

KEMENTERIAN KESIHATAN MALAYSIA

**NATIONAL STANDARD
FOR
DRINKING WATER QUALITY**

- prepared by -

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Ministry of Health Malaysia**



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PREFACE

Seventeen years ago, in response to the need for a realistic and appropriate set of guidelines regarding safe and potable water supply throughout Malaysia, the Drinking Water Quality Surveillance Unit, Engineering Services Division, Ministry of Health Malaysia prepared a set of guidelines. This was done under the guidance of experts from the World Health Organization, Western Pacific Regional Centre for the Promotion of Environmental Planning and Applied Studies (WHO)/PEPAS. A panel comprising of representatives from Public Works Department (PWD), Department of Chemistry (DOC) and Department of Environment (DOE), which are agencies directly or indirectly involved in the surveillance of drinking water quality in this country, was formed to vet through this set of guidelines, after which the National Guidelines for Drinking Water Quality 1983 was published.

The following year saw the launching and implementation of the National Drinking Water Quality Surveillance Programme throughout the nation resulting in an increase in the number of workers involved in water quality.

The ensuing years saw an increase in experience and expertise among the workers, as well as an increase in awareness of the complex inter-relationships that determine water quality. Coupled with the advancement and progress that has developed in the field, the Federal Committee for the National Drinking Water Quality Surveillance Programme felt a need to review the National Guidelines for Drinking Water Quality, 1983.

This led to the formation of a technical sub-committee in November 1988 that had the specific task for reviewing the National Guidelines for Drinking Water Quality, 1983. In the review and development of the Revised Edition of the National Guidelines for Drinking Water Quality 1989, efforts were made to reflect the experiences gained in the field as well as new knowledge in water treatment technology and health sciences. The development of this revised edition was made possible with the contributions of the committee under the invaluable guidance and technical advice of WHO/PEPAS consultant, Dr. Paul Guo.

The application of the Revised Edition of the National Guidelines for Drinking Water Quality 1990 was instrumental for an increased and more effective surveillance and this led to provision of drinking water that is both safe and pleasant to use.

After 10 years of implementation and in keeping pace with new developments in the field of water quality, the Engineering Services Division, Ministry of Health undertook the task of reviewing the National Guidelines for Drinking Water Quality, 1990. A technical subcommittee was formed in 1998. Reviewing was based on new scientific information as well as new chemicals found in drinking water as available in the WHO Guidelines for Drinking Water, 1993-1998. A literature search was also performed and drinking water quality guidelines of several different countries were compared before the National Drinking Water Quality Standards, 2000 was drawn up. The views of the National Technical Committee for Drinking Water Quality were also incorporated in the revision of the guidelines.

As with the previous guidelines this revised guidelines will be reviewed in future to keep pace with further technological developments and available scientific knowledge.

The Drinking Water Quality Surveillance Unit, Engineering Services Division, Ministry of Health Malaysia thank the members of the technical sub-committee and the National Technical Committee for KMAM for their invaluable input in the development of the National Drinking Water Quality Standards, 2000.

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List of Abbreviations

MOH	-	Ministry of Health
UDWQS	-	Unit of Drinking Water Quality Surveillance
WHO	-	World Health Organization
PEPAS	-	Promotion of Environmental Planning and Applied Studies
PWD	-	Public Works Department
WSD	-	Water Supply Department
WB	-	Water Board
DOC	-	Department of Chemistry
DOE	-	Department of Environment
DID	-	Department of Irrigation and Drainage
DOL	-	Department of Labour
NDWQSP	-	National Drinking Water Quality Surveillance Programme
SEDC	-	State Economic Development Corporation

1. INTRODUCTION

- 1.1 Water for drinking, culinary and other domestic use should be safe, palatable and aesthetically appealing. The aim of this document is thus, to set limits to constituents that may be present in water, which may be hazardous to health or objectionable to the physical senses of the consumer.
- 1.2 This document is divided into the following sections;
 - (i) Definition of terms,
 - (ii) Quality requirements, and
 - (iii) Recommended procedures.
- 1.3 The raw water quality criteria included in this document is intended to assist users in determining the appropriate treatment needed for raw water in order to produce water that will conform with the drinking water quality standards. The possible users include;
 - (i) Water Authorities
 - (ii) Ministry of Health (MOH)
 - (iii) Department of Chemistry (DOC)
 - (iv) Department of Environment (DOE)
 - (v) Other agencies
 - (vi) Public Organizations
 - (vii) Private Organizations
- 1.4 The drinking water quality standards are applicable to all water intended for human consumption. This includes drinking water from all public water supply systems, tank supplies and water used for bottled drinks and ice manufacturing.
- 1.5 The procedures recommended such as the protection of source, treatment of water, sanitary survey, monitoring, record keeping etc, have been included here as guidelines for the relevant authorities as means of achieving the drinking water quality standards.
- 1.6 In drawing up these guidelines, the 2nd edition of the WHO Drinking Water Quality Guidelines, 1993/96/98 was used as the main reference.

Note:

 - *WHO Guidelines for Drinking Water Quality, Volume 1, 1993.*
 - *WHO Guidelines for Drinking Water Quality, Second Edition, Volume 2, 1996.*
 - *WHO Guidelines for Drinking Water Quality, Second Edition, 1998.*
- 1.7 Those who are interested in the rationale by which recommended standard values were derived should refer to Volume 2 of WHO Drinking Water Quality Guidelines, 1996.

- 1.8 The values described herein are not to be regarded as legal standards, but it is hoped that judicious use of these criteria and standards will result in the provision of a safe and wholesome drinking water to the consumer.

2. DEFINITION OF TERMS

- 2.1 **Conventional Treatment** includes the following water treatment processes namely screening, straining, aeration, coagulation and flocculation, sedimentation, filtration, disinfection and fluoridation.
- 2.2 **Public Water Supply** is defined as a water supply system that either;
- (i) has 15 or more service connections, or
 - (ii) regularly serve an average of 25 or more people daily for at least 60 days each year.

