

THE UNITED REPUBLIC OF TANZANIA



No. 10 OF 1981

I ASSENT,

*Julius Nyerere*  
.....  
President

22nd MAY, 1981

**An Act to amend the Water Utilization (Control and Regulation) Act, 1974, to make better provision for the control of pollution of water**

[.....]

ENACTED by the Parliament of the, United Republic of Tanzania.

1. This Act may be cited as the Water Utilization (Control and Regulation) (Amendment) Act, 1981 and shall be read as one with the water Utilization (Control and Regulation) Act, 1974, in this Act referred to as "the principal Act".

Short title  
and  
constru-  
tion

2. This Act shall come into operation on such date as the Minister may, by notice published in the Gazette, appoint.

Commence-  
ment.

3. Section 2 of the principal Act is hereby amended-

Amendment  
of section 2

(a) by deleting the definition "appointing authority" and substituting for it the following definition:

""appointing authority" means in the case of the Chairman of the Central Water Board, the President and in the case of other members of every Basin Water Board, the Minister; ,

(b) by deleting the definition "Regional Water Advisory Board" and substituting for it the following definition:

""Central Water Board" means the Central Water Board established by section 5;";

(c) by deleting the definition "Regional Water Advisory Board" and substituting for it the following definition:

""Basin Water Board" means a Basin Water Board established under section 7 in relation to a water basin;";

(d) by inserting, in the appropriate alphabetical positions, the following definition-

"" direct discharge" means the discharge of effluents into receiving waters without prior treatment;

"effluent" includes any flowing-out or fluid material discharged from domestic or industrial wastes systems which, by reason of its quality, quantity or characteristics, is likely to impair the beneficial use of receiving waters by adversely affecting their natural state;

"effluent treatment plant" means any device or structure designed for the treatment of effluents removing matters in suspension, detoxicating or stabilising biodegradable organic impurities so as to prevent the occurrence of secondary decomposition upon the effluent mingling with water;

"indirect discharge" means the discharge of effluents into a sewer leading to, a municipal treatment plant;

"pollutant" means any substance or characteristic, whether or not harmful, added or imposed onto natural or supplied water;

"water basin" means any area of land delimited and declared by the Minister under section 7 to be a water basin in relation to any river or other water source<sup>6</sup>;

(e) by deleting the whole of subsection (2).

Amendment  
of section 3

**4.** Section 3 of the principal Act is amended by deleting the passage "the East African Community and all Corporations within the Community"

Repeal and  
replacement  
of sections  
5, 6 and 7

**5.** Section 5, 6 and 7 of the principal Act are hereby repealed and replaced by the following-

'Establish-  
ment of  
Central  
water  
Board

**5.-(1)** There is hereby established a central Water Board consisting of a Chairman who shall be appointed by the President, and not less than ten nor more than fifteen other members, who shall each be appointed by the Minister from among persons holding qualifications in scientific technical fields of learning, or having adequate knowledge and experience in the public affairs of Tanzania.

(2) Every member shall hold office-

(a) in the case of a member appointed in his own name, until such time as the appointing authority revokes his appointment and appoints another person in his place;

(b) in the case of a member who is appointed by virtue of his holding some other office, until such time as he ceases to hold that other office.

(3) Where any member is, by reason of illness, infirmity or absence from the United Republic, unable to attend any meeting of the Central Water Board the appointing authority may appoint a temporary member in his place and the temporary member shall cease to hold office on the resumption of office of the substantive member.

(4) The Central Water Board shall elect one of its members to be the Vice-Chairman who shall, subject to his continuing to be a member, hold the office of Vice-Chairman for a term of two years from the date of his election and shall be eligible for re-election.

(5) The Central Water Board shall hold meetings on such occasions at such place as it may in its discretion determine.

(6) The business of the Central Water Board shall be conducted in such manner as the Minister may, by order published in the Gazette, prescribe; but where no procedure is prescribed the Central Water Board shall conduct its business in such manner as it shall determine.

6.-(1) The Central Water Board shall be the principal advisory organ in matters relating to the utilization of water, and shall have and exercise functions in relation to the control and regulation of water pollution subject to the provisions of this Act.

