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Basic sanitation technologies suitable for smaller European communities

Report on a WHO Working Group

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WHO WORKING GROUP ON BASIC SANITARY TECHNOLOGIES FOR SMALLER EUROPEAN COMMUNITIES

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1. INTRODUCTION

The World Health Organization Regional Office for Europe considers that the first priority in its environmental hygiene activities should be the control of chemical pollution of industrial origin, but rectification of shortcomings that still exist in basic sanitation should not be neglected. For this reason the Regional Office for Europe convened a small expert consultation in Copenhagen in December 1976 to identify these shortcomings. The conclusions of the meeting were then used to plan activities under project ICP/BSM 003 "Basic sanitation for European communities".

The participants in the expert consultation considered that the shortcomings in basic sanitation in Europe were chiefly to be found in geographically handicapped regions, rural areas and small communities, but were also found among large communities in southern countries. They also considered that the difficulties observed in small communities were due to a lack of skilled technical staff, equipment and financial resources, and finally to use of wrong technologies.

In the light of these conclusions it was recommended that the Regional Office for Europe convene, as part of its activities in this sphere, a working group to collate the experience of different European countries and identify the sanitation systems most suitable for the conditions encountered in small communities of the European type.

In the meantime, the Thirtieth World Health Assembly in Geneva in May 1977 adopted resolution WHA30.33, which recommended that the World Health Organization undertake a "rapid assessment" of the situation of drinking-water supply and sanitation in all Member States. This exercise was carried out in 1977–78 and yielded the following general results: some 90% of people in the Region have a satisfactory drinking-water supply, but only half of this population has adequate waste disposal facilities. In northwestern and eastern Europe the portion of the population without proper sanitation lives mainly in rural areas and small communities. In southern European countries a large proportion of the urban population has no better facilities than the rural population. Thus, the "rapid assessment" provided additional grounds for the Organization to

convene the Working Group, which the French Government agreed to host at the National School of Public Health, Rennes, and which the French Ministry of Health and Family Affairs generously agreed to finance through a voluntary contribution.

The Working Group opened on 6 November 1978 under the chairmanship of Dr J. Pietrapiana of the French Ministry of Health and Family Affairs. The meeting brought together 22 participants and 13 observers from 12 different countries, with French as the working language. Its scope and purposes were as follows:

— to identify the characteristics of smaller European communities and to deduce from them the specific problems involved for basic sanitation services;

— to submit recommendations on hygiene specifications for small communities to be observed in monitoring drinking-water quality, the establishment and operation of sanitation equipment and for the cleaning of streets and public places;

— to identify and lay down the most suitable technological procedures for the disposal and treatment of waste waters and for the collection and treatment of household refuse for smaller European communities;

— to compare solutions adopted for the grouping of smaller communities and recommend the best systems of grouping to make the three public services, drinking-water supply, waste water disposal and solid waste disposal profitable and technically efficient, either separately or together.

2. DISCUSSION AND CONCLUSIONS OF THE WORKING GROUP

2.1 General characteristics of smaller communities

In its work the Group considered as being small communities hamlets, villages or isolated towns with less than 5000 inhabitants, but it did not study the separate case of dwellings or buildings situated far outside settlements or built-up areas.

The geographical situation of the communities is of key importance for sanitation, and several different types may be identified:

— communities close to large built-up areas with which technical cooperation may be arranged;

— communities close to one another in areas where the population density is relatively high, for which joint facilities may be planned;

— small isolated communities which have to be dealt with independently.

As mentioned above, the small communities generally lack technical facilities, financial resources and skilled personnel, all of which must be taken into account in developing sanitation policies. However, the sanitation problems encountered in such areas also show that in rural areas where population density, and thus amounts of wastes per hectare, are low, pollutant disposal techniques and slow waste-conversion procedures may be used.

In rural areas the problems of wastes of human origin are compounded by those of agricultural or animal origin.

2.2 Liquid waste disposal technology — criteria for selection

The chief goals of sanitation are to ensure family health and protect the environment while conserving available resources.

