Ecological Sanitation Pilot Project in Palestine – a project appraisal

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INTRODUCTION

This is the report of an appraisal of the Sida-funded "Ecological Sanitation Pilot Project in Palestine". The appraisal was carried out during six days in September-October 2002 by a Swedish consultant, Uno Winblad, on behalf of the Swedish International Development Cooperation Agency (Sida) and the Palestine Hydrology Group (PHG). For Terms of Reference see Attachment 1, for Itinerary and Persons Met, see Attachment 2.

The purpose of the project is, according to the project document (PHG 1999), to test and demonstrate "an ecologically, economically and technically intelligent way of alleviating drinking water scarcity and community health problems". The specific objectives are:

1. *Conduct research on the applicability or modifications that need to be made on the operation of dry sanitation systems in this region.*
2. *Test the operation of dry sanitation models: community involvement and participation aspects, technical performance, financial benefits, management criteria.*
3. *Build the capacity of Palestinian sanitation professionals in operating and maintaining dry sanitation systems.*

The overall goal for Swedish support to the West Bank and Gaza is to contribute to the progress of the peace process where water is one of the issues. The Ecological Sanitation Pilot Project in Palestine should be seen as an exploration of a method to protect water resources and economize with the use of water.

The project has been severely affected by the current political, economic and military situation on the West Bank: the original physical targets have not been reached, unit costs have increased and the household installations have, contrary to what was stated in the project document of 1999, been heavily subsidized. In spite of all problems the overall purpose of the project has been reached. The project shows convincingly that at the household level an ecological sanitation system based on urine diversion can function very well in the Hebron area, that it saves water, protects the environment, is reasonably safe and that it is readily accepted by the users. The project has also through courses and demonstrations contributed to capacity building among Palestinian sanitation professionals.

This appraisal report outlines the background to the project, describes the findings and discusses the implications of a large-scale introduction of ecological sanitation systems in Palestine.

BACKGROUND

The main rationale for the project is the water situation on the West Bank: no fresh surface water, polluted springs, deteriorating groundwater, inadequate rainfall, insufficient water supply and high costs of water supply and wastewater disposal.

About 80% of the rainwater falling on the West Bank (average 350-450 mm/year but can vary from 0 to 1,000) is appropriated by Israel (Rabi 2002). Municipal piped water systems can provide only 45% of demand for the Palestinian population.

The water scarcity is aggravated by uncontrolled discharge of blackwater and greywater from Palestinian towns and villages and from Israeli colonies ("settlements"). Households without connection to sewerage network commonly discharge their wastewater to leaking cesspits. These pits are considered to be the main source of groundwater pollution on the West Bank. Only 30% of the Palestinian population on the West Bank is connected to sewerage networks. Most of the sewage collected by these networks is discharged into wadies and open land without treatment. Infiltrated wastewater can rapidly reach the aquifers through the many cracks in the rock structure. (PHG 1999).

The project's choice of an ecological sanitation system is also influenced by the climate. Although ecological sanitation can work under any climatic conditions, the hot, dry climate of the West Bank is ideal for a dry system based on urine diversion.

Another factor favouring the introduction of a dry sanitation system is the abundant availability of limestone powder from quarries and workshops in the Hebron area.

The development of the project must be seen in the light of changes in the security situation over the past two years. According to an Oxfam press release (Oxfam 2002) Israel's tightening of restrictions on the movement of Palestinian people, vehicles and goods since the second *intifada* began in September 2000 has resulted in widespread impoverishment, unemployment, chronic health problems and stress. Between 70 and 90% of the workforce is now unemployed, the price of water delivered by tankers has risen by an average of 80%, and many villages can no longer be reached by water tankers.

WORK PLAN

The project document as approved by Sida on 11 January 2000 (Sida-Inec-Urban 2000) envisages a research, development and demonstration project lasting 12 months with a total Sida input of 1.3 MSEK. The first household unit was completed in July 2001. The agreement has been prolonged several times within the original budget. The Work Plan is divided into the following five phases:

Phase 1 Project preparation, 9 weeks

Project report March-September 2000:

- Gert de Bruijne appointed Project Manager.
- Yousef Subuh appointed Project Coordinator.
- Ms Huda Gazavneh contracted as social and hygiene promoter.
- 1 pedestal imported from South Africa and 1 squatting pan from China.
- Prototype development.
- Basic hand-out in Arabic introducing the principles of dry sanitation to households.
- Home visits – met with more interest and less reservations than expected. Farm communities in Wad Sud interested in the reuse aspects. Interest in the reuse of urine.
- Household questionnaire tested in Beni Naim and evaluated by the Community and Public Health Institute.

