

L.N. 223 of 2001

**ENVIRONMENT PROTECTION ACT, 2001
(ACT NO. XX OF 2001)
FEES ORDINANCE
(CAP. 35)**

Waste from the Titanium Dioxide Industry Regulations, 2001

BY virtue of the powers conferred by article 3, 9, 11 and 28 of the Environment Protection Act, 2001 the Minister for the Environment has made the following regulations:-

1. (1) The title of these regulations is the Waste from the Titanium Dioxide Industry Regulations, 2001. Citation and entry into force.

(2) These regulations shall come into force on such date as the Minister responsible for the environment may by notice in the Gazette appoint, and different dates may be so appointed for different provisions and different purposes of these regulations.

(3) A notice under sub-regulation (2) of these regulations may make such transitional provisions as appear to the Minister to be necessary or expedient in connection with the provisions thereby brought into force.

2. For the purpose of these regulations and unless the context otherwise requires:- Definitions.

“authorization” means a licence;

“competent authority” means the Department for Environment Protection under the guidance of the Director for Environment Protection and such other body or person as the Minister responsible for the environment may by order in the Gazette prescribe and different bodies or persons may be designated as a competent authority for different provisions and different purposes of these regulations;

“disposal” means:

(a) the collection, sorting, transport and treatment of waste as well as its storage and tipping above ground or underground and its injection into the ground;

(b) the discharge thereof into surface water, ground water and the sea, and dumping at sea;

(c) the transformation operations necessary for its re-use, recovery or recycling;

“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;

“existing industrial establishments” means those industrial establishments already set up on the date of entry into force of these regulations;

“new industrial establishments” means those industrial establishments which are in the process of being set up on the date of entry into force of these regulations or which are set up after that date. Extensions to existing industrial establishments leading to an increase of 15 000 tonnes per year or more in the titanium dioxide on-site production capacity of the establishment concerned shall be treated as new industrial establishments;

“pollution” means the discharge by man, directly or indirectly, of any residue from the titanium dioxide manufacturing process into the environment, the results of which are such as to cause hazards to human health, harm to living resources and to ecosystems, damage to amenities or interference with other legitimate uses of the environment concerned;

“sampling point” means the point at which samples are taken;

“waste” means:

(a) any residue from the titanium dioxide manufacturing process of which the holder disposes or is obliged to dispose under current national legislation;

(b) any residue from a treatment process of a residue referred to in paragraph (a) above.

Elimination of
waste.

3. The competent authority shall ensure the prevention and progressive reduction of pollution caused by waste with a view to its elimination.

4. Waste shall be disposed of without endangering human health and without harming the environment, and in particular: Disposal of waste.

(a) without risk to water, air, soil and plants, and to animals;

(b) without deleteriously affecting beauty-spots or the countryside.

5. The competent authority shall encourage the prevention, recycling and processing of waste, and any other process for the re-use of waste. Recycling, processing, re-use, etc. of waste.

6. (1) The discharge, dumping, storage, tipping and injection of waste shall be prohibited unless prior authorization is issued by the competent authority. Authorization to discharge, etc. waste.

(2) Prior authorization shall also be issued by the competent authority of a State:

(a) in whose territory the waste is discharged, stored, tipped or injected;

(b) from whose territory it is discharged or dumped.

(3) An authorization may be granted for a limited period only.

(4) An authorization may be renewed.

7. In the case of discharge or dumping, the competent authority may, in accordance with regulation 4 of these regulations and on the basis of the information supplied in accordance with Annex I to these regulations, grant the authorization referred to in regulation 6 of these regulations provided that: Granting of authorization.

(a) the waste cannot be disposed of by more appropriate means:

(b) an assessment carried out in the light of available scientific and technical knowledge shows that there will be no deleterious effect, either immediate or delayed, on the aquatic environment;

(c) there is no deleterious effect on boating, fishing, leisure activities, the extraction of raw materials, desalination, fish and shellfish breeding, on regions of special scientific importance or on other legitimate uses of the waters in question.

