

Royal Decree No. 115/2001

Issuing law on Protection of sources of potable water from pollution

We, Qaboos bin Said Sultan of Oman

After perusal of the State's Basic Law issued by the Royal Decree No. 101/96 and

The Royal Decree No. 66/2001 on determination of the responsibilities of the Ministry of Regional Municipalities, Environment & Water Resources and approved by of its Organizational chart, and

The Law on Protection of the Environment and Pollution Control issued by the Royal Decree No. 114/2001 and

In accordance with the exigencies of the public interest.

HAVE DECREED THE FOLLOWING

Article 1

The provisions of the attached law shall have effect on protection of sources of potable water from pollution.

Article 2

The Minister of Regional Municipalities, Environment and Water Resources shall issue the regulations and decisions implementing this law. Until then the current regulations and decisions shall remain applicable in such a manner that shall not conflict with the provisions of this law.

Article 3

This decree shall be published in the Official Gazette and shall come into force from the date of its issue.

Issued on 28 Shaaban 1422 AH
Corresponding to: 14 November 2001

Qaboos bin Said
Sultan of Oman

Law on Protection of sources of potable water from pollution

Article 1

In application of this law, the following words and expressions shall have the meanings assigned to each of them unless the context otherwise requires.

The Ministry:	The Ministry of Regional Municipalities, Environment and Water Resources
The Minister:	The Minister of Regional Municipalities, Environment and Water Resources
Water Protection:	Maintaining safety and natural balance of components and characteristics of water and prevention of deterioration of its quality or reduction and control of water pollution
Sources of potable water:	Includes rainwater, surface and ground water, whether fresh saline or brackish, within the territory of the Sultanate
Discharge level:	Percentage of concentration of pollutants in the discharge according to the specified standards of pollution
Pollution standard:	The maximum discharge level which should not be exceeded during specific period
Water Pollution	Any change or alteration to the quality or chemical, physical or biological characteristics of water through direct or indirect introduction of any polluting element or material which may damage or endanger health of human beings or the environment or render water unsuitable for any of its intended uses.
Water Pollution Inspector:	Any employee appointed by the Minister in order to enforce the provisions of this law and its implementing regulations and resolutions.
Water Pollutants:	Liquid, solid, gaseous, radiation or any other material, which leads directly or indirectly to water pollution.
Discharge:	Direct or indirect dropping, leakage, emission, pumping, pouring discharging or dumping any water pollutants in soil or water.
Protection zones of sources potable water:	Zones specified by the Ministry to prevent water pollution.
Owner:	Any natural or juristic person, whether public or private, national or foreign, owning or leasing a source or area of work or being responsible for management or operation of the same.
The Source:	The operation of the activity, which may directly or indirectly lead to water pollution.

Area of work:	The site in which there is one source or more.
Waste water:	Liquid wastes discharged from any household, commercial, agricultural, industrial or laboratory uses or any other uses.
Treated waste water:	Waste water after being treated in a wastewater treatment plant.
Sludge:	Liquid, solid or semi-solid material resulting from treatment of wastewater.
Treated sludge:	Sludge which has been suitably treated in order to be re-used or disposed of in accordance with this law.
Wastewater Treatment Plant:	A single integrated unit or several different units for treatment of wastewater through physical, chemical or biological methods or any other method in an open or partially closed system.
Final point of discharge:	The point at which the pollutants are disposed of from the source or the area of work, and after which the owner cannot control the discharge resulting from his activities.
Septic Tank:	Any structures designed to treat household effluent by integrated settlement and anaerobic biological degradation.
Holding tanks:	Any structures designed to hold effluent without any leakage, seepage or overflow of the effluent into the surrounding environment.
Soakaway:	Any pits or any other subsurface system constructed for seep away of treated household effluent into the ground by permeability.
Wastes:	The various types of refuse resulting from industrial, mining, agricultural, artisanal, domestic, hospitals, public establishments or other operations which are disposed, recycled or neutralized in accordance with the provisions of the laws in force in the Sultanate.
Treatment of wastes:	Any natural, physical, chemical or biological process applied to wastes in order to alter their properties in a way that prevents or reduces their harmful effects or renders them more suitable for re-use in part or whole.
Sanitary landfill:	Any site licensed by the Ministry for disposal of non-hazardous solid waste.
The concerned authority:	The authority responsible for day-to-day work and management of collection and disposal of non-hazardous solid wastes.
Wastes recycling:	The selective controlled and beneficial separation of wastes components at or after the point of origin.

