

COMMISSION OF THE ~~EUROPEAN~~ COMMUNITIES

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Proposal for a

COUNCIL DIRECTIVE

concerning the limit values for discharges of cadmium into the aquatic environment and quality objectives for cadmium in the aquatic environment

(submitted to the Council by the Commission)

COM(81) 56 final

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PROPOSAL FOR A COUNCIL DIRECTIVE CONCERNING THE LIMIT VALUES APPLICABLE
TO DISCHARGES OF CADMIUM INTO THE AQUATIC ENVIRONMENT AND QUALITY OBJECTIVES
FOR CADMIUM IN THE AQUATIC ENVIRONMENT

Explanatory memorandum

1. INTRODUCTION

In adopting on 4 May 1976 a Directive on pollution caused by certain dangerous substances discharged into the aquatic environment of the Community (76/464/EEC) (1) the Council identified a need to eliminate pollution caused by the dangerous substances included in List I of the Annex to that Directive.

The Directive requires the competent authorities in the Member States to set emission standards for discharges liable to contain List I substances. It stated that "The Council, acting on a proposal from the Commission, shall lay down the limit values which the emission standards must not exceed for the various dangerous substances included in the families and groups of substances within List I".

The Directive also provided, as an exception, for emission standards for List I substances to be based on quality objectives. These quality objectives are either to be those laid down by the Council, acting on a proposal from the Commission, or more severe Community quality objectives.

Proposals for directives concerning mercury (2) and aldrin, dieldrin and endrin (3) have already been made to the Council. These substances were selected by a meeting of national experts held on 14 June 1976. The meeting also selected cadmium as one of the first set of dangerous substances to be studied. This present proposal for a directive completes the set which follows from this meeting of national experts.

In preparing this proposal for a directive the Commission has been advised by further meetings of national experts, by consultants and individual experts, and by the Ecotoxicology Section of the Commission's Scientific Advisory Committee to examine the toxicity and ecotoxicity of chemical compounds.

2. THE PURPOSE OF THE DIRECTIVE

The purpose of the directive is to eliminate pollution caused by discharges containing cadmium (*), an element which is objectionable in the environment by reason of its toxicity, persistence and bioaccumulation. Being a chemical element, cadmium cannot be destroyed by any chemical means. Once cadmium has been introduced into the environment it will almost certainly stay there.

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

(2) OJ No C 169 - 6.7.1979 - p. 2 and 6

(3) OJ No C 146 - 12.6.1979 - p. 5 and 9

(*) Directive 76/464/EEC refers to cadmium and its compounds. The toxicity of cadmium compounds is related to their content of cadmium and for this reason no distinction is made between the various chemical forms in which cadmium might be present.

The directive will apply to all industrial discharges except for those from the manufacture of phosphoric acid from phosphate rock, for which it is not practicable to set limit values. It will apply to all the waters referred to in Directive 76/464/EEC except for groundwater, which is the subject of another Directive (1).

Direct discharges liable to contain cadmium will have to meet emission standards complying with the limit values set in the directive. These limit values are set primarily on the basis of the toxicity, persistence and bio-accumulation of cadmium and take account of best technical methods.

As an exception to setting emission standards in accordance with the limit values given in this proposal for a directive, the emission standards may be set in relation to quality objectives. The proposal for a directive provides two sets of quality objectives, one for fresh water and the other for salt water. These objectives have been set on the basis of protecting the environment and human health.

The limit values proposed for 1 January 1983 and 1 January 1986 are in accord with the present state of technology. However, it is considered likely that improved methods of removing cadmium from discharges will be developed in the future. To take advantage of these improvements it is proposed that emission standards for new plants must be set in accordance with the best available technical means in addition to respecting the other requirements of the directive. In this way the directive will become progressively stricter, in line with the need to eliminate pollution caused by discharges containing cadmium.

The proposal for a directive also contains requirements for monitoring and surveillance and defines a reference method of analysis.

Provision is made for the Member States to take the appropriate administrative measures and to carry out the necessary monitoring and surveillance to ensure that the directive is being complied with. Provision is made in the parent directive for the Commission to receive information on the operation of the directive, and to make reports to the Council.

The proposed directive contains provisions for the Member States to supply information to the Commission and for the Commission to make reports to the Council.

3. COMMENTS ON THE PROPOSAL

3.1. General

Cadmium is not known to be necessary to any living organism. On the other hand, it is known to be harmful to man and to a large number of aquatic species. It is therefore desirable to keep the amounts of cadmium present

(1) OJ L 20 - 26.1.1980 - p. 43

in the environment to the lowest possible levels. The purpose of this directive is to control discharges of cadmium to the aquatic environment so as to reduce and eliminate pollution from this source.

