

COUNCIL DIRECTIVE

of 15 July 1980

relating to the quality of water intended for human consumption

(80/778/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 the proposal from the Commission,

Having regard to the opinion of the European Parliament ⁽¹⁾,

Having regard to the opinion of the Economic and Social Committee ⁽²⁾,

Whereas, in view of the importance for public health of water for human consumption, it is necessary to lay down quality standards with which such water must comply;

Whereas a disparity between provisions already applicable or in the process of being drawn up in the various Member States relating to the quality of water for human consumption may create differences in the conditions of competition and, as a result, directly affect the operation of the common market; whereas laws in this sphere should therefore be approximated as provided for in Article 100 of the Treaty;

Whereas this approximation of laws should be accompanied by Community action designed to achieve, by more extensive rules concerning water for human consumption, one of the aims of the Community with regard to the improvement of living conditions, the harmonious development of economic activities throughout the Community and a continuous and balanced expansion; whereas certain specific provisions to this effect should therefore be laid down; whereas Article 235 of the Treaty should be invoked as the necessary powers have not been provided for by the Treaty;

Whereas the 1973 ⁽³⁾ and 1977 ⁽⁴⁾ programmes of action of the European Communities on the environment provide for both the setting of standards to

apply to toxic chemical substances and to bacteria presenting a health hazard which are present in water intended for human consumption and the definition of physical, chemical and biological parameters corresponding to the different uses of water and, in particular, to water for human consumption;

Whereas special rules are envisaged for natural mineral waters; whereas, furthermore, it is necessary to exclude from the scope of this Directive medicinal waters and certain waters used in the food industry where such use does not constitute a hazard to public health;

Whereas by Directive 75/440/EEC ⁽⁵⁾, the Council has already laid down standards for surface water intended for the abstraction of drinking water;

Whereas the values fixed for certain parameters must be equal to or lower than a maximum admissible concentration;

Whereas, in the case of softened water intended for human consumption, the values fixed for certain parameters must be equal to or greater than a required minimum concentration;

Whereas it is desirable that the Member States should take the values adopted as a 'guide level';

Whereas, since the preparation of water for human consumption may involve the use of certain substances, rules should be drawn up to govern the use thereof in order to avoid possible harmful effects on public health due to excessive quantities of such substances;

Whereas the Member States should be authorized to make provision, under certain conditions, for derogations from this Directive, in particular to take account of certain special situations;

Whereas, in order to check the values of concentrations for the different parameters, it is necessary to provide that Member States take the steps required to ensure

⁽¹⁾ OJ No C 28, 9. 2. 1976, p. 27.

⁽²⁾ OJ No C 131, 12. 6. 1976, p. 13.

⁽³⁾ OJ No C 112, 20. 12. 1973, p. 1.

⁽⁴⁾ OJ No C 69, 11. 6. 1970, p. 1.

⁽⁵⁾ OJ No L 194, 25. 7. 1975, p. 34.

regular monitoring of the quality of water intended for human consumption;

Whereas the reference methods of analysis defined in the Annexes to this Directive must be speedily adapted to scientific and technical progress; whereas, in order to facilitate application of the measures required for this purpose, provision should be made for a procedure establishing close cooperation between the Member States and the Commission within a committee responsible for the adaptation to scientific and technical progress,

HAS ADOPTED THIS DIRECTIVE:

Article 1

This Directive concerns standards for water intended for human consumption.

Article 2

For the purposes of this Directive, water intended for human consumption shall mean all water used for that purpose, either in its original state or after treatment, regardless of origin,

- whether supplied for consumption, or
- whether
 - used in a food production undertaking for the manufacture, processing, preservation or marketing of products or substances intended for human consumption and
 - affecting the wholesomeness of the foodstuff in its finished form.

Article 3

With regard to water referred to in the second indent of Article 2, Member States shall apply the values for the toxic and microbiological parameters listed in Tables D and E respectively of Annex I and the values for the other parameters which the competent national authorities consider are likely to affect the wholesomeness of the foodstuff in its finished form.