This definition encompasses all water supply systems supplied by different agencies, which varies with their capacity or in the type of treatment process employed. The categories of water supply systems are;

- (i) Urban water supply systems
 - (ii) Rural water supply
 - (iii) Local authority water supply
 - (iv) Privately owned water supply
 - (v) Water Authorities
 - (vi) Water Authorities/MOH
- 2.3 **Recommended Raw Water Criteria** sets out the maximum acceptance levels of characteristics and constituents in raw water, which if exceeded will require special treatment. For raw water with constituents whose level of concentration is below the recommended criteria, only conventional water treatment is necessary.
- 2.4 **Recommended Standards** sets out the maximum acceptance levels of characteristics and constituents in drinking water necessary to ensure maximum protection of the health and well being of the consumer. Most of these levels are based on the WHO Guidelines for Drinking Water, 1996.
- 2.5 **Special Treatment** includes the following additional unit water treatment process namely, pre-sedimentation, pre-disinfection, activated carbon adsorption, ion exchange, reverse osmosis, electrodialysis, fluoridation, etc.
- 2.6 **Surveillance Agency** shall mean the Ministry of Health.
- 2.7 **Water Authorities** shall mean the Public Works Department, Water Supply Department, the Water Board, privatized or the corporatised water authority or organization.

- 2.8 **Water Purveyor** shall mean the waterworks or any person or agency supplying water to the public and shall include hotel management, army camps, SEDC, estate management, etc.
- 2.9 **Water Supply System** includes the works and auxiliaries for collection, conveyance, treatment, storage and distribution of the water from the source of supply to the consumer's tap.

3. QUALITY REQUIREMENTS

3.1 Raw Water Quality Criteria

- 3.1.1 Table 1, Column I lists the recommended criteria for microbiological, physical, chemical and radioactive constituents of raw water which will be suitable as a potable source after undergoing conventional treatment.
- 3.1.2 If a raw water source has a quality that conforms to the recommended standards set in the drinking water quality standards as listed in Table 2, Column I, then it can be supplied with minimal treatment, which in most cases involves disinfection only.
- 3.1.3 If a raw water source has quality that does not conform to the recommended raw water quality criteria, then appropriate action shall be taken to identify and overcome the problem to allow for continued operation of conventional treatment. Special treatment should only be considered as a last resort.

3.2 Drinking Water Quality Standards

- 3.2.1 Drinking water must be clear, and does not have objectionable taste, colour and odour. It must be pleasant to drink and free from all harmful organisms, chemical substances and radionuclides in amounts, which could constitute a hazard to the health of the consumer.
- 3.2.2 The quality of drinking water is measured in terms of its microbiological, physical, chemical and radioactivity characteristics. Table 2 lists some of these characteristics and constituents with their recommended standards, which shall not be exceeded for maximum protection of the consumer.
- 3.2.3 If the characteristics or constituents in water after repeated sampling exceed the recommended standards listed in Table 2, then it shall be investigated by the personnel of the Department of Health and the water purveyor immediately to ascertain the cause and to remove the source of contamination. If these measures fail repeatedly the public shall be notified and possibly an alternative source of supply should be sought.

3.2.4 The parameters listed in Table 2 do not carry equal weight of significance. More attention is to be given to parameters relating to the bacteriological quality and chemical toxicity of the water. The other important parameter is residual chlorine.

3.3 Expression of Results

3.3.1 Results of chemical analysis shall be expressed in terms of milligrams per litre (mg/l) or parts permillion (ppm).

3.3.2 Turbidity shall be expressed in Nephelometric Turbidity Units (NTU).

3.3.3 Colour shall be expressed in units based on the platinum cobalt scale, reported in TCU (True Colour Units).

3.3.4 Volumes shall be expressed in millilitres or litre (ml or l).

3.3.5 Temperature shall be expressed in degree centigrade (°C).

3.3.6 Radioactivity shall be expressed in Bacqeral/litre (Bq/l).

3.3.7 For microorganisms, estimation of bacteria shall be given in terms of Most Probable Number per 100ml (MPN/100ml) for the multiple-tube fermentation method and in colonies per 100ml (cfu/100ml) for the membrane filter method.

3.3.8 In reporting results of chemical analysis, the accuracy and precision of the method shall be indicated whenever possible. This includes the proper use of significant figures and the indication of confidence limits.

4. PROCEDURES RECOMMENDED TO ACHIEVE THE DRINKING WATER QUALITY STANDARDS

4.1 Protection of Source

4.1.1 The quality of wastewater discharges upstream of water supply sources shall conform to the standard A levels listed in the Environmental Quality (Sewage and Industrial Effluents) Regulations 1979 (see Table 3).

4.1.2 In the case of parameters not listed under Standard A, Schedule 3 of the Environmental Quality (Sewage and Industrial Effluents) Regulations 1979, the parameter limits listed in the Environmental Quality (Prescribed Premises) (Crude Palm Oil) Order 1977 [see Table 4] and Environmental Quality (Prescribed Premises) (Raw Natural Rubber) Regulations 1978 [see Table 5 & Table 6] shall be used as a guide to determine the discharge standard for control and enforcement purposes.

- 4.1.3 The responsibility for the protection of the intake shall be with the water purveyor while the preservation of the raw water quality of the source is within the jurisdiction of the DOE with joint responsibility and cooperation of the other agencies such as Department of Agriculture, Veterinary Department, Local Authorities, Land and Mines Department, etc.
- 4.1.4 The MOH, the DOE and other relevant agencies shall be informed of all sources for new public water supplies.
- 4.1.5 Monitoring of water sources shall be carried out regularly to detect any deterioration in raw water quality and its impact on the treatment plant concerned. This monitoring of raw water quality shall be carried out in conjunction with sanitary surveys.

4.2 Preventive Measures

- 4.2.1 Water treatment plants must be well designed and maintained; and upgraded if necessary in order to prevent and minimize operation deficiencies or functional failures, which may lead to the production of unsatisfactory water.
- 4.2.2 Service reservoirs must be designed so constructed, maintained and adequately protected so as to minimize contamination from human and animal activities.
- 4.2.3 When designing, constructing or maintaining a distribution system, special consideration must be given to ensure that the distribution system does not become a contamination source and pipe material and fittings is relatively inert to the water conveyed.
- 4.2.4 The responsibility of maintaining water quality within the private premises shall be with the consumer.

4.3 Treatment

- 4.3.1 When the raw water quality at the intake of a supply exceeds the recommended criteria listed in Table 1, Column I, special treatment of water is required to ensure satisfactory sanitary quality.
- 4.3.2 Where applicable the methods of treatment shall include screening, microstraining, aeration, coagulation and flocculation, sedimentation, filtration, disinfection, pH correction, fluoridation, or any other physical or chemical process or any combination thereof that may be required.
- 4.3.3 The water purveyor is required to engage qualified and competent personnels for carrying out plant operation and maintenance. They are to maintain proper records and also to ensure plant safety and cleanliness.