There are various types of individual and collective collection, disposal and treatment systems, that can be tailored to fit various types of economic capacity for use with water of different types.

2.2.1 *Individual sanitation systems*

General

Individual sanitation methods are patently the most suitable ones for low population density areas. Where they are well chosen, of the correct size and carefully installed and operated, the concentration of domestic liquid wastes and discharges at one spot in the environment can be avoided.

Individual systems

Individual systems may be used to collect and remove liquid wastes to a safe distance to eliminate direct or indirect contamination risks for minor groups of buildings (hotel, school, farm, etc.). Such systems treat and

return to the environment substances that can be taken up by the latter and do not harm it.

Individual sanitation systems can be divided into so-called dry systems, which do not require running water, and those that do.

The development of individual sanitation policies must include the training of users in both the installation and the operation of such systems.

It is also recommended that an authority supervise the installation of individual sanitation systems and the community take at least partial responsibility for monitoring and maintenance of them. Even where privately owned, they should be inspected by the health services annually.

As individual sanitation is a technical system in its own right, it should receive technical and financial public assistance proportionately as large as that granted to community sanitation.

(*a*) *Dry systems.* Such systems normally deal with the waste waters which emanate from privies and are considered to be the most dangerous to health. The main types are:

— latrines;
— honey buckets/bags;
— closed tanks (cesspool/cesspit);
— chemical toilets (chemical tanks);
— compost toilets.

Latrines are the simplest and cheapest system. They are often the first step in establishing a sanitation infrastructure. The World Health Organization has developed recommendations on them that remain applicable today.

Primitive solutions of this type solve only some of the health problems and other more hygienic and aesthetic systems must take their place when a rise in living standards makes it possible for more substantial financial resources to be devoted to sanitation.

Sanitary tubs are still used in certain countries, particularly in the modern form of honey buckets/bags. These enable inside privies to be used in very cold climates.

At the same time, they create high health risk during collection and transportation because of the number of handling operations involved. Because it is so important, studies should be set in motion to limit risks and to enable honey buckets/bags to be properly used in regions where other systems appear impracticable in the present economic situation.

Sealed tanks could be recommended if waste and household water could be collected together. Systems of this sort require a very well organized collection disposal and treatment procedure for the wastes involved.

Chemical toilets (chemical tanks) are generally effective in removing the source of contaminants. However, they have two major drawbacks: the

handling of chemical substances is often a dangerous procedure; and treatment to eliminate toxic disinfectant residues is a problem.

Such methods should be set aside for clearly specified uses and they should be prevented from coming into widespread employment.

Generally speaking, dry systems are used for waste waters from toilets, but are not sufficient for collection or treatment of tap-produced waste water, where the quantities produced increase with rising living standards, particularly when various types of washing machine come into use. At that point sanitation methods should be modified to suit the new circumstances.

(*b*) *Water systems.* In all countries, a system that uses water-flushed privies and passes domestic waste water into a septic tank is the most widespread and can be considered as being the basic individual sanitation system.

A septic tank is a sealed and covered apparatus which collects, settles and gives initial anaerobic treatment to the organic matter contained in effluent, most of the organic matter thereby being liquefied.

The septic tank must include a purifier treatment element and a water disposal system. In most cases both functions are performed by an underground dispersal bed.

The system generally provides very satisfactory sanitation when installed and maintained in line with certain criteria:

— it is recommended for treating all domestic water, i.e. water containing sewage and water from the tap;

— the septic tank should be large enough to ensure that solid elements are separated properly and undergo prolonged fermentation;

— the water must flow into the tank smoothly and flow out without taking with it the contents of the tank; the tank must have ventilation;

— the most important point concerns the system of treatment and elimination of water; the underground dispersal field must be designed to suit the characteristics of the soil used.

The prime technical problem is to decide on the suitability of soils for underground dispersal.

On the one hand, the soil must be able to absorb the amount of liquid released into it, which involves calculating the permeability of the soil and determining the highest level of the water-table; and on the other, the activity of microorganisms in it must be sufficient to eliminate pollutant substances and, in particular, pathogens. Numerous studies of these problems have recently been conducted or are at present under way. Their

results should be given the widest possible dissemination and a review of the various techniques should be compiled.

