

## II

(Acts whose publication is not obligatory)

## COUNCIL

## COUNCIL DIRECTIVE

of 3 December 1982

**on procedures for the surveillance and monitoring of environments concerned by waste from the titanium dioxide industry**

(82/883/EEC)

THE COUNCIL OF THE EUROPEAN COMMUNITIES,

Having regard to the Treaty establishing the European Economic Community, and in particular Articles 100 and 235 thereof,

Having regard to Council Directive 78/176/EEC of 20 February 1978 on waste from the titanium dioxide industry<sup>(1)</sup>, and in particular Article 7 (3) thereof,

Having regard to the proposal from the Commission<sup>(2)</sup>,

Having regard to the opinion of the European Parliament<sup>(3)</sup>,

Having regard to the opinion of the Economic and Social Committee<sup>(4)</sup>,

Whereas, irrespective of the method and extent of the treatment of wastes from the titanium dioxide industry, the discharge, dumping, storage on, tipping on or injection into the ground of such wastes must be accompanied by measures for the surveillance and monitoring of the environments concerned from a physical, chemical, biological and ecological point of view;

Whereas, in order to monitor the quality of these environments, samples should be taken with a mini-

imum frequency so that the parameters specified in the Annexes may be measured; whereas the number of these sampling operations could be reduced in the light of the results obtained; whereas, to ensure that the monitoring is effective, samples should also be taken if possible in a zone deemed to be unaffected by the discharges in question;

Whereas, in connection with the analyses carried out by the Member States, common reference methods of measurement should be fixed for determining the parametric values which define the physical, chemical, biological and ecological characteristics of the environments concerned;

Whereas, for the surveillance and monitoring of the environments affected, Member States may at any time lay down other parameters in addition to those laid down by this Directive;

Whereas it is necessary to define the details of the methods of surveillance and monitoring which Member States communicate to the Commission; whereas the Commission shall, with the prior agreement of the Member States, publish a consolidated report on these details;

Whereas in certain natural circumstances it may prove difficult to carry out the surveillance and monitoring operations, and, accordingly, provision must be made for derogation, in certain cases, from this Directive;

Whereas technical and scientific progress may require the rapid adjustment of certain of the provisions contained in the Annex; whereas to facilitate implementation of the requisite measures a procedure should be laid down to establish close coopera-

(1) OJ No L 54, 25. 2. 1978, p. 19.

(2) OJ No C 356, 31. 12. 1980, p. 32 and OJ No C 187, 22. 7. 1982, p. 10.

(3) OJ No C 149, 14. 6. 1982, p. 101.

(4) OJ No C 230, 10. 9. 1981, p. 5.

tion between the Member States and the Commission through a committee on adaptation to scientific and technical progress,

HAS ADOPTED THIS DIRECTIVE:

#### *Article 1*

This Directive lays down, pursuant to Article 7 (3) of Directive 78/176/EEC, the procedures for the surveillance and monitoring of the effects on the environment, having regard to its physical, chemical, biological and ecological aspects, of the discharge, dumping, storage on, tipping on or injection into the ground of waste from the titanium dioxide industry.

#### *Article 2*

For the purpose of this Directive:

- 'environments affected' means the water, the land surface and underground strata and the air in or into which waste from the titanium dioxide industry is discharged, dumped, stored, tipped or injected,
- 'sampling point' means the point at which samples are taken.

#### *Article 3*

1. The parameters applicable for the surveillance and monitoring referred to in Article 1 are specified in the Annexes.
2. Where a parameter appears in the 'mandatory determination' column in the Annexes, sampling and analysis of the samples must be carried out in respect of the environmental components indicated.
3. Where a parameter appears in the 'optional determination' column in the Annexes, the Member States shall, if they consider it necessary, have the sampling and analysis of samples carried out for the environmental components indicated.

#### *Article 4*

1. Member States shall carry out surveillance and monitoring of the environments affected and of a neighbouring zone deemed to be unaffected, special account being taken of local environmental factors and the manner of disposal, i.e. whether intermittent or continuous.