Non-household liquid wastes:	Liquid wastes out flowing out of any site used partially or wholly for industrial, agricultural, commercial, constructional or research purposes or any other purposes, save household wastewater.
Hazardous waste:	Waste that maintain its toxic properties or susceptibility to explosion or combustion or their ability to cause corrosion or having radiation activity of more than 100 Becquerels/gm and which by their nature, formation, quantities or otherwise pose risks to human health and life or to environment and water, whether by itself or as a result of contact with other waste.
Institutions:	Public or private buildings such as schools, colleges, universities and offices, save factories and hospitals.
Population Equivalent:	The estimated number of population discharging domestic effluent equivalent in its organic load to that of the effluent discharged by non-residential premises. For design purposes, the population equivalent shall be calculated by dividing the daily biochemical oxygen demand (in grams) by 60 or the daily volume (in litres) by 180 assuming that the population equivalent is the larger of the two figures so calculated.

Article 2

The Ministry shall assume the powers stated in this law and shall have the right to take all measures necessary to maintain safety of sources of drinking water and protect them from pollution.

All concerned parties are required to cooperate with the Ministry in implementing the provisions of this law.

Article 3

The Ministry shall, in coordination with concerned bodies, specify zones of protection of sources of potable water from pollution, and the activities prohibited to be practiced within such zones, which may pollute water and its sources.

The Ministry shall also, specify terms, specifications and requirements of maintaining safety of drinking water and its sources, protection from pollution and conformity to the standards. The Ministry shall monitor the implementation of the same.

Article 4

Owners of wells, water tankers and distribution networks, shall abide by hygienic and environmental conditions stipulated by the Ministry in coordination with the concerned bodies. Such water shall be in conformity with national standards for potable water.

It is not allowed to sell potable water or to construct networks pertaining thereto, unless the necessary environmental permits are obtained in accordance with the rules and principles specified by the Minister.

Article 5

The owner undertakes to apply the best technical and scientific methods approved by the Ministry to prevent, discharge of environmental pollutants or to treat them or reduce their effect on water from all sources (surface or underground water or rain water), subject to the provisions of article (3) of this law.

Article 6

The Ministry shall approve all private laboratories conducting tests of potable water and treated wastewater and shall set up the necessary rules. Test results issued by laboratories not approved by the Ministry shall not be accepted.

Article 7

Construction of septic tanks connected to holding tanks or soakaways shall be allowed to serve institutions and houses discharging domestic effluent with an equivalent population less than (150) according to appendix no. (2) attached to this law. Large institutions shall be served by sewage treatment plants according to appendix no. (1) attached to this law.

Article 8

Non-household effluent shall not be discharged in sewage networks unless it is treated in order to be in conformity with the specifications stated in appendix no. (3) attached to this law. No sewage water or any other water pollutants shall be discharged in rainwater drainage networks.

Article 9

Solid non-hazardous waste shall only be disposed of in sanitary landfills licensed by the Ministry. No solid non-hazardous waste shall be mixed with any category of hazardous waste at any stage.

Article 10

The concerned authority shall obtain from the Ministry, a licence for its sanitary landfill, which will be designed and operated in accordance with the guidelines stated in appendix (4) attached to this law. The concerned authority shall submit to the Ministry an environmental impact statement about sanitary landfills showing their effect on potable water sources and whether such landfills are used or not.

Article 11

No solid non-hazardous waste shall be disposed of without obtaining a permit from the Ministry. The owner shall submit to the Ministry a detailed statement of the hazardous waste generated by his activities including the method of disposal of such waste and the extent of its effect on sources of potable water.

Article 12

The Minister of Justice shall issue, upon request from the Minister, a decision granting judicial powers to water pollution inspectors and other persons designated by him.

Article 13

Without prejudice to the penalties stipulated by this law, every person who pollutes water shall be bound to remove such pollution at his own expense and pay compensation for the damage. The Ministry shall have the right, in the event of the failure of the violator to remove the violation within the specified period, to arrange for removal of the violation at the expense of the violator.

Article 14

After coordination with the Ministry of Finance, the Minister shall issue a decision fixing the fees payable against obtaining permits pertaining to protection of sources of potable water from pollution and the services rendered by the Ministry in accordance with the provisions of this law and its implementing regulations and decisions.

Article 15

The Minister, in cases where the violation causes serious danger or harmful effect on sources of potable water or public health, shall take the necessary action to avoid the damage or mitigate its effect and to prevent the violator from practicing his activity.