The suitability of different soils for such purposes must be examined in areas where new individual sewerage systems of this type are planned, for example on small building sites and, where the soil is not suitable, other sanitation techniques must be used or the planned systems must be modified.

With regard to maintenance, the simplicity of the technique must not be a reason for dispensing with inspections, which would sooner or later lead to malfunctioning of the septic tank and the cleaning system. Inspection should include annual examination of the system and periodic emptying of the tank, the frequency of which must be governed by the latter's condition.

Sludge

Individual sanitation systems produce sludge and slurry, which must be periodically removed from the system. An individual sanitation policy must include provision for the collection and treatment of such substances. To this end, sludge disposal schemes may be drawn up by geographical area, to provide centralized collection arrangements for accumulated sludge and for treating it at selected sites.

In producing such schemes, the most accurate understanding possible is needed of:

— the origins and quantities of the sludge to be collected;

— collection parameters (available equipment, distances that may be travelled, etc.);

— existing facilities for its reception and treatment.

New installations must take acount of:

— programmes for developing sewage plant networks in areas still not served;

— the foreseeable spread of built-up areas;

— the hydrological features of the area concerned;

— economic considerations.

The complexity of the problem normally means that any such scheme must be drawn up in collaboration with the sanitation authorities, representatives of communities or users and collection and treatment system managers.

Techniques for use in treating sewage sludge are of various types, but must incorporate the following main characteristics.

(*a*) *Discharge at sewage works.* This is only practicable with larger facilities (in terms of present experience, at least 10000 pop. equivalent).

Moreover, the sewage plant must not be overloaded and must be in good working order. It must have a settling plant allowing storage of the sludge and making it possible to control the rate of input into the plant.

Depending on the type of plant, experiments must be conducted to assess the effect of different quantities introduced on the performance of the facility.

It is generally recognized that for conventional biological sewage treatment plant the ratio of the total sludge input to the total plant capacity must be less than 3 : 100 and that the biochemical oxygen demand after five days (BOD_5) from sludge fed in must be less than 20% of the total admissible BOD_5 load for the given plant.

(*b*) *Discharge at mains sewerage inlet pipes in sewage treatment plants.* This solution is an exceptional one and can only be employed if the above technical parameters for the sewage treatment plant are respected.

This will involve preliminary agreement with those responsible for managing the network and sewage treatment plant, and supervision of the discharge procedures involved.

(*c*) *Processing of sludge in a sewage treatment plant digester.* For a heated digester, the overall admissible daily input of sludges is about one twentieth of the digester volume.

Preliminary experiments can be conducted to obtain the most accurate assessment of capacity, depending on the region and the operating conditions of the different facilities.

(*d*) *Intermediate sludge storage.* This is a purpose-built, open-air site (containing separated settling ponds, enclosures, sedimentation tanks, etc.), designed to receive a given volume of sewage sludge and allow it to break down and dry out satisfactorily without creating a nuisance for the surroundings.

Experience shows that such systems provide good treatment. They must be located on sites that provide every guarantee for the protection of groundwater. Design and operating regulations must be closely supervised.

(*e*) *Composting with household wastes.* This technique is of interest, mainly in the light of the high water content of sludge. Procedures for using it should be experimented with and followed up with particular care.

(*f*) *Discharge at controlled domestic refuse dumps.* This practice requires that the site for a dump be selected with greater care than where household refuse alone is treated.

2.2.2 *Communal sanitation systems*

Whether public or private, communal sanitation systems gather waste water, sewage and household water, and in some cases, rainwater, and bring it to a central collection point.

Networks

The older networks for small communities generally developed from rudimentary systems for rainwater disposal, initially through drains and later pipes; these were then transformed into combined wastewater systems as a result of people making either clandestine or tacitly permitted connections of sewerage or septic tank effluent to them.

