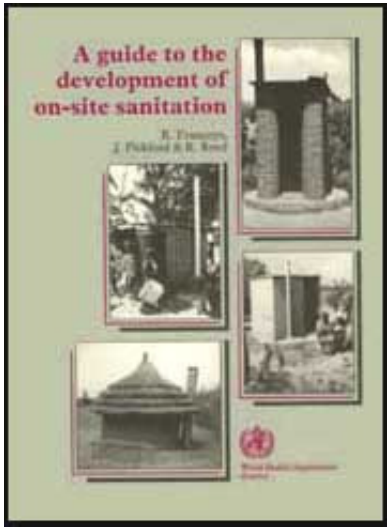


- **Guide to the Development of On-site Sanitation (WHO, 1992, 245 p.)**
  - ***(introduction...)***
  - **Acknowledgments**
  - **Preface**
  - **Part I - Foundations of sanitary practice**
  - **Part II - Detailed design, construction, operation and maintenance**
  - **Part III - Planning and development of on-site sanitation projects**
  - **References**
  - **Selected further reading**
  - **Glossary of terms used in this book**
  - **ANNEX 1 - Reuse of excrete**
  - **ANNEX 2 - Sullage**
  - **ANNEX 3 - Reviewers**

References

ALUKO T. M. (1977) Soil percolation tests in the Lagos area. Journal of the Institution of Public Health Engineers, 5 (6): 152-155.

ASSOCIACAO BRASILEIRA DE NORMAS TECNICAS (1982) Construcao e instalcao

de fossas septicas e disposicao dos efluentes finais. Rio de Janeiro (NBR 7229).

BALASEGARAM, M. & BURKITT, D. P. (1976) Stool characteristics and western diseases. Lancet, 1: 152.

BASKARAN, T. R. (1962) A decade of research in environmental sanitation. New Delhi, Indian Council on Medical Research (Special Report Series No. 40)

BERG, A. (1973) The nutrition factor and its role in national development. Washington, DC, Brookings Institution.

BLUM, D. & FEACHEM, R. G. (1983) Measuring the impact of water supply and sanitation investments on diarrhoeal diseases: problems of methodology. International journal of epidemiology, 12 (3):357 365.

BOESCH A. & SHERTENLEIB, R. (1985) Emptying on-site excreta disposal systems: field tests with mechanized equipment in Gaborone (Botswana). Dubendorf, Switzerland, International Reference Centre for Waste Disposal (IRCWD Report No. 03185).

BRADLEY R. M. (1983) The choice between septic tanks and sewers in tropical developing countries. 7 he public health engineer, 11 (1): 20 28.

BRANDBERG, B. (1985) Why should a latrine look like a house? Waterlines, 3:24 26.

BRISCOE, J. (1984) Water supply and health in developing countries: selected primary health care revisited. American journal of public health, 74 (9): 1009 1013.

BRISCOE, J. El AI.. (1986) Evaluating health impact: water supply, sanitation, and hygiene education. Ottawa, International Development Research Centre.

BRITISH STANDARDS INSTITUTION (1972) Code of practice: small sewage treatment works. London (CP302).

FRANCEYS, R. (1987) Sanitation for low income housing, Juba, Sudan. In: African Water Technology Conference, Nairobi. London, World Water, pp. 141 149.

GEYER, J. C. ET Al.. (1968) Water and wastewater engineering, Vol. 2. New York, Wiley.

GEENNIE, C. (1983) Village water supply in the Decade: lessons from field experience. Chichester, Wiley.

GROVER, B. (1983) Water supply and sanitation project preparation handbook: Vol. 1: Guidelines. Washington, DC, World Bank (World Bank Technical Paper No. 12).

Hutton, L. G. ET Al.. (1976) A report on nitrate contamination of ground waters in some populated areas of Botswana. Lobatse, Botswana, Geological survey (unpublished report BGSD/8/76).

INTERNATIONAE DEVELOPMENT RESEARCH! CENTRE (1983) The latrine project, Mozambique. Ottawa (IDRC-MR58e).

JEEYASEELAN, S. ET AL. (1987) Low-cost rural sanitation - problems and solutions. Bangkok, Environmental Sanitation Information Center.

KALBERMATTEN, J. M. ET Al.. (1980) Appropriate technology for waler supply and sanitation: a planner's guide. Washington, DC, World Bank.