4.3.4 The following tests are required for process control: jar test, pH, colour, turbidity, residual chlorine, residual aluminium and fluoride, and shall be carried out within the treatment plant.

4.3.5 The above mentioned tests shall be carried out by trained plant operators who are to be supervised regularly (at least once in 3 months) by a chemist or a qualified laboratory staff. In the case of rural water supplies, there should be at least one trained plant operator.

4.4 Sanitary Survey

4.4.1 Sanitary survey is an on-the-site inspection and evaluation of all conditions, devices and practices in the water supply system that pose or could pose a danger to the health and well being of the consumer.

4.4.2 Sanitary surveys for each treatment plant shall be undertaken on a regular basis (preferably once a year) by personnel from the water purveyors and the Department of Health who shall also act as the coordinator. Where necessary, personnel from the department of environment or any other relevant agency shall provide assistance and cooperation.

4.4.3 In addition, sanitary surveys shall also be conducted;

- i) When new sources are being developed.
- ii) When repeated laboratory analysis of a water sample has results exceeding the recommended maximum levels.
- iii) When there is an outbreak of waterborne diseases.
- iv) When there is a significant change of events that could affect the water quality (e.g. beginning of a raining season, new development in a catchment, etc).

4.4.4 The survey may be partial or complete depending on circumstances.

4.5 Monitoring

4.5.1 Design of Monitoring Programme

4.5.1.1 The monitoring programme shall be designed so that any temporal variations, both systematic and random, in the quality of the water can be detected, and it should ensure that data collected is representative of the water quality throughout the whole system.

4.5.1.2 The monitoring programme shall be in accordance with the defined methods as prescribed by the surveillance agency. Table 1, Column II and Table 2, Column II lists respectively the recommended frequency for each parameter for raw and drinking water. However, the selection of parameters to be monitored shall be based on the availability of resources as well as the analytical capability of the relevant agencies.

4.5.2 **Sample Size**

The minimum number of samples for bacteriological sampling per month developed by the United States Public Health Service shall be adopted here as a guide to determine the total number of samples required monthly for a water supply system (see Figure 1).

4.5.3 **Sample Locations**

Sample or samples shall be taken from points in the water supply system which are as representative as possible of that supply. This shall include points at the intake, the treatment plant outlet, the reservoir outlet, the main pipeline as well as the rest of the distribution inclusive of the consumer's tap.

4.5.4 **Sampling Procedures**

4.5.4.1 Samples shall be collected in either glass, plastic bottles or thiobags with the appropriate pre-treatment (such as additives and sterilization). Appropriate sampling devices shall be employed for sampling of water especially from lakes, reservoirs and wells. Great care shall be taken during sampling and transport of the sample in order to prevent contamination or change in composition. The volume of water collected shall be sufficient for the required analysis. The sampler shall complete the appropriate forms (Form S1, S2 and S3).

4.5.4.2 The sample boxes shall be sealed, and remain so until they are opened for analysis at the laboratory.

4.5.4.3 The sample shall be placed in sturdy boxes, packed with ice and kept in a dark environment at a constant temperature (4 - 10°C) for despatch. Any possibility of contamination to the boxes and samples must be avoided.

4.5.4.4 The sample box shall be forwarded to the analytical laboratory as quickly as possible. It must reach the laboratory within 24 hours of sampling.

4.5.5 Laboratory Procedures

4.5.5.1 The water samples must be attended to immediately when it reaches the laboratory.

4.5.5.2 All water samples upon reaching the laboratory shall be analyzed as soon as possible. Bacteriological samples shall be examined, if possible, on site or within 24 hours after collection. However, physical parameters, such as pH, turbidity, residual chlorine and colour shall be measured on site. The other parameters shall be measured at the laboratory as soon as possible (preferably not exceeding 72 hours after collection; provided the samples preserve with preservative and temperature preservation).

4.5.5.3 Laboratory examination of water: All laboratories shall use the methods recommended in the "Standard Methods for the Examination of Water and Waste Water" published by the American Public Health Association and the American Water Works Association or any other Standard Methods recommended by the DOC. Reference should be made to the latest edition.

4.5.6 Field Procedures

4.5.6.1 Field examination of water: All field-testing kits must be standardized, where required, with the DOC before being put into use. The application methods of the field test kits shall be followed in detail as recommended by the manufacturer.

4.6 Reporting of Results, Record Keeping and Data Evaluation

4.6.1 Reporting of Results

4.6.1.1 Upon completion of tests on the sample, all results shall be reported in the accompanying form (Form S1, S2 and S3) and be signed by the analyst. In the case of field testing, results shall be reported immediately in the monthly summary report by the Health Inspector.

4.6.1.2 Routine samples with results exceeding the recommended standards for bacteria (Table 2, Column I) shall be reported immediately by the analyst through telephone or facsimile to the following agencies.

- (i) The affected water purveyor, or in the case of Water Authorities, the state office, who shall then inform by telephone the district office and by writing to the Federal Water Authorities.

- (ii) The State Health Office who shall immediately inform by telephone the District Health Office and by writing to the Unit of Drinking Water Quality Surveillance, Ministry of Health Malaysia.

4.6.1.3 Routine samples with results exceeding the recommended standards for chemical parameters shall be reported within 14 days of collection to the following agencies.

- (i) The water purveyor, or in the case of the Water Authorities, the district office who shall inform by writing to the State and Federal Authorities.
- (ii) The District Health Office who shall then inform by writing to the State Medical and Health Services Department.

4.6.1.4 For a routine sample with normal results, it shall be reported within 30 days of collection to the following agencies;

- (i) The water purveyor concerned; or in the case of the Water Authorities, the district office.
- (ii) The District Health Office who shall send a monthly summary to the State Medical and Health Services Department.

4.6.2 Record Keeping

4.6.2.1 Monthly summary reports sent by the District Health Offices shall be compiled and sent to the Unit of Drinking Water Quality Surveillance, Ministry of Health Malaysia by the State Medical Health Services Department. All data pertaining to drinking water quality shall be retained, analyzed and filed for as long as they may be useful (minimum of five years).