The parent directive provides for the Council to set limit values for emission standards applicable to discharges liable to contain List I substances. This directive also provides, as an exception, that these emission standards may be set in relation to quality objectives established by the Council or more severe Community objectives.

3.2. Limit values for emission standards

Emission standards for cadmium in discharges must be set so as to comply with the limit values given in this directive. The limit values proposed call for a progressive reduction in the quantities of cadmium discharged to the aquatic environment.

Two sets of limit values are proposed. The first, which is to come into operation on 1 January 1983, is based upon existing good practice. The second set of limit values is based upon the best technical means at present available ; these limits apply as from 1 January 1986.

These results have been derived from the advice of national experts and other experts, and from a report (1) prepared for the Commission by Dr. Rauhut. In this report it was noted that the precipitation of cadmium under alkaline conditions can give a residual concentration of 0.05 mg/l or less. However, in the presence of ammonia, which reacts with cadmium, or in solutions of relatively high ionic strength the precipitation is less efficient and residual concentrations of up to about 0.5 mg/l cadmium were found. The author noted that the residual concentration of cadmium to be found in any particular industrial discharge would depend upon numerous factors.

Precipitation under alkaline conditions is not the only way of removing cadmium from effluents. Other processes, such as ion exchange or precipitation as cadmium sulphide, can produce lower residual concentrations of cadmium. At present such processes have not been developed to the point where their general use is technically and economically feasible. However, the Commission will keep the position under review and, if appropriate, will make further proposals.

In some cases the limit values relate only to the maximum concentrations of cadmium permissible in the discharge. In other cases they relate both to the maximum concentration of cadmium in the discharge and to the maximum weight of cadmium that may be discharged in proportion to the amount of cadmium handled at the plant in question. Where both such limit values are specified, it is for the competent authority of the Member State concerned to apply the stricter limit in individual cases.

(1) A. Rauhut, Methods and costs of preventing cadmium emissions, ENV.298/78, Part IV

Different limit values are set according to the industry concerned. In the cases of zinc mining, lead and zinc refining, the non-ferrous metal industry and 'other industries' the limit values proposed relate only to concentration. In the first three cases it is not possible, for technical reasons, to propose limit values in relation to the quantity of cadmium handled ; in the case of 'other industries' there is no reasonable basis for setting a single limit value.

The limit values proposed relate to the use of cadmium or substances containing cadmium. In the case where the discharge which is sampled and analysed contains contributions from processes other than those involving the use of cadmium or substances containing cadmium the limit value is reduced to take account of this dilution, in accordance with Article 5 (1) of the parent directive. In this way the intention of the directive, to reduce pollution of the aquatic environment by cadmium, is upheld ; it will not be open to a discharger to comply with the limit value merely by diluting a cadmium-containing discharge with other matter. .

Cadmium is objectionable in the environment by reason of its toxicity, persistence and bioaccumulation. Application of the limit values proposed, or the quality objectives described subsequently (Section 3.3), should ensure that the concentrations of cadmium in the environment never approach the toxicity threshold. The harm caused by cadmium's persistence and bioaccumulation is a long-term effect, and short-term fluctuations in the quantities of cadmium are not very important. It is for this reason that the limit values relate either to a monthly load of cadmium or to a flow-weighted monthly average concentration and that daily values of up to twice the monthly values can be accepted.

The limit values apply equally to discharges to sewers. Depending on the purification processes used part or all of the cadmium in sewage will be discharged to waters specified in the proposal. Any cadmium not discharged this way will remain in the sewage sludge. The usual methods of disposing of sewage sludge are putting in on to land, incineration or dumping at sea. Thus, any cadmium discharged to sewers will either be directly discharged to the waters specified in this proposal or will be disposed of in a way that might lead indirectly to pollution of these waters.

It is necessary to control discharges to sewers. If this were not done the provisions of the directive could be circumvented by making discharges to sewers rather than to controlled waters. The limit values proposed for discharges to sewers are the same as those for discharges to waters specified in this proposal. This is reasonable because the same processes for the reduction of the cadmium content of effluents are applicable to discharges regardless of their destination.

Article 5(2) of Directive 76/464/EEC provides that, for each authorization, the competent authority of the Member State concerned may, if necessary, impose more stringent emission standards than those resulting from the application of the limit values laid down by the Council pursuant to Article 6 of that directive, taking into account in particular the toxicity, persistence and bioaccumulation of the substances concerned in the environment into which it is discharged. The limit values contained in the proposal are therefore maximum values and, as necessary, more stringent values may be applied by the Member States.