KALBERMATTEN, E N, J. M. ET Al.. (1982) Appropriate sanitation alternatives: a technical and economic appraisal. Baltimore, Johns Hopkins University Press.

KARLIN B. & ISELEY, R. B. (1984) Developing and using audio-visual materials in water supply and sanitation programs. Arlington, Water and Sanitation for Health Project (WASH Technical Paper No. 30).

KHANNA, P. N. (1985) Indian practical civil engineer's handbook. New Delhi, Engineers' Publishers.

KIBBEY, H. J. E l AI.. (1978) Use of faecal streptococci as indicators of pollution of soil. Applied and environmental microbiology, 35 (4): 711 717.

LAAK, R. (1980) Multichamber septic tanks. Journal of the environmental engineering division, Proceedings of the American Society of Civil Engineers, 106:539 546.
LAAK, R. ET AI.. (1974) Rational basis for septic tank system design. Ground waler, 12:348 352.

LAYER, S. (1986) Communications for low-cost sanitation in Zimbabwe. Waterlines, 4 (4):26 27.

PACEY, A., ed. (1978) Sanitation in developing countries. Chichester, Wiley.

PACEY, A. (1980) Rural sanitation: planning and appraisal. London, IT

Publications.

PARRY, J. (1985) Fibre concrete roofing. West Midlands, Intermediate Technology Workshops.

PHADKE, N. S. E I AI.. (undated) Study of a septic tank at Borivli, Bombay. Bombay, CPHERI Bombay Zonal Laboratory.

PICKFORD, J. (1980) The design of septic tanks and aqua-privies. Garston, Building Research Establishment (Overseas Building Note No. 187).

PRADT, L. A. (1971) Some recent developments in night-soil treatment. Water research, 5:507 521.

REYNOLDS C. E. & STEEDMAN, J. C. (1974) Reinforced concrete designers' handbook. London, Viewpoint.

ROY, A. K. ET Al.. (1984) Manual on the design, construction and maintenance of low-cost pourflush waterseal latrines in India. Washington, DC, World Bank (TAG Technical Note No. 10).

RYAN, R. A. & MARA, D. D. (1983) Ventilated improved pit latrines: vent pipe design guide/ines. Washington, DC, World Bank (TAG Technical Note No. 6).

RYBCZYNSKY, W. (1981) Double vault composting toilets: a state of the art review. Bangkok, Environmental Sanitation Information Center (ENSIC Review No. 6).

SANCHES, W. R. & WAGNER, E. G. (1954) Experience with excrete disposal programmes in rural areas of Brazil. Bulletin of the World Health Organization, 10:229 249.

SCOTT, J. C. (1952) Health and agriculture in China: a fundamental approach to some of the problems of world hunger. London, Faber & Faber.

SHAW, V. A. (1962) A system for the treatment of nightsoil and conserving tank effluent in stabilization ponds. In: Proceedings of the twentieth Annual Health Congress. East London, South Africa, Institute of Public Health.

SIMPSON-HEBERT, M. (1984) Water and sanitation: cultural considerations. In: Bourne, P. G., ea., Waler and sanitation: economic and sociological perspectives. Orlando, Academic Press.

SRIDHAR, M. K. C. ET A.. (1981) Health hazards and pollution from open drains in a Nigerian city. Ambio, 10:29-33.

STUMM, W. & MORGAN, J. J. (1981) Aquatic chemistry. New York, John Wiley & Sons. WHO (1954) Expert on Environmental Sanitation: third report. Geneva, World Health Organization (WHO Technical Report Series, No. 77).

WHO (1983) Minimum evaluation procedure (MEP) for water supply and sanitation projects. Unpublished document ETS/83.1."

WHO) (1984) Guidelines for drinking water quality, Vol. 1 3. Geneva, World health Organization.

WHO 19851 The control of schistosomiasis: report of a WHO Expert Committee. C,eneva, World Health Organization (WHO Technical Report Series, No. 72X).

WHO (1986) The International Drinking Water Supply and Sanitation Decade Directory: Review of National Progress (as at December 1983) (WHO CWS Series of Cooperative Action for the Decade).a

WHO (1987a) Technology for water supply and sanitation in developing countries: report of a WHO Study Group. Geneva, World Health Organization (WHO Technical Report Series, No. 742).

WHO (1987b) Prevention and control of intenstinal parasitic infectios: report of a WHO Expert Committee. Geneva, World Health Organization (WHO Technical Report Series, No. 749).