2. Except where otherwise specified in the Annexes, Member States shall determine on a case-by-case basis the exact sites from which samples are to be taken, the distance of these sites from the nearest pollutant disposal point and the depth or height at which the samples must be taken.

The samples must be taken at the same location and depth and under the same conditions in the course of successive sampling operations, for example in the case of tidal waters, at the same time in relation to high tide, tidal coefficient.

3. For the monitoring and inspection of the environments affected, Member States shall determine the frequency of sampling and analysis for each parameter listed in the Annexes.

For parameters where determination is mandatory, the frequency of sampling and analysis must not be less than the minimum frequencies indicated in the Annexes. However, once the behaviour, fate and effects of the waste have, as far as possible, been established, and provided there is no significant deterioration in the quality of the environment, Member States may provide for a frequency of sampling and analysis below these frequencies. Should there subsequently be any significant deterioration in the quality of the environment as a result of the waste or of any change in the disposal operation, the Member State shall revert to sampling and analysis at a frequency not less than that specified in the Annexes. If a Member State considers it necessary or advisable, it may distinguish between different parameters, applying this subparagraph to those parameters where no significant deterioration in the quality of the environment has been recorded.

4. For the monitoring and inspection of an appropriate neighbouring zone deemed to be unaffected, the laying down of the frequency of sampling and analysis shall be assessed by the Member States. When a Member State finds that it is not possible to identify such a neighbouring zone, it shall inform the Commission to that effect.

#### *Article 5*

1. The reference methods of measurement for determining the parametric values are specified in the Annexes. Laboratories using other methods must ensure that the results obtained are comparable.
2. The containers used to carry the samples, the agents or methods used to preserve a part sample

with a view to analysis of one or more parameters, the transport and storage of samples and their preparation for analysis must be such that they do not significantly affect the analytical results.

#### *Article 6*

For the surveillance and monitoring of the environments affected, Member States may, at any time, lay down other parameters in addition to those laid down by this Directive.

#### *Article 7*

1. The report which the Member States are required to forward to the Commission pursuant to Article 14 of Directive 78/176/EEC shall contain details of the surveillance and monitoring operations carried out by the bodies appointed in accordance with Article 7(2) of that Directive. These details shall, in respect of each environment affected, include the following information:

- a description of the sampling point, including its permanent features, which may be coded, and other administrative and geographical information. This information shall be provided only once when the sampling point is designated,
- a description of the sampling methods used,
- the results of the measurements of the parameters whose determination is mandatory and, where Member States consider it useful, also those of parameters whose determination is optional,
- the methods of measurement and analysis used and, where appropriate, their limit of detection, accuracy and precision,
- changes, adopted in accordance with Article 4(3), in the frequency of sampling and analysis.

2. The first set of data to be communicated pursuant to paragraph 1 shall be that gathered during the third year following notification of this Directive.

3. The Commission shall, with the prior agreement of the Member State concerned, publish a summary of the information supplied to it.

4. The Commission shall assess the effectiveness of the procedure for the surveillance and monitoring of the environments affected and shall — no later than six years after notification of this Directive —

place before the Council, if appropriate, proposals to improve this procedure and, if necessary, to harmonize the methods of measurement including their limit of detection, accuracy and precision and the sampling methods.

#### *Article 8*

Member States may derogate from this Directive in the event of flooding or natural disaster or on account of exceptional weather conditions.

#### *Article 9*

The requisite amendments to adapt the contents of the Annexes as regards:

- parameters listed in the 'optional determination' column,
- reference methods of measurement,

to scientific and technical progress shall be adopted in accordance with the procedure laid down in Article 11.

#### *Article 10*

1. A committee on adaptation to technical progress (hereinafter referred to as 'the committee'), consisting of representatives of the Member States and chaired by a Commission representative, is hereby set up.

2. The committee shall draw up its rules of procedure.

#### *Article 11*

1. Where the procedure laid down in this Article is to be followed, the matter shall be referred to the committee by its chairman, either on his own initiative or at the request of the representative of a Member State.