8. In the case of storage, tipping or injection, the competent authority may, in accordance with regulation 4 of these regulations, and on the basis of the information supplied in accordance with Annex I, grant the authorization referred to in regulation 6 of these regulations, provided that:

(a) the waste cannot be disposed of by more appropriate means;

(b) an assessment carried out in the light of available scientific and technical knowledge shows that there will be no detrimental effect, either immediate or delayed, on underground waters, the soil or the atmosphere;

(c) there is no deleterious effect on leisure activities, the extraction of raw materials, plants, animals, on regions of special scientific importance or on other legitimate uses of the environment in question.

9. (1) Irrespective of the method and extent of treatment of the waste in question, its discharge, dumping, storage, tipping and injection shall be accompanied by the monitoring referred to in Annex II of the waste and of the environment concerned having regard to its physical, chemical, biological and ecological aspects.

(2) The monitoring operations shall be carried out periodically by one or more bodies appointed by the State the competent authority of which has issued the authorization provided for in regulation 6 of these regulations. In the case of cross-frontier pollution between States, the body in question shall be appointed jointly by the parties concerned.

10. (1) The competent authority shall take all appropriate steps to remedy each one of the following situations and, if necessary, shall require the suspension of discharge, dumping, storage, tipping or injection operations:

(a) if the results of the monitoring provided for in Annex II (A) (1) show that the conditions for the prior authorization referred to in regulations 6, 7 and 8 have not been fulfilled, or

(b) if the results of the acute toxicity tests referred to in Annex II (A) (2) show that the limits laid down therein have been exceeded, or

(c) if the results of the monitoring which the competent authority is obliged to carry out on the environment concerned reveal a deterioration in the area under consideration, or

(d) if discharge or dumping produces a deleterious effect on boating, fishing, leisure activities, the extraction of raw materials, desalination, fish and shellfish breeding, on regions of special scientific importance or on other legitimate uses of the waters in question, or

(e) if storage, tipping or injection produces a deleterious effect on leisure activities, the extraction of raw materials, plants, animals, on regions of special scientific importance or on other legitimate uses of the environments in question.

(2) If several States are concerned, the measures shall be taken after consultation.

11. (1) The competent authority shall draw up programmes for the progressive reduction and eventual elimination of pollution caused by waste from existing industrial establishments.

Programme for
elimination of
waste.

(2) The programmes mentioned in sub-regulation (1) of this regulation shall set general targets for the reduction of pollution from liquid, solid and gaseous waste.

(3) The programmes shall also contain intermediate objectives and information on the state of the environment concerned, on measures for reducing pollution and on methods for treating waste that is directly caused by the manufacturing processes.

12. The programmes referred to in sub-regulation (1) of regulation 11 of these regulations shall cover all existing industrial establishments and shall set out the measures to be taken in respect of each of them.

Contents of
programmes.

13. New industrial establishments shall be subject to applications for prior authorization made to the competent authority. Such authorizations shall be preceded by environmental impact assessments. They shall be granted only to firms which give an undertaking to use only such of the materials, processes and techniques available on the market as are least damaging to the environment.

New industrial
establishments.

14. The procedures for the surveillance and monitoring of environments concerned by waste from the titanium dioxide industry mentioned in regulation 9 shall be regulated by the provisions of regulations 14 to 21 of these regulations.

Surveillance and
monitoring.

Tri-annual report.

15. At intervals of three years the competent authority shall prepare a report on the implementation of these regulations.

Applicable parameters for surveillance and monitoring.

16. (1) The parameters applicable for the surveillance and monitoring referred to in regulation 14 of these regulations are specified in Annexes III to VII of these regulations.

(2) Where a parameter appears in the "mandatory determination" column in the Annexes III to VII of these regulations, sampling and analysis of the samples shall be carried out in respect of the environmental components indicated.

