Sustainable Sanitation for the 21st Century

Sanitation is multifaceted comprising hygiene, engineering, planning, design, architecture, culture, social marketing, nutrient reuse, etc. Any training of professionals must aim at understanding all aspects in order to become an active player in implementing sustainable sanitation. There is a wealth of textbooks on the individual subjects. The present learning material or source book aims to give a topic-based, integrated understanding of the fascinating sanitation challenges in different parts of the world.

Today, the need for sustainability means that resource saving and protection of the environment are vital and there is a need for innovation and rethinking. This cannot be achieved by conventional methods. Also, in our emerging consumer and chemical societies it will not be enough that residents pay for sanitation and water services – they have to be partners to make sanitation sustainable.

This learning material provides the TRAINER (researcher, teacher, instructor, mobilizer, etc.) with ready-to-use PowerPoint slides. Each slide has an explanatory text and references for more reading.

The slides are logically sequenced and can be used as a full academic course of 5–6 weeks. Also, it is easy to take out desired slides and combine them with your own material to fit your training plan. This flexibility is particularly important in formal training institutions where a syllabus steers training activities, and does not allow for major changes in the short term.

The training material will be updated as the authors gain new knowledge and more experience.

The team of main authors:

Jan-Olof Drangert, Associate Professor, PhD., Linköping University and Vatema capacity building consultant, Sweden
Caroline Schönning, Microbiologist, PhD., Swedish Institute of Infectious Disease Control, Solna, Sweden.
Björn Vinnerås, Associate Professor, PhD., Swedish University of Agricultural Sciences, Uppsala, Sweden.

Acknowledgement

Several people have been involved in the creation of this material. The following persons have contributed to the texts and PowerPoint slides:

Pedro Kraemer, Borda in Bangalore and Jörgen Ejlertsson, Linköping University and Scandinavian Biogas, have contributed to Module 4.4 on biogas;

Karin Tonderski, Linköping university, and Gunnar Jacks, Royal Institute of Technology, Sweden, have contributed to Modules 4.6 and 4.7 about greywater treatment;

Clara Greed, University of the West of England, Bristol, has contributed to the Module 5.2 on public toilets;

Sumita Ganguly, previously Unicef-India, has contributed to the Module 5.3 on school toilets;

Dana Cordell, Linköping University, has contributed to the Module 5.1 on phosphorus.

We want to thank Oliver Ives, Håkan Jönsson, Tetyana Knyazkova, Elisabeth Kvarnström, Carl Lindström, Maria Ines Matiz, Agnes Montangero, Peter Ridderstolpe, Roshan Shrestha, Rosemary Stanton, An Tran Thi Thu, Thor Axel Stenström, and Marachi Subburaman for their valuable contributions.

No progress can be made unless good technical support is available, and our resource persons are:

John Revington, NSW, Australia, did the language check of the sourcebook and slides.

Hans Wessgren, provided continuous technical support and Per-Erik Rydergren constructed the homepage.

We are indebted to all researchers and teachers who have tried out the learning material and given feedback for revisions.

Copyright and the use of the PowerPoint slides and the sourcebook

Intro 2

Long-term sanitation challenges

- The urban population will double in the next 50 years
- Foreseen scarcity of water, energy, and nutrients
- Chemical society, emissions and global warming
- Manpower/capacity constraints

Learn from past experiences!

Jan-Olof Drangert, Linköping University, Sweden

Four factors will have a great impact in the near future; urban population growth, scarcity of natural resources, the increasing number of chemical compounds in all products we use and subsequent harmful emissions, and human capacity constraints such as poverty, a lack of access to information, conflict and lack of good governance.

Housing and feeding nine billion people instead of four or six billion puts enormous pressure on global resources, and products which are used and then discarded put pressure on waste management systems. Fast-growing urban areas and mega-cities in the world become hot spots of used materials. Sustainable sanitation deals with what we do with used items; we may discharge them nearby (which affects only ourselves), further away (which affects others), or recycle them (which benefits all). Ongoing urbanization is both a challenge and an opportunity in this respect, since in cities there are more people to pay for joint solutions.

We foresee increasing scarcity of various resources: water, energy, and plant nutrients for food production. A major flaw of linear material flows is that resources are wasted. They also contribute to environmental degradation, which is severe in the chemical society we inhabit today. Waste streams of unprecedented volumes are produced – but also waste of unprecedented complexity. This calls for closing resource flows into loops with reuse of resources. The sanitation sector can contribute to a sizeable reduction of environmental degradation, including global warming.