3.3. Quality objectives

Council Directive 76/464/EEC allows for emission standards for substances within List I to be set in relation to quality objectives rather than limit values. The quality objectives are to be laid down principally on the basis of toxicity, persistence and accumulation of the substances in living organisms ; they are to take account differences between salt water and fresh water.

Pollution, as defined in the parent directive, includes inter alia hazards to human health. The dose-effect relationships for cadmium have been evaluated in a report prepared for the Commission (1). This report considers the various toxicological effects of cadmium. The acute lethal oral dose is estimated to be between 0.35 and 3.5 grams. However, the long-term effects of chronic exposure are insidious. The most sensitive organ is the kidney. Cadmium is accumulated and when the concentration reaches a value of the order 200-400 $\mu\text{g/g}$ wet weight signs of damage become evident.

The World Health Organization has proposed a provisional maximum tolerable weekly intake of 400-500 μg per individual (2). Assuming a weekly intake of water of 14 litres containing 5 $\mu\text{g/l}$ cadmium - the maximum concentration in surface water to be abstracted for drinking water according to Council Directive 75/440/EEC (3) - the contribution of cadmium from drinking water is 70 μg .

However, fish and other aquatic organisms spend their lives in water, and so are continuously exposed to the harmful effects of cadmium. The nature of these effects, which range from impaired growth to death, have been described by Mr Alabaster in a study prepared for the Commission. (4).

The Commission has considered the study prepared for it by Mr Alabaster, the advice it has received from national experts and from the Exotoxicity Section of its Scientific Advisory Committee to examine the toxicity and ecotoxicity of chemical compounds, and the comments made by national experts and other experts.

The evidence, especially in the case of salt water, is not as complete as might ideally have been desired. However, quality objectives proposed are in accord with the latest conclusive scientific data.

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- (1) Criteria (Dose/effect Relationships) for Cadmium, Commission of the European Communities, 1978.
 - (2) World Health Organization, Technical Report 505, Evaluation of certain food additives and contaminants ; mercury, lead and cadmium.
 - (3) OJ L 194, 25.7.1975, p.26
 - (4) ENV/298/78, Part V

3.3.1. Fresh water

Both the report prepared by Mr Alabaster and the EIFAC report on cadmium and fresh water fish (1) draw attention to the need for reliable field data from polluted and unpolluted rivers to reinforce the criteria put forward. However, the following points are clearly established :

- (a) the toxicity of cadmium towards fish depends upon the pH and hardness of the water, and on the presence of other poisons.
- (b) The concentration of cadmium in fresh water not known to be polluted is usually between 0.01 and 0.5 $\mu\text{g}/\text{l}$.
- (c) The concentration factor for cadmium in fish muscle is usually between 0.1 and 100 times.
- (d) The criteria proposed by EIFAC as being suitable for salmonid fish are adequate to protect other aquatic life.

The criteria proposed by EIFAC are taken as the quality objective for fresh water.

This proposal does not conflict with Council Directive 78/659/EEC (2) on the quality of water for fish life, which does not refer specifically to cadmium.

The proposal does not contain a numerical quality objective for water from which fish are taken for human consumption. This is because the available evidence does not allow universally applicable values to be put forward. However, Member States are to apply more stringent quality objectives than those in the directive where this is necessary either for the protection of the health of consumers of fresh water fish or to protect other legitimate uses of the environment. In the case where a stretch of water has more than one use which is to be protected, the quality objective must be stringent enough to protect all those uses.

(1) EIFAC Technical Paper No 30, Food and Agriculture Organization of the United Nations, Rome, 1977

(2) OJ No L 122, 14.8.1978 - p. 1

The concentrations of cadmium proposed are within the requirements of Council Directive 75/440/EEC (1), which relates to the quality of surface water to be abstracted for drinking water. In this respect the quality objective proposed also protects human health.

3.3.2. Salt water

The cadmium content of most sea waters is of the order of 0.1 µg/l although higher values, up to about 1 µg/l, have been reported for sea water not thought to be polluted. Cadmium concentrations of 1 µg/l are considered to have no harmful long-term effects, and a quality objective of 1 µg/l is proposed. As an exception, it is proposed that where the natural concentration of cadmium makes it impossible to achieve this quality objective, a concentration of 1 µg/l higher than that in an adjacent area of unpolluted salt water will be taken as the quality objective.