(3) Where a parameter appears in the "optional determination" column in Annexes III to VII of these regulations, the competent authority shall, if it considers it necessary, have the sampling and analysis of samples carried out for the environmental components indicated.

Surveillance and monitoring of a neighbouring zone.

17. (1) The competent authority 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, whether intermittent or continuous.

(2) Except where otherwise specified in Annexes III to VII of these regulations, the competent authority 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 shall be taken. The samples shall be taken at the same location and depth and under the same conditions in the course of successive sampling operations.

(3) The competent authority shall determine the frequency of sampling and analysis for each parameter listed in Annexes III to VII of these regulations. For parameters where determination is mandatory, the frequency of sampling and analysis shall not be less than the minimum frequencies indicated in Annexes III to VII of these regulations:

Provided that if the competent authority considers it necessary, it may distinguish between different parameters, applying this sub-regulation to those parameters where no significant deterioration in the quality of the environment has been recorded.

Reference methods of measurement.

18. (1) The reference methods of measurement for determining the parametric values, are specified in Annexes III to VII of these

regulations. The competent authority shall ensure that laboratories using other methods can provide comparable results.

(2) The competent authority shall ensure that 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 shall be such that they do not significantly affect the analytical results.

19. For the surveillance and monitoring of the environments affected, the competent authority may, at any time, lay down other parameters in addition to those laid down by these regulations.

Additional parameters.

20. (1) The competent authority shall at regular intervals draft a report which shall contain details of the surveillance and monitoring operations carried out by the bodies appointed in accordance with sub-regulation (2) of regulation 9 of these regulations. These details shall, in respect of each environment affected, include the following information:

Report by competent authority.

(a) 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;

(b) a description of the sampling methods used;

(c) the results of the measurements of the parameters whose determination is mandatory and, where the competent authority considers it useful, also of those parameters whose determination is optional;

(d) the methods of measurement and analysis used and, where appropriate, their limit of detection, accuracy and precision;

(e) changes, adopted in accordance with sub-regulation (3) of regulation 17 of these regulations, in the frequency of sampling and analysis.

(2) The first report set of data to be communicated pursuant to sub-regulation (1) of this regulation shall be that gathered during the third year following the entry into force of these regulations.

21. The provisions of regulations 14 to 21 of these regulations shall not apply in the event of flooding or natural disaster or on account of exceptional weather conditions.

Non-applicability of these regulations.

22. Where waste elimination requires that, in accordance with sub-regulation (1) of regulation 6 of these regulations, the competent authorities of more than one State should issue prior authorizations, the competent authority shall consult other States involved on the content and the implementation of the monitoring programme.

23. For the purposes of regulations 23 and 24 of these regulations:

(a) where the sulphate process is used -

(i) the expression "solid waste" shall mean:

(a) insoluble ore residues not broken down by sulphuric acid during the manufacturing process,

(b) copperas, i.e. crystalline ferrous sulphate ($\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$),

(ii) the expression "strong acid waste" shall mean the mother liquors arising from the filtration phase following hydrolysis of the titanyl sulphate solution. If these mother liquors are associated with weak acid wastes which overall contain more than 0.5 % free sulphuric acid and various heavy metals, the liquors and waste taken together shall be considered strong acid waste,

(iii) the expression "treatment waste" shall mean filtration salts, sludges and liquid waste arising from the treatment (concentration or neutralization) of strong acid waste and containing various heavy metals, but not including neutralized and filtered or decanted waste containing only traces of heavy metals and which, before any dilution, has a pH value above 5.5,

(iv) the expression "weak acid waste" shall mean wash waters, cooling waters, condensates and other sludges and liquid wastes, other than those included in the above definitions, containing 0.5 % or less free sulphuric acid,

(v) the expression "neutralized waste" shall mean any liquid which has a pH value over 5.5, contains only traces of heavy metals, and is obtained directly by filtration or decantation from strong or weak acid waste after its treatment to reduce its acidity and its heavy metal content,