Article 16

No hazardous substances or waste or other water pollutants shall be discharged in *aflag* and their channels, surface watercourses, wadis or places of underground water recharge.

Article 17

The Minister shall issue a decision specifying procedures for obtaining licences provided for in this law, detailing term of such licences, procedures for renewal and appeal to the concerned bodies against decisions in this regard, in addition to determination of administrative penalties, and fines payable in cases of delay of renewal of licences prescribed by this law, provided that fine shall not exceed RO 1000/-.

Article 18

Without prejudice to any severer penalty provided for in any other law, whoever violates the provisions of articles (5 and 11) shall be punished with fine not less than RO 200/- and not more than RO 2000/-. The fine shall be increased at a rate of 10% per day as from the fourth day of the date of notifying the violator of the violation. The violator may be suspended from practicing his activity until the causes and effects of the violation are removed and the concerned bodies are notified of the same.

Article 19

Without prejudice to any severer penalty provided for in any other law, whoever violates the provisions of articles (8,9 and13) shall be punished with imprisonment from one month to three years and with fine not exceeding RO 2000/- or by either of the two penalties.

Article 20

Without prejudice to any severer penalty provided for in any other law, whoever prevents or cause to prevent the water pollution inspector from exercising the powers vested in him shall be punished with imprisonment for a period not exceeding two months and with fine not exceeding RO 1000/- or by either of the two penalties. The penalty shall be doubled if the same violation is repeated.

Appendix No. 1**Conditions for treatment, re-use and discharge of wastewater**

1. The discharge of any wastewater or sludge is prohibited without a discharge permit from the Ministry. The Ministry may amend the permit at any time after giving reasonable notice of any change to the owner.
2. Details of wastewater and sludge re-use practices shall be in accordance with tables (b) and (c) attached to this law.
3. Discharge of wastewater shall be in accordance with the drawings attached to the permit.
4. Discharge shall be in accordance with the standards set out in the attached table (a) or in accordance with any other standards contained in the permit.
5. The soil on which sludge may be applied shall be tested by the owner for the metals listed in table (b) and for PH value prior to any initial application. The sludge quality and re-use method shall be in accordance with the standards contained in table (b) or in accordance with any further limits included in the permit.
6. Any sludge having concentrations of metals greater than the limits prescribed in table (b) shall be disposed of in solid waste sanitary landfill or in any other site but only with the prior approval of the Ministry.
7. The owner undertakes to maintain wastewater treatment plant and its accessories and to provide equipment for sampling, measuring and recording quantity and rate of discharge of wastewater and determining its characteristics.
8. The owner shall take samples and readings at intervals to be specified in the permit or as required by the Ministry. All data shall be recorded and submitted at the end of each month to the Ministry in the prescribed form.
9. Wastewater or sludge shall not be discharged sacrificially except in exceptional circumstances where no form of wastewater re-use is possible.
10. No wastewater or sludge shall be transported from the site of its origin without obtaining a prior approval from the Ministry showing transportation method.
11. The Ministry shall have the right to inspect any wastewater treatment plant and to collect samples of wastewater, sludge or soil.
12. These provisions shall not apply to discharge from septic tanks, or to the discharge of wastewater into the marine environment or to the discharge of wastewater or sludge, which contain radioactive matter.

Table (A)**Wastewater standards (maximum allowed limits mg/l unless otherwise stated)**

Matter	Standard (see table c)	
	A-1	A-2
Biochemical oxygen demand (5 days @ 20° c)	15	20
Chemical oxygen demand	150	200
Suspended solid	15	30
Total dissolved solids	1500	2000
Electrical conductivity (micro s/cm)	2000	2700
Sodium absorption ratio *	10	10
PH (within range)	6-9	6-9
Aluminum (as Al)	5	5
Arsenic (as As)	0.100	0.100
Barium (as Ba)	1	2
Beryllium (as Be)	0.100	0.300
Cadmium (as Cd)	0.010	0.010
Chloride (as Cl)	650	650
Chromium (total as Cr)	0.050	0.050
Cobalt (as Co)	0.050	0.050
Copper (as Cu)	0.500	1
Cyanide (as Cn)	0.050	0.100
Fluoride (as F)	1	2
Iron (total as Fe)	1	5
Lead (as Pb)	0.100	0.200
Lithium (as Li)	0.070	0.070
Magnesium (as Mg)	150	150
Manganese (as Mn)	0.100	0.500
Mercury (as Hg)	0.001	0.001
Molybdenum (as Mo)	0.010	0.050
Nickel (as Ni)	0.100	0.100
Nitrogen: Ammonical (as N)	5	10
Nitrogen: Nitrate (as NO ₃)	50	50
Nitrogen: Organic (kjeldahl) (as or)	5	10
Oil and Grease (total extractable)	0.500	0.500
Phenols (total)	30	30
Phosphorus (total as P)	0.020	0.020
Selenium (as Se)	0.010	0.010
Silver as (Ag)	200	300
Sulphide (as S)	0.100	0.100
Vanadium (as V)	0.100	0.100
Zinc (as Zn)	5	5
Faecal Coliform Bacteria (per 100 ml)	200	1000
Viable Nematode Ova (per litre)	< 1	< 1

