order of $20 \text{ m}^3/\text{t}$ chlorine are characteristic of plant which has been in service for some years.

Plant of more recent construction needs much more water, even if the volume of contaminated water is less than in older plants, as electrolysis is carried out at high temperatures to improve the yield. According to engineers' estimates, water requirements could be as high as $100 \text{ m}^3/\text{t}$ chlorine production capacity in these plants.

¹ Conversely, it is possible to deduce the concentration which would correspond, e.g., to discharges of 0.5 g mercury/t chlorine and to water requirements of $20 \text{ m}^3/\text{t Cl}_2$.

This would give: $C \times 20 \text{ m}^3/\text{t chlorine} = 0.5 \text{ g mercury/t chlorine}$

$$C = \frac{0.5 \text{ g mercury}}{20 \text{ m}^3} = 25 \text{ mg mercury/m}^3 = 25 \text{ } \mu\text{g mercury/l}$$

A new plant, within the meaning of the Directive, whose contaminated effluents were 2 m³/t chlorine and whose cooling water requirements were 98 m³/t chlorine should therefore comply with a concentration limit value obtained by the formula:

$$C = 700 \times \frac{2}{100} = 14 \mu\text{g mercury/l}$$

The discharges from this plant should also be compatible with a limit value expressed in terms of quantity (see paragraph 3.1.2). Compliance with this value is an additional constraining factor affecting the maximum allowable concentration. If a new plant whose total effluent amounts to 100 m³/t chlorine may not discharge more than 0.5 g mercury/t chlorine, the maximum allowable concentration in the discharges would be obtained from the following formula:

$$C \times 100 \text{ m}^3/\text{t chlorine} = 0.5 \text{ g mercury/t chlorine}$$

$$C = \frac{0.5 \text{ g mercury}}{100 \text{ m}^3} = 5 \text{ mg mercury/m}^3 = 5 \mu\text{g mercury/l}$$

If the effluent from electrolysis works (including decommissioned plant) is mixed with other waste before being discharged, the maximum concentration is proportionately reduced, since, in the formula $C = 700 \frac{V}{V}$, V refers to all the effluent discharged, whether or not it comes from electrolysis plant. Further, if the effluent which does not come from this type of plant contains mercury, it must not be taken into account for ascertaining whether the limit value is complied with¹.

¹ In practice, one could measure the concentration C' of these discharges before they are mixed and then make the following calculation:

$$C^* = \frac{C'v'}{V} \text{ where } v': \text{ volume of effluent at the point of measurement of } C'$$

$$V : \text{ volume of effluent at the point of discharge, and check whether: } (C-C^*) = 700 \frac{V}{V}$$

The toxicity of mercury for the aquatic environment justifies such limit values. The lethal concentration for 50% of a sample of young rainbow trout is reported to be $16 \mu\text{g}/\text{l}^1$. With a dilution factor of 8, which is suggested as characteristic of good mixing conditions in flowing water, this would correspond to a concentration of $128 \mu\text{g}$ mercury/l in the discharges.

It may be feared that sub-lethal effects on aquatic organisms or their predators may be caused by much weaker concentrations and, in accordance with current practice in such cases, it would appear desirable to set a limit concentration in discharges of the order of $10 \mu\text{g}/\text{l}$. If account were taken of the synthesis of methyl mercury in the environment, its accumulation in fish and its toxic effects on the nervous system of consumers, the conclusions reached could be even more stringent.

3.1.2. Maximum quantity

In this proposal for a Directive, the limit values are expressed in concentration and in quantities per tonne of chlorine production capacity. This variable was preferred to the tonne of chlorine produced because mercury pollution is largely independent of the rate of capacity utilization. The timetable laid down takes account of the cost of the measures to be taken to collect and purify all the contaminated waters. These operations are made particularly

¹ See R.H.W. Schubert: Appraisal of the ecological consequences (ecotoxicity) of mercury discharges for the aquatic environment, page 41; report prepared for the Commission of the European Communities.

difficult by the presence on the ground and in the drainage system of mercury discharged previously by the plant and likely to be leached. This means that fairly long periods are needed in which to meet the cost of cleaning the effluent of the mercury originating in these residual deposits.

New plants do not have to be concerned with previous deposits and an optimum water collection and drainage system can be designed without conversion costs; they can therefore comply with the limit value of 0.5 g mercury/t chlorine without a transition period.