(2) In relation to the utilization of water-

(a) the Central Water Board shall advise the Principal Water Officer on all matters concerning the appointment of national water supplies, the determination, diminution or modification of water rights, the measures to be taken in case of drought and the priorities to be given from time to time and in accordance with prevailing circumstances for the different purposes for which the water is required in any area of the United Republic.

(b) subject to paragraph (c), the Principal Water Officer shall consider the advice of the Central Water Board before granting or refusing any application for a water right, before determining revising, diminishing or modifying any water right or existing right and before specifying a quality of water under section 21, but shall not be bound to follow that advice;

(c) Nothing in paragraph (b), shall require the Principal Water Officer to make any reference to, or to consider the advice of the Central Water Board in respect of

"Functions  
of Central  
Water  
Board

any suspension or variation of a right under section 20 or in respect of any modification, variation, determination or diminution of a right with the consent of its holder.

- (3) In relation to the control and regulation of water pollution, the Central Water Board shall have Power-
- (a) to carry out, and promote the carrying out of research and investigations into the causes and ways for the efficient prevention or control, of water pollution in the United Republic;
  - (b) to formulate and recommend to the Government comprehensive Plans for the regulation of the discharge of effluents by industrial, trade and other categories of users of water;
  - (c) to formulate, and recommend to the Minister the best ways of ensuring compliance With' uniform procedure for the sampling and examination of water sewage and industrial effluents, designating units for expressing results;
  - (d) to advise and assist the Government, Public authorities and other persons or bodies of persons measures for the more efficient control or prevention of water Pollution;
  - (e) to recommend to the Minister legislative measures necessary or suitable for the effective control of water pollution;
  - (f) to formulate effluent and receiving water standards, and programmes for ensuring compliance with those standards by domestic, commercial, industrial and other users of water;
  - (g) subject to the provisions of this Act, and of any other written law relating to the extraction, supply or use of water, to any other act or thing which, in the opinion of the Central Water Board, is necessary or expedient for the more effective control of water pollution in the United Republic- .

Establishment,  
functions  
and proceeding of  
Basin  
water Board

7.-(1) The Minister may, by order published in the *Gazette*, declare any area of land to be water basin in relation to any river.

(2) There shall be established a Basin Board in respect of each water basin declared under subsection (1) and the Minister shall, in the order made under subsection (1), appoint not less than seven nor more than ten persons to be members of that Basin Water Board-

(3) The provisions of section 5, and 6 (1) and (2) shall apply *mutatis mutandis* in relation to a regional water supply as it references in those Provisions to the Central Water Board and to the Principal Water Officer were references to a Basin Water Board and to a Regional Water Officer, subject to the preceding provisions of this section and to those of subsection (4).

(4) All the function provided for or referred to in section (1) and (2) shall, in the application of that section to a Basin Water Board and a Regional Water Officer be performed in relation to a regional water source only in so far as it is within the water basin concerned."

6. The principal Act is hereby amended by adding immediately after section 15, the following new section:

Addition  
of new  
section 15A  
"Consent  
for dis-  
charges

15A.-(1) No person may discharge effluents; from any commercial, industrial or other trade wastes systems into receiving waters without a consent duly granted by a Water Officer under this section.

(2) Upon receipt of an application for the grant of a consent to discharge, the Water Officer shall give notice of application in the prescribed manner. Any interested person may notify the Water Officer that he objects to the grant of a consent to discharge and may specify the grounds for such objection, and shall, if he so requires, have a right to be heard on the objection by the Central Water Board or the Basin Water Board concerned, as the case may be.

(3) A consent, to discharge granted under this section shall entitle the person to whom it is granted to discharge effluents into any underground stratum subject to the provisions of section 18A.

(4) The Minister may make provisions regulating the procedure for making and considering applications for the grant of consents to discharge, the making of objections to any such application, the making of appeals against refused applications or conditions imposed on consents granted, and any other matters related to or grant of consents to discharge."