Article 4

1. This Directive shall not apply to:
 - (a) natural mineral waters recognized or defined as such by the competent national authorities;

- (b) medicinal waters recognized as such by the competent national authorities.

2. Member States may not prohibit or impede the marketing of foodstuffs on grounds relating to the quality of the water used where the quality of such water meets the requirements of this Directive unless such marketing constitutes a hazard to public health.

Article 5

This Directive shall apply without prejudice to the specific provisions of other Community regulations.

Article 6

1. Member States shall send the Commission:
 - appropriate information as to the industrial sectors in which the competent national authorities consider that the wholesomeness of the finished product, within the meaning of Article 2, is unaffected by the quality of the water used;
 - national values for parameters other than the toxic and microbiological parameters referred to in Article 3.
2. The Commission shall examine this information and shall take any measures which may be appropriate. It shall periodically draw up a comprehensive report for the Member States.

Article 7

1. Member States shall fix values applicable to water intended for human consumption for the parameters shown in Annex I.
2. Member States may refrain from fixing, pursuant to the first paragraph, the values of parameters in respect of which no value is shown in Annex I, as long as these values have not been determined by the Council.
3. For the parameters given in Tables A, B, C, D, and E of Annex I:
 - the values to be fixed by the Member States must be less than or the same as the values shown in the 'Maximum admissible concentration' column;

— in fixing the values, Member States shall take as a basis the values appearing in the 'Guide level' column.

4. For the parameters appearing in Table F of Annex I, the values to be fixed by Member States must be not lower than those given in the 'Minimum required concentration' column for softened water, of the kind referred to in the first indent of Article 2.

5. In the interpretation of the values shown in Annex I account shall be taken of the observations.

6. Member States shall take the steps necessary to ensure that water intended for human consumption at least meets the requirements specified in Annex I.

Article 8

Member States shall take all the necessary measures to ensure that any substances used in the preparation of water for human consumption do not remain in concentrations higher than the maximum admissible concentration relating to these substances in water made available to the user and, that they do not, either directly or indirectly, constitute a public health hazard.

Article 9

1. Member States may make provision for derogations from this Directive in order to take account of:

(a) situations arising from the nature and structure of the ground in the area from which the supply in question emanates.

Where a Member State decides to make such a derogation, it shall inform the Commission accordingly within two months of its decision stating the reasons for such derogation;

(b) situations arising from exceptional meteorological conditions.

Where a Member State decides to make such a derogation, it shall inform the Commission accordingly within 15 days of its decision stating the reasons for this derogation and its duration.

2. Member States shall report to the Commission only those derogations referred to in paragraph 1 which relate to a daily water supply of at least 1 000 m³ or a population of at least 5 000.

3. In no case shall the derogations made by virtue of this Article relate to toxic or microbiological factors or constitute a public health hazard.

Article 10

1. In the event of emergencies, the competent national authorities may, for a limited period of time and up to a maximum value to be determined by them, allow the maximum admissible concentration shown in Annex I to be exceeded, provided that this does not constitute an unacceptable risk to public health and provided that the supply of water for human consumption cannot be maintained in any other way.

2. Without prejudice to the application of Directive 75/440/EEC, and in particular Article 4 (3) thereof, when, for its supply of drinking water, a Member State is obliged to resort to surface water which does not reach the concentrations required of category A3 water within the meaning of Article 2 of the aforementioned Directive and when it cannot devise suitable treatment to obtain drinking water of the quality laid down by this Directive, it may, for a limited period of time and up to a maximum permissible value which it shall determine, authorize the maximum admissible concentration shown in Annex I to be exceeded provided that this does not constitute an unacceptable risk to public health.

3. Member States which have recourse to the derogations referred to in this Article shall immediately inform the Commission thereof, stating the reasons for and probable duration of such derogations.

Article 11

Member States shall ensure that all necessary measures taken to apply the provisions taken pursuant to this Directive shall in no case have the effect of allowing, directly or indirectly, either any deterioration in the present quality of water intended for human consumption or an increase in the pollution of waters used for the production of drinking water.