In 1977 a survey was made of 56 plants which electrolysed sodium chloride and to a lesser extent potassium chloride, using mercury¹.

Of these plants, six producing about 15% of the chlorine manufactured in mercury-cell electrolysis works, were using the "lost brine" process. The mercury concentrations in the discharges of these works are similar to those found in electrolysis units using the recycled brine process, but, since the volumes of contaminated water are many times greater than those discharged by a plant of the same capacity using recycled brine, the quantities of mercury discharged by a lost-brine plant are also many times greater than those discharged by a recycled brine plant for the same production capacity.

The scale of the discharges of these plants means that a special effort must be made to achieve a relative reduction as already required by the competent authorities in the Member States concerned.

¹ See Economist Intelligence Unit: The economic effects of pollution control measures on defined industrial sectors - mercury-discharging industries, p. 6; report prepared for the Commission of the European Communities.

The Commission proposes that the entry into force of the Directive should prompt these establishments to make a new effort immediately and to take steps for a gradual reduction of their discharges. Under these conditions, the plants in operation at the date of notification of the Directive will follow a special timetable which will take into account technical possibilities and the useful life of the various lost-brine electrolysis plants. To meet the timetable, some establishments will have to supplement or replace their water treatment facilities. This leeway will not be allowed to new plants.

3.2. Authorizations

Compliance with the limit values discussed in point 3.1 must be ensured by means of a system of prior authorization of discharges delivered by the competent authority of the Member State where the plant is situated. Each authorization must fix the emission standards, which may not be less stringent than the limit values or the emission standards already in force on the date of entry into force of the Directive. This is to be interpreted as follows.

If a standard is expressed as a concentration, it may be applicable at the point of discharge, like the corresponding limit value, or upstream of that point. In the latter case, it must be possible to establish that the standard or maximum allowable concentration under the authorization is not less stringent than the limit value. This implies, first, that the standard applies to all the waters contaminated as a result of electrolysis operations, so that a comparison can be made with the limit value. Secondly, the maximum concentration of mercury must not exceed the value of 700 $\mu\text{g/l}$ multiplied by the ratio between the volume of the contaminated waters flowing, throughout a given period, past the point or points designated in the authorization and upstream of a discharge point¹ and the total volume of water flowing past this point (or these points) during that period.

¹ As the standard applies to all the contaminated waters, this volume is equal to that of the waters used for the manufacture of electrolysis products which are subsequently discharged.

By way of exception, if the standard applies to waters which are to undergo a further treatment of known efficiency, the value given above may be divided by the fraction which represents the residual mercury content after treatment.

This may be formulated as follows:

v: for a given period, the volume discharged at one point and corresponding:

- to the waters used in the manufacture of electrolysis products and subsequently discharged;
- washing waters used in the plant; and
- precipitations forming part of the liquid effluent of the plant and contaminated by mercury to a degree such that they may be purified if the best available technical methods are used;

V: for the same period, all the liquid effluents which come wholly or in part from the plant and which are discharged at the point under consideration;

V': for the same period, all the liquid effluents of the plant which flow past the point or points designated in the authorization and which arrive at the point of discharge under consideration;

r: the efficiency of a mercury-removal unit downstream of the point or points designated in the authorization. It is expressed as a figure between 0 and 1;

(1-r): the fraction which represents the residual mercury content after treatment.

If an emission standard is expressed as a concentration, it must comply with the formula:

$C = 700 \frac{V}{V'}$ if the standard is applicable at the point of discharge

$C = 700 \frac{V}{V'}$ if the standard is applicable upstream of the point of discharge and downstream of the mercury-removal facilities

$C = \frac{700}{1-r} \frac{V}{V'}$ if the standard is applicable upstream of the point of discharge and of the mercury-removing facilities.

The authorization fixing the emission standards may be granted for a period of up to five years. However, if an establishment installs a new electrolysis unit to which may be attributed direct mercury discharges distinct from those produced by the existing plant, this new unit must be treated as a new plant and the authorization adapted accordingly. This provision virtually excludes the entry into service of electrolysis plant using the lost-brine process.

3.3. Reduction of pollution caused by indirect discharges

The mercury used in the electrolysis operations may leave the plant or remain there for a long period. If it leaves the plant, it may be incorporated in a liquid, a gas or a solid. In the first case, there is a direct discharge within the meaning of the Directive and the mercury emitted must be covered by emission standards which meet limit values.