The following disposal systems can nowadays be distinguished:

— *the separated system*, which removes waste water by separate piping, with rainwater being collected in separate piping or by street guttering or drains; this second solution is recommended where the pattern of settlement is highly scattered, the ground has low permeability, and where runoff is unlikely to cause water to accumulate at sensitive places in the community.

— *the quasi-separate system*, which consists of a network for piping of wastewater and some runoff (from roofs, courtyards, etc.) as well as a network for piping of rainwater or its removal by street guttering or drains, the advantage of this system over the separate system being that it reduces the number of rainwater collection sumps.

— *the combined system*, where pipes collect both waste water and rainwater.

In every case there is a need to ensure that direct discharge of rainwater or overflows from a mixed system do not create any problems for the surroundings into which they are discharged.

Selection and techniques of treatment

(*a*) *Importance of selecting a treatment system.* For small communities it is important to study the various constraints governing the selection of a procedure rather than studying in detail the various methods of treatment themselves. In practice, the scale of the treatment system can be calculated by checking that the figures given in the different parameters are not greater than currently accepted margins. It would not be worth while

using the optimum scale since, generally speaking, efficient characteristics are poorly known. Moreover, skilled personnel who can make a highly sophisticated system operate properly are often not available.

Thus, rationalization of sewage treatment plant capacities by a given technique is to be recommended since it may facilitate technical planning from the point of view of scale and may make it possible to select more standardized equipment, thereby facilitating maintenance.

The main factors to be taken into consideration in selecting a waste treatment system for a small community are the following:

Constraints linked to effluent characteristics. In certain cases effluent in small communities contains:

- an organic load lower than the figures obtained when the scale of the system was selected, which is connected with the way collection systems are introduced in phases and the time taken to connect users to a system;
- considerable dilution through seepage into the system of water from various sources;
- sharp variations in load resulting from small-scale undertakings of the industrial type;
- septic effluent from individual septic tanks still linked to the system;
- in some areas, seasonal variations.

Constraints linked to the situation of a particular community and to its prospects for development. These are of great importance when population growth or increases in economic activities are planned for the near future. The system must lend itself to adaptation at moderate cost. Moreover, the prospect of grouping the system with other communities or neighbouring towns, particularly in densely populated areas, must be examined. A particular problem exists in the case of communities subjected to seasonal fluctuations in population (tourism). The variations in hydraulic load and pollutant content must not endanger the proper operation of the system.

Constraint of site. Wherever possible, the selection of the site for the facility must keep construction problems to a minimum (stability of the terrain, areas liable to flooding, etc.), profiting where possible from slopes which allow gravity flow. This must be adapted where necessary to fit particular climatic conditions. Distance from inhabited dwellings must be ensured to guarantee the absence of nuisance (odours, noise, insects, etc.). The system must be fenced in. Landscaping may be necessary to ensure that the site blends with its surroundings.

Constraints linked to recipient area. One of the goals of treatment is to maintain or improve the quality of the location receiving discharges in order to permit certain uses to be continued. The quality goals established will make it possible to specify the degree of treatment to be carried out as well as the site and the mode of discharge. To this end, it is important to arrive at a better understanding of the quality of different types of recipient environment and to develop methods that can allow the impact of discharges into them to be estimated. For small communities, the recipient may be surface water, or soil. Dispersal fields should only be used for effluent that has already been clarified by preliminary settling.

Operating constraints. At the moment of selecting the treatment system itself, operating constraints must be analysed by evaluating the nature and degree of sophistication of the available technical support. Systems which require operation by highly qualified technicians or where repairs are costly will have high operating costs. The costs must also include those arising from slurry removal operations. Specifications should regularly include provisional estimates of operating costs set out in such a fashion as to permit comparison of different possible solutions.

Economic constraints. These are of particularly crucial importance in that the resources of small communities as a rule are limited and the cost curve for treatment systems tapers off as the numbers of users rise. There are therefore good grounds for paying particularly close attention to investment and operating costs. The criteria to be sought are simplicity of construction methods, minimization of electrical or mechanical equipment, and limitations on the amounts of sludge produced.

(*b*) *Main treatment systems suitable for use in small communities.* Pollutant matter present in water may float, or be held in suspension or in solution. For the purification process to be most effective, water should be treated in successive steps.

