Developing a Water & Sanitation Safety Plan in a rural community

How to involve schools

3rd revised edition

COMPENDIUM PART C

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Dr. Christiane Rohleder

Foreword from Germany

Environmental policy contributes to social progress

Providing safe drinking water and sanitation is the basis for a dignified life and public health. A well-functioning, modern public water supply and a connected wastewater system are key public service tasks and a prerequisite for good living conditions and securing livelihoods. Therefore, water and sanitation are major tasks for the environmental policy agenda worldwide.

We want to achieve good water quality for all. The EU focuses on strengthening local actors and active public participation through competent authorities. Safe water supplies and sanitation systems need the active involvement of local actors: environmental organisations and other interest groups as well as every single citizen.

This "Water & Sanitation Safety Plan" (in short WSSP compendium), which is in its third edition, provides an excellent basis for all stakeholders to raise awareness on the nexus of water, sanitation, environment and health. It also gives advice to jointly improve local hygienic conditions and to support the water protection policies.

The funding program "Export Initiative Environmental Protection" of the German Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection (BMUV) supports Women Engage for a Common Future WECF e.V. and its project partners in the Balkan region because their engagement proofs on how Environmental policy can contribute to social progress.

The compendium is regularly presented to an international audience - including at Stockholm World Water Week or the UNECE Regional Forum on Sustainable Development in Geneva - and has already been applied by various stakeholders.

I would like to express my greatest gratitude to WECF and its partners for the commitment and support. The compendium is therefore also an outstanding example of successful cross-regional and cross-national collaboration. I wish that many people in as many locations as possible will get access to and work with this WSSP compendium. Of particular importance is the fact that children and youth, especially women and girls, are being involved so that they learn in practice how to make a difference through their engagement and change the world for the better.

Christiane Rohleder

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Foreword from the Republic of North Macedonia

Prof. Mihail Kochubovski

In the pan-European region* some 200 million people rely on small-scale water supplies (SSWS), mainly in rural and remote areas. In the European Union water supplies serve up to 5000 people or those that have a daily production of up to 1000 m^3 are generally considered as SSWS. Other countries may consider public non-piped or individual supplies as SSWS.

In many countries the quality of small-scale water supplies and sanitation systems are a matter of concern. In the EU the level of non-compliance for microbiological parameters of drinking water is estimated to be 40% for SSWS. Every day, over 700 children under five years old die from diarrhoea linked to unsafe water, sanitation and poor hygiene. 2.3 billion people – lack basic handwashing facilities at home.

Public health, safe water supply and safe sanitation are very much interrelated and are neglected or have their relevance underestimated, particularly in rural communities. Better protection and management of drinking water sources and sanitation facilities are possible, if weaknesses and strengths are identified. For the identification of possible sources of hazards and risks, the knowledge about adequate quality of water and sanitation, the pathways of contamination and the associated risks, as well as the prevention of risks are essential.

A water and sanitation safety plan (WSSP) can be one way to obtain and maintain safe drinking water and sanitation systems and to minimise related diseases. The approach of Water Safety Plans was laid out by the World Health Organisation (WHO) in the WHO Guidelines for Drinking Water Quality. The approach of risk assessment and risk management of water (and sanitation) systems are internationally recognised principles on which the production, distribution, monitoring and analysis of parameters in drinking water is based. This approach was adopted in the revised and entered in force 2021 EU Directive on the quality of water intended for human consumption (2020/2184).

The provision of safe and sufficient water and adequate sanitation and hygiene is key to protecting human health during the infectious disease outbreaks, such as COVID-19. Frequent handwashing according to appropriate hygiene standards require a continuous supply of safe water and sanitation systems that are operational. Recent developments in the environmental surveillance of SARS-CoV-2 in wastewater, encouraged countries to make use of the WHO guidance in improving the work in this area.

The presented Compendium aims to enable communities to develop a WSSP for small-scale water supplies, e.g. dug wells, boreholes, springs and piped centralised water supply systems, as well as to assess the quality of sanitation facilities such as school toilets. It gives guidance and background information for managing and planning safe drinking water and sanitation.

The management of a safe drinking water supplies and sanitation systems, concerns many stakeholders, such as public health institutions, water operators, local authorities, schools, citizens and non-governmental organisations. More activities with education stakeholders who have expertise on existing and planned inclusion of environmental issues in primary and secondary education is introduced.

I hope, that water operators, local authorities, and schools will largely use this compendium as a practical tool to improve the public health situation in the pan-European Region!

Professor Mihail Kochubovski

*Pan-European Region includes Eastern Europe, Caucasus and Central Asia (EECCA), South Eastern Europe (SEE), as well as Western and Central Europe (WCE).

Literature: https://unesdoc.unesco.org/ark:/48223/pf0000377362

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This compendium is the result of the work of many contributors from the pan-European Region who have become enthusiastic about the WSSP approach. Initiator was WECF senior water professional Margriet Samwel who understood the rich potential of WSSP which had been developed by WHO. During the last 15 years, WECF has been working with their local partners on improving water and sanitation in small communities. In this frame, the compendium has been consistently further developed adopting the WSSP approach to the local needs in the pan-European Region.

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C

HOW TO INVOLVE SCHOOLS

C1

INTRODUCING WATER AND SANITATION SAFETY PLANS TO SCHOOLS

Authors: Margriet Samwel, Claudia Wendland

SUMMARY In this module the principles of developing a water and sanitation safety plan (WSSP) for small-scale systems, with the involvement of schools, their pupils and the community, are explained. Several steps and tasks are presented on how to develop a WSSP with schools. The WSSP team to be established, and the community will also play an important role. The 10 main steps and hints for developing a WSSP are presented, and suggestions are given on how to realise this task. Reference will also be made to other modules, which will provide more detailed information on the issue, and/or frameworks for reporting analyses and conducting interviews and risk and quality assessments of local water sources and sanitation systems (such as school toilets).

The 10 WSSP steps presented are:

Step 1: Workshop for teachers; set up a WSSP working team and program
Step 2: Description of the local drinking water system(s) and sanitation facilities
Step 3: Identification of relevant stakeholders and regulations
Step 4: Documenting and village mapping Objectives
Step 5: Hazard identification & Risk assessment and water tests
Step 6: Sharing information, mobilising the community
Step 7: Development of an action plan
Step 8: Report and share the planned actions
Step 9: Implementation of the planned actions
Step 10: Monitor, improve or adjust the WSSP activities

OBJECTIVE From this module, the reader should gain a knowledge and understanding of the aims and approaches of developing a WSSP. The reader should be given the tools to facilitate and support the involvement of schools in developing a WSSP for small-scale systems in their community.

KEY WORDS AND TERMS Small-scale water supplies, small-scale sanitation, hygiene, safety, risk assessment, monitoring, analysis, control and eliminating hazards and risks, minimising health risks, action plans.

1. Why involving youth via schools?

Children and young people are open to accepting new knowledge and participating in new activities. The know-how those children learn at a young age will guide them through their whole life, especially in the case of interactive learning, where children can grasp a concept using all their senses. Children can multiply knowledge within their society, as they share and transfer it with and between their parents, siblings, and friends.

Children can be the drivers for the development of water and sanitation safety plans (WSSP) for small-scale systems in their communities or schools, but the support of teachers, parents and authorities is also needed. With the cooperation of all stakeholders, children can be taught to share information and will be given a broader perspective on their environment and community. A major advantage of WSSPs is that children and other stakeholders can discover and gather information about the environmental situation in their community together. This 'learning by doing' approach has proven a very effective way to internalise knowledge.

Experiments facilitate learning for children

Depending on the age of the children, the available time and the level of involvement of teachers and other stakeholders, an approximate final outcome of the WSSP will be outlined below. Parts of the proposed programme can be selected and even changed and adapted to suit the local circumstances. Certain activities will be indispensable for a basic knowledge of the quality and risks of water supply and sanitation systems (e.g., school toilets). This action plan proposes a programme for children's involvement in the monitoring of the quality of drinking water in toilets belonging to their school, other public toilets, and in the general environment of their village.

This programme will have several outcomes, such as:

- Understanding of the water supply system and the risks and dangers of pollution
- Understanding of toilet systems and their advantages and disadvantages
- Awareness-raising about possible water borne diseases and the link between sanitation, hygiene, and health
- Knowledge about the quality of local drinking water and sanitation systems
- Insight into the seasonal fluctuations of nitrate concentrations in the water
- Awareness-raising about the relationship between water quality and the environment
- Rising about potential health risks from unsafe drinking water and poor sanitation and hygiene practices.
- Environmental awareness among children and citizens, through active participation
- Cooperation with local authorities and other stakeholders
- Capacity-building of local youth and citizens
- Strengthening the demand for active water protection measures and access to safe sanitation
- Action planning towards improving the water and sanitation situation in the school and community

It should be underlined that within this frame, the WSSP is explained for educational and demonstrative purposes. The responsibility for elaborating the operational Water Safety Plan belongs to the water provider if it is a centralized supply system or to the owner if it is the situation of a private well. Health inspections and health risk assessment are the task of the public health professionals.

2. How to develop a Water and Sanitation Safety Plan (WSSP) with schools

The methodology of developing a WSSP within schools is the same as the general methodology explained in Part A of this Compendium. In this part of the Compendium, there are some additional activities proposed which are specific to schools, such as the assessment of the school's water and sanitation situation.

The procedure for carrying out the programme should be discussed in the school with the children and teachers. Ideally, parents and local authorities should be informed about the project and be involved in it too. For covering different aspects of the water supply and sanitation system, a team of people with different background and expertise will participate at the development of a WSSP. Finally, the results of the WSSP school program will depend a lot on the available time, the level, and the age of the pupils.

However, much can be achieved simply by raising awareness about the situation within the school and community. What follows are some thoughts and the most important steps for developing a WSSP, presented in more detail.

2.1. The toolbox

There are core activities for developing a WSSP, such as conducting for example Nitrate quick tests or investigating the pH or colour of the water, and in which tools are needed. Therefore, it will be convenient to have a (tool) box for each class or group to gather the tools needed and related to the WSSP lessons. The toolbox consists of practical tools, which can be combined according to the needs and circumstances. Furthermore, educational and/or practical tools can be stored in the box.

Pupils' drawing of a painting competition in a Romanian school on the topic "the value of water" ("The magical journey" by Petra Szücs, Timisoara)

The content of the toolbox can be:

- Clear drinking glass of 2 dl or 3 dl
- Nitrate quick test strips – with a range from 0-500 mg/l
- pH –indicator strips
- Colour strip or white paper for observing the colour or turbidity of the water
- Puzzle poster of "bad" and "good wells"
- Other pictures or drawings e.g. "The water cycle"
- Precipitation measure beaker
- Thermometer
- Towel or tissues, notebook, pens, scissors, etc.

It is necessary to keep in mind that the methodology of developing a real WSSP recommend carrying out first a hazard identification activity, to calculate the risk scores for associated risks, to rank them, and then to establish the parameters to be analysed to confirm the findings of the sanitary inspection. Based on the results of the sanitary inspection and risk scores, and analysis reports, the corrective measures (action plan) shall be established under the supervision of professionals.

3. Steps and hints for developing a WSSP for small-scale systems

Although, in general, school staff have a lot of knowledge and skills, there will undoubtedly be situations where a consultancy or interview with a local authority, or water and sanitation or health expert, will be beneficial for obtaining advice and information. Therefore, the school will not develop the WSSP alone but rather, by a WSSP team, together with different stakeholders from the community. It is important to have regular team meetings, to share information, to communicate progress and challenges and, overall, to work in a transparent way.

Finally, the results of all the activities and investigations should be shared and discussed, not only by the WSSP team or school, but also by the citizens of the community. The local media are often interested and willing to publish articles in the newspaper or conduct interviews for radio or television. Furthermore, exhibitions in the school or town hall, public meetings, or special national

or international days dedicated to water and/or toilets, are excellent occasions for presenting the WSSP results and raising awareness among the broader public.

Below, 10 basic steps for developing a WSSP for small-scale systems are summarised and presented. The estimated time need for conducting the steps, and the module numbers for more information related to the activity mentioned, are given.

Overview of 10 steps for developing WSSP for small-scale systems

Step & timeframe (week)	Compendium reference & activity	Tool / interaction	Cooperation partner
1 (1-3)	**C1, A1, A2, A3**: Set up a WSSP working team and develop a WSSP program	Public meeting, contacting local authorities, water operator and school's staff	Local authorities, water operator, community, NGO, school staff and secondary school pupils
2 (2-5 4-continue)	**B1, B2, B3, B5, A5**: Description of the local drinking water system(s) and sanitation facilities; Nitrate monitoring of local water sources is a common example, but any other parameter associated with the identified hazards, shall be checked, e.g., pesticides	Visiting/interviewing the water supplier/ operators and local authorities; field visits; Nitrate quick tests	Authorities, water operator, school, citizens, NGO
3 (3-6)	**A1, A8, B5, B8**: Identification of relevant stakeholders for the water supply and sanitation systems and services	Interviewing water supplier/ operators, and local (regional) authorities; Internet search; mapping the stakeholders	Authorities, water operator, school (secondary pupils), NGO
4 (5-8)	**A6**: Documenting and village mapping: visualisation of the water and sanitation systems; stakeholder mapping	Information collected from the different steps	Local authorities, school
5 (9-14)	**C3, C4, A5, A7, A8, B1, B2, B3, B4, B5, B6**: Risk assessment of local water supply and sanitation	Sanitary inspection forms, interviews, field visit of water protection zones, water sources and toilets. Collecting results of water analyses. Handwashing exercise	Authorities, water operator, school, citizens, NGO laboratory
6 (15-20)	**A1, A6**: Visualisation of the results and findings; sharing of information, mobilising community	Information collected from steps 4 and 5; Exchange with other schools, Exhibitions, meetings; Working with the media	Partner schools, journalists, authorities and community, NGO
7 (21-25)	Development of an action plan for improving the situation	Meetings and discussions with all stakeholders	All relevant stakeholders
8 (26-27)	Report and share the planned action	Exchange with other schools; sharing information with the community and authorities	NGO media
9 (28 ff)	Implementation of the action plan	Cooperation and collaboration with all relevant stakeholders	All relevant stakeholders
10 (ongoing)	Monitor, improve or adjust the WSSP activities	All relevant stakeholders, WSSP team	

3.1. Step 1: Workshop for teachers; set up a WSSP working team and program

The set-up of the appropriate working team is an important first step for the WSSP programme. The team consists of teachers, NGO supporting staff, persons responsible for water and sanitation in the community, and perhaps representatives of the local youth and community. The WSSP team should be composed of an equal number of males and females and should involve minorities and vulnerable groups.

As a start, the kick-off workshop will take place. Here, the aim of the project and compendium will be introduced to the whole team, in particularly the teachers who will work with the youth and relevant local authorities. The workshops last ca. two days, during which the background of the WSSP, the Compendium and the 10 steps of the WSSP programme will be explained in detail and some practical activities will be conducted. A 'Training of Trainers' methodology will be used, so that teachers and participants will be able to develop a WSSP programme tailored to their specific conditions, community, and school.

For further planning, it is important to discuss the forecast WSSP activities with educational authorities or the school director. The question must be asked: will the curriculum permit time for WSSP activities during school lessons, or only after school finishes?

After a local WSSP working team is established, a WSSP programme should be developed. Ideally, a preliminary program will be made for a time frame of one school year. For the implementation of the WSSP, the most relevant activities should be defined, as well the persons responsible for carrying out the activities. Further, someone should be identified who can document and report on the meetings, WSSP activities, results, and experiences. Furthermore, the time frame outlining what should be done and when, as well as the related costs, should be estimated.

Moreover, issues like the communication of activities and the sharing information with other classes or schools and communities must be discussed. Particular activities, experts or field visits may also be needed.

3.2. Step 2: Description of the local drinking water system(s) and sanitation facilities

The team starts with a description of the local water supply system. In cases where the community uses water from wells and/ or springs, the number and location of these water sources should be investigated. If needed, and with the support of local authorities, pupils and teachers might also make an inventory of the local water supply and local sanitation solutions (see module A2 and A3).

What kind of supply is there? Are there dug wells, boreholes, or public taps? Which water source is used and how deep is the tapped water layer? Where are the water points? What is the distance between them and the houses of consumers? Which households have access to the water point or supply?

If centralised piped water is available then the whole system should be looked at, from the point where the water comes from, to the method of abstraction and, the volume and location of water reservoirs (if applicable, also the water treatment system and distribution network of the water), to the households where the water is supplied. An overview of the households or public institutions served by the piped network or by other water sources should be made.

What type of toilet do households have? Are there public toilets? Much of this information can be represented on a map. Using an existing map for identification and mapping purposes is

very useful. If no map is available, an overview of the village, its water supply points, and sanitation systems should be drawn up.

Furthermore, if applicable, it would make sense to identify the location of the sewage network, the wastewater treatment plant and the location the point of release of the wastewater into the environment. If no sewage system is used, then the type of (public) toilets and how the content of these toilets is stored, treated, used or released into the environment should be looked at.

For this task and for the processing of the information gathered, it is very useful to present it on a map (see module A6 and step 4).

3.3. Step 3: Identification of relevant stakeholders and regulations

An investigation of the current situation concerning the responsibilities and management of the water supply system will be useful for identifying who is doing what. The NGO involved and the local administration could potentially support this process by facilitating the gathering of information from the different stakeholders.

Questions such as: "Who officially has the task of monitoring, cleaning and maintaining the water system?" should be posed. Is there any system or institution analysing the water quality and, if yes, with whom are its results shared?

Is there any budget available for operation and maintenance; is there any contribution from the local citizens for water consumption? Who makes the decision about the budget etc.? Particular attention should be paid to the role of women, as they are often responsible for the household budget, as well as health and sanitation issues. Local and national joint actions can be developed, by creating an atmosphere of understanding and cooperation, by knowing the different tasks and responsibilities, and by bringing consumers, water suppliers and all other stakeholders closer together. An important part of this step is investigating the relevant regulations and laws applicable for the local water supply and sanitation systems. In other words, how frequently should water quality be monitored, and which substances should be analysed? What should be done in case the water does not comply with the set standards? For more information, see modules B4 and B8.