Airborne escapes of mercury outside the establishment and mercury incorporated in electrolysis products or in solid waste may cause water pollution, but the proposal does not lay down emission standards for these cases.

Yet these losses are greater than those through direct discharges. Moreover, mercury remaining in the plant for a long period - often more than half the total consumption - may be discharged to the environment, for example, when the installations are dismantled.

Control of mercury pollution of water therefore demands a global approach. First of all, the consumption of mercury must be analysed to obtain a clearer understanding of the components¹ and to assess more accurately the risks to the environment. The Member States will then draw up plans for gradually reducing emissions which, taking account of available technical resources, will lead to minimal discharges of mercury into water.

3.4. Monitoring the application of the Directive

Mercury-cell electrolysis plants are in operation in all the Member States except Ireland and Luxembourg.

Public concern about mercury pollution is prompting the authorities and the industry to make special efforts to reduce mercury discharges. These efforts are coordinated under international conventions to which the Community is a Contracting Party.

For these reasons, the monitoring of the application of the Directive demands special measures.

The Member States are to supplement the measures laid down for the checking of compliance with discharge authorizations by studying their effects in the zones affected. Every five years, they will send to the Commission a report on all the measures taken pursuant to the Directive and on the reduction of pollution obtained through these measures.

¹ At the moment, the "unidentified losses" are of the same order of magnitude as the identified quantities used.

The Commission may ask the Member States for further information and will then report to the Council and to Parliament; the Commission will propose any further measures which it considers would help eradicate mercury pollution.

The Council may consider it useful to send the Commission's report to the international bodies concerned with this type of pollution.

4. Aim of the second proposal for a Directive

The aim of the Directive is to eliminate pollution of the aquatic environment caused by mercury discharged from electrolysis plant by obtaining compliance with quality objectives.

These objectives are based on the toxicity of mercury, particularly for human beings, its persistence and its bioaccumulation in the aquatic environment. Emission standards must be derived therefrom.

Compliance with the standards and objectives must be checked in accordance with the procedure laid down in the Directive.

To supplement the means of combating the pollution of the aquatic environment by mercury, provision is made for the gradual reduction of indirect discharges which can make it difficult to achieve the quality objectives.

Finally, the proposal lays down that the Commission, after receiving information from the Member States, reports to the Council and to Parliament on the application of the Directive and presents proposals as provided for in Article 6(3) of Directive 76/464/EEC.

5. Comments on the second proposal for a Directive

5.1. Quality objectives

5.1.1. Water

In fresh water, the objective is the guide value laid down in Directive 75/440/EEC concerning the quality required of surface water intended for the abstraction of drinking water: 0.5 ug/l.

The guide value is selected in accordance with Article 4 of the Directive, which requires substantial improvements to the quality of water between 1975 and 1985. The quality objective must be complied with by 1 July 1983.

In estuaries and coastal waters, the quality objective is set at 0.05 ug/l. The selection of this value is a guarantee against increased contamination of the waters in question. Furthermore, it incorporates adequate safety coefficients for the marine species about which the Commission possess scientific data¹.

5.1.2. Fish

The protection of fish species would be guaranteed by the quality objectives adopted for water. However, those who consume the most fish need specific protection.

¹ These data are given in the report "Appraisal of the ecological consequences (ecotoxicity) of mercury discharges for the aquatic environment", prepared by Prof. R.H.W. Schubert for the Commission of the European Communities.

The quality objective adopted is 0.3 mg mercury/kg wet fish flesh. It applies to a representative sample of the fish consumption of persons exposed to substantial risk. The first symptoms of mercury poisoning may be said to occur as follows:

WHO considers that in the most sensitive subjects the effects of methyl mercury can be detected as from a blood concentration of 20 to 50 $\mu\text{g}/100\text{ ml}$ ¹. By regression analysis it can be found that this concentration corresponds at least to a daily intake of methyl mercury of 3.5 $\mu\text{g}/\text{kg}$ body weight for a person of 70 kg.

This finding is confirmed by direct estimates of the intake of methyl mercury likely to cause disorders in human beings; it is thought to be equal or greater than 3 $\mu\text{g}/\text{d}/\text{kg}$ ², which corresponds to 210 $\mu\text{g}/\text{d}$.