(vi) the expression "dust" shall mean all kinds of dust from production plants and in particular ore and pigment dust,

(vii) the expression "SOx" shall mean gaseous sulphur dioxide and trioxide released in the various stages of the manufacturing and internal waste treatment processes, including acid droplets;

(b) where the chlorine process is used –

(i) the expression "solid waste" shall mean:

(a) insoluble ore residues not broken down by the chlorine during the manufacturing process,

(b) metal chlorides and metal hydroxides (filtration substances), arising in solid form from the manufacture of titanium tetrachloride,

(c) coke residues arising from the manufacture of titanium tetrachloride,

(ii) the expression "strong acid waste" shall mean waste containing more than 0.5 % free hydrochloric acid and various heavy metals,

(iii) the expression "treatment waste" shall mean filtration salts, sludges and liquid waste arising from the treatment (concentration or neutralization) of strong acid waste and containing various heavy metals, but not including neutralized and filtered or decanted waste containing only traces of heavy metals and which, before any dilution, has a pH value over 5.5,

(iv) the expression "weak acid waste" shall mean wash waters, cooling waters, condensates and other sludges and liquid wastes, other than those included in the above definitions, containing 0.5 % or less free hydrochloric acid,

(v) the expression "neutralized waste" shall mean any liquid which has a pH value over 5.5, contains only traces of heavy metals, and is obtained directly by filtration or decantation from strong or weak acid waste after its treatment to reduce its acidity and its heavy metal content,

(vi) the expression "dust" shall mean all kinds of dust from production plants and in particular ore, pigment and coke dust,

(vii) the expression "chlorine" shall mean gaseous chlorine released in the various stages of the manufacturing process;

(c) where the sulphate process or the chlorine process is used, the expression "dumping" shall mean any deliberate disposal into inland surface waters, internal coastal waters, territorial waters or the high seas, of substances and materials by or from ships or aircraft.

Prohibition of
dumping of waste.

24. The dumping of any solid waste, strong acid waste, treatment waste, weak acid waste, or neutralised waste, as referred to in regulation 23 of these regulations, shall be prohibited with effect from the date of entry into force of these regulations.

Offences under
these regulations.

25. Any person shall be guilty of an offence under these regulations if :

(a) he fails to comply with any provision of these regulations or with any order lawfully given in terms of any provision of these regulations; or

(b) he contravenes any restriction, prohibition or requirement imposed by or under these regulations; or

(c) he acts in contravention of any of the provisions of these regulations; or

(d) he conspires or attempts, or aids, or abets, any other person by whatever means, including advertising, counselling or procurement to contravene the provisions of these regulations or to fail to comply with any such provisions, including any order lawfully given in terms of any of the provision of these regulations, or to contravene any restriction, prohibition or requirement imposed by or under the said regulations.

Penalties.

26. Any person who commits an offence against these regulations shall, on conviction, be liable:

(a) on a first conviction to a fine (*multa*) of not less than five hundred liri but not exceeding one thousand liri;

(b) on a second or subsequent convictions, to a fine (*multa*) of not less than one thousand liri, but not exceeding two thousand liri or to imprisonment for a term not exceeding two years, or to both such fine and imprisonment:

Provided that whenever any person is found guilty of committing an offence under these regulations by means of a

vehicle, the owner of the said vehicle, where applicable, is held liable in the same manner and degree;

Provided further that the court shall order any person who has been found guilty of committing an offence against these regulations to pay for the expenses incurred by the public entities and/or other persons acting on their behalf involved in the implementation of these regulations and restitution of the environment as a result of the said offence, the revocation of the permit issued by the Police and the confiscation of the *corpus delicti*.

27. (1) The provisions of article 23 and subarticle (1) of article 30 of the Criminal Code shall, *mutatis mutandis*, apply to proceedings, in respect of offences against these regulations, so however that the disqualification from holding or obtain a licence, permit or authority shall in no case be for less than one year.