For the time being, the priority in the world seems to be on production and consumption of goods, and there is a serious shortage of manpower and capacity in the sector receiving all used materials. This situation is likely to persist, and therefore the next generation of products and systems must be benign by design, that is non-toxic and with re-use in mind. This is a major area for private sector contribution to improve sanitation conditions by producing environmentally friendly products and, at the same time, addressing scarcity and emission issues.

We need to learn from past experiences in order to make predictions about the future. Only then can good policies and measures guide us towards a sustainable society. Policies have more credibility when they are based on an understanding how we reached our present situation.

A holistic approach taking account of the above issues – and other relevant considerations – should guide the design of sanitation arrangements and long-term planning. This training material will provide up-to-date information from the scientific as well as the practical world that can enhance sanitation arrangements as well as improve the training of future professionals.

Intro 3

Content and relevance - a brief presentation

- Sustainable sanitation - a review
- Sanitation management today and in the future
- Sanitation and public health
- Treatment and reuse
- Applications

Jan-Olof Drangert, Linköping University, Sweden

As sustainable sanitation is an emerging field, this e-learning material is not intended to be a manual or a set of directives. Rather, it aims to organise and illustrate approaches and tools which trainers as well as sanitation-sector practitioners and households may find useful.

It covers all aspects of sanitation: sanitation conditions, health and hygiene, agriculture and food production, recycling of nutrients and water, treatment methods, planning and design, technical issues and physical arrangements, socio-cultural issues, management, systems analysis, etc. Urban and periurban contexts are emphasised, since these are hot-spots of sanitation activities.

Each chapter focuses on one of the five main areas (the bullet points in the picture above) but is approached in a holistic way in order to emphasise the complex nature of sanitation. The challenge facing trainers is to prepare students and other trainees to think broadly when they try to develop sustainable sanitation systems. The task is no longer just to move waste products out of sight, but to develop management and physical arrangements to recycle waste material in a safe and productive manner.

We discuss ways in which humans can manage their used materials, be it excreta or other organic matter, so that these do not cause unnecessary human health problems or environmental problems but rather become available for use. If these arrangements are successful, human health is protected and there will be no shortages of resources such as nutrients and water to secure food production.

We acknowledge that a lot is already being done by individuals as well as organisations. We view industry and the private sector as partners in sanitation in the same way as other bodies such as NGOs and authorities. Industry has the capacity, and is hopefully ready to develop, new viable ideas, products and systems. It may be more difficult to get monopolies such as municipal utilities and engineering companies interested in alternatives in sanitation.

This learning material has been gathered over several years of teaching at an international training programme called Ecological Alternatives in Sanitation (1999–2009) by the team from Linköping University, the Swedish University of Agricultural Sciences, and the Swedish Institute of Infectious Disease Control. Much of our understanding originates from discussions with the 300 participants in the international training programme from all over the world. Also, the participants' individual professional projects have provided inspiration as has the training team's work with the WHO Guidelines for sanitation (2006).

Objectives of the learning material

Intro 4

- To provide a cost-effective, up-to-date set of pedagogical slides with commentaries
- To serve as capacity building material
- To improve the quality of instruction
- To encourage students/participants to learn more about different aspects of sanitation
- To challenge learners to think 'out-of-the-box'

Jan-Olof Drangert, Linköping University, Sweden

The target group for the learning material comprises trainers at training institutions for professionals such as schools of public health, engineering departments of sanitation and water, agricultural universities, schools of architecture, university departments for social and economic sciences, etc. The material is similar to distance-learning material; it can be studied in a place and at a time the learner finds appropriate, the content can be studied partially or as a whole, and at a pace that the learner decides. Also, sections can be used for information and advocacy activities.

The material is composed of up-to-date information and knowledge, and is presented in a pedagogical format. Capacity building occurs when the trainee adds knowledge and skills to their existing repertoire. There are exercises to each chapter which are intended to stimulate the trainee to think through what he or she knows about the topic already, and what ideas and attitudes he or she entertains. The next step is to confront these ideas with the scientific and experience-based knowledge presented in the e-learning material.

There is a host of training materials on sanitation. Our ambition is to complement such material by integrating different topics in a way that is not normally done. In this way, the quality of instruction will improve and it will have a long-term impact on the trainee's attitudes and problem-solving skills.

