

5.1. LATRINE CONSTRUCTION AND USE OF HUMAN EXCRETA IN CHINA

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For thousands of years the Chinese have regarded human excreta as an excellent fertiliser. However, because of the pathogen content of faeces and the potential for disease spread, the Ministry of Health has over the past 40 years implemented a policy of prevention by improving the standard of sanitation.

Four forms of latrine using no water have been developed. The three-compartment septic tank type gradually filters excreta from one tank to the next, finally storing it for at least 30 days, undergoing anaerobic digestion to produce an odour-free and harmless fertiliser. Parasitic ova and bacteria are all destroyed in the process.

The double-urn latrine (earthenware jars) separates urine from faeces. Urine is an excellent fertiliser and the separated faeces have a parasite sedimentation rate of 99.7%, leaving them harmless. A total of 5 million rural families in the Henan Province have constructed such latrines.

The biogas tank latrine integrates household, livestock and farm wastes, producing methane as an energy resource and a high-quality manure for fertiliser, although some ovicidal treatment is needed. Such latrines are excellent for use in rural areas.

The urine separating latrine works on the principle that urine from healthy people is not pathogenic and can be mixed with water for direct use in the vegetable gardens and fields, while faeces are treated separately.

A final option is thermophilic composting, where bacteria are killed by biogenic heat (50-70 °C). The compost is ready for use after 20 days in the summer and up to 60 days in the winter.

China has a problem of scarce water resources as well as a large rural population. Dry sanitation is therefore essential for both health and agricultural reasons.

5.2. EXPERIMENTAL RESEARCH INTO SMALL-SCALE HIGH-TEMPERATURE COMPOSTING FOR PEASANT FAMILIES

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Using organic fertiliser is important for the development of agriculture and the improvement of rural sanitation. If chemical fertiliser is used soil fertility gradually decreases and the ecological balance of farmland is destroyed. Meanwhile, poorly treated excreta pollute the environment and cause disease. We have carried out experimental research into the small-scale high-temperature composting common in rural China in order to discover whether the high temperature necessary can be maintained long enough to produce complete fermentation and harmless manure.

Factors to be considered are ventilation, raw materials, mixing and covering. Good ventilation is essential to create the aerobic conditions and high temperature needed to kill bacteria. The contents of the compost should ideally be 25% each human and livestock excreta, and 25% each vegetable and dry matter. Mixing and turning of the compost ensures an even temperature and thorough

decomposition. Finally, the whole must be covered to keep the surroundings clean and prevent animals digging in the pile.

Under these conditions a pile up to 0.8 m³ can create temperatures in the range 50-60°C and maintain these for up to one week, thereby achieving the required standard for bacteria-free manure.

5.3 SANITARY EVALUATION OF RURAL ALTERNATIVE-SERVICE DOUBLE-PIT DRY LATRINES

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The alternative-source double-pit dry latrine is a seepage-resistant, ventilated rural household latrine. After three months in sealed storage the faecal *E. coli* level decreases by 2 orders of magnitude and the death rate of *Ascaris* eggs is near 95%. With improvements this form of sanitation is suitable for arid and semi-arid rural areas. The single-pit dry latrine is also seepage resistant and can produce harmless excreta using high-temperature composting. In northeastern China these types of latrine are becoming increasingly popular and our study was aimed at confirming their suitability for the area.

The construction of both types of latrine meets basic sanitation requirements, being built of brick with a tiled roof and ventilation duct, and concrete-lined pits to prevent seepage. During daily use the excreta are covered with soil to prevent odour and begin the composting process. When one pit is full it is sealed and the second one is used. After 2-3 months the first is emptied and the excreta used as manure.

In single-pit latrines extra high-temperature composting is required to achieve bacteria-free manure.

Faecal *E. coli* levels do not vary with the season, but the longer the storage period the greater the kill rate. We suggest the use of larger pits and longer storage times (6 months) to improve standards and reduce pollution.