WHO (1987c) Review of mid-Decade progress (l)ecetwber 1985). Unpublished document CWS/87.5."

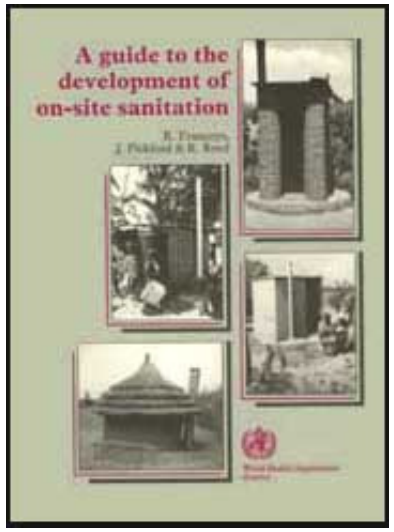
WHO (1989) Health guidelines for the use of wastwater in agriculture and aquaculture report of a WHO Scientific Group (WHO Technical Report Series, No. 778).

WHO (1990) The International Drinking Water Supply and Sanitation Decade. Review of detade progress (as at December 1988). Unpublished document WHO/EHE/CWS/90.16.a

YEAGER, J. G. & O. BRIEN, R. 1. (1979) Enterovirus inactivation in soil. Applied and environmental microbiology, 38: 694 701.

DI ZOYSA, I. ET AL. (1984) Perceptions of childhood diarrhoea and its treatment in rural Zimbabwe. Social science and medicine, 19:727 734.

Home"" """"> ar.cn.de.en.es.fr.id.it.ph.po.ru.sw



- **Guide to the Development of On-site Sanitation (WHO, 1992, 245 p.)**
  - ***(introduction...)***
  - **Acknowledgments**
  - **Preface**
  - **Part I - Foundations of sanitary practice**
  - **Part II - Detailed design, construction, operation and maintenance**
  - **Part III - Planning and development of on-site sanitation projects**
  - **References**
  - **Selected further reading**
  - **Glossary of terms used in this book**
  - **ANNEX 1 - Reuse of excrete**
  - **ANNEX 2 - Sullage**
  - **ANNEX 3 - Reviewers**

Selected further reading

ASHWORTH, J. (1982) Urban sullage in developing countries. Waterlines,1 (2):14 16.1

BOURNE, P. G., ed. (1984) Water and sanitation: economic and sociological perspectives. Orlando, Academic Press.

CROSS, P. (1985) Existing practices and beliefs in the use of human excrete. IRCWD news, 23:2 4.

DECK, F. L. O. (1986) Community water supply and sanitation in developing countries, 1970 1990: an evaluation of the levels and trends of services. World health statistics quarterly, 39 (1):2-39.

EDWARDS, P. (1985) Aquaculture: a component of low cost sanitation technology. Washington, DC, World Bank (World Bank Technical Paper No. 36).

ELMENDORF, M. & BUCKLES, P. (1980) Socio-cultural aspects of ware? supply and excreta disposal. Washington, DC, World Bank.

GOLLADAY, F. L. (1983)Appropriatetechnologyforwatersupplyandsaniturion: meeting the needs of the poor for water supply and sanitation. Washington, DC, World Bank.

GOTAAS, H. B. (1956) Composting: sanitary disposal and reclamation of organic wastes. Geneva, World Health Organization (WHO Monograph Series No. 31).

GUNNERSON, C. G. & STUCKEY, D. C. (1986) Anaerobic digestion: principles and practice of biogas systems. Washington, DC, World Bank (World Bank Technical

Paper No. 49).

HEALEY, K. A. & LAAK, R. (1974) Site evaluation and design of seepage fields. Journal of the environmental engineering division' Proceedings of the American Society of Civil Engineers, 100: 1133 1146.

HINDHAUGH, G. M. A. (1973) Night soil treatment. Consulting engineer, 37 (9):47, 49.

INTERNATIONAL DEVELOPMENT RESEARCH CENTRE (1981) Sanitation in developing countries. Proceedings of a workshop on training held in Lobatse, Botswana, 14-20 August 1980. Ottawa (IDRC-168e).

INDIAN STANDARDS INSTITUTION (1969) Code of practice for design a d construction of septic tanks. New Delhi (IS 2470, part 1 and part 2).

US PUBLIC HEALTH SERVTCE (1933) The sanitary privy. Washington, DC (revised type No. IV of Public health report (Wash), Suppl. 108).