* the effect of sodium on soil absorption

Table (B)**Re-use of sludge in agriculture – conditions for application to land**

Metal	Maximum concentration (mg/kg of dry solids)	Maximum Application rate (kg/ha)*	Maximum permitted concentration in soil (mg/kg of dry solids)
Cadmium	20	0.150	3
Chromium	1000	10	400
Copper	1000	10	150
Lead	1000	15	150
Mercury	10	0.100	1
Molybdenum	20	0.100	3
Nickel	300	3	75
Selenium	50	0.150	5
Zinc	3000	15	300
After the spreading of sludge there must be a minimum period of three weeks before grazing or harvesting of forage crops.			
Sludge use is prohibited: - On soils whilst fruits or vegetable crops, other than fruit trees, are growing or being harvested. - For six months preceding the harvesting of fruit or vegetables, which grow in contact with the soil and which are normally eaten raw. - On soils with a PH < 7.0			

* Based on a ten-year average and a soil PH > 7.0

TABLE C**WASTEWATER RE-USE****AREAS OF APPLICATION OF STANDARDS A-1 AND A-2 (TABLE A)**

	See Table (A)	
	A-1	A-2
Crops	Vegetables and fruits likely to be eaten raw within two weeks of irrigation	Vegetables to be cooked or processed. Fruits if not irrigated within two weeks of cropping Fodder cereal and seed crops
Grass and ornamental areas	Public Parks Hotel Lawns Recreational areas Areas and lakes accessed by the public	Pastures And Areas with no public access
Aquifer re-charge	All aquifer recharge controlled and monitored by the Ministry	
Methods of irrigation	Spray or any other method of aerial irrigation not permitted in areas with public access unless with timing control.	
Any other re-use applications	Subject to the approval of the Ministry	

APPENDIX NO.2**Provisions and Conditions for Septic Tanks, Holding Tanks and Soakaways****Provisions for Septic Tanks**

1. Septic tanks shall be allowed in institutions and houses discharging domestic effluent having an equivalent population not greater than 150. Larger institutions shall be served by sewage treatment plant as per provisions Annex no.1.
2. Septic tanks shall only be installed with the approval and consent of the competent municipality, which shall only be given where public sewage system is not available.
3. Septic tank capacity shall be calculated according to the procedures set out in Appendix A2 and shall be designed according to the criteria given in Appendix B2.
4. Soakaways or Seep away systems shall be designed on the basis of permeability tests to be carried out by the owner at his expense and under the supervision of the competent municipality as described in Appendix 2-C of these regulations. The wastewater from septic tanks shall be discharged into holding tanks which shall be installed according to Appendix 2D. If the ground nature, hydrological conditions and population density so allow, the wastewater from septic tanks will be discharged into permeable soakaways or into a permeable underground construction approved by the concerned authorities.
5. Septic tanks shall be constructed by using appropriate materials and in a manner that prevents seepage and keeps them watertight at all times.
6. Septic tanks shall always be maintained so as to remain in a fully functional condition.
7. Sludge within septic tanks shall periodically be removed when necessary. Disposal shall be in a manner approved by the competent municipality.
8. Septic tanks and soakaways shall comply with the following conditions –
 - Always be constructed on land under the legal control of the owner of the premises or on a land to be designated by the competent municipality in coordination with other concerned authority.
 - Be located at least 100 meters away from public water sources, wells and *aflaj* or at least 30 meters away from private wells. The competent municipality, in coordination and consultation with the concerned authorities, may change these distances.
 - Be located at least 3 meters away from any wall of an occupied building, water pipes and matured trees. The competent municipality in coordination with the concerned authorities may determine the distance which shall not be less than 2 metres.
 - Their top levels shall not be higher than the levels of the nearest wellheads so that the pollutants cannot reach such wells. They shall be located in an appropriate position to facilitate future connection when a public sewer becomes available.