5.4. GENERAL SITUATION ON ENVIRONMENTAL HEALTH DEVELOPMENT IN CHINA

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In December 1952 the Chinese government set up the Central Patriotic Health Campaign Committee (CPHCC), whose brief was 'to eliminate pests [rats, bedbugs, flies and mosquitoes], pay attention to hygiene and improve sanitation'. This has since become one of the foundations of Chinese health care.

Now known as the NHPCC, this committee has branches all over the country, chaired by local officials responsible for health care. Its brief now also includes health education and municipal planning for infrastructure and the environment. The achievements of the NPHCC have attracted worldwide attention for their part in transforming society and traditions.

With the establishment of New China the country's main task was to restore normality and develop the economy. There was no finance to create an infrastructure, and from the 1950s to the 1970s the PHC's aim was for temporary solutions only.

In the 1980s China adopted a more open policy and greater reforms. The economy began to grow, together with living standards and expectations, leading to systematic development and improvement of sanitation in urban areas. Environmental protection has also become an issue: by the end of 1995 49.6% of urban waste and 20% of wastewater was being rendered harmless. The sanitation quality of 25 major cities is on a level with well developed cities worldwide.

In rural areas advances have a longer-term perspective. Policies and plans have been drawn up in three main areas: drinking water, sanitation and health education, affecting 0.9 billion rural dwellers. The use of composted nightsoil as a fertiliser is encouraged, together with the use of dry latrines of varying types. By the end of 1996 more than 49% of the rural population had such sanitation; the rest use public or community facilities.

China is a very large country which is still largely isolated and backward, despite huge economic improvements. In rural areas in particular developments have been slow, and affected by traditional ways of thinking. Changing this is an arduous task. The Chinese government has undertaken to achieve the goals of 'Health for all' and the '90s National Program for Child Development' by 2000. The NPHCC will continue to be responsible for coordination, mobilisation, propaganda and education; for regulation and control, training and research, and for the exchange of information.

5.5 SANITATION IN BOLIVIA

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The Republic of Bolivia is situated in central South America and can be divided into three zones: the highlands, where the climate is cold and dry; the valleys, with a mild, wet climate; and the plains, where it is hot and humid, with high rainfall.

According to the 1992 census Bolivia has 6,420,792 inhabitants, with a density of 5.8 per km². For the first time in its history the urban population is greater than the rural (58% to 42%), and this trend is set to continue. Infant mortality in 1992 was 75/1000 live births before 1 year of age, and 156/1000 before 5 years. Acute diarrhoea, closely related to water usage and sanitation, has long been the main cause of death.

Like other countries in Latin America, Bolivia shows notable differences in its water and sanitation sources, especially between rural and urban areas. In 1992 only 44.5% had such services, mostly in urban areas. In rural areas latrines are commonplace. According to the few diagnoses that exist, sanitation services have problems of implementation, construction, operation and maintenance. A study in 1996 concluded that the majority of latrines are not properly operated or maintained, and that people are reluctant to use them. Intensive action to promote and implement their use is recommended.

The main problems are poor community participation, lack of affordable options, and weakness in implementation and administration. Only 2% of the population in the areas studied were educated about sanitation and hygiene. Projects to study the sociocultural aspects of sanitation and to motivate users are needed to attract finance for implementation.

5.6. SUMMARY REPORT ON WASTEWATER MANAGEMENT IN BOTSWANA

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The management of waste water in Botswana is dispersed between a number of different bodies, reducing the possibility of a unified management strategy. Owing to rapid economic development and population growth the demand for water and the amount of subsequent waste has increased substantially, creating problems for those responsible for its management.

Although some wastewater treatment facilities exist they are poorly managed and maintained. Also, for much of the population latrines, septic tanks and soakaways are the only affordable options, despite their limitations, especially in densely populated areas. Leaching of pollutants, which are usually rich in nitrogen, is a serious problem, but the general public approach to waste disposal is careless. The result of course is a reduction in the environment's capacity to assimilate pollution and a consequent threat to public health.