2. The Commission representative shall submit to the committee a draft of the measures to be taken. The committee shall give its opinion on the draft within a time limit set by the chairman having regard to the urgency of the matter. Opinions shall be delivered by a majority of 45 votes, the votes of the Member States being weighted as provided in Article 148(2) of the Treaty. The chairman shall not vote.

3. (a) Where the measures envisaged are in accordance with the opinion of the committee, the Commission shall adopt them.

- (b) Where the measures envisaged are not in accordance with the opinion of the committee, or if no opinion is delivered, the Commission shall, without delay, submit to the Council a proposal on the measures to be taken. The Council shall act by a qualified majority.
- (c) If the Council has not acted within three months of the proposals being submitted to it, the proposed measures shall be adopted by the Commission.

*Article 12*

Point (c) of Article 8 (1) of Directive 78/176/EEC is hereby replaced by the following:

- '(c) if the results of the monitoring which the Member States are obliged to carry out on the environment concerned reveal a deterioration in the area under consideration, or'

*Article 13*

Where waste elimination requires that, in accordance with Article 4 (1) of Directive 78/176/EEC, the competent authorities of more than one Member State should issue prior authorizations, the Member States involved shall consult each other on the con-

tent and the implementation of the monitoring programme.

*Article 14*

1. The Member States shall bring into force the laws, regulations and administrative provisions necessary to comply with this Directive within two years following its notification. They shall forthwith inform the Commission thereof.

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

*Article 15*

This Directive is addressed to the Member States.

Done at Brussels, 3 December 1982.

*For the Council*

*The President*

Ch. CHRISTENSEN

## ANNEX I

## METHOD OF WASTE DISPOSAL: DISCHARGE INTO AIR

| Components | Parameters to be determined  |            | Minimum annual sampling and analysis frequency | Comments   |
|------------|--|------------|--|--|
|            | mandatorily  | optionally |  |  |
| Air        | Sulphur dioxide (SO <sub>2</sub> ) <sup>(1)</sup><br>Chlorine <sup>(2)</sup> | Dust       | Continuously                                   | 1. Region with surveillance by an existing air pollution surveillance network with at least one station near the production site giving representative readings for pollution emanating from the site  |
|            |  |            | 12 <sup>(3)</sup>                              | 2. Region with no surveillance network.<br><br>Measurement of total amounts of gaseous discharges emitted by the production site. Where a site has a number of discharge sources, sequential measurements may be made.<br><br>The reference method of measurement for sulphur dioxide is that given in Annex III to Council Directive 80/779/EEC of 15 July 1980 on air quality limit values and guide values for sulphur dioxide and suspended particulates (OJ No L 229, 30. 8. 1980, p. 30) |

<sup>(1)</sup> If the production process used is the sulphate process.

<sup>(2)</sup> To be used once measuring technology allows continuous measurements to be carried out and where the chlorine process is used.

<sup>(3)</sup> The figures must be sufficiently representative and significant.