- Be located in a position where they can be served by wastewater tanker vehicles and at a distance not more than 20 metres from the nearest tanker access point.
- Be located at least 30 metres from excavation and filling sites.

Provisions for Holding Tanks:

1. Holding tanks shall only be installed with the approval of the competent municipality and shall be designed according to the criteria given in Appendix D-2.
2. The effluent from Holding tanks shall be transported by wastewater tankers to a place approved by the competent municipality at such intervals as will ensure there is no overflow of waste from the Holding tanks at any time.
3. Holding tanks shall be constructed by using appropriate materials and in a manner that prevents leakage and keeps them watertight. They shall comply with the following conditions –
 - Always be constructed on land under the legal control of the owner of the premises or on a land to be designated by the competent municipality in coordination with other concerned authorities.
 - Be located at least 15 meters away from any water source and in such a position that the wastewater flow cannot reach such source.
 - Be located at least 1.5 meters away from any wall of an occupied building.
 - Their top levels shall not be higher than the levels of the nearest wellheads, so that the pollutants cannot reach such wells. They shall be located in an appropriate position to facilitate future connection when a public sewer becomes available.
 - Be located in a position where they can be served by wastewater tankers and at a distance of not more than 20 meters from the nearest tanker access point.

APPENDIX A-2

Calculation of Septic Tank Capacity:

The capacity of the Septic tank is calculated on the basis of the volume of the wastewater discharge into it in a normal operation mode.

In case of Houses

The tank capacity is calculated on the basis of 240 litres per person provided that the capacity shall not be less than 2000 litres.

In case of Institutions

The tank capacity is calculated on the same basis applied to houses and the number of persons at each institution shall be considered according to the population equivalent.

APPENDIX B-2**Design and measurements of Septic Tanks:**

1. Septic tank capacity shall be calculated according to the procedures set out in Appendix A-2.
2. The Septic tank will normally be rectangular where the length of the tank shall not be less than 3 times and not more than 4 times the width and the depth of the tank shall not be less than 1.2 metres for tanks serving 10 persons or less, and not less than 1.5 metres serving more than 10 persons. In special circumstances alternative shapes may be accepted at the discretion of the competent municipality.
3. The Septic tank shall have two compartments. The compartment into which the wastewater feeds shall have twice the capacity of that from which the tank effluent discharges. Alternative designs can be accepted at the discretion of the competent municipality.
4. The two compartments shall be interconnected by means of circular holes of 150 mm diameter or by a square or rectangular slot or slots of 100 mm deep, the top of which shall be 300mm below the water level. The horizontal distance between the pipes or slots shall be 300 mm from the slots center.
5. There shall be 2 tanks operating in parallel when serving population equivalent that exceeds 100 persons. Each tank shall be capable of operating when isolated from the other. Each tank shall have half of the total capacity calculated according to Appendix A-2.
6. The tank floor shall be flat but for large tanks a floor slope of 1:4 is preferred.
7. The inlet to the tank shall consist of a single 'T' shaped dip pipe for tanks not wider than 1.2 meters. For tanks wider than 1.2 meters there shall be two 'T' shaped dip pipes each set at a distance from the side nearest to it equivalent to one quarter of the tank width.
8. The inlet dip pipe shall have a diameter not less than the diameter of the incoming sewer. The top limb shall rise at least 150 mm above the water level and the bottom limb shall extend 450 mm below the water level.
9. The outlet of a tank less than 1.2 metre wide shall consist of a single 'T' shaped dip pipe of 100mm internal diameter set at a level of 25mm below the tank inlet level.
10. For tanks wider than 1.2 metres, a full width outlet weir shall be provided and shall be fitted with a full width steel plate (weir plate set at a distance of 200mm in front of the weir) to hold scum within the tank. The apex of the deflector shall be 150 mm above the water level and the bottom 600mm below the water level. The weir plate shall be painted with anti rust paint.
11. In tanks fitted with weir, a full width triangular deflectors of 200mm thick shall be fitted in the internal wall to hold solid waste and shall be 150mm below the bottom of the weir.
12. Drawings of typical Septic tanks are given in Appendix E and F.