First of all the floating impurities and those held in suspension are removed; those in solution are then eliminated, except where the surroundings can have poorly treated water discharged into them without harm.

Subject to consideration of the above-mentioned constraints, the following is the situation of most small communities:

— an advanced degree of treatment before discharge is not required;
— there is sufficient land available;
— financial resources are limited;
— there are no highly skilled staff to operate the system.

All these factors imply the adoption of lagoon-type treatment.

This extensive treatment approach should be the subject of further study and research to widen its field of application by improving design and layout, behaviour in different climatic conditions, and performance.

In cases where intensive treatment proves necessary (insufficient land available, more sophisticated treatment required, or where the lagoon approach is ruled out for technical reasons), so-called "bacteriological" or soft aeration techniques are recommended.

None of these techniques poses major operating problems with regard to sludge accumulation.

Unless there is particular reason for doing so, disinfection of waste water before discharge does not seem to be advisable.

2.2.3 *Conclusion*

Individual sanitation systems are considered to be the most suitable for small communities where the population density is low.

However, installation of such sanitation systems is generally incompatible with the use of individual wells for domestic water supply. Moreover, some of these systems may not be installed within the catchment areas of community water supply systems.

For more densely populated communities, the choice between individual or communal sanitation must take account of the loading capacity of the recipient, including ground discharges, but should also take account of the overall costs, namely: investment and operating costs, with provision, where individual sanitation is used, for the means and costs of collection and treatment of degradable material and, where communal sanitation is installed, for sludge removal costs.

In community sanitation, the techniques ensuring optimum conditions of public health and environment are those of extensive treatment or otherwise intensive "bacteriological" or soft aeration treatment.

Finally, the two approaches, individual and communal, may be allowed to exist side by side in some cases.

2.3 Solid wastes

Household refuse and solid waste collection and treatment systems are being gradually established for small communities in the European Region, but widely varying systems exist in different areas. Nonetheless, where the service has existed for some time the methods adopted and the equipment used are becoming increasingly standardized in countries, and this process should be continued.

The following remarks may be made with regard to the collection and disposal of solid waste in small communities.

2.3.1 *Need for grouping*

Outline plans have been drawn up to establish major groupings (up to several tens of thousands of population or sometimes even hundreds of thousands) to permit satisfactory solid waste disposal even in areas of low population density. This type of centralization is made all the more easy because waste collection is conducted by transport (in most cases, road vehicles) and does not presuppose fixed infrastructures.

2.3.2 *Nature of wastes and their appearance at times of collection*

The composition and amount of refuse depends on the frequency of collection and on the potential possessed by users for utilizing degradable wastes in their gardens or farming operations.

Moreover, in some countries, the rise in living standards in rural areas has been leading to the large-scale production of highly obtrusive scrap and rubbish, e.g. electrical household goods, commercial or minor manufacturing rubbish. Collection of such wastes has become essential in order to avoid the proliferation of illegal dumping that damages the environment and is a cause of poor hygiene.

Rural areas seem open to the introduction of selective collection systems, although no move should be made until there is proof of the efficiency of such an approach, particularly in built-up areas where materials that can be recycled are present in larger amounts.

As in urban areas, care must be taken to prevent refuse awaiting collection from causing a nuisance or being dispersed by animals.

Where collections are infrequent, the use of sealed receptacles, such as bags, is recommended.

2.3.3 *Frequency of collections*

On economic grounds, the frequency of collection in small communities is more widely spaced than in built-up areas, but for reasons of hygiene this should never be less than once a week or even twice a week for areas in the south during the hot season.

2.3.4 *Equipment*

Specialized vehicles for rural areas have been reported but the general practice seems to be to use the same types of vehicle as are employed in built-up areas, which makes it possible, as a side-benefit, to use mass-produced and mass-maintained refuse collection trucks of the same type as those used in towns.

Multipurpose vehicles or trucks or even carts are only occasionally employed and they cannot be considered satisfactory from a hygiene standpoint unless the refuse is contained in hermetically sealed receptacles such as sacks.