Applicability of the Criminal Code.

Cap. 9.

(2) Notwithstanding the provisions of article 370 of the Criminal Code, proceedings for an offence against these regulations shall be taken before the Court of Magistrates (Malta) or the Court of Magistrates (Gozo), as the case may be, and shall be in accordance with the provisions of the Criminal Code regulating the procedure before the said courts as courts of criminal judicature.

(3) Notwithstanding the provisions of the Criminal Code, the Attorney General shall always have a right of appeal to the Court of Criminal Appeal from any judgement given by the Court of Magistrates (Malta) or the Court of Magistrates (Gozo) in respect of proceedings for any offence against these regulations.

28. Annexes I to VII attached to these regulations shall be published in the English language with the English version of these regulations.

Language of Annexes.

ANNEX I

PARTICULARS WHICH MUST BE SUPPLIED IN ORDER TO OBTAIN THE PRIOR AUTHORISATION REFERRED TO IN REGULATIONS 6, 7 AND 8

A. Characteristics and composition of the matter:

1. total amount and average compositions of matter dumped (e.g. per year);
2. form (e.g. solid, sludge, liquid or gaseous);
3. properties : physical (e.g. solubility and density), chemical and biochemical (e.g. oxygen demand) and biological;
4. toxicity;
5. persistence : physical, chemical and biological;
6. accumulation and biotransformation in biological materials or sediments;
7. susceptibility to physical, chemical and biochemical changes and interaction in the environment concerned with other organic and inorganic materials;
8. probability of production of taints or other changes reducing marketability of resources (fish, shellfish, etc.).

B. Characteristics of dumping or discharge site and methods of disposal:

1. location (e.g. coordinates of the dumping or discharge area, depth and distance from the coast), location in relation to other areas (e.g. amenity areas, spawning, nursery and fishing areas and exploitable resources);
2. rate of disposal per specific period (e.g. quantity per day, per week, per month);
3. methods of packaging and containment, if any;
4. initial dilution achieved by proposed method of release, particularly the speed of the ship;
5. dispersal characteristics (e.g. effects of currents, tides, and wind on horizontal transport and vertical mixing);
6. water characteristics (e.g. temperature, pH, salinity, stratification, oxygen indices of pollution
- dissolved oxygen (DO), chemical oxygen demand (COD), biochemical oxygen demand (BOD), nitrogen present in organic and inorganic form, including ammonia, suspended matter, other nutrients and productivity);
7. bottom characteristics (e.g. topography, geochemical and geological characteristics and biological productivity);
8. existence and effects of other dumpings or discharges which have been made in the area concerned (e.g. heavy metal background reading and organic carbon content).

C. Characteristics of the tipping, storage or injection area and disposal methods:

1. geographical situation;
2. characteristics of adjacent areas;
3. methods of packaging and containment, if any;

4.characteristics of the methods of tipping, storage and injection, including an assessment of precautions taken to avoid the pollution of waters, the soil and the atmosphere.

ANNEX II

SURVEILLANCE AND MONITORING OF DISPOSAL

A. Monitoring of waste

Disposal operations shall be accompanied by:

1. checks on the quantity, composition and toxicity of the waste to ensure that the conditions for prior authorization referred to in Articles 4, 5 and 6 are fulfilled;
2. tests for acute toxicity on certain species of molluscs, crustaceans, fish and plankton, preferably species commonly found in the discharge areas. In addition, tests shall be carried out on samples of the brine shrimp species (*Artemia salina*).

Over a period of 36 hours and at an effluent dilution of 1/5 000, these tests must not reveal:

- more than 20 % mortality for adult forms of the species tested,
- and for larval forms, mortality exceeding that of a control group.

