MINISTRY OF EDUCATION,
CULTURE AND RESEARCH
OF THE REPUBLIC OF MOLDOVA

MINISTRY OF HEALTH,
LABOR AND SOCIAL PROTECTION
OF THE REPUBLIC OF MOLDOVA

GUIDE

for the school managers

Options for the improvement of sanitation in rural schools in Moldova

Ministry of Education, Culture and Research of the Republic of Moldova
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Options for the improvement of sanitation in rural schools in Moldova

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CHISINAU 2018

Message
of The Ministry of Education, Culture and Research

In the Republic of Moldova, education is a national priority. In major terms, the quality of education defines the future life quality. Therefore, an important role in achieving this goal is creating adequate study conditions, including school sanitation and hygiene. Environmental contamination and degradation causes a significant deterioration of people's health, children being the most communities of Moldova there are still problems in providing water supply and sewerage services. These problems need to be addressed as soon as possible, considering the possibilities for each locality.

In this context, the Ministry of Education, Culture and Research recommends to all managers of general education institutions to analyze the options proposed in this Guide, to study the good practices already carried out in the country and jointly with the local public administration authorities, to improve the hygiene and sanitation conditions in schools, in accordance with the Quality standards for primary and secondary general education institutions from a child-friendly school perspective (Health, Safety and Protection dimensions).

We thank all decision-makers, advisors and donors for engaging in solving the issues that are the subject of this guide.

We wish you good luck!

Angela CUTASEVICI,
State Secretary,
Ministry of Education, Culture and Research

Message
of The Ministry of health, Labor and Social Protection

Disease prevention is a priority of the health system in the Republic of Moldova. The waterborne diseases, diseases caused by poor sanitation and hygiene are a burden for the society. According to the World health Organization (WHO) estimates, 88% of the acute diarrheal diseases are caused by unsafe water consumption, inadequate sanitation facilities and hygiene. Schools that lack access to safe drinking water, proper sanitation facilities and hygiene are environments with increased health risk for pupils and school stuff.

One of the main targets, both for the National Programme for the Implementation of the Protocol on Water and Health in the Republic of Moldova for the years 2016-2025, approved by the Government Decision nr. 1063 of September 16, 2016, and for the Sustainable Development Goals (Agenda 2030), is to ensure access for all children to improved water, sanitation systems and hygiene practices.

The Ministry of Health, Labor and Social Protection recommends to all managers of general and early education institutions, local public administration specialists and public health professionals to study and apply the best practices mentioned in this Guide in order to provide a favorable educational environment. On this occasion, we would like to thank the donors for their support in helping create healthier education environment for the rural areas of the Republic of Moldova.

We wish you all good luck in applying the Guide!

Aliona **SERBULENCO**,

State Secretary,

The Ministry of health, Labor and Social Protection

Definitions and Acronyms

LPA	Local Public Administration. Rayon level administration (LPA II) or local level (LPA I).
Greywater	Greywater is wastewater from the kitchen, washbasins and after cleaning, without fecal contamination. Because greywater does not contain waste human pathogenic potential can be manipulated and treated with more simple technologies than domestic wastewater (black water).
ApaSan	Swiss Water and sanitation Project in Moldova
Drinking water	Water intended for human consumption, supplied from a network distribution or from a well, in bottles or containers, and which is not a threat to human health.
Waste water	Wastewater containing: human excretions, household water and water resulting from hygienic activities. Also called black water.
Sewerage	Assembly of technical works executed for collection, evacuation and treatment of the wastewater in a locality, in a technical system, on a land etc., or rainwater, in order to protect the soil, underground and surface water.
Public Health Center	Territorial subdivision of the National Agency of Health.
Ecosan	From English "ecological sanitation", ecological sanitation system, with collection separate urine and faeces.
Septic tank	Watertight underground tank with at least 2 chambers, where the solids in the wastewater is retained and digested anaerobically at the bottom, while the solid-free liquid is usually discharged into a soil infiltration system.
Pit	Watertight underground tank of relatively small size, used for collection faeces and urine.
Pit latrine or pit toilet	A type of sanitary group that includes rudimentary construction located on an underground basin.
Sanitation	Generic term used to describe a range of facilities, services, and actions in order to safely and hygienically eliminate human excretions and waste water in order to reduce the spread of pathogenic germs and to maintain a healthy and sustainable environment. Specific actions related to sanitation include wastewater treatment, household waste and rainwater management.
Sanitation System	A system that includes: sanitation groups (WCs, external toilets), collection, containment, transport (with or without sewerage network) of toilet waste (urine, faeces, liquid waste or wastewater), treatment and final disposal or utilization. A sanitation system includes the technical infrastructure as well as the organizational structure for management, operation and system maintenance.
Treatment station	Assembly of constructions and installations for wastewater treatment by mechanical, mechanic-chemical and/or biological methods.
Local treatment of the waste water	On site wastewater treatment, or in close proximity from where the wastewater is produced. It is also called in situ wastewater treatment.
Water toilet	WC (water closet)
Ecosan toilet	Dry toilet with urine separation system (also known as UDDT – Urine Diverting Dry Toilet). A toilet that runs without water and has a separator so that the urine and the faeces are collected separately and do not mix.

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Introduction

Background

Access to safe water supply, adequate sanitation and hygiene (WASH) in schools is important for a many reasons: it contributes to ensuring a healthy learning environment and lessening the spread of disease, it positively affects school participation and learning, helps to improve gender equality and supports school attendance of girls, and it can help reaching communities for adoption of good WASH behaviors and technologies.

The Republic of Moldova has set targets to improve WASH in schools as a party to the Protocol on Water and Health in 2010[1]. By 2020, 100 % of the schools and pre-schools should achieve full compliance with drinking water quality and provide access of children to improved water supply and sanitation systems.

The Sustainable Development Goals, adopted in 2015 by the United Nations[2], emphasise the importance of WASH in schools in its goal 6 on universal and equitable access to safe and affordable drinking water and adequate and equitable sanitation and hygiene for all: "universal access" means access not only at households but also at schools, health facilities, workplaces, etc[3].

Currently, most schools in rural areas in Moldova don't have facilities satisfying

1 Government Decision no. 1063 of September 16, 2016 regarding the approval of the National Programme for Implementation of the Protocol on Water and Health in the Republic of Moldova for the years 2016-2025. Source: http://lex.justice.md/index.php?action=view&view=doc&lang=1&id=366749

2 http://www.md.undp.org/content/moldova/ro/home/sustainable-development-goals.html

3 WHO, UNICEF (2015) Methodological note: Proposed indicator framework for monitoring SDG targets on drinking - water, sanitation, hygiene and wastewater

basic WASH standards. The most common option is the use of cesspit toilets located away from the school building. According to a UNICEF study[4] from 2009, 95 % of schools in rural areas use such toilets.

However, frequently these toilets are in bad conditions, without cabins or separators for privacy, without electricity or heating in winter, with no hand washing facilities, poorly maintained and rarely cleaned. In addition, these toilets often also pollute the environment, e.g. when contents of cesspits are dumped in the environment. The next study conducted by the National Center of Public Health in 2014 shows an improved situation, but far from optimal sanitation and hygiene conditions - 75% of rural schools used external toilets.

A range of options are available to improve sanitation in schools. The common cesspit toilets can be improved and better maintained, flush toilets can be constructed when sewer connections are available or wastewater is treated locally, and ecosan toilets are an increasingly popular alternative choice. However, planners and decision makers are often not sufficiently aware of the different available options and their specific advantages and disadvantages.

This guide provides information on the available sanitation options and on the conditions in which they can be applied. The aim of the guide is that people responsible for school sanitation are better informed and take action to improve the conditions in schools by providing better and lasting sanitation solutions.

This guide has been developed by the Ministry of Education of the Republic of Moldova, the Ministry of Health of the Republic of Moldova and the ApaSan project.

The ApaSan project, funded by Switzerland and Austria, supports since many years the implementation of safe and comfortable toilets in rural schools in Moldova.

4 UNICEF (2009): Summary Report Study on the Quality of Water, Sanitation and Hygiene Practices in the Schools of Moldova.