In the smaller communities of Europe there are many preliminary collection systems. Members of the community take their refuse to a central collection point often made up of standardized mobile garbage containers of the type used for blocks of apartments in towns. Other systems may be used: skips such as those employed in public works or on building sites, specially selected dumps, etc.

Whatever the approach used, the system must incorporate provision for their maintenance; otherwise there is a high risk that they will very swiftly constitute a nuisance. Public education and education of members of local authorities is essential.

Elsewhere, the establishment of intermediate collection points makes it possible to bring together refuse collected from different communities or pre-collection points in considerable quantities and then to use large transporters (semi-trailers, rail, ship, etc.) to deliver it to the treatment centre. Practices of this type are already widespread in the European Region, even in rural areas.

2.3.5 *Treatment*

Uncontrolled dumping must be eliminated.

At the very least treatment must take the form of a *controlled sanitary landfill.* A dump of this type must be properly designed and fenced off, and the refuse must be covered with landfill or other material. Its location should take account of groundwater flows. Its operation must be properly supervised so that it does not revert to an uncontrolled dump. One way of providing supervision and ensuring effectiveness is to limit the number of such dumps and to increase their capacity.

Composting is a method to be recommended since refuse can be recovered and reconditioned, but for this to be done the quality of the end-product must be guaranteed and the existence of an outlet secured before any decision is taken. The establishment of standards or regulations governing such compost can be useful to that end.

This technique can yield a high quality product and although the likelihood of glass and plastic fragments being present in large amounts has often been referred to, experts consider that these can be removed or their effects avoided.

The *discharge of segregated and chopped refuse* is particularly suitable for groupings of small communities, if only because the installation can be more easily maintained and refuse later recovered for agricultural use.

For subsequent agricultural use it is also possible to crush and screen material from refuse that has not been precrushed. All that has to be done is to wait some time for the refuse to break down enough. The end product cannot be so easily commercialized as compost.

Apart from areas where major groupings exist, it seems at the present state of knowledge that *incineration* is not particularly suitable for the normal circumstances in small communities in the European Region. The varied nature of refuse and its different physical and chemical properties make it very difficult for low-capacity, irregularly operating furnaces to work well. On the other hand, compost refuse incinerators and individual types of incinerator for commercial refuse and hospital waste, etc., provide satisfactory performance.

2.4 Highway cleaning

Small communities should be grouped together with the neighbouring town or towns for the purposes of highway cleaning. This operation can be placed in the hands of the department dealing with solid waste disposal.

When such a solution cannot be adopted, insufficient financial resources will prevent the community from taking charge of cleaning its public highways. In such a case, those responsible for properties bordering the highway have to take charge of cleaning the streets outside their buildings and houses, where necessary including snow removal (the pavement plus one half the width of the public highway or a portion of a square).

Since this is heavy work, street cleaning should be mechanized as much as possible. The cleaning department should have mechanical equipment and a fleet of vehicles that can be used for different purposes according to season.

In most cases the equipment employed in major urban areas can be successfully used in smaller communities, the dimensions of streets and roads permitting (attention to street width is particularly relevant in the oldest communities).

Highway cleaning activities must be planned for each season according to the work force available, the equipment that can be used, the vehicle fleet, the surfacing of highways, climatic imperatives or public demand, etc.

From a sanitation standpoint, highway cleaning results in the production of increased volumes of solid wastes, with sweepings being added to household refuse, and in the overloading of rainwater conduits with washing water and accompanying solid matter.

Due stress should be given to the link between the proper cleansing of gutters, the unblocking of drains and the proper functioning of rainwater conduits.

2.5 Water for human consumption

2.5.1 Installations

The inhabitants of smaller communities obtain their water supplies from:

— private sources (well/spring),
— collective sources (well/spring) with standpipe,
— piped water supply.

The design and installation of such systems must be in accordance with the health rules laid down by the country's health authorities and must respect the recommendations made in this field by the World Health Organization. The health authorities must be consulted over new plans or on the modification of existing installations.