7. Section 17 of the principal Act is hereby amended-  
(a) in paragraph (a)-

Amendment  
of section  
17

- (i) by deleting the conjunction "and" at the end of sub-paragraph (iii); and
- (ii) by adding, immediately after sub-paragraph (iii), the following sub-paragraph-



"(iv) shall, before its direct discharge into receiving waters, be so treated or otherwise modified as to comply with prescribed effluent and receiving water standards;"

(b) in paragraph (b) by deleting the full-stop at the end of that paragraph and substituting for it a semicolon; and

(c) by adding, immediately after paragraph (b), the following paragraphs-

"(c) that the owner of the water right shall make periodical returns to the Water Officer in such form and at such intervals as the Minister may prescribe, setting out the nature of wastes or effluents produced by his use of the water; and

(d) that the owner of the water right shall install or facilitate the installation at the point of discharge all machinery and other facilities necessary for the taking of samples and the collection and treatment of effluents."

Addition of  
new sections

18A and 18B  
"Restriction  
on discharge  
into under-  
ground  
strata

**8.** The principal Act is hereby amended by adding, immediately after section 18, the following new sections:

**18A.--**(1) No person to whom a consent to discharge is granted under section 15A may construct or discharge into an underground water body within 230 metres of any well or borehole or any other water body or within 90 metres of any body of underground water or enlargement of any well, borehole or other water body which is within those distances from any other well or borehole or body of underground water, as the case may be.

(2) The Minister may, upon recommendation made by the Central Water Board in that behalf, make provisions for the better regulation of the discharge of effluents into underground strata.

Declaration  
of standards

**18B.--**(1) The standards specified in the First and the Second Schedule to this Act shall be standards in respect of effluence and receiving water, respectively, which shall be complied with by users of water before or during discharge into water courses, receiving waters or sewers.

(2) The Minister may, by order published in the *Gazette*, add to, vary or replace any of the provisions of the First and the Second Schedule.

(3) The Central Water Board may, with the consent of the Minister, exempt any person or body of persons from complying with the provisions of this section of such period as it may determine."

9. Section 32 of the principal Act is hereby amended by renumbering subsections (1), (2) and (3) as subsections (2), (3) and (4), respectively- Amendment of section 32  
and by inserting, immediately before the new subsection (2), the following new subsections (1)

"(1) The Minister shall make provision for the procedure of making and hearing appeals arising from decisions Of the Central Water Board and Basin Water Boards and may, for that purpose, establish an appeals committee or committees and provide for the exercise of the Powers- and the regulation of the procedure, of the committee or committees, as the case may be."

10. The principal Act is hereby amended by deleting all references to the designations "Central Water Advisory Board" and "Regional Water Advisory Board" wherever they occur in the Act, and substituting for them, respectively, the designations "Central Water Board" and "Basin Water Board". General amendment

11. The principal Act is hereby amended by adding, immediately after section 39, the following Schedules: - Addition of Schedule

### FIRST SCHEDULE

#### Standards for Receiving Waters

Category 1: Water suitable for drinking water supplies, swimming pools, food and beverage manufacturing industries, pharmaceuticals manufacturing industries or industries requiring a water source of similar quality.

Category 2: Water suitable for use in feeding domestic animals; in fisheries, shell-cultures, recreation and water contact sports.

category 3 : Water suitable for irrigation and other industrial activities requiring water of standards lower than those of water in category 1 or 2.

Substance characteristic		unit	Maximum permissible concentration		
			Category 1	Category 2	Category 3
A2.1.1.	General				
A2.1.1.1.	Suspended Matter (turbidity)	mg/l (as S102)	discharge of effluents shall not cause formation of sludge or scum in the receiving water discharge, of effluents shall not cause any change in the natural colour of the receiving water discharge of effluents shall not cause change in the natural taste or odour of the receiving water		
A2.1.1.2	Colour	number (pt-Coscale)			
A2.1.1.3	Taste and odour	—			
A2.1.1.4		°C	discharge of effluents shall not raise the temperature of the receiving water by more than 5C		
A2.1.1.5	Total dissolved solids	mg/l	2,000, 2,000	No Limit	
A2.1.1.6	pH		6.5-8,5	6.5-8.5	6.5-9.0
A2.1.1.7	Dissolved oxygen	mg/l			3
A2.1.1.8	oxygen solution	%	80	60	40
A2.1.1-9	B.O.D -5days 200C	mg/l	5	5	10