Article 12

1. Member States shall take all necessary steps to ensure regular monitoring of the quality of water intended for human consumption.

2. All water intended for human consumption shall be monitored at the point where it is made available to the user in order to check whether it meets the requirements laid down in Annex I.

3. The points of sampling shall be determined by the competent national authorities.

4. For such monitoring, Member States shall conform with Annex II.

5. Member States shall as far as practicable use the reference methods of analysis set out in Annex III.

Laboratories using other methods shall ensure that the results thus obtained are equivalent to or comparable with the results obtained by the methods indicated in Annex III.

Article 13

Such changes as are necessary for adapting the reference methods of analysis set out in Annex III to scientific and technical progress shall be adopted in accordance with the procedure laid down in Article 15.

Article 14

(a) A Committee on the Adaptation to Scientific and Technical Progress, hereinafter called 'the Committee', is hereby set up; it shall consist of representatives of the Member States with a representative of the Commission as chairman.

(b) The Committee shall adopt its own rules of procedure.

Article 15

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 a representative of a Member State.

2. The representative of the Commission shall submit to the Committee a draft of the measures to be taken. The Committee shall give its opinion on that draft within a time limit set by the chairman having regard to the urgency of the matter. Opinions shall be adopted by a majority of 41 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, within three months of the proposal being submitted to it, the Council has not acted, the proposed measures shall be adopted by the Commission.

Article 16

Without prejudice to Article 4 (2), Member States may lay down more stringent provisions than those provided for in this Directive for water intended for human consumption.

Article 17

Member States may adopt special provisions regarding information — both on packaging or labels and in advertising — concerning a water's suitability for the feeding of infants. Such provisions may also concern the properties of the water which determine the use of the said information.

Member States which intend taking such measures shall inform the other Member States and the Commission of them beforehand.

Article 18

1. Member States shall bring into force the laws, regulations and administrative provisions necessary to comply with this Directive and its Annexes 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 19

The Member States shall take the necessary measures to ensure that the quality of water intended for human consumption complies with this Directive within five years of its notification.

Article 20

Member States may, in exceptional cases and for geographically defined population groups, submit a special request to the Commission for a longer period for complying with Annex I.

This request, for which grounds must be duly put forward, shall set out the difficulties experienced and must propose an action programme with an appropriate timetable to be undertaken for the improvement of the quality of water intended for human consumption.

The Commission shall examine these programmes, including the timetables. In the case of disagreement with the Member State concerned, the Commission shall submit appropriate proposals to the Council.

Article 21

This Directive is addressed to the Member States.

Done at Brussels, 15 July 1980.

For the Council

The President

J. SANTER

ANNEX I

LIST OF PARAMETERS

A. ORGANOLEPTIC PARAMETERS

	Parameters	Expression of the results ⁽¹⁾	Guide level (GL)	Maximum admissible concentration (MAC)	Comments
1	Colour	mg/l Pt/Co scale	1	20	
2	Turbidity	mg/l SiO ₂ Jackson units	1 0.4	10 4	— Replaced in certain circumstances by a transparency test, with a Secchi disc reading in meters: GL: 6 m MAC: 2 m
3	Odour	Dilution number	0	2 at 12 °C 3 at 25 °C	— To be related to the taste tests.
4	Taste	Dilution number	0	2 at 12 °C 3 at 25 °C	— To be related to the odour tests.

⁽¹⁾ If, on the basis of Directive 71/354/EEC as last amended, a Member State uses in its national legislation, adopted in accordance with this Directive, units of measurement other than these indicated in this Annex, the values thus indicated must have the same degree of precision.

B. PHYSICO-CHEMICAL PARAMETERS (in relation to the water's natural structure)

	Parameters	Expression of the results ()	Guide level (GL)	Maximum admissible concentration (MAC)	Comments
5	Temperature	°C	12	25	
6	Hydrogen ion concentration	pH unit	$6.5 \leq \text{pH} \leq 8.5$		— The water should not be aggressive. — The pH values do not apply to water in closed containers. — Maximum admissible value: 9.5.
7	Conductivity	$\mu\text{S cm}^{-1}$ at 20 °C	400		— Corresponding to the mineralization of the water. — Corresponding relativity values in ohms/cm: 2 500.