The material is intended to encourage students to learn more about different aspects of sanitation. Such broader knowledge can help them avoid mistakes and inappropriate choices. For instance, instead of fitting a fly screen on top of a vent pipe (where it will corrode and not be replaced) a plastic fly trap (which is easy to monitor and replace) can be fitted. Another example is that building inappropriate systems can result in operational costs in a community with no system for providing the financial means to keep it going. It is enough if one component is missing for the whole system to collapse.

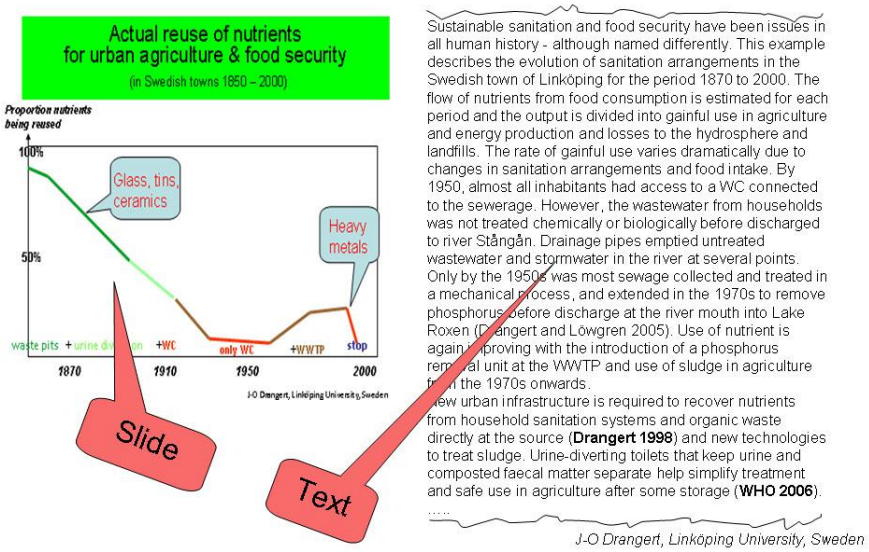
The learning material also challenges the reader to think 'out-of-the-box'. For example, a sludge drying bed is viewed as an emitter of greenhouse gases. Residents are seen as partners in sanitation. The current short term solution to alleviating hunger is to provide relief to starving people – rather than to change rules or conditions for farming. In this learning material we see food shortages as missed chances to direct nutrient flows in the sanitation sector to food production.

The Sourcebook and set of animated PowerPoint slides can fill the gap of knowledge and skills required to overcome the following five challenges for mankind:

1. There is **no water scarcity in cities**, only poor management of the available water
2. **Morbidity can be reduced** through washing hands and safe handling of child faeces
3. Future **toxic shocks can be avoided** through harnessing our chemical society by source control of products
4. **Food security** can be achieved through recirculation of nutrients and changes in diets
5. Households and **residents hold the key to improvements** mainly through improved sanitation routines, and also through exercising the power as consumers and voters

Guide to the user – the design of the material

Intro 5



The Sourcebook comprises an introduction and five chapters. Each chapter consists of a number of Modules. Each Module comprises Sections containing one slide/picture and one or two pages of text.

Each slide is a pedagogical unit, often comprising a picture or diagram and some bullet points (left picture). It is animated so that the information on the slide gradually appears on clicking. More theoretical aspects are often illustrated in an effort to connect theories and methods to practical situations. The examples are drawn from various countries and time periods to impress upon the reader the varied conditions and also the similarities, which exist in different situations.

There is an accompanying explanatory text (right picture) to each slide in a separate pdf document called the Sourcebook, which the trainer can print out and keep as a guide. The text page also includes references and proposed further readings on the topic.

The text box under the slide itself is left empty so that the trainer can use it for his or her own comments.

The reader can click on links or bookmarks to literature references and Sections respectively within the same Module. A reader who has downloaded a full chapter can come to other Modules in the same chapter by clicking on a bookmark. Technical instructions are found under "**Document Help**".

Maneuvering in pdf documents

Links: The sourcebook contains blue-coloured underlined links to text references and Sections/slides.

Position the cursor over the link and ***click*** Alt are transferred to the text refere ← slide.