4.6.2.2 The maintenance of accurate and complete records shall be an integral part of the surveillance of drinking water quality. Apart from the recording of analytical results, the following shall also be recorded;

- (i) Information on construction and location of the water supply and its auxiliary structures,
- (ii) Details of treatment, operation and maintenance,
- (iii) Sanitary survey reports, and
- (iv) Reports on corrective actions taken.

4.6.3 Data Evaluation

4.6.3.2 The keeping of records shall not become an end in itself but a part of a greater aim, i.e. in evaluating system performance and planning improvements.

4.7 Remedial Action Procedures

Upon receiving reports of violations to the recommended standards in drinking water, the District Health Office shall liaise with the District Water Authorities or the Water Purveyor concerned to investigate the probable cause. The line of action may involve one or a combination of the following procedures;

- (i) Re-sampling the affected area.
- (ii) Carrying out a sanitary survey.
- (iii) Carrying out a detailed engineering system investigation. Assistance may be sought from the state or federal agencies.

Following the investigations carried out, the remedial actions that may be recommended may involve one or a combination of the following procedures;

- (i) Flushing of the pipelines or service reservoirs.
- (ii) Increased chlorine dosage.
- (iii) Correction of chemical dosage.
- (iv) Use of alternative source of water.
- (v) Major correction measures undertaken based on findings of engineering investigation.
- (vi) Notification and advice to the public.
- (vii) Terminating the supply.

4.8 Examination of Staff Employed by Waterworks

4.8.1. Care should be exercised in the selection of waterworks staff/personnel as well as contractors and their staff who are to be employed on jobs where a risk to the safety of the water supply is likely to arise. The clinical history of each person, particularly with reference to any infection capable of being waterborne, should be thoroughly investigated.

4.8.2. Individual medical records for every plant operator and contractor employed in the plant should be maintained for easy reference and follow-up action.

4.8.3. Prior to employment, the worker should be sent to the District Health Office and a rectal swab and stool examination made to ascertain that he is free from infection by waterborne diseases. The rectal swab and stool sample should be carried out 3 times in 3 successive days or once a week over a period of 3 weeks. Laboratory results should be recorded in his medical record.

- 4.8.4. He should not be so employed unless physical and medical examination shows the absence of infection by waterborne diseases.
- 4.8.5. Information on all vaccinations received by prospective employees must be recorded. Those requiring boosters or other vaccinations not received so far, must be given to the employee if recommended by the Medical Officer of Health examining the prospective employee.
- 4.8.6 If any employee is known to have any clinical signs and symptoms of any waterborne disease (e.g. diarrhea), he is required to be examined and certified fit by a Government Medical Officer of Health before he resumes work at the treatment plant.
- 4.8.7 Standing arrangement should also be made to ensure that each member of the staff is examined every six months and certified fit by the Government Medical Officer of Health.

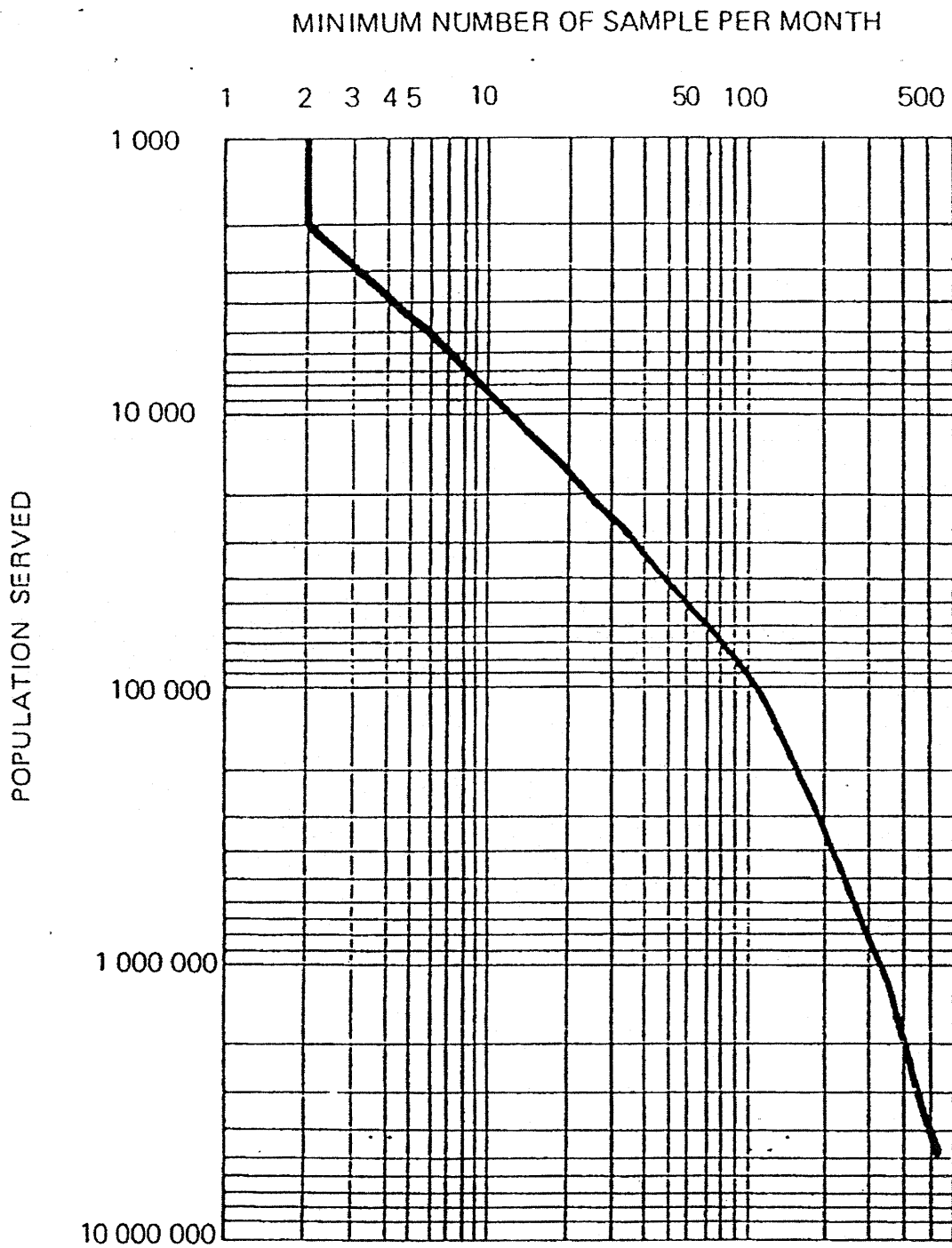


Fig. 1. Recommended minimum monthly samples per population served by water supply (bacteriological).