	Parameters	Expression of the results	Guide level (GL)	Maximum admissible concentration (MAC)	Comments
8	Chlorides	Cl mg/l	25		— Approximate concentration above which effects might occur: 200 mg/l.
9	Sulphates	SO ₄ mg/l	25	250	
10	Silica	SiO ₂ mg/l			— See Article 8.
11	Calcium	Ca mg/l	100		
12	Magnesium	Mg mg/l	30	50	
13	Sodium	Na mg/l	20	175 (as from 1984 and with a percentile of 90) 150 (as from 1987 and with a percentile of 80) (these percentiles should be calculated over a reference period of three years)	<p>— The values of this parameter take account of the recommendations of a WHO working party (The Hague, May 1978) on the progressive reduction of the current total daily salt intake to 6 g.</p> <p>— As from 1 January 1984 the Commission will submit to the Council reports on trends in the total daily intake of salt per population.</p> <p>— In these reports the Commission will examine to what extent the 120 mg/l MAC suggested by the WHO working party is necessary to achieve a satisfactory total salt intake level, and, if appropriate, will suggest a new salt MAC value to the Council and a deadline for compliance with that value.</p> <p>— Before 1 January 1984 the Commission will submit to the Council a report on whether the reference period of three years for calculating these percentiles is scientifically well founded.</p>
14	Potassium	K mg/l	10	12	
15	Aluminium	Al mg/l	0.05	0.2	
16	Total hardness				— See Table F, page 23.
17	Dry residues	mg/l after drying at 180 °C		1 500	
18	Dissolved oxygen	% O ₂ saturation			— Saturation value > 75 % except for underground water.
19	Free carbon dioxide	CO ₂ mg/l			— The water should not be aggressive.

C. PARAMETERS CONCERNING SUBSTANCES UNDESIRABLE IN EXCESSIVE AMOUNTS ⁽¹⁾

	Parameters	Expression of the results ⁽¹⁾	Guide level (GL)	Maximum admissible concentration (MAC)	Comments
20	Nitrates	NO ₃ mg/l	25	50	
21	Nitrites	NO ₂ mg/l		0.1	
22	Ammonium	NH ₄ mg/l	0.05	0.5	
23	Kjeldahl Nitrogen (excluding N in NO ₂ and NO ₃)	N mg/l		1	
24	(K Mn O ₄) Oxidizability	O ₂ mg/l	2	5	— Measured when heated in acid medium.
25	Total organic carbon (TOC)	C mg/l			— The reason for any increase in the usual concentration must be investigated.
26	Hydrogen sulphide	S µg/l		undetectable organoleptically	
27	Substances extractable in chloroform	mg/l dry residue	0.1		
28	Dissolved or emulsified hydrocarbons (after extraction by petroleum ether); Mineral oils	µg/l		10	
29	Phenols (phenol index)	C ₆ H ₅ OH µg/l		0.5	— Excluding natural phenols which do not react to chlorine.
30	Boron	B µg/l	1 000		
31	Surfactants (reacting with methylene blue)	µg/l (lauryl sulphate)		200	

⁽¹⁾ Certain of these substances may even be toxic when present in very substantial quantities.

