SYNERGETIC EFFECTS OF MUNICIPAL SOLID WASTE COLLECTION, RECYCLING AND DISPOSAL

by Roland Schertenleib and Werner Meyer

1. INTRODUCTION

During the International Drinking Water and Sanitation Decade 1980 - 1990, the main emphasis was placed on the improvement of water supply and safe disposal of human excreta. Solid Waste Management (SWM) received comparatively little attention. Today, since urban SWM is considered to be one of the most immediate and serious environmental problems confronting urban governments in developing countries (DCs), it should be given high priority in the '90s [1]. The major environmental consequences of the present situation are serious negative impacts on human health and on the quality of life. The hygienic situation with regard to basic sanitation and domestic waste collection is generally very poor, especially in peri-urban areas with low-income communities.

A SWM scheme is a complex system of different strongly interrelated activities: (a) primary and secondary collection including transport to transfer points, processing plants or disposal sites; (b) operation of transfer points, processing plants and disposal sites; (c) resource recovery and recycling activities.

External assistance to urban SWM schemes in DCs was centred in the past predominantly on the procurement of collection-related equipment and had little impact on the quality and efficiency of service provision [2]. In most lending and funding programmes, little emphasis was placed on strategic service planning, institutional arrangements, efficient management and finances, and environmental protection at disposal sites.

On the other hand, material recovery and recycling from Municipal Solid Waste (MSW) has been a daily practice in most low-income countries for many years. However, these mostly economically-driven informal recycling activities are usually not recognized as an important part of an integrated SWM scheme. The recycling activities by the informal sector, which are an eyesore to the public and in conflict with efficient waste management practices, have often been discouraged and even outlawed by authorities. In contrast to the situation encountered in most DCs, resource recovery and recycling have become, in the past few years, a recognized and important component of MSW management in many industrialized countries. In simple terms, the present situation can be characterized as follows: Although material recovery and recycling activities are actually persued to a great extent in DCs, they are carried out in a rather inefficient, unplanned and unauthorized manner. In industrialized countries, however, the need and benefits of recycling are generally recognized, but the actual recycling activities are still rather limited.

This paper discusses the interdependence between collection, disposal and recycling of MSW as well as its consequences for the design of an urban SWM scheme in a DC. It is based on experiences and observations from industrialized as well as DCs, and tries to identify some lessons which can be learned from past experience in industrialized countries.

2. HOW DOES THE COLLECTION SYSTEM AFFECT WASTE DISPOSAL ?

The direct relation between collection and disposal of MSW is obvious. The better and more efficient a collection system works, the more SW has to be handled and disposed of. In the context of a typical urban area in a developing country where the municipal service picks up about 60 to 70 percent of the refuse and serves only about 50 percent of the urban population, any improvement in the efficiency of the existing collection services tends to aggravate the disposal problem. This can, on the one hand, be an additional disincentive for authorities to extend collection services to the unserved population, on the other, collection and disposal can no longer be regarded as two separate activities. As we shall see in the following section, the link between these two activities are actually the recycling activities .

3. HOW DOES DISPOSAL AFFECT THE RECYCLING ACTIVITIES ?

Experiences in industrialized countries

The rapidly rising tipping fees and transportation costs due to stricter requirements imposed by environmental protection laws and political opposition on new landfill sites ("NIMBY"[not in my backyard] effect) constitute the main motivating factors for increased recycling activities in most industrialized countries. There, the main bulk of the MSW is brought to the landfill for final disposal (e.g. Canada, U.S., U.K.). In the US for instance, a reduction of the amount of SW to be landfilled is the main objective in the setting up of extensive recycling programmes. In a country like Switzerland where 70 to 80% of the municipal waste are incinerated due to a lack of available landfill space, the main purpose for recycling material from municipal waste is to save resources (e.g. energy and raw ma-

terials) and reduce environmental pollution caused by incineration.