TABLE 1

**RECOMMENDED RAW WATER QUALITY
CRITERIA AND FREQUENCY OF MONITORING**

NO.	PARAMETERS	COLUMN I	COLUMN II			COLUMN III
		ACCEPTABLE VALUE	FREQUENCY TO BE MONITORED			SOURCE OF REFERENCE
		mg/l (unless otherwise stated)	SURFACE	GROUND	DIRECT IMPOUNDING	
GROUP I						
1	TOTAL COLIFORM	5,000 MPN/100ml or cfu/100ml	W	M	M	WHO1
2	TURBIDITY	1,000 NTU	W	M	M	WHO2
3	COLOUR	300 TCU	W	M	M	WHO1
4	pH	5.5 – 9.0	W	M	M	MAL
GROUP II						
1	TOTAL DISSOLVED SOLIDS	1,500	M	Y/4	Y/4	WHO1
2	BIOLOGICAL OXYGEN DEMAND	6	M	Y/4	Y/4	WHO1
3	CHEMICAL OXYGEN DEMAND	10	M	Y/4	Y/4	WHO1
4	CHLORIDE	250	M	Y/4	Y/4	MAL
5	ANIONIC DETERGENT MBAS	1.0	M	Y/4	Y/4	WHO1
6	AMMONIA (as N)	1.5	M	Y/4	Y/4	WHO1
7	NITRATE (as N)	10	M	Y/4	Y/4	MAL
8	IRON (as Fe)	1.0	M	Y/4	Y/4	MAL
9	FLUORIDE	1.5	M	Y/4	Y/4	WHO1
10	HARDNESS	500	M	Y/4	Y/4	MAL
11	MANGANESE	0.2	M	Y/4	Y/4	WHO1
GROUP III						
1	MERCURY	0.001	Y/4	Y/4	Y/4	MAL
2	CADMIUM	0.003	Y/4	Y/4	Y/4	MAL
3	SELENIUM	0.01	Y/4	Y/4	Y/4	WHO1
4	ARSENIC	0.01	Y/4	Y/4	Y/4	MAL
5	CYANIDE	0.07	Y/4	Y/4	Y/4	MAL
6	LEAD	0.05	Y/4	Y/4	Y/4	MAL
7	CHROMIUM	0.05	Y/4	Y/4	Y/4	WHO1
8	SILVER	0.05	Y/4	Y/4	Y/4	MAL
9	COPPER	1.0	Y/4	Y/4	Y/4	MAL
10	MAGNESIUM	150	Y/4	Y/4	Y/4	MAL
11	SODIUM	200	Y/4	Y/4	Y/4	MAL
12	ZINC	3	Y/4	Y/4	Y/4	MAL
13	SULPHATE	250	Y/4	Y/4	Y/4	MAL
14	MINERAL OIL	0.3	Y/4	Y/4	Y/4	MAL
15	PHENOL	0.002	Y/4	Y/4	Y/4	WHO1

TABLE 1 (continued)

**RECOMMENDED RAW WATER QUALITY
CRITERIA AND FREQUENCY OF MONITORING**

NO.	PARAMETERS	COLUMN I	COLUMN II			COLUMN III
		ACCEPTABLE VALUE	FREQUENCY TO BE MONITORED			SOURCE OF REFERENCE
		mg/l (unless otherwise stated)	SURFACE	GROUND	DIRECT IMPOUNDING	
	GROUP IV					
	<u>ORGANOCHLORINE PESTICIDES:</u>					
1	ALDRIN/DIELDRIN	0.00003	Y/4	Y/4	Y/4	MAL
2	DDT	0.002	Y/4	Y/4	Y/4	MAL
3	HEPTACHLOR & HEPTACHLOR EPOXIDE	0.00003	Y/4	Y/4	Y/4	MAL
4	METHOXYCHLOR	0.02	Y/4	Y/4	Y/4	MAL
	<u>NON-ORGANOCHLORINE PESTICIDES:</u>					
5	HEXACHLOROBENZENE	0.001	WN	Y/4	Y/4	MAL
6	LINDANE	0.002	Y/4	Y/4	Y/4	MAL
7	CHLORDANE	0.0002	Y/4	Y/4	Y/4	MAL
	<u>HERBICIDES:</u>					
8	2,4-D (DICHLOROPHENOXYACETIC ACID)	0.03	WN	Y/4	Y/4	MAL
	GROUP V					
	<u>RADIOACTIVITY:</u>					
1	GROSS α	0.1Bq/l	WN	WN	WN	MAL
2	GROSS β	1.0Bq/l	WN	WN	WN	MAL
TOTAL	40 PARAMETERS					

W : Indicates parameters to be monitored at least once a week.

M : Indicates parameters to be monitored at least once a month.

Y/4 : Indicates parameters to be monitored at least once in 3 months.

Y : Indicates parameters to be monitored at least once a year.

WHO1 : Refers to WHO International Standards for Drinking Water 1963.

WHO2 : Refers to WHO Guidelines for Drinking Water Quality Vol. 1 & 2 1984.

MAL : Refers to values adapted for Malaysian conditions.

Notes:

Collection of samples of both raw and treated water for examination for toxic substances should be carried out more frequently if values above the acceptable values are known to be present in the source of supply, or where such potential pollution exists.