Return to original page by pressing the key and click left-arrow key

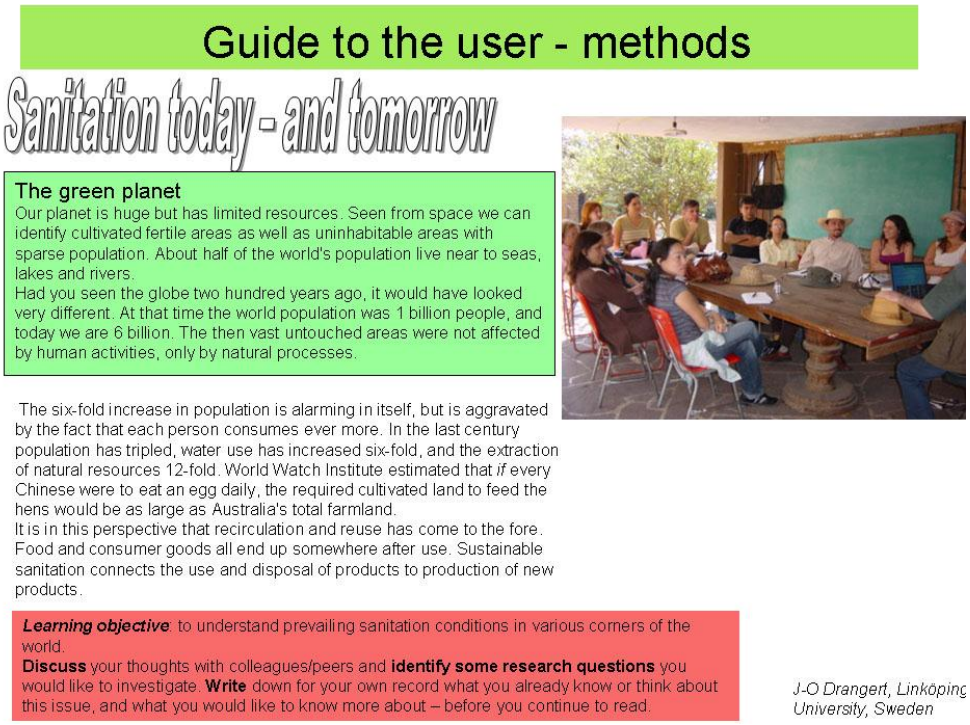
Pages and bookmarks: There are two symbols in the upper left corner of the screen:

◀▪▪▪▪▪ Click here to open a panel for quick maneuvering between ***pages***.

◀▪▪▪▪▪ Click here to open a panel for maneuvering between ***bookmarks***.

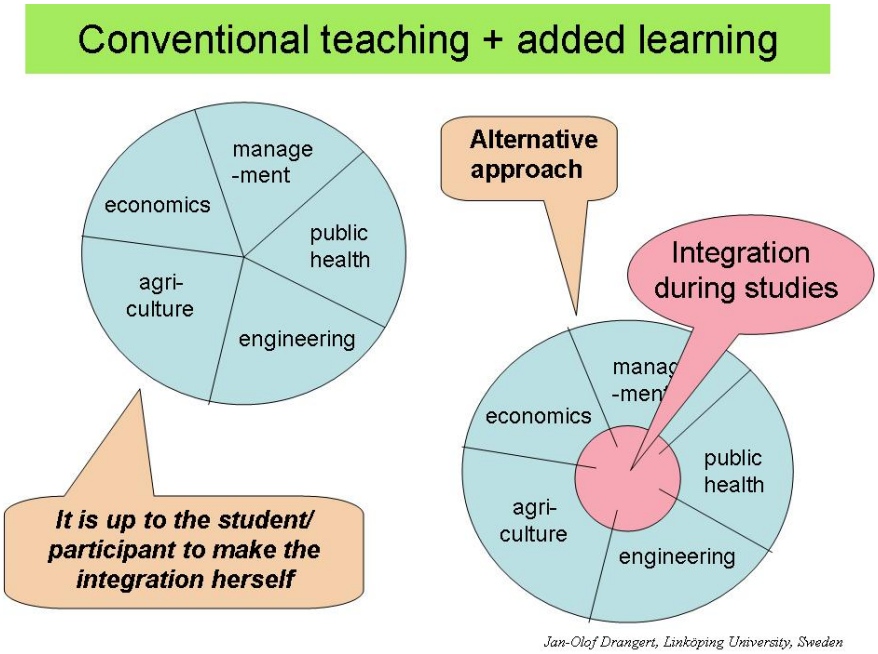
Return to page by pressing the Alt key and click left-arrow key ←

Problems? Please let us know if you experience problems when using the material!