The recycling programmes elaborated in industrialized countries include mostly that part of the inorganic fraction which contributes significantly to the total volume of the MSW, and which has a predictable value in the recycling market (e.g. glass, paper, aluminium, tin). The predictability and stability of the market value of the recovered material is important since the recycling is performed mainly by the formal private sector and on a profit basis. The recycling activities by the private sector are often encouraged by local governments through separate collection of selected materials.

The experience in several industrialized countries reveals that the market for compost produced from MSW is rather limited on account of the competitive market of commercial fertilizers, which are often heavily subsidized, and the contamination of the compost with noxious substances (e.g. heavy metals). Therefore, the organic fraction of the SW is usually not recycled in urban areas of industrialized countries. However, this situation is now changing due to the rising costs of disposal fees.

Present situation in developing countries

In most DCs, material recovery and recycling from the inorganic fraction of MSW has been practised for quite some time. However, it is important to realize that in the case of DCs, the reduction of the amount of SW to be disposed of has usually not been the main reason for the existence of extensive recycling activities. These have mostly been carried out by the informal sector which is driven by the large number of unemployed and unskilled labour on one hand, and the existing but often unpredictable market for recovered inorganic material on the other*. Import of primary resource material and foreign exchange, but also complicated import procedures, customs' duties, transportation risks and costs, can thus be saved and income generated, especially for the poorest segment of the population.

The putrescible organic fraction which accounts for typically 60 - 80 % of the total MSW generated in low income areas of DCs, is usually not recycled on a regular and full-scale basis. In the past few years, numerous pilot projects were initiated in different parts of the developing world, however, with very little success. The main reasons are a lack of actual and/or potential markets for compost, governmental subsidies for commercial fertilizers and often a lack of professional marketing techniques with regard to compost. In order to successfully market compost, as any other similar product, detailed knowledge of the agricultural economics is required as well as pricing and market mechanisms, market potentials for compost and respective quality requirements, public relations and sales promotion. Low disposal costs provide little economic incentive to reduce the volume of MSW by recycling the putrescible fraction through composting.

Expected development in developing countries

From the above observations it can be concluded that, at present, the reasons for recycling activities in DCs are quite different from the ones in industrialized countries. However, there is strong indication that, in the near future, this will change for the following reasons:

In DCs, the most common practice of MSW disposal is still uncontrolled open dumping at sites which were originally and mostly located at a safe distance outside the municipal boundaries. However, the rapid urbanization process of the past few decades resulted in the encircling of these dumping areas by settlements and housing estates, which made use of the access roads to the dumping sites. Nowadays, these dumping areas are rather centrally located and subjected to growing opposition from the public due to odour, dust and other nuisances. However, the central location of the dumping sites; i.e.; close to the collection area, as well as the low-cost open dumping methods, have enabled local governments to dispose the MSW at little cost and to utilize the budget mainly for collection. This situation is expected to change quite dramatically. Not least due to the rather neglected disposal method, it is becoming more and more difficult to find new landfill sites which cause minimal adverse environmental impacts, which find the approval of the public and which are located at a reasonable distance from the collection area. On account of growing local opposition, local governments find little support from politicians in site selection. The public is often not convinced that the improved landfill technique; i.e., controlled landfilling, can considerably improve the nuisance problems. One of the drawbacks of many of the recently selected landfill sites in larger cities (e.g. Jakarta, Manila) is the long distance of 20-40 km from the central collection areas. This results in high transfer, hauling and transportation costs as well as in additional investments in the road infrastructure. Growing awareness of environmental pollution results in higher requirements for the disposal sites and, consequently, leads to growing investment and operation costs.