The consumption of other foodstuffs besides fish does not lead to an ingestion of mercury greater than 5 $\mu\text{g}/\text{d}$ ³.

Drinking water consumed cannot contain a mercury content of over 2 $\mu\text{g}/\text{d}$, if the Community Directives on this subject are applied. The ambient air carries no more than 50 mg mercury/ m^3 , equivalent to an exposure of 1 $\mu\text{g}/\text{d}$ ⁴. If, to simplify the calculations we assume that exposures of these three types are entirely due to methyl mercury which the organism assimilates to a rate of 100%

¹ WHO, Environmental Health Criteria 1: Mercury; Geneva, 1976.

² WHO, op. cit., pp 80 and 118.

³ See Department of the Environment, Environmental Mercury and Man, Pollution Paper No. 10, HMSO, London, 1976.

⁴ See WHO, op. cit., pp 64 and 65.

a consumer sensitive to methyl mercury could ingest 200 µg/d of this substance before running the risk of suffering toxic effects, provided that he is not exposed to mercury by reason of his occupation¹.

If the fish consumed contains 300 µg/kg mercury, a consumer could ingest two-thirds of 1 kg/d before running a risk of nervous disorders, the probability of which is less than 5%².

The highest daily consumption rates recorded do not exceed 500 g³:

The quality objective adopted would therefore be adequate to protect consumers against the risks, as currently identified⁴.

However, the Commission could change this opinion if new toxicological effects due to the ingestion of mercury, or biochemical or physiological damage for intakes below the toxicity threshold were discovered⁵.

¹ The main consumers of mercury are fishermen who are not exposed to risks of poisoning by virtue of their occupation, as distinct from those connected with their consumption pattern.

² See WHO, op. cit., p. 66.

³ See WHO, op. cit., p. 118.

⁴ In Minamata Bay the mercury content of the fish flesh has reached 50.000 µg/kg, see DOE op. cit., p. 7.

⁵ WHO has drawn particular attention to this point; see WHO op. cit., p. 26.

5.1.3. Sediments and molluscs

The mercury content of sediments is important for the protection of the environment, particularly because they are thought to be the site where bacteria synthesize methyl mercury passing through the food chain¹. It is not at present possible to propose a maximum mercury content for sediments, but in principle it can be ascertained whether the content is increasing or not.

It may be difficult to obtain this information, as the movements of sediments over a period of time are likely to prevent the results obtained being comparable. In this case it would be preferable to observe sedentary organisms which accumulate mercury, and this is why the proposal for a Directive includes this possibility.

5.2. Compliance with the objectives

The proposal for a Directive provides that the quality objectives are to be attained by means of compliance with emission standards for direct discharges and the implementation of programmes to reduce pollution caused by indirect discharges.

This dual approach is necessary, as indirect discharges are responsible for a large proportion of mercury pollution. To ignore them would make it very difficult to ensure compliance with the objectives.

¹ See WHO, op. cit., pp. 50 to 56.

5.3. Monitoring procedure and report

For each quality objective, the proposal stipulates:

- (i) the preliminary research to be carried out;
- (ii) sampling frequency;
- (iii) the reference method of analysis;
- (iv) the method of expressing and interpreting the results.

The information which the Member States applying the Directive will supply every five years on the implementation of the monitoring procedure will enable the Commission to prepare the report to the Council and the proposals referred to in Article 6(3) of Directive 76/464/EEC.

The proposal provides that the Commission will also report to Parliament on the application of the Directive. The importance which public opinion attaches to mercury pollution makes this report particularly advisable.

6. Consultation of Parliament and of the Economic and Social Committee

As these proposals for Directives are based on Article 6 of Directive 76/464/EEC, consultation of Parliament and of the Economic and Social Committee is not required. However, the Commission considers, in view of the political importance of the proposals, that they should be submitted to both these Institutions.