Wastewater treatment systems in use in Botswana can be defined as follows:

- ◇ large stabilisation ponds to treat wastewater from the community in general, run by local authorities. some large institutions have their own ponds;
- ◇ septic tanks, both in institutions and in individual homes;
- ◇ manufacturing companies may have pretreatment tanks to treat effluent before discharging it to the sewers;
- ◇ biological filter systems, sand filters and activated sludge systems.

The problems with these systems generally stem from overloading, causing the system to break down and pollution to increase. Also, there is no practice of separating the waste streams, so that systems become blocked and ineffective. Untreated or poor-quality effluent is also discharged into the sewer network, affecting the biological capacity of the treatment ponds.

Poor maintenance is another major problem - removal of sludge and vegetation is necessary for cleanliness and proper operation. Sludge removal is made more difficult because of the lack of vacuum tankers and the large volumes of sludge. there is also a lack of sludge drying beds, so that even when sludge is removed it is often dumped in unsuitable areas.

In most cases management is on a crisis-only basis, and no routine maintenance is carried out. Solutions are therefore only short term.

The Botswana Department of Water Affairs, in collaboration with the Danish Cooperation for Environment and Development, is to begin a water quality management project with the aim of improving the country's use and treatment of water by promoting public awareness. Strong pollution control measures are needed, with legislation and guidelines for users. Making the polluter pay is important.

A sanitation and waste management department should be established to coordinate local efforts and promote new programmes. Central sewerage schemes should be established for large villages, and local authorities should set up monitoring programmes to control the quality of effluent.

Expanding the capacity of septic tanks or ponds is also essential to prevent biological breakdown of the system. Also the siting and operation of latrines must be supervised, to prevent contamination of aquifers, and the siting of graveyards near rivers discouraged.

5.7. ENVIRONMENTAL SANITATION IN EL SALVADOR

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El Salvador is currently undergoing an economic revival, with consequent increases in demand for resources and in pollution. The aim of any approach to sanitation must be to maintain a balance between resource use and costs, taking into account social inequalities. In urban areas wastewater is not treated and is discharged directly into rivers. A small proportion is discharged into septic tanks. Treatment plants are under construction but not yet functioning.

A certain amount of solid garbage remains uncollected every year and is generally dumped. Of that collected, the method of disposal is landfill or open dumps, although an informal market exists for recycling of products such as paper, glass, iron etc.

The Ministry of Housing and Urban Development has undertaken an ambitious planning project in El Salvador's largest urban areas, the main thrusts of which are sustainable resource management and environmental/sanitation issues. The Environmental Plan defines critical areas for aquifer protection and environmental hazards such as landslides and flooding. The Solid Refuse Programme seeks to provide local authorities with the tools to collect and dispose of garbage.

5.8. ENVIRONMENTAL SANITATION IN NAMIBIA

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Sanitation in Namibia is controlled by the Ministry of Health and Social Services, the Ministry of Regional and Local Government and Housing, and local authorities.

The use of more environmentally friendly sanitation systems is restricted to ventilated improved pit latrines and aqua privies. Both systems are regarded by the local population as inferior and are normally rejected within the urban environment.

During 1992 a major investigation was carried out into the use of alternative sanitation systems for higher-density areas in Windhoek. Various meetings were held with the communities involved. Some of the leaders of the different communities were taken to different sites in South Africa where alternative systems are used. The result was positive and it was decided to install 300 of a more advanced type of aqua privy. All installations were provided with soakaways and users were advised to plant trees to make use of evapotranspiration. The system was installed only in areas where there was no possibility of groundwater pollution. In cases where consumers were able to carry the cost of water connection low flush toilets were installed. The system was in the end rejected by the community, and the aqua privies were sold for use on farms and in some rural areas.

The only system which is acceptable at the moment is based on the principle of incremental construction. Every new township is planned in such a way that water connections and toilets (waterborne sewage) are shared by more than one family. When consumers are able to afford a higher level of service, services can be extended. Affordability remains a critical problem.

In most urban settlements in other towns and villages all alternative sanitation systems which are available are regarded as inferior.