As soon as this new generation of controlled landfill sites are in operation in cities of DCs, a key issue in MSW management is the reduction of the amount of waste to be transported and disposed of in landfills as is actually the case in most industrialized countries. If this situation occurs, more emphasis will have to be placed on the organic fraction which accounts, in middle and low income

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* So far, the formal private sector in developing countries has been rather reluctant to enter the market although materials recovery from the waste stream has great potential for formal private sector involvement since the outputs are marketable. The two main reasons interrelated are: (a) the market for recovered material which is often controlled by cartels, leads to oligopolistic situations; and (b) prices for recovered materials are subject to large fluctuations and are not predictable.

countries, to typically 50-80% of the total amount of MSW produced. This percentage may vary more as regards the sand/dust fraction than the inorganic recyclable material fraction [3].

In summary, the significant reduction in a typical developing country does not result from the separation and recycling of the inorganic fraction (metal, plastic, paper, glass, etc.), as this fraction is already recycled to a large extent by the informal sector and is relatively small anyhow (10-30%), but results from the recycling activities of the relatively large organic fraction.

When comparing the different processes and methods of organic recycling, composting is the most promising option for recycling large quantities of MSW. Small quantities can, for example, be directly used as pig feed (kitchen waste). Composting is the natural decomposition process of all the biomass in the biocycle. Compared to other organic decomposition processes such as anaerobic digestion, composting of MSW can be applied on all technical and quantitative levels, ranging from simple domestic backyard composting to fully mechanized and computerized large-scale central composting plants. An important requirement for successful composting is a good understanding and control of the basic requirements and limiting factors of the biological process such as moisture content and carbon/nitrogen ratio.

MSW composting has become quite popular worldwide during the '60s. Manufacturers offered centralized, large-scale and mechanized plants for composting MSW and national governments were convinced by the manufacturers that they would no longer need hard currency to purchase mineral fertilizers after a few years of operation. However, most of these projects failed and turned out to be technically and financially not viable. As a result, the composting process itself became suspect instead of the technology applied. In times of rising transfer, transportation and final disposal costs, composting of MSW might become a viable option. However, economical viability can only be expected if considerable savings in transportation costs and tipping fees can be achieved. This means that composting facilities should be decentralized and located as near as possible to the source of generation and to the potential compost users. However, there are also important limitations such as space for example. In high density urban areas, it is certainly not feasible to decentralize the composting activities to the household level. Besides space limitations, there are other arguments which speak in favour of a communal plant and lead to a better compost quality and less nuisance around the plant: economy of scale; easier control of operation and maintenance; improved conditions for the composting process due to smaller fluctuations in the composition of the waste to be composted. Therefore, small-scale communal composting plants for a community of up to several thousand people seem to be a good compromise for keeping the transportation costs low and, at the same time, minimizing the problems and difficulties encountered in small plants.

4. How does recycling affect the collection system ?

Market for recovered material, quality requirements and consequences for the collection

As mentioned earlier, material recovery and recycling from the inorganic fraction of the MSW stream has been for quite some time a daily practice in most DCs. Material recovery is usually conducted by the informal sector and takes place at all stages of a SWM system. Waste is retrieved for purposes of recycling (a) at the source of waste generation, (b) at the designated place of waste pick-up, such as along curbs or at the communal bin, (c) within the refuse collection and transport vehicle, (d) at transfer stations/points or waste processing plants, and/or (e) at the ultimate disposal sites. As a rule, the higher the rate of underemployment and unemployment in an urban area, the higher the MSW recycling rate by the informal sector. Another very interesting and informative observation made in most DCs is that, although material recovery from the waste stream has a great potential for formal private sector involvement (the outputs are marketable), the formal private sector has so far been rather reluctant to enter the recycling market. One of the main reasons is the fact that prices for recovered materials are subject to large fluctuations and unpredictable. Prices vary widely as they depend on several factors such as market requirements for secondary raw material in domestic industrial production, the trading system between the collector (scavenger) and the consuming industry and, last but by no means least, the cleanliness (i.e., same chemical composition) and purity (i.e., free from dirt) of the recovered material. Poorly separated and "contaminated" material is generally of little value. Prices increase mostly sharply with increasing pureness and cleanliness of the recovered material. Similarly to the inorganic fraction, the "pureness" of the composted organic material also plays a vital role for the potential buyer. Small farmers reject compost containing glass fragments, nails, etc. as they often work barefoot and manually in their fields. The agricultural use of compost mixed with MSW is also problematic from a public health point of view due to its content of toxic materials such as heavy metals and refractory (non-biodegradable) organic substances.