Proposal for a Council Directive on the
limit values applicable to discharges of
mercury into the aquatic environment by
the chlor-alkali electrolysis industry

THE COUNCIL OF THE EUROPEAN COMMUNITIES,

Having regard to Council Directive 76/464/EEC of 4 May 1976 on pollution caused by certain dangerous substances discharged into the aquatic environment of the Community¹, and in particular Article 6 thereof,

Having regard to the proposal from the Commission²,

Having regard to the opinion of the European Parliament³,

Having regard to the opinion of the Economic and Social Committee⁴,

Whereas, in order to protect the aquatic environment of the Community against pollution by certain dangerous substances, Article 3 of Directive 76/464/EEC provides for a system of prior authorization laying down emission standards for discharges of the substances falling within List I contained in the Annex thereto, and Article 6 thereof provides that limit values shall be laid down for such emission standards;

¹ OJ No L 129 of 18 May 1976, p.23.

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Whereas mercury and its compounds are included in the List;

Whereas that Directive also provides for the establishment of quality objectives, and whereas these have been laid down in Council Directive¹;

Whereas, since the pollution caused by discharges of mercury into water arises principally from the electrolysis of alkali chlorides, in the first instance limit values should be established for this industry and its discharges made subject to prior authorization;

Whereas provision should be made for the Member States to fix emission standards and time-limits which are no less stringent than the limits laid down by the Council;

Whereas the Member States should take the requisite measures to ensure that discharges and their effects are monitored;

Whereas it is important that the Member States should take measures to reduce pollution caused by mercury discharged indirectly into the aquatic environment;

Whereas, since groundwater is to be the subject of a specific Directive, it is excluded from the scope of this Directive;

Whereas it is important that the Council and the European Parliament be kept regularly informed as to the operation of the Directive,

HAS ADOPTED THIS DIRECTIVE,

Article 1

1. The purpose of this Directive is to lay down for the chlor-alkali electrolysis industry the limit values which emission standards must not exceed and the time-limits for implementation in respect of discharges of mercury and mercury compounds into the aquatic environment.
2. This Directive applies to the waters referred to in Article 1 of Directive 76/464/EEC, with the exception of groundwater.

Article 2

For the purposes of this Directive:

(a) "limit value" means:

- the maximum allowable concentration of mercury and its compounds in direct discharges;
- the maximum quantity of these substances whose discharge has been authorized, in relation to the production capacity of the establishments in question;

(b) "discharge" means the introduction by an industrial establishment of mercury or its compounds into the waters referred to in Article 1(2);

(c) "direct discharge" means any discharge which has not beforehand been:

- borne through the air outside the industrial establishment, or
- incorporated into the products or wastes;

(d) "indirect discharge" means any discharge which is not a direct discharge;

- (e) "industrial establishment" means any plant where alkali chlorides are or have been electrolysed and which is in a position to make direct discharges of mercury which may be directly attributed to it;
- (f) "existing establishment" means an industrial establishment in operation on the date of notification of this Directive;
- (g) "new establishment" means an industrial establishment brought into operation after the date of notification of this Directive.

Article 3

The emission standards, the time-limits for compliance and the sampling frequencies laid down in the authorization referred to in Article 3 of Directive 76/464/EEC shall comply with the limits given in Annex I to this Directive.

The methods of analysis laid down in the authorization shall comply with the reference method of analysis given in Annex II to this Directive. Where the use of other methods of analysis is authorized, such methods shall comply with the detection limit, precision and accuracy laid down in Annex II.

No authorization may be granted for a period of more than five years.

Article 4

The Member States shall draw up programmes for the gradual reduction and eventual elimination of pollution caused by indirect discharges into the waters referred to in Article 1(2). These programmes shall provide for an analysis of the consumption of mercury by industrial establishments and shall lay down intermediate objectives to be reached seven years after notification of this Directive.

Article 5

The Member States shall keep the entire zone affected by the discharges from industrial establishments under surveillance and shall monitor the effects of these discharges. In the event of transfrontier pollution affecting more than one Member State, the States concerned shall act in concert with a view to adopting appropriate control measures and shall forthwith inform the Commission thereof.

Article 6

1. Every five years following notification of this Directive, the Member States shall draw up and send to the Commission a report on the reduction of pollution caused by discharges of mercury into the aquatic environment by the chlor-alkali electrolysis industry.
2. The Member States shall, in accordance with Article 13 of Directive 76/464/EEC, supply the Commission, at its request, with any necessary additional information specifically concerning:
 - the authorizations granted in accordance with Article 3 and in particular the emission standards, the monitoring procedures introduced, the sampling frequencies and the methods of sample analysis;
 - the programmes for the gradual reduction of the pollution in question, drawn up pursuant to Article 4;
 - the results of the surveillance and monitoring carried out in accordance with Article 5.
3. The Commission, on the basis of the information it has received pursuant to this Article, shall report every five years to the Council and to the European Parliament on the operation of this Directive and, if necessary, shall place appropriate additional proposals before the Council.