Each chapter starts with an exercise intended to create interest in the topic, and to stimulate the learner to think through what he or she already knows and how they perceive the situation. The exercise may be used by the trainer or facilitator in groups, where learners are discussing the issue. The format is inspired by the problem-based learning methodology (Study Guides and Strategies, 2010; http://www.studygs.net/pbl.htm).

Ideally, a training session stimulates participants to take responsibility for their learning process through their own activities. Problem-based learning (PBL) emphasizes that each participant learns from peer knowledge and experiences. Sanitation is a very good topic for PBL since most problems are related and can usually be addressed using a variety of technical and management options. Discussions and problem-solving in small groups stimulates participants to become responsible for their learning process, and the facilitator's job is simply to formulate the learning goals and the cases. Lectures ideally serve as a support to address the questions and problems that the small-group discussions lead to. The idea is to give answers and contexts after the questions have been raised, not to give an answer before the learner has formulated the question. This methodology is also feasible for participants who already work in the sanitation sector and could share their experiences and knowledge with peers from other sectors. This is the essence of the aim of inter-sectorial understanding.



The hallmark of a competent professional is that she can combine pieces of knowledge, experiences and skills into a holistic view of the situation. It takes time and effort to reach such maturity, and any basic training programme should aim to instil such maturity.

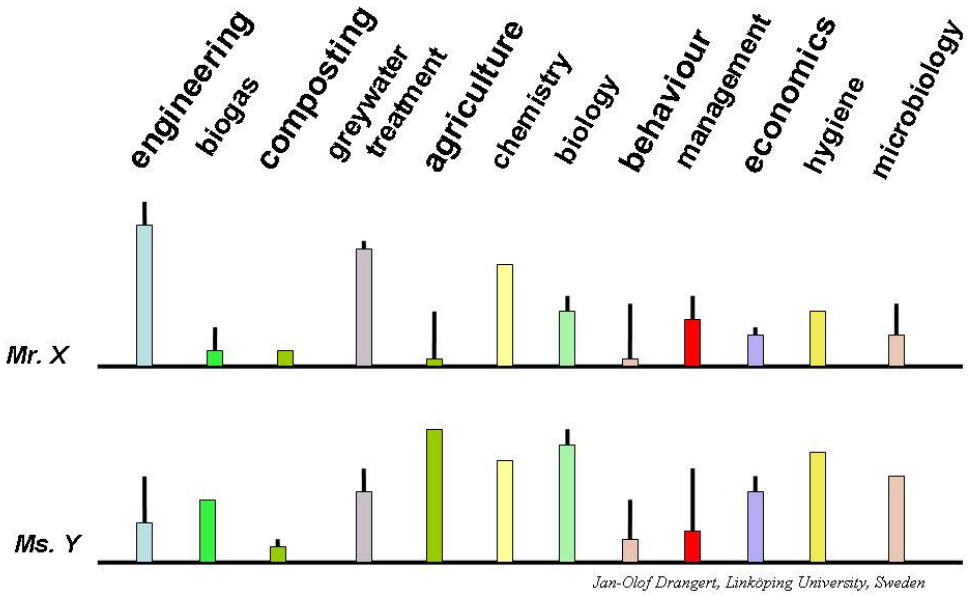
Due to competition and time constraints most institutionalised training programmes tend to deal with separate facets of each subject and leave the integrative task to the students (left picture). This approach represents a lost opportunity for working towards a major training goal. A training schedule or syllabus should make provision for integrative activities (right picture) where the student is trained under the supervision of an experienced instructor.

There are several practical ways to provide such training activities: (i) Students can work on **case studies** which are designed to require knowledge about various subjects if they are to be solved satisfactorily. (ii) Students can conduct **interviews** with persons who are managing complex situations in order to find out how such people think and act. (iii) Student may also make well-prepared **study visits** to places where they can experience integration aspects in an actual situation.