Structures of the responsibilities of the whole system can be summarised in an overview of responsibilities or in a 'network diagram', for example see module A6. Other graphs listing, ranking and connecting institutions, groups or individuals, communication systems and information sources that influence the community's decision-making on water supply can also be used.

3.4. Step 4: Documenting and village mapping

A component of the WSSP is the documentation of the collected information and the making of results and plans visible to all stakeholders. All the collected information should be documented, objective, understandable and made available in reports. The documentation might be in a notebook or computer- the most important thing is that the task is adequately done.

Water mapping

Depending on the issue at hand, the results can be made visible in graphs or maps (see module A6). In many cases, the administration of the community or the institution responsible for water supply will have a village map, one which possibly indicates water sources, water networks (if applicable) or other water-related information.

If no village map is available, water supply systems can be made visible using drawings with the input of all stakeholders (see module 6).

Mapping could include the following elements:

- North, south, east, west indications
- Available infrastructure, streets, rivers, lakes, public institutions, schools, areas with housing and agriculture
- Location of water sources, public wells or taps, location of pipes/network etc.
- Citizens connected or dependent on which source
- Types of supplies, e.g., wind wheels or pumps, dug wells or bore holes
- Stream direction of the groundwater or river
- Different water layers or sources in use. If there are, what are their given properties, such as depth
- Geographical information, height of the area

Sanitation mapping

The mapping of the sanitation system can be done in the same village map as the water supply system. In a joint mapping exercise, the linkages between water and sanitation become much more visible. Potential cross- contamination can be identified much more easily if both systems are visible on one map. The following elements of the sanitation system should be included in a map of it.

Type of toilets

- If **flush toilets** and **no collection and treatment system**: what are the existing regulations and plans for water and sanitation? Observations made by the pupils might identify risks for the population.
- If **flush toilets** and **septic tanks**: ask households or authorities how the septic tanks are emptied, how their content is treated and what regulations there are. Observations made by pupils might show that septic tanks are flooded in the rainy season, or that they are overflowing.
- If **flush toilets**, **canalisation**, and **treatment**: visiting the wastewater treatment plant would be very interesting, to interview the operator and see if they keep to standards for the treated wastewater. Where do they discharge the wastewater and are all the village's households connected?
- If **pit latrines**: how are they operated and is the groundwater level high? Can the excreta contaminate drinking water sources? Where is the latrine content discharged? Is it used for agricultural purposes? What are the experiences of households in this area?

Special attention should be given to the school toilet and other public toilets, as their management often poses a challenge. The school toilet should be visited, and teachers and cleaning staff should be talked to. Step 5 gives more detailed recommendations about interviews.

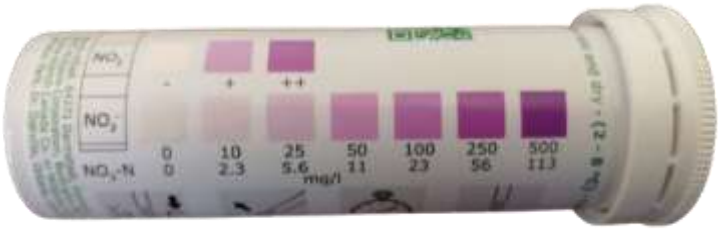
3.5. Step 5: Hazard identification, risk assessment and water tests

Two basic elements in developing a WSSP are the investigation of current water and sanitation quality, and the hazards (dangers) and risks for the water supply and sanitation systems. Hazards can occur temporarily, during turns in the weather (rainfall or snowmelt); during the season when the fields are fertilised; or continuously, because the content of pit latrines and septic tanks may infiltrate the soil or because toilets, wells, pipes or reservoirs are badly maintained. Making observations and conducting interviews with relevant persons can identify many hazards and risks. Water quality can only be assessed by water analyses, whereas the quality of toilets can be investigated principally through observation. Information about water tests and the assessment of water supplies and sanitation will be provided below. However, it is advisable to also see the modules referenced.

Water tests

In general, operators of public water supplies should conduct regular tests on the quality of water supplied to consumers. Therefore, the first step would be to contact the local authority responsible for water quality and ask for a copy of their analysis report. Besides studying "official" analysis reports, it is very interesting for pupils to conduct water tests themselves.

Quick tests can be a good way of obtaining an indication of the water quality, and easy to carry out. After pupils are instructed on how to do the tests and report the results, pupils can do this task also. For example, nitrate pollution can quickly be detected in water samples by using nitrate test strips.



Nitrate pollution can quickly be detected in water samples by using nitrate test strips

Nitrate monitoring of water sources

Monitoring water sources for nitrate contamination can be done in two different ways. First, a good overview of the existing nitrate concentration of the well water should be obtained. Water sources should be chosen in such a way that they could be considered representative of all water sources. This means that sources from different parts of the village, which are potential sources of drinking water for the public, must be analysed. It is preferable to test these different water samples in the same season, e.g., during spring or autumn. Pupils can take the sample to school, or the tests can be carried out directly on the spot. The depth of the water source should be noted. Other observations on water quality, like colour, turbidity, or others, should be reported. Physical parameters such as suspended sediments (turbidity) might indicate possible microbiological pollution. The locations of the investigated wells and the test results must be noted and can be transferred to the map. For reporting and mapping see modules A5 and A6.

Secondly, it can be very informative to monitor nitrate levels in the same wells throughout the year. For example, high, low and medium nitrate-polluted wells can be chosen for seasonal monitoring. The test results of a whole year give an overview of seasonal fluctuation, which might be useful for the WSSP. Depending on the particular soil layers, the leakage of nutrients into the groundwater by precipitation, manure fertilisation or nitrogen can be assessed clearly using such a monitoring programme. It is good, therefore, to measure precipitation and

temperature as well, since these parameters could be related to nitrate concentration. It must be ensured that everything is adequately registered, to avoid any potential mistakes. Please be aware that the nitrate test should not be carried out in the cold, but at temperatures above 150C (see module A5). When this is done on a 14-day basis throughout the whole year, what results is an interesting and useful picture of the fluctuations of nitrate, temperature and precipitation.

Other water quality parameters

Microorganisms, such as bacteria originating from faecal matter, cause many water-related diseases. Therefore, bacteria are the most important parameters to identify the safety of drinking water. Water from unprotected and badly maintained sources is easily infected by microorganisms due to contamination with human and/or animal excreta. One gram of faecal material contains millions of bacteria and viruses (see module B4 and B5).

Water from public wells and central water supplies should be analysed on a regular basis and the results should be made accessible for the public. The frequency of analyses depends on the amount of water supplied to the community. The presence of microorganisms, such as Escherichia coli (*E. coli*) or Enterococci, should be known. Otherwise, an authorised laboratory should be requested for analysing the drinking water for microorganisms. Both are indicator bacteria for faecal pollution: zero *E. coli* or Enterococci at all should be found in 100 ml of drinking water (see module B4).

Interviewing relevant persons, water and health authorities, consumers

The users of water systems often focus on problems or have different perceptions about for example water quality, or access to water, compared to water suppliers. By using questionnaires or participatory approaches like ranking, an insight into the problems and experiences of the supplier and user can be obtained. First of all doctors, teachers and other key informants in the village can be asked about the occurrence of water-related diseases. A survey can be done among villagers about their perceptions of drinking water quality. The authorities should be asked for data on water analyses and about how public water supply systems are maintained (see some examples of questionnaires and guidance on conducting interviews in module A8). After instruction from a teacher, pupils could conduct interviews.

Risk assessment by using sanitary checklists

For the risk assessment either of the danger of well/groundwater pollution caused for example by animal manure or wastewater, or of the quality of the school toilets, checklists can be used. See several examples of sanitary forms and checklists, and information on how to use these forms in module A7.

The state of the well or tap and its surroundings should also be investigated. It might be asked if there is cover, or an apron around the pump or well etc.? After instructions and awareness-raising by the teacher, children can make their own observations, such as estimating the distances from manure heaps or pit latrines to the well, population density, or the location of the source of pollution (e.g., from uphill or downhill, from north or south of the water source.) Citizens living near wells should be interviewed about their practices of fertilising their fields. If flush toilets are used, how is the wastewater collected and treated? Is there any risk of spreading disease or contaminating water sources? In the case of dry toilets, how do households manage their latrine content? Is it emptied from time to time and discharged somewhere?

Other sources of microbiological pollution, such as the tools used for extracting the water or for the storage of water in houses, should be observed and identified. A checklist adapted to the area and circumstances should be prepared. For sanitation, the children could do inspections of their school toilet and other public toilets, assessing their risks (see modules A7 and A8). To better understand the background of sanitation and hygiene, modules C3 and C4 explain the links between WASH and health. An interactive exercise is part of C3, which illuminates the transmission of pathogens through hands and the need for handwashing. The key challenge in working on sanitation and hygiene in comparison to water is the inherent taboo surrounding the topic. It is important to overcome this taboo and to start to openly discuss toilets and why pupils

might not like to go to the school toilet. Who is responsible for the operation and maintenance of the toilet? Is the school director taking responsibility for the facilities? Citizens, medical and water administrations, and doctors are important sources of information and should be interviewed about WASH and related health diseases.

3.6. Step 6: Sharing information, mobilising the community

Pupils become the "experts" for water and sanitation in the communities and start to share information. For example, the children analyse nitrate in water samples, which people bring to them. Nevertheless, it will be important to cooperate with the local authorities and to organise common actions and jointly raise awareness about the situation, the water and sanitation quality observed, the identified risks of the systems, and the general perception of the water and (school) toilets.

Pupils can start to mobilise the press for the related UN days:

- **World Water Day**: March 22
- **MHM Day**: May 28
- **World Toilet Day**: November 19
- **Global Handwashing Day**: October 15

To present the results and share information it is beneficial to make posters, graphs, drawings etc. For example, the sources and dangers of pollution can be plotted manually on tracing paper and overlaid on top of the map of the village. It is further recommended that a poster be prepared and hung in a classroom or school corridor, where the results of the analyses are open to the pupils and visitors of the school.

Children from Albania visiting a wastewater treatment plant on World Water Day

3.7. Step 7: Development of an action plan

Finally, the main goal of the WSSP is to identify the weaknesses and strengths of the system; reach an improvement; and minimise hazards and risks, which can deteriorate the water quality. After identification hazards, risks and possible improvements to the water system, joint actions on a local level could lead to better risk management, e.g., by cleaning and restoring the source or pipes; installing closed pump systems; safely managing human and animal excreta; or even lobbying for an upgrade or installation of a central water supply system. For the implementation of the defined actions, financial investments should be estimated, and potential sources should be discussed as well. Nevertheless, many improvements – like cleaning water reservoirs or wells, or raising awareness and informing the public – can be done with little or no financial resources. Furthermore, the responsibilities for the defined tasks and actions, as well as realistic timing, will be very important for satisfactory progress and improvements.

The following points may be important for developing a sustainable and transparent action plan:

- Establish an active local water and sanitation committee.
- Be realistic in planning, and in setting targets and timeframes Improvement can be a step-by-step process and be affordable, sustainable, and adapted to the local situation. Recommendations from other experts and similar projects can be useful.
- Identify the most important stakeholders needed for the implementation of the action plan.
- If applicable, develop a visibility study for the plans with experts and other stakeholders.
- Ensure the involvement of men and women, and all social, political and cultural classes of the community, at all stages in the decision-making processes; ensure all citizens of the community have access to information.
- Ensure the operation and maintenance of a planned installation by skilled staff and an adequate water protection policy.
- Estimate potential financial sources for the implementation of the plans.
- Ensure a cost-covering operation and maintenance of the system.
- Use the results of the WSSP to lobby for financial support at local, regional, and national levels; involve the media.

3.8. Step 8: Report and share the planned actions

A crucial part of the WSSP is the adequate documentation of the collected information and making the results and plans visible to all members of the community. The information collected on the water and sanitation systems and the improvements required should be objective and available made in reports, and, depending on the issue, the results can be made visible in graphs or maps. See also step 6 and module A6. Furthermore, the WSSP team should document the agenda of meetings and decisions made, as well as the financial aspects of the implementation of the WSSP program. The WSSP program should be transparent and accessible to all.

3.9. Step 9: Implementation of the action plan

The most crucial element of the WSSP is the implementation and effectiveness of the identified plans. Sometimes the measures will have an immediately visible effect - for example, if the catchment area or well is cleaned - but the effect on water quality may not be directly apparent. Such actions as increasing restrictions on human activities in the water protection zones may have their first measurable effects on water quality after 1 or even 3 years. Other measures - for example the disinfection of water or boiling it - will have a direct effect on the safety of that water. Therefore, it is advisable to consider the effect of the planned measures and actions, and to rank and perform those actions with the highest priority and highest effectiveness in minimising health risks.

3.10.Step 10: Monitor, improve or adjust the WSSP activities

To know the effectiveness of the measures and actions taken it is necessary to control and monitor their results, and to assess risks not only before, but also after, the implementation of the actions. This can, again, be done by water analyses, by observations and using sanitary inspection forms, etc. It is possible that certain actions will be successful, but others may be less so and might need to be adapted to new situations.

Therefore, the activities of the WSSP team should be made as part of a continuous process of monitoring, risks assessment, adaption of the situation and documenting and sharing information.

C2

ABOUT WATER

Author: Friedemann Klimek

SUMMARY This module consists of 3 parts: A. Water properties; B. Water cycle; C. Ground and drinking water
A brief overview of some water properties is presented in lesson *A. Water properties*, to encourage observation of them in daily life. Associated experiments are also suggested. In lesson *B. Water cycle*, local and global water cycles are generally distinguished. Regarding groundwater, specific aspects of regional and local conditions and climate characteristics are summarized. In lesson *C. Ground and drinking water*, the occurrence of different types of natural drinking water sources are presented.

OBJECTIVES The pupils achieve physical and chemical background of water and carry out related experiments. They can describe important aspects of the water cycle and link these aspects to their own local water sources and water supply. They become more aware of the influence (changing) climate and varying weather conditions have on the local water supply. The pupils can distinguish between different types of natural drinking water sources, do experiments to see how soil cleans water and do first water tests to identify the water quality.

KEY WORDS AND TERMS Density, freezing and melting point, specific heat capacity, polarity and solubility, pH, surface tension; water cycle, evaporation, condensation, precipitation, infiltration, storage, runoff, groundwater, surface water; soil structure, soil type, aquifer, groundwater, spring.

PREPARATION / MATERIALS

Material	Preparation
Little glass bottles (2), plastic sticks (2)	Pupils should bring several water samples
Freezer, thermometer, Bunsen burner (or hot water burner)	
Model of water molecule	
Salt, sugar, oil, soap, glasses, towels (or tissue)	
Paper clips, screws, cork, ice cubes	Ice cubes must be prepared before
Paper and pens for drawing, scissors	
Charcoal (cotton wool), silt, gravel, big plastic bottles with a cap	

A. Water properties

Introduction

Do the pupils know about any living organism which can exist without needing water at least every now and then? Is there any flower that does not fade, any animal that does not die without water? Every species on earth, whether it is a big animal like an elephant or a small insect like a bee or an ant, depends on water. Human beings not only depend on water to survive, but they consist of 60-70 % water. Water bodies are also important habitats for living creatures (e.g., sea, swamp, lakes, and rivers). Water is a very important element in our daily life. We need water to produce goods for (daily) consumption (clothes, food, etc.), transportation (rivers, sea, etc.) or recreation (swimming, skiing, ice-skating). Water is also essential for everyday activities like cooking, drinking, and cleaning. Water is a very crucial element for life and especially for our wellbeing and prospering. To gain a deeper understanding of our drinking water's vulnerability, it is helpful to know some of its properties. These properties are sometimes very astonishing (and at first glance more or less hidden) and show us an admirable, vibrant and vivacious element.

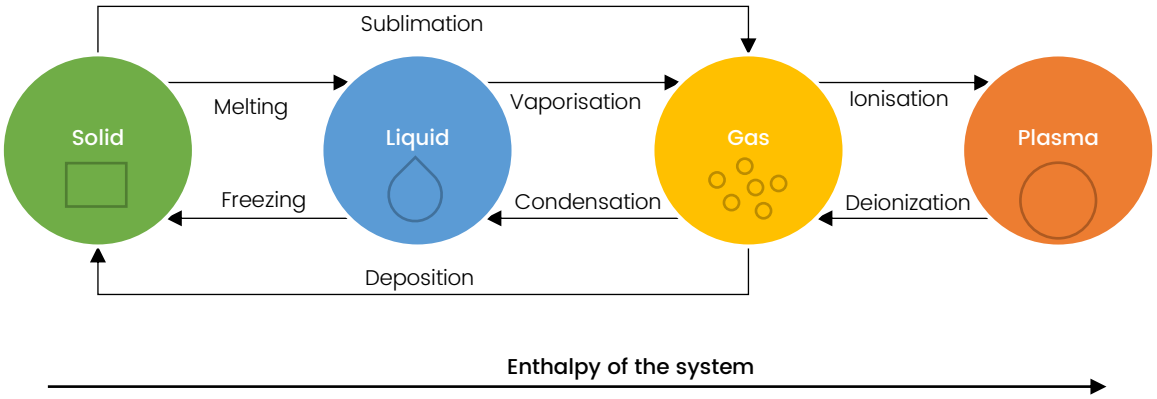
1. Water properties

Density

Water has an approximate density of 1 g/cm³ in its liquid state. However, this changes when water freezes. The volume expands during the phase transition from water to ice and so the density lowers to around 0.9 g/cm³. Therefore, ice seems to be "lighter" than water because it floats on the water surface. As the volume of water increases when freezing, it develops a huge power as well. For example, water pipes can burst during winter if not properly insulated.

States of matter

Our temperature scale of "degree centigrade" uses the freezing and boiling point of water for scaling. At both points water changes its state of matter. The graphic names all the changes of water's states of matter. Water is the only molecule on earth which shows all three states of matter in a natural environment.