## ANNEX II

**METHOD OF WASTE DISPOSAL: DISCHARGE INTO OR IMMERSION IN SALT WATER  
(estuarine, coastal, open sea)**

| Components   | Parameters to be determined                              |                               | Minimum annual sampling and analysis frequency          | Reference method of measurement  |
|--|--|-------------------------------|---|--|
|  | mandatorily  | optionally                    |   |  |
| <b>Water column</b><br>Non-filtered sea water <sup>(1)</sup> | Temperature (°C)   |                               | 3   | Thermometry. Measurement is to be carried out on the spot at the time of sampling  |
|  | Salinity (‰)   |                               | 3   | Conductimetry  |
|  | pH (pH unit)   |                               | 3   | Electrometry. Measurement is to be carried out on the spot at the time of sampling   |
|  | Dissolved O <sub>2</sub> (mg/O <sub>2</sub> dissolved/l) |                               | 3   | — Winkler method<br>— Electrochemical method   |
|  | Turbidity (mg solids/l)<br>or<br>suspended matter (mg/l) |                               | 3   | For turbidity: turbidimetry<br>For suspended matter: gravimetry<br>— Weighing after filtration through 0.45 µm pore size membrane filter and drying at 105 °C<br>— Weighing after centrifugation (minimum time five minutes, average acceleration 2 800 to 3 200 g) and drying at 105° C |
|  | Fe (dissolved and in suspension) (mg/l)                  |                               | 3   | After the sample has been appropriately prepared, determination by atomic absorption spectrophotometry or by molecular absorption spectrophotometry  |
|  |  | Cr, total Cd, total Hg (mg/l) | 3   | — Atomic absorption spectrophotometry<br>— Molecular absorption spectrophotometry  |
|  | Ti (mg/l)  | V, Mn, Ni, Zn (mg/l)          | 3   | Atomic absorption spectrophotometry  |
|  | Cu, Pb (mg/l)  | 3                             | — Atomic absorption spectrophotometry<br>— Polarography |  |

<sup>(1)</sup> Member States may choose whether to analyse non-filtered or filtered water for substances under 'Parameters'.

| Components  | Parameters to be determined                      |                          | Minimum annual sampling and analysis frequency | Reference method of measurement   |
|---|--|--------------------------|--|---|
|   | mandatorily                                      | optionally               |  |   |
| Sea water filtered through 0.45 µm pore size membrane filter <sup>(1)</sup> | Dissolved Fe (mg/l)                              |                          | 3  | Determination by atomic absorption spectrophotometry or by molecular absorption spectrophotometry   |
|   |  | Cr, Cd, Hg (mg/l)        | 3  | — Atomic absorption spectrophotometry<br>— Molecular absorption spectrophotometry   |
|   |  | Ti, V, Mn, Ni, Zn (mg/l) | 3  | Atomic absorption spectrophotometry   |
|   |  | Cu, Pb (mg/l)            | 3  | — Atomic absorption spectrophotometry<br>— Polarography   |
| Suspended solids remaining in 0.45 µm pore size membrane filter             | Total Fe (mg/l)                                  | Cr, Cd, Hg (mg/l)        | 3  | — Atomic absorption spectrophotometry<br>— Molecular absorption spectrophotometry   |
|   |  | Ti, V, Mn, Ni, Zn (mg/l) | 3  | Atomic absorption spectrophotometry   |
|   |  | Cu, Pb (mg/l)            | 3  | — Atomic absorption spectrophotometry<br>— Polarography   |
|   | Hydrated oxides and hydroxides of iron (mg Fe/l) |                          | 3  | Extraction of the sample under appropriate acid conditions; measurement by atomic absorption spectrophotometry or by molecular absorption spectrophotometry.<br><br>The same method of acid extraction must be used for all samples coming from the same site |

<sup>(1)</sup> Member States may choose whether to analyse non-filtered or filtered water for substances under 'Parameters'.

| Components   | Parameters to be determined                       |  | Minimum annual sampling and analysis frequency | Reference method of measurement   |
|--|---|--|--|---|
|  | mandatorily                                       | optionally   |  |   |
| <b>Sediments</b><br>In the top layer of sediment as near the surface as possible   | Total Ti, Fe (mg/kg dry matter)                   | V, Cr, Mn, Ni, Cu, Zn, Cd, Hg, Pb (mg/kg dry matter) | 1  | Identical methods to those for measurements in the water column.<br>After appropriate preparation of the sample (wet or dry mineralization and purification). The quantities of metals must be measured for a specific range of particle sizes  |
|  | Hydrated oxides and hydroxides of iron (mg Fe/kg) |  | 1  | Identical methods to those for measurements in the water column   |
| <b>Living organisms</b><br>Species representative of the site: benthic fish and invertebrates or other appropriate species (1) | Ti, Cr, Fe, Ni, Zn, Pb (mg/kg wet and dry weight) | V, Mn, Cu, Cd, Hg (mg/kg wet and dry weight)         | 1  | Atomic absorption spectrophotometry after appropriate preparation of the composite sample of ground flesh (wet or dry mineralization and purification)<br>— For fish, the metals must be measured in muscle or other appropriate tissue; the sample must consist of at least 10 specimens<br>— For molluscs and crustaceans, the metals must be measured in the flesh. The sample must consist of at least 50 specimens |
| <b>Benthic fauna</b>   | Diversity and relative abundance                  |  | 1  | Qualitative and quantitative classification of representative species, indicating the specimen count per species, density, dominance  |
| <b>Planktonic fauna</b>  |   | Diversity and relative abundance                     | 1  | Qualitative and quantitative classification of representative species, indicating the specimen count per species, density, dominance  |
| <b>Flora</b>   |   | Diversity and relative abundance                     | 1  | Qualitative and quantitative classification of representative species, indicating the specimen count per species, density, dominance  |
| <b>Fish in particular</b>  | Presence of morbid anatomical lesions in fish     |  | 1  | Visual inspection of samples of the representative species taken for chemical analysis  |