Article 7

1. The Member States shall, within two years of the date of notification of this Directive, bring into force the measures necessary to comply therewith and shall forthwith inform the Commission thereof.
2. The Member States shall communicate to the Commission the texts of the provisions of national law which they adopt in the sector covered by this Directive.

Article 8

This Directive is addressed to the Member States.

Done at

For the Council,

The President

ANNEX I

Limit values and time-limits

The limit values and time-limits within the meaning of Article 1(1) are as follows:

1. Maximum concentrations

- 1.1. At each point of discharge the average monthly concentration of the mercury emitted as a result of chlor-alkali electrolysis operations may not be greater than that given by the formula:

$$C = 700 \frac{v}{V}$$

where C = maximum allowable concentration in μg mercury/l

v = volume discharged at a specific point and corresponding, for the month in question, to:

- (a) the water used in the manufacture of the products of electrolysis and subsequently discharged,
- (b) the washing water used in the plant, and
- (c) the precipitations which form part of the effluent from the plant and which are contaminated by mercury to a degree such that they can be purified if the best available technical means are used.

V = all the effluent arising, in whole or in part, from plant over the same period and which is discharged at the point in question.

In order to check compliance with the limit values, measurements must be taken at least once a day from representative discharge samples.

The sampling method must allow for instantaneous values for concentration and flow in such a way as to ensure that the samples are representative¹.

The average monthly concentration must be calculated on the basis of the arithmetic mean of the daily average concentrations.

1.2. The provisions of paragraph 1.1 apply to establishments existing at 1 July 1983. They apply to new establishments:

- two years after the date of notification of the Directive;
- as soon as the establishment is brought into service if this occurs after that date.

2. Maximum quantities

2.1. Existing recycled-brine plants

Such plants may not discharge, on an average monthly basis, directly into the waters referred to in Article 1(2) more than:

- (a) 1.5 g mercury/t chlorine at 1 July 1983
- (b) 1 g mercury/t chlorine at 1 July 1986
- (c) 0.5 g mercury/t chlorine at 1 July 1989.

In this and subsequent paragraphs the expression "t chlorine" refers to the production capacity.

¹ It is accepted that the analysis every 24 hours of a sample constituted in proportion to the flow meets this requirement. The concentration measured may be regarded as a daily average. Hourly analysis of samples coupled with a flow measurement is also permitted. Daily concentrations must then be calculated as the average of the concentrations measured, weighted by the flow readings.

2.2. Existing lost-brine plants

Such plants may not discharge, on an average monthly basis, directly into the waters referred to in Article 1(2) more than:

- (a) 8 g mercury/t chlorine at 1 July 1983;
- (b) 5 g mercury/t chlorine at 1 July 1986;
- (c) 2.5 g mercury/t chlorine at 1 July 1989.

2.3. New establishments

Such establishments may not discharge, on an average monthly basis, more than 0.5 g mercury/t chlorine directly into the waters referred to in Article 1(2):

- two years after the date of notification of the Directive, or
- as soon as the establishment is brought into service, if this occurs after that date.

ANNEX II

Reference method of analysis

For the purposes of Article 3, the reference method of analysis is flameless atomic absorption at 0.2537 μm , after pre-oxidation of the unfiltered sample and reduction of the mercury ions Hg (II) by stannous chloride (SnCl_2) and entrainment of the mercury vapours.

- Detection limit* : 0.0001 mg/l Hg
- Precision* : $\pm 15\%$
- Accuracy* : $\pm 30\%$

* cf. the definitions given in the proposal for a Council Directive on the methods of measurement and frequencies of sampling and analysis of the parameters of the quality required of surface water intended for the extraction of drinking water in the Member States (O J No C 208, of 1 September 1978).