13. Septic tanks shall be of reinforced concrete or any other material strong enough to withstand heavy loads such as cars and trucks.
14. Tanks shall be provided with openings of not less than 600mm in dimension to permit easy access to tank inlets, connecting holes, sludge and scum boards and should be provided with covers of heavy duty type in order to withstand heavy traffic and prevent escape of air and they should be approved by the competent municipality.
15. Septic tanks shall be provided with ventilation pipes 100 mm in diameter, to a height not less than 1metre above the roof of the adjoining buildings or above the eaves of buildings having pitched roofs according to the following;
 - No ventilation pipe shall be fixed in a manner that allows escape of foul air into the building.
 - The open end of every ventilation pipe shall be provided with suitable wire netting to prevent the access of extraneous matter whilst not impeding airflow.
 - Ventilation pipes shall be straight except where this is not possible provided that the competent municipality shall approve change of shape.
 - Ventilation pipes shall not be used for drainage of rain water.

APPENDIX C-2

Procedure for percolation test and soakaway design

1. Percolation test:

In order to determine the area of land required, the following tests should be carried out:

Level the ground and then excavate a hole 300mm square and 600 mm deep. Fill it with water and allow it to seep away. Refill the hole with water to a depth of at least 300mm and observe the time in minutes for this to seep away completely. Divide the time in minutes by the depth in mm of water placed in the holes, and the result is the average time taken for the water to drop 1mm. The effective absorption area can then be calculated from the following table.

Absorption area required for soakaways

Time for test water to fall 25mm (in minutes)	Actual absorption/seep away area required m ² /person	
	Houses	Institutions
2 or less	1.2	0.5
3	1.8	0.6
4.	2.4	0.7
5.	2.8	0.8
10	3.7	0.9
15	4.6	1.2
30	6.3	1.7
60	8.4	2.2

The above figures give the actual area required for absorption, calculated on the basis of the area of the walls and base of the pit.

Remarks:

Percolation test shall be conducted three times at least and the average shall be taken as a basis.

Soakaway shall be either filled with brickbats or large pieces of special materials or may be empty and lined with brickbats or prepared concrete rings (porous or perforated) allowing percolation of wastewater into the surrounding land. The pit should be covered by a slab with a manhole. Appendix (g) shows a drawing of a typical soakaway.

Appendix (D-2)

Design and Measurements of Holding Tanks

1. The holding tank capacity shall be calculated on the basis of storage for a period not less than three days at a rate of 240 litres for each one of the occupants of the building, provided that the tank capacity shall not be less than 3000 litres.
2. The holding tank shall normally be rectangular, but other shapes may be used at the discretion of the competent municipality.
3. The depth of the holding tank shall be between 1.5 and 2 meters.
4. When the number of people exceeds 100 people, two separate holding tanks operating in parallel, shall be used. Each tank shall be controllable in isolation from the other. The capacity of each tank shall be half the capacity calculated according to clause (1) of this appendix.
5. The tank floor shall have a slope of 1:4 towards the suction side and a sump 600x600mm and 300mm depth from the tank floor beneath the opening provided for the suction pipe to facilitate complete emptying of the tank.
6. Tank openings shall be of reinforced concrete or any other materials as stated in clause (10) of appendix B-2. They shall be strong enough to withstand heavy load such as cars and trucks.
7. Holding tanks shall be provided with manholes of dimensions not less than 600mm. Manhole covers shall be heavy-duty type in order to withstand heavy traffic and prevent escape of air and they should be approved by the competent municipality.
8. Ventilation: Holding tanks shall be provided with ventilation pipes as per the conditions stated in clause (5) of Appendix (B). Appendix C shows a drawing of a typical holding tank.

Appendix (3)