Phase 2 Training of project personnel, 2 weeks

Report First Training Workshop in Palestine

- 2-day workshop in Beni Naim 20-21 May 2000.
- Aussie Austin, CSIR, S Africa, and Reem Musleh, Community and Public health Institute, Birzeit, hired as resource persons.
- A set of guidelines prepared:
  General procedure for practical implementation of the project.
  Design and construction guidelines for urine diversion sanitation systems.
  Operation and maintenance (user) guidelines for urine diversion sanitation systems.

Phase 3 Community participation, 4 weeks

Project report March-September 2000:

- Beni Naim and Wad Sud selected for the pilot project..
- Questionnaire tested in Beni Naim.
- Participating households selected and visited for discussions.
- Meeting about the project at the request of the Ministry of Environment.
- Agremment between PHG and the Arab Center for Agricultural Development about loans to households for toilet construction.
- Continued prototype development.

Phase 4 Project implementation, 14 weeks

Project reports October 2000-December 2001 + Project Document

- Implementation delayed due to deterioration of the security situation, travel restrictions, curfews etc.
- Due to significant decrease of household incomes families no longer able/willing to pay for improved sanitation or to take loan for this purpose.
- Project taking over most of the construction cost.
- Number of toilets completed and under construction by December 2001 = 18
- Number of toilets to be built according to Work Plan: initially 75, later reduced to 50.
- Target group was poor households in peri-urban and rural areas.
- The technical solutions were supposed to be economically feasible for such households.

Phase 5 Follow-up and evaluation.

See this Appraisal Report.

APPRAISAL MISSION

Methodology

The appraisal was originally supposed to have been carried out by two Swedish consultants. A last minute cancellation left the entire job to one person. As there was no time to find replacement or to extend the mission, full attention could not be given to each point in the terms of reference. Highest priority was given to visit as many project households as possible and to discuss various issues with the project staff. On all visits the Swedish consultant was accompanied by Mr Yousef Subuh, the Project Coordinator, who also acted as interpreter between the consultant and the household members.

During three days we visited 20 of the altogether 28 households with ecotoilets in use: 8 in Beni Naim, 8 in Wad Sud and Kresa in Dura Municipality, 2 in Alfawar Camp and 2 in Tafoueh. The purpose of the visits was to establish, through observations and interviews, if the new toilets were properly designed and constructed, if they were accepted, correctly used and maintained, how the output from the toilets was handled, and what kind of problems there were, if any.

Findings

Design and construction

The ecotoilets built in this project consist of a squatting pan for urine diversion, a short chute (Ø 200 mm), a lid, a drain for water used for anal cleaning, a urinal, a washbasin, and, below the floor, a processing chamber with access door and ventpipe. Each units is also supplied with a container for used toilet paper and a bucket for lime/ash, two or three 80-liter containers for faeces and a 20-liter container for urine. The unit is either placed inside the house, attached to the house or freestanding. Toilets located on upper floors have a chute down to the ground floor processing chamber.

The squatting pan has been specially designed for this project and is made in a ceramic workshop on the West Bank. The squatting pan (280x600 mm) is designed for urine diversion and is similar to the models designed and produced by the SanRes projects in China. As most Palestinians use water for anal cleaning (actually first toilet paper, then water), the squatting pan is designed to handle four separate streams: faeces, toilet paper, anal cleaning water and urine.

The squatting pan is equipped with a hinged lid that is supposed to collect the cleaning water. The lid is made of plastic. Via an aperture by the drop hole, see Appendix 4,

Figure 1, it diverts the water to a soakpit. This was the original idea. All the units have since been provided with a drain next to the squatting pan, see Appendix 4, Figure 2.

The urinal and the washbasin are standard models available in the market.

These components are installed in a bathroom with piped water and with tiled floors and walls. Many bathrooms have a hand shower placed low for anal cleaning.