Proposal for a Council Directive on the quality
objectives for the aquatic environment into which
mercury is discharged by the chlor-alkali
electrolysis industry

THE COUNCIL OF THE EUROPEAN COMMUNITIES,

Having regard to Council Directive 76/464/EEC of 4 May 1976 on pollution caused by certain dangerous substances discharged into the aquatic environment of the Community¹, and in particular Article 6 thereof,

Having regard to the proposal from the Commission²,

Having regard to the opinion of the European Parliament³,

Having regard to the opinion of the Economic and Social Committee⁴,

Whereas, in order to protect the aquatic environment of the Community against pollution by certain dangerous substances, Article 3 of Council Directive 76/464/EEC provides for a system of prior authorization laying down emission standards for discharges of the substances falling within List I contained in the Annex thereto, and Article 6 thereof provides that limit values shall be laid down for such emission standards and also quality objectives for the aquatic environment affected by these substances;

¹ OJ No L 129 of 18 May 1976, p.23

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3

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Whereas mercury and its compounds are included in the List;

Whereas Council Directive ...¹lays down' limit values for discharges of mercury into the aquatic environment ;

Whereas, although the Member States are required to apply the limit values, they may in certain cases employ a system of quality objectives;

Whereas a monitoring procedure should be instituted to enable the Member States to demonstrate that the quality objectives are complied with;

Whereas, since the pollution caused by discharges of mercury into water arises principally from the electrolysis of alkali chlorides, quality objectives should, in the first instance, be laid down for the aquatic environment into which mercury is discharged by this industry and these discharges should require prior authorization.

Whereas, in order to attain the quality objectives, Member States should lay down emission standards in the authorizations granted and whereas the Member States should take steps to reduce pollution caused by mercury discharged indirectly into the aquatic environment;

Whereas it is important that reports be prepared on cases where the system of quality objectives has been applied;

Whereas, since groundwater is to be the subject of a specific Directive, it is excluded from the scope of this Directive,

HAS ADOPTED THIS DIRECTIVE:

Article 1

1. The purpose of this Directive is to lay down quality objectives for the aquatic environment into which mercury is discharged by the chlor-alkali electrolysis industry and to institute a monitoring procedure.
2. This Directive applies to the waters referred to in Article 1 of Directive 76/464/EEC, with the exception of groundwater.

Article 2

For the purposes of this Directive:

- (a) "quality objective" means the maximum allowable concentration of mercury or its compounds in the aquatic environment concerned;
- (b) "discharge" means the introduction by an industrial establishment of mercury or its compounds into the waters referred to in Article 1(2);
- (c) "direct discharge" means any discharge which has not beforehand been:
 - borne through the air outside the industrial establishment;
or
 - incorporated into the products or waste;
- (d) "indirect discharge" means any discharge which is not a direct discharge;
- (e) "industrial establishment" means any plant where alkali chlorides are or have been electrolysed and which is in a position to make direct discharges of mercury which may be directly attributed to it.

Article 3

The Member States shall draw up programmes for the gradual reduction and eventual elimination of pollution caused by indirect discharges into the waters referred to in Article 1(2).

These programmes shall provide for an analysis of the consumption of mercury by industrial establishments and shall lay down intermediate objectives to be reached seven years after notification of this Directive.

Article 4

Where the area liable to be affected by the discharges is a trans-frontier area, the Member States concerned shall consult one another on the implications arising from the application of this Directive and shall forthwith inform the Commission thereof.

Article 5

1. Every five years following notification of this Directive, the Member States shall draw up and send to the Commission a report on the reduction of pollution caused by discharges of mercury into the aquatic environment by the chlor-alkali electrolysis industry.
2. The Member States shall, in accordance with Article 13 of Directive 76/464/EEC, supply the Commission, at its request, with any necessary additional information specifically concerning:
 - the authorizations granted and in particular the emission standards,
 - the implementation of the monitoring procedures,
 - the programmes for the gradual reduction of the pollution in question, drawn up pursuant to Article 3,

- the application of the Directive to transfrontier areas, in accordance with Article 4.

3. The Commission, on the basis of the information it has received pursuant to this Article, shall report every five years to the Council and the European Parliament on the operation of this Directive and shall place appropriate proposals before the Council, on which the latter shall act pursuant to Article 6(3) of Directive 76/464/EEC.

Article 6

1. The Member States shall, within two years of the date of notification of this Directive, bring into force the measures necessary to comply therewith and shall forthwith inform the Commission thereof.
2. The Member States shall communicate to the Commission the texts of the provisions of national law which they adopt in the sector covered by this Directive.

Article 7

This Directive is addressed to the Member States.