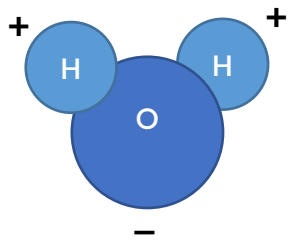
Water – states of matter

Specific heat capacity

Water has a very high specific heat capacity (4.186 kJ/ kg*K) in comparison to a lot of other materials like metals (e.g., steal 0.477 kJ/ kg*K) or other liquids (e.g., oil 1.67 kJ/ kg*K). Water needs – as it can store much more energy – a lot of energy to get heated. In return it keeps this energy and slowly cools down. Therefore, large water bodies can serve as a local energy reservoir, and we can use water for heating (hot water bottle). The Black Sea works as a large heating source in winter (higher temperatures at the coast of the Black Sea than in the inland).

Polarity / solubility

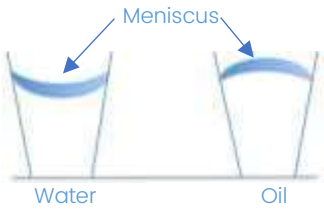
Water has a molecular structure with a positive and a negative part. This property is responsible for the solubility or insolubility of other substances in water. Polar molecules like sugar, salt and ethanol can easily be dissolved in water. Oil is nearly insoluble and floats as a thin layer on the water surface. However, if we use soap or a similar detergent we can "dissolve" substances like oil or fat.



Model of a water molecule

Surface tension

The above-mentioned polarity of water molecules causes strong forces between them. The forces between molecules (surface tension) cause also the curve (meniscus) in the surface of a liquid close to the surface of a glass or other object. The meniscus of oil is different than the meniscus of water. The forces between the water molecules are lower than between water and the glass, and the forces between oil molecules are higher than between oil and the glass. In the illustration below, water and oil show the effect of building respectively a concave and convex meniscus when poured into a glass. Intermolecular forces are also responsible for water-building drops. In the nature and daily life we can see effects of the surface tension liquids. For example, some animals can "walk" on the water surface (e.g. water strider). The addition of some drops of a detergent interrupts the strong connection between the water molecules and destroys the surface tension.



Surface tension of water and oil

pH

pH is a measure that describes how acid or alkaline the (watery) environment is. It ranges from 0 (very acid) to 7 (neutral) to 14 (very alkaline). For many biological and chemical processes, a specific pH is important. If it differs too much from the optimum for a specific reaction, the process will not work. For example, our stomach needs a pH of around 1 (which is provided by the stomach acid) to digest food properly.

2. Exercises and activities

Let the pupils describe which results they expect from the following experiments, why they expect them and what they observed doing the experiments:

Density

- Different materials (screws, cork, wood, ice) show different behaviour when put into a container with water. They float or sink in water depending on their density.
- Freezing water in a small glass bottle. The bottle will be cracked when ice is formed and expands.
- Fill two glass bottles with water and close it with a cap. Put them into the freezer. Next time when taking the bottles out (after a few hours) they should be broken.

States of matter

- Where can we find the different states of matter (water, ice, steam) in our natural (or artificial) environment?

Polarity / solubility

- Show with an electrostatic chargeable material like plastic sticks (e.g. 2 plastic pens, or wool) that flowing water (tap) can be deflected by electric voltage.
- Solubility of different materials: salt, sugar, oil. What happens if soap is used?

Surface tension

- What does the surface look like when water is filled into a thin, flat-bottomed flask?
- Children stand together and each child takes the hands of two other children (no row!) This should demonstrate the forces between the water molecules and that they tend to build "round" structures e.g., a meniscus (or drop). An object (e.g., book, glass) that each child should hold in one hand (in the other one still holding a hand of another child) demonstrates the effect of a detergent to lessen the surface tension.
- A paper clip can float on the water surface. If the children are not able to put the clip carefully on the water surface, they can use some absorbent paper. The addition of some drops of detergents will destroy the surface tension and the clip will sink to the ground.

pH

Measurement of pH of different liquids: Vinegar, soap, Cola, rainwater, mineral water, drinking water, orange, apple

General questions

- A person weights 100kg. How much of him/her is water?
- In which states of matter does water exist?
- At which temperature does water freeze and boil?
- At which temperature does sea water freeze and boil?

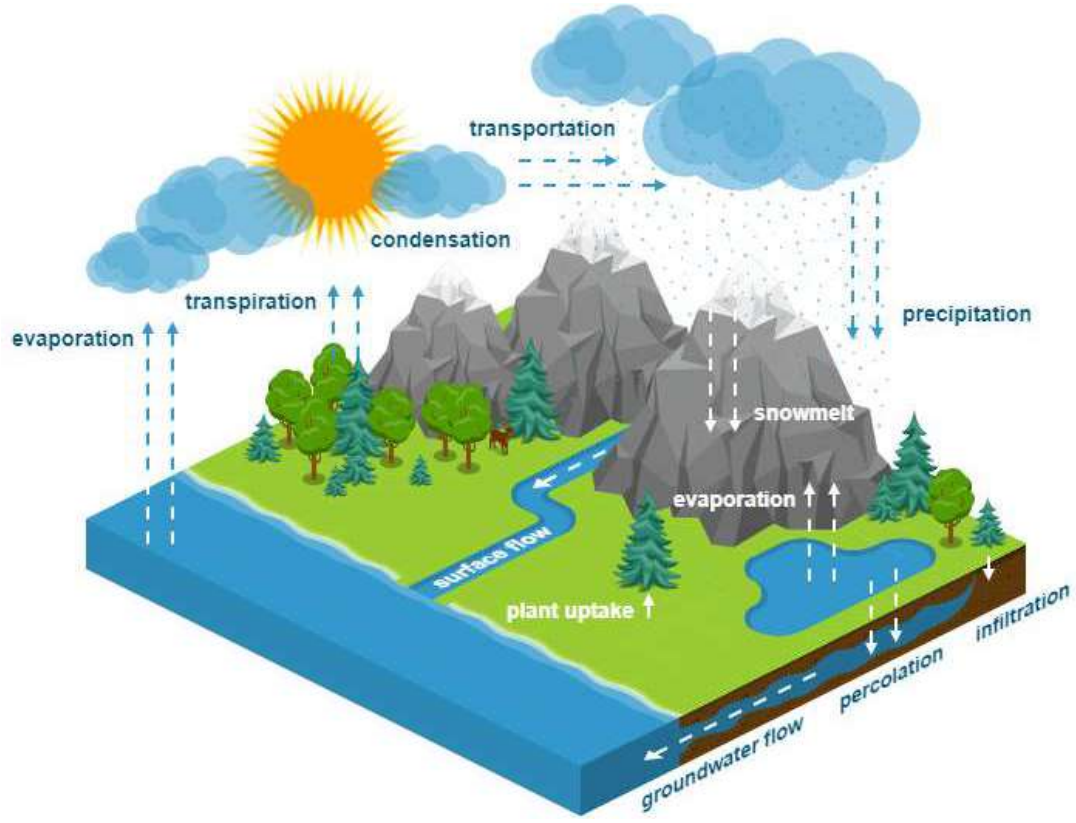
3. Text sources and further reading

Water Science for Schools, U.S. Geological Survey (USGS), (2012). Available from http://ga.waters.usgs.gov/edu Water Structure and Science, (2012). Available from http://www.lsbu.ac.uk/water

B. Water cycle

4. Water cycle – global

The water cycle starts in the ocean because it is the largest water reservoir on earth. It covers 71% of the earth's surface. Solar energy heats the water, particularly in the tropics. Through evaporation, especially at the sea surface and to a lesser extent also on the mainland, humidity is created. Because this vaporised water is lighter than air, it rises into the atmosphere. In higher altitudes, the air cools down and the water vapour condenses. This creates clouds. The wind transports the moist air and clouds to the mainland. When humid air meets cold air layers, it is lifted (warm front); it is also lifting when it meets mountain flanks (convection). When air rises, it cools down. Cold air can hold less moisture than warm air can. If the clouds are already saturated with condensed water to a certain extent, precipitation occurs and the water falls to the ground as rain, snow or hail. The form of precipitation depends on the local temperature. When the water falls to the ground, it can infiltrate the soil and seep into the groundwater layer, or it can flow on the surface directly into the next creek or river. Via a spring or well, the groundwater reaches the surface again and flows through a river system back into the ocean. In the polar-regions and high mountain ranges, a part of the precipitation is stored in solid form as ice or snow, where it could pass through as melted water into the ocean again:



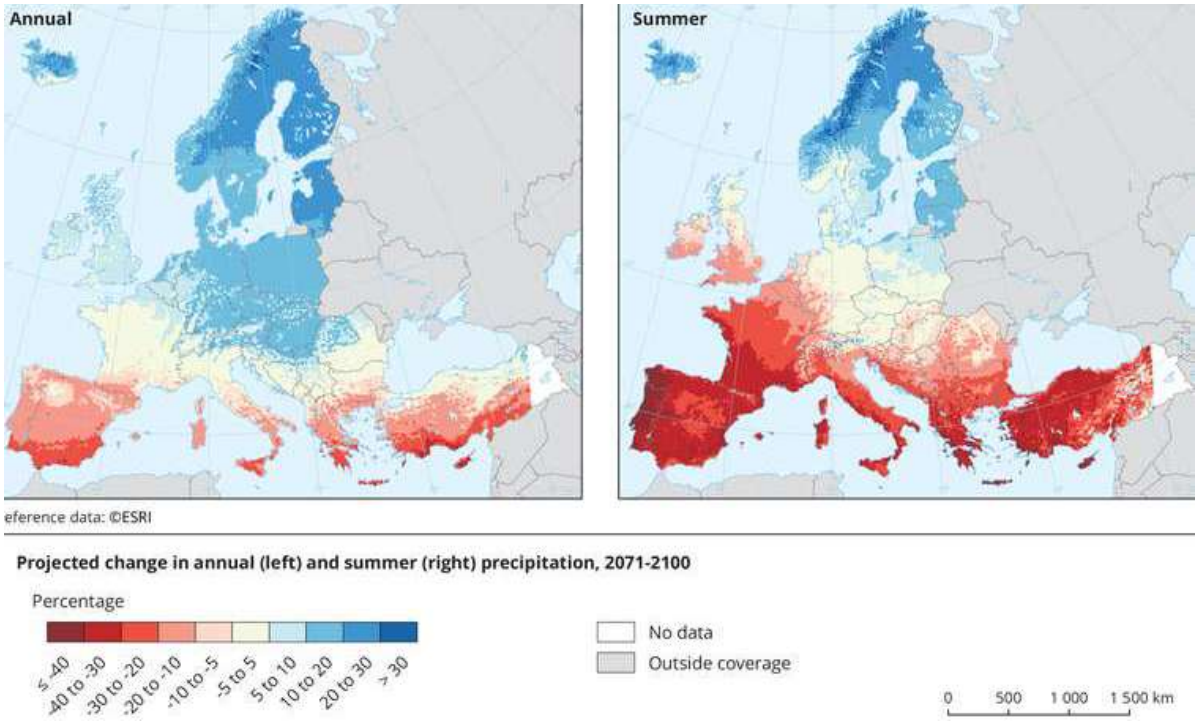
The water cycle (source: Dribble)

5. Water cycle – local

The local water cycle depends on geographical aspects like latitude, distance to the sea, main wind direction, temperature profile (on a yearly basis) and topography. In the table, you can see annual average temperature and precipitation in some European cities. Among others due to climate change, annual precipitation is changing around the world – in some cases dramatically. The annual changes in precipitation as well as those in summer can be seen in the map.

Average annual temperature and Precipitation of different European cities

Town	Temperature [°C] (annual average)	Precipitation [mm] (annual average)
Sofia	10.6	625.7
Belgrade	12.5	690.9
Berlin	10.3	515.2
Bucharest	10.8	643
Istanbul	13.9	849.6
London	11.3	601.7
Moscow	5.8	707
Paris	12.3	637.4
Skopje	12.4	483
Tirana	15.2	1,266



Projected change in annual and summer precipitation, 2071-2100 (source: European Environment Agency, 2021)

6. Exercises and questions

- Which forces generate the water cycle?
- How much of the earth's surface is covered by water?
- Draw a simplified picture of the water cycle. Name and describe all important stations of the water cycle.
- Mention different types of precipitation.
- What happens to your water sources (springs, wells or water supply) if there is less precipitation?
- Have the pupils already experienced drought/flooding, what could it mean to their daily life?
- How does the precipitation of the local area occur throughout the year?
- Is the local area considered as an area prone to droughts, hence leading to water scarcity?

7. Text sources and further reading

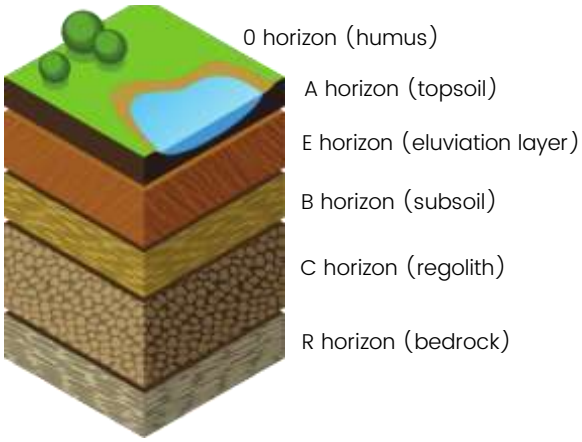
European Water 1 / 2: 25-30, (2003). Climate Variability and Change Impact on Water Resources in Bulgaria. Available from http://www.ewra.net/ew/pdf/EW_2003_1-2_04.pdf

Water Science for Schools, U.S. Geological Survey (USGS), (2012). Available from http://ga.water.usgs.gov/edu

C. Ground and drinking water

8. Groundwater

The following text describes the flow of water, starting from the point where it soaks into the soil to the point where it appears on the earth's surface, e.g., a spring or in a well. Groundwater, as mentioned in module 3B (water cycle), is generated by precipitation infiltrating (rainfall, snow) into the soil. Gravity forces water to seep deeper and deeper through the soil and move through the groundwater system where it eventually makes its way back to the surface.



Soil layers (source: Pixabay)

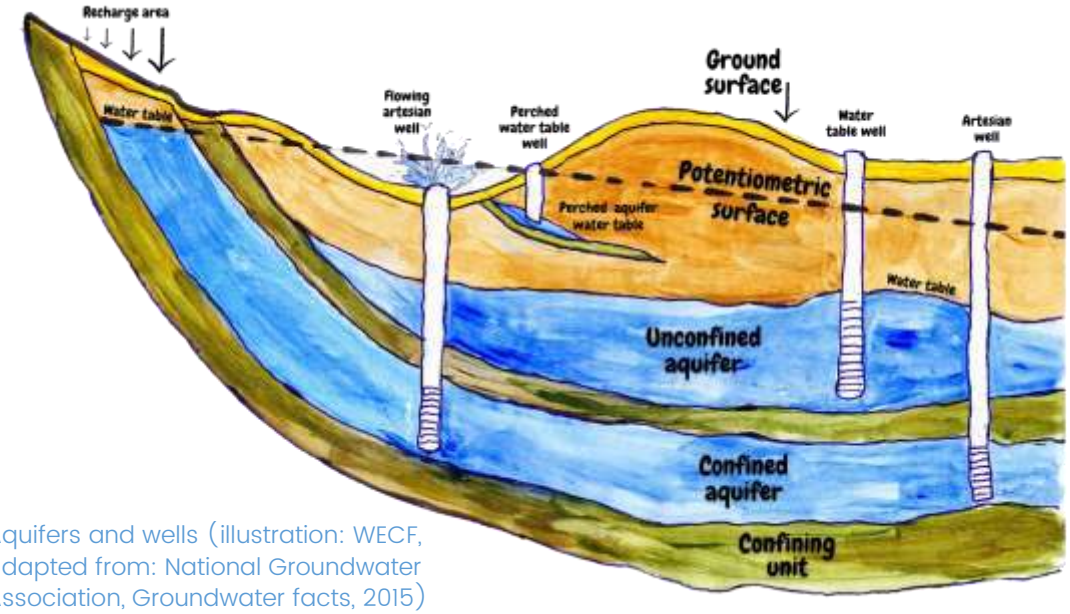
Soil is – simply put – a mixture of bedrock, clay, silt, organic material, air, water and many different organisms. It also has many different layers. There is a large variety of different soil types and each one has unique characteristics, including its colour, texture, structure, depth and minerals. The composition and depth of the soil influences the compounds of the groundwater. There is an intense exchange of substances between water and soil components resulting in, for example, mineral-rich or mineral-poor water with different hardness's. Soil can act as a filter and can absorb substances like minerals (fertiliser), pesticides or acids. As water passes through the soil it can take up beneficial substances, like minerals, but also harmful substances such as arsenic, nitrate or pesticides.

As water seeps deeper, it sometimes encounters an impermeable layer. It flows horizontally along this layer filling all the cracks, crevices and pores like a sponge. This water-filled layer is called an aquifer. When the aquifer water returns to the surface, the groundwater forms a spring. Depending on the local geographical conditions, there are different types of springs and aquifers which require different technical devices to extract water from the ground. An interesting type of spring or well is the artesian well. It is a well in geographical depression where the groundwater is exposed to a certain pressure. This pressure is high enough that the water comes to the surface without pumping.

The depth of groundwater can vary and can reach hundreds of metres deep into the earth. Another term for groundwater is aquifer, however, this term is usually used to describe water-bearing formations capable of providing enough water for people's needs (urban, domestic and industry). Often the different layers of aquifers structure the ground deep in the earth. Usually, the deeper the groundwater reaches, the more protected the water is. The different layers in the

ground enhance the filter effect by purifying the water, as mentioned above, by soil. Aquifers near the surface are prone to pollution. Severe pollution of groundwater is mostly caused by man. Thus, the protection of water is essential (see module B6 for information on water protection).

The recharge of local springs depends largely on the local geology and climate. As aquifers store only a certain amount of water, the local water supply depends largely on the precipitation received in past weeks or months. If there is less precipitation and/or higher temperatures, the wells and springs could dry up.