Modification of existing SW schemes, which generally mix all the waste fractions during collection, is a promising approach for achieving cleaner recyclables of a higher economic value. The introduction of separate collection of the waste fractions can prevent the undesirable diffusion process. The deciding of which fractions to collect separately depends much on the potential markets and perceived benefits (e.g. energy and resource conservation). For instance, if there is a market for high quality "pure" compost, a separate collection of the putrescible organic garbage from the rest has not only a positive effect on the compost quality, but it also improves the "cleanliness" of the inorganic fraction and permits a more efficient retrieval of the inorganic recyclables.

Different types of separated MSW collection schemes have recently been introduced in different cities of DCs (e.g. Indonesia) as well as of industrialized countries (e.g. USA, Switzerland). Although the experiences are still very limited, it is evident that one important prerequisite for obtaining a satisfactory separation of the different waste fractions at the source (households), and for keeping them separated during collection, is the introduction of some kind of incentives for households as well as for waste collectors. This is particularly important in low-income high density areas where separated waste storage may cause space problems if the collection frequency is not adjusted.

Separate collection of the different fractions has, of course, financial implications. When deciding if a separate collection should be introduced, a careful comparison has to be made between the additional costs and all the benefits (e.g. higher prices for recovered material, cost savings in transportation and final disposal) to be achieved. However, this cost/benefit analysis should not be limited to the financial aspects, it should also include other benefits such as for example labour income generation, conservation of energy and non-renewable resources, and saving of foreign currency.

5. Conclusions

This short paper has attempted to raise the following points:

- The different components (collection, disposal and recycling) of a SWM scheme are closely interrelated. Changes in one of these components affect the others, and improvements in one component may often lead and/or aggravate the problems of the other components.
- The amount of waste to be transported and disposed of in landfills will become a key issue in SWM in DCs. Therefore, more emphasis will have to be placed on recycling the organic putrescible fraction which accounts for the main portion of the MSW produced in DCs.
- Composting of MSW in decentralized and small-scale communal plants becomes a viable option if considerable savings in transportation costs and tipping fees (extended lifetime of landfills) can be achieved.
- Prices and markets for recovered material depend strongly on their pureness and cleanliness. This can best be achieved by separate collection of the different fractions.

References

[1] Global Consultation on Safe Water and Sanitation for the 1990s, Delhi 1990, "New Delhi Statement"

[2] Bartone C. et al., "Investments in Solid Waste Management; Opportunities for Environmental Improvement". Working Paper WPS 405, Infrastructure and Urban Development Department, The World Bank (April 1990)

[3] Cointreau Sandra J., "Environmental Management of Urban Solid Wastes in Developing Countries; A Project Guide", The World Bank (1982)

Important Publications in SWM With Special Relevance to DCs

Refuse Collection Vehicles for Developing Countries, ***UNCHS (1988), Nairobi: United Nations Centre for Human Settlement-Habitat; Address: P.O. Box 30030, Nairobi, Kenya, 46 pp.*** *Price upon request.*

This report provides an insight into common problems and issues of municipal solid waste management with a special view on operational inefficiency in collection, transportation and handling. The factors affecting a waste collection system are defined and appropriate collection methods and vehicle requirements for improved collection are discussed. Design criteria for refuse collection optimization are described. It also contains a large catalogue of non-motorized as well as motorized refuse collection vehicles and their characteristics. Finally, an appraisal of the solid waste collection system and its costs are discussed and emphasized in the Annex of the report.

The publication addresses decision makers, service engineers and consultants engaged in planning and management of refuse collection services.