A study visit can serve as a training session in observation and interview skills. Here is an example: During the study visit, while the participants look around, the facilitator takes strategic photographs and collects oral information from guides and others. A day later, a few strategic pictures serve as a starting point for detailed discussions about what the participants saw and heard during the visit. Such discussions around the pictures take at least two to three hours – as long as the study visit itself. The participants are asked to tell what they see in each picture and how they understand the situation. Typically, the start of the session is slow, and only gradually do they come forward with their comments. They should not be rushed, however, because that would deprive them of the chance to learn. After a while they realise that they have each seen very different things, and they have not made the same mental connections and interpretations of the situation. At this stage they become eager to understand how things are connected and they try to relate the findings to what has been discussed in various subject courses. A frequent comment from participants is that they had seen and heard very little. They add that they benefited a lot more through this exercise and it made the study visit worthwhile and productive. In this way they are trained to become observant and make full use of the visit. The discussion also serves the purpose of getting the students to apply what they have learnt earlier in the course and now have to apply in a real-life context. This proves to be an effective way of reviewing the major points in the training.

Knowledge development through peer learning

Intro 8



A lone professional cannot cover all aspects of sanitation, but a team of specialists can. Work in a team is beneficial if each member is sufficiently familiar with the others' areas of competence. Familiarity means knowing enough to be confident to ask questions, to exchange ideas and to negotiate about the system under consideration.

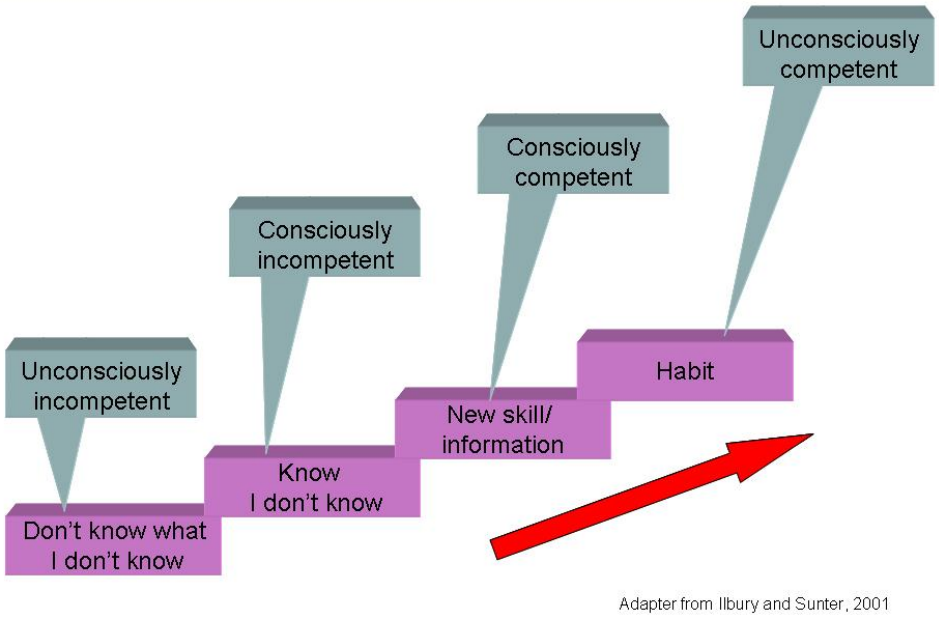
The above picture depicts the knowledge-level profiles of a number of subjects connected to sanitation issues. If two people together take on a task, they complement one another (picture). The result will be that they learn from each other (black lines). This learning from a peer is closely related to a problem-solving activity and therefore tends to be well understood. Research has also shown that it is easier for a person to admit and adjust preconceived ideas in a group of peers than in a formal training situation. One reason is that they are more engaged in a discussion in the group and have a chance to test their own ideas and also to listen to peer arguments for and against. Such a change in perception can be done without loss of face.

The present material is designed to encourage students to learn from their peers. Communication skills are important for learning from peers to take place and, more generally, is a fundamental attribute of any change agent. This is facilitated if the syllabus or study programme also contains a section on interview skills training. An example of a training format is as follows. Each participant conducts a mock interview in front of a video camera, and a professional communication expert assists the group (of four trainees) to observe and comment on each trainee's performance. The tape is then replayed to find out to what extent the first impressions and comments are valid. Each participant later conducts real-life interviews for which they select a topic and prepare questions that will enable them to get in-depth answers during the interview. The task of producing an interview protocol commonly requires detailed guidance (Boot and Cairncross, 1993). Finally, they present their interview results to the group and in this way each participant gains more information/knowledge than could be collected by a single person.