VINCENT, L. J. ET AL. (1961) A system of sanitation for low cost high density housing. In: Proceedings of a symposium on hygiene and sanitation in relation to housing, Niamey, pp. 135 172 (Publication No. 84, CETA/WHO, Niger).

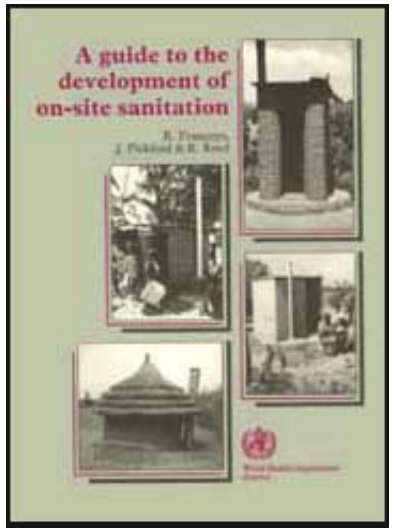
WHO (1980) Epidemiology and control of schistosomiasis: report of a WHO Expert Committee. Geneva, World Health Organization (WHO Technical Report Series, No. 643).

WHO REGIONAL OFFICE FOR SOUTH-EAST ASIA (1985) Achieving success in

community water supply and sanitation projects. New Delhi (Regional Health Paper No. 9).

VAN WIJK-SIJBESMAN, C. (1985) Participation of women in water supply and sanitation: roles and realities. The Hague, International Reference Centre for Community Water Supply and Sanitation (IRC Technical Paper No. 22).

Home"" """"> ar.cn.de.en.es.fr.id.it.ph.po.ru.sw



- **Guide to the Development of On-site Sanitation (WHO, 1992, 245 p.)**
  - ***(introduction...)***
  - **Acknowledgments**
  - **Preface**
  - **Part I - Foundations of sanitary practice**
  - **Part II - Detailed design, construction, operation and maintenance**
  - **Part III - Planning and development of on-site sanitation projects**
  - **References**
  - **Selected further reading**
  - **Glossary of terms used in this book**
  - **ANNEX 1 - Reuse of excrete**

ANNEX 2 - Sullage
ANNEX 3 - Reviewers

Glossary of terms used in this book

adobe • Bricks dried slowly in the sun, but not in direct sunlight, made of clay that has been thoroughly mixed with water, often with straw, grass or other natural fibres added.

adsorption • The adhesion, in a thin layer, of liquids to the surface of solids with which they are in contact.

aerobic • Living or taking place in the presence of air or free oxygen.

agency • Government department, or bilateral, international, nongovernmental or similar organization taking primary responsibility for a project.

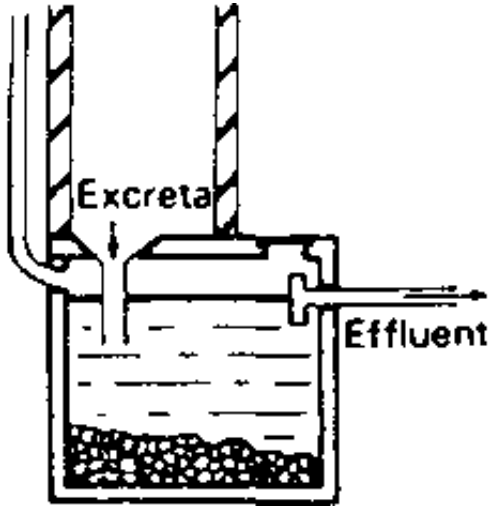
aggregate • Gravel, broken rock or sand that is mixed with cement to make concrete; coarse aggregate particles are normally 6 18 mm in size; sand is known as fine aggregate.

anaerobic • Living or taking place in the absence of air or free oxygen.

aqua-privy • Latrine in which excrete fall directly through a submerged pipe into a watertight settling chamber below the floor, and from which effluent overflows to a soakaway or drain, biochemical oxygen demand. See ROD.

biodegradable • Able to be broken down by biological processes through the

action of bacteria and other microorganisms.



Figure

biogas • Mixture of gases, mostly methane and carbon dioxide, produced in anaerobic decomposition of waste materials.