TABLE 2

DRINKING WATER QUALITY STANDARDS AND FREQUENCY OF MONITORING

NO.	PARAMETERS	COLUMN I	COLUMN II				COLUMN III
		MAXIMUM ACCEPTABLE VALUE	FREQUENCY TO BE MONITORED				
		mg/l (unless otherwise stated)	WATER TREATMENT PLANT OUTLET	SERVICE RESERVOIR OUTLET	DISTRIBUTION SYSTEM	WELL/ SPRING	
	GROUP I						
1	<u>MICROBIOLOGICAL:</u> TOTAL COLIFORM	MPN METHOD/MEMBRANE FILTRATION METHOD: MUST NOT BE DETECTED IN ANY 100ml SAMPLE	W	W	M	2Y	MAL
2	<i>E. coli</i> OR THERMOTOLERANT COLIFORM BACTERIA	ABSENT IN 100ml SAMPLE	W	W	M	2Y	WHO2
3	FAECAL STREPTOCOCCI	MEMBRANE FILTER METHOD: ABSENT IN 100ml SAMPLE	WN	WN	WN	WN	EEC
4		MPN METHOD: < 1 IN 100ml SAMPLE					
5	CLOSTRIDIUM PERFRINGENS	ABSENT	WN	WN	WN	WN	MAL 1990
6	VIRUSES	ABSENT IN 100ml	WN	WN	WN	WN	NZ
7	PROTOZOA	ABSENT IN 100ml	WN	WN	WN	WN	NZ
8	HELMINTHS	ABSENT IN 100ml	WN	WN	WN	WN	NZ
	<u>PHYSICAL:</u>						
9	TURBIDITY	5 NTU	W	W	M	2Y	WHO2
10	COLOUR	15 TCU	W	W	M	2Y	WHO2
11	pH	6.5 - 9.0	W	W	M	2Y	MAL
12	FREE RESIDUAL CHLORINE	0.2 - 5.0	W	W	M	2Y	WHO1
13	COMBINED RESIDUAL CHLORINE	NOT LESS THAN 1.0	W	W	M	2Y	MAL1990
14	MONOCHLORAMINE	3	WN	WN	WN	WN	WHO2
	GROUP II						
	<u>INORGANIC:</u>						
1	TOTAL DISSOLVED SOLIDS	1000	M	M	Y/2	2Y	WHO2
2	CHLORIDE	250	M	M	Y/2	2Y	WHO2
3	AMMONIA (as N)	1.5	M	M	Y/2	2Y	WHO2
4	NITRATE (as N)	10	M	M	Y/2	2Y	WHO1
5	IRON	0.3	M	M	Y/2	2Y	WHO2
6	FLUORIDE	0.4 - 0.6	M	M	Y/2	2Y	MAL
7	HARDNESS	500	M	M	Y/2	2Y	WHO1
8	ALUMINIUM	0.2	M	M	Y/2	2Y	WHO2
9	MANGANESE	0.1	M	M	Y/2	2Y	WHO2
	GROUP III						
1	MERCURY (TOTAL)	0.001	Y/4	Y/2	Y	2Y	WHO2
2	CADMIUM	0.003	Y/4	Y/2	Y	2Y	WHO2
3	ARSENIC	0.01	Y/4	Y/2	Y	2Y	WHO2
4	CYANIDE	0.07	Y/4	Y/2	Y	2Y	WHO2
5	LEAD	0.01	Y/4	Y/2	Y	2Y	WHO2
6	CHROMIUM	0.05	Y/4	Y/2	Y	2Y	WHO2
7	COPPER	1	Y/4	Y/2	Y	2Y	WHO1
8	ZINC	3	Y/4	Y/2	Y	2Y	WHO2
9	SODIUM	200	Y/4	Y/2	Y	2Y	WHO2
10	SULPHATE	250	Y/4	Y/2	Y	2Y	WHO2

TABLE 2 (continued)

DRINKING WATER QUALITY STANDARDS AND FREQUENCY OF MONITORING

NO.	PARAMETERS	COLUMN I	COLUMN II				SOURCE OF REFERENCE
		MAXIMUM ACCEPTABLE VALUE	FREQUENCY TO BE MONITORED				
		mg/l (unless otherwise stated)	WATER TREATMENT PLANT OUTLET	SERVICE RESERVOIR OUTLET	DISTRIBUTION SYSTEM	WELL/ SPRING	
	<u>TRIHALOMETHANE:</u> The sum of the ratio of the concentration to each of the guideline value should not exceed 1.						
11	CHLOROFORM	0.2	Y/4	Y/2	Y	2Y	WHO3
12	BROMOFORM	0.1	Y/4	Y/2	Y	2Y	WHO2
13	DIBROMOCHLOROMETHANE	0.1	Y/4	Y/2	Y	2Y	WHO2
14	BROMODICHLOROMETHANE	0.06	Y/4	Y/2	Y	2Y	WHO2
15	SELENIUM	0.01	Y/4	WN	WN	WN	WHO2
16	SILVER	0.05	Y/4	WN	WN	WN	MAL 1990
17	MAGNESIUM	150	Y/4	WN	WN	WN	MAL 1990
18	ANTIMONY	0.005	WN	WN	WN	WN	WHO2
19	BARIUM	0.7	WN	WN	WN	WN	WHO2
20	BORON	0.5	WN	WN	WN	WN	WHO3
21	MOLYBDENUM	0.07	WN	WN	WN	WN	WHO2
22	NICKEL	0.02	WN	WN	WN	WN	WHO2
23	URANIUM	0.002	WN	WN	WN	WN	WHO3
24	HYDROGEN SULFIDE	0.05	WN	WN	WN	WN	WHO2
25	MINERAL OIL	0.3	WN	WN	WN	WN	MAL 1990
26	PHENOL	0.002	WN	WN	WN	WN	WHO1
27	BROMATE	0.025	WN	WN	WN	WN	WHO2
28	CHLORITE	0.2	WN	WN	WN	WN	WHO2
29	2-CHLOROPHENOL	0.0001	WN	WN	WN	WN	WHO2
30	2,4-DICHLOROPHENOL	0.0003	WN	WN	WN	WN	WHO2
31	2,4,6 -TRICHLOROPHENOL	0.2	WN	WN	WN	WN	WHO2
32	FORMALDEHYDE	0.9	WN	WN	WN	WN	WHO2
33	DICHLOROACETIC ACID	0.05	WN	WN	WN	WN	WHO2
34	TRICHLOROACETIC ACID	0.1	WN	WN	WN	WN	WHO2
35	CHLORAL HYDRATE (TRICHLOROACETALDEHYDE)	0.01	WN	WN	WN	WN	WHO2
36	DICHLOROACETO-NITRILE	0.09	WN	WN	WN	WN	WHO2
37	DIBROMOACETO-NITRILE	0.1	WN	WN	WN	WN	WHO2
38	TRICHLOROACETO-NITRILE	0.001	WN	WN	WN	WN	WHO2
39	CYANOGEN CHLORIDE (as CN)	0.07	WN	WN	WN	WN	WHO2

TABLE 2 (continued)