This quality objective will protect all marine life, including shellfish. However, it is known that shellfish are capable of concentrating relatively large quantities of cadmium within their flesh. Consumption of such fish, even those taken from "unpolluted" water, might present a threat to human health. Article 3.3. of Council Directive 79/923/EEC(2) states that for "metals", which includes cadmium, the emission standards laid down pursuant to Council Directive 76/464/EEC shall be applied at the same time as the quality objectives and other obligations arising from directive 79/923/EEC.

Alabaster reports that "The relationships between aqueous concentration of cadmium and concentration of tissues is not well established, even for the common edible species". It is therefore considered that the available evidence does not allow universally applicable values to be put forward for a quality objective for water from which edible fish were taken. However Member States are to apply more stringent quality objectives than those in the directive where this is necessary either for the protection of the health of consumers of sea-fish or to protect other legitimate uses of the environment. In the case where a stretch of water has more than one use which is to be protected, the quality objective must be stringent enough to protect all those uses.

3.3.3. Sediments and molluscs

There is a need to ensure that there is no long-term build-up of cadmium in the aquatic environment. Both sediments and molluscs concentrate cadmium from surrounding water, and analysis of them will provide an indication of changes in water quality.

The choice between analysing sediment or a characteristic mollusc is left to the competent authorities in the Member States, and is to be made according to local circumstances.

The requirement that the cadmium content of sediments or of a characteristic mollusc must not increase significantly with time applies to fresh water and to salt water.

(1) OJ No L 194 - 27.7.1975 - p. 26

(2) OJ No L 281 - 10.11.1979 - p. 47

3.3.4. Timetable for quality objectives

It is proposed that the timetable for the application of quality objectives will correspond to that for limit values.

However, in the case of new or changed discharges which comply with the other quality objectives in this proposal there might well still be a build-up of cadmium in sediments and molluscs. This would reflect an increased, but still acceptable, cadmium concentration in the receiving water. It is for this reason that in the case of new or changed discharges two years is allowed before the quality objectives for sediments and molluscs must be respected.

3.3.5. Other Community quality objectives

Council Directive 76/464/EEC allows Member States to set emission standards based on compliance with quality objectives laid down by the Council or more severe Community quality objectives. This proposal includes quality objectives, but there are other Council directives which relate to cadmium in waters designated for particular uses.

Council Directive 75/440/EEC (1) sets a guide value of 1 µg/l for cadmium in surface water intended for abstraction of drinking water. This is similar to the values in this proposal for fresh water.

Council directives 79/923/EEC (2) and 76/160/EEC (3) refer respectively to cadmium in the flesh of shellfish and in bathing water but lay down no numerical values. However, Article 3(3) of directive 79/923/EEC makes it clear that emission standards for "metals", including cadmium, laid down pursuant to Council Directive 76/464/EEC, should be applied at the same time as the quality objectives in that directive.

3.4. Monitoring procedure

The proposal contains a monitoring procedure in connection with the application of quality objectives. For technical reasons it is likely that the detailed procedures to be adopted in individual cases will be very different, and the monitoring procedure is given in outline form.

In accordance with Article 6(3) of Council directive 76/464/EEC Member States choosing to set emission standards according to quality objectives must prove to the Commission that the quality objectives are being met and continuously maintained. This proof must be in accordance with the monitoring procedure set up by the Council.

The same article requires the Commission to report to the Council the instances where the quality objective method has been used. It is also provides for the Council to review such cases every five years, on the basis of a Commission proposal. There will thus be adequate opportunity to consider, in the light of experience, whether a more specific monitoring procedure should be laid down at a later date.

(1) OJ No L 194 - 25.7.1975 - p.26
(2) OJ No L 281 - 10.11.1979 - p.47
(3) OJ No L 31 - 5.2.1976 - p.1

3.5. Review of authorizations

The proposal provides for authorizations to be reviewed at least once every four years. This is in conformity with Article 3(4) of Council directive 76/464/EEC, which lays down that authorizations may be granted for a limited period only.

It is necessary that all authorizations should be examined from time to time so as to ensure that they are still suitable. The frequency at which these re-examinations need to be made will vary from case to case, but it is considered that once every four years is the minimum frequency consistent with the objectives of the proposed directive.

3.6. New plant

The proposal requires that emission standards for discharges from new plant shall be set in relation to best technical means of removing cadmium from effluents. This is in addition to conforming with the limit values or being consistent with the quality objectives laid down in the directive.