(1) Species representative of the site of discharge in particular in terms of their sensitivity to bioaccumulation, e.g. *Mytilus edulis*, crangon crangon, flounder, plaice, cod, mackerel, red mullet, herring, sole (or other appropriate benthic species).



## ANNEX III

## METHOD OF WASTE DISPOSAL: DISCHARGE INTO FRESH SURFACE WATER

| Components   | Parameters to be determined                               |            | Minimum annual sampling and analysis frequency | Reference method of measurement  |
|--|---|------------|--|--|
|  | mandatorily   | optionally |  |  |
| <b>Water column</b> <sup>(1)</sup><br>Non-filtered fresh water | Temperature (°C)  |            | 3  | Thermometry. Measurement is to be carried out on the spot at the time of sampling  |
|  | Conductivity at 20 °C (µS cm <sup>-1</sup> )              |            | 3  | Electrometric measurement  |
|  | pH (pH unit)  |            | 3  | Electrometry. Measurement is to be carried out on the spot at the time of sampling   |
|  | Dissolved O <sub>2</sub> (dissolved mg O <sub>2</sub> /l) |            | 3  | — Winkler method<br>— Electrochemical method   |
|  | Turbidity (mg solids/l or suspended matter (mg/l))        |            | 3  | For turbidity: turbidimetry<br>For suspended matter: gravimetry<br>— Weighing after filtration through 0.45 µm membrane filter and drying at 105 °C<br>— Weighing after centrifugation (minimum time five minutes, and average acceleration 2 800 to 3 200 g) and drying at 105 °C |

<sup>(1)</sup> Samples must be taken at the same time of the year and if possible at a depth of 50 cm below the surface.

| Components  | Parameters to be determined             |                               | Minimum annual sampling and analysis frequency | Reference method of measurement   |
|---|---|-------------------------------|--|---|
|   | mandatorily                             | optionally                    |  |   |
| Non-filtered fresh water <sup>(1)</sup>                                       | Fe (dissolved and in suspension) (mg/l) |                               | 3  | After the sample has been appropriately prepared, determination by atomic absorption spectrophotometry or by molecular absorption spectrophotometry |
|   |   | Cr, total Cd, total Hg (mg/l) | 3  | — Atomic absorption spectrophotometry<br>— Molecular absorption spectrophotometry   |
|   | Ti (mg/l)                               | V, Mn, Ni, Zn (mg/l)          | 3  | Atomic absorption spectrophotometry   |
|   |   | Cu, Pb (mg/l)                 | 3  | — Atomic absorption spectrophotometry<br>— Polarography   |
| Fresh water filtered through 0.45 µm pore size membrane filter <sup>(1)</sup> | dissolved Fe (mg/l)                     |                               | 3  | Measurement by atomic absorption spectrophotometry or by molecular absorption spectrophotometry   |
|   |   | Cr, Cd, Hg (mg/l)             | 3  | — Atomic absorption<br>— Molecular absorption spectrophotometry   |
|   |   | Ti, V, Mn, Ni, Sn (mg/l)      | 3  | Atomic absorption spectrophotometry   |
|   |   | Cu, Pb (mg/l)                 | 3  | — Atomic absorption spectrophotometry<br>— Polarography   |