The most important problem in this regard in the smaller European communities is water quality monitoring.

2.5.2 *Importance of water quality monitoring*

Generally speaking, water quality monitoring can be described as the periodic and regular evaluation of the general condition of every aspect of water supply systems and the physical, chemical and bacteriological characteristics of water for human consumption.

Monitoring includes:

(*a*) sanitary inspection consisting of inspection of different parts of the water supply system, including the water resources catchment area, collection facilities with associated equipment, protected areas, treatment plant, storage basins, water supply and distribution networks (during visits, rapid analytical tests may be conducted for indicative purposes); and an examination of operating conditions liable to influence different parts of the distribution network and water quality, with particular reference to products employed, network management, intercommunication between different networks, cleaning of reservoirs and pipes, conditions governing work on such networks, disinfection, skills of personnel and size of work force;

(*b*) water sampling in quantities at specific points in the network sufficient to obtain satisfactory analytical results, such samples being transmitted to a laboratory for physical, chemical and microbiological evaluation;

(*c*) examination of the conclusions of visits and the results of analyses, and the recommendation of suitable measures where water quality is threatened or inadequate.

All data collected must be properly filed so as to assist in such examinations, take into account situations that have occurred in the past and follow trends.

2.5.3 *Adapting monitoring to the circumstances of small communities*

Irrespective of the type of water supply (individual or communal standpipe, public supply), the health inspection of installations and monitoring of their mode of operation and maintenance must be obligatory.

With community water supply networks, health inspection must include, wherever and whenever local conditions permit, sampling and analysis of water samples. This is particularly necessary when raw water for human consumption needs physical or chemical treatment. A laboratory is essential for these analyses to be carried out.

The tests and interpretation of their results are conducted according to the regulations of each country, or, where these do not exist, by reference to the recommendations of the World Health Organization.

If local conditions do not permit the latter to be applied, it is recommended that, at the very least, bacteriological tests be performed to investigate and calculate the quantity of faecal coliforms, with the sampling being conducted at individual fixed points of the water distribution system.

Where there is a possible risk of organic pollution, monitoring should be supplemented by summary chemical tests, covering at the very least the strength of the following ions: ammonia, nitrite, nitrate, chloride.

2.6 Operation and maintenance problems — need for training and education

Proper operation and maintenance of the installations described above are essential if hygiene standards are to be observed.

As the smaller communities have few resources, this fact must be taken into account in the selection of the technologies employed and the design of installations and apparatus.

In addition, the work of personnel should be made easier by protecting their safety and health. Similarly, access to the various installations, sometimes located far from the centre of the communities, must be provided (access road or approaches, snow clearance, transportation of equipment and supplies, etc.).

As those engaged in this work are often not specially qualified but perform a variety of functions in the community, they must receive training for the purpose.

Generally speaking, as smaller communities pose specific problems, professionals in this area and the decision-makers should be informed of them and of particular solutions already tried out. To this end, visits may

be conducted, training courses organized, and the results of trials disseminated.

Technical manuals must be drawn up for design work and the relevant technologies be described in detail, including their practicable ranges.

In addition, when a system is introduced into a small community, training must be given to users to teach them the hygiene rules to be observed and the precautions to be taken in using wells or assembling household refuse for collection.

2.7 Grouping of communities

Apart from specific geographical regions with low populations such as the subarctic regions, arid areas, mountains and small islands, the various small communities in Europe must group themselves to ensure joint provision of the different services.

Depending on the nature of the sanitation operations under consideration, the community group or associations of small communities can take responsibility either for initiating and conducting joint activities (mains drainage systems and intercommunal treatment plants, household refuse disposal and collection centres), or for carrying out particular operations in each locality.

In most cases, grouping will prove to be easier and more effective on a sector by sector basis. This is because the three different services described hereunder are in practice very different, namely:

— drinking-water supplies have the goal of providing a population with water from a limited number of sources either by gravity flow or under pressure over a distance that can be as high as several score or even hundreds of kilometres;

— the removal and treatment of waste water consists, where community sanitation is concerned, in collecting and removing waste water to one or more treatment plants through pipes, i.e. fixed installations; such installations can rarely be more than a few kilometres long for both economic and technical reasons (the time effluents spend in the piping is a limiting factor);

— removal of solid wastes covers both their collection and transportation to disposal sites, these being the sole economic criteria limiting transportation distances.