Solid Waste Management in Low-income Housing Projects: The Scope for Community Participation, ***UNCHS (1989), Nairobi: United Nations Centre for Human Settlement-Habitat; Address: P.O.Box 30030, Nairobi, Kenya, 53 pp.*** *Price upon request.*

This publication has been prepared as a general introduction to community participation in solid waste management in low-income areas lacking official municipal solid waste services. It provides an easily readable overview of local community involvement in the major solid waste management components such as waste collec-

tion systems, intermediate storage at various levels, transportation and disposal methods. Resource recovery and recycling at local level are explained as they provide solutions to solid waste disposal problems as well as productive and local work through recycling activities.

The publication is prepared for solid waste specialists and community development officers interested in increasing the coverage through community-based approaches of municipal solid waste management schemes in low-income areas.

Improvement of Solid Waste Management in Developing Countries, ***Sakurai, K. (1990), Tokyo: Technical Handbook Series Vol. 1, Institute for International Cooperation/Japan International Cooperation Agency; Address: 10-5, Hommura-cho, Ichigaya, Shinjuku, Tokyo 162, Japan, 272 pp.*** *Price upon request.*

This publication is divided into two parts. The first main part contains six chapters and the second part eleven annexes. In the introduction, external, internal and mixed problems of solid waste management are distinguished. The second chapter justifies the need for a national solid waste management action plan and describes its formulation and implementation. The third chapter describes the necessity for municipal waste management master plans, their formulation as well as their implementation. The fourth chapter analyses the main factors influencing the collection process with a view to improving its efficiency. In chapter eight, the problem of non-coverage in urban fringe areas is analyzed and eight basic concepts are discussed to improve coverage. The last chapter deals with the problem of hazardous solid waste management and provides practical guidelines. Special considerations are paid to administrative procedures, technical standards, and managerial issues.

Social Aspects of Solid Waste Recovery in Asian Cities, ***Furedy, Ch., Bubel, A.Z. (1990), Bangkok: ENSIC Environmental Sanitation Reviews No. 30, ENSIC/AIT; Address: P.O.Box 2754, Bangkok 10501, Thailand, 66 pp.*** *Price U.S.$ 8.00.*

The report consists of two main parts. The first part discusses social aspects of solid waste recovery in Asian cities and the second presents a supplementing case study on waste picking and waste pickers in Manila. The first section deals with the links of urban poor and urban wastes. Relations of basic needs and wastes, wastes and work, social rights to wastes and issues of poverty and modernization are discussed. The next sections analyze the social status of waste workers and discuss the informal waste recovery practices in municipal solid waste management. Attempts to solve the problems of informal recovery are proposed since the elimination of informal waste picking has failed in most cities. The formalizing of the informal activities is suggested and exemplified. The last section analyses social and technological issues in compost production. Part two presents a study of waste picking and municipal solid waste management in Manila. The social characteristics of the scavenging population and the different types of working condition of scavengers/waste pickers, middle people and factories are described. The second part ends with a discussion on recycling benefits.

Environmental Management of Urban Solid Wastes in Developing Countries: a project guide, ***(Urban development technical paper, no. 5) Cointreau, S.J. (1982), Washington D.C.: The World Bank; Address: 1818 H. Street, N.W., Washington, D.C. 20433, USA, 213 pp.*** *Price upon request.*

This project guide provides information and procedures for planning and implementation of solid waste management improvements. It reflects the lessons and experience gained from World Bank-supported projects. It discusses the establishment of an acceptable standard of collection and disposal service delivery, the selection of appropriate technology, the development of suitably phased action plans, arrangements of institutions for planning and management, arrangement of financial resources, development of regulatory and enforcement support services, provision of public education and participation programmes, and incorporation of incentives and disincentives to facilitate project success. Information on solid waste generation rates and compositions in countries of different economic levels is provided, and case study information on prevalent refuse collection and disposal activities by formal and informal sector are described in cities of DCs. Problems and issues in the planning of solid waste management programmes are addressed and highlighted through case study examples.