In this way the requirements of the directive will become progressively stricter, in line with the intention to reduce pollution by cadmium.

3.7. Reference method of analysis

It is necessary to propose a reference method of analysis, and atomic absorption spectrophotometry was selected as being suitable and widely used. However, other methods of equivalent performance may be used. The values proposed for accuracy, precision and limit of detection have been selected on the basis of what is necessary to ensure that the limit values and quality objectives are being observed. It is accepted that in some cases the analyses will need to include a pre-concentration step.

In the cases of the quality objectives applying to fresh and salt water, but not to sediments and characteristic molluscs, filtration through a 0.45 micron filter is permitted. These analyses will therefore measure the "soluble" cadmium. This is in accordance with the toxic effects of cadmium, which are only manifested by cadmium in solution.

This dispensation does not apply in other cases, where it is the total quantity of cadmium present which is significant.

The reference method does not distinguish between the various chemical forms in which cadmium might be present in a sample. This is in accordance with the definition of cadmium given in the proposal and with the fact that the toxicity of cadmium compounds is related to their cadmium content.

3.8. Phosphate rock

Phosphate rock is the principal raw material from which phosphoric acid is manufactured in the Community. The phosphate rock contains cadmium and much of this remains in the phospho-gypsum which is produced as a by-product. At present there are no technically and economically feasible methods for removing cadmium either from phosphate rock or from phospho-gypsum. The proposal therefore does not relate to cadmium discharged as a result of the manufacture of phosphoric acid from phosphate rock.

However the Services of the Commission are examining the ways in which discharges of cadmium from this industry might be controlled. Other countries are also concerned to limit the dissemination of cadmium from phosphate rock and it is hoped to benefit from their experience. A further proposal to the Council may be made in due course.

3.9. Surveillance of areas affected by discharges

The limit values for cadmium in discharges have been proposed according to the toxicity, persistence and bioaccumulation of cadmium and have taken into account the best technical means. It is intended that their application shall protect the quality of the receiving waters, and Member States are called upon to keep the zones affected by discharges under surveillance.

The form of the surveillance has been left to Member States to decide, according to local circumstances, except in the cases where the quality objective approach is used. However, when the area affected includes waters in more than one Member State, then the States concerned are called upon to act in concert, and to inform the Commission of their action.

3.10. Reports to the Council

Article 13 of the parent directive provides for the Member States to supply the Commission with, among other things, details of authorizations granted and the result of monitoring by the national network.

The proposed directive requires the Commission to make a comparative assessment of the implementation of the directive. At least every five years the Commission must send this report to the Council. Where necessary the Commission must also submit proposals for further action to the Council.

In this way both the Council and the Commission will be able to keep the operation of the directive under continual review.

3.11. Pollution caused by indirect discharges

Cadmium is a chemical element and so cannot be destroyed by any chemical means. Once cadmium has been introduced into the environment it will almost certainly stay there ; the quantity will not be reduced by any process of biodegradation.

There are very many chemical forms in which cadmium might exist in the environment. Some will be very soluble in water, others virtually insoluble. However, all forms of cadmium are to greater or lesser degree mobile.

It follows, for example, that cadmium discharged to the atmosphere will ultimately come to pollute water. Some will fall directly into water, some may be absorbed through the lungs of animals and ultimately be excreted in a soluble form or released in a soluble form after the animal has died, some will fall on to land and find its way into underground water or surface water or be taken up by plants. The cadmium taken up by plants will be returned ultimately to the environment, either directly when the plants die and decay or indirectly after they have been eaten.

The principal control measures envisaged in this proposed directive relate to discharges of cadmium to the specified surface waters. These measures relate to liquid effluents arising during the operation of plants processing cadmium or materials containing cadmium. However, discharges of cadmium can arise in other ways. Cadmium may be discharged to the atmosphere with flue gases, or it may be dumped on to land as part of a solid waste. Much of this cadmium ultimately find its way into controlled waters.

Article 8 and 9 of Council directive 76/464/EEC provide some protection against pollution arising from indirect discharges. The Commission is studying the matter of pollution arising from indirect discharges containing List I substances, and hopes to present appropriate proposals to the Council in due course. It is for this reason that the present proposal does not refer to indirect discharges.