## FIRST SCHEDULE-(contd.)

Substance/Characteristic		Unit	Maximum permissible I concentration		
			Cat. 1	Cat. 2	Cat. 3
	-5days 25°C	Mg/l	6	6	12
	-5days 30°C	Mg/l	6	6	12
	-5days 35°C	Mg/l			13
A2.1.1.10	Permanganate Value	M/l	20	20	30
A2.1.2.	Inorganic Substance ,	Mg/l	03	03	03
A2.1.2.1.	Aluminium (AL)	Mg/l	03	03	03
A2.1.2.2.	Arsenic (AS)	Mg/l	0.05	0.1	0.1
A2.2.3	Barium (Ba)	mg/l		1.0	1.5
A2.1.2.4	Boron (D)	mg/l.	115	1.5	1.5
A2.1.2.5	Cadmium (Cd)	mg/l	0.03	0.1	0.2
A2.1.2.6	Chromium III (Cr3 +)	mg/l.	01	0.3	0.5
A2.1.2.7	Chromium VI (Cr6+)	mg/l	0.65	0.1	0.1
A2.1.2.8	Cobalt (Co)	mg/l	0.1	01	0.5
A2.2.9 .	Copper (Cu)	mg/l	3.0	3.0	4.0
A2.1.2.10	Iron (Fe)	mg/l	110	1.2	1.5
A2.1.2.11	Lead (Pb)	mg/l	0.1	0.1.	0.2
A2.1.2.12	Manganese (m)	mg/l	0.5	08	0.8
A2.1.2.13	Mercury (Hg)	mg/l	0.001	0.0001	01005
A2.1.2.14	Nickel (Ni)	mg/l	0.05	0.05	0.1
A2.1.2.15	Selenium (Se)	mg/l	0.05	0.05	05
A2.1.2.16	Silver (A&)	mg/l.	0.05	0.05	0.65
A2.1.2.17	Tin (Sn)	mg/l	0.5	0.5	01
A2.1.2.18	(V)	mg/l	0.005	0.005	0.01
A2.1.2.19	(zn)	mg/l	0.2	0.2	1.0
A2.1.2.20	Ammonia+Ammonim (NH3+NH4)	mg/l	0.5	0.5	2.0
A2.1.2.21	Chlorides (Cl)	mg/l	200	200	400
A2.1.2.22	Fluorides (F-)	mg/l	8.0	80	8.0
A2.1.2.23	Cyanides (CN)	mg/l	0.05	0.65	01
A2.1.2.24	Nitrate-, (NO3)	mg/l	50	50	160
A2.1.2.25	Nitrites (NO2)	Mg/l			
A2.1.2.26	Phosphates (PO4)	mg/l	as low as is required to prevent eutrophication or excessive weed growth if nitrogen is a limiting nutrient in waters which are susceptible to eutrophication or excessive weed growth, or in rivers and streams draining into such waters, the lowest possible concentration should be aimed as if phosphorous is a limiting nutrient.		
A2.1.2.27	Sulphates (SO)	mg/l	600	600	600
A2.1.2.28	Sulphides (S -)	mg/l	600	0.01	0.1 -
A2.1.3.	Organic substances		0.01		
A2.1.3.1.	Alkyl benzene sulphonates (ABS)	mg/l	0.5	1.0	1.0
A2.1.3.2.	Aromatic and aliphatic hydrocarbons	mg/l	0.05	0.05	0.1
A2.1.3.3.	Aromatic nitrogen containing compounds (egaromatic amines)	mg/l	0.01	0.01	01
A2.1.3.4.	Chloroform extract (CE)	mg/l	0.5	0.5	1.0
A2.2.1.3.5.	Formaldehyde	mg/l	0.2	02	0.5
A2.1.3.7.	Non-volatile chlori- nated compounds	mg/l	0.005	0.005	0.10



## FIRST SCHEDULE-(contd.)

A2.1.3.8.	Volatile chlorinated hydrocarbons (CI)	mg/l	0.005	0.005	0.01
A2.1.3.9.	Organochlorine Pesticides (CI)	mg/l	0.0005		0.001
A2.1.3.10	Other Pesticides	Mg/l	0.001	0.001	0.005
A2.1.3.11	Phenols	mg/l	0.002	0.002	0.1
A2.1.3.12	Resins, tar etc	mg/l	0.1	0.1	0.5