DRINKING WATER QUALITY STANDARDS AND FREQUENCY OF MONITORING							
NO.	PARAMETERS	COLUMN I	COLUMN II				SOURCE OF REFERENCE
		MAXIMUM ACCEPTABLE VALUE	FREQUENCY TO BE MONITORED				
		mg/l (unless otherwise stated)	WATER TREATMENT PLANT OUTLET	SERVICE RESERVOIR OUTLET	DISTRIBUTION SYSTEM	WELL/ SPRING	
	GROUP IV						
1	ALDRIN/DIELDRIN	0.00003	Y/4	WN	WN	WN	WHO2
2	DDT	0.002	Y/4	WN	WN	WN	WHO2
3	HEPTACHLOR & HEPTACHLOR EPOXIDE	0.00003	Y/4	WN	WN	WN	WHO2
4	METHOXYCHLOR	0.02	Y/4	WN	WN	WN	WHO2
5	LINDANE (BHC)	0.002	Y/4	WN	WN	WN	WHO2
6	ENDOSULFAN	0.03	Y/4	WN	WN	WN	WHO2
7	CHLORDANE	0.0002	WN	WN	WN	WN	AUS
8	1,2-DICHLOROPROPANE	0.04	WN	WN	WN	WN	WHO2
9	1,3-DICHLOROPROPENE	0.02	WN	WN	WN	WN	WHO3
10	HEXACHLOROBENZENE	0.001	WN	WN	WN	WN	WHO2
11	PENTACHLOROPHENOL	0.009	WN	WN	WN	WN	WHO2
12	ALACHLOR	0.02	WN	WN	WN	WN	WHO3
13	ALDICARB	0.01	WN	WN	WN	WN	WHO2
14	AMETRYN	0.05	WN	WN	WN	WN	WHO2
15	ATRAZINE	0.002	WN	WN	WN	WN	AUS
16	BENTAZONE	0.3	WN	WN	WN	WN	WHO2
17	CARBOFURAN	0.007	WN	WN	WN	WN	WHO3
18	CHLOROTOLURON	0.03	WN	WN	WN	WN	WHO3
19	CYANAZINE	0.0006	WN	WN	WN	WN	WHO2
20	2,4-DICHLOROPHOXY-ACETIC ACID (2,4D)	0.03	WN	WN	WN	WN	WHO3
21	DIQUAT	0.01	WN	WN	WN	WN	WHO3
22	1,2-DIBROMO-3-CHLOROPROPANE	0.001	WN	WN	WN	WN	WHO2
23	1,2-DIBROMOETHANE	0.0004	WN	WN	WN	WN	WHO3
24	ISOPROTURON	0.009	WN	WN	WN	WN	WHO2
25	MCPA	0.002	WN	WN	WN	WN	WHO2
26	METOLACHLOR	0.01	WN	WN	WN	WN	WHO2
27	MOLINATE	0.006	WN	WN	WN	WN	WHO2
28	PENDIMETHALIN	0.02	WN	WN	WN	WN	WHO2
29	PERMETHRIN	0.02	WN	WN	WN	WN	WHO2
30	PROPANIL	0.02	WN	WN	WN	WN	WHO2
31	PYRIDATE	0.1	WN	WN	WN	WN	WHO2
32	SIMAZINE	0.002	WN	WN	WN	WN	WHO2
33	TRIFURALIN	0.02	WN	WN	WN	WN	WHO2
34	2,4 DB	0.09	WN	WN	WN	WN	WHO2
35	DICHLORPROP	0.1	WN	WN	WN	WN	WHO2
36	FENOPROP	0.009	WN	WN	WN	WN	WHO2
37	MECOPROP	0.01	WN	WN	WN	WN	WHO2
38	2,4,5-T	0.009	WN	WN	WN	WN	WHO2
39	TERBUTHYLZAZINE	0.007	WN	WN	WN	WN	WHO3

TABLE 2 (continued)

DRINKING WATER QUALITY STANDARDS AND FREQUENCY OF MONITORING

NO.	PARAMETERS	COLUMN I	COLUMN II				SOURCE OF REFERENCE
		MAXIMUM ACCEPTABLE VALUE	FREQUENCY TO BE MONITORED				
		mg/l (unless otherwise stated)	WATER TREATMENT PLANT OUTLET	SERVICE RESERVOIR OUTLET	DISTRIBUTION SYSTEM	WELL/ SPRING	
	ORGANIC SUBSTANCES:						
40	CARBON TETRACHLORIDE	0.002	WN	WN	WN	WN	WHO2
41	DICHLOROMETHANE	0.02	WN	WN	WN	WN	WHO2
42	1,2-DICHLOROETHANE	0.03	WN	WN	WN	WN	WHO2
43	1,1,1-TRICHLOROETHANE	2	WN	WN	WN	WN	WHO2
44	VINYL CHLORIDE	0.005	WN	WN	WN	WN	WHO2
45	1,1-DICHLOROETHENE	0.03	WN	WN	WN	WN	WHO2
46	1,2-DICHLOROETHENE	0.05	WN	WN	WN	WN	WHO2
47	TRICHLOROETHENE	0.07	WN	WN	WN	WN	WHO2
48	TETRACHLOROETHENE	0.04	WN	WN	WN	WN	WHO2
49	BENZENE	0.01	WN	WN	WN	WN	WHO2
50	TOULENE	0.7	WN	WN	WN	WN	WHO2
51	XYLENE	0.5	WN	WN	WN	WN	WHO2
52	ETYL BENZENE	0.3	WN	WN	WN	WN	WHO2
53	STYRENE	0.02	WN	WN	WN	WN	WHO2
54	BENZO (A) PYRENE	0.0007	WN	WN	WN	WN	WHO2
55	MONOCHLOROBENZENE	0.3	WN	WN	WN	WN	WHO2
56	1,2-DICHLOROBENZENE	1	WN	WN	WN	WN	WHO2
57	1,4-DICHLOROBENZENE	0.3	WN	WN	WN	WN	WHO2
58	TRICHLOROBENZENE (TOTAL)	0.02	WN	WN	WN	WN	WHO2
59	DI (2-ETHYLHEXYL) ADIPATE	0.08	WN	WN	WN	WN	WHO2
60	DI (2-ETHYLHEXYL) PHTHALATE	0.008	WN	WN	WN	WN	WHO2
61	EDETIC ACID (EDTA)	0.6	WN	WN	WN	WN	WHO3
62	ACRYLAMIDE	0.0005	WN	WN	WN	WN	WHO2
63	EPICHLOROHYDRIN	0.0004	WN	WN	WN	WN	WHO2
64	HEXACHLOROBTADIENE	0.0006	WN	WN	WN	WN	WHO2
65	MICROCYSTIN-LR	0.001	WN	WN	WN	WN	WHO3
66	NITRILOTRIACETIC ACID (NTA)	0.2	WN	WN	WN	WN	WHO2
67	TRIBUTYLIN OXIDE	0.002	WN	WN	WN	WN	WHO2
	GROUP V						
	RADIOACTIVITY:						
1	GROSS α	0.1Bq/l	WN	WN	WN	WN	WHO2
2	GROSS β	1.0Bq/l	WN	WN	WN	WN	WHO2
TOTAL	131 PARAMETERS						