In particular, grouping must make it possible to:

— plan the introduction of the requisite facilities;

— develop improved techniques;

— improve management, both technically and financially, which will reduce costs through more rational use of facilities, equipment and personnel.

These goals will be all the more easily attainable since:

— the grouping will result in a large enough population for it to be possible to adopt solutions designed for large communities and to set up a technical service of the right scale, that can carry out or direct studies and work and ensure that installations are properly operated;
— the grouping will be entitled to outside technical assistance that will operate independently of the monitoring and controls undertaken by the competent authorities and may help to provide the local staff with the requisite training;
— regulations governing the formation of such groupings will be clearly set forth;
— the way in which the necessary financial resources are to be spent will be well documented.

3. RECOMMENDATIONS

3.1 International action

The WHO Regional Office for Europe should:

— continue its activities relating to basic sanitation in rural areas;
— ensure wide distribution of the present report and of studies and technical documents on the problems of sanitation in smaller communities;
— collate all information on trials carried out by Member States on sanitation systems, particularly those of an individual type;
— convene a meeting on hygiene specifications for septic tanks, a matter that has not been discussed since the Third European Seminar for Sanitary Engineers in 1952, and include in its agenda the problems of operation, collection and treatment of sludge;

— undertake activities relating to extensive sanitation techniques suitable for smaller communities, and prepare a European manual on the subject;
— draw up a European manual on the operation of sanitation installations in small rural communities;
— inquire among Member States as to the conditions governing the grouping of smaller communities so as to make the installation of sanitation systems easier, review the different systems and disseminate the resultant conclusions; and, depending on the results of this inquiry, a working group may be made responsible for preparing a more thorough investigation of the technical, administrative and financial problems arising out of the establishment and day-to-day operations of such groupings.

3.2 Action by Member States

Governments of Member States of the European Region of the World Health Organization are recommended to:

— establish national reference centres for sanitary engineering;
— include health education in the general curricula of government schools;
— continue their efforts to increase the proportion of the population having proper sanitary facilities;
— introduce legislation or regulations allowing study of the different solutions that are possible from the technical standpoint for solving sanitary problems in small communities; and, at the same time, the policies pursued must take account not only of the design and introduction of facilities, but equally, their operation and the problems posed by their by-products (cesspool products, sewage treatment plant sludge);
— give due importance to hygiene factors in selecting sanitation facilities for smaller communities;
— allow sanitary engineering research institutes in the European Region to continue their studies to develop soft aeration techniques for waste water treatment as well as their research on combined composting of household refuse and sludge produced from waste water or drainage materials;
— encourage the self-financing of sanitation systems in smaller communities, especially for operating costs;
— continue their policy of regrouping smaller communities to improve the effectiveness of basic sanitary services (those responsible for

drinking-water supply, the treatment and disposal of waste water and the collection and disposal of solid wastes);

- step up the training of the technical staff of sanitary services in small communities;
- inform technical personnel and decision-makers of the particular problems arising in sanitation systems for smaller communities;
- make provision for the necessary staff and resources for health monitoring of smaller communities, including at least a system of health inspection.

The host government was recommended to transmit to the Regional Office for Europe of the World Health Organization the final results of a competition to standardize certain sewage treatment facilities to meet the sanitation needs in communities with between 400 and 5000 population-equivalents, so that Member States might be informed of the results.

3.3 Action at technician level

Technicians dealing with the basic sanitation problems in smaller localities were recommended to study them carefully and to develop suitable technologies, while taking into account the constraints governing the introduction and operation of such systems as a whole as well as those resulting from the generation of the consequent by-products.

Officers responsible for basic sanitation services were recommended to ensure the requisite hygiene and work safety standards for those employed at liquid or solid waste treatment stations.

Annex I

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Annex II

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