## SECOND SCHEDULE

## Effluent Standards

Substance/Characteristic	Unit	Maximum permissible value		
		Effluents meant for direct discharge into receiving waters	Trade and Industrial effluents meant for indirect discharge into receiving waters, eg. via a municipal sewage treatment plant	
A2.2.1. General				
A2.2.1.1 Suspended solids	mg/l	not to cause form sludge or scum in the receiving water	No limit	
A2.2.1.2 Colour	Number (Pt-Co)	not to cause any change in the natural colour of the receiving water	100	
A2.2.1.3 Taste and Odour	—	not to cause any change in the natural taste or odour of the receiving water		
A2.2.1.4 Temperature	°C	not to cause any increase of the receiving water by more than 50°C	350°C or not more than 50°C above ambient temperature of the supplied water, which ever is greater	
A2.2.1.5 Total dissolved,	mg/l	3000; No restrictions for discharge into the sea.,	7,500	
A2.2.1.6 PH		6.5-8.5		
A2.2.1.7 B.O.D. 5 days, 200C	mg/l	30		
B.O.D. 5 days, 250C	mg/l	34	No limit	
B.O.D 5 days, 300C	mg/l	37	No limit	
B.O.D 5 days 350C	mg/l	40	No limit	
1.8 Permanganate value	mg/l	80	No limit	
Inorganic Substances				
A2.2.2.1 Aluminum (AL)	mg/l	20	5.0	
A2.2.2.2 Arsenic (As)	mg/l	0.1	0.1	
A2.2.2.3 Barium (Ba)	mg/l	1.5	3.0	
A2.2.2.4 Cadmium (Cd)	mg/l	0.1	0.1	

## SECOND SCHEDULE—(contd.)

*Inorganic substances*

A2.2.2.5	Chromium—III (Cr)	mg/l	0.1	2.0
A2.2.2.6	Cobalt (Co)	mg/l	1.0	1.0
A2.2.2.7	Copper (Cu)	mg/l	1.0	1.0
A2.2.2.8	Iron (Fe)	mg/l	3.0	5.0
A2.2.2.9	Lead (Pb)	mg/l	0.2	0.2
A2.2.2.10	Manganese (Mn)	mg/l	3.0	5.0
A2.2.2.11	Mercury (Hg)	mg/l	0.005	0.005
A2.2.2.12	Nikel (Ni)	mg/l	0.2	0.5
A2.2.2.13	Selenium (Se)	mg/l	0.5	1.0
A2.2.2.15	Silver (Ag)	mg/l	0.1	0.1
A2.2.2.16	Tin (Sn)	mg/l	2.0	2.0
A2.2.2.17	Vanadium (V)	mg/l	1.0	1.0
A2.2.2.18	Zinc (Zn)	mg/l	1.0	1.0
A2.2.2.19	Ammonia + Ammonium (NH <sub>3</sub> + 3NH <sub>4</sub> )	mg/l	10	No limit
A2.2.2.20	Chlorides (CL)	mg/l	800	800
A2.2.2.21	Free chlorine	mg/l	1.0	5.0
A2.2.2.22	Cyanides (Cn—)	mg/l	0.1	0.2
A2.2.2.23	Nitrates (NO <sub>3</sub> )	mg/l	50	80
A2.2.2.24	Nitrites (NO <sub>2</sub> )	mg/l	1.0	10
A2.2.2.25	Phosphates (PO <sub>4</sub> —)	mg/l	6.0	45
A2.2.2.26	Sulphates (SO <sub>4</sub> —)	mg/l	600	600
A2.2.2.27	Sulfides (S—)	mg/l	0.5	1.0