Management of Solid Wastes in Developing Countries, ***(WHO Regional Publications. South-East Asia Series; No.1) Flintoff, F. (1984, 2nd ed.) New Delhi: World Health Organisation, Regional Office for South-East Asia; Address: World Health House, Indraprastha Estate, New Delhi 110002, India, 231 pp.*** *Price upon request.*

This manual is designed primarily to guide municipal officers responsible for the collection and disposal of solid waste. Although based on practical examples mainly from South-East Asia, it is an important reference document for solid waste management in all DCs. It describes methods of waste sampling, refuse storage, collection, transportation and final disposal in general use throughout the South-East Asian region at the time the book was published. Composting and compost utilization is discussed in great detail. The author suggests that technical literature from the West is not directly applicable to DCs. Cultural differences, lack of capital and waste characteristics need to be considered when planning a solid waste management system. The importance as regards the introduction of a labour-intensive system with the use of indigenous tools and equipment is emphasized. Costs should be kept within local budgets. The manual underlines the fact that since

there are no universally applicable solid waste management systems, every country and city must evolve its own technology based on the local indicators, aspects and conditions.

Urban Solid Waste Management, ***Pescod, M.P. ed. (1991), Florence-Grassina: IRIS Institute for the promotion of International Health Actions and WHO/EURO World Health Organisation's Regional Office for Europe; Address: Via Campigliano 90, I-50015 Grassina/Florence, Italy, 266 pp.,*** *Price US$ 170.00.*

This handbook describes, in an updated comprehensive manner, the most important components and key aspects of conventional urban solid waste management with a slight slant towards European conditions. It begins with discussions on programme planning, public health and safety risks to justify the need for planning and implementation of reliable solid waste management systems. The following sections deal with the standard components of waste composition and analysis, collection and transport, incineration, composting, sanitary landfill and other treatment and disposal methods, as well as hospital waste management. The following two sections deal with managerial and social aspects. The last chapter focuses on future trends in solid waste management. It includes most important issues such as current strategies and their limitations, recycling, recovery and waste reduction, future strategies for minimizing environmental and health impacts, including future research requirements.

Although important aspects regarding common constraints in third world cities are not sufficiently discussed, this handbook provides a valuable sectorial information basis to solid waste managers not only in European cities but also in metropolitan urban areas of economically less developed countries.

These publications are available from the publishing organizations or international book sellers

CALL FOR INFORMATION AND OTHER IRCWD NEWS

❑ Solid Waste Management

As you can learn from the article "Municipal Solid Waste Management in Developing Countries: Problems and Issues; Need for Future Research", inadequate service coverage of the population in low-income urban areas has been identified as one of the main problem areas. In view of the chronic shortage of financial resources in the municipal budgets, **community-based primary collection schemes** (perhaps combined with recycling and decentralized composting activities) seem to be a most promising approach for improving this situation prevailing in most cities of the developing world. This basically means that the people in low-income communities assume the responsibility of the municipality with regard to the handling of their garbage and set up of a system appropriate to their economic situation. Such types of community-based waste management schemes, involving the participation of local communities in the collection, sorting and recycling activities, have been tried out over the past few years in different places in Latin America, Africa and Asia. However, very little has been reported on the experiences so far. To learn how, why and under which conditions such systems can be established and operated successfully, IRCWD is looking for any **information dealing with community-based solid waste collection systems which are either still in operation or which have been tried out but stopped functioning**. We are also interested in collaborating with people and institutions interested in setting up and testing pilot schemes.

Furthermore, IRCWD also plans on being actively involved in research on **decentralized composting** as a means of minimizing municipal solid waste quantities to be transported and disposed of and, consequently, of avoiding costs. A third area in which IRCWD is interested in collaborating with individuals/institutions is in the development of **"realistic" guidelines for the safe landfill disposal of municipal solid waste** by taking into account the basically different physical and economic situation prevailing in DCs.