An interview training session provides the opportunity to become conscious of the impact of one's own behaviour as interviewer and as a member of a working group. Such a skill will be readily applicable in their future work, not least when conducting surveys and studies about residents' perceptions and values. The training could help trainees to avoid some common mistakes when they approach respondents and formulate questionnaires. Respect and good rapport with respondents and peers is a must that is often overlooked.

Life-long learning: climbing a competence ladder

Intro 9



Adapter from Ilbury and Sunter, 2001

Fortunately, there is no end to learning and we learn all our lives. Our social and physical environment changes more or less constantly and we strive to become competent in new situations. The competence ladder (picture) indicates the steps we have to climb over and over again to adapt to or control new situations. In most situations these steps are taken on the initiative of the individual to solve an immediate need. The individual typically searches for the required knowledge and information from friends, peers, written material etc., and nowadays also on the internet.

Formal training programmes can offer the students more long-term fulfilment of needs such as a certificate that in turn will open new opportunities for a new job or a step in their career. In this case, however, a trainer cannot rely on students having an immediate interest in learning each topic. The trainer has to create a learning environment that inspires the students to search for the knowledge and skills that are required. Fortunately, the trainer can rely on the inbuilt human desire to understand and to feel competent. The learning should be a win-win situation for the student and the university.

This training material aspires to provide a programme that can be used to inspire students to want to understand the various issues pertaining to sustainable sanitation.

Chapter 1. Sustainable sanitation – a review

Module 1.1 **Sanitary conditions in the world**	What functions should a sustainable system fulfil ? Is sanitation in the world improving or not?	Sanitary conditions in various parts of the world. Critical understanding of data and functions.
Module 1.2 **Resources**	Where are the resources? What might be the problem to access them?	Limits of nutrients, water and staff. Understanding the role of sanitation.
Module 1.3 **Resource flows**	From where do resources come and where do they end up?	How resource flow are created and manipulated. Methods to analyse flows.
Module 1.4 **Demographic change**	Does population growth impact service levels? Is urbanisation a solution or a problem for improvement?	Urban-rural links. The role of demography in sanitation planning and implementation.

Jan-Olof Drangert, Linköping University, Sweden

Intro 10

Chapter 1 gives an overview of sanitation in the world and elaborates on its connections to other sectors, mainly agriculture, energy, manufacturing, and natural and human resources.

Improved sanitation can reduce global warming as well as scarcity of resources such as nutrients, water and energy.

Chapter 2. Sanitation management today & in future

Module 2.1. **Sanitation arrangements**	Is there one system that suits most conditions or must we choose and combine?	Matching management with technology and local conditions.
Module 2.2. **Major changes over time**	How does consumption impact on reuse over time? What footprints are left?	Long-term impacts shaping sanitation arrangements and tracing origins of change.
Module 2.3. **Policy to action**	What is allowed to do? Do polluters really pay?	Translating guidelines & laws to local action and change.
Module 2.4. **User perspective**	What are residents appreciating? Why?	Be sensitized to challenges of bottom-up approaches.
Module 2.5 **A way forward**	How to obtain all the information we need?	Advanced selection criteria for sustainable sanitation.
Module 2.6 **Plans & design**	What difference does good planning and design make?	Opportunities to improve sustainability provided by nature.
Module 2.7 **Construction**	What bottlenecks are there for councils and residents?	The paramount role of good construction for operation.

Jan-Olof Drangert, Linköping University, Sweden

This chapter deals with the interface between humans and physical arrangements. Several examples are presented to show the many options available to reach towards sustainable sanitation.

Intro 11

Chapter 3. Sanitation and public health

Module 3.1 **Exposure and effects in humans**	Public health as a driving force for sanitation? How are infectious diseases transmitted? What happens if and when we are exposed to pathogens?	The present global situation. Health risks related to sanitation. Pathogens of concern in water and sanitation systems. Epidemiology.
Module 3.2 **Environmental transmission**	Where do the pathogens we are exposed to come from? How do pathogens in excreta contaminate the environment?	Pathogens in different waste fractions. Different routes of transmission related to water and sanitation. Zoonotic diseases.
Module 3.3 **Pathogen reduction**	How persistent are pathogens in the environment? How can we prevent exposure and disease transmission in sanitation systems which involve the agricultural reuse of excreta?	Persistence of microorganisms in different environments. Treatment options for urine and faeces in theory. Barriers in agricultural reuse systems.
Module 3.4 **Health targets and guidelines**	Which targets can be achieved in relation to exposure and treatment? How are barriers used in guidelines to minimise health risks?	Health targets and the microbial risk concept. Faecal indicators. Options for guidelines and regulations (WHO).
Module 3.5 **Risk management**	Can we measure a risk of disease transmission? How can sanitation systems be evaluated?	Control strategies (barriers) and risk management. Systematic evaluations of health risks.