<sup>(1)</sup> Member States may choose whether to analyse non-filtered or filtered water for substances under 'Parameters'.

| Components  | Parameters to be determined                       |  | Minimum annual sampling and analysis frequency | Reference method of measurement   |
|---|---|--|--|---|
|   | mandatorily                                       | optionally   |  |   |
| Suspended solids remaining in 0.45 µm pore size membrane filter                   | Fe (mg/l)   | Cr, Cd, Hg (mg/l)                                    | 3  | — Atomic absorption spectrophotometry<br>— Molecular absorption spectrophotometry   |
|   |   | Ti, V, Mn, Ni, Zn (mg/l)                             | 3  | Atomic absorption spectrophotometry   |
|   |   | Cu, Pb (mg/l)  | 3  | — Atomic absorption spectrophotometry<br>— Polarography   |
|   | Hydrated oxides and hydroxides of iron (mg Fe/l)  |  | 3  | Extraction of the sample under appropriate acid conditions, measurement by atomic absorption spectrophotometry or by molecular absorption spectrophotometry.<br><br>The same method of acid extraction must be used for all samples coming from the same site   |
| <b>Sediments</b><br>In the top layer of sediment, as near the surface as possible | Ti, Fe (mg/kg dry matter)                         | V, Cr, Mn, Ni, Cu, Zn, Cd, Hg, Pb (mg/kg dry matter) | 1  | Identical methods to those for measurements in the water column.<br><br>After appropriate preparation of the sample (wet or dry mineralization and purification). The quantities of metals must be measured for a specific range of particle sizes  |
|   | Hydrated oxides and hydroxides of iron (mg Fe/kg) |  | 1  | Identical methods to those for measurements in the water column   |
| <b>Living organisms</b><br>Species representative of the site                     | Ti, Cr, Fe, Ni, Zn, Pb (mg/kg wet and dry weight) | V, Mn, Cu, Cd, Hg (mg/kg wet and dry weight)         | 1  | Atomic absorption spectrophotometry after appropriate preparation of the composite sample of ground flesh (wet or dry mineralization and purification)<br><br>— For fish, the metals must be measured in muscle or other appropriate tissue; the sample must consist of at least 10 specimens<br><br>— For molluscs and crustaceans, the metals must be measured in the flesh. The sample must consist of at least 50 specimens |

| Components         | Parameters to be determined      |   | Minimum annual sampling and analysis frequency | Reference method of measurement  |
|--------------------|----------------------------------|---|--|--|
|                    | mandatorily                      | optionally                                    |  |  |
| Benthic fauna      | Diversity and relative abundance |   | 1  | Qualitative and quantitative classification of representative species, indicating the specimen count per species, density, dominance |
| Planktonic fauna   |                                  | Diversity and relative abundance              | 1  | Qualitative and quantitative classification of representative species, indicating the specimen count per species, density, dominance |
| Flora              |                                  | Diversity and relative abundance              | 1  | Qualitative and quantitative classification of representative species, indicating the specimen count per species, density, dominance |
| Fish in particular |                                  | Presence of morbid anatomical lesions in fish | 1  | Visual inspection of samples of the representative species taken for chemical analysis   |