We would highly appreciate your help in informing us of any community-based solid waste collection scheme which is still in operation or which has been tried out but abandoned. Please also let us know if you have any information on small composting plants. We are interested in specific information as well as in contacts with people/institutions working actively in this field.

We are looking forward to your reply to:

Werner P. Meyer, IRCWD
Tel.: + 41 - 1 - 823 50 25
Fax : + 41 - 1 - 823 50 28

❑ Septage and Nightsoil Management ("SNM")

IRCWD is engaged in a new applied research project on **septage** and **nightsoil management** in **developing countries**. We wish to address the **technical, organisational, cultural, environmental, and health aspects** related to the emptying, transport, treatment, and final disposal or use of faecal sludges from septic tanks and latrines. The impulse came from our own observations made during our visits to DCs, from informal discussions with people directly concerned and/or having to deal with septage and nightsoil on a day-to-day basis, and from observations and experiences made in some of the other activities of our Centre. They are notably projects on pit emptying technology, human waste reuse and municipal solid waste management. We consider the septage management project to be complementary to them.

Similarly to the other IRCWD R+D activities, the objective of this new project is to find solutions which are well embedded in the local socioeconomic context, and therefore also sustainable.

We shall first carry out a **state-of-the-practice** and **knowledge** review since we know that septage and nightsoil management are creating, in many places, significant problems. We know only little particularly about the **causes of the problems** and the **prevailing conditions** in which septage management is embedded. By the state-of-the-practice review, which forms the **first part** of the project, we hope to gain a better understanding of these causes and conditions, and to identify the specific R+D activities in which IRCWD may later engage itself.

Depending on the outcome of the "armchair" review, this first phase may also include observation visits to selected towns and cities. This would allow us to enter into direct and personal contact with those responsible for the planning, execution and control of septage and nightsoil disposal, and to wet our own feet! It will also help us identify potential places and institutions where we could jointly carry out pilot or demonstration projects planned in the **second part of the project.**

The search for published literature on the managerial aspects of septage and nightsoil is likely to only yield few results since little has been written about such day-to-day problems, which are often difficult to grasp and professionally rather unattractive. Therefore, we are sending out a **call for information** to all those who have their "feet in the sludge" or who are in other ways linked to urban septage and nightsoil management aspects, e.g. municipal authorities, non-government organisations, external support agencies, universities, or private contractors in charge of septage collection and disposal. We are interested in **case studies and appraisal material about SNM schemes** and would, at this stage, very much appreciate receiving answers to the following few questions:

- How are septage and nightsoil dealt with in your city or country; i.e., their emptying, transport, treatment, disposal or use ? How high is the percentage of unserved areas and improperly discharged septage and nightsoil ?
- What institutions are responsible for SNM ? Are septage and nightsoil collection and disposal partly or fully contracted out, or are the authorities handling them with their own infrastructure ?
- Do you have regulations governing SNM, particularly the treatment and disposal of septage ? Are they adhered to and enforced ?
- What are the major problems of the scheme or schemes you are dealing or familiar with, and what might be their causes ?
- What would you change if you could ?

Documents, information and contacts on this particular subject should be sent to:

Martin Strauss, IRCWD
Tel.: + 41 - 1 - 823 50 20
Fax : + 41 - 1 - 823 50 28

❑ Roughing Filtration in Water Treatment - An Old Technology with a Great Potential

(International Workshop in Zurich, June 25 - 27, 1992)

The International Reference Centre for Waste Disposal (IRCWD/EAWAG) organizes in collaboration with the Swiss Federal Institute of Technology (ETH) a Workshop on Roughing Filtration under the patronage of the Swiss Gas and Water Industry Association (SGWA), the Swiss Development Cooperation (SDC) and the World Health Organisation (WHO). Host of the venue is the Water Supply Zurich.