Aquifers and wells (illustration: WECF, adapted from: National Groundwater Association, Groundwater facts, 2015)

9. Drinking water

According to the Protocol on Water and Health of UNECE and WHO "Drinking water means water which is used, or intended to be available for use, by humans for drinking, cooking, food preparation, personal hygiene or similar purposes," drinking water or potable water is water of sufficiently high quality that it can be consumed or used especially for drinking and cooking with low risk of immediate or long-term harm. It has to be very pure.

There can be various sources of drinking water depending on local conditions. Drinking water can originate from groundwater (springs, wells), surface water (rivers, lakes, reservoirs, sea), rainwater or even mist. The usage of surface water can be necessary if local groundwater is scarce or inexplorable. Surface water is much more vulnerable to contamination by anthropogenic and natural activities and should always be analysed and treated adequately. Though 71% of our planet is covered in water, only a fraction can be used as drinking water.

Water volume of the earth (Marcinek & Rosenkranz 1996, Data according to Baumgartner & Reichel 1975)

		Water volume [km³]	Percentage [%]	
Total		1,384,120,000	100	
Saltwater (sea)		1,348,000.000	97.39	
Freshwater (total)		36,020,000	100	2.60
Freshwater	Water in polar ice, sea ice, glaciers	27,820,000	77.23	2.01
	Groundwater, soil moisture	8,062,000	22.38	0.58
	Water in rivers and lakes	127,000	0.35	0.01
	Water in the atmosphere	13,000	0.04	0.001

Only 1 % of all freshwaters can be used as drinking water. This is an equivalent of 0.0026 % of the total water volume. To make this a little bit more quantifiable here is a comparison: If a bathtub is full of water (150 l) and this stands for the whole water reservoir of our world, then roughly 4.2 l (½ bucket) are freshwater and of these:

- 3.2 l are ice (poles and glaciers)
- 1 l is groundwater and only
- 0.02 l (a brandy glass) are surface water bodies (lakes, rivers)
- 0.004 l (a thimble!) are theoretically usable as drinking water

10. Experiment

Build your own water filter

- Cut the bottom of the plastic bottle. Turn it around (the cap is now at the bottom), put charcoal in first, then silt and add some gravel at the top.
- Create some "dirty water" (soil + water and stir it)
- Remove the cap of the bottle and place the bottle on a glass. Fill some of the dirty water into the bottle which is now the filter and see what happens. What does the dripping water look like?
- Fill one bottle with pure garden soil and one with clay as explained above. Put some water on the top of the soils and observe what happens. Try to explain why.

WSSP related activities

- Which types of water sources are found in the local environment?
- What is the geographical location of the area?
- Which soil layers are found and how do they protect the water?
- Which source is the drinking water taken from? How deep is the source?

11. Text sources and Further Reading

UNECE, WHO (2000). Protocol on Water and Health. Available from http://www.unece.org/fileadmin/DAM/env/documents/2000/wat/mp.wat.2000.1.e.pdf

UN-Statistics Water Resources (2012). Available from http://www.unwater.org/statistics_res.html

Nelson, Stephen A., Tulane University (2011). Groundwater. Available from http://www.tulane.edu/~sanelson/geol111/groundwater.htm


elle Avril / WECF

C3

HANDWASHING

‘

Authors: Diana Iskreva, Claudia Wendland

SUMMARY Handwashing with clean water and soap is the single most effective technique to protect public and individual health. It can prevent distribution of diseases like flu, diarrhoea, hepatitis A, cholera, etc. Worldwide each year 1.5 million children die from diarrhoea. Handwashing with soap could reduce child deaths from diarrhoea by 44%. In this module, the relation between water, wastewater, hygiene, and human health is discussed connecting new information with information of previous modules. Some historical data about WASH are given as well.

OBJECTIVES The pupils are informed about the importance of handwashing in order to prevent a number of health risks they might face in their everyday life; they are encouraged to create the habit of handwashing; and furthermore, to inform the community and in particular schools about the importance of handwashing and its role to prevent diseases.

KEYWORDS AND TERMS Handwashing, faecal-oral transmission mechanism, private hygiene, public health, pathogens.

PREPARATION / MATERIALS

Material	Preparation
Sink, water, soap, towel	Check that soap and a towel are there
Paper and pens for drawing	
“GlitterBug” powder	Can be ordered online
UV lamp	Can be bought/ordered

1. Handwashing: The most important component of personal hygiene

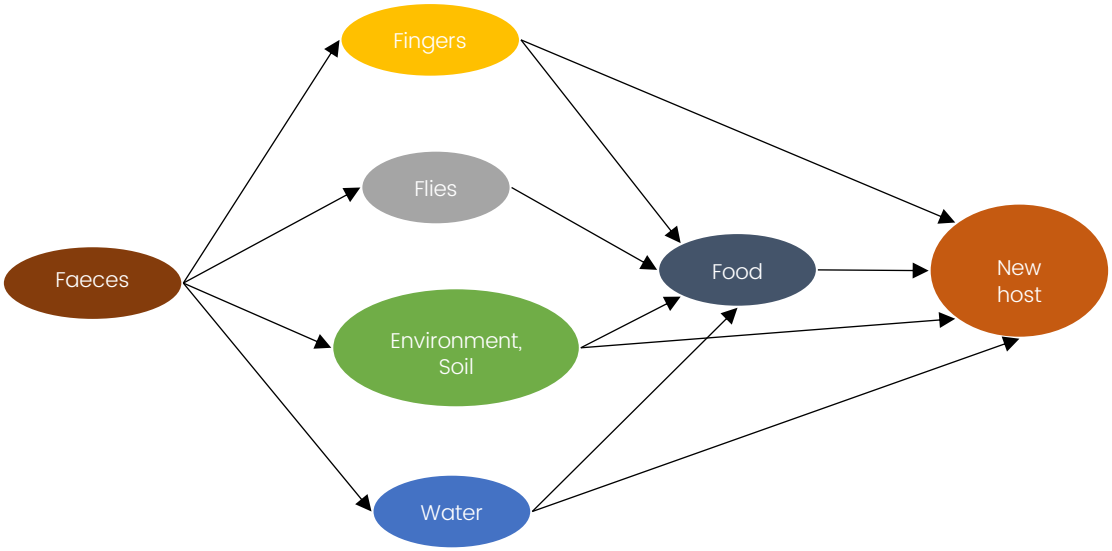
Hands must always be washed at so called critical times, especially after visiting the toilet, before processing food or drinks, and before putting anything into your mouth to prevent the potential transmission of diseases. Handwashing is the most important component of personal hygiene for the prevention of public and personal health. Hands are washed with clean water and soap. Hands are first wetted with water, soaped, and then intensively brushed (at least 20 seconds). At the end they must be rinsed with clean water. If absolutely clean material for drying is missing, it is better to leave the hands dry by themselves. In case dirty material is used to dry the hands, handwashing does not have any positive effect. Be aware of the fact that dirty computer keyboards, door handles, and etc. might contain more microorganisms than a toilet ring of a well-maintained toilet.

Faecal–oral transmission occurs when diseases-causing microorganisms found in the stool of one person or animal, are swallowed by another person. This is especially common in group-day-care settings, where faecal organisms are commonly found on surfaces and on the hands of providers. Usually, the contamination is invisible. Concerning some infections, such as by rotavirus, only a few viral particles (<100) are needed to cause an infection. Other infections, such as caused by salmonella, require a larger number of organisms (>100,000) to create an infection. In the absence of visible stool contamination, these infections often travel through contaminated food or beverages.

Investigation showed, the simple act of washing hands with soap could significantly cut the risk of diarrhoea from 30 percent to 50 percent, and that of respiratory tract infection from 21 % to 45 %.

1 gramme of faeces can contain

- 10 million viruses
- 1 million bacteria
- 1,000 parasitic cysts
- 100 parasitic eggs



Faecal-oral transmission route of pathogens

Many common infections spread through faecal–oral transmission include diarrhoeal diseases, Cholera, Typhoid fever, Coxsackievirus (hand-foot-mouth disease) and helminth infections. Pathogens that can be found to cause these diseases are (exemplary): Adenovirus, Campylobacter, Enteroviruses, *E. coli*, Giardia lamblia, Hepatitis A, Pinworms, Poliovirus, Rotavirus, Salmonella, Shigella, Tapeworms, Toxoplasma.

Since the COVID-19 pandemic, the importance of handwashing, and hygiene gained worldwide attention. As a result, numerous informational and educational materials for children are now available online.

Example of an illustration on proper handwashing (source: Ellen Forney)

Example of an illustration of areas that are most frequently and less frequently missed during handwashing (source: Osmosis, 2021)

2. How to reduce and prevent the spread of infectious diseases in schools

2.1. Information for students

Wash your hands

Wash your hands with soap and water after going to the toilet, before touching food and eating, after coughing and sneezing, and after playing or doing things outside. You should wash your hands for at least 20 seconds – the equivalent of singing "Happy Birthday" twice.

How to do it properly

To eliminate all traces of the virus on your hands, a quick scrub and a rinse will not cut it. Here is a step-by-step process for effective handwashing

1. Wash hands with running water
2. Properly soap your wet hands
3. Make sure to clean every surface on your hands for at least 20seconds – including the back of the hands, palms, wrists, spaces between fingers and under nails
4. Clean your hands of soap and dirt using running water
5. Rub hands dry with a single-use towel, paper towel or a clean piece of cloth

Sneeze and cough carefully

Whenever you sneeze or cough, keep in mind to cover your face. It is best to sneeze in your elbow, cover your mouth and nose with a tissue which afterwards must be thrown away in a closed bin. While sneezing or coughing, turn away from people standing nearby, if possible.

Be open and honest

In case you feel unwell, for example if you have caught a cold/fever or are coughing a lot, please consult a family member or someone you live with.

Keep a distance

It may be tough, but please try not to touch others e.g., when greeting. Instead, you can use gestures, e.g., waving, bowing, a namaste or hand on your heart.

Keep a reasonable distance of minimum 1.5 meters (the length of a pony) to everyone you do not live with. Just imagine that a pony is standing between you and your classmates.

To prevent the virus from reaching your mucosa, do not touch your face, nose, or mouth.

2.2. Information for school principals and education staff

Education ministries, school principals, teachers, and administrators are expected to disperse knowledge about appropriate behaviour e.g., by including it in the curriculum. Consequently, information on adequate hand hygiene can trickle down from administrative entities to students, their families and local communities. Proper hand hygiene facilities should be provided by executives (e.g., water and soap).

Create an environment that enables physical distancing

Steps to encourage physical distancing during in-person schooling may include:

- Close down lockers.
- Create one-way traffic in school hallways, also by using pylons or sticky tape.
- Classes, instructions, meals and recess should be given in outside areas.
- Limit the number of children on school buses to facilitate physical distancing.
- Move desks apart with enough space in between them, ideally desks face in the same direction.
- Install Plexiglas shields and partitions as physical barriers between educators and students.
- Physical distancing while handwashing must be secured in inside and outside facilities: To meet official physical distance guidelines, some of the water outlets (e.g., taps) should be covered with foil or sealed with stickers. Floor markings secure orientation and enough space among all users.
- Divide students in learning groups.
- Aerate the classrooms every 40minutes.

Ensure a hygienic environment

For students to comply with hygiene rules, an appropriate environment must be created in schools. The following points must be observed:

- Provide sufficient hand-washing opportunities at entrances and in restrooms with clean water and adequate soap.
- Washing opportunities must allow physical distancing and be accessible to all.
- Ensure an adequate water supply. If problems arise in this regard, ask the community for assistance, and encourage children to bring bottled water from home.
- Ensure the supply of consumables (soap, hand sanitizers, cleaning supplies, protective equipment).
- Make sure that the school is cleaned and disinfected regularly.
- Appoint staff member(s) or older students from a WASH club as a monitoring team to regularly check the toilets.
- Train school staff, parents, and pupils on hygienic behaviour.

2.3. Advice for parents or guardians

Wear a mask

The WHO recommends wearing (cloth)face masks in schools. Parents or guardians may consider the following tips:

- In surroundings where physical distancing becomes a challenge, wearing cloth face masks should be a priority. In particular, this applies to school buses, bus stops or carpool drop-off areas.
- Every child should possess several face masks to wear throughout the school week. Washing masks on a daily basis is key. Provide your child each day with a clean mask, a back-up mask, and a hygienic, resealable bag for occasional storage.
- Attach a label to your child's mask so it is not confused with another child's.
- Teach your child in putting on and taking off cloth face masks. Remember to touch your child's mask minimally.
- Tell your child that they should wash their hands before and after touching their face covering.
- Instruct your child to never share or trade masks with peers.
- Explain the importance of wearing a face mask and depict a role model by wearing masks.

Keep hands clean

To create a learning effect, practise handwashing at home with your child and explain why it is important to wash their hands with soap and water for at least 20 seconds. Explain to your child why they should avoid touching their eyes, nose, and mouth. Show them how to cover their mouths and noses with their elbows or tissues when they cough or sneeze and then wash their hands.

Should your child attend in-person schooling, develop daily routines before and after school that foster healthy habits, such as packing a back-up facemask and hand sanitizer in the morning and washing their hands as soon as they come home.

Clean and disinfect

Regular cleaning of frequently touched surfaces (e.g., faucets, doorknobs, counter tops, keyboards, tablets, and phones) reduces the risk of an infection, no matter if your child is being schooled at home or in school.

Stay home if sick

Closely monitor your child each day for signs of an infection. In case your child feels unwell, prevent them from joining group activities or attending class. Contact your doctor for case-dependent information and medical advice.

3. Importance of eating clean food, drinking clean water, and using clean water for bathing

Swimming pools and water parks can also be places where faecal-oral transmission of diseases occur. If the water is not visibly contaminated and is adequately chlorinated, getting water in the mouth is usually not enough to cause an infection; the risk is greatly increased by swallowing. Never swallow water from sea, rivers, pools and water-play areas or from irrigation pumps.

4. Exercises and questions

- What does the abbreviation WASH stand for?
- Take the children to the handwashing facility in the school and show them all the steps of correct handwashing. Some pictures can be copied and hung up in the room and used as a basis for further discussions.
- Meet an expert from the community who will demonstrate how to prepare homemade soap.
- Discuss the importance of safe water for human health. In which situations is safe water essential, and why is handwashing so important?
- Explain what is meant by the faecal-oral transmission of pathogens.
- How many bacteria, viruses, pathogenic cysts and eggs can be found approximately in 1 gramme of faeces?
- A questionnaire could be prepared together with the pupils, including the following questions:
    - When is Global Handwashing Day?
    - Why is handwashing important?
    - Describe the correct handwashing technique.
    - Which diseases are prevented by handwashing?
    - How many pathogens may be found on hands after using toilet?
    - What does the faecal-oral mechanism explain? Make a drawing of it.
    - What is the most important practice to prevent hepatitis A?
    - How many children approximately die of diarrhoea each year in the world?
    - What is the importance of soap?
    - When is it critical to wash hands?
    - How important is it to use clean bathing water?
    - Parents and other persons from the community could be invited to the presentation of the results where gained knowledge is also demonstrated. By this, the pupils contribute to the awareness raised on this topic.

Interactive handwashing exercise

You need the "glitterbug" potion and powder and a UV lamp. The potion and the powder represent pathogenic bacteria. You give some potion and powder to a pupil who is supposed to apply it on his/her hands. Then the pupils should give a hand to another pupil and touch it somewhere. Then she/he washes her hands like she/he always washes her/his hands. With the UV lamp, you can detect where the bacteria have been spread and if the pupil has washed her hands well. It will only glow when not washed properly or touched any surface which has not been cleaned.

WSSP related activities

- Discuss if schools and other public institutions provide appropriate facilities for handwashing.
- Discuss where in the local environment pathogens are more likely to spread. What are the reasons for this and how could the situation be improved?
- Which actions could the participants take in order to raise awareness about the importance of handwashing?

5. Text sources and further reading

To order "glitterbug" material: Hand Hygiene Europe http://www.handhygieneeurope.com

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C4

SANITATION IN SCHOOLS

Authors: Claudia Wendland, Diana Iskreva

SUMMARY WASH in schools comprises safe water, sustainable sanitation and hygienic behaviour in schools. Many schools, particularly in rural areas, lack adequate drinking water, sanitation and handwashing facilities, which pose a risk to public health. The ability of children to learn can be affected by lack of adequate water, sanitation and hygiene (WASH) conditions in different ways: these include diarrhoeal diseases and helminth infections. Different types of toilets are explained as flush toilets and pit latrines are not the only technological solutions. The key criteria for acceptance of school toilets by pupils are cleanliness, lack of bad smell and privacy.

It is well known that operation and maintenance are a challenge in any school even if the infrastructure is adequate. That is why in this module, awareness is raised about the importance of especially sanitation in schools, suitable solutions, and in which way to take action.

OBJECTIVES The pupils understand the importance of WASH in schools, the linkage to health and environment, how to break the taboo and talk about school sanitation and discuss related problems. The reader knows how to start an action to improve the WASH situation at their school if needed.

KEYWORDS AND TERMS WASH, school sanitation, hygiene, public health, pathogens.

PREPARATION Create a good and open atmosphere: Sanitation in schools is very important but at first glance not a very attractive topic. It is a taboo to talk about toilets for many people and pupils as well. That is why it is very important to create a very good and open atmosphere so that pupils will feel free to openly talk about their opinion and attitudes in order to reach useful results in this module.

Introduction

It is estimated that 88% of diarrhoeal disease is caused by unsafe WASH conditions. Many schools, particularly those in rural areas, often lack adequate drinking water, sanitation and handwashing facilities. The WASH aspect in schools is very much neglected and no priority in many municipalities, although the school setting is an area where diseases easily spread due to the intense personal contact. Families have to bear the burden of their children´s diseases because of inadequate WASH conditions in schools. Summarised, the provision of adequate WASH in schools and proper operation and maintenance lead to a number of benefits (WHO 2009):

- The disease burden among children, staff and their families is reduced.
- Healthy children in a healthy environment learn more effectively.
- There can be a greater gender equity in access to education and meeting hygiene related needs.
- Educational opportunities are created to promote safe environments at home and in the community.
- School children can learn and practice life-long positive hygiene behaviour.