4. CONSULTATION OF PARLIAMENT AND OF THE ECONOMIC AND SOCIAL COMMITTEE

As the proposal for the Directive is based on Article 6 of Directive 76/464/EEC and Article 235 of the Treaty, consultation of Parliament, but not of the Economic and Social Committee, is 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 concerning the limit values for discharges
of cadmium into the aquatic environment and quality objectives for cadmium
in the aquatic environment

THE COUNCIL OF THE EUROPEAN COMMUNITIES,

Having regard to the Treaty establishing the European Economic Community, and
in particular Article 235 thereof,

Having regard to Council Directive 76/464/EEC of 4 May 1976 on pollution
caused by certain dangerous substances discharged into the aquatic environ-
ment of the Community (1), and in particular Articles 3, 6 and 12 thereof,

Having regard to the proposal from the Commission,

Having regard to the opinion of the European Parliament,

Having regard to the opinion of the Economic and Social Committee ;

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 ;

Whereas cadmium and its compounds are included in List I ;

Whereas Article 6 of Directive 76/464/EEC provides that limit values shall
be laid down for emission standards ;

Whereas, since pollution caused by discharges containing cadmium and its
compounds arises from many industries, it is necessary to lay down limit values
for each industry or group of industries ;

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

Whereas at the present time it is not practicable to establish limit values for discharges arising from the manufacture of phosphoric acid from phosphate rock ;

Whereas Article 6 of Directive 76/464/EEC provides that quality objectives shall be laid down for substances in List I, and whereas that Article provides that as an exception emission standards may be set in relation to quality objectives ;

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

Whereas it is necessary for the protection of the aquatic environment that discharges to sewers should be subject to prior authorization, as provided for in Article 3 of Directive 76/464/EEC ;

Whereas groundwater is the subject of Council Directive 80/68/EEC (1) and is excluded from the scope of the present Directive ;

Whereas certain specific provisions must be laid down in connection with the protection of the aquatic environment against pollution by cadmium; whereas, since the specific powers required to this end have not been provided for in the Treaty, it is necessary to invoke Article 235 thereof ;

HAS ADOPTED THIS DIRECTIVE :

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

Article 1

1. This Directive, in pursuance of :

- Article 6(1) of Directive 76/464/EEC, lays down limit values for emission standards for cadmium from industrial plant as defined in Article 2 (d) of this Directive ;
- Article 6(2) of Directive 76/464/EEC, lays down quality objectives for cadmium in the aquatic environment ;
- Article 6(4) of Directive 76/464/EEC, lays down time limits for compliance with the conditions of the authorizations granted by the competent authorities of the Member States in the case of existing discharges ;
- Article 12(1) of Directive 76/464/EEC, lays down the methods of measurement applicable for determining cadmium in discharges and the aquatic environment ;
- Article 6(3) of Directive 76/464/EEC, establishes a monitoring procedure concerning quality objectives.

2. This Directive applies to the waters referred to in Article 1(1) of Directive 76/464/EEC, with the exception of groundwater.

Article 2

For the purposes of this Directive :

(a) 'cadmium' means :

- the chemical element cadmium,
- the cadmium contained in any of its compounds ;

(b) 'limit value' means :

the values described in Annex I ;

(c) 'quality objective' means :

the values described in Annex II ;

(d) 'industrial plant' means :

a plant at which cadmium or any substance containing cadmium is handled, with the exception of plant at which phosphoric acid is manufactured from phosphate rock ;

- (e) "existing plant" means :
an industrial plant which is operational on 1 January 1983 ;
- (f) "new plant" means :
- an industrial plant which has become operational after the date of notification of this Directive ;

- an existing plant whose capacity for handling cadmium has been substantially increased after the date of notification of this Directive;
- (g) "sewer" means :
a pipe forming part of a system through which liquid containing domestic effluent is transported to a purification plant external to the industrial plant in question prior to transfer to one or more of the waters referred to in Article 1 (2).

Article 3

1. The limit values for emission standards and the time limits by which they must be applied are given in Annex I. The limit values shall apply at the point immediately before the discharge enters any of the waters referred to in Article 1(2) or a sewer.
2. Without prejudice to paragraph 4, the authorizations referred to in Article 3 of Directive 76/464/EEC must contain provisions at least as strict as those laid down in Annex I to this Directive, except in those cases where a Member State complies with the provisions of Article 6(3) of Directive 76/464/EEC and applies Annexes II and III.
3. The authorizations referred to in paragraph 2 must be reviewed at least once every four years.
4. In the case of new plants the emission standards shall be set in accordance with the best technical means available.

5. The reference method for the analysis of cadmium is laid down in Annex IV. Other methods may be used provided that the limits of detection, precision and accuracy are at least as good as those given in Annex IV. The accuracy required in the measurement of flow of discharge is laid down in Annex IV.