The processing chamber is about 1x2 m wide and 0.6-0.8 m high, built of bricks and plastered. It has a sheet-metal access door towards the outside and a Ø100 mm ventpipe extending sometimes above the roof, sometimes just halfway up the outer wall of the house. The faeces are collected in a wide, low, plastic container. When one container is full, an empty one is placed under the drophole and the full container is stored in the processing chamber until the second container is full.

A standard bathroom wastepaper basket is used for toilet paper and a plastic bucket with a ladle for the lime/ash.

The designs are good, the construction of good quality and the finishing standards extremely high. The use of a special lid to collect and divert waste water from anal cleaning is a novel and interesting idea but probably not all that functional: Waste water from anal cleaning is likely to splash outside the rather small lid. The alternative design with a special drain in the floor is better and seems to be the one that most households prefer to use. It might be a good idea to provide a ceramic pan also for this purpose. With a separate drain for anal cleaning water there is no need for the special aperture in the squatting pan.

A processing chamber height of 0.6 m is the absolute minimum considering the large number of users of each toilet. The chamber should whenever possible be higher, preferably >1.0 m.

The ventpipe is supposed to extend 0.8-1.0 m above roof. But many houses have flat roofs used as terraces. In such cases the ventpipe is shorter and ends halfway up the wall. If this works, and there are no odours emanating from the drophole - well and good. But if the result is no or insufficient draft something must be done.(Draft can be checked with a simple smoke test: If a burning cigarette is held at the drophole the smoke should be drawn down into the chamber.) – The possibility of extending a ventpipe above the roof is something that must be considered already at the planning stage.

In one case (household #4 in Beni Naim) the owner mentioned that there were odour problems during winter. In this case the ventpipe is on the northern side of the house

and receives no sunlight. What might happen is that cold air in the ventpipe prevents a natural draft. Another possibility is that during windy days air is entering the vault through narrow gaps around the access door. In both cases air from the processing chamber may get into the toilet room through the drophole. A contributing factor could be that the ventpipe is short and reaching only halfway up the wall. – The ventpipe should be extended and the access door made tight. During winter the users should sprinkle a larger amount of lime/ash over the faeces. If these measures fail to solve the problem, a small fan could be installed in the ventpipe. – For new construction the ventpipe should whenever possible be placed on the sunny side (morning sun) of the building so that the air in the pipe will be warmed, rise and thus create a downdraft through the drophole.

Most of the units we visited were odourfree and showed no signs of flybreeding. From a few of the units in Wad Sud the contents of the processing chambers were damp and we could noticed a faint smell. The first measure in such a case must be to discuss the problem with the household members to ensure that the toilets are operated properly: no water or urine going into the processing chamber but plenty of dry lime/ash.

For a processing chamber placed by a southern wall it is possible to extend it outside the wall and provide a solar heated lid. This would increase the chamber's temperature, improve dehydration and contribute to rapid pathogen destruction.

Operation and maintenance

Operation and Maintenance (user) Guidelines were developed in Phase 2. They seem to be applied by the users as intended. Two or three trays are used in rotation, depending on the number of regular users.

The extremely dry climate of the West Bank facilitates the operation and maintenance of ecotoilets, so does the good availability of lime and the high standard of finishing of the toilet rooms. The use of water for anal cleaning was expected to be a complicating factor, and also the large number of regular users (up to 13) in some of the households. No major problems have been encountered though.

Recycling

Some households discharge urine and anal cleaning water into cesspits or septic tanks. Other households are using the urine (diluted with water) to fertilize tomatoes and olive trees. Many households have not yet emptied the processing chamber because the toilets have only been in use for a short time. Amongst those who had emptied the chambers some were placing the dehydrated faeces around olive trees, others were dumping it with household waste.

Recycling human excreta is the very essence of ecological sanitation. The first part of the project is now completed: a number of ecotoilets have been built and are being used. The second part of the project is "closing the loop" (Esrey 2001). The Hebron project is not completed until this has been done. Human urine is an excellent fertilizer. Peter Morgan reports (personal communication 30 October 2002) from his current research in Zimbabwe:

> *"As far as urine application is concerned, I am aware that there are many ways of doing this, each with its own merits. Currently I am using a simple formula of applying a mix of water and urine - ratio 3:1 - applied 3 times per week ... interspersed with normal watering. ... this amount of urine has had quite a big influence on plant yield. For lettuce over a 30 days period the yield doubled from 230 gms (water treatment) to 500 gms (urine treatment). In another case for lettuce over a 33 day period, the yield trebled from 120 gms (water treatment) to 345 gms (urine treatment). For spinach over a 30 days period the yield increased from 52 gms (water treatment) to 350 gms (urine treatment) - i.e. 7 times. Note the soils used in these trials are poor. For tomato over a 4 month period the yield trebled from 1680 gms (water treatment) to over 5043 gms (urine treatment) ...."*

Peter Morgan has noted that the application of urine on barren sandy soils is negligible, and may even retard growth. He speculates that this may be the lack of suitable bacteria in the soil to do the conversions from ammonia into nitrate. However when humus (for example from decomposed human faeces) is mixed with the sand then the influence of urine seems to be felt.

Similar studies should be done in the Hebron area so that positive results can be used to encourage ecotoilet project households to recycle their urine and the sanitized faeces. When plans are prepared for going to scale this aspect becomes even more important.

Other aspects of ecological sanitation that require attention are the recycling of anal cleaning water and greywater. In a water starved environment like the West Bank the

policy should be to recycle every drop of water. The ecological sanitation concept with its emphasis on diversion ("don't mix") and local (household or neighbourhood) solutions facilitates such a policy. Greywater can be filtered through charcoal, charcoal can be obtained through carbonization of organic solid waste. Anal cleaning water may be recycled together with greywater or urine or used to humidify a compost where organic kitchen garbage is composted together with dehydrated faeces from the processing chambers. Ecological sanitation is basically a systems approach. In a true ecological system nothing is disposed of - everything is reused or recycled.

Cost and subsidy

The total cost of each household unit in the project was said to be in the range of USD 700-1,000. The subsidy is about 80% (USD 550 for indoor location, USD 750 for outdoor location). If the value of the household's labour is included in the calculation the subsidy rate would be around 65%.

The Project Document is based on the assumption that the households would pay for the construction. The Progress Report for March-September 2000 states:

> *"... most families were willing and able to pay for the unit construction, either without financial support or otherwise through a loan. The issue of providing loans for Dry Sanitation promotion was discussed at length during August and September. The project team felt that, thought /sic/ they objected paying for DS construction (apart from exceptional cases) providing loans could be an incentive to disseminate the use of dry sanitation. For this reason PHG sought and agreed on cooperation with ACAD* (Arab Center for Agricultural Development) ...."

The Progress report of July 2001 states:

> *"Families have been preoccupied with daily problems of unemployment, travel restrictions, injuries and death caused by the Israeli occupation forces and general insecurity. Under those circumstances the improvement of sanitation is not considered a priority. – As a result of a significant decrease of household income, families are no longer able/willing to pay the cost of improved sanitation. ... ... The agreement with the loan credit organization ACAD can not be implemented, as it is to be expected that people will be reluctant to accept a loan under these uncertain conditions."*

With subsidy rates of 65-80% the project is obviously not sustainable. Besides, many of the participating households definitely do not belong to the poorest half of West Bank society. Nevertheless, *in this case* both the subsidy and the selection of

households can be justified. This is a research and development project and it is only natural that people are reluctant to invest their own money into what they perceive as a high-risk experiment. It is also a demonstration project intended to show that ecosan can offer a service standard equivalent to that of flushsan. It is therefore essential that ecosan is not labelled a second-rate solution only suitable for the poor.

If ecological sanitation is to be applied on a larger scale in the future it is important to arrive at a consistent policy regarding service levels and subsidies. Ideally there should be no subsidies, at least not for households above the poverty line. In the case of ecological sanitation subsidies are totally unjustified as the investment cost for ecosan is far below that of any conventional sanitation system. Besides, the ecosan provides two valuable products: fertilizer and soil conditioner.

A calculation of costs of ecological sanitation should take into account the water saved, the simplified construction (no septic tanks or cesspools required), and the savings on cesspit emptying. The current price of municipal piped water is the equivalent of
USD 1/cum, the price of water delivered by vendors is USD 4-6/cum and the normal charge for a cesspit emptier is about USD 30 per 6 cum. A rough calculation indicates that the investment cost of the high standard ecotoilets installed in this project could be recovered by household water and wastewater savings over a period of 3-5 years.

For large-scale ecosan projects a calculation of costs and benefits should take into account savings in investment, operation and maintenance of physical infrastructure as well as the value of the new jobs that will result from the operation of a complete ecosan system based on recycling.