On the 5th Ministerial Conference on Environment and Health in Parma, Italy, 2010, 53 countries of the European, Caucasus and Central Asian region adopted a ministerial declaration with clear targets and commitments strengthening the implementation of environmental health programmes for children, inter alia to improve the hygiene and sanitation situation in schools and kindergartens.

1. Historical data on sanitation

Looking far back into history, mankind has been made observations for a very long time about the importance of safe collection and treatment of human and animal excreta to protect public and individual health. The first hygienic toilets were used in ancient times.

Roman public toilets (source: Science, 2016)

We can learn about the importance of toilets and health-behaviour, for example, from museums about toilets, like in India and Germany. It might be interesting for you to know that the most sophisticated toilet was built for spaceships. The spacecraft Soyuz had an on-board toilet facility since its introduction in 1967. In 2008 Russia sold the technology to NASA for their International Space Station for 19 million USD. The system recycles urine into water. In some

countries there are very strict rules that prescribe specific behaviour for the protection of public and private health. In India, the left hand is the dirty hand, and the right hand is the clean hand. In Japan, it is strictly forbidden to sneeze and clean your nose in public, and hands have to be washed immediately after.

JETS 50M vacuum toilet inside Lau Fau Shan Roundabout Public Toilet (source: Wrightbus, 2011)

Composting toilet (source: Rene Cortin, 2015)

Urine diverting toilet with water flush (source: Pixabay)

Interior of a UDDT cabin (source: WECF)

2. Different types of toilets

2.1 Water flush toilets

Flush toilet: The standard toilet is the flush toilet, flushed with different volumes of flush water. Common toilets use up to 10 litre per flush, but new water saving toilets use only 3-5 litre. Toilets, which use less water – only one litre per flush, are vacuum systems, which you might know from airplanes or trains.

There are many people, also water professionals, who criticise the fact that people flush their excrements with high quality drinking water, which needs high efforts to treat the wastewater afterwards to discharge it into the environment. That is why there is some development towards modern waterless or dry toilets. See for more information in detail in module B5.

2.2 Pit latrines

You might know the traditional pit latrines, which do not use any water for flushing. They are applied in areas where there is no reliable water supply and are usually located far away in the

garden, because they often smell badly. They are difficult to keep hygienic and might pollute the groundwater with excreta substances in case of high groundwater level, because the excreta are mostly not collected and treated safely.

2.3 Composting toilets

A composting toilet does not use any flush water. It is a dry toilet system where the human excreta are biologically decomposed by aerobic compost bacteria. The human excreta are commonly mixed with sawdust or wood shavings to support the biological aerobic processing, absorb liquids and to reduce the odour. Therefore, the toilets can also be placed indoor. Composting toilets are used as an alternative to flush toilets in settings where there is no reliable water supply or a waste treatment facility available or to capture nutrients in human excreta. The produced compost can be used for gardening or agriculture.

2.4 Urine diverting toilets

Modern toilets have been developed with urine diversion so that the urine and faecal matter can be collected separately. There are also dry toilets with urine diversion, which ensures that the toilet does not smell and can also be implemented indoors (in contrast to a pit latrine). Instead of using water for flushing, these toilets are "flushed" with dry material such as ash, soil or shredded wood to prevent odor. Urine contains high concentrations of nutrients such as Nitrogen and Phosphorus and can serve as fertilizer in agriculture. The faecal matter is collected underneath the toilet in a chamber, stored and post-composted afterwards.

Since 2002 many demonstration models for modern sustainable dry sanitation such as urine diverting dry toilets (UDDT or Ecosan) were constructed for households, schools and town halls in the pan European countries. The UDDTs were introduced in particular in regions were centralised piped water and/or sewerage systems were lacking. For households mostly seat models, for public places squatting models are used.

The WHO guidelines on safe use of human excreta in agriculture (2006) are applied for the treatment and safe reuse of the separated urine and faecal matter.

For schools in Armenia, Moldova, Romania, Ukraine, Kyrgyzstan, Tajikistan or Georgia many UDDT toilets attached to the school or in the yard were constructed. The urine is stored during 6 months in reservoirs and according to the WHO safe for usage as a fertiliser in agriculture; the covered and dry faecal matter is stored for at least one year and used as soil conditioner. The wash water of the schools is drained off and treated in a simple sand filter. More than 10 years Ecosan proved that this system is working well and a considerable improvement for the environment, for the dignity of the users and comfort, in particular in areas with cold winters and for schools and kindergartens, please see more information in WECF (2009).

3. Sanitation and hygiene in schools

Providing adequate sanitation conditions and applying hygiene practices are challenges in many schools. WHO (2009) developed guidelines on WASH in Schools especially for low-cost settings, which are suitable to be applied in rural areas of the pan European Region as well. These guidelines are summarised below. The hardware (installations) is important but the software (operation and maintenance, training) for a good acceptance. Studies showed that for pupils the technology of the toilet is not important but the key criteria are: cleanliness, absence of smell and privacy.

Urinals at different heights for boys (Ariel Levchenko, 2016)

3.1. School toilets

According to WHO (2009), the toilets should be sufficient, accessible, private, secure, clean and culturally appropriate. The number of toilets depends of course on the size of the school. It is recommended to have one toilet per 25 girls and one for the female staff and one toilet plus one urinal per 50 boys and one for the male staff. Boys' and girls' toilets need to be separated.

To provide security and privacy, the toilets need to be located carefully after discussion and selection by pupils and staff. They should be easily accessible and safe. Each toilet cabin should be separated from the other and lockable from the inside but to be left unlocked when not in use. Especially for older girls, the privacy and security issues are important so that they can go to school also when they are menstruating. A waste bin is to be provided which needs to be emptied on a regular basis by the cleaning staff.

Toilets should be cleaned whenever they are dirty and at least once per day. A cleaning roster should be in operation, and trained staff should do cleaning and maintenance preferably.

3.2. Hygiene

Sufficient water points and hand wash facilities (equipped with soap) should be available in the school to allow convenient access and use of water for drinking, personal hygiene, cleaning and if necessary for food preparation and laundry. The toilets should have handwashing facilities close by. Basic hygiene measures taken by staff and pupils should not be compromised by lack of water or soap or lack of access to handwashing facilities. If possible, all water provided to the school should be of drinking water quality. Hygiene education should be part of the school curriculum and positive hygiene behaviours are systematically promoted among staff and pupils. One of the important routines is handwashing at critical times, especially after toilet use and before eating. The teachers and other staff and their behaviour, highly influence the behaviour of pupils and need to be positive role models.

3.3. WASH clubs

WASH clubs (or sanitation club, health club, environment club or an ecosan club) are committees set up in the schools, consists of pupils meeting on a regular basis to raise awareness on WASH issues in the schools and develop planning and action to constantly improve the WASH situation in the school. The members are preferably from different classes and ages in order to ensure the sustainability over time and are supported by a teacher. The WASH club can train peers on hygiene, can change the attitude of pupils towards WASH issues, can propose ideas how to improve operation and maintenance of the WASH situation, where to get soap and toilet paper. The WASH club might have a special responsibility to report to the school director directly about the WASH situation on a regular basis.

4. Questions and exercises

- When are the first built toilets dated back to?
- Why is school sanitation important?
- When is the UN World Toilet Day?

Assessing and discussing the existing school toilet conditions

- **Special note for the teacher**: Take care that the topic of sanitation is still a Taboo to talk about.
- Create a good open atmosphere with the pupils in order to achieve good results. You go together to the school toilet and do an on-site spot check. Use the quality assessment form in Module A7 and maybe add specific questions and comments, which are important for you. Do a survey with your schoolmates and use the questionnaire in Module A8. Summarise the results and discuss them with the teacher, the school director and parents, what needs to be changed?

Set up a WASH club in the school

Initiate the setup of a WASH club in the school and support the pupils in their activities.

Members of the WASH club in an Albanian school

5. Text sources and further reading

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C5

PERSONAL HYGIENE FOR YOUNG PEOPLE

Authors: Hanna Gunnarsson, Natasha Dokovska-Spirovska

SUMMARY As children reach puberty, and their bodies change, their cleaning habits need to change with them. More than half of the world's population will at some point in their life menstruate, yet lack of menstrual health management (MHM) affects women's and girl's access to education and public participation. This chapter addresses the negative impacts of stigmatisation and lack of proper MHM. It gives guidance in how to involve girls and boys in normalising menstruation; and sets out best practices for girls' and boys' personal hygiene.

OBJECTIVES The purpose of this module is to increase girls' and boys' knowledge about menstrual health; to overcome existing taboos about this topic; to raise awareness on the need and benefits of separate school toilet facilities for girls and boys; to make sure hand wash facilities has clean water and soap, and that girls restrooms has sanitary product disposal units; to mobilise school staff and local authorities to enable an adequate MHM at school.

KEYWORDS AND TERMS Menstruation, menstrual health management, MHM, taboo, sanitary products, clean toilet facilities, period, menstrual cycle

PREPARATION / MATERIALS

Material	Preparation
Flip chart and markers	
Sanitary products (pad, tampons, sanitary napkins, menstrual cup)	
Risk assessment forms of a school toilet and hand--wash facilities	Making copies from Compendium part A, form A7--h and A7--i
Questionnaires for pupils	Adapt questionnaire A8--d, including questions about MHM

Introduction

Everyday personal hygiene is about washing hands (see Module C3), keeping the body clean, brushing teeth, and covering the mouth when coughing. When becoming teenagers, children´s bodies change and in order to stay healthy, personal hygiene habits need to change too. An important aspect of personal hygiene is menstrual health management. While living in the 21st century, there are still several women and girls worldwide who face problems during their menstrual cycle. Many girls are embarrassed and do not know how to best manage their menstruation, nor whom to talk to as they are ashamed of their monthly period. Menstruation is often treated as taboo and as something you should not talk openly about. In certain communities, menstruating girls and women are forced to be invisible. Additionally, girls are often bullied by boys e.g., in the school. Health problems due to poor hygiene during menstruation; lack of sanitation facilities; lack of affordable sanitary products may push menstruating girls temporarily or permanently out of school. Inadequate menstrual health management negatively impacts girls' right to education. Improving water and sanitation can therefore have a massive positive impact on the lives of girls and women.

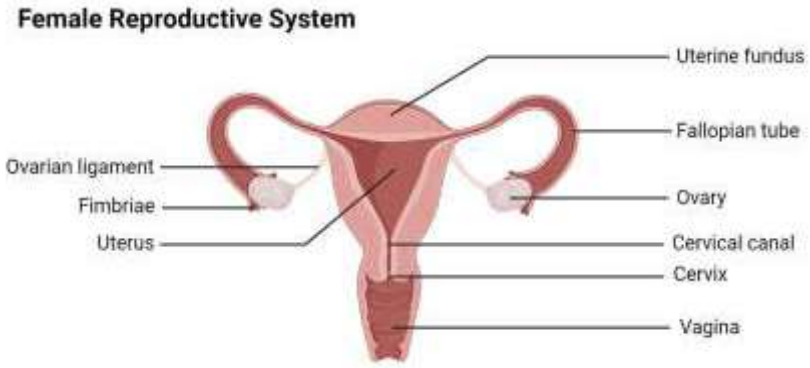
1. Puberty

Puberty is when boys' and girls' bodies start to change and develop into an adult's body. This change is due to an extra amount of chemicals, so called hormones, being produced in the body. Every individual experience puberty differently; and it can be a difficult time as the body is changing. When pubescent, girls and boys might have unexplained mood swings; feel depressed at times; have low self-esteem. Girls usually reach puberty when they are 8-16 years old, while boys reach it a little bit later when they are 12-16 years old.

Changes in boys	Changes in girls
• Chest broadens, shoulders get wider, muscles start to get bigger and stronger and also breasts look like they're developing a bit • Penis and testicles start to grow • Ejaculations begin – boys start to experience "wet dreams" while sleeping • Voice "breaks" and deepens • Boys gain weight and grow taller • Body and facial hair appears (armpits, pubic area, moustache, beard, or sideburns)	• Breasts start to develop • Girls gain weight, particularly on the hips • Menstruation starts – girls have to start to manage their blood flow • Bodies become curvier and hip bones widen • Hair grows in pubic area and armpits • Muscles get bigger and stronger, but they do not show up as much as boys' muscles

2. Some facts about menstruation

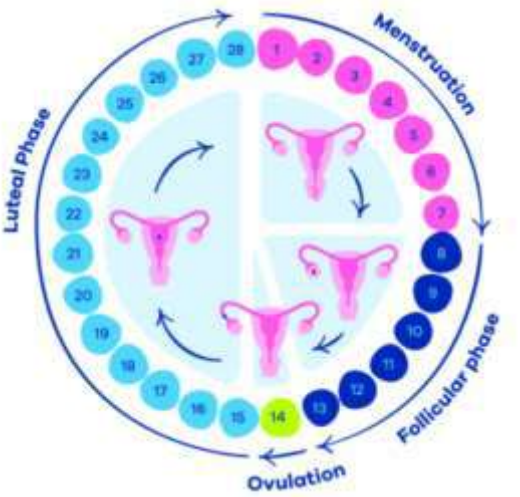
Menstruation (also called "period" and "menses") is the monthly flow of blood from the uterus through the vagina. Girls have their first menstruation during their puberty, when they are about 10-14 years. They then have it about once a month until they reach menopause. Menopause is when a woman stops having periods, meaning she will no longer be fertile and not able to get pregnant naturally (at the age of late 40s to mid-50s).



Female reproductive system (source: Sagar Aryal, 2020)

The menstrual cycle is the time between the first day of a woman's menstruation to the first day of her next. Most common length for the menstrual cycle is 21-35 days, with an average of 28 days. In the first part of the cycle, levels of oestrogen increases, causing the lining of the uterus to grow and thicken. Simultaneously, an egg starts to mature in the ovaries and about halfway into the menstrual cycle (around day 14) the egg leaves the ovary. This is what is referred to as "ovulating". The egg then travels through the fallopian tube to the uterus. If the egg is fertilized by sperm and attaches to the uterine wall, the girl or woman becomes pregnant. If the egg is not fertilized, it will break apart and the thickened lining of the uterus will shed, causing the menstrual blood flow (Women's Health, 2014, Menstruation and menstrual cycle fact sheet). The bleeding usually lasts 2-7 days and around 5-12 tablespoons of blood are lost during this time (NHS, 2016, Periods). The first years of a girl's menstrual cycles are usually irregular.

Pre-menstrual syndrome (PMS) happens in the latter part of every menstrual cycle (after ovulation) and is caused due to changes in the levels of hormones (House et al., page 212). PMS symptoms include bloating, swollen and sore breasts, mood swings, pain ("cramps"), as well as acne (House et al., page 33.). Every woman and girl's PMS is different. Whereas some might have PMS for two weeks, others might have it just for a couple of days, or not at all. Some might feel very moody and not in control of their emotions, whereas others have painful cramps (or both). Your symptoms might also be different from cycle to cycle. Many girls skip school because their cramps are causing them pain and physical discomfort. There are ways to alleviate the pain though by applying warmth to the lower belly (a hand or hot water bottle), eating healthy (avoiding high levels of salt, sugar, alcohol, and caffeine), exercising, and practicing relaxing techniques (yoga).



An average menstrual cycle

3. Belief, myths, taboos & stigma around menstruation

In many cultures all around the world, it is taboo to speak about menstruation, even though more than half of the world's population menstruates. Almost all cultures have some form of beliefs, myths and taboos relating to menstruation. These include unwritten rules and social

norms about managing menstruation and menstruating women. For example, in some cultures, women and girls are told that during their menstrual cycle they should not bathe (or they will become infertile), touch a cow (or it will become infertile), look in a mirror (or it will lose its brightness), or touch a plant (or it will die, House et al., page 25). Also, whereas tampons and menstrual cups can tear the hymen, they will never cause you to lose your virginity, as that requires sexual intercourse.

Due to the many cultural and/or religious misconceptions, myths, superstitions, and taboos regarding menstrual blood and hygiene, women and girls are sometimes deemed "impure" during their menstruation. This can have devastating effects on women and girls, who can have the control over their own mobility restricted by their family and community.

Taboos and stigmatisation (i.e., condemning or showing disapproval) has a huge individual impact on women and girls. Expensive sanitary products, lack of water, soap, disposal bins and individual toilet cubicles, mean that girls might not be able to change their pads and tampons as frequently as they ought and wish to. Causing, occasionally, odour and blood stains on clothes. The bullying of girls for their blood stains (caused by factors they cannot control themselves) causes psychological distress and can lead to girls skipping and missing out of school (SSWM (N/A) Menstrual Hygiene Management)

Silencing and stigmatising of women and girls for the sole reason that they are menstruating has a tremendous larger scale impact. It means society gives low priority and funding in finding solutions for MHM. It also means that certain necessities, such as tampons, might get taxed higher and become more expensive only because decision-makers, whom are most often male, see them as "luxury products". Stigma around menstruation violates women and girls' right to human dignity, non-discrimination, freedom from inhumane and degrading treatment, equality, health, privacy, and bodily integrity. The first step to end stigmatisation of menstruating women and girls is to break the silence and let them voice their needs for improved menstrual health (House et al., page 8).

4. Personal hygiene for girls

4.1. Menstrual Health Management (MHM)

MHM definition

"Women and adolescent girls use a clean material to absorb or collect menstrual blood, and this material can be changed in privacy as often as necessary for the duration of menstruation. MHM also includes using soap and water for washing the body as required, and having access to facilities to dispose of used menstrual management materials." – *Sommer, Marni, Emily Vasquez, Nancy Worthington and Murat Sahin (2013) WASH in Schools Empowers Girls' Education*

Women and girls make up 50 % or more of users of WASH services and are the actual (de facto) water and sanitations managers on the ground across the world. Women menstruate on average 3000 days over their lifetime. Yet, water, hygiene and sanitation services often ignore the needs of half of the global population (Patkar, Archana, 2011, Preparatory Input on MHM for End Group). About 52% of the female population is of reproductive age and most of them are menstruating every month. Worldwide however, most of them, particularly girls at school and women working (using public institutions), have no access to clean, private, and safe sanitary facilities. Meaning, they have no space to change their pads or tampons, nor a place to wash their hands.