B. Surveillance and monitoring of the environment concerned

I. In the case of discharge into fresh water or into the sea or in the case of dumping, such checks shall relate to the three following items : water column, living matter and sediments. Periodic checks on the state of the area affected by the discharges will make it possible to follow the development of the environments concerned.

Monitoring shall include the determination of:

1. pH;
2. dissolved oxygen;
3. turbidity;
4. hydrated iron oxides and hydroxides in suspension;
5. toxic metals in water, suspended solids, sediments and in accumulation in selected benthic and pelagic organisms;
6. the diversity and the relative and absolute abundance of flora and fauna.

II. In the case of storage, tipping or injection the monitoring shall include:

1. tests to ensure that surface waters and ground waters are not contaminated. These tests shall include the measurement of:
 - acidity,
 - iron content (soluble and particulate),
 - calcium content,
 - toxic metal content (soluble and particulate) if any;
2. where necessary, tests to determine any adverse effects on the structure of the subsoils;
3. a general assessment of the ecology of the area in the vicinity of the tipping, storage or injection point.

ANNEX III

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 ₂) ¹ Chlorine ²	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 ³	2. Region with no surveillance network. Measurement of total amounts of gaseous discharges emitted by the production site. Where the site has a number of discharged sources, sequential measurements may be made. The reference method of measurement for sulphur dioxide is that given in Annex V to Council Directive 80/779/EEC of 15 th 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)

¹ If the production process used is the sulphate process.

² To be used once measuring technology allows continuous measurements to be carried out and where the chlorine process is used.

³ The figures must be sufficiently representative and significant.

ANNEX IV

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		
Water column Non-filtered sea water ⁴	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 ₂ (mg/O ₂ dissolved/l)		3	- Winkler method - Electrochemical method
	Turbidity (mg solids/l) or suspended matter (mg/l)		3	For turbidity: turbimetry For suspended matter: gravimetry - Weighing after filtration through 0.45 µm pore size membrane filter and drying at 105° C - 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

⁴ The competent authority may choose whether to analyse non-filtered or filtered water for substances under "Parameters".

		Cr, Total Cd, Total Hg (mg/l)	3	spectrophotometry - Atomic absorption spectrophotometry - Molecular absorption spectrophotometry
	Ti (mg/l)	V, Mn, Ni, Zn (mg/l)	3	Atomic absorption spectrophotometry
		Cu, Pb (mg/l)	3	- Atomic absorption spectrophotometry - Polarography
Sea water filtered through 0.45µm pore size membrane filter ⁵	Dissolved Fe (mg/l)		3	Determination by atomic absorption spectrophotometry or by molecular absorption spectrophotometry
		Cr, Cd, Hg (mg/l)	3	- Atomic absorption spectrophotometry - Molecular absorption spectrometry
		Ti, V, Mn, Ni, Zn (mg/l)	3	Atomic absorption spectrophotometry
		Cu, Pb (mg/l)	3	- Atomic absorption spectrophotometry - Polarography
Suspended solids remaining in 0.45µm pore size	Total Fe (mg/l)	Cr, Cd, Hg (mg/l)	3	- Atomic absorption spectrophotometry - Molecular absorption spectrophotometry

⁵ The competent authority may choose whether to analyse non-filtered or filtered water for substances under "Parameters".

membrane filter	Ti,V,Mn, Ni,Zn (mg/l)		3	Atomic absorption spectrophotometry
	Cu,Pb (mg/l)		3	- Atomic absorption spectrophotometry - Polarography
	Hydrated oxides And hydroxides of iron (mg Fe/l)		3	Extraction of the sample under appropriate acid conditions; measurement by atomic absorption spectrometry or by molecular absorption spectrophotometry. The same method of acid extraction shall be used for all samples coming from the same site
Sediments In the top layer of sediments 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. After appropriate preparation of the sample (wet or dry mineralization and purification). The quantities of metals shall 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
Living organisms Species	Ti,Cr,Fe, Ni,Zn,Pb (mg/kg wet and dry weight)	V,Mn,Cu, Cd, Hg (mg/kg wet and dry)	1	Atomic absorption spectrophotometry after appropriate preparation of the composite sample of ground