- W** : Indicates parameters to be monitored at least once a week.
M : Indicates parameters to be monitored at least once a month.
Y/2 : Indicates parameters to be monitored at least once in 6 months.
Y : Indicates parameters to be monitored at least once a year.
2Y : Indicates parameters to be monitored at least once in 2 years.
WN : Indicates parameters to be monitored when necessary.
WHO1 : Indicates WHO Guidelines for Drinking Water Quality 1984.
WHO2 : Indicates WHO Guidelines for Drinking Water Quality 1993/96.
WHO3 : Indicates WHO Guidelines for Drinking Water Quality Addendum to Vol. 1) 1998.
MAL : Indicates values adapted for Malaysian conditions.
AUS : Indicates Australian Drinking Water Quality Guidelines, 1996.
EEC : Indicates EEC Standard Council Directive (80/778/EEC).
NZ : Indicates Drinking Water Standards for New Zealand 1995.

Notes: Any toxic substances not listed shall be deemed as not allowable in drinking water.

TABLE 3

PARAMETER LIMITS FOR SEWAGE AND INDUSTRIAL EFFLUENTS

PARAMETER (1)	UNIT (2)	STANDARD*	
		A (3)	B (4)
(i) Temperature	°C	40	40
(ii) pH	-	6.0 – 9.0	5.5 – 9.0
(iii) BOD ₅ at 20°C	mg/l	20	50
(iv) COD	mg/l	50	100
(v) Suspended Solids (SS)	mg/l	50	100
(vi) Mercury	mg/l	0.005	0.05
(vii) Cadmium	mg/l	0.01	0.02
(viii) Chromium Hexavalent	mg/l	0.05	0.05
(ix) Arsenic	mg/l	0.05	0.1
(x) Cyanide	mg/l	0.05	0.1
(xi) Lead	mg/l	0.1	0.5
(xii) Chromium, Trivalent	mg/l	0.2	1
(xiii) Copper	mg/l	0.2	1
(xiv) Manganese	mg/l	0.2	1
(xv) Nickel	mg/l	0.2	1
(xvi) Tin	mg/l	0.2	1
(xvii) Zinc	mg/l	1	1
(xviii) Boron	mg/l	1	4
(xix) Iron (Fe)	mg/l	1	5
(xx) Phenol	mg/l	0.001	1
(xxi) Free Chlorine	mg/l	1	2
(xxii) Sulphide	mg/l	0.5	0.5
(xxiii) Oil and Grease	mg/l	Not detectable	10

Notes:

* A
B

: Discharge upstream of water supply sources.
: Discharge downstream of water supply sources.

Source:

Environmental Quality (Sewage & Industrial Effluent) Regulations 1979.

TABLE 4

**PARAMETER LIMITS FOR WATERCOURSE DISCHARGE OF EFFLUENT
FROM PRESCRIBED PREMISES OCCUPIED OR USED FOR THE PRODUCTION
OF PALM OIL OR ITS ASSOCIATED PRODUCTS**

PARAMETERS	LIMITS OF DISCHARGE FOR PERIOD 1-1-1984 AND THEREAFTER
Biochemical Oxygen Demand (BOD) – 3 days, 30°C; mg/l	100
Chemical Oxygen Demand (COD); mg/l	-
Total Solids; mg/l	-
Suspended Solids; mg/l	400
Oil and Grease; mg/l	50
Ammoniacal Nitrogen; mg/l	150*
Total Nitrogen; mg/l	200*
pH	5.0 – 9.0
Temperature; °C	45

Notes:

* Value of filtered sample.

Source:

Environmental Quality (Prescribed Premises) (Crude Palm Oil) Regulations, 1977 Second Schedule.

TABLE 5

**PARAMETER LIMITS FOR WATERCOURSE DISCHARGE OF EFFLUENT
FROM PRESCRIBED PREMISES OCCUPIED OR USED FOR THE PRODUCTION
OF PALM OIL OR ITS ASSOCIATED PRODUCTS**

PARAMETERS	LIMITS OF DISCHARGE FOR PERIOD 1-4-1983 AND THEREAFTER
Biochemical Oxygen Demand (BOD) – 3 days, 30°C; mg/l	100 (50*)
Chemical Oxygen Demand (COD); mg/l	400
Total Solids; mg/l	-
Suspended Solids; mg/l	150 (100*)
Ammoniacal Nitrogen; mg/l	300
Total Nitrogen; mg/l	300
pH	6.0 – 9.0

Notes:

* This additional limit is the arithmetic mean value determined on the basis of a minimum of four samples taken at least once a week for four weeks consecutively.

Source:

Environmental Quality (Prescribed Premises) (Raw Natural Rubber) Regulations 1978 Third Schedule.

TABLE 6

**PARAMETER LIMITS FOR WATERCOURSE DISCHARGE OF EFFLUENT
FROM PRESCRIBED PREMISES OCCUPIED OR USED FOR THE PRODUCTION
OF PALM OIL OR ITS ASSOCIATED PRODUCTS**

PARAMETERS	LIMITS OF DISCHARGE FOR PERIOD 1-4-1981 AND THEREAFTER
Biochemical Oxygen Demand (BOD) – 3 days, 30°C; mg/l	100 (50*)
Chemical Oxygen Demand (COD); mg/l	250
Total Solids; mg/l	-
Suspended Solids; mg/l	150 (100*)
Ammoniacal Nitrogen; mg/l	40#
Total Nitrogen; mg/l	60#
pH	6.0 – 9.0

Notes:

* This additional limit is the arithmetic mean value determined on the basis of a minimum of four samples taken at least once a week for four weeks consecutively.

Value on filtered sample.

Source:

Environmental Quality (Prescribed Premises) (Raw Natural Rubber) Regulations 1978 Fourth Schedule.