	Parameters	Expression of the results	Guide level (GL)	Maximum admissible concentration (MAC)	Comments
32	Other organochlorine compounds not covered by parameter No 55	µg/l	1		— Haloform concentrations must be as low as possible.
33	Iron	Fe µg/l	50	200	
34	Manganese	Mn µg/l	20	50	
35	Copper	Cu µg/l	100 — at outlets of pumping and/or treatment works and their sub-stations 3000 — after the water has been standing for 12 hours in the piping and at the point where the water is made available to the consumer		— Above 3 000 µg/l astringent taste discolouration + corrosion may occur.
36	Zinc	Zn µg/l	100 — at outlets of pumping and/or treatment works and their sub-stations 5 000 — after the water has been standing for 12 hours in the piping and at the point where the water is made available to the consumer		— Above 5 000 µg/l astringent taste, opalescence and sand-like deposits may occur.
37	Phosphorus	P ₂ O ₅ µg/l	400	5 000	

	Parameters	Expression of the results	Guide level (GL)	Maximum admissible concentration (MAC)	Comments
38	Fluoride	F µg/l 8 — 12 °C 25 — 30 °C		1 500 700	— MAC varies according to average temperature in geographical area concerned.
39	Cobalt	Co µg/l			
40	Suspended solids		None		
41	Residual Chlorine	Cl µg/l			— See Article 8.
42	Barium	Ba µg/l	100		
43	Silver	Ag µg/l		10	If, exceptionally, silver is used non-systematically to process the water, a MAC value of 80 µg/l may be authorized.

D. PARAMETERS CONCERNING TOXIC SUBSTANCES

	Parameters	Expression of the results	Guide level (GL)	Maximum admissible concentration (MAC)	Comments
44	Arsenic	As µg/l		50	
45	Beryllium	Be µg/l			
46	Cadmium	Cd µg/l		5	
47	Cyanides	CN µg/l		50	
48	Chromium	Cr µg/l		50	
49	Mercury	Hg µg/l		1	
50	Nickel	Ni µg/l		50	
51	Lead	Pb µg/l		50 (in running water)	Where lead pipes are present, the lead content should not exceed 50 µg/l in a sample taken after flushing. If the sample is taken either directly or after flushing and the lead content either frequently or to an appreciable extent exceeds 100 µg/l, suitable measures must be taken to reduce the exposure to lead on the part of the consumer.

	Parameters	Expression of the results	Guide level (GL)	Maximum admissible concentration (MAC)	Comments
52	Antimony	Sb µg/l		10	
53	Selenium	Se µg/l		10	
54	Vanadium	V µg/l			
55	Pesticides and related products — substances considered separately — total	µg/l		0.1 0.5	'Pesticides and related products' means: — insecticides: — persistent organochlorine compounds — organophosphorous compounds — carbamates — herbicides — fungicides — PCBs and PCTs
56	Polycyclic aromatic hydrocarbons	µg/l		0.2	— reference substances: — fluoranthene/benzo 3.4 — fluoranthene/benzo 11.12 — fluoranthene/benzo 3.4 — pyrene/benzo 1.12 — perylene/indeno (1, 2, 3 - cd) pyrene

E. MICROBIOLOGICAL PARAMETERS

	Parameters	Results: volume of the sample in ml	Guide level (GL)	Maximum admissible concentration (MAC)	
				Membrane filter method	Multiple tube method (MPN)
57	Total coliforms ⁽¹⁾	100	—	0	MPN < 1
58	Fecal coliforms	100	—	0	MPN < 1
59	Fecal streptococci	100	—	0	MPN < 1
60	Sulphite-reducing Clostridia	20	—	—	MPN ≤ 1

Water intended for human consumption should not contain pathogenic organisms.

If it is necessary to supplement the microbiological analysis of water intended for human consumption, the samples should be examined not only for the bacteria referred to in Table E but also for pathogens including:

- salmonella,
- pathogenic staphylococci,
- fecal bacteriophages,
- entero-viruses;

nor should such water contain:

- parasites,
- algas,
- other organisms such as animalcules.

(1) Provided a sufficient number of samples is examined (95 % consistent results).

	Parameters		Results: size of sample (in ml)	Guide level (GL)	Maximum admissible concentration (MAC)	Comments
61	Total bacteria counts for water supplied for human consumption	37 °C	1	10 ⁽¹⁾ ⁽²⁾	—	
		22 °C	1	100 ⁽¹⁾ ⁽²⁾	—	
62	Total bacteria counts for water in closed containers	37 °C	1	5	20	On their own responsibility and where parameters 57, 58, 59 and 60 are complied with, and where the pathogen organisms given on page 22 are absent, Member States may process water for their internal use the total bacteria count of which exceeds the MAC values laid down for parameter 62.
		22 °C	1	20	100	

(1) For disinfected water the corresponding values should be considerably lower at the point where it leaves the processing plant.