What is the guide about?

The aim of this guide is to present different options for sanitation systems for schools and to provide guidance on the selection of the most appropriate sanitation system.

By whom the guide can be used?

The guide is written for professionals, institutions and decision makers in Moldova who are working on improving school sanitation.

- General school and kindergartens directors
- Education, Public health, environment and construction decision makers at rayon/municipality level and TAU Gagauzia
- Designers, architects and engineers
- Funding institutions
- Public health specialists

What is the scope of the guide?

This guidebook describes different school sanitation options which are suitable for Moldovan schools. The guide focusses on the specific conditions in schools located in rural areas.

It is important to note that while infrastructure for sanitation in schools is important, it is just one element needed together with safe water supply, hygiene practices and maintenance of the infrastructure. This guide only covers the part of sanitation infrastructure and its maintenance.

How to use the guide?

Chapter 1 gives a short general overview on the importance of water supply, sanitation and hygiene in school. While this guide focuses on options for sanitation systems in schools, this chapter recalls the other elements that have to go together with sanitation in schools.

Chapter 2 describes the four options for school sanitation systems that are currently present in Moldova:

- Cesspit toilets, the most widespread type of toilet found in rural schools in Moldova
- Ecosan toilets, also called urine diverting dry toilets
- Flush toilets connected to a public sewer system
- Flush toilets with local treatment of the wastewater

Each of the options is described in detail, considering the full sanitation system from toilet to final disposal or reuse. For each option, advantages and disadvantages are described, as well as the conditions for which this option is best suited. Information on maintenance and organizational requirements is also given.

The provisions of the building normative document NCM C.01.03:2017 – "Design of buildings for general education institutions" will be considered when selecting a sanitation option. This document does not admit the construction of sewerage systems in education institutions with the discharge of the wastewater in a cesspit, only with the discharge in a centralized sewerage system or to a local wastewater treatment plant.

The final chapter 3 then gives advice on how to select the sanitation system best suited to the particular conditions of a school.

01

What matters for sanitation in schools

1.1 WASH in schools

Access to safe water supply, adequate sanitation and hygiene (WASH) in schools is important for a number of reasons:

- Health: WASH in schools is a basic condition for ensuring a healthy physical learning environment and to lessen the spread of disease.
- Education: Education and health work in synergy. Nutrition deficiencies, diarrhoea and worm infestations are all related to inadequate water, sanitation and hygiene – and all affect school participation and learning.
- Gender equality: Girls are particularly vulnerable to dropping out school, partly because many are reluctant to continue their schooling when toilet and washing facilities are not private or not safe.
- Community outreach: WASH in and through schools is one of the best routes to reach entire communities. Directed engagement with students can lead to community adoption of good WASH behaviours and technologies as well as improved health

Ensuring safe water supply, adequate sanitation and hygiene (WASH) in school requires a wide range of actions. This guide focusses on sanitation infrastructure.

However, it is important to note that sanitation infrastructure is only one element of WASH and needs to be combined with other elements to be effective. Other important elements, not covered by this guide, include the provision of safe water for drinking, installation of handwashing facilities, training of pupils for good use of water, toilets and in particular hand washing

habits, involving the community in hygiene training, ensuring cleaning and maintenance of facilities.

1.2 Sanitation systems

A sanitation system comprises the toilets as well as collection and transport of waste from the toilets (urine, faeces, sludge or wastewater), their treatment and final disposal or reuse. A sanitation system comprises the infrastructure for the previously listed elements as well as the organisational set-up for the management, operation and maintenance of the system.

In locations where a public system for managing wastewater exists, e.g. a municipal utility managing a sewer system and wastewater treatment plant, the concern of school administrations is limited to the toilet facilities in schools. However, in rural areas in Moldova, only 1 % of the villages have sewer systems. Therefore, in the absence of a public sanitation system, the school administration needs to take care of the entire sanitation system, from toilet to final disposal or reuse.

1.3 Toilets

In the following the standards for school toilets as required by the Moldovan Centre for Public Health[5] and recommended by the WHO[6] are listed:

- Sufficient toilets need to be available for girls, boys, female and male teachers. WHO recommends 1 toilet per 25 girls or women and 1 toilet plus 1 urinal per 50 boys or men. Toilets of teachers and pupils should be of the same standard.
- Toilets need to be accessible to all, including staff and children with disabilities.
- Toilets should be attached to or integrated in the main building, not located in a separate building away from the school building. This allows easy access.

5 Decision no. 21 of 29.12.2005 regarding the approval and implementation of the State Sanitary and Epidemiological Rules and Norms "Hygiene of primary, secondary and high school education institutions". Source: http://lex.justice.md/index.php?action=view&view=doc&lang=1&id=317324

6 WHO, 2009. Water, Sanitation and Hygiene Standards for Schools in Low-cost Settings

Also heating and lightening is easier with toilets integrated in the main building. In addition, toilets integrated in the main building are more likely to be well maintained, while backyard toilets tend to be neglected.

- Toilets need to provide privacy and security. Male and female toilets need to be completely separated. Inside male and female toilets, the individual toilets also need to be separated to allow for privacy.
- The toilets need to be hygienic to use and easy to clean. Daily cleaning with disinfectant is required by Moldovan standards
- The toilets need to have convenient handwashing facilities close by.
- A cleaning and maintenance routine needs to be in operation and ensure that clean and functioning toilets are available at any time.

In accordance with the Health Regulations for preschool Education[7] (Health Regulations for Early Childhood Education Institutions, Government Decision nr. 1241 of 4.11.2016 there are specific provisions for pre-school institutions:

- In the localities without sewage facilities, pre-school institutions are equipped with a local sewage system and a local wastewater treatment plant.
- In the localities where the centralized sewerage system is missing, the toilets are built on site, at a minimal distance of 25 m from the closest building, and are connected to a cesspit. For children, one seat is reserved for 5 to 10 pupils, for stuff – 2 seats.

  The prekindergarten toilet room is located in a single room, where there are installed:

  a) 3 sinks with hot and cold running water taps for children

  b) 2 closets with lids

7 Health Regulations for Early Childhood Education Institutions, Government Decision no. 1241 of 4.11.2016 http://lex.justice.md/index.php?action=view&view=doc&lang=1&id=367518)

c) sink for the personnel

d) electric hand dry device

e) bathtub

f) shelves for potties and a pot for processing them

g) closet for the cleaning inventory

The pre-school toilet room includes:

a) 4 sinks with hot and cold running water taps for children

b) 3 closets with lids, incorporated into the floor

c) sink for the personnel

d) electric hand dry device

e) bathtub

The toilets intended for the pre-school children (aged 5 to 7) are separated for boys and girls.

The sanitary facilities for the toilets are subject to disinfection. The seats and door handles are washed daily with hot water and soap. The potties are washed with detergents after each use. The bathtub and the sinks are cleaned twice a day with brushes and disinfectants.

1.4 Collection, treatment, disposal or reuse of wastewater

Wastewater from toilets

Collection, treatment, disposal or reuse of waste from the toilets needs to ensure that people do not come into direct contact with these materials, which potentially contain disease causing germs. It also needs to minimize environmental pollution.

Excluding direct contact of people with waste from toilets requires application of safety measures when these materials are handled (e.g. during removal of sludge from cesspits), treatment of material to safe levels or excluding discharge in location frequented by people. It also requires ensuring that no water resources used for drinking water supply are contaminated.

Minimizing environmental pollution requires treatment of waste streams to levels that do not harm the receiving water bodies or soils[8].

If a sewer system exists in villages, discharge of wastewater from school toilet is a straightforward option. However, it is important to keep in mind that proper treatment of wastewater is almost non-existent in Moldovan villages[9], and that discharge of toilet wastewater in a public sewer system is likely to cause harm to the environment at the point of discharge of the public sewer.

If no public sewer exists, the management of waste from toilets is an important part of consideration when choosing the sanitation system and technology. In dry toilets like cesspit toilets or ecosan toilets, waste needs to be removed periodically and brought to a treatment or safe disposal site, or being reuse in a safe way. With flush toilets, wastewater needs to be treated locally and treated wastewater discharged at a point near the school.