Social acceptability

The concept of ecological sanitation is easily understood by the participating communities and the advantages to the individual households in terms of water and cost savings are obvious. The design of the ecosan unit is well adapted to local defecation practices. In the local culture there are no strong taboos against handling material of faecal origin. The high, even luxurious, finishing standard of the toilet rooms no doubt contributes to the acceptability as does the fact that all this was given virtually free.

For women the ecosan approach should be particularly welcome: the toilet can be used regardless of the availability of water, more water is available for the household, the indoor location provides convenience, privacy and security, the high finishing standard and the functional design facilitate the cleaning of the toilet room. The system provides a free fertilizer that can be used for intensive vegetable and fruit

production on the plot. - So far there is too little experience of emptying procedures to assess if they cause additional work for women.

Impact on the environment

Current sanitation practices in Palestine have a disastrous effect on the environment as outlined in the project document. Even when "improvements" are made, the result is questionable from an environmental point of view. For example, Alfawar Refugee Camp was six months ago provided with sewers in a project funded by UNRWA. The sewage generated by the 5,000 inhabitants of Alfawar is now piped to a wadi 1 km away and discharged without treatment. The risk is that the effluent will contaminate groundwater via fractures in the rocks. A project like this does not solve the problem – it is just relocating it.

The PHG ecological sanitation project for about 30 households is too small and scattered to have any measurable impact on the environment. But if ecological sanitation were to be applied on a large scale on the West Bank there would be substantial impact:

- a major reduction in household water consumption;
- no pollution of groundwater and springs from wastewater;
- the creation of humus-rich topsoil for wasteland reclamation.

Impact on health

An ecological sanitation system properly implemented does not pose any unacceptable risks to public health. The volume of potentially infectious material is minimized by the “don’t mix” approach and rendered harmless by a stepwise approach to pathogen destruction, see Winblad (ed) 1998, pp 13-14.

Pathogens are reduced to a harmless state by sanitization through primary and secondary treatment. The primary treatment takes place in the processing chamber directly under the toilet. The factors contributing to pathogen destruction in the chamber are: *increased pH* (through the addition of lime), *dehydration* by ventilating away moisture through the ventpipe) and *time* (by keeping the material in the chamber for a period of time). The secondary treatment takes place outside the processing chamber and may consist of further dehydration, further pH increase, high temperature composting and/or vermiculture.

The major health issue is therefore to ensure that the excreta derived products from the toilet should be safe enough to be applied to the soil after primary *and* secondary treatment. ("Safe enough" depends on how and where the products are to be used and what is considered as acceptable risks. The public health risks of an ecological sanitation system need to be balanced against its benefits and the risks from current sanitation systems.)

When testing for pathogen destruction we should test the output from the secondary treatment. There is no need to carry out elaborate microbiological studies of pathogen destruction in the processing chamber. The purpose of the primary treatment in the chamber is to facilitate storage and handling, not to produce a pathogen-free product.

Certain microbiological tests have already been carried out in the project. Preliminary reports indicate that after a couple of months "viruses are totally eliminated in most samples tested" and that there is a "dramatically decreased count of microorganisms" (information from the Project Coordinator). – This is to be expected: a well managed project, favourable, hot-dry climate and an ample supply of lime for increasing the pH of the contents of the processing.

On the basis of the preliminary results and the knowledge we have from earlier studies elsewhere (SanRes 2001) I suggest that the current projects concentrates on monitoring temperature, humidity and pH in the contents of the primary processing chamber:. This can be done without access to elaborate laboratory facilities.

Sustainability

If we use the definition of "sustainable development" originally defined by the Brundtland Commission in 1987: "... it meets the needs of the present generations without compromising the ability of further generations to meet their needs ..." (Brundtland 1987), it is clear that the ecosan concept represents sustainable development in a West Bank context: it saves a considerable amount of water, prevents pollution of groundwater and springs, and creates topsoil (a valuable commodity in the badly eroded West Bank). – The project is ecologically and socially sustainable. If we compare investment and running costs with potential savings on water and cesspit emptying charges it is also economically sustainable. But with a direct subsidy per household of the equivalent of USD 550-750 the project has no financial sustainability.