(2) If, during successive sampling, any of these values is consistently exceeded a check should be carried out.

F. MINIMUM REQUIRED CONCENTRATION FOR SOFTENED WATER INTENDED FOR HUMAN COMSUMPTION

	Parameters	Expression of the results	Minimum required concentration (softened water)	Comments
1	Total hardness	mg/l Ca	60	} The water should not be aggressive.
2	Hydrogen ion concentration	pH		
3	Alkalinity	mg/l HCO ₃	30	
4	Dissolved oxygen			

NB: — The provisions for hardness, hydrogen ion concentration, dissolved oxygen and calcium also apply to desalinated water.

— If, owing to its excessive natural hardness, the water is softened in accordance with Table F before being supplied for consumption, its sodium content may, in exceptional cases, be higher than the values given in the 'Maximum admissible concentration' column. However, an effort must be made to keep the sodium content at as low a level as possible and the essential requirements for the protection of public health may not be disregarded.

TABLE OF CORRESPONDENCE BETWEEN THE VARIOUS UNITS OF WATER HARDNESS MEASUREMENT

	French degree	English degree	German degree	Milligrams of Ca	Millimoles of Ca
French degree	1	0.70	0.56	4.008	0.1
English degree	1.43	1	0.80	5.73	0.143
German degree	1.79	1.25	1	7.17	0.179
Milligrams of Ca	0.25	0.175	0.140	1	0.025
Millimoles of Ca	10	7	5.6	40.08	1

ANNEX II

PATTERNS AND FREQUENCY OF STANDARD ANALYSES

A. TABLE OF STANDARD PATTERN ANALYSES (Parameters to be considered in monitoring)

	Standard analyses Parameters to be considered	Minimum monitoring (C 1)	Current monitoring (C 2)	Periodic monitoring (C 3)	Occasional monitoring in special situations or in case of accidents (C 4)
A	ORGANOLEPTIC PARAMETERS	— odour ⁽¹⁾ — taste ⁽¹⁾	— odour — taste — turbidity (appearance)	Current monitoring analyses + other parameters as in footnote 4	The competent national authorities of the Member States will determine the par- ameters ⁽⁵⁾ according to circumstances, taking account of all factors which might have an adverse affect on the quality of drinking water supplied to consumers.
B	PHYSICO- CHEMICAL PARAMETERS	— conductivity or other physico- chemical parameter — residual chlorine ⁽³⁾	— temperature ⁽²⁾ — conductivity or other physico- chemical parameter — pH — residual chlorine ⁽³⁾		
C	UNDESIRABLE PARAMETERS		— nitrates — nitrites — ammonia		
D	TOXIC PARAMETERS				
E	MICRO- BIOLOGICAL PARAMETERS	— total coliforms or total counts of 22° and 37° — fecal coliforms	— total coliforms — fecal coliforms — total counts of 22° and 37°		

Note: An initial analysis, to be carried out before a source is exploited, should be added. The parameters to be considered would be the current monitoring analyses plus *inter alia* various toxic or undesirable substances presumed present. The list would be drawn up by the competent national authorities.

(1) Qualitative assessment.

(2) Except for water supplied in containers.

(3) Or other disinfectants and only in the case of treatment.

(4) These parameters will be determined by the competent national authority, taking account of all factors which might affect the quality of drinking water supplied to users and which could enable the ionic balance of the constituents to be assessed.

(5) The competent national authority may use parameters other than those mentioned in Annex I to this Directive.