The International Workshop concentrates specifically on roughing filtration in water treatment. Roughing filters are used primarily for solids separation and can, to a certain extent, also achieve a microbiological and chemical improvement of the water quality. In Europe they are used as gravel filters in combination with slow sand filters, particularly in artificial groundwater recharge plants. The presentations of the first day will basically focus on this application and will be illustrated by case studies from Germany, Austria and Switzerland.

Over the last few years, roughing filtration was thoroughly studied in various DCs. New filter designs capable of treating in combination with slow sand filters even highly turbid surface water have been developed and successfully applied in these countries. This new technology of intake filters and horizontal or vertical-flow roughing filters will be described in detail on the second day of the workshop and their practical application will be presented by experts from Colombia, Peru, Ghana, Tanzania, and China. As a result of increasing energy prices, these innovative technologies could constitute, in the long run, potential treatment processes also for rural water supplies in industrialized countries.

Visits to two gravel filter plants in Switzerland will be organized on the second and third day of the workshop. The workshop, which will be held in German and English with simultaneous interpretation in either language, addresses a broad public: Water works managers, public institutions, consulting engineers working at home and abroad, as well as field workers will be equally interested in the topic.

Information about the Workshop can be obtained from:

Martin Wegelin, IRCWD
Tel.: + 41 - 1 - 823 50 19
Fax : + 41 - 1 - 823 50 28

RECENT IRCWD PUBLICATIONS

Human Waste Use in Agriculture and Aquaculture - Utilization Practices and Health Perspectives by Martin Strauss and Ursula J. Blumenthal, December 1990, 327 pages, 77 photos (IRCWD Report No.08/90).

The publication reviews available information on the practices of excreta and wastewater use in agriculture and aquaculture in Latin America, North Africa Western and South-East Asia. It is addressed to planners, decision-makers, support agency officials, and any others interested in the various aspects of human waste use. The information is based on the team's own observations and discussions held with farmer owners and farm workers, scientists, officials and other professionals as well as on documents received during visits made to the various countries between July and December 1985. Reuse cases covered are from Argentina, Chile, Guatemala, Mexico, Peru, Tunisia, Saudi Arabia, India, Indonesia and South Korea.

Following an introductory chapter on the resource potential and health risks of human waste use and on a review of health protection measures, the case material is presented under four main headings, viz untreated and treated wastewater use in agriculture, excreta use in agriculture, wastewater use in aquaculture and excreta use in aquaculture. These main chapters are summarized individually.

The cases are structured so as to cover the historical perspective of the specific practice, the waste use pattern, institutional and regulatory aspects and the health dimension. In each case, the health dimension is discussed with respect to the current health protection status and the potential health risks of the practice. The authors give their views regarding possible remedial actions which might be apt in the particular context to reduce health risks attributable to the reuse practice. Also provided in each case study are the acronyms of relevant organisations in the country dealing with waste use, a map of the country, geographic and demographic information, and bibliographic references. Annexed to the publication is a non-exhaustive list of addresses of institutions and persons dealing with the health aspects of excreta and wastewater use.

The publication is available at SFr.35.- from SKAT, Swiss Centre for Appropriate Technology, Tigerbergstrasse 2, CH-9000 St.Gallen/Switzerland.

Human Waste Use in Agriculture and Aquaculture - Utilization Practices and Health Perspectives - Executive Summary (Martin Strauss and Ursula J. Blumenthal), prepared by M. B. Pescod for IRCWD, December 1990, 52 pages, 15 photos (IRCWD Report No. 09/90).

This publication is a concise review of the above IRCWD Report no.08/90 and serves as a ready reference to the subject. The readers are provided with quick overviews of the wastewater and excreta use practices in the countries covered and of the health implications of those practices.

The publication is available free of charge from IRCWD, Ueberlandstrasse 133, CH-8600 Duebendorf/ Switzerland.

Editors:
Brigitte Hauser and Sylvie Peter
"IRCWD NEWS"
Swiss Federal Institute for Water Resources and Water Pollution Control (EAWAG)
Ueberlandstrasse 133
CH-8600 Duebendorf / SWITZERLAND