- ◆ The following points need further discussion: alternative systems are not yet developed to such an extent that they can replace waterborne sewage systems.
- ◆ Treatment of wastewater with appropriate technology may provide a cheaper system in the long term.

5.9. VIETNAM ENVIRONMENTAL SANITATION: STATUS AND SOLUTIONS

Professor Pham Song, National Steering Committee for Safe Water Supply and Sanitation

Vietnam is severely affected by environmental degradation caused by poor sanitation practices. Most rivers and water sources are heavily polluted by human excreta and industrial waste, owing to the practice of open defecation and the use of rivers to dispose of garbage and toilet products. Bird populations are depleted by hunting and forests have been destroyed by toxins during the war and by fires caused by carelessness. As a result biodiversity is being lost. Flooding in the Mekong Delta is increasing and the destruction of upstream forests exacerbates the problem. Bucket latrines are common and the contents are used untreated on the fields.

The control of waste is poor, with only 50% of an estimated total 19,315 tonnes per day being collected for disposal. Toxic and domestic wastes are not separated, being all dumped together, leading to serious pollution problems. Legislation to control waste is insufficient and not properly applied.

Untreated wastes are the cause of much disease, affecting health and socioeconomic development. Food hygiene is poor, only 40-50% of samples tested meeting hygiene requirements. In a region where technology is backward occupational safety is also a concern. workers are badly affected by noise, dust and chemicals, and only 15% of enterprises surveyed are attempting to improve the situation.

The protection of water from contamination is becoming a pressing issue. A pilot project in Hanoi is concentrating on the provision of domestic rainwater tanks and the use of biogas tanks and composters for waste disposal.

A project in Phuc Yen is testing the use of bioponds to provide water for irrigation, and domestic sanitation arrangements that create cleaner effluent. Various types of latrine suitable for different areas are being tried in an attempt to prevent pollution while producing safe agricultural fertilisers. It is important to educate users to follow the guidelines carefully and not to use the compost before it has become safe. The construction of public latrines is also a concern.

The use of hydrolysis to speed up composting and the control of chemical fertilisers are other important health issues.

Various public awareness projects are being set up to educate people about hygiene and health, covering waste disposal, food safety, environmental cleanliness, air pollution and industrial safety. Other objectives include strengthening the sanitation companies, monitoring standards of pollution control and protecting the environment.

5.10 URBAN SANITATION, MAHARASHTRA, INDIA

Nandita Kapadia-Kundu, Institute of Health Management, Pachod, India

Maharashtra is the most urbanised state in India. Currently about 40% of its 78 million people live in urban areas, and by the turn of the century this is expected to increase to 50%.

Pune city has a population of 2.5 million (Census of Maharashtra, 1991). Of these, an estimated 40% reside in slums, only half of which are recognised and have a few basic facilities. The unrecognised slums do not have even basic facilities.

Unlike rural India, where the demand for sanitation facilities is low, urban slums rank sanitation as their greatest need. A study (IHMP, 1996) shows that slum women ranked sanitation as their number one problem, higher than water and electricity.

There is a difference between the magnitude of the problem of sanitation in recognised and unrecognised slums. Although facilities do exist in recognised slums, they are highly inadequate and poorly maintained. Unrecognised slums epitomise the exigencies of the urban struggle for survival. Obtaining basic facilities such as water, toilets and electricity is seen as their greatest problem. There is constant friction within the slum community because of the fight for scarce resources.

Problems stated by women from the recognised slums centre on improving and upgrading the available facilities, which are inadequate due to rapid population growth. The overall magnitude of the problems cited by women in the recognised slums was less than in the unrecognised slums.

5.11 ENVIRONMENTAL SANITATION IN THE REPUBLIC OF SOUTH AFRICA

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The current situation in the field of environmental sanitation in South Africa is best understood by referring to the Draft White Paper on a National Sanitation Policy, released by the government in June 1996. This recognised that sanitation needs to be seen in the context of an integrated development strategy. It was thus clear that the task of developing a national sanitation policy could not be assigned to a single government department, and that a cooperative approach was needed. The commitment of the government to making all citizens aware of the importance of sanitation is evidenced by the six departments involved in the preparation of this document, namely:

- Department of Water Affairs and Forestry
- Department of Environment Affairs and Tourism
- Department of Education
- Department of Health
- Department of Housing
- Department of Provincial Affairs and Local Government.