B. TABLE OF MINIMUM FREQUENCY OF STANDARD ANALYSES ⁽³⁾

Volume of water produced or distributed in m ³ /day	Population concerned (assuming 200 l/day per person)	Analysis C 1	Analysis C 2	Analysis C 3	Analysis C 4
		Number of samples per year	Number of samples per year	Number of samples per year	
100	500	(¹)	(¹)	(¹)	Frequency to be determined by the competent national authorities as the situation requires
1 000	5 000	(¹)	(¹)	(¹)	
2 000	10 000	12	3	(¹)	
10 000	50 000	60	6	1	
20 000	100 000	120	12	2	
30 000	150 000	180	18	3	
60 000	300 000	360 (²)	36	6	
100 000	500 000	360 (²)	60	10	
200 000	1 000 000	360 (²)	120 (²)	20 (²)	
1 000 000	5 000 000	360 (²)	120 (²)	20 (²)	

(¹) Frequency left to the discretion of the competent national authorities. However, water intended for the food-manufacturing industries must be monitored at least once a year.

(²) The competent health authorities should endeavour to increase this frequency as far as their resources allow.

(³) (a) In the case of water which must be disinfected, microbiological analysis should be twice as frequent.

(b) Where analyses are very frequent, it is advisable to take samples at the most regular intervals possible.

(c) Where the values of the results obtained from samples taken during the preceding years are constant and significantly better than the limits laid down in Annex I, and where no factor likely to cause a deterioration in the quality of the water has been discovered, the minimum frequencies of the analyses referred to above may be reduced:

- for surface waters, by a factor of 2 with the exception of the frequencies laid down for microbiological analyses;
- for ground waters, by a factor of 4, but without prejudice to the provisions of point (a) above.

ANNEX III

REFERENCE METHODS OF ANALYSIS

A. ORGANOLEPTIC PARAMETERS

1 Colour	Photometric method calibrated on the Pt/co scale.
2 Turbidity	Silica method — Formazine test — Secchi's method.
3 Odour	Successive dilutions, tested at 12 °C or 25 °C.
4 Taste	Successive dilutions, tested at 12 °C or 25 °C.

B. PHYSICO-CHEMICAL PARAMETERS

5 Temperature	Thermometry.
6 Hydrogen ion concentration	Electrometry.
7 Conductivity	Electrometry.
8 Chlorides	Titrimetry — Mohr's method.
9 Sulphates	Gravimetry — complexometry — spectrophotometry.
10 Silica	Absorption spectrophotometry.
11 Calcium	Atomic absorption — complexometry.
12 Magnesium	Atomic absorption.
13 Sodium	Atomic absorption.
14 Potassium	Atomic absorption.
15 Aluminium	Atomic absorption — absorption spectrophotometry.
16 Total hardness	Complexometry.
17 Dry residue	Dessication at 180 °C and weighing.
18 Dissolved oxygen	Winkler's method — Specific electrode method.
19 Free carbon dioxide	Acidimetry.

C. PARAMETERS CONCERNING UNDESIRABLE SUBSTANCES

20 Nitrates	Absorption spectrophotometry — Specific electrode method.
21 Nitrites	Absorption spectrophotometry.
22 Ammonium	Absorption spectrophotometry.
23 Kjeldahl Nitrogen	Oxidation with Titrimetry or Absorption spectrophotometry.
24 Oxidizability	Boiling for 10 minutes with KMnO_4 in acid medium.
25 Total organic carbon (TOC)	—

26 Hydrogen sulphide	Absorption spectrophotometry.
27 Substances extractable in chloroform	Liquid/liquid extraction using purified chloroform at neutral pH, weighing the residue.
28 Hydrocarbons (dissolved or in emulsion); Mineral oils	Infra-red absorption spectrophotometry.
29 Phenols (phenol index)	Absorption spectrophotometry, paranitroaniline method and 4-aminoantipyrine method.
30 Boron	Atomic absorption — Absorption spectrophotometry.
31 Surfactants (reacting with metylene blue)	Absorption spectrophotometry with methylene blue.
32 Other organo-chlorine compounds	Gas-phase or liquid-phase chromatography after extraction by appropriate solvents and purification — Identification of the constituents of mixtures if necessary. Quantitative determination.
33 Iron	Atomic absorption — Absorption spectrophotometry.
34 Manganese	Atomic absorption — Absorption spectrophotometry.
35 Copper	Atomic absorption — Absorption spectrophotometry.
36 Zinc	Atomic absorption — Absorption spectrophotometry.
37 Phosphorus	Absorption spectrophotometry.
38 Fluoride	Absorption spectrophotometry — Specific electrode method.
39 Cobalt	—
40 Suspended solids	Method of filtration on to μ 0.45 porous membrane or centrifuging (for at least 15 minutes with an average acceleration of 2 800 to 3 200 g) dried at 105 °C and weighed.
41 Residual chlorine	Titrimetry — Absorption spectrophotometry.
42 Barium	Atomic absorption.