Reuse of treated waste from toilets, e.g. irrigation with wastewater from handwashing or use of treated faecal material and urine collected from ecosan toilets as fertilizers is well suited to be combined with education on agriculture practices and natural nutrient circles. However, safety has always to be the priority when designing reuse systems.

Greywater

Wastewater is produced not only from flush toilets but also from handwashing facilities, use of water for cleaning. Many schools also have kitchens where water is used for cooking and cleaning. Wastewater from handwashing, cleaning and kitchen is called greywater, if it is not mixed with toilet wastewater. Greywater is usually less problematic from a hygienic point of view and also contains lower concentrations of organic pollution and nutrients, compared to mixed wastewater. However, kitchen wastewater can sometimes be highly loaded with pollutants, especially fats.

8 The regulation on the requirements for the collection, treatment and discharge of sewage and/or emissive wastewater for urban and rural areas, Decision no. 950 of 25.11.2013. Source: http://lex.justice.md/md/350537/

9 The activity of water supply and sewerage systems in 2017 Source: http://www.statistica.md/newsview.php?l=ro&idc=168&id=6012&parent=0

02

Options for school sanitation

Overview

Options for school sanitation can be separated broadly in two categories: dry toilets and flush toilets.

Dry toilets do not mix urine and faeces with water. In cesspit toilets, both faeces and urine are mixed and collected together in a tank. In urine diverting dry toilets, they are collected and further managed separately.

Flush toilets use water to flush urine and faeces down a pipe and to transport them away via a public sewer system or via pipes to a local treatment plant.

Greywater from handwashing, cleaning and school kitchens also needs to be managed. If schools have flush toilets, greywater is usually mixed with toilet wastewater and discharged into a sewer system or treated locally. If schools have dry toilets, greywater needs to be managed locally separately from toilet waste.

2.1 Cesspit toilets

Introduction

A cesspit is a sealed tank without an outlet, which collects faeces, toilet paper and urine as mixed sludge. As it has no outlet, the sludge needs to be removed when the tank is full.

Cesspit toilets usually consist of a toilet building with the cesspit structure underneath. Toilets consist of simple holes in the floor, faecal materials and urine fall in the tank.

The sludge of mixed urine and faeces develops a strong smell. The cesspit can

Example of cesspit toilets

be ventilated by pipes leading from the underground tank to above the roof of the toilet building, which can reduce smell to some extent. However, even with ventilation present, a strong smell usually remains. For this reason, cesspit toilets are built in some distance from the school building.

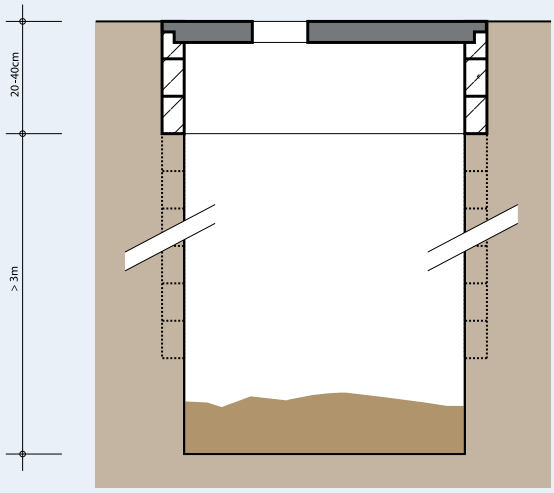
A cesspit does not treat the waste but is a collection facility only. Sludge removed from a cesspit needs to be treated in larger municipal wastewater treatment plants or in dedicated sludge treatment plants, or discharged in sanitary landfills.

Application in Moldova

Cesspit toilets are by far the most common toilets in schools and other public buildings in rural areas. According to a UNICEF study from 2009, 95 % of schools in rural areas use such toilets. However, many of these are in very bad shape and state of maintenance: separators are often lacking and there is no heating or light. Often they are not cleaned enough or not at all. Handwashing facilities are often absent or dysfunctional. Most of the toilets found therefore do not fulfil the necessary standards of hygiene and accessibility.

Cesspits in Moldovan school toilets are often not emptied in the required frequency due to the cost for emptying by vacuum trucks. Therefore many of the toilets have full cesspits, and pupils or teachers use them very little.

The sludge removed from cesspit toilets is unlikely to be handled properly, as municipal wastewater treatment plants or dedicated sludge treatment plants are rarely available. There is no information available how the sludge is handled in practice, but it is likely that an important proportion of the sludge is dumped



Scheme of a cesspit toilet Source: EAWAG, 2014

Example of cesspit toilets

indiscriminately and may threaten public health and pollute the environment.

Cesspits may not always be properly sealed, leakages may occur due to old age or low construction quality. In some cases, the pits may also be constructed without sealed bottom. Rather than cesspits, the pits function then as soak pits or latrines, where infiltrate to the underground and only solids remain in the pit.

Improving cesspit toilets

While in current practice, cesspit toilets very often are not implemented or maintained in a satisfactory way, the system still can be valid option for school sanitation if a range of criteria for good design and maintenance are respected.

The interior design has to be up to privacy and security standards, be attractive to the users and allow easy cleaning:

- Separate toilet tracts for girls and boys, and separators inside each of the toilet tracts
- Ceramic squatting pans or toilet seats instead of not simple holes in the cement floor
- Tiled floors and walls make the toilets more attractive and easier to clean than bare cement
- Lighting
- Handwashing facilities with working water supply near the toilet
- Ventilation of the cesspit to reduce smell
- Easy access of vehicles for sludge removal

Operation and maintenance

Cesspit toilets are simple systems without a lot of maintenance requirements. Daily cleaning and supply of soap and toilet paper is the most important element and crucial for ensuring that the toilets are safe and actually used. Experience shows that good cleaning is often neglected, which is a main reason for failure of the toilets to meet standards, so extra care is needed to ensure that cleaning is actually done.

Otherwise, normal maintenance requirements for buildings apply, which mainly means swift repair of damaged elements like doors, windows, separators and handwashing facilitates.

Regular removal of sludge is very important. Sludge should be removed before the cesspit gets too full. Removal of sludge is done through vacuum trucks or other equipment of a private service provider or a public utility. It is very important to foresee a budget for sludge removal in the school budget.

A safe sanitation system has also to include safe sludge management. If cesspit toilets are going to be applied in the future, authorities need to make sure that a safe sludge management is in place. Schools may build their own small sludge treatment facilities, e.g. drying beds. Solutions for sludge management for a larger number of schools or other public buildings are likely to be more efficient.

Advantages, disadvantages, conditions of application

The main advantage of cesspit toilets is that they are commonly known by the population, authorities, and design and construction companies as the standard option for rural schools.

Construction costs are in a similar range as the other toilet types that require a separate building.

However, they have a range of serious disadvantages:

- The mixture of urine and faeces produces a strong smell that cannot be entirely controlled even with electrical ventilators. Cesspit toilets will always be perceived as smelly and unpleasant toilets.
- The smell problem has several other important negative consequences. Because of the smell, toilets cannot be attached to main buildings but have to be located at some distance, which adds discomfort. Because of the smells, windows tend to be left open permanently, which makes heating in winter difficult or impossible, again adding to the discomfort. Because of the smell and the backyard location, the toilets have a negative connotation among users and maintenance personal and tend to be neglected.
- Maintenance is not cheap, as sludge removal by heavy equipment is a cost factor
- Environmental pollution is hard to avoid, as proper sludge management is rarely available.

The above list of disadvantages indicates that cesspit toilets are rather an option to be avoided in most cases. Cesspit toilets may still be the preferred option if involved stakeholders cannot agree on alternative options or if no investment budget is available for constructing new toilets. When rehabilitating existing toilets, it is important to keep in mind, that next to improvement of the infrastructure, it is very important to change habits of use and maintenance.