Done at

For the Council,

The President

ANNEX I

Quality objectives

The following stipulations apply in the areas affected by discharges from industrial establishments:

1. The concentration of mercury in waters must not be more than 0.5 µg/l within the freshwater limit. It must not be more than 0.05 µg/l beyond this limit.
2. The mercury content in the flesh of fish living beyond the freshwater limit must not exceed 0.3 mg/kg wet weight.
3. The mercury content in sediments or in a characteristic mollusc must not increase with the passage of time.
4. These quality objectives must be attained by 1 July 1983.

ANNEX II

Monitoring procedure

- I Compliance with the quality objectives laid down in point 1 of Annex I must be monitored as follows:
1. For each geographical area affected by the discharges three zones must be demarcated:
 - A The immediate mixing zone: zone in the immediate vicinity of the discharge point where the degree of dilution is very slight;
 - B Dispersion zone: zone more remote from the discharge point characterized by a higher degree of diffusion and greater discharge dilution;
 - C Zone unaffected by the discharges: zone where the effects of the discharges are not detectable.
 2. Samples must be taken over a network of points located in such a way that the samples taken are statistically representative of the quality of the waters throughout zone B.

The concentration of mercury must be determined at each sampling point and the dilution factor for the mercury discharged by the industrial establishment(s) concerned must be estimated by dividing the concentration in the discharges by the highest concentration measured in the zone.
 3. The discharge standard must be fixed or reviewed in the light of the quality objective and of the concentrations measured, bearing in mind the possibilities of additional mercury discharges in zone B during the period covered by the authorization.

4. In order to check compliance with the standard, measurements must be taken at least once a day from representative discharge samples. The sampling method must allow for instantaneous values for concentration and flow in such a way as to ensure that the samples are representative. The reference method is that defined in Annex II to the proposal for a Council Directive on the limit values applicable to discharges of mercury into the aquatic environment by the chlor-alkali electrolysis industry.
5. Compliance with the quality objective must be estimated daily by dividing the concentration measured in the discharges by the dilution factor.

The mercury concentration in the receiving waters must be measured directly every six months and the dilution factor re-estimated on that occasion.

If the value measured is more than 0.4 µg/l within the freshwater limit and 0.04 µg/l beyond this limit, the measurements must be taken more frequently.

6. Measurement of the mercury concentration in the receiving waters must be carried out from an unfiltered sample. The reference method of analysis is that referred to in point 4, and is carried out after the mercury has been concentrated in carbon tetrachloride in the form of dithizonate and extracted.

Detection limit : 0.004 µg mercury/l
Precision : ± 15%
Accuracy : ± 30%

II Compliance with the quality objective laid down in point 2 of Annex I must be monitored as follows:

1. In each of the areas in the vicinity of an industrial establishment which makes discharges beyond the freshwater limit, the consumption pattern of the main fish-eaters is to be studied in order to draw up a typical diet.
2. A sample of fish muscle tissue reflecting the pattern of the typical diet is to be taken every six months from each zone and this sample is to be analysed. If the value measured exceeds $0.25 \mu\text{g/kg}$, the measurements must be taken more frequently.
3. The reference method of analysis is that referred to in point 1.4 and is carried out after the sample has been taken up in solution with nitric acid.

Detection limit : $10 \mu\text{g mercury/kg}$

Precision : $\pm 5\%$

Accuracy : $\pm 15\%$

III Compliance with the quality objective laid down in point 3 of Annex I must be monitored as follows:

1. In each of the areas in the vicinity of an industrial establishment, the competent national authority decides whether it is preferable to select sediment or a specific mollusc as the indicator of changes in the mercury content with the passage of time in the area concerned.
2. Samples must be taken every twelve months of the target selected such that the samples are statistically representative of the area in question.

3. The reference method of analysis is that referred to in point 1.4 and is carried out after:

- digestion with nitric acid in the case of sediment;
the results must be expressed in mg mercury/kg dry matter, and
- separation of the solid and liquid substances and digestion
with nitric acid in the case of molluscs.

The analysis must be carried out on the solid substances.

Detection limit : 10 μ g mercury/kg

Precision : $\pm$ 5%

Accuracy : $\pm$ 15%

4. In order to ensure that the quality objective is maintained, the results of the measurements carried out over a given period must not, on average, be significantly higher than those obtained the previous year.

The significance threshold is 90%.