CONCLUSIONS AND RECOMMENDATIONS

The project must be regarded as a success: it is well adapted to local conditions, it is well planned, has made good use of the experience gained from similar projects in other parts of the world and was implemented with high technical standards. The acceptability amongst the users is high.

It is now important to go beyond toilet technology and do research, development and advocacy on recycling of urine, sanitized faeces, anal cleaning water and greywater. The next step in the development of ecosan in Palestine should aim at large-scale implementation, preferably covering a whole town. PHG should closely follow what is happening in the new Sida-funded urban ecosan project in China (centred on Daxu town, near Guilin in the Guangxi Autonomous Region in southern China). This project aims at testing a total ecosan system (including environmental sanitation, ecostations, recycling, agricultural production) and creating an ecological town.

To gain acceptance for such ideas within the PA it is worth considering to undertake a study of the financial benefits of ecosan versus flushsan in a West Bank context. For example: Dura Municipality is now planning a sewage system with support from the European Community and the World Bank (which means that there is also a Swedish contribution). - Suppose PHG undertakes a study of the ecological, economical and social implications of an ecosan alternative for the whole of Dura Municipality? Such a study would provide valuable data for a comparison of ecosan versus flushsan and be relevant for other municipalites in Palestine and elsewhere. What I have in mind is a major study taking into consideration such issues as sludge disposal and groundwater pollution (in the flushsan alternative) and potential long-term soil salinity problems of recycling urine in agriculture as well as the costs and benefits of returning human urine and sanitized human faces to the soil (in the ecosan alternative).

Specific recommendations:

PHG should organize a 1- or 2-day seminar for high level professionals within the PA to discuss

- conventional sanitation and water pollution
- the concept of ecological sanitation
- examples of ES from around the world
- presentation of the Hebron project
- site visit to some households in Beni Naim
- discussion: the role of ES in the development of Palestine

PHG might also consider a study visit by high-level municipal and PA decision-makers to the ecosan projects in southern China. The main purpose of such a study visit would be to influence attitudes and prejudices against non-flush technologies.

(For straight-forward technology transfer there are more cost-effective ways than sending people half way around the world.)

REFERENCES

Austin A, Musleh R, Subuh Y and De Bruijne G (2000): Report on community visits 15-27 May 2000. Jerusalem.

de Bruijne G and Subuh Y (2000): Dry sanitation in Palestine. Paper presented at the GTZ Ecological Sanitation Symposium, Bonn, Germany, 2000.

de Bruijne G (2001?): Dry sanitation pilot project in Palestine. Report October 2001-February 2001.

Esrey S, Andersson I, Hillers A, Sawyer R (2001): Closing the loop - ecological sanitation for food security. UNDP -Sida, Cuernavaca, Mexico.

Oxfam (2002): Forgotten villages struggling to survive under closure. Press release, Jerusalem Times, 4 October 2002, Jerusalem.

Palestine Hydrology Group (1999): Dry sanitation in Palestine – a pilot project. Proposal submitted to Sida, Stockholm,

Palestine Hydrology Group (2000): Biannual report March-September 2000. Jerusalem.

Palestine Hydrology Group (2000): Questionnaire on dry sanitation project. Hebron.

Palestine Hydrology Group (2001): Annual progress report March 2000-March 2001. Jerusalem.

Palestine Hydrology Group (2001): Quarterly progress report April-June 2001. Jerusalem.

Palestine Hydrology Group (2002): Progress report July-December 2001. Jerusalem

Palestine Hydrology Group (2002): Training course on ecological alternatives in sanitation, 3-5 June 2002, Hebron,

Rabi A (2002): Israel förbjuder palestinier att borra efter vatten, in Dagens Nyheter, Stockholm, 23 October 2002.

SanRes (2001): First International Conference on Ecological Sanitation, Nanning, China, November 2001. Conference report online, Complete Proceedings: See www.ecosanres.org.

Sida-Inec-Urban (2000): Beslut om insatsstöd till ekologisk sanitet, Västbanken. (Beslut nr Inec Urban 8/00), Stockholm.

Winblad U (ed) et al (1998): Ecological sanitation. Sida, Stockholm.

World Commission on Environment and Development (1987): Our common future. University Press, Oxford.

Comments on the PHG project /similar to those put forward in the Appraisal Report of 30 October 2002/.