*Organic substances*

A2.2.3.1	Alkyl benzyl sulfonate ABS	mg/l	2.0	5.0
A2.2.3.2	Aromatic and aliphatic hydrocarbons	mg/l	1.0	5.0
A2.2.3.3	Aromatic nitrogen containing compounds (e.g. aromatic amines)	mg/l	0.05	0.05
A2.2.3.4	Chloroform extract (CE)	mg/l	5.0	10
A2.2.3.5	Formaldehyde	mg/l	1.0	1.0
A2.2.3.6	Grease and oils (petroleum ether extract)	mg/l	5	20
A2.2.3.7	Non-Volatile chlorinated compounds (CIL)	mg/l	0.05	0.05
A2.2.3.8	Organochlorine pesticides (a)	(CL)	0.005	0.005
A2.2.3.9	Other Pesticides	mg/l	0.01	0.01
A2.2.3.10	Phenols	mg/l	0.2	1.0
A2.2.3.11	Resins, tar, etc.	mg/l	2.0	5.0
A2.2.3.12	Volatile chlorinated hydrocarbons (CI)	mg/l	0.05	0.05

**THE TANZANIAN TEMPORARY STANDARDS OF QUALITY OF  
DOMESTIC WATER**

				International (WHO 1963)	Tanzania Standard Rural Water
Group	No.	Substance	Units	Allowable	
<b>T O X I C</b>	1	Lead Pb	mg/l	0.05	0.1
	2	Arsenic As	mg/l	0.05	0.05
	3	Selenium Se	mg/l	0.1	0.5
	4	Chromium (6+) Cr	mg/l	0.05	0.05
	5	Cyanide CN	mg/l	0.2	0.02
	6	Cadmium Cd	mg/l	0.01	0.05
	7	Barium Hg	mg/l	1.0	1.0
	8	Mercury Hg	mg/l	—	—
	9	Silver Ag	mg/l	—	—
<b>Affecting Human Health</b>	1	Fluoride F	mg/l	1.5	8.0
	2	Nitrate NO—3	mg/l	30.0	30/100*
<b>Organoleptic</b>	1	Colour	mg pt/l	50	50*
	2	Turbidity (SIO <sub>2</sub> )	mg/l	25	30*
	3	Taste	mg/l	—	Unobecti
	4	Odour	mg/l	—	—
<b>SUBSTANCES AFFECTING POTABILITY AND SUITABILITY OF WATER FOR GENERAL DOMESTIC USE</b>	<b>Salinity and Hardness</b>	5	PH—	mg/l	6.5-9.2
		6	Total Filtrable Residue	mg/l	1,500
		7	Total Hardness (Ca Co <sub>3</sub> )	mg/l	—
		8	Calcium Ca	mg/l	200
		9	Magnesium Mg	mg/l	150
		10	Magnesium + Sodium SO	mg/l	1,000
		11	Sulphate SO	mg/l	400
		12	Chloride Cl	mg/l	600
	<b>Less Toxic Metals</b>	13	Iron Fe	mg/l	1.0
		14	Manganese Mn	mg/l	0.5
		15	Copper Cu	mg/l	1.55
		16	Zinc Zn	mg/l	15
	<b>Organic Pollution of Natural Origin</b>	17	BOD(5 days, at 65°F)	mgO <sub>2</sub> /l	6
		18	PV (Oxygen Abs. KMNO)	mg/2	10
		19	Ammonium (NH+NH)	mg/l	0.5
		20	Total Nitrogen (Excluding NO <sub>3</sub> )	mg/l	0.1
	<b>Organic Pollution Introduced Artificially</b>	21	Surfactants (Alkyl Benzyl sulphonates)	mg/l	1.0
		22	Organic Matter (As carbon in chloriform extr ct)	mg/l	0.5
		23	Phenolic Substance (As Phenol)	mg/l	0.002

## TOXICOLOGY OF SOME ELVIRONM

## A4 1 HAZARDS OF POLLUTANTS

## A4 TABLE-CAUSES OF POISONING

Type	Example
A4.1 Foods	Water, Plants, Fungi,,Aquatic fauna
A4.2 Allergens	
A4.3 Micro-organisms	(a) Bacterea-small dose,*spreading rapidly e.g. <i>Dysentery bacilli</i> , (b) Bacteria-Large dose*, grows on in food e.g. <i>Salmonella</i> , Staphylococcus, Clostridiurn welchil and botulinum, Bacillus coreus, Vibrio parahaemolyticus (c) Viruses-Small dose* Inorganic e.g metals, synthetic e.g. pesticides, and
A4.4 Chemicals	Organi eg. alkalidis
A4.5 Parasites	Trichinella, Taenia
*Small dose	--few organisms only
*Large dose	-thousand to millions of organisms