⁶ 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, mackarel, red mullet, herring, sole (or other appropriate benthic species).

representative of the site: benthic fish and invertebrates and other appropriate species ⁶	weight)		flesh (wet or dry mineralization and purification) For fish, the metals shall be measured in muscle or other appropriate tissue: the sample shall consist of at least 10 spicimens For molluscs and crustaceans, the metals shall be measured in the flesh. The sample shall consist of at least 50 specimens.
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 V

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		
Water column ⁷ 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 ($\mu\text{S cm}^{-1}$)		3	Electrometric measurement
	PH (pH unit)		3	Electrometry. Measurement is to be carried out on the spot at the time of sampling
	Dissolved O ₂ (dissolved mg O ₂ /l)		3	<ul style="list-style-type: none"> - Winkler method - Electrochemical method
	Turbidity (mg solids/l or suspended matter mg/l)		3	For turbidity: turbimetry For suspended matter: gravimetry <ul style="list-style-type: none"> - Weighing after filtration through 0.45μm membrane filter and drying at 105°C - Weighing after centrifugation (minimum time five minutes, and average acceleration 2 800 to 3 200 g) and drying at 105°C

⁷ Samples shall be taken at the same time of the year and if possible at a depth of 50 cm below the surface.

Non-filtered fresh water ⁸	Fe (dissolved 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 - Molecular absorption spectrophotometry
	Ti (mg/l) V, Mn, Ni, Zn (mg/l)	3	Atomic absorption spectrophotometry
	Cu, Pb (mg/l)	3	- Atomic absorption spectrophotometry - Polarography
Fresh water filtered through 0.45µm pore size membrane filter ⁹	Dissolved Fe (mg/l)	3	Measurement by atomic absorption spectrophotometry or by molecular absorption spectrophotometry
	Cr, Cd, Hg (mg/l)	3	- Atomic absorption spectrophotometry - Molecular absorption spectrophotometry
	Ti, V, Mn, Ni, Sn (mg/l)	3	Atomic absorption spectrophotometry
	Cu, Pb (mg/l)	3	- Atomic absorption spectrophotometry - 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. The same method of acid extraction shall be used for all samples coming from the same site
Suspended	Fe Cr, Cd, Hg	3	- Atomic absorption

⁸ The competent authority may choose whether to analyse non-filtered or filtered water for substances under "Parameters".

⁹ The competent authority may choose whether to analyse non-filtered or filtered water for substances under "Parameters".

solids remaining in 0.45µm pore size membrane filter	(mg/l)	(mg/l)		spectrophotometry - Molecular absorption spectrophotometry
		Ti, V, Mn, Ni, Zn (mg/l)	3	Atomic absorption spectrophotometry
		Cu, Pb (mg/l)	3	- Atomic absorption spectrophotometry - Polarography
	Hydrated oxides And hydroxides of iron (mg Fe/l)		3	Extraction of the sample under appropriate acid conditions; measurement by atomic absorption spectrometry or by molecular absorption spectrophotometry. The same method of acid extraction shall be used for all samples coming from the same site
Sediments 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. After appropriate preparation of the sample (wet or dry mineralization and purification). The quantities of metals shall 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
Living organisms Species	Ti, Cr, Fe, Ni, Zn, Pb (mg/kg wet and dry)	V, Mn, Cu, Cd, Hg (mg/kg wet and dry)	1	Atomic absorption spectrophotometry after appropriate preparation of the composite sample of ground

representative of the site	weight) weight)		flesh (wet or dry mineralisation and purification) <ul style="list-style-type: none"> - For fish, the metals shall be measured in muscle or other appropriate tissue; the sample shall consist of at least 10 specimens - For molluscs and crustaceans, the metals shall be measured in the flesh. The sample shall consist of at least 50 specimens.
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 VI