Appendix: Pictures

Fig 1: The squatting pan developed by the PHG project and made in porcelain at a factory in Palestine. A hinged lid made of plastic covers the drop hole. In the upper right-hand corner of the lid is an opening for drainage of anal cleaning water.

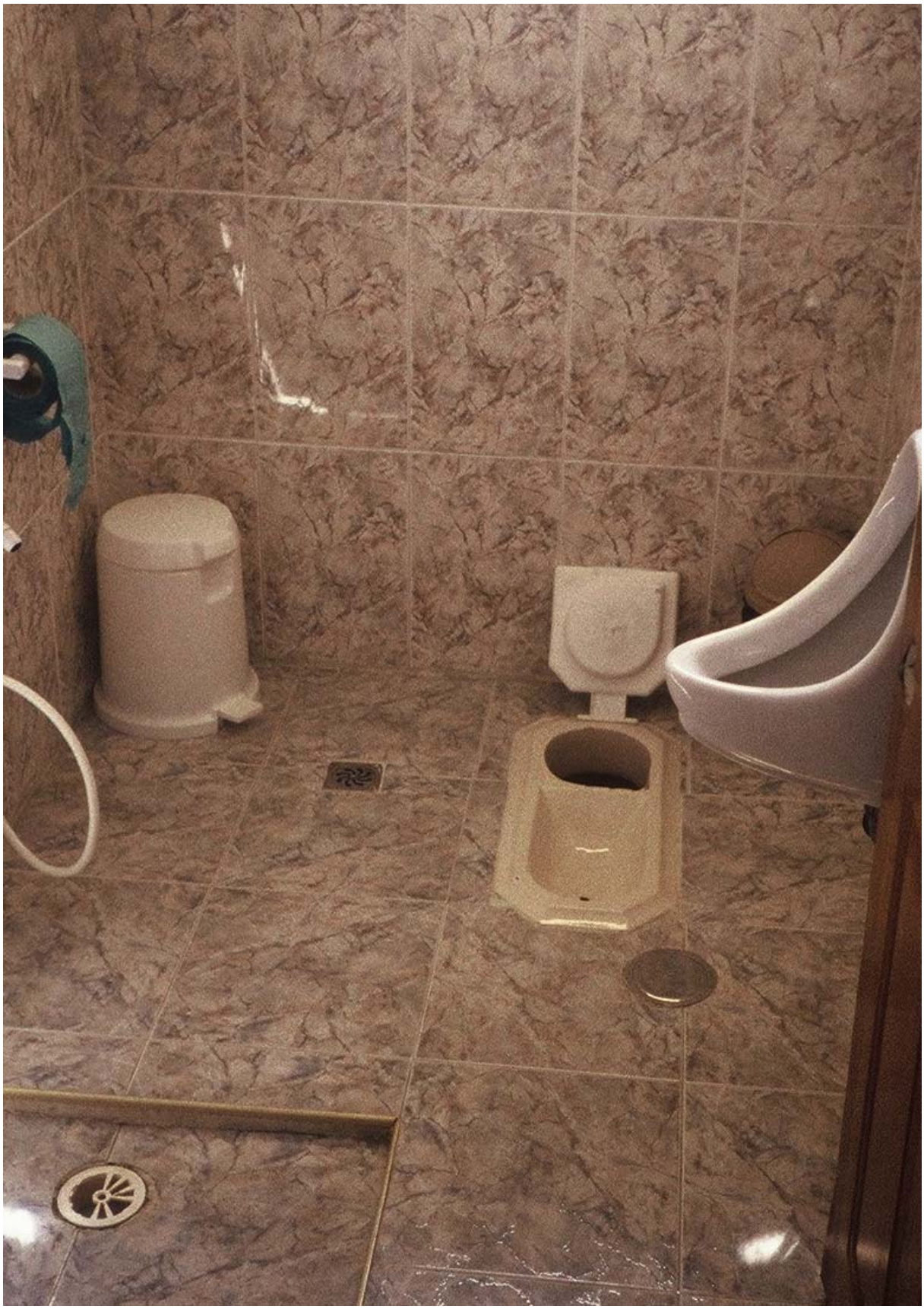

Fig 2: A typical toilet room in the PHG project . The lid is open and the drop hole for faeces is visible. To the left of the squatting pan is a drain for anal cleaning water. The bucket further to the left is for soiled toilet paper.