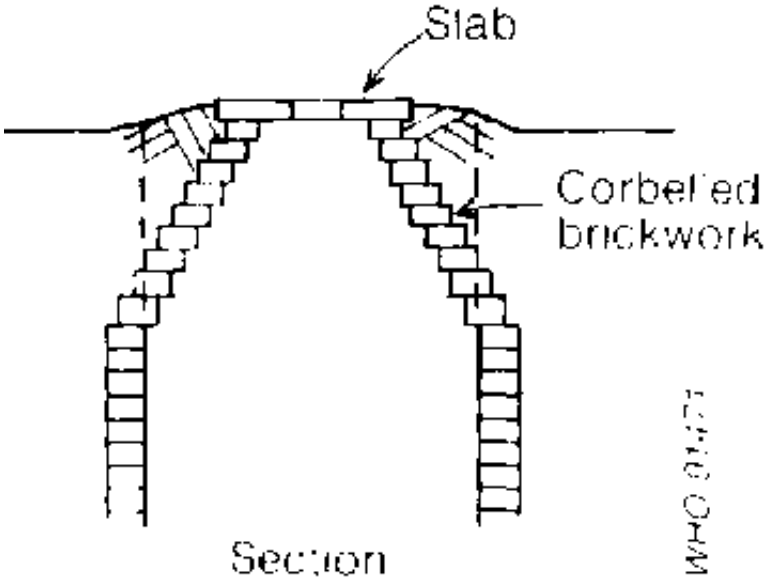
BOD • Biochemical oxygen demand: the mass of oxygen consumed by organic matter during aerobic decomposition under standard conditions, usually measured in milligrams per litre during five days; a measure of the concentration of sewage.

cement mortar • Mixture of four or fewer parts of sand to one part of cement, with a suitable amount of water.
cesspit • A subsurface container for the retention of sewage until it is removed by vacuum tanker or other means.
compost • Humus produced by composting of organic matter; valued as a fertilizer or soil conditioner.

composting • Controlled decomposition of organic solid waste in moist conditions so as to produce humus.

concrete • Mixture of cement, sand, aggregate and water which hardens to a stone-like solid.

corbelling • Construction in which bricks, blocks or stones are built so that an upper course projects inwards beyond the course below to support a load, such as a manhole cover or squatting slab.



Figure

curing • Process of keeping concrete or mortar damp for at least the first week after it is cast so that the cement always has enough water to harden.

decomposition • Breakdown of organic matter into more stable forms by the action of aerobic or anaerobic microorganisms.

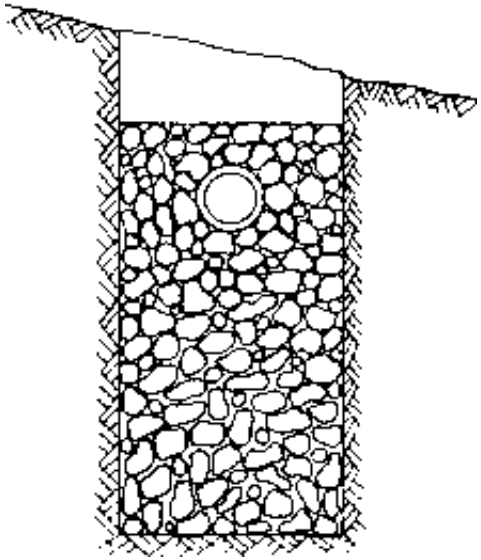
desludging • Removing settled solids from pits, vaults, tanks and septic tanks, digestion • Decomposition of organic matter in wet conditions.

drain • Pipe or channel for carrying wastewater, effluent, rainwater or surface water.

drainage field • Area of land used for infiltration of wastewater into soil.

drainage trench • Trench in which a drain is surrounded by stone or other inert material used as a soakaway for liquid dispersion.

effluent • Liquid flowing out of a tank or sewage works, excrete. Faeces and urine.



Figure

facultative anaerobe • Organism that can live in either the presence or absence of air or free oxygen.

fall • Slope along a pipe or channel or across a floor, measured as the amount by which one point is lower than a higher point.

ferrocement • Cement mortar reinforced by layers of steel mesh.

flotation • Process by which solids less dense than water rise to form a scum.
former (mould)

• Frame, usually wooden, to hold and maintain the shape of concrete while it is setting.