Intro 12

Caroline Schönning, Sweden

Chapter 4a. Sanitation and the environment

Module 4.1 **Nutrient and water cycles in biosphere and society**	How do plant nutrients and water flow in the bio-sphere? How have flows been changed by society?	Cycles of nutrients and water in the biosphere. Flows of nutrients and contaminants in excreta/greywater/waste.
Module 4.2 **Treatment of excreta for safe reuse**	Can urine and faeces be made safe for use in crop cultivation? Can house-hold organic material be incorporated?	Effects of digestion, storage, desiccation, composting, heat & ammonia treatment, incineration on pathogens and fertiliser quality.
Module 4.3 **Compost treatment**	What happens in a compost? How is the material degraded and what are the end products like?	Composting as a biological treatment of organic waste. Processes and the function of the system.
Module 4.4 **Biogas reactors for treatment**	Why do substances degrade and form biogas? What amounts can be produced?	How to manage anaerobic processes to obtain biogas. Biogas generation in the world today.

Björn Vinnerås Swedish University of Agricultural Sciences

Intro 13

Chapter 4b. Sanitation and the environment

Module 4.5 **Greywater is man-made**	Greywater as a resource? What happens with used household chemicals?	What we add to water while using it. Source control in homes and industries.
Module 4.6 **Greywater – processes**	How can Nature assist or react? What compounds can be removed?	Be familiar with how treatment processes work and why they function.
Module 4.7 **Greywater-treatment options**	Can we remove all metals and pathogens? What is in the sludge?	Various treatment options and how they combine physical/ biological/chemical processes
Module 4.8 **Excreta fertilisers in agriculture**	How can ecological fertilisers from excreta best be used?	Factors limiting yield. Functions of plant nutrients. Examples, recommendations.
Module 4.9 **Environmental systems analysis**	Can sanitation systems be compared fairly? How to measure impacts?	System boundaries. Quanti-fication of environmental effects and resource use.
Module 4.10 **Comparisons of sanitation systems**	How can a dry UD toilet system be compared with a conventional system?	Effects on water, climate and various resource use. Cost-benefit analysis.

Björn Vinnerås Swedish University of Agricultural Sciences

Intro 14

Chapter 5 Applications

Module 5.1 **Sanitation, food security and plant nutrients**	Does recirculation of human-derived nutrients make a difference? Are there substitutes?	Flow analysis to assess potentials of reusing nutrients for future food security. Role of sanitation sector.
Module 5.2 **Public toilets**	Can public toilets be attractive? Can vandalism be avoided?	How to plan and implement appreciated toilets in public places. Design criteria.
Module 5.3 **School toilets**	Can schools inspire good hygiene and promote eco-sanitation ?	Function-based design and management of school sanitation.
Module 5.4 **For emergency**	To be completed	To be completed
Module 5.5 **Toilet systems**	To be completed	To be completed

Intro 15

Web pages and other information material

Intro 16

- Rapidly growing number of web-sites with info on sanitation issues
- Broad information on sanitation activities in the whole world

J-O Drangert, Linköping University, Sweden

It is becoming difficult to navigate and evaluate sanitation information due to the explosion in web-sites and written materials. The team of authors of the present learning material has screened available resources and tried to identify scientifically sound material and included it in the lists of references and recommended additional learning materials.

Research and guidelines:

A wide range of research papers about hygiene, risk assessment, treatment methods, sociocultural conditions, planning, reuse, flow analysis. etc. are referred to in the text. Also, guidelines from national agencies and international organisations such as WHO (2006) Guidelines for reuse of urine, greywater and faecal matter are referred to.

Course modules on CD

"Water Management and Water-related Risks" United Nations University, LEAD-Japan

"EcoSan course" by Agricultural University of Norway

"e-moderation training course" by CSE, New Delhi-India

"Ecosan in China" by Unesco-IHE, Delft-Holland

"EcoSan" by WASTE, Gouda-Holland

"Low-cost sanitation" by WEDC, Loughborough-UK

www.unesco-ihe.org/