The White Paper recognises that the proper operation of sanitation systems is essential in order to protect the environment. It makes the point that a complicated and expensive system which is poorly maintained can be just as harmful to the environment as having no system at all. It is further stated that inadequate sanitation leads to dispersed pollution of water sources, which in turn increases the cost of downstream water treatment, as well as the risk of disease transmission.

The Department of Water Affairs and Forestry has developed a comprehensive water quality management policy. In evaluating the most appropriate type of sanitation system for a particular situation, the relevant quality objectives for local water resources must be taken into account. The department has further published a number of documents to assist in evaluating the potential impact of sanitation systems on the environment.

The need for public awareness and participation is emphasised, and for information to be presented in an even-handed manner to convey the potential costs and trade-offs. The correct EIA procedures must be followed, while appropriate risk assessment procedures still need to be developed.

Waste recycling is also addressed. Where economically viable and sustainable, the government expects both the liquid and solid constituents of sewage to be recycled for further use. The return of treated effluent to the water cycle is also considered essential.

Environmental education, both formal and informal, is viewed as being of great importance, to create an environmental ethic. Communities are also encouraged to become involved in monitoring the quality of their own water resources.

Finally, it is intended that the provision of adequate sanitation as a prerequisite for sound environmental management will be recognised by legislation. To this end existing legislation, as well as government structure and functions, is currently being reviewed.

Appendices

Sida Sanitation Workshop, Balingsholm 6-9 August 1997

PROGRAMME

Day 0 (Wednesday 6/8)

1800 Registration, dinner, presentation/introduction of participants

Day 1 (Thursday 7/8) (Chair: Ingvar Andersson, rapporteur Jan-Olof Drangert)

0830-0840	Introduction	Ingvar Andersson
0840-0900	Opening speech	Bo Göransson
0900-0945	Closed vs linear flows	Erik Arrhenius
0945-1030	A new paradigm	Mayling Simpson
1030-1045	<i>coffee</i>	
1045-1120	Ecological sanitation: a global overview	Uno Winblad
1130-1205	Ecological sanitation in Sweden	PA Malmqvist
1205-1220	Discussion	
1220-1300	<i>lunch</i>	
1310-1900	Field visit 1	
1915	<i>dinner</i>	
2000-	Informal discussions of field visits etc	

Day 2 (Friday 8/8) (Chair: Mayling Simpson Hébert, rapporteur: Elisabeth Kvarnström.)

0830-0915	System assessment and reuse	Håkan Jönsson
0915-1000	Disease control	Thor Axel Stenström
1000-1020	Discussion	
1020-1035	<i>coffee</i>	
1035-1120	Behavioural aspects	Jan-Olof Drangert
1120-1205	Institutional and financial aspects	Jorge Vargas
1205-1230	Discussion	
1230-1330	<i>lunch</i>	
1330-1400	Case study: Mexico	George Ann Clark
1300-1430	Case study: El Salvador	Jean Gough
1430-1500	Case study: Pacific Islands	Dave Rapaport
1500-1530	Case study: Japan	Saburo Matsui
1530-1545	<i>coffee</i>	
1545-1630	Discussion	
1630 -1800	Group work	
1800	<i>dinner</i>	
1900-2200	Group work continues (by 2030 intermediate reports from working groups to those responsible for preparing draft final statement)	

Day 3 (Saturday 9/8) (Chair: Dave Rapaport, rapporteur: Jorge Vargas)

0800-1300	Field visit 2	
1310-1400	<i>lunch</i>	
1400-1515	Concluding session	
1530	Departure for Field visit 3 and Hotel City/Kungsgatan, Stockholm	
1720	Arrival Hotel City	

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