Global trends, in particular rural areas, show that lack of proper menstrual health management affects girl's participation in school. Occasionally, it is so severely disruptive it even results in

school dropouts of girls at higher forms (grade four and five) of primary and secondary education (SSWM (N/A) Menstrual Hygiene Management) These gender unfriendly school environments undermine schoolgirls' and female teachers' right to privacy, water and sanitation (SSWM, (N/A) The right to water and sanitation). Consequently, with inadequate MHM, girls and women get left behind in society, disrupting their equality to opportunity and participation in public life as protected by the Convention on the Elimination of all Forms of Discrimination Against Women (CEDAW, (1997) General Recommendation No. 23, paragraph 7).

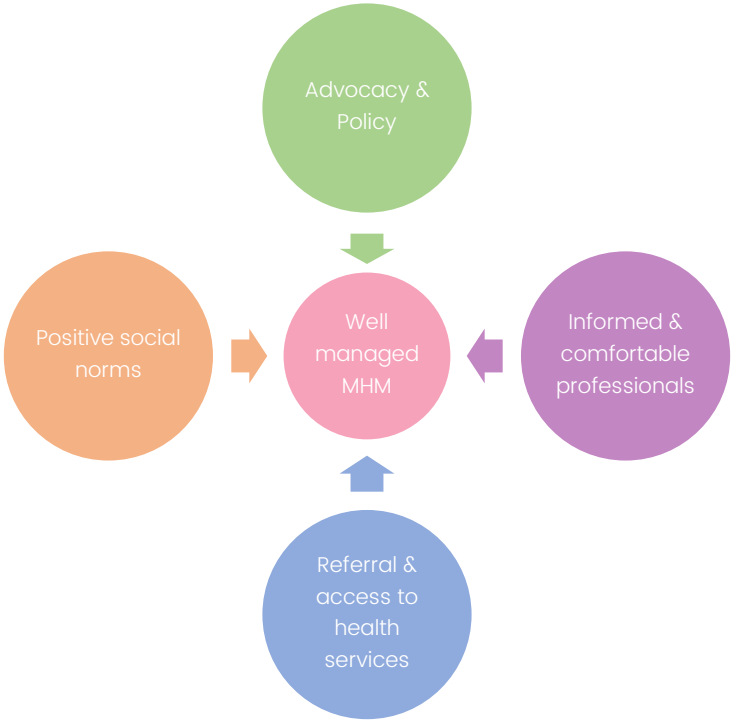
There tends to be a huge difference between MHM in urban and rural schools, particularly in lower income countries. Whereas schools in the cities might already have separate toilet facilities (with water, soap and disposable bins) for girls and boys; rural schools might not even have sufficient water to wash hands. This means that girls living in rural areas face greater challenges than girls living in the city.

CEDAW recently recognised that rural women and girls experience even further discrimination of their human rights than urban women. To decrease the risk of ill health, the distances walked to find privacy and toilet facilities, CEDAW recommends that rural women and girls must have "physical and economic access to sanitation" (CEDAW, 2016, General Recommendation 34: Rights of Rural Women. UN Doc CEDAW/C/GC/34, paragraph 83). All state parties who have ratified CEDAW have a positive obligation to ensure that rural women have access to essential services and goods, such as sanitary pads, to ensure that they have adequate sanitation and hygiene (CEDAW, 2016, paragraph 85 (b)). This obligation also stretches out to girls' equal right to education, and imposes an obligation upon ratified state parties to ensure "schools in rural areas have adequate water facilities and separate, safe, sheltered latrines for girls, and offer hygiene education and resources for menstrual health, with special focus on girls with disabilities." CEDAW, (2016), paragraph 34(h).

How you can use the Convention on the Elimination of all Forms of Discrimination Against Women (CEDAW)

Are you advocating for your school or local authority to improve the MHM facilities in your school? Go to www.un.org/en/member-states/index.html to see if your country has ratified CEDAW. If they have, then you can refer to your country's obligations to CEDAW mentioned above. Tell them that poor MHM is a violation against girls´ right to education. Bear in mind though, the CEDAW Recommendation is not legally binding, but is there to give guidelines to its Member States in how to interpret the Convention.

UNESCO includes additional systemic factors impacting menstrual health management (MHM) positively (UNESCO, 2014, Booklet 9: Puberty Education, & menstrual Hygiene Management, page 32).



Factors impacting positively on menstrual management

Advocacy & Policy – the civil society must advocate for local, national and international authorities to implement good policies on MHM. Policies should work to remove the stigma of menstruation and make it more visible in our societies. Policies should offer more affordable and sustainable solutions, with particular assistance in rural communities.

Informed & comfortable professionals – it is important that teachers and health workers can talk about menstruation in an informed, accessible and comfortable way with both girls and boys. For MHM to be incorporated into planning and building phases of water and sanitation efforts, it is important that project planners are aware and consult on issues regarding menstrual management.

Referral & access to health services – schools need to set up a strong referral system for issues they cannot resolve themselves. The referral system should include health service providers, child protection services and community support groups.

Positive social norms – a shift is needed in how society treats menstruation; it should be treated positively and with greater understanding instead of as taboo and shameful. After all, more than half of the world's population will at some point throughout their life cycle menstruate. We need to break myths and misconceptions, so that we can develop good public policies and practices around it.

4.2. SDGs and Menstrual Health Management

In 2015, 193 member states of the United Nations agreed on a set goal "The Sustainable Development Goals (SDGs)" to end poverty, protect the planet and ensure prosperity for all (see also module B7). The SDGs consists of 17 goals with targets and indicators for achieving sustainable development and equality by 2030. Like in life, many issues intersect with several SDGs simultaneously. Meaning, menstrual health is not only linked to SDG 6, but it also affects SDG 3, 4, 5, 8, and 12. Therefore, good MHM is vital for achieving the SDGs.

SDGs case study

Try match the following statements with the affected SDGs:

a) Anna lives in a rural community and goes to a rural school which does not have any separate toilet cabins for girls and boys.

b) The toilet cabin does not have any sanitary disposal bins and almost no water to wash your hands.

c) Once, while standing in front of her class, her classmate noticed that she had a menstrual stain on her trousers. Everyone laughed, and as Anna had not brought any change of clothes, she left school early.

d) Now when Anna has her period she rather stays at home, as she would have nowhere to change her pad at school and she does not want be embarrassed by her classmates again.

e) Her menstrual flow is quite heavy, and sometimes Anna stays home from school up to a week. Because of all the chores she has at home, it is difficult for her to catch up with the schoolwork she has missed while she has been away.

f) As Anna's family is rather poor, she cannot always afford buying new pads and tampons and must use toilet paper sometimes.

g) Anna's teacher a uses contraceptives that ensure that she will not get her period at all. All, because there are no clean toilets at school, and she does not want to miss her work.

h) Anna's friend Ani gets really bad cramps the week before her period arrives (PMS), they hurt so bad all she wants to do is cry. The teacher and her male classmates just tell her to "toughen up".

Can you think of any menstrual health management practices that would have prevented these situations?

Answer: SDG 3(bfg), SDG 4(cdeh), SDG 5(abcdefgh), SDG 6(abg), SDG 8(adefg), SDG 12(f)

4.3. Practical tips for MHM

Poor menstrual protection and inadequate washing facilities can increase the risk of getting an infection. It also increases the risk of girls being stigmatised by the odour of menstrual blood (SSWM (N/A) Menstrual Hygiene Management). In addition, the risk of infections (including sexually transmitted infections) is heightened during the menstrual period as the cervix is more open than normal and blood containing bacteria might get into the uterus (House et al., 2012, page 36). Certain practices are more likely to increase the risk of infection, as can be seen in the table.

Best practices to avoid potential health risks caused by poor hygiene (source: House et al., 2012)

Practice	Health risk	Prevention & best practices
Unclean sanitary pads/materials	Bacteria can cause local infections or travel up the vagina and enter the uterus.	Never use unclean sanitary products. Deep clean your reusable cloths, pads and menstrual cups after the period has finished. Keep them clean by wrapping them in a tissue or plastic bag when not used.
Changing pads infrequently	Wet pads can cause irritation which can lead to infection if the skin breaks.	Change your pads regularly (every 2---6 hours depending on your flow). This will also help to avoid staining of clothes and odour.
Insertion of unclean material into vagina	Bacteria will have easier access to the cervix and uterus.	Never insert unclean material (tissues, pad, cloths, rags etc.) inside your vagina. Only insert clean tampons or cleaned menstrual cups.
Using highly absorbent tampons during a time of light blood loss	Toxic Shock Syndrome (TSS) which is caused by a strain of bacteria that produces a toxin in your body. Signs of TSS include rash, sudden fever, dizziness, fainting, muscle aches, disorientation, vomiting, and diarrhoea.	Change tampons regularly (every 4---8 hours). Do not use tampons when you are only spotting.
Wiping from back to front following urination or defecation	Increases the chances of bacteria (from the anus) being introduced to the vagina.	Always wipe from front to back.
Unprotected sex	Possible increased risk of sexually transmitted infections (including the transmission of HIV or Hepatitis B) during menstruation.	Always use protection during sexual intercourse, particularly the days coming up to and during your period.
Unsafe disposal of used sanitary materials or blood	Risk of infecting others, especially with Hepatitis B (HIV and other Hepatitis viruses do not survive for long outside the body and pose a minimal risk except where there is direct contact with blood just leaving the body).	If using a reusable pad, then put it into a plastic bag, until it can be washed and dried. If using disposable pads, tampons or clots then wrap it in paper to make a clean package and put it in the bin.
Frequent douching (forcing liquid into the vagina)	Can facilitate the introduction of bacteria into the uterus.	Never douche during your period. Do wash the outside of your genitals every day with a mild soap and water. Avoid getting the soap inside your vagina, as that might affect your pH value and cause irritation.

4.4. Female sanitary products

Female sanitary products absorb or collect the blood when you menstruate. See photo below for examples of sanitary products:

Variety of menstrual products (Pexels, Karolina Grabowska)

Disposable pads

Come with and without wings. They are strips of padding with an absorbent layer to collect blood and a sticky side which helps holding them in place in the underwear. Most common commercial sanitary product.

Pros – easily available, easy to use, comes in different sizes (you can change them according to your menstrual flow), sometimes available to buy separately.

Cons – not always available in remote rural areas, generates a lot of waste, not very environmentally friendly, often expensive.

Use – remove the protective film and place the sticky against the inside of the underwear.

MHM – to avoid leakage, odour and risk of infections, pads should be changed every 2-6 hours depending on your flow.

Reusable pads

Absorbs the menstrual blood and is a more sustainable option to disposable pads, as each pad can be used, washed and used again. When making your own cloth pads, it is suggested that you use 100% cotton fabrics (such as old towels, sheets, pyjamas, t-shirts, cotton flannel), hemp, or anything you feel is comfortable, soft, and gentle next to your skin.

Pros – environmentally friendly, cheap if you make them yourself, income generating (particularly a bonus if produced locally)

Cons – commercial versions are quite expensive, user needs somewhere private to wash and dry the pads, not always absorbent enough or sufficient for higher-flow days.

Use – attach the pad holder to the underwear and place a fresh pad into the slot. Pads without a holder are simply placed in the underwear.

MHM – change regularly, particularly if you have a heavy flow. Store used pads in a plastic bag until they can be washed and dried. Wash your hands before and after changing the pad. When pads are not in use, store them in a plastic bag or piece of fabric to keep them clean.

Tampons

Absorbs blood in the vagina, before it has the chance to leave the body. Are made of soft cotton and shaped as a small cylinder with a string. They expand when being exposed to humidity. Comes in a variety of sizes and absorbency abilities.

Pros – convenient, comfortable, good option for when going swimming or doing other sports

Cons – generates a lot of waste, may not be culturally appropriate, needs MHM facilities, and might be difficult to get hold of (particularly tampons with applicator).

Use – Don't have them in too long as that can cause irritation and diseases (such as TSS).

MHM – user needs somewhere private, with accessible water and soap, to change the tampon. Important to wash your hands thoroughly before and after changing the tampon.

Menstrual cups

Are made of durable silicon and collect, rather than absorb, menstrual blood from the vagina. Menstrual cups are the most sustainable alternative of sanitary products as it is reusable, durable, economically and environmentally friendly.

Pros – reusable & environmentally friendly, easy to clean, a one-time purchase, can last up to 10 years, you cannot get TSS from them, you can go an entire day without the need to change/empty it.

Cons – not always culturally appropriate to use, needs MHM facilities, are expensive in the short term but cheap in the long term.

Use – The menstrual cup is not inserted as deep into the vagina as a tampon but is positioned closer to the vaginal opening. You can use the menstrual cup even if you have never had sexual intercourse. But if the hymen remains unbroken/unstretched, it can be advisable to use lubricant to decrease the discomfort when inserting.

MHM – always wash hands thoroughly before and after inserting/ emptying the menstrual cup. Remove and clean every 4-10 hours (depending on the menstrual flow). To clean it during your menstruation, simply empty it into the toilet, wash it in clean water and pat dry with paper. After the menstruation it should be cleaned more thoroughly (in for example boiling water).

Rags & cloths

Absorbs the blood and is one of the cheaper options as it recycles old fabric you have at home.

Pros – cheap, reusable and can be made of old clothes.

Cons – if old clothes are not cleaned well, they can become unhygienic, user needs somewhere private to wash and dry the rags

Use – Place the cloth in your underwear; never insert the cloth in your vagina. Use material that breathes (e.g., cotton), absorbs well, is not too rough (an old towel can be wrapped with a softer material), is dark in colour (so stains will not be too visible), and which dries easily.

MHM – Wash your hands before and after changing the pad. Always clean the old clothes before using. Dispose of similarly as with reusable pads.

Toilet paper

Absorbs the blood and is easily accessible and cheap.

Pros – easily available in local markets

Cons – not convenient, falls apart when wet, difficult to hold in place. Use – place paper/tissue in underwear, change every 2 hours (depending on your flow) to avoid odour and irritation.

MHM – simply throw the used paper in the toilet or wrap up in paper to a clean package and throw it in the bin.

5. Personal hygiene for boys

Personal hygiene of the penis is also very important for boys. If the foreskin is washed inaccurately, a cheese- looking substance called smegma can start to form. Smegma acts as a natural lubricant and is found at the head of the penis. If not washed away it builds up in the foreskin and starts to smell, enables bacteria to grow, and makes the foreskin more difficult to pull back. This can cause redness and swelling. Also, if the area between the base of the penis and the testicles are not washed regularly, sweat can accumulate and create a strong odour. Smegma and odour are easily preventable by thoroughly washing the head of the penis while pulling back the foreskin gently; the area between the base of the penis and testicles; the area between the testicles and anus. Too much washing and too strong soap can cause irritation. Therefore, washing the penis once a day is enough, and make sure to use a mild soap.

6. International Menstrual Hygiene Day

Menstrual Hygiene Day on May 28 is a global annual awareness day for MHM. The day aims at breaking taboos and raise awareness about the importance of good MHM for women and adolescent girls worldwide. It was initiated by the German-based NGO WASH United in 2014. The initiative for Menstrual Hygiene Day has received the support of over 270 global partners who are committed to making good menstrual health and hygiene a priority worldwide. May 28 was chosen for its symbolism since May is the 5th month of the year and most women average 5 days every month and their cycle is approximately 28 days. You can read more about it and get ideas for activities from other parts of the world on their website: menstrualhygieneday.org

7. Questions and exercises

Questionnaire or quiz game for students (add on the questions you think are missing):

- What usually happens to a girl/boy during puberty?
- When does a girl/boy usually enter puberty?
- Between which years do girls usually get their first period?
- How long does a menstrual cycle usually last?

- How many days does the bleeding part of the menstrual cycle usually last for?
- What do menstrual sanitary products do?
- Can you lose your virginity by using a tampon or menstrual cup?
- What products can you use to collect or absorb the blood when you are on your period?
- What is PMS (pre-menstrual syndrome)? Give some examples of PMS symptoms.
- How can you end the stigmatisation of menstruation?
- What is ovulation?
- Once a woman/girl gets her first period, she will have periods until she dies; true or false?
- What is menopause?
- What is smegma, and why does it occur? How do you prevent smegma?

Focus group discussions with boys and girls separately

- As introduction, ask your class what they know about menstruation and menstrual health. Write up their answers on the board/flipchart. After your presentation, take help from the class to go through and correct the statements on the board. Tell the class if the statement is correct, incorrect or a myth.
- For girls: bring a wide range of different female sanitary products (either samples or pictures of). Display so that the entire class can see them. Then go through them one by one, define the use and disposal of them. For example: illustrate the absorbency of a tampon and pad by placing a tampon in a glass of water, and by pouring food-coloured water onto a pad. With a menstrual cup, show the different folding techniques, and how to rinse and wipe it.
- For boys: start discussing their personal hygiene issues. Teachers (good if male teachers are available for such focus group discussion) should create an open atmosphere with the boys so that they are open to discuss taboo issues. Another point is to raise awareness about how girls manage their menstruation and to trigger them so they will stop teasing and embarrassing their female classmates. The role play is a good tool to open their eyes.

Interactive role reversal play

Use the "SDGs case study" but change all the names to boy names – Anna to Alexander, Maya to Stefan, Ani to Filip. You will need three male volunteers from the class to play Alexander, Stefan, Filip and four to six female students to play the classmates. Ask the volunteers to act out what you are reading to them. Then read the case story with the changed names. After the play, ask the student who played Alexander how he feels and what scenario had most impact on him. Then turn to the rest of the class and ask them. Ask them what could have been done differently to improve Alexander's situation.

WSSP related activities

See our Module A7-h on "risk assessment of a school or public toilet" and Module A7-i on "risk assessment of hand wash facilities in the school". In addition, see the checklist below. Which items can your school tick off:

- Repeat (or add to) the exercise in Module C3 where the children are brought to the school toilet. Let them answer the checklist. Ask them what could be improved to ensure that your school toilets have proper MHM.
- Share the results with school staff, responsible authorities and the community (parents).
- Discuss and implement actions leading to improvements.