## A41 1. Dangers of Micro- Organism

Bacteria are organisms of minute living cells, with characteristic varying shapes and visible only through a microscope. They are present everywhere. Most bacteria are harmless and even useful to man but a small proportion are harmful (see Tables 2&3) Given optimal conditions bacteria can divide into two every 10-30 minutes, and into million or billions within one day. Symptoms of bacterial illness are characteristic-diarrhea, abdominal pains, with or without vomiting.

## A4 Table2-BacterialIllnesses

Micro-organism	Effect	Incubation Period (hrs)	Duration of illness Death (days)
Bacillus cereus	Toxin in food	2-15	1-2
Clostridium-Welchi	Toxin in intestine	8-22	1/2-1
Clostridium botulinum	Toxin in food	24-72	Death in 1-2 or slow convalescence over 4-6 months
Escherichia coli	Infection	4-36	1-7
Salmonella	Infection	12-36	1-7
Staphylococcus	Toxin in food	2-6	
Streptococcus	Toxin in food	3-12,	1-2

Any pathogenic micro-organism including viruses living in or passing through the intestinal tract may be transmissible by untreated water which is polluted by raw or even inadequately treated sewage. In order to cause an illness the water must be grossly polluted. That is why sewage should be well treated before being discharged into or near a water body.

## A4 TABLE 3-RESERVOIRS AND TRANSMISSION OF HARMFUL BACTERIA

Man or Beast	
Nose/Skin Lesion	Bowels
Staphylococcus	Sewage/Water, Meats, Offals, Sick Cas carrie.
Hands	Salmonelae, Dysenter bacilli Cl. wetchii.
Food	Food
multiphyll in warm kitchen	Food poisoning.
Food poisoning.	

**A4 111-DANGERS OF ECONOMIC POISONS**

There are nowadays several economic poisons, including pesticides which often cause poisoning and death to man and beast by the pesticides themselves, their raw materials, their containers and effluents etc., being dumped into or near water bodies. The toxicity of a chemical is expressed by means of an LD value, which is a statistical estimate of the dosage necessary to kill 50 per cent of a large Population of the test species, under stated conditions (see Table 4).

The organic Phosphorus as well as carbonate poisons, act as more or less irreversible inhibitors of the enzyme cholinesterase, and thus allow the accumulation of acetylcholine. Organo-chlorine Pesticides and several rodenticides are also so deadly poisonous that both manufacturers, traders and users of pesticides should never be allowed to dump any pesticides or under contaminated containers or effluents into or near a water body.

**A4 TABLE 4-ACUTE, ORAL AND DERMAL LD<sub>50</sub> VALUES OF SOME ORGANO-PHOSPHORUS PESTICIDES FOR WHITE RATS**

pesticide	Oral LD <sub>50</sub> (mg/Kg.)		Dermal LD <sub>50</sub> (mg/Kg.)	
	Males	Females	Males	Females
Cabophenothien	30	40	54	27
Clorhion	880	890	4,500	54,100
DDCP	80	56	107	75
Delnav	43	23	235	63
Demeton	6.2	2.5	14	8.2
Diazinon	108	76	900	455
Dicaphthon	400	330	790	1,250
Dimethoatz	215		400	
Ethien	65	27	245	62
Fenthion	215	245	330	330
Guthion	13	11	120	220
Malathion	1,375	1,000	4,444	4,444
Methyl parathion	14	14	67	67
Methyl trithion	98	120	215	190
Parathion	13	3.6	21	6.8
Phorate	2.3	1.1	6.2	25
Phosdrin	6.1	3.7	4.7	4.2
phosphamidon	23.5	23.5	143	107
TEPP	1.05		2.4	
Trichlorofon	630	560	1,000	2,000