Standards for discharge of non-household liquid waste into sewage system

Components	Standards
HP	6-10
Colour	Raises no objection
Biochemical Oxygen Demand (5 days)	Not more than (1000) mg/L
Chemical Oxygen Demand	Not more than (1500) mg/L
Temperature	Not more than 43C ⁰
Suspended solid	Not more than (1000) mg/L
Total dissolved solids	Not more than (3000) mg/L
Grease and oil	Not more than (30) mg/L
Sulphide (expressed in tons)	Not more than (3) mg/L
Sulphate (expressed in tons)	Not more than (500) mg/L
Phenols	Not more than (5) mg/L
Cyanide	Not more than (1) mg/L
Detergents	Not more than (30) mg/L
Alkalinity	Not more than (2000) mg/L
Toxic metals	Not more than (10) mg/L
Aluminum (expressed in tons of Aluminum)	Not more than (10) mg/L
Arsenic (expressed in Arsenic)	Not more than (1) mg/L
Barium (expressed in Barium)	Not more than (10) mg/L
Beryllium (expressed in Beryllium)	Not more than (5) mg/L
Cadmium (expressed in cadmium)	Not more than (2) mg/L
Chromium (total in tons of chromium)	Not more than (2) mg/L
Copper (expressed in tons of copper)	Not more than (1) mg/L
Iron (expressed in tons of iron)	Not more than (5) mg/L
Lead (expressed in tons of lead)	Not more than (2) mg/L
Mercury (expressed in tons of mercury)	Not more than (0.1) mg/L
Nickel (expressed in tons of nickel)	Not more than (2) mg/L
Silver (expressed in tons of silver)	Not more than (0.1) mg/L
Zinc (expressed in tons of zinc)	Not more than (2) mg/L
Calcium Carbide	Not seen
Radioactive substances	Not seen
Yeast, sugar, raw tar, crude oil	Not seen
Hydrogen sulphide and polysulphides	Not seen
Petroleum spirit, flammable solvents or volatile noxious solvents gases or solids.	Not seen
Unpolluted water (including condensation and cooling water and water drained from roof's of buildings	Not seen
Insecticides, herbicides, pesticides, fungicides	Imperceptible
Any substance (whether by itself or with any other substance allowed to be discharged into sewage system)	Imperceptible
Any material that may render wastewater harmful or makes formal treatment of such waste difficult.	Imperceptible

Appendix (4)
Guidelines for location, design and operation
of sanitary landfills for non-hazardous solid waste

1. Introduction:

These guidelines are advisory. Although they are not binding, they should not be ignored. Moreover they do not constitute a design pamphlet nor they set up specified rules for the procedures to be followed for optimum operation of waste sanitary landfills, as all details relating to design and operation shall be prepared by competent specialists.

These guidelines apply to all sanitary landfills for disposal of existing or future non-hazardous solid waste as specified by the Regulations for Management of non-hazardous solid waste issued by the Ministerial Decision No.17/93. These guidelines may be amended to suit small rural sites.

2. Risks of sanitary landfills:

It is well known that waste sanitary landfills involve a lot of environmental risks during and after their operative lifetime. Such risks continue until landfills reach a state of environmental stability. These risks include:-

- 2-1 Diffusion of disposed of solid waste to cover large space by wind.
- 2-2 Accumulation and re-production of insects and rodents and spread of the same outside the waste site.
- 2-3 Congregation of animals and birds, which may lead to spread of diseases.
- 2-4 Other risks arising out of spread of disease either directly from the landfill or by reason of solids dispersed by wind or through people who may catch diseases at the site of the landfill.
- 2-5 Fire and/or explosions inside or outside the landfill by reason of gases generated by buried materials and the possibility of seepage of pollutants into the earth. Such seepage may extend to large distances and may continue for years after close of the landfill.
- 2-6 Air pollution as a result of odor emissions from buried materials or by smoke; fumes and smells emitted by sudden combustion.
- 2-7 Pollution of surface and underground water.

There are other less important risks such as:

- 2-8 Solid waste dropping out of trucks transporting wastes to sanitary landfills.
- 2-9 Noise generated by trucks moving on the road or activities practiced at the site of the landfill.

Abidance by the guidelines shall reduce the above mentioned health and environmental risks and the dangers arising out of other less important risks.

3- Standards of the site and its design.

Article (14) of the Regulations for Management of solid non-hazardous waste stipulates that the competent authority or the body responsible for day to day work and management of collection and disposal of solid non-hazardous waste, shall prepare an environmental impact statement for each sanitary landfill or dumping site as designated by the Ministry. The environmental impact statement shall be produced taking into account the “Guidelines for location, design and operation of sanitary landfills for solid non-hazardous waste” as mentioned in the permit

Below are the standards and guidelines to be observed upon site selection.