Article 4

The Member States shall keep the entire zone affected by industrial plants under surveillance. In the case of transfrontier pollution affecting more than one Member State, the States concerned shall, acting in concert, adopt appropriate measures to eliminate the pollution and shall forthwith inform the Commission thereof.

Article 5

1. From the information supplied under Article 13 of Directive 76/464/EEC, in particular :
 - details of authorizations laying down emission standards with regard to discharges of cadmium,
 - results obtained by the national network set up to determine concentrations of cadmium,the Commission shall make a comparative assessment of the implementation by the Member States of the present Directive.
2. At least every five years the Commission shall submit to the Council the comparative assessment referred to in paragraph 1. Where necessary, the Commission shall also submit to the Council proposals for further action.

Article 6

1. The Member States shall, by 1 January 1983, bring into force the necessary measures 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.

A N N E X I

Limit values, time-limits and verification frequencies and procedures
for discharges of cadmium

Industry	Unit of measurement	Limit values which must be respected by stated dates		Verification frequency
		1.1.1983	1.1.1986	
Zinc mining, lead and zinc refining and the non-ferrous metal industry	Milligrams of cadmium per litre of discharge	1.0 (1)	0.6 (1)	daily
		0.5 (2)	0.3 (2)	monthly
Manufacture of pigments	milligrams of cadmium per litre of discharge	2.0 (1)	1.0 (1)	daily
		1.0 (2)	0.5 (2)	monthly
	grams of cadmium discharged per kilogram of cadmium handled	1.4 (3)	0.6 (3)	daily
		0.7 (4)	0.3 (4)	monthly
Manufacture of stabilisers	milligrams of cadmium per litre of discharge	2.0 (1)	1.0 (1)	daily
		1.0 (2)	0.5 (2)	monthly
	grams of cadmium per kilogram of cadmium handled	1.6 (3)	1.0 (3)	daily
		0.8 (4)	0.5 (4)	monthly
Manufacture of batteries	milligrams of cadmium per litre of discharge	2.0 (1)	1.0 (1)	daily
		1.0 (2)	0.5 (2)	monthly
	grams of cadmium per kilogram of cadmium handled	5.0 (3)	3.0 (3)	daily
		2.5 (4)	1.5 (4)	monthly
Electroplating	milligrams of cadmium per litre of discharge	2.0 (1)	1.0 (1)	daily
		1.0 (2)	0.5 (2)	monthly
	grams of cadmium per kilogram of cadmium handled	1.0 (3)	0.6 (3)	daily
		0.5 (4)	0.3 (4)	monthly

(contnd)

Manufacture of cadmium compounds	milligrams of cadmium per litre of discharge	2.0 (1) 1.0 (2)	1.0 (1) 0.5 (2)	daily monthly
	grams of cadmium per kilogram of cadmium handled	2.0 (3) 1.0 (4)	1.0 (3) 0.5 (4)	daily monthly
Other industries, except the manufacture of phosphoric acid from phosphate rock	milligrams of cadmium per litre of discharge	2.0 (1) 1.0 (2)	1.0 (1) 0.5 (2)	daily monthly
	<p>(1) maximum daily average concentration</p> <p>(2) maximum monthly average concentration</p> <p>(3) maximum daily load</p> <p>(4) maximum monthly load</p>			

If the discharge contains a contribution from a process or processes in which cadmium is not handled the limit value for monthly average concentration of cadmium must be calculated from the following formula :

$$C = L v/V$$

where

C	is the limit value to be applied,
L	is the appropriate limit value taken from the above table
v	is the total monthly flow of discharge attributable to the handling of cadmium
V	is the total monthly flow of the discharge in question.

In this case the limit value for daily average concentration is twice the limit value for monthly average concentration.

Verification procedure for emission standards

The daily average concentration of cadmium in the discharge must be measured by analysing a sample of the discharge collected on a flow-weighted basis over a period of one day. The total flow of the discharge over the same period must also be measured.

The daily weight of cadmium must be calculated by multiplying the daily average concentration of cadmium by the total flow for the day in question. The daily weight, expressed in grams, must be divided by the weight of cadmium, expressed in kilograms, handled during the day in question.

The monthly weight of cadmium must be calculated by adding together the daily weights of cadmium for the month in question. The monthly weight, expressed in grams, must be divided by the weight of cadmium, expressed in kilograms, handled during the month in question.

The monthly average concentration of cadmium must be calculated by dividing the monthly weight of cadmium by the sum of the daily flows for the month in question.