**A4 TABLE 5-ACUTE ORAL AND DERMAL DL<sub>50</sub> VALUES FOR ORGANO-CHLORINE PESTICIDES FOR WHITE RATS**

Pesticide	Oral LD (mg/Kg.)		Dermal LD <sub>50</sub> (mg/Kg.)	
	Males	Females	Males	Females
Aldrin	39	60	99	98
Chlordane	335	430	840	690
Chlorobenzilate	040	1,22	-	-
D D A	740	600	-	-
D D E	890	1,240	-	-
D D T	113	118	-	2,510
Dieldrin	46	46	90	60
Endrin	17.8	7.5		15
Heptachlor	100	162	195	250
Lindane (BHQ)	89	91	1,000	900
Thiodan	43	18	130	74
Toxaphene	90	80	1,015	780



A4. TABLE 6—TOXICITY OF OTHER PESTICIDES

Pesticide	Toxic Dose	Lethal Dose	Test Species	Other
<b>Rodenticides:</b>				
Phosphorus ...	15mg.	50mg.	man	
Sodium fluoroacetate ...	0.5mg/kg.	2mg/kg.	man	limit in air —0.05mg/m <sup>3</sup>
Thallium ...	4mg/kg	—	—	limit in air —0.1mg/m <sup>3</sup>
Warfarin ...	1.7mg/kg.	—	—	limit in air —0.1mg/m <sup>3</sup>
<b>Fungicides:</b>				
Ferban ...	LD <sub>50</sub> mg/kg	— 17,000	rats	—
Ziram ...	LD <sub>50</sub> mg/kg	— 1,400	—	—
Maneb ...	LD <sub>50</sub> mg/kg	— 7,500	—	—
Zineb ...	LD <sub>50</sub> mg/kg	— 5,200	—	—
Nabam ...	LD <sub>50</sub> mg/kg	— 395	—	—
Organo-Mercurys ...	—	30mg/kg	rats	limit in air —0.01mg/m <sup>3</sup>
Pentachlorophenols ...	2 percent Na salt	—	—	limit in air —0.5mg/m <sup>3</sup>
<b>Herbicides:</b>				
Arsenic compounds ...	50 mg.	128 mg.	man	limit in air —0.5mg/m <sup>3</sup>
Chlorophenoxys (2,4.D) ...	—	—	—	limit in air —10mg/m <sup>3</sup>
Dinitrophenols ...	LD <sub>50</sub> —10	LD <sub>50</sub> —30	—	limit in air —0.2mg/m <sup>3</sup>

A4—TABLE 7—TOXICITY OF SOME METALS AND OTHER TOXICANTS

Toxicant	Toxic Dose	Lethal Dose	Test Supp.	Other
Arsenic ...	—	2mg/kg	man	max. in food—3 ug/g; in water— 0.05 mg/l.
Asbestos Cadmium ...	5mppcf 14mg.	300mg/kg.	rabbit	max in food —0.2—30 ppm.
Carbon monoxide ...	—	4000 ppm.	man	
Formaldehyde ...	—	800 ppm.	rat	
Hydrogen-sulphide ...	—	700 ppm	man	
Lead ...	—	5mg/100g.	man (adult) (bone)	max in food —0.2—30 ppm; in water—0.1 ppm.
Mercury ...	8mg/m <sup>3</sup>	—	man	—
Nitrogen Oxide...	—	320 ppm.	mice	in 1 hr.
Ozone ...	2 ppm.	—	man	in 2 hrs.
Sulphur dioxide ...	—	50ppm.	rabbit	in 30 days.
Iron ...	30mg/m <sup>3</sup>	—	man	max. in food—250 ppm; in water— 1.0 ppm.

## A4. IV.—HAZARDS OF IONIZING RADIATIONS

All radiation exposure is harmful, and any unnecessary exposure to or dumping of wastes containing ionizing radiation should be avoided. Ionizing radiation can cause bodily harm (somatic hazards) to the individual who is exposed, or even genetic harm to his offsprings. The pollution of water bodies by radioactive material is an increasingly serious problem, particularly where reactors are in operation; or where radioisotopes are used e.g. treatment of malignancies by Radium or Cobalt in hospitals or in studies of sea pollution by effluents using radioisotope tracers. Nuclear weapon tests too pollute the atmosphere and some environments by their "fall-out". Use of radio-active materials is subject to some supervision, by agencies supplying it and other material and international bodies.

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