METHOD OF WASTE DISPOSAL: STORAGE AND DUMPING ON LAND

Components	Parameters to be determined		Minimum annual sampling and analysis frequency	Reference method of measurement
	Mandatorily	Optionally		
1. Unfiltered surface water around the site in the area affected by the storage and at a point outside this area ⁽¹⁰⁾	pH (pH unit)		1	Electrometry. Measurement is to be carried out at the time of sampling
	SO ₄ ¹³ (mg/l)		1	<ul style="list-style-type: none"> - Gravimetry - Complexometric titration with EDTA - Molecular absorption spectrophotometry
2. Unfiltered groundwater around the site including, where necessary, outflow points ⁽¹¹⁾ ⁽¹²⁾	Ti ¹⁴ (mg/l)	V, Mn, Ni, Zn (mg/l)	1	Atomic absorption spectrophotometry
	Fe ¹⁵ (mg/l)	Cr (mg/l)	1	<ul style="list-style-type: none"> - Atomic absorption spectrophotometry - Molecular absorption spectrophotometry
	Ca (mg/l)		1	<ul style="list-style-type: none"> - Atomic absorption spectrophotometry - Complexometric titration
		Cu, Pb (mg/l)	1	<ul style="list-style-type: none"> - Atomic absorption spectrophotometry - Polarography
	Cl ¹⁶ (mg/l)		1	Titrimetry (Mohr method)

¹⁰ Sampling shall be carried out at the same time of year.

¹¹ Sampling shall be carried out at the same time of year.

¹² When monitoring surface water and groundwater, particular attention shall be paid to any matter carried by running water from the waste storage area.

¹³ Mandatory determination where storage or dumping contains waste from the sulphate process

¹⁴ Mandatory determination where storage or dumping contains waste from the chlorine process.

¹⁵ Also includes the measurement of Fe in the filtrate (suspended solids).

Environment of the storage and dumping site	Visual inspection of: - topography and site management - effect on subsoil - ecology of the site	1	Method to be chosen by the competent authority
--	---	---	---

¹⁶ Mandatory determination where storage or dumping contains waste from the chlorine process.

ANNEX VII

METHOD OF WASTE DISPOSAL: INJECTION INTO SOIL

Components	Parameters to be determined		Minimum annual sampling and analysis frequency	Reference method of measurement
	Mandatorily	Optionally		
1. Unfiltered surface water around the site in the area affected by the injection	pH (pH unit)		1	Electrometry Measurement is to be carried out at the time of sampling
	SO ₄ ¹⁷ (mg/l)		1	<ul style="list-style-type: none"> - Gravimetry - Complexometric titration with EDTA - Molecular absorption spectrophotometry
2. Unfiltered groundwater around the site including outflow points	Ti ¹⁸ (mg/l)	V, Mn, Ni, Zn (mg/l)	1	Atomic absorption spectrophotometry
	Fe ¹⁹ (mg/l)	Cr (mg/l)	1	<ul style="list-style-type: none"> - Atomic absorption spectrophotometry - Molecular absorption spectrophotometry
	Ca (mg/l)		1	<ul style="list-style-type: none"> - Atomic absorption spectrophotometry - Complexometric titration
		Cu, Pb (mg/l)	1	<ul style="list-style-type: none"> - Atomic absorption spectrophotometry - Polarography
	Cl ²⁰ (mg/l)		1	Titrimetry (Mohr method)
Environment Topography	Ground stability		1	Photographic and topographic survey

¹⁷ Mandatory determination where waste from the sulphate process is injected into soil.

¹⁸ Mandatory determination where waste from the chlorine process is injected into soil.

¹⁹ Also includes the measurement of Fe in the filtrate (suspended solids).

²⁰ Mandatory determination where waste from the chlorine process is injected into soil.

	Permeability Porosity		Pumping tests Well-logging
--	--------------------------	--	-------------------------------