- 3-1 The site shall be at a reasonable distance from a network of good roads in order to reduce transportation costs and to avoid expenditure in construction of subways. Nuisance to the public by traffic in highways should be avoided.
- 3-2 The site shall be far away from residential areas and other sensitive areas. The site should not be less than two km from residential areas and one km from other institutions.
- 3-3 The site shall be far away from air navigation lines in order to avoid air incidents arising out of congregation of birds in an around the site. The distance preferably be not less than seven km and the approval of the Ministry of Transport and Housing (DG Civil Aviation & Meteorology) should be obtained in this regard.
- 3-4 The site shall be away from wadi courses and flood plains. The approval of water resources should be obtained in this regard.
- 3-5 The site shall be hygienically suitable. The approval of the Ministry of Health should be obtained.
- 3-6 There shall be near the site sufficient quantities of non-organic soil. (Clay, sandy or alluvial soil) to be used for filling up.
- 3-7 A comprehensive survey shall be conducted at the site including soil survey as part of a detailed survey covering technical, topographical, hydrological and geological aspects.
- 3-8 The site should be, as far as possible, on a non-porous or impermeable rocky layer. If this is not possible the site should be lined by impermeable material such as clay soil or plastic or both to prevent seepage of pollutants from the site to the ground water.
- 3-9 Construction of a drainage system to discharge liquids flowing from the site. The system should end with an evaporation bond lined by impermeable material.
- 3-10 Installation of water pollution monitoring network and monitoring programme. Collection of samples and site visits should not be less than twice a year in order to detect the efficiency of the precautionary measures at the site.
- 3-11 Installation of ventilation system including wells and conduits to control release and disposal of gases in a safe way in accordance with experts recommendations and nature of each site in order to avoid generation of toxic or explosive gases and to make use of some of these gases if required.
- 3-12 The site should be outside the area of direct recharge of underground water.

- 3-13 Preparation of a site plan detailing all development activities, premises if any, geographical features and natural resources including water resources such as wells and *afalaj*. The plan shall cover a circle of a radius of 10km around the site.

4 Equipment necessary at the sanitary landfill:

The required equipments differ according to the quantity of solid waste to be disposed of.

Equipment to be available at the site.

- 4-1 Compactor and earthmover to be available on daily basis.
- 4-2 Bulldozer to remove and distribute the soil required for the daily filling up operation, if this cannot be done by the compactor.
- 4-3 Drilling equipment and tippers for transportation and dispersion of the soil required for filling up operation.
- 4-5 Simple fire fighting equipment

5. General site plan

The site of sanitary landfill shall include waste receipt area and waste disposal area. The receipt area shall be at the entrance of the landfill. Movement to all directions shall be branched from this point. Disposal area is divided into various stages. One stage shall be operative at a time. The design of each stage shall allow accommodation of waste for a period ranging between 3 to 4 years.

In order to estimate the site capacity it can be assumed that compacted waste, after a certain degree of stability, may occupy a space reaching 1.2 m³/ton while incompact waste may occupy a space of 2 m³/ton.

Moreover, materials used for daily and final, filling up operations must be included in capacity estimation. Ironware and old vehicles shall be stored at a specific area in order to be disposed of in due time.

6. Operation

- 6-1 No waste other than solid non-hazardous waste shall be disposed of in sanitary landfills.
- 6-2 Sludge originating from treated wastewater shall be dried in order to contain at least 20% of dry solid, provided that sludge shall not exceed 15% of the total volume of deposited solids. No sludge shall be accepted or disposed of in the site without obtaining the approval of this ministry.
- 6-3 No carcass or slaughterhouse waste shall be disposed of at the site without obtaining the approval of this Ministry.
- 6-4 No liquid waste or hazardous waste including hospital waste shall be disposed of in sanitary landfills.
- 6-5 The site shall be fenced and the entrance shall be closed in order to avoid random waste dumping and dispersion by wind and to keep animals out of the site.

- 6-6 The entrance should be guarded during work hours and closed by the end of work hours.
- 6-7 All waste received at the site shall be monitored and recorded by type quantity and source.
- 6-8 Site staff shall be given necessary instructions about management of the site and type of solid waste, which may be received at the site.
- 6-9 Large refuse heaps should be covered by nets or temporary fences to avoid dispersion of refuse.
- 6-10 Incoming solid waste shall be discharged at front edge of the dump.
- 6-11 Discharged solid waste shall be layered and compacted.
- 6-12 Spaces between waste particles allow penetration of oxygen, which mixes with gases generated by waste decomposition, a process that may lead to internal combustion by heat. Therefore the compactor shall be moved over the waste layers several times so as to crush and compress waste particles.
- 6-13 Depth of each waste layer shall be in the range of 0.5-2.0 metres before compaction. Compacted waste layers shall be covered by a layer of suitable filling material of a thickness of 0.25 meters.
- 6-14 It is not allowed to leave solid waste uncovered after the end of work hours.
- 6-15 Sanitary landfill shall always be kept clean and tidy. Sweeping and scavenging are not allowed in order to avoid health hazards and interruption of operation process. Waste incineration and setting on fire is not allowed at the site.
- 6-16 After final closing of the sanitary landfill, measures necessary to maintain environmental integrity of the site shall immediately be taken in coordination with this Ministry.