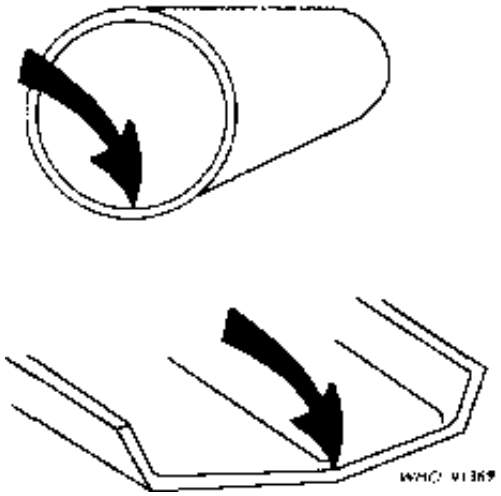
greywater • See sullage.

groundwater • Water beneath the ground surface.

helminth • A worm, which may be parasitic or free-living.

host • A man or animal in which a parasite lives and from which it obtains food.

humus • Decomposed vegetable matter - the end-product of the composting process.



Figure

invert • Bottom of the inside of a pipe or channel.

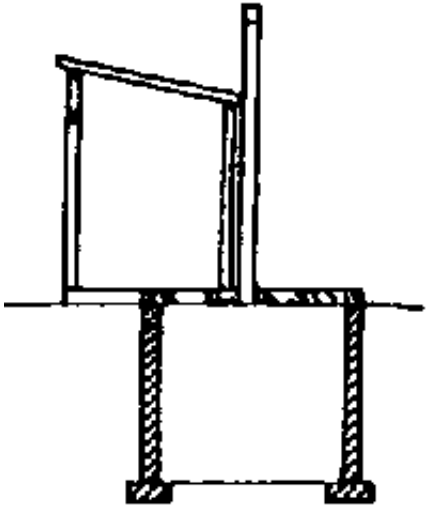
Iarva • Worm-like stage of development of insects and helminths, which can move and seek food.

Iatrine • Place or building, not normally within a house or other building, for deposition, retention and sometimes decomposition of excrete.

mortar • Mixture of mud, or of lime and/or cement with sand and water, used for joining or for providing a smooth waterproof surface.

mould • See former.

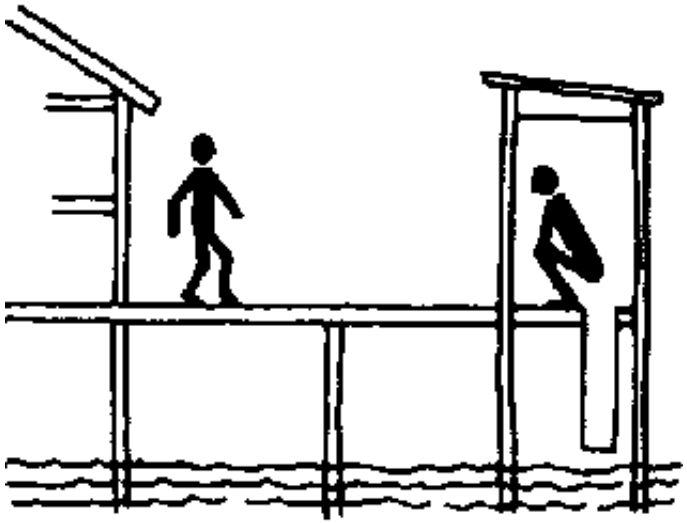
nightsoil • Human excrete, with or without anal cleaning material, which are deposited in a bucket or other receptacle for manual removal (often taking place at night).



Figure

offset pit • Pit that is partially or wholly displaced from its superstructure.

overhung latrine • Latrine sited such that excrete falls directly into the sea or other body of water.



Figure

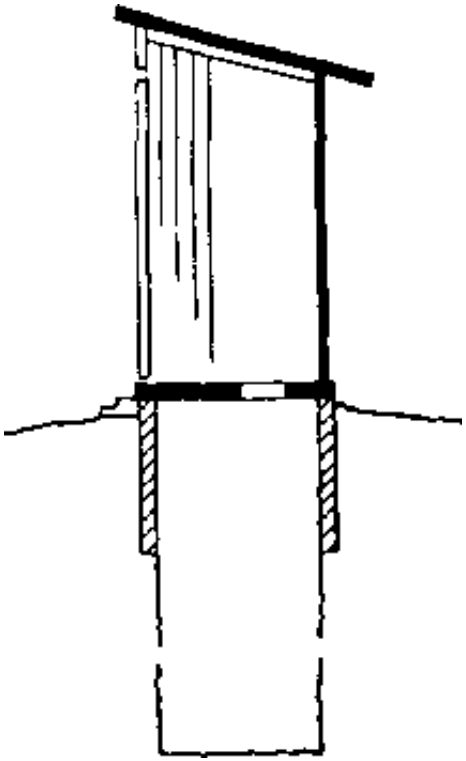
pan • Basin to receive excrete which are then flushed into an outlet pipe by water poured in or by water delivered around the rim of the pan from a cistern.