2.2 Ecosan toilets (Urine diverting dry toilets, UDDT)

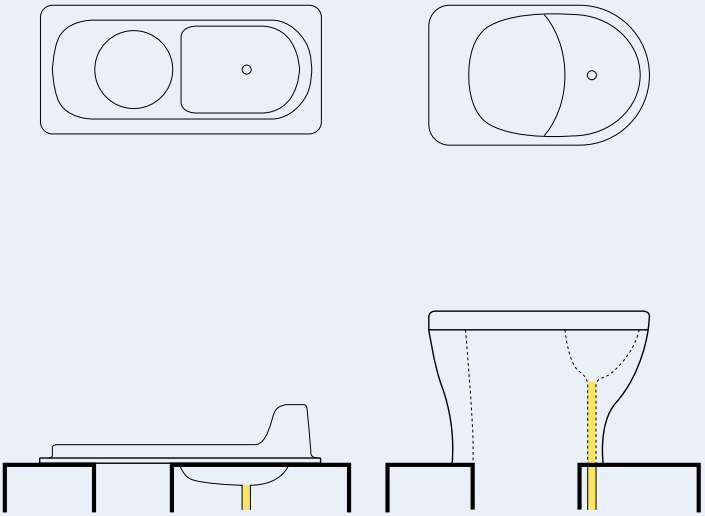
Introduction

The ecosan toilet is a relatively new sanitary technology introduced to Moldova and is described in detail in the Practical Code C.01.08 (the Construction of dry toilets with urine separation system) adopted by the Ministry of Constructions and Regional Development no. 91 of 13.07.2016.

The Ministry of health in the document "Establishing Objectives and Target Indicators in Accordance with the Water and Health protocol in the Republic of Moldova, 2011", mentions ecosan toilet as one of the recommended solutions for achieving the sanitation objectives.

Ecosan toilets collect urine and faeces separately, without the use of flushing water. The technical term for ecosan toilets is Urine Diverting Dry Toilets, UDDT. The toilet bowl has a divider or two separate openings, which allow the separate collection of urine and faeces. A urine separation toilet can be both done as a squatting pan or toilet seat.

Example of ecosan toilet blocks attached to existing school buildings



Top and profile views of urine separation toilets.
Left – squatting type, right – seating type. (EAWAG, 2014)

The urine is drained away in pipes and collected in tanks.

The faeces fall in a chamber beneath the toilet where they are collected. As urine is collected separately, the faeces dry in the collection chamber. Ash, sawdust or dry soil is added after use to enhance the drying process. Good ventilation of the chambers also helps drying.

An important effect of the separating of urine and the drying of the faeces is that development of bad smells is greatly reduced and can be completely controlled by good ventilation of the chambers and the toilet building. Urine pipes need an odour seal after the toilet to avoid bad smells from urine collection tanks reaching the toilet building. If properly designed and well maintained, UDDTs do not smell. Therefore, ecosan toilets can be attached to school building and be accessed without leaving the buildings, just as flush toilets.

Urine and dried faeces need to be removed periodically from the collection tanks or chambers. Volumes that need to be managed are relatively small, as urine and

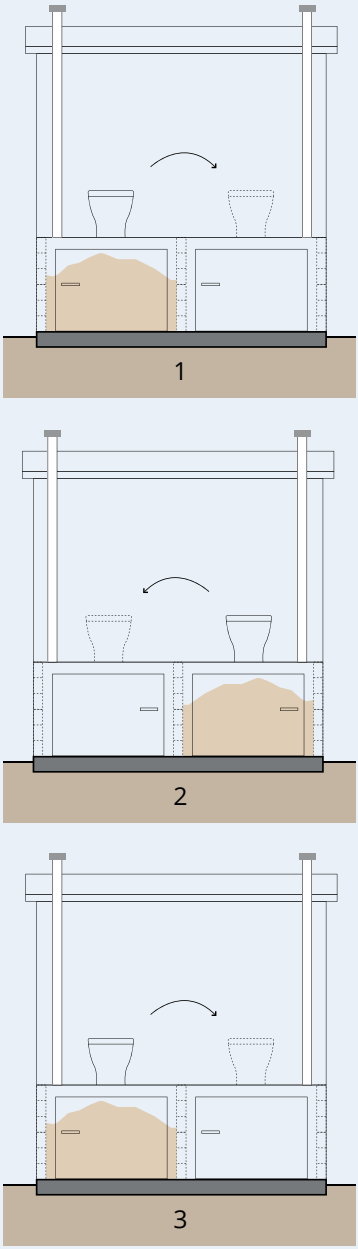
faeces are not mixed with flushing water. The largest fraction to be handled is urine, which is easy to pump out as it remains liquid, not being mixed with faeces. Faeces are of very small volume, and drying further reduces their volume. The drying process renders them inoffensive and they resemble of compost that is easy to handle.

In order to reduce health risks from handling of urine and dried faeces, parallel tanks are being installed that allow storage of urine and dried faeces for some time without fresh material being added. This allows for dying of pathogen organisms. Urine that has been stored for several months can be safely used as fertilizer. Faeces need to be stored longer before they can be safely used, but safe disposal by burying them local is also possible as quantities are small.

Ecosan toilets have special requirements how they are to be used, cleaned and maintained. Thorough training of users and caretakers is therefore required.

Inside view of an ecosan toilet cabin (squatting type)

Inside view of an ecosan toilet cabin (seating type)



Scheme of drying chambers in ecosan (EAWAG, 2014)

Application in Moldova

Ecosan toilets are known worldwide as an alternative sanitation option, but their application in Moldova is rather recent. Since 2007, Swiss cooperation has supported various NGOs for the promotion of UDDTs as an alternative option to the often desolate backyard cesspit toilets. Acceptance of this type of toilet was good and Swiss cooperation increased support to ecosan school toilets via the ApaSan project.

More than 60 school toilets have been built meanwhile in all parts of Moldova in cooperation with district authorities, local design and construction companies, and with technical and financial support of the Swiss project.

Design considerations

Ecosan toilets are difficult to be integrated in existing school buildings, due to the faeces collection chambers needed under the toilet floor. However, they can be attached to the school building, which allows direct access of users to the toilets, while the faeces collection chambers can be accessed from outside for emptying. It is strongly recommended to attach the toilets to main buildings, as this increases user comfort and accessibility con-

siderably, compared to separate backyard toilets. It also leads to better cleaning and maintenance, as the toilets are treated as part of the main school building.

Ecosan toilets must to be designed in accordance with the Practical Building Code cp c.01.08:2016, ICS, construction of dry toilets with separate collection of excreta, approved and implemented by order of the Ministry of Regional Development and Construction no. 91 of 13.07.2016 (Monitorul Oficial al RM, 2016, nr. 217-229, art. 1210).

Ecosan toilets should be built to high standards, as this increases comfort, acceptance and leads to better maintenance:

- Separate toilet tracts for girls and boys, and separators or closed cabins inside each of the toilet tracts

Example of ecosan toilet blocks attached to existing school buildings

- Urine separating squatting pans made out of plastics have proven to be a good choice for school toilets, but seats can also be used.
- Tiled floors and walls make the toilets more attractive and easier to clean
- Lighting and heating
- Handwashing facilities, hand driers
- Good ventilation of the faeces collection chambers and of the toilet building and odour seals in between toilets and pipes
- Urine storage tanks can be constructed underground at some distance from the toilets, access of vehicles to the tanks for emptying needs to be possible

Fitting boy's toilets with urinals allows to safe space. Urinals are then operated without flushing water and need to have odour seals.

All materials needed for building ecosan toilets can be procured locally. Urine separating toilet bowls, both squatting pans and seats, can be procured in Moldova. Odour seals for urine plumbing can be made from locally available materials.

Operation and maintenance

Correct use and cleaning is crucial for the functioning of ecosan toilets. Faeces and urine need to go into the right holes of the toilet bowl, dry material needs to be added to the faeces chamber after use, and cleaning has to minimize water going into the chambers. This requires thorough instruction and training of users and cleaning personal, including regular refreshing.

Urine tanks need to be emptied once or twice per year at maximum. Caretakers need to monitor the filling level of the urine tanks to plan for emptying. The school administration needs to organise the emptying, e.g. by contacting a farmer who is interested to use the urine to fertilize his fields. Urine stored for sufficient time is safe to be used as fertiliser. However, urine should in no circumstances be dumped at one point at a field or in a water body, as the nutrients then will cause environmental pollution.

Faeces chambers need to be monitored for the filling level. When one chamber approaches a certain level, the toilet bowl needs to be switched so that the parallel chamber is used. Once this chamber also approaches full level, the first one can be emptied. Experience shows that the filling up of faeces collection chambers in

schools takes several years, so emptying of the chambers is necessary only every few years. Dried and stored faeces from ecosan toilets resemble compost and are easy to handle with rakes shovels and simple receptacles. Dried faeces will be mostly pathogen free, but some may remain, e.g. worm eggs. Caretakers emptying the chambers should therefore wear protective clothing and gloves. Dried faeces can have considerable value as compost and can be used in gardening. However, as some pathogens may remain when taking the compost from the toilets, they should be stored for additional time or used only with adequate safety measures. Dried faeces can also simply be buried for final disposal.

Advantages, disadvantages, conditions of application

Ecosan toilets can offer a similar comfort and safety as modern flush toilets. As they are smell free and can be attached to main buildings, they are much more comfortable than cesspit toilets.

Ecosan toilets are very environmentally friendly as due to the separation of urine and faeces they turn toilet waste in products that are much easier to handle and to safely dispose or reuse than sludge from cesspit toilets or wastewater from flush toilets. With ecosan toilets, a school alone can take care of the entire sanitation system up to final disposal or reuse, which is much more difficult with cesspits or flush toilets.

Costs of ecosan toilets are in similar range as cesspit toilets, if built to the same standards. Ecosan toilets need to be slightly larger to give room for two faeces collection vaults per toilet cabin, but cesspits need a bigger underground structure.

The main disadvantage of ecosan toilets is that they are still not as well-known as flush toilets and cesspit toilets. Parents and teachers and administrations may be opposed to this system, unknown to them, and some authorities may hesitate to give required approvals. Experience has shown that these problems can be overcome with awareness raising and good communication, but this requires some effort and dedication.

If ecosan toilets are not properly used or well maintained, they can quickly develop smell problems. Good training and information of users and caretakers is therefore necessary.

Ecosan toilets can in principle be applied in any rural school, as long as sufficient space is available for an annex building. They are most suitable if a school wants to upgrade from a cesspit toilet, but if there is no sewer connection available.

2.3 Flush toilets connected to the public sewer system

Introduction

Flush toilets connected to a sewer system are the standard option in most urban areas and some rural areas, where sewer systems exist. Flush toilets are comfortable, the siphon in the toilets effectively seals against odours and cleaning is easy. Flush toilets are generally known by everybody and perceived as attractive, so there are no acceptance problems. The installation of toilets that can be connected to sewers, is generally cheaper than cesspit toilets or ecosan toilets, because they can be integrated in existing buildings easily. Structures for collection and treatment do not need to be included, as they are provided by the public services.

In case the sewer system is well managed and if there is a functioning municipal wastewater treatment, flush toilets can also be considered as a satisfactory solution for environmental protection. However, in Moldova today, there are only few locations with functioning wastewater treatment. In most locations with sewer systems, wastewater is discharged to water bodies with insufficient or not treatment at all. In such cases, the environmental pollution caused by the large volume for wastewater can be worse than the one from badly managed cesspit toilets.

Operation & Maintenance

Daily cleaning and quick repair of damages is needed with flush toilets as much as with the other descried toilet types. Insufficient cleaning and repair of blockings or leaking plumbing and other issues will quickly lead to the determination of the toilets and they may be no more safe or pleasant to use than neglected cesspit toilets.

Flush toilets consume a lot of water, so the water bill will be high. In addition, wastewater tariffs need to be paid. It is important that the school foresees a budget for this.

Example of flush toilets in schools

Advantages, disadvantages, conditions of application

Flush toilets are comfortable, safe and easy to maintain. They can be built indoors, heated and made easily accessible. The comfort for the user is similar than the one provided by well-maintained ecosan toilets, but their use is simpler and needs less instruction or training. They are definitely more comfortable and pleasant to use than backyard cesspit toilets.

Cost of construction is lower as for cesspit toilets or ecosan toilets. Maintenance is also simpler and basically limited to cleaning and repairs. However, there are higher running costs due to the high water consumption and tariffs for wastewater to be paid.

The most important disadvantage of flush toilets is the production of large amounts of wastewater that needs to be treated. If the sewer system is not connected to a functioning wastewater ,treatment plant, serious environmental pollution will

result. As functioning wastewater treatment exists only in a very small number of rural locations, flush toilets connected to sewers are therefore not an option for most locations in rural Moldova.

2.4 Flush toilet with local wastewater treatment

Introduction

The previous chapter has described flush toilets connected to a sewer. However, in most Moldovan villages, connection to a public sewer is not possible because there is no sewer or because wastewater collected in the sewer is not sufficiently treated.

An option for such situations is that the school builds their own small wastewater treatment plant: Flush toilets are installed in the school building; a wastewater pipe conducts the wastewater to a treatment site nearby or at some distance from the school, where the wastewater is treated before being discharged to a stream or infiltrated to the underground. Many technologies are available that are suitable for small local wastewater treatment plants. The main challenge with local wastewater treatment is the higher investment costs and the high operation and maintenance requirements.

If building a wastewater treatment plant is considered, it is always worth to assess wheather wastewater from other building can also be included in the treatment. This would bring down costs for the school, but also may make the operational set-up more complex. If there is already a sewer present in the village but treatment is lacking, it is definitely advisable for the authorities to consider investing into a municipal wastewater treatment plant, rather than into treatment of the school wastewater alone.

Options for local wastewater treatment

A wide range of options for treating wastewater local are available; however only a few have been applied in Moldova. Available technologies range from simple technologies that are easy to operate but need more space, to complex technologies that are compact but need professional maintenance.

Technologies that are suitable for local wastewater treatment in Moldova include, among others, the following:

- Septic tank
- Anaerobic baffled reactor
- Constructed wetlands
- Ponds

Activated sludge (package plants)

Sludge drying beds

These technologies are described briefly in the annex. For more details and further options, specialist literature needs to be consulted. A good overview on most available technologies is provided by the Compendium of Sanitation Systems and Technologies (EAWAG, 2014)[10]

Even the simpler treatment technologies need regular maintenance, thus a dedicated care taker is needed. Wastewater treatment plants that are not properly operated and maintained become dysfunctional quickly. Most wastewater treatment technologies produce some type of sludge that needs to be removed periodically and managed either local or externally.

The selection of the specific technology and design of the wastewater treatment plant always needs to be done by specialised engineers.

Advantages, disadvantages, conditions of application

For the toilets, the same advantages and disadvantages described for flush toilets connected to public sewers apply.

Treating wastewater locally allows using flush toilet even in the absence of a public sewer system or a functioning municipal wastewater treatment system. However, maintaining may be a complex task for the school maintenance staff or expensive if maintenance is contracted externally. Local wastewater treatment may not be possible if no suitable land is available for building a treatment plant or if discharge of treated wastewater is not possible near the location of the school.

10 https://www.eawag.ch/en/department/sandec/publikationen/compendium/

Example of school wastewater treatment in a package plant based on activated sludge

Costs for the wastewater treatment may be in a similar range as for a cesspit or ecosan toilet facility. However, if flush toilets cannot be integrated in existing buildings and a new annex building needs to be built, the cost of the total systems will be higher compared to the other described options.

2.5 Greywater management

In case flush toilets are built, it is easiest to discharge greywater in the same sewer pipes as toilet wastewater and either treat the mixed wastewater locally or discharge it to the public sewer system.

If the school has dry toilets, cesspit or ecosan toilets, greywater needs to be managed separately from toilet waste. Due to the volume of greywater produced, it is very uneconomic to conduct greywater to a cesspit and remove it by trucks. Therefore, the only option is to manage greywater locally. In principle all the wastewater technologies described for local wastewater treatment can also be applied for greywater treatment. However, due to the lower degree of contamination of greywater, local treatment facilities can usually built much smaller than for mixed wastewater. Hygienic concerns are lower than for toilet wastewater, as greywater contains less or no pathogenic organisms.

For example, water from handwashing and cleaning can be infiltrated directly after passing a screen and a smaller settling tank. Kitchen wastewater has a stronger pollution load and should be pre-treated, e.g. in a septic tank or a grease trap before infiltration.

03

How to select the sanitation system

3.1 Decision making scheme to help choosing the most appropriate sanitation option for the school o kindergarten

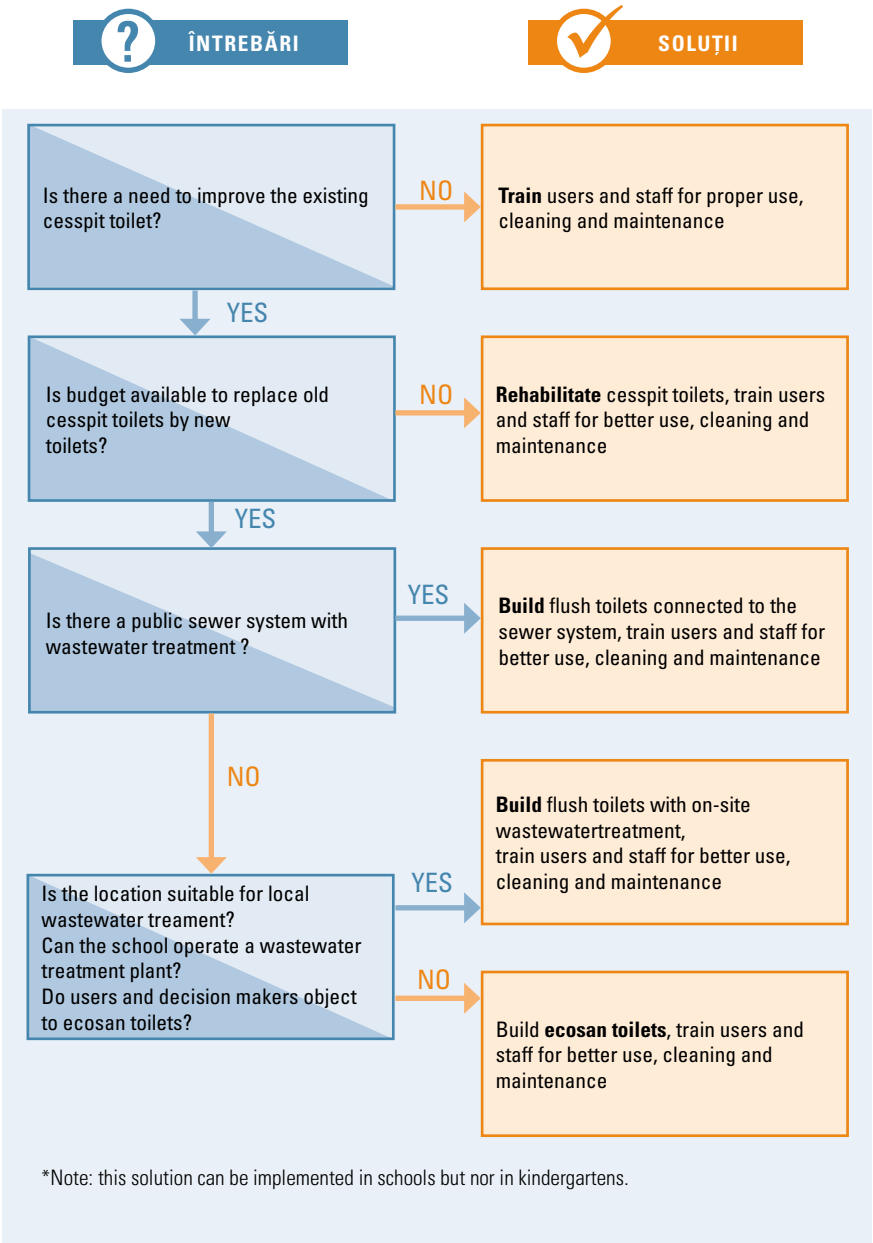
The choice of the sanitation system best suited to a particular situation depends on a range of questions:

- What is the current situation? Does the existing toilet need to be replaced or is it possible to rehabilitate it?
- What do the involved people – school administrators, pupils, teachers, parents – want?
- Does the village have a public sewer system? Is wastewater treated adequately?
- Are there any (realistic) plans to a build sewer system and a municipal wastewater treatment in the future?
- Is there a service provider for sludge removal who manages sludge safely?
- What budget is available?

If ever possible, cesspit toilets in the backyard should be replaced by more comfortable toilets indoors.

However, if budget is not available for constructing new toilets, rehabilitating the existing toilet is often the only option for improvement. In many cases, improvements in cleaning, maintenance and usage alone can achieve a significant improvement even without up-grading of the infrastructure.

Simplified decision tree for selection of school sanitation system



*Note: this solution can be implemented in schools but nor in kindergartens.

If budget is available to build better toilets, indoor flush toilets or ecosan toilets should be built. Building new cesspit toilets is rarely justifiable, as it is not cheaper than the other options and clearly below their standard.

If a functioning public sewer system with adequate wastewater treatment exits in the village, installing flush toilets and connecting them to the sewers is the straight forward choice.

If there are no sewers, or no treatment system, the choice is between ecosan toilets and flush toilets with local treatment.

Building and operating local wastewater treatment is more difficult and costly, compared to ecosan toilets and ecosan toilets are preferable by most objective criteria.

However, ecosan toilets may not always be accepted by all involved people due to their novelty and the need of the users to adapt, so local wastewater treatment may be chosen instead.

The future development and planning in the village is also an important aspect to consider. For example there might be plans to construct sewer systems in the near future. Planning for new school sanitation systems should assess how the sanitation system may evolve in future and how today's investment fits into the future planning. For example, local wastewater treatment systems may become obsolete once a municipal wastewater treatment is built; or an annex building for ecosan toilets may continue to be used for flush toilets when sewers are being built.

In any selection process it is very important to consult all concerned people (teachers, pupils, parents and caretakers) for their preferences or involve them in decision making. As they may not be well aware of the available choices and the implications of different options, good information needs to be provided as well.

3.2 Checklist for self-assessment

The following checklist allows quick self-assessment of school administrations in order to identify the needs for improvement of their school sanitation system.

Questions to check if school sanitation meets required or recommended standards	Yes	No
Is there at least 1 toilet for every 25 girls or female teachers? (for kindergartens, one toilet seat for each 5-10 children and 3-4 cabins/ toilet seats per each age group)		
Are there at least 1 toilet and 1 urinal for every 50 boys or male teachers? (for kindergartens, one toilet seat for each 5-10 children and 3-4 cabins/ toilet seats per each age group)		
Are the pupils' toilets of the same good standard as the teacher's toilets?		
Are toilets easy to access, including for people with special needs?		
Are the toilets accessible directly from the main building?		
Are male and female toilets separate?		
Are the toilets cabins separated and allow privacy and security?		
Are toilets easy to clean (smooth surface on walls and foor, e.g. tiles)		
Are toilets cleaned at least once per day with disinfectant?		
Are handwashing basins with functioning water supply available near the toilets?		
Is soap and toilet paper (or other materials needed for toilet use) always available?		
Is all equipment of the toilets (toilet bowls, doors, windows, ventilators, etc.) functioning and in good shape?		
Are pupils trained regularly about how to use the toilets and to wash hands?		

3.3 Comparison of sanitation systems for schools

	Cesspit toilets	Ecosan toilets	Flush toilets connected to sewers	Flush toilets with local wastewater treatment
Safety and user comfort	Not very comfortable as located away from main building and as smell is unavoidable; hygiene is good if well maintained	Comfortable and safe to use, requires good understanding how to use the toilet	Comfortable and safe to use	Comfortable and safe to use
Accessibility by people with special needs	Distant from my building, otherwise can be constructed for easy access	Can be constructed for easy access	Can be constructed for easy access	Can be constructed for easy access
Environmental protection	Good if sludge is treated or disposed or disposed safely Bad if sludge is dumped indiscriminately	Good, all waste can be safely managed in the village without harm to the environment Bad if urine is dumped instead of being spread on fields	Good if wastewater is treated Bad if wastewater is not treated	Good, if treatment plant operated well Bad if treatment plant is not maintained and fails
Construction costs	Similar to ecosan toilets	Similar to cesspit toilets	Lower than cesspits or ecosan toilets	Similar to cesspit or ecosan toilets, if no annex building for the flush toilet is needed, otherwise higher than either option

Operation and maintenance requirements	Daily cleaning and caretaking of toilets needed Monitoring sludge levels and organising sludge removal (calling vaccum truck)	Daily cleaning and caretaking of toilets needed Monitoring of urine and dried faeces levels, organising removal of urine (with local farmers) and dried faeces (by school caretakers)	Daily cleaning and caretaking of toilets needed	Daily cleaning and caretaking of toilets needed Operation and maintenance of the treatment plant; daily presence required for most technologies; for some technologies, external service providers are needed
Running costs	Costs for sludge removal by vacuum trucks (several times per year)	None	Water and wastewater tariffs	Water tariffs; depending on treatment technology: electricity costs and costs for service contracts
Applicability	Where sludge management is available	Everywhere, acceptance needed	Where sewers and wastewater treatment plant exists	Where land for wastewater treatment is available and where sludge management is available (depending on treatment technology)
Risks	Maintenance and cleaning is often neglected due to backyard location; sludge management not available in most locations	Without regular training of users and caretakers, toilets will not function well; urine may not be properly used but dumped	Wastewater treatment may be dysfunctional	Operation and maintenance may be neglected and treatment fail

04

ANNEX: Options for local wastewater treatment technologies

In the following, a brief and non-exhaustive overview on options for local wastewater treatment technologies is given. For more details and more options, specialist literature needs to be consulted. A good overview is provided by the Compendium of Sanitation Systems and Technologies (EAWAG, 2014)[11]. The drawings in the descriptions below are taken from this publication.

4.1 Septic tank

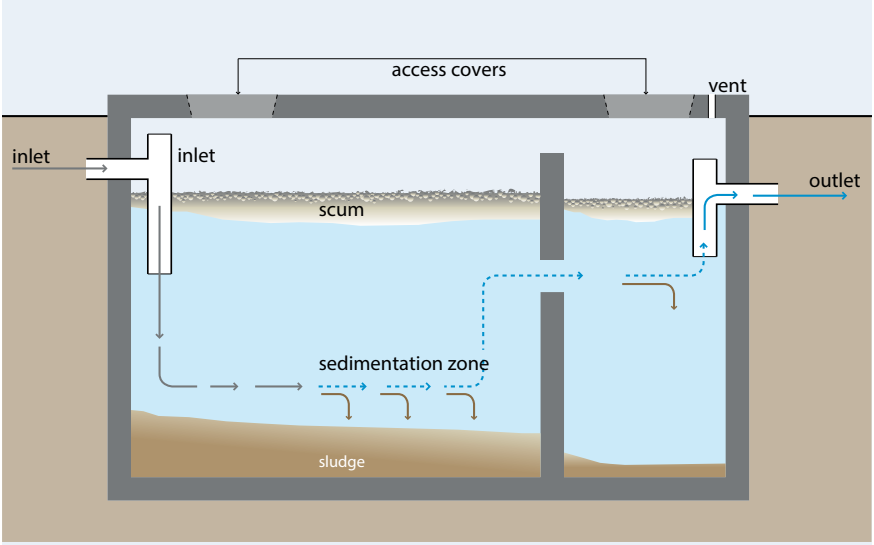
A septic tank is one of the most common and most simple wastewater treatment technologies. It is an underground tank with at least 2 chambers, where solids contained in wastewater are retained and digested anaerobically at the bottom. The solids-free liquid fraction leaves the tank through a pipe, and needs further treatment before being discharged into the environment. The solids-free wastewater can also be infiltrated in the underground. The solids accumulate as sludge in the tank and need to be removed by vacuum trucks once every 2 to 5 years.

Septic tanks are often used as pre-treatment before wastewater is treated in constructed wetlands, ponds or other systems. If infiltration of pre-treated wastewater is admissible, it can also be used alone. Proper sludge management is needed, as described for cesspit toilets.

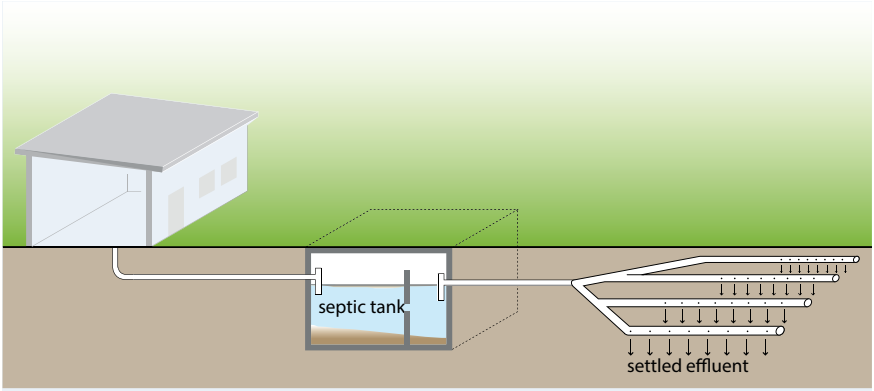
Septic tanks need no special maintenance except periodical removal of sludge. It is important for the function of the septic tank that sludge is removed at the designed frequency.

11 EAWAG, 2014. Compendium of Sanitation Systems and Technologies. 2nd Revised Edition. Swiss Federal Institute of Aquatic Science and Technology (Eawag). Dübendorf, Switzerland. (On-line version: http://ecompendium.sswm.info)

Note: In Moldova, septic tanks are sometimes confused with cesspits. Most structures called “septic tanks” in Moldova are actually cesspits. Cesspits collect urine, faeces and possibly wastewater; they only collect the waste but do not treat the content in any way and need to be emptied when full. Septic tanks receive wastewater and treat it by separating solids from the liquid fraction. Sludge accumulates and is digested at the bottom, requiring emptying at a much lower frequency than cesspits. Liquids are drained from septic and further treated locally; they are not removed by vacuum trucks.



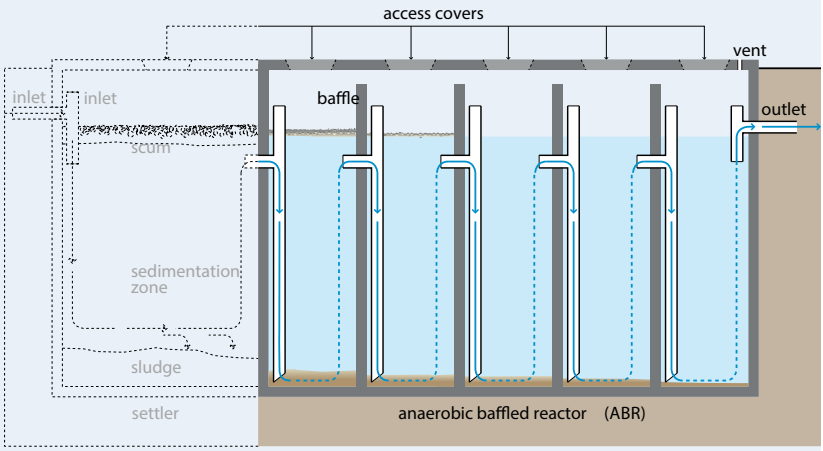
Scheme of a septic tank (EAWAG, 2014)



Infiltration of solids-free effluent from a septic tank to the underground (EAWAG, 2014)

4.2 Anaerobic baffled reactor (ABR)

An anaerobic baffled reactor (ABR) is an improved septic tank with a series of baffles under which the wastewater is forced to flow. The increased contact time with the active biomass (sludge) results in improved treatment. The up- flow chambers



Scheme of an aerobic baffled reactor (ABR) (EAWAG, 2014)

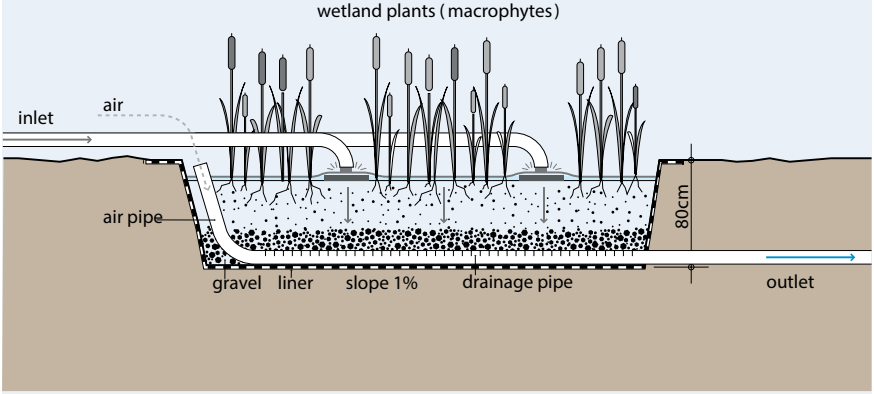
provide enhanced removal and digestion of organic matter, which may be reduced by up to 90%, which is far superior to its removal in a conventional Septic Tank.

ABRs require low maintenance, but it is important to remove sludge often enough.

4.3 Constructed Wetlands

Constructed wetlands are planted filters where wastewater is drained vertically or horizontally. The filters consist of basins filled with layers of sand and gravel; the plants are normally reed plants. Constructed wetlands usually require pre-treatment of wastewater to remove solids (e.g. in a septic tank) so that the filters do not clog. However, some types of constructed wetlands also can receive raw wastewater without pre-treatment.

Constructed wetlands need regular care, but tasks are not too complex.

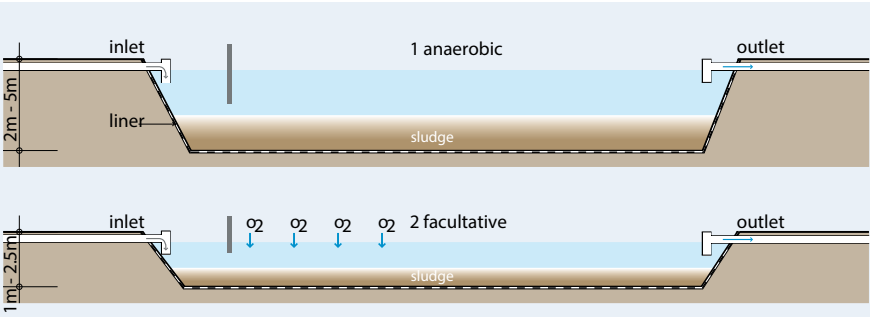


Scheme of a vertical flow constructed wetlands (EAWAG, 2014)

4.4 Ponds

Ponds, also called waste stabilisation systems or lagoons, are simple ponds that treat wastewater through natural processes. Different types of ponds can be

combined. A deep pond can receive raw wastewater and act as anaerobic pond, which removes solids in a similar way as a septic tank. Pre-treated wastewater can be conducted to a shallow pond where sunlight, oxygen provided algae and both aerobic and anaerobic bacteria play roles for treating the wastewater. Wastewater ponds are kept free of vegetation. They are simple to operate but require a lot of land.



Scheme of waste stabilization ponds (EAWAG, 2014)

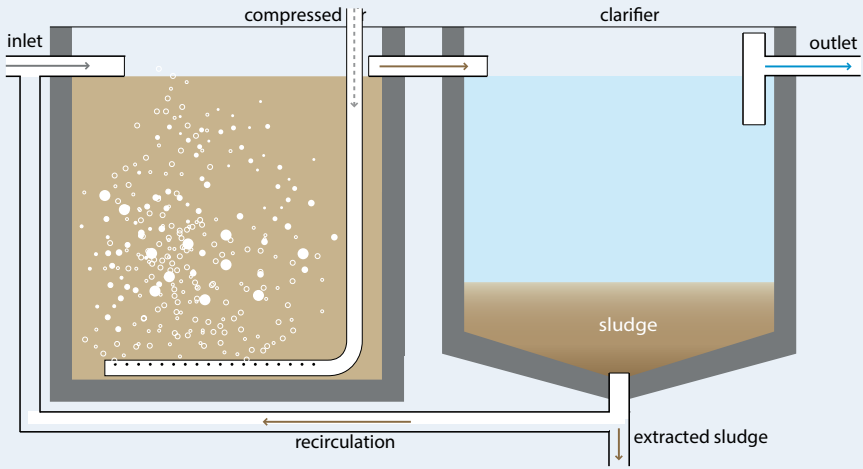
4.5 Activated sludge

An activated sludge treatment plant is a multi-chamber reactor unit that makes use of highly concentrated microorganisms to degrade organics and remove nutrients from wastewater. To maintain aerobic conditions and to keep the activated sludge suspended, a continuous and well-timed supply of oxygen is required.

The activated sludge process is typically used in large municipal treatment plants. For small-scale treatment it is often used in so called “package plants”, where the reactors and electronics are provided in a compact container and process control is automated.

Compared to the above listed technologies, treatment plants based on the activated sludge process are much more compact and thus do not need much land. They are relatively expensive, need a reliable electricity supply and consume electrical power. Due to the complex technology, they can’t be maintained by a

school caretaker or village technician but need service by professionals. Running costs from electricity bills and service contracts are therefore high.

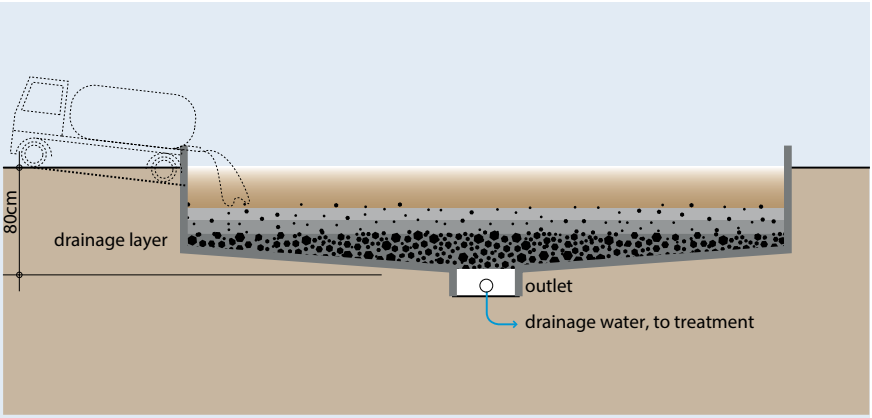


Scheme of an activated sludge plant (EAWAG, 2014)

4.6 Sludge drying beds

Most wastewater treatment technologies produce sludge. Sludge can be removed by vacuum trucks and transported to an external treatment plant or safe disposal site; however in Moldova this possibility rarely exists. Treatment of sludge directly on the same site is an alternative possibility. Sludge drying beds are the simplest option for sludge treatment. Drying beds are basins filled with gravel and sand layers, and with drainage pipes on the bottom. Sludge is filled on the top of the basin and liquid then percolates through the filter layer towards the drainage pipes. Sludge remaining on the top is left to dry for several weeks until completely dry. It can then be removed with shovels and disposed safely, e.g. by burying.

Only stabilised sludge from septic tanks, ABR or ponds is suitable to be treated in this way, fresh sludge from cesspits or from activated sludge plants is less suitable for direct drying.



Scheme of a sludge drying bed (EAWAG, 2014)

05

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WHO (2009) Water, Sanitation and Hygiene Standards for Schools in Low-cost Settings

Copii ale acestui document pot fi obținute la Agenția Națională de Sănătate Publică,
(strada Gh. Asachi, 67A) Centrul de informare (Clearing House) al Agenției Naționale de Sănătate.
http://ansp.md/index.php/clearing-house/

Varianta electronică a documentului poate fi descărcată:
http://apasan.skat.ch/wp-content/uploads/Guide:Optionsfortheimprovementofsanitation.pdf