D. PARAMETERS CONCERNING TOXIC SUBSTANCES

43 Silver	Atomic absorption.
44 Arsenic	Absorption spectrophotometry — Atomic absorption.
45 Beryllium	—
46 Cadmium	Atomic absorption.
47 Cyanides	Absorption spectrophotometry.
48 Chromium	Atomic absorption — Absorption spectrophotometry.
49 Mercury	Atomic absorption.
50 Nickel	Atomic absorption.
51 Lead	Atomic absorption.
52 Antimony	Absorption spectrophotometry.

53 Selenium	Atomic absorption.
54 Vanadium	—
55 Pesticides and related products	See method 32.
56 Polycyclic aromatic hydrocarbons	Measurement of intensity of fluorescence ultraviolet after extraction using hexane — gas-phase chromatography or measurement in ultraviolet after thin layer chromatography — Comparative measurements against a mixture of six standard substances of the same concentration ⁽¹⁾ .

E. MICROBIOLOGICAL PARAMETERS

57 ⁽²⁾ Total coliforms	Fermentation in multiple tubes. Subculturing of the positive tubes on a confirmation medium. Count according to MPN (most probable number) or Membrane filtration and culture on an appropriate medium such as Tergitol lactose agar, endo agar, 0.4% Teepol broth, subculturing and identification of the suspect colonies — Incubation temperature for total coliforms: 37 °C Incubation temperature for fecal coliforms: 44 °C
58 ⁽²⁾ Fecal coliforms	
59 ⁽²⁾ Fecal streptococci	Sodium azide method (Litsky). Count according to MPN — Membrane filtration and culture on an appropriate medium.
60 ⁽²⁾ Sulphite-reducing Clostridia	A spore count, after heating the sample to 80 °C by: — seeding in a medium with glucose, sulphite and iron, counting the black-halo colonies; — membrane filtration, deposition of the inverted filter on a medium with glucose, sulphite and iron covered with agar, count of black colonies; — distribution in tubes of differential reinforced clostridial medium (DRCM), subculturing of the black tubes in a medium of litmus-treated milk, count according to MPN.
61/62 ⁽²⁾ Total counts	Inoculation by placing in nutritive agar.

ADDITIONAL TESTS

Salmonella	Concentration by membrane filtration. Inoculation on a pre-enriched medium. Enrichment, subculturing on isolating agar. Identification.
Pathogenic staphylococci	Membrane filtration and culture on a specific medium (e.g. Chapman's hypersaline medium). Test for pathogenic characteristics.

(1) Standard substances to be considered: fluoranthene/benzo-3,4, fluoranthene/benzo-11,12, fluoranthene/benzo-3,4, pyrene/benzo-1,12, perylene and indeno (1,2,3-cd)pyrene.

(2) Comments: The incubation period is generally 24 or 48 hours except for total counts, when it is 48 or 72 hours.

Fecal bacteriophages	Guelin's process.
Enteroviruses	Concentration by filtration, flocculation or centrifuging, and identification.
Protozoa	Concentration by filtration on a membrane, microscopic examination, test for pathogenicity.
Animalcules (worms — larvae)	Concentration by filtration on a membrane. Microscopic examination. Test for pathogenicity.

F. MINIMUM REQUIRED CONCENTRATION

Alkalinity	Acidimetry with Methyl orange
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