parasite • Organism that lives in or on another living organism, called the host, from which it obtains its food.

pathogen • Organism that causes disease.

percolation • Movement of liquids through soil

pit latrine • Latrine with a pit for accumulation and decomposition of excrete and from which liquid infiltrates into the surrounding soil



Figure

pollution • The addition of harmful liquid, solid or gaseous substances to water, soil or air

pour-flush latrine • Latrine where a small quantity of water is poured in to flush excrete through a water seal into a pit

programme • Continuous undertaking for planned objectives with commitment by an institution for long-term support of operation and maintenance; may include a series of projects

project • Planned budgeted event with realizable goals within a specified time period

retention time • Time taken for a volume of liquid to pass through a tank or treatment process, or the time during which a solid or liquid is held in a container

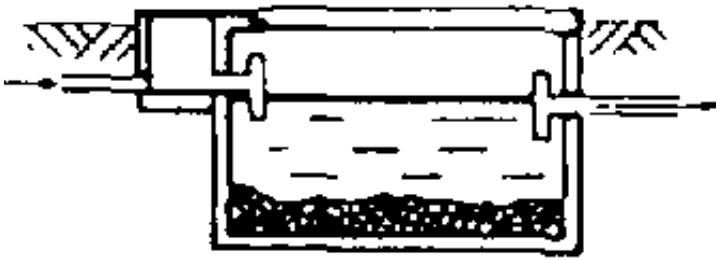
sanitation • The means of collecting and disposing of excrete and community liquid waste in a hygienic way so as not to endanger the health of individuals or the community as a whole

screed • Layer of mortar (usually cement mortar) laid to finish a floor surface

scum • Layer of suspended solids less dense than water and floating on top of liquid waste from which they have separated by flotation

sedimentation • Process by which suspended solids denser than water settle as

sludge



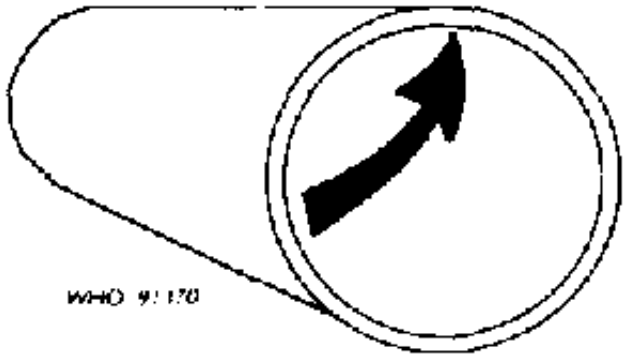
Figure

septic tank • Watertight chamber for the retention, partial treatment, and discharge for further treatment, of sewage

sewage • Wastewater that usually includes excrete and that is, will be, or has been carried in a sewer

sewer • Pipe or conduit through which sewage is carried sewerage system • System of interconnected sewers sludge. Solids that have been separated from liquid waste by sedimentation

soakaway • Soakpit or drainage trench for subsoil dispersion of liquid waste



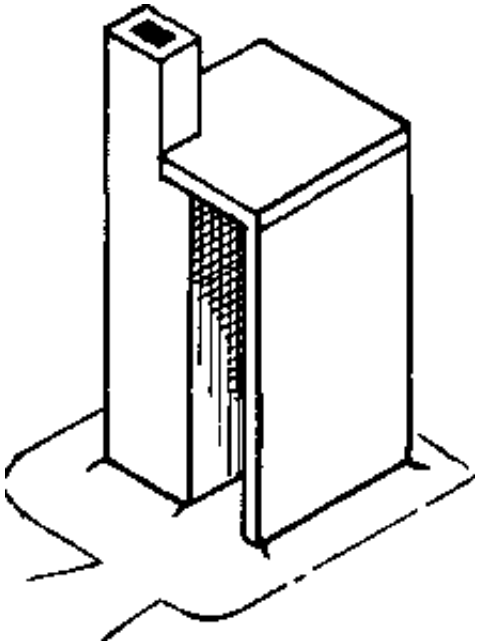
Figure

soakpit • Hole dug in the ground serving as a soakaway

soffit • Top of the inner surface of a pipe (also known as "crown") or lower surface of a slab

squat hole • Hole in the floor of a latrine through which excrete fall directly to a pit below

sullage • Wastewater from bathing, laundry, preparation of food, cooking and other personal and domestic activities that does not contain excrete superstructure. Screen or building of a latrine above the floor that provides privacy and protection for users