## ANNEX IV

## METHOD OF WASTE DISPOSAL: STORAGE AND DUMPING ON LAND

| Components  | Parameters to be determined   |                         | Minimum annual sampling and analysis frequency | Reference method of analysis   |
|---|---|-------------------------|--|--|
|   | mandatorily   | optionally              |  |  |
| 1. <b>Unfiltered surface water</b> around the site in the area affected by the storage and at a point outside this area<br>( <sup>1</sup> ) ( <sup>2</sup> ) ( <sup>3</sup> ) | pH<br>(pH unit)   |                         | 1  | Electrometry. Measurement is to be carried out at the time of sampling                           |
|   | SO <sub>4</sub> ( <sup>4</sup> )<br>(mg/l)  |                         | 1  | — Gravimetry<br>— Complexometric titration with EDTA<br>— Molecular absorption spectrophotometry |
| 2. <b>Unfiltered groundwater</b> around the site including, where necessary, outflow points ( <sup>1</sup> ) ( <sup>2</sup> )   | Ti ( <sup>5</sup> )<br>(mg/l)   | V, Mn, Ni, Zn<br>(mg/l) | 1  | Atomic absorption spectrophotometry  |
|   | Fe ( <sup>6</sup> )<br>(mg/l)   | Cr<br>(mg/l)            | 1  | — Atomic absorption spectrophotometry<br>— Molecular absorption spectrophotometry                |
|   | Ca<br>(mg/l)  |                         | 1  | — Atomic absorption spectrophotometry<br>— Complexometric titration                              |
|   |   | Cu, Pb<br>(mg/l)        | 1  | — Atomic absorption spectrophotometry<br>— Polarography  |
|   | Cl ( <sup>5</sup> )<br>(mg/l)   |                         | 1  | Titrimetry (Mohr method)   |
|   |   |                         |  |  |
| Environment of the storage and dumping site.  | Visual inspection of:<br>— topography and site management<br>— effect on subsoil<br>— ecology of the site |                         | 1  | Methods to be chosen by Member States  |

(<sup>1</sup>) Sampling must be carried out at the same time of year.

(<sup>2</sup>) When monitoring surface water and groundwater, particular attention is to be paid to any matter carried by running water from the waste storage area.

(<sup>3</sup>) Sampling must be carried out 50 cm beneath the surface of the water, if possible.

(<sup>4</sup>) Mandatory determination where storage or dumping contains waste from the sulphate process.

(<sup>5</sup>) Mandatory determination where storage or dumping contains waste from the chlorine process.

(<sup>6</sup>) Also includes the measurement of Fe in the filtrate (suspended solids).

## ANNEX V

## METHOD OF WASTE DISPOSAL: INJECTION INTO SOIL

| Components   | Parameters to be determined           |                          | Minimum annual sampling frequency and analysis | Reference method of analysis   |
|--|---------------------------------------|--------------------------|--|--|
|  | mandatorily                           | optionally               |  |  |
| 1. <b>Unfiltered surface water</b> around the site in the zone affected by the injection<br><br>2. <b>Unfiltered groundwater</b> around the site including out-flow points | pH (pH unit)                          |                          | 1  | Electrometry. Measurement is to be carried out at the time of sampling                           |
|  | SO <sub>4</sub> <sup>(1)</sup> (mg/l) |                          | 1  | — Gravimetry<br>— Complexometric titration with EDTA<br>— Molecular absorption spectrophotometry |
|  | Ti <sup>(2)</sup> (mg/l)              | V, Mn, Ni, Zn (mg/l)     | 1  | Atomic absorption spectrophotometry  |
|  | Fe <sup>(3)</sup> (mg/l)              | Cr (mg/l)                | 1  | — Atomic absorption spectrophotometry<br>— Molecular absorption spectrophotometry                |
|  | Ca (mg/l)                             |                          | 1  | — Atomic absorption spectrophotometry<br>— Complexometric titration                              |
|  |                                       | Cu, Pb (mg/l)            | 1  | — Atomic absorption spectrophotometry<br>— Polarography  |
|  |                                       | Cl <sup>(2)</sup> (mg/l) |  | 1  |
| Environment<br>Topography  | Ground stability                      |                          | 1  | Photographic and topographic survey  |
|  | Permeability<br>Porosity              |                          | 1  | Pumping tests<br>Well-logging  |

(<sup>1</sup>) Mandatory determination where waste from the sulphate process is injected into soil.

(<sup>2</sup>) Mandatory determination where waste from the chlorine process is injected into soil.

(<sup>3</sup>) Also includes the measurement of Fe in the filtrate (suspended solids).