MHM school checklist (adapted from SPLASH, 2015)

Are the following MHM program elements in place?	✓ Yes	✓ No	Notes/plan and date to turn No to Yes!
Informational program for school and community			
Local and/or national regulations concerning MHM at schools in place			
Washrooms for girls			
Water and soap in girl's washrooms			
Disposal place (bins) for used pads and regular emptying			
Emergency pads in a place where girls know to find them			
Guidance teacher or counsellor designated for MHM			
MHM training for all teachers			
WASH Club with MHM activities			
Talks on MHM from local nurses or environmental health technicians			
Mentoring by older girls for younger girls			
Booklets on puberty for boys and girls			
Guidance materials for teachers			
Visual aids (posters, photos, videos, diagrams) on menstruation and puberty			
Inclusion of menstruation and puberty in classroom subject teaching			
Add your own ideas!			

8. Text sources and further reading

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UTILISATION OF WATER IN OUR DAILY LIFE

C6

Author: Friedemann Klimek

SUMMARY Water is utilised for a variety of purposes in everyday life. Domestic water used for body care and household purposes is most familiar. Domestic water consumption varies among countries, also within Europe. In brief, this lecture describes for what purposes humans utilise water. This module gives an overview of water consumption in Europe, which puts it in an international context. The first part illustrates water consumption in Europe and the different sectors of water use. The second part focuses on 'Virtual Water' and the 'Water Footprint' by explaining their concepts and giving some examples.

OBJECTIVES The readers gain knowledge of the amount of water used for different purposes and especially in their immediate environment and abroad. The reader gets an idea of different terms of water, the concept of 'virtual water' and the 'water footprint', and how water consumption and the water footprint are connected to water use and scarcity.

KEY WORDS AND TERMS Water consumption, sectorial water use, water abstraction, virtual water, water footprint.

PREPARATION / MATERIALS Copies of the table at the end of this module

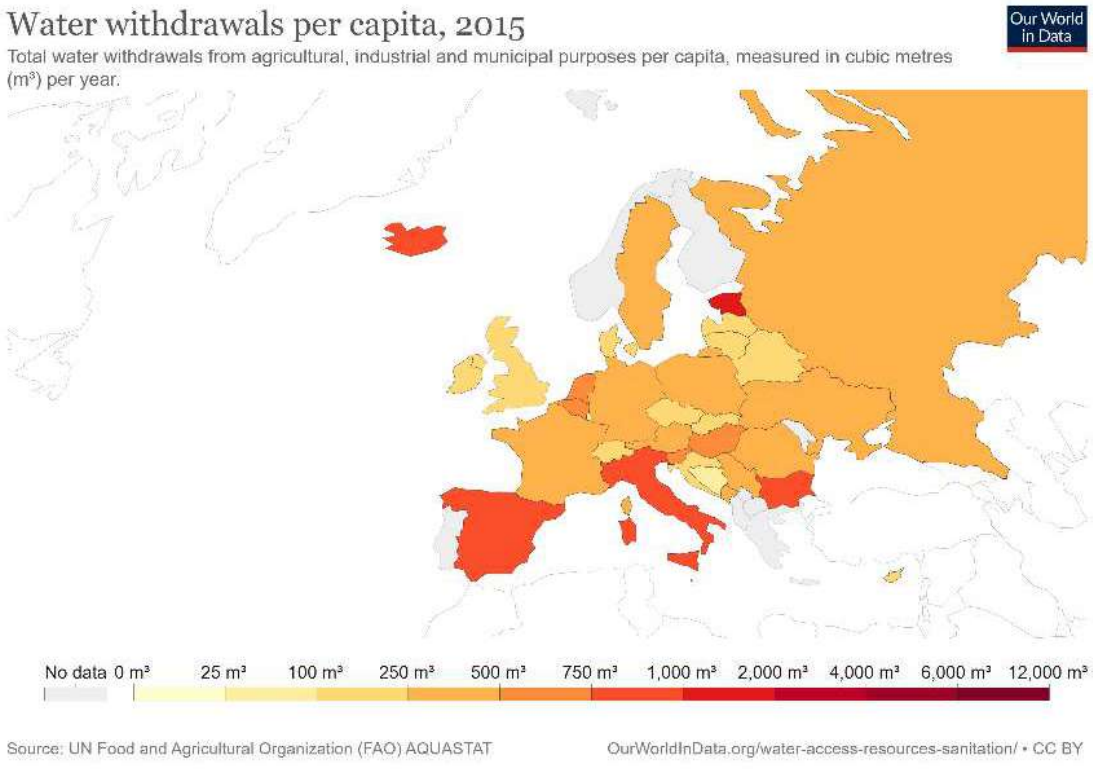
REMARKS This module is directly linked with module C6. The suggested activities are very suitable to implement in cooperation with or by students of a secondary school or university.

Introduction

In Europe 42 % of total water abstraction is used for agriculture, 32% for industry, 18% for energy production and around 8% for domestic use. The water consumption between the different economic sectors varies considerably from one region to another, depending on natural conditions and economic and demographic structures. In South-western Europe, where the climate is drier, agriculture accounts for 50–70% of total water abstraction. In Central European countries, which have a higher presence of industry, water is dominantly used for cooling processes in electricity production. In Northern European countries, for example Finland and Sweden, little water is used for agriculture. In contrast, water is abstracted mainly for industrial purposes such as cellulose and paper production, both very water-intensive industries.

Population distribution and density are other key factors influencing the availability of water resources. Increased urbanisation concentrates water demand and can lead to the overexploitation of local water resources. Water usage is not the only thing that puts pressure on water resources; pollution puts pressure on water resources as well. For example, the cooling process in energy production causes substantial heating of water or evaporation. The runoff from power plants heats rivers and influences the ecosystem heavily. Many processes in industry and in households (toilets!) contaminate drinking water, which has to be treated adequately afterwards.

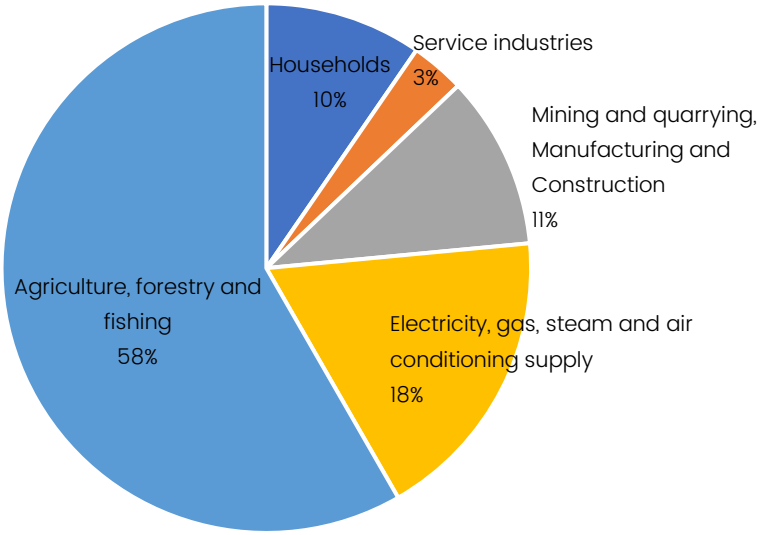
"Our World in Data" provides several interactive maps for water use and stress. For example, the water withdrawal per capita can be displayed for each country worldwide, but also the freshwater use in agriculture, industry, for households and public services.



Water withdrawals per capita in Europe (source: Our World in Data, 2015)

1. Sectorial use of water

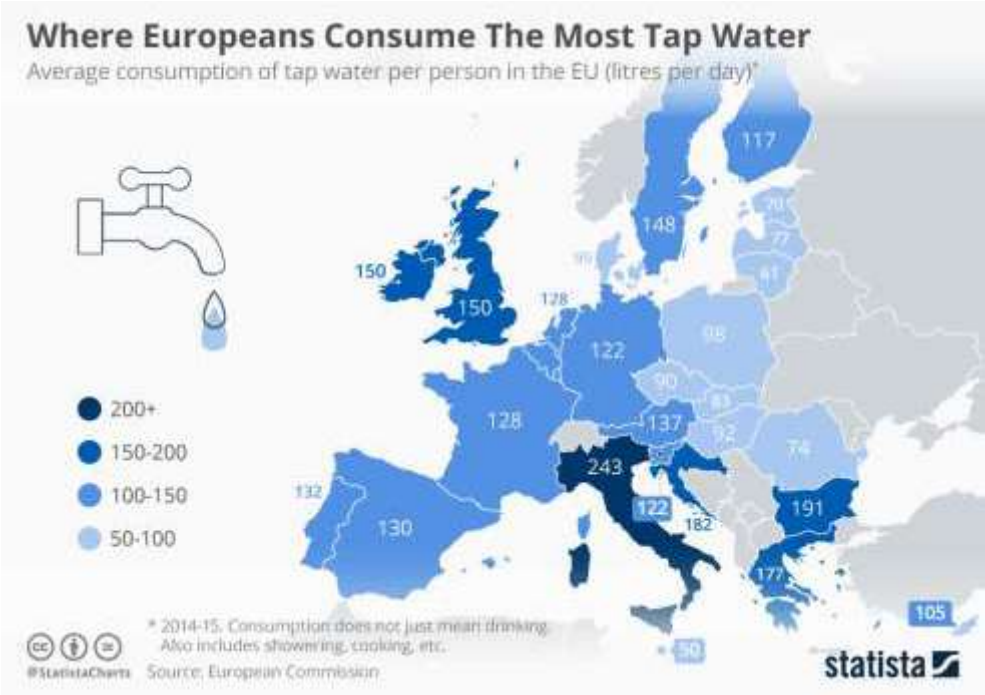
Within the total freshwater withdrawal of a country or defined groups of water users, water is used in different sectors. A distinction between sectorial uses of water is helpful especially when a decision must be made to save water (see module C6). Three sectors are distinguished: domestic, industrial and agricultural water use.



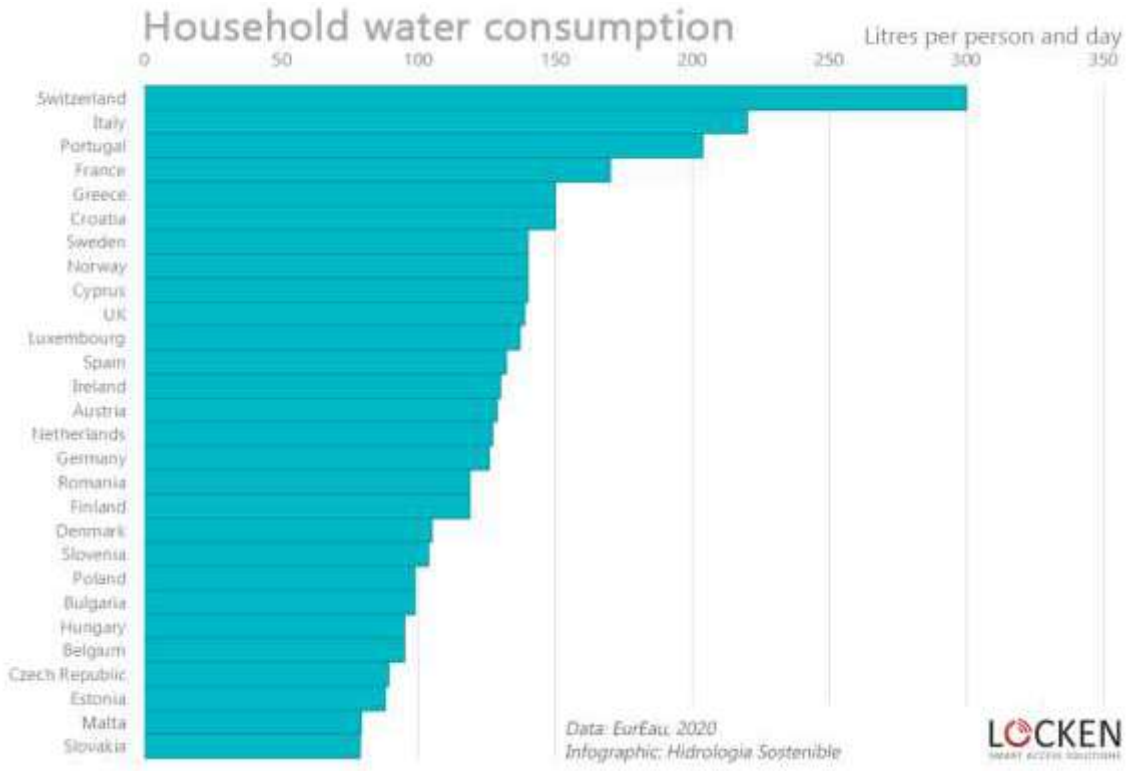
Annual water use in Europe by economic sector (source: European Environment Agency, 2017)

1.1. Domestic water use

Water required for drinking and domestic purposes is the smallest proportion of the total water demand. In European countries, household level water consumption ranges between around 80 litres/person a day in Lithuania and around 250 litres/person a day in Spain. On a global scale, the variation is much bigger. People in arid zones, for example in Africa, have an average water consumption of only 20 litres/person a day – an extreme contrast to the 300 litres/person a day in the USA.



Household water use in Europe (source: Statista, 2014-2015)



Household water consumption (source: EurEau, 2020)

Higher standards of living are changing water demand patterns in Europe. This is reflected mainly in increased domestic water use, especially for personal hygiene. Most of the European population has indoor toilets and showers for daily use. Most of the water used in households is for toilet flushing (33 %), bathing and showering (20-32 %) and for washing machines and

dishwashers (15 %). The proportion of water for cooking and drinking (3 %) is minimal compared to other utilisations.

1.2. Industrial water use

Industrial water demand is especially high in urban areas with high populations and where many industries are located. The amount of water used by industry and the proportion of total abstraction accounted for by industry varies greatly between countries. In Europe, the abstraction of water for industrial use has decreased over the past 20 years: 10% reduction in western (central & northern) countries, 40% reduction in southern countries and up to 82% reduction in eastern countries. In Turkey, the reduction reaches 30%. The decrease is partly due to the general decline in water-intensive industry, but also because of increase in water efficiency. The cooling processes in energy production accounts for 45% of total water abstraction in Europe. In Poland, France and Germany, more than half of the water abstraction is used for energy production (cooling).

1.3. Agricultural water use

As mentioned above, water use for agricultural activities in Europe can be very high, especially in parts where intensive irrigation takes place. Firstly, this depends largely on climate and soil conditions, not to forget the crop. Secondly, the common agricultural policy of the EU regulates type and quantity of crops and therefore has a major influence on the amount of irrigated land. Therefore, the use of water in irrigation is insignificant in countries like Ireland and Finland, but very high in the southern part of Europe, e.g., Spain, Greece, Italy and highest in Portugal. Around 5,000 to 7,500 m^3/ha/year of water is used for irrigation. The water demand can differ significantly depending on the technology used and maintenance of the irrigation system and grown crops. In summer, irrigation puts a lot of pressure on water resources and can have a great impact on the groundwater table and water quality. Vegetation, animals and the domestic use of water (wells, springs and other aquifers) can be affected as well.

2. Virtual water and water footprint

Household water can originate from almost anywhere, from a tap to a nearby well/borehole. Prior to use (for e.g., for baking bread or growing vegetables) it is clearly visible as water. In contrast, water that is used to manufacture commodities, goods or services, is not tangible to consumers in the end product. When buying fresh vegetables or fruits from a market or grocery store, it can be difficult to imagine the amount of water that was used to grow them. This kind of water is called 'virtual water'. Thus, virtual water plays an important role in everyday water consumption. The two aforementioned paragraphs on industrial and agricultural water use belong to this water classification (for us as consumers).

A broader, comparatively new concept is the 'water footprint' for different kinds of products, consumer groups, geographical units, etc. Box 1 explains some important terms regarding the concepts of 'virtual water' and the 'water footprint'.

Terms regarding water footprint

Virtual water This term defines a specific 'type' of water (like rainwater, drinking water or wastewater). It describes water used to produce a good or service, which is not visible as water in the final product. Virtual water refers to freshwater "embodied" in the product, not in a real sense, but in a virtual sense. The virtual water content of a product stands for the volume of fresh water consumed or polluted for producing a product, measured over its full production chain. Examples: the production of 1 kg wheat costs 1,300l water, the production of 1 kg beef costs 15,500l water, Jeans (1,000g) contain 10,850 litres of embedded virtual water.

Water footprint The water footprint is a multi-dimensional indicator of freshwater use that calculates both direct and indirect water use of a consumer or producer. Like the virtual water content, the water footprint refers to the embodied water in a product. In addition, the water footprint also accounts for which type of water is being used and when and where that water is being used. The water footprint is a geographically explicit indicator, not only showing volumes of water use and pollution, but also considering the locations. Water use is measured in terms of water volumes consumed (evaporated) and/or polluted per unit of time. The water footprint of an individual, community or business is defined as the total volume of freshwater that is used to produce the goods and services consumed by them. A water footprint can be calculated for a particular product, for any well-defined group of consumers (e.g., individual, family, village, city, province, state, nation) or producers (e.g., public organisation, private enterprise, economic sector).

The above terms consist of the following three components:

Blue water Fresh surface or groundwater, i.e., the water in freshwater lakes, rivers and aquifers.

Green water The precipitation on land that does not run off or recharge the groundwater but is stored in the soil or temporarily stays on top of the soil or vegetation. Eventually, this part of precipitation evaporates or transpires through plants. Green water can be made productive for crop growth (but not all green water can be taken up by crops because there will always be evaporation from the soil and not all periods of the year or areas are suitable for crop growth).

Grey water The grey water footprint measures the volume of water flow, aquifers and rivers polluted by humans.