It shall be deemed that the requirements of this Annex in respect of the industrial establishment in question have been satisfied if during the course of any period of one year ninety five percent of samples taken and analysed in accordance with the procedure laid down in Annex IV conform to the relevant emission standard.

ANNEX II

Quality objectives

1. Fresh water

1.1. The maximum permissible concentration of cadmium must be set in relation to the hardness of the water in question and must not exceed the following values :

<u>Hardness of water (mg/l as CaCO₃)</u>	<u>Maximum cadmium concentration (μg/l)</u>
< 10	0.6
\geq 10 to < 50	0.8
\geq 50 to < 100	1.0
\geq 100	1.5

1.2. The cadmium content of sediments or of a characteristic mollusc must not increase significantly with time. The choice between these two possibilities must be made by the competent national authorities according to local circumstances.

1.3. The quality objective must be such as to protect the health of persons consuming fish taken from the water in question and to protect any other legitimate use of such water.

2. Salt water

2.1. The cadmium content of salt water shall not exceed 1 μ g/l
Where this quality objective cannot be achieved because of existing concentrations of cadmium the quality objective shall be that the cadmium concentration must not be more than 1 μ g/l higher than that in an adjacent area of unpolluted salt water.

2.2. The cadmium content of sediments or of a characteristic mollusc must not increase significantly with time. The choice between these two possibilities must be made by the competent national authorities according to local circumstances.

2.3. The quality objective must be such as to protect the health of persons consuming fish taken from the water in question and to protect any other legitimate use of such water.

3. It shall be deemed that the quality objectives specified in paragraph 1.1 and 2.1 have been satisfied if during the course of any period of one year, at least ninety five percent of the relevant samples comply with the appropriate quality objective.
4. Higher cadmium concentration than those referred in paragraphs 1.1. and 2.1. shall not be taken into account when they arise as a result of floods, natural disasters or exceptional meteorological conditions.
5. The quality objectives given in paragraphs 1.1 and 2.1 apply from 1 January 1986. Less severe quality objectives apply from 1 January 1983 but in no case may these exceed twice the relevant value specified in 1.1 and 2.1.

The quality objectives specified in 1.2, 1.3, 2.2 and 2.3 apply from 1 January 1983.

6. When as a result of changes in the pattern of industry areas of water are affected by discharges from new plant, the quality objectives in paragraphs 1.2 and 2.2 shall apply two years after the start of the new discharge.
7. Where a stretch of water has more than one use which is to be protected, the quality objective must be stringent enough to protect all these uses.

ANNEX III

Monitoring procedure for quality objectives

1. For each authorization granted in pursuance of this Directive, the competent authority shall specify the monitoring methods to ensure compliance with the quality objective or objectives appropriate to that authorization, throughout the area affected by the discharge.
2. In accordance with the procedure outlined in Article 6 (3) of Directive 76/464/EEC, the Member State shall report to the Commission for each quality objective chosen and applied to :
 - the points of discharge and the dispersal apparatus ;
 - the area in which the quality objective is applied ;
 - the location of sampling points ;
 - the frequency of sampling ;
 - the methods of sampling and of measurement ;
 - the results obtained.
3. Samples must be properly representative of the quality of the aquatic environment for the area affected by the discharge, and the frequency of sampling must be sufficiently high to show changes in the state of the aquatic environment.

ANNEX IV

Methods of measurement

1. The reference method of analysis to determine cadmium in water, molluscs and sediments is atomic absorption spectrophotometry after appropriate treatment of the sample. In the case of samples taken in connection with the quality objectives defined in paragraphs 1(1), 2(1) and 2(2) of Annex II this pretreatment may include filtering the sample through a 0.45 micron filter.

2. The limits of detection (1) must be such that the cadmium concentration may be measured to an accuracy (1) of $\pm 30\%$ and a precision (1) of $\pm 30\%$ at concentrations :
 - in the cases of discharges, one tenth of the maximum permitted concentration specified in the authorization ;
 - in the case of waters to which a quality objective applies, one tenth of the cadmium concentration specified in the quality objective ;
 - in the case of unpolluted waters, one tenth of the cadmium concentration in the water ;
 - in the case of sediments, molluscs and fish, one tenth of the cadmium concentration in the sample.

3. Flow measurement should be carried out to an accuracy of $\pm 20\%$.

(1) The definitions of these terms are as given in Council Directive 79/869/EEC concerning the methods of measurement and the frequencies of sampling and analysis of surface water intended for the abstraction of drinking water in the Member States, OJ L 271, 29.10.1979, p.44