Figure

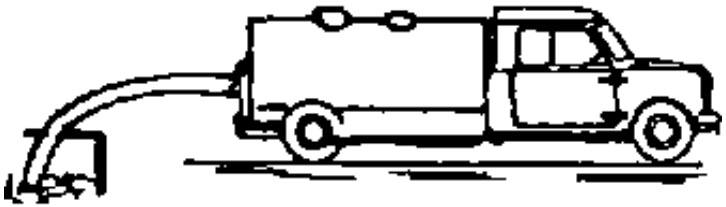
surface water • Water from rain, storms or other precipitation, or street washing Iying on or flowing across the surface of the ground

toilet • Place for defecation and urination, which may be the superstructure of a latrine

toilet, chemical • Receptacle used for defecation and urination that contains a strong chemical disinfectant which retards decomposition and reduces smell

transpiration • Loss of moisture by a plant through its leaves trap • See water seal

vacuum tanker • Lorry-mounted tank into which the contents of septic tanks, aqua-privies, cesspits, vaults or pits are drawn by vacuum pump for transport to a treatment or disposal site



Figure

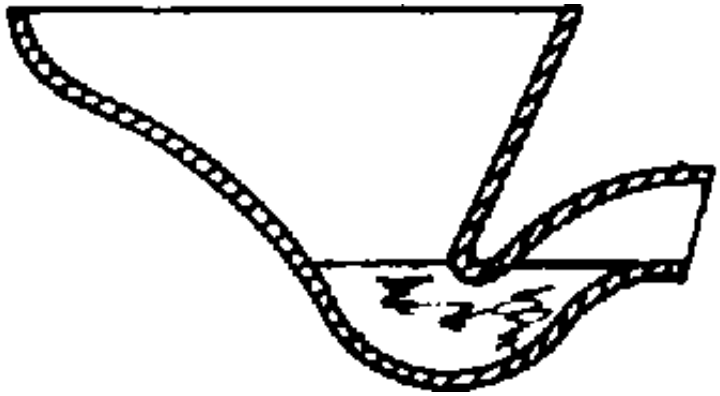
vault • Watertight tank for storage of excrete

vector • Insect or other animal that can transmit infection directly or indirectly from one person to another, or from an infected animal to a person

vent pipe • Pipe provided to facilitate the escape of gases from a latrine or septic tank

VIP latrine • Ventilated improved pit latrine; pit latrine with a screened vent pipe and a partially dark interior to the superstructure.

Wastewater • Sewage or sullage.



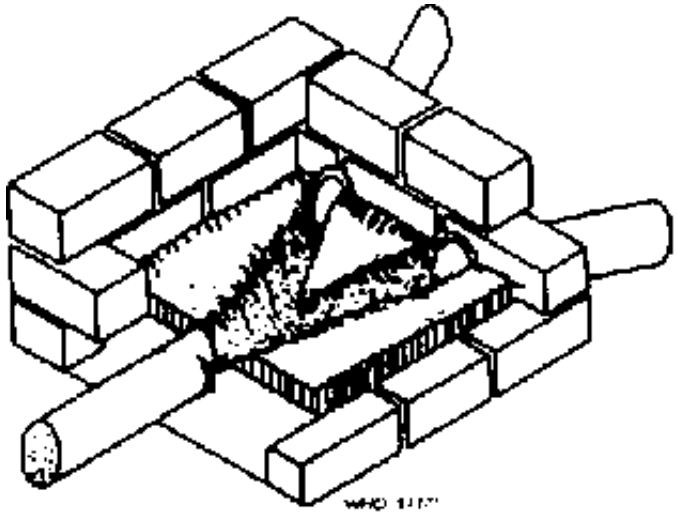
Figure

water closet (WC) • Pan from which excrete is flushed by water into a drain.

water seal • Water held in a U-shaped pipe or hemispherical bowl connecting a pan to a pipe, channel or pit to prevent the escape of gases and insects from the sewer or pit.

water table • Surface level of groundwater.

Y-junction • Chamber in which liquid may be directed along either of two pipes or channels.



Figure