2.1. An example: the water footprint in beverage production

The food and beverages processing industry requires a huge amount of water. One of the main problems is the amount of wastewater produced in the food plants. Water is used for several purposes: as an ingredient, a cleaning agent, for boiling and cooling purposes and for transportation and conditioning of raw materials. The production of a soft drink includes the following process steps: bottle making (from PET resins to PET-bottle forms), bottle cleaning (by air), syrup preparation, mixing, filling, labelling and packing. The highest contribution to the water footprint of a soft drink comes from its supply chain, mainly from its ingredients (95 %). A smaller fraction stems from packaging and labelling materials (4 %), particularly from its bottle. In production processes, the amount of water consumed is very small compared to its supply chain (1 %), which is mainly water incorporated into the product. Sugar is one of the main water-consuming ingredients in soft drinks. Three different sugar types are typically used in soft drinks: sugar beet, sugar cane and high fructose maize syrup (HFMS). Type and origin of sugar input significantly affect the total water footprint of the soft drink. For example, the total water footprint of the soft drink is 310 litres when the sugar originates from cane sugar from Cuba, 170 litres when the sugar comes from beet sugar from the Netherlands, and 180 litres with HFMS from USA.

Hidden water use in domestic goods (virtual water, source: UNEP)

Commodity	Water consumed (l)
1 litre of beer	7
1 litre of gasoline	10
1 cola	70
A single bath	200
1 kg of paper	320
1 kg of bread	1,000
1 kg of potatoes	1,000
Television set	1,000
1 kg of meat	4,000 to 10,000
One pair of jeans	8,000

2.2. A global 'virtual water balance'

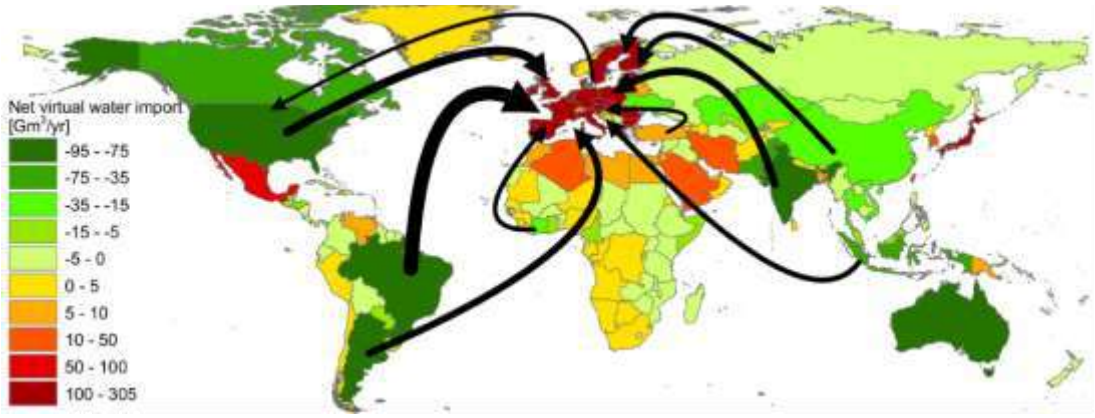
The link to the Water Safety Plan: With the aforementioned concepts of virtual water and water footprint, it is easier to compare the amount of water actually used for different approaches. This can be done for certain products, geographical locations, time scales, consumer groups, etc.

Two factors determine the magnitude of the water footprint of national consumption:

- The volume and pattern of consumption
- The water footprint per ton of consumed products.

In the case of agricultural products, the latter factor depends on climate, irrigation and fertilisation practice and crop yield. The global average water footprint related to consumption was 1,385 m³/year per capita from 1996 to 2005. Industrialised countries have water footprints in the range of 1,250-2,850 m³/year/cap, while developing countries show a much larger range of 550-3,800 m³/year/cap.

The low values for developing countries relate to low consumption volumes; the large values refer to very large water footprints per unit of consumption. Module C7 'Water Saving' gives some recommendations on how to reduce stress on local water resources and how to balance out the country's virtual water balance by choosing or putting aside certain products.



Virtual water balance per country related to trade in agricultural and industrial products over the period 1996-2005. Net exporters are shown in green and net importers in red. The arrows show the biggest gross international virtual water flows (> 15 Gm³/yr); the thicker the arrow, the bigger the virtual water flow (source: Mekonnen, M.M. and Hoekstra, A.Y. (2011) National water footprint accounts)

3. Exercises and questions

- Please complete the following table.
- How much water do you use on a daily base? And for which purpose?
- Think about 2 or 3 goods you use: how much virtual water was used to produce them (Internet search). Which countries do they originate from (have a look at the map. Are these countries net water importers or exporters?
- In which steps of the production of a PET-bottle for a soft drink is water used?
- Where do you have production sites of drinks (juices, soft drinks, etc.) in your vicinity in Bulgaria? What does that mean for the (water) environment (water abstraction, water pollution, water treatment, etc.)?
- Is "virtual water" exported in your region or village? Make a list of products.
- Make suggestions on how the consumption of virtual water could be minimised.
- Calculate your own water footprint: www.waterfootprint.org and discuss it in class.

Average water consumption per person and day in litre

Average water consumption per person and day in litre			Germany
Drinking			1
Cooking			3
Dishwasher			2
Showering, Bathing			40
Body care			6
Washing machine			20
Room cleaning			4
Toilet			40
Car washing			3
Watering (flowers)			1
Watering (garden)			6
Other			
Total			**126**

WSSP related activities

- How much water do the households and the enterprises in your village consume? And for which purpose? Do a short survey (ask the water supplier).
- Make an estimate on how much water is used for irrigating crops for livestock; which source of water is used?
- Is there a water shortage in your village? If yes, how is this shortage noticeable?
- Make suggestions on how the water usage in the village could be reduced.

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C7

WATER SAVING

Authors: Diana Iskreva, Claudia Wendland

SUMMARY Water is a limited resource of enormous importance for nature and all living creatures on earth. Climate change and population growth add to the burden on water resources. It is vitally important to conserve water, establish water efficient measures and decrease water scarcity. In this module, water-saving methods and techniques for households are discussed in detail and examples of water-saving methods are given. Also, the personal responsibility of each human being to protect water resources is generally addressed.

OBJECTIVES The pupils can explain which human activities are responsible for the most extensive water usages. They can describe sources of possible water loss within a water supply network and the households. Furthermore, they are able to make suggestions on how to save water in daily life.

KEY WORDS AND TERMS Water conservation, water efficiency, water saving, water reuse

PREPARATION / MATERIALS

Materials	Preparation
Bucket	
Measuring bowl	
Electronic clock or stop--watch	
Precipitation beaker	
A few centilitres of food colouring	Could be e.g., from beetroot juice

Introduction

Water is fundamentally important, not only for human beings, but for all other living creatures on earth and the environment. Water plays a substantial role in numerous processes on the planet and is essential for living and non-living elements. We are responsible for preserving quality water for future generations.

Water is a limited resource. Climate change reduces the availability of water in our geographical area as average annual temperatures increase and average annual precipitation decreases. Population growth also adds to the increasing burden on the planet's water resources.

We all need to take responsibility for monitoring our water consumption and apply water-efficient solutions in our households, schools, offices, and factories. It is extremely important to introduce water-efficient irrigation systems into our yards and farms (see module B8). More than 70 % of consumed water serves the needs of agriculture, especially concerning irrigation water (see module C5).

In our households, the biggest potential for saving water is through the efficient use of water in toilets and bathrooms. Residents of households need to consider options for reusing the water used for toilet flushing, e.g., reusing the flushed water for the irrigation of the garden and lawn. Also, the consideration of not using drinking water for flushing the toilet, which is common, should be an appropriate action.

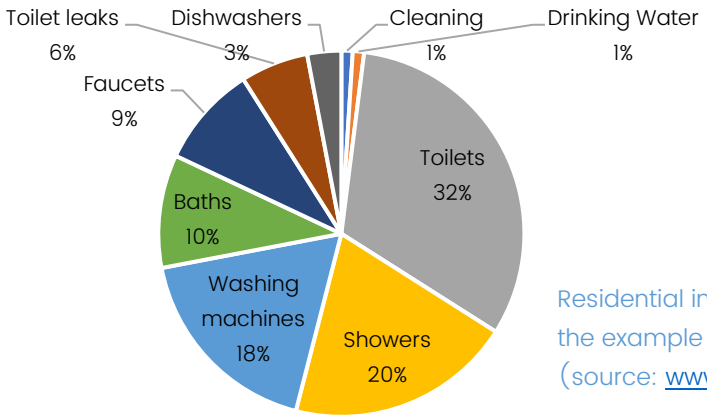
Leaks are another very large burden to our supply system and burden the financial status of our households. Only one leaking tap can contribute to thousands of litres of water loss per year. Saving water also means saving energy and other resources. By doing this, we protect natural resources and help animals and plants that also need water to sustain their lives.

1. Water Conservation

Water conservation is the process of applying measures for the efficient use of water. This includes actions, changes in behaviour, devices, technologies, and improved designs to reduce the loss of water (by wasting or leakages), and to increase water reuse. More efficient water use leads to a reduced demand for water. The key for efficiency is reducing the wasting of water rather than restricting use.

Examples of water conservation steps include fixing leaking taps, taking showers rather than baths, installing displacement devices inside toilet cisterns, and using dishwashers and washing machines with full loads.

Water efficiency is of growing importance. If present levels of consumption continue, two-thirds of the global population will live in areas of water stress by 2025 according to the Second UN World Water Development Report (2006). Now, 2.6 billion people do not have safe drinking water. Changes in climate, population growth, and lifestyles influence the situation.



Residential indoor water use on the example of Winnipeg, Canada (source: www.winnipeg.ca)

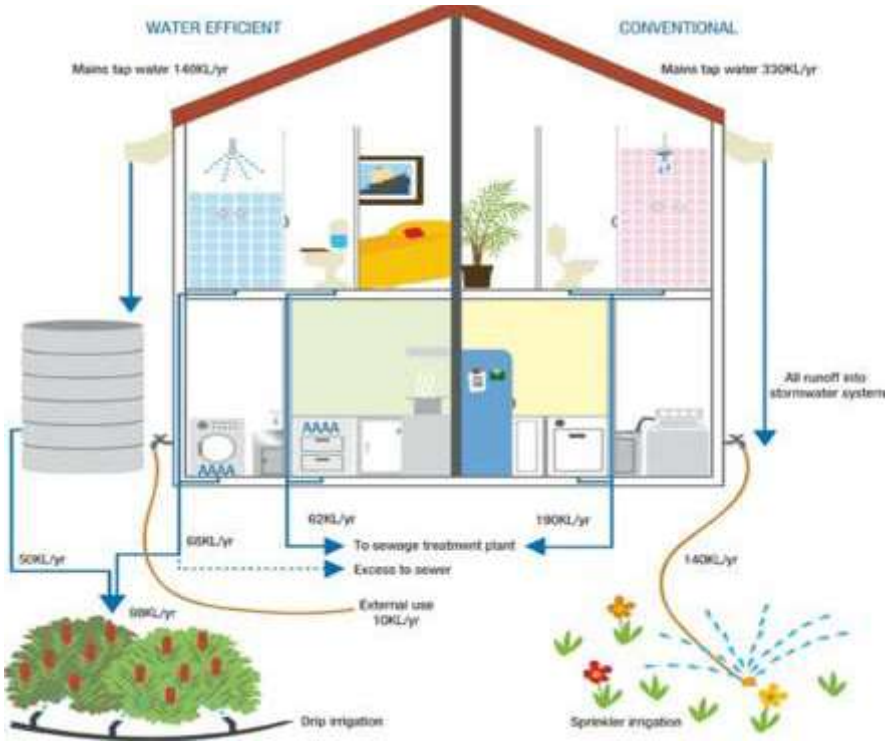
The graphic gives an example from Canada showing how 35 % of the water used within the household is used in the bathroom, and another 32 % in the toilet. That means that an average of about 10,000 to 20,000 litres of drinking water is used per person per year for flushing excreta into the sewerage. About 23% of the water used inside our home is used for laundry. About 10 % of the water used inside our home is used in the kitchen. A running tap can use around 9 litres of water per minute.

1.1. Ways to save water in the house

In addition to saving money on your water fee, water saving helps prevent water pollution in nearby surface waters such as lakes and rivers. Conserving water can also reduce any pollution due to leaks in the sewerage system. The smaller the amount of water used and afterwards discharged, the lower the likelihood of pollution by wastewater.

You can be more efficient at home by applying simple methods to reduce water, by:

- Turning off the tap while brushing teeth or shaving - a running tap can waste more than six litres per minute.
- Fixing dripping taps. A dripping tap can waste more than 2,000 litres of water per month, which is 24,000 litres per year.
- Using the dishwasher and washing machine only when they are full.
- Installing water-saving showerheads.
- Having a short shower instead of a bath. Every minute cut from a shower reduces up to 20 litres of water use.
- Washing fruits and vegetables in a bowl rather than under a running tap.
- Using leftover water e.g. from washing vegetables. Not all used water needs to be thrown away immediately as it may still be useable for e.g. watering the plants. Used water does not necessarily mean that it is not useful anymore.
- Using water-saving devices like aerators, etc. to reduce the water amount used in the kitchen sink. Tap aerators break up the solid flow of water, effectively adding air to the water flow. This results in less water passing out of the tap each second.

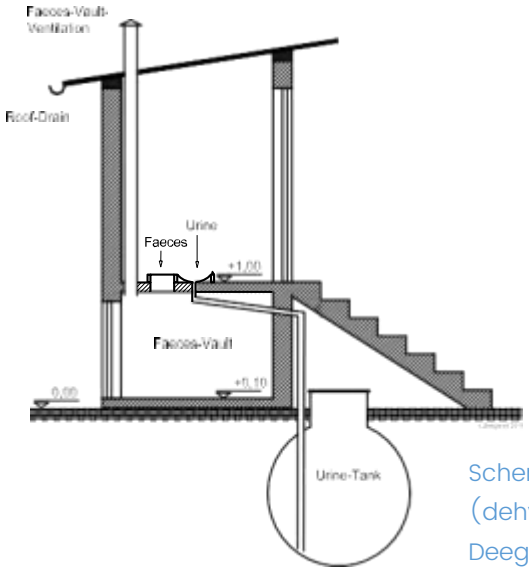


Water-efficient house (source: www.thinkwater.act.gov.au)

Since the flush toilet is, with almost a third of the total volume, the major water consumer in the house, special attention has to be paid to the water efficiency of the toilet. What you can do:

- Put a plastic bottle or other displacement device into the toilet cistern to reduce the flush volume.
- Check for toilet leaks. A barely visible leak into your toilet bowl can waste more than 4,000 litres of water per year. Visible constant leaks (creating a hissing sound) can waste 95,000 litres per year.
- Reusing grey water to flush the toilet or use a waterless or low flush-toilet (see module B5).
- Do not use the toilet as an ashtray or wastebasket. It uses additional flush water and contributes to water pollution.

If there is the possibility to change the toilet system, you could select a low flush toilet or a dual flush toilet that need much less water for flushing. There are also waterless toilets, such as the urine-diverting dry toilets (UDDT, also called Ecosan toilets), which are very useful in water-scarce regions or in regions where no sewage or water-supply system exists. A special urine-diverting toilet seat or squatting slab is used for a proper diversion of the urine from the faeces. With an Ecosan toilet urine and faecal matter are stored and treated separately. No water is needed for flushing because faeces are stored in a dry condition and covered with ashes or saw dust, making sure that bad odours and flies are kept away. After a certain storage and/or composting period, the products are used as a fertiliser in the fields. See also module B5 and C3.



Schematic cross-section of a urine diverting dry (dehydration) toilet (UDDT, source and design: Stefan Deegener, TUUH)

1.2. Ways to save water in the garden

In the garden there are also simple ways to conserve water:

- Water your garden during the early or late parts of the day to reduce loss by evaporation; avoid watering when it is windy.
- Put a layer of mulch around trees and plants to increase water retention in the soil.
- Use a bucket and sponge when washing the car rather than a running hosepipe.
- Check for leaks in pipes, hoses, taps, and couplings.
- Harvest rainwater where possible and store in e.g. simple rainwater tanks, and use it for watering or toilet flushing (see more information module B7 on rainwater harvesting).

2. Questions and exercises

Interview the oldest person you know and write a short story of how people used water before. Examples for questions to be asked:

- Name of the interviewed person and how you know him/her.
- How old is he/she (year of birth)?
- Was he/she living in a rural or urban area?
- Did his/her household have access to tapped water?
- How was his/her family supplied with water?
- How much water was used in their household for the use of the family (what kind) and/or for animals and/or for the garden?
- Which needs were prioritised?
- Had they been collecting rainwater in their households? How was the rainwater collected? How often and to which amounts? What was rainwater used for?
- Which amounts of water do they collect now and what are they using it for?
- What is his/her advice for young people concerning protection and usage of water?

Make some observations at home:

- How much water is used for flushing the toilet and for irrigation?
- Approximately how much water is wasted if the tap is open while brushing the teeth?
- Which kind of everyday activities consume the largest amounts of water?

- What can people do to reduce the usage?
- Check your toilets for leaks: Put a little food colouring (e.g beetroot juice) in your toilet tank. If, without flushing, the colour begins to appear in the bowl within 30 minutes, you have a leak that should be repaired immediately. Most replacement parts are inexpensive and easy to install.
- Measure weekly or monthly the amount of precipitation with a precipitation beaker.
- Measure how much water will run from the tap while brushing teeth or while shaving.
- How much water runs out of the tap in 1 minute? (Save the water used for this experiment in order to use it for another use as well.)

WSSP related activities

- Gather information from the water supplier in order to assess the quantity of water:
- How much water (m^3) is yearly/monthly supplied into the network?
- How much water is yearly/monthly used and paid by the consumer?
- How much drinking water is non-accountable / is lost by leakages within the network?
- Interview a consumer on his/her daily or yearly water need from the water supply and/or from a well.
- Make an inventory / estimation of how many taps or flush--toilets within the households are leaking (by interviews, observations).
- Make an estimation of the amount of yearly precipitation within the area of the village.
- Relate the level of precipitation/evaporation to the water usage in the village.
- Find out if the water supplier or local experts have information about the balance between the groundwater use and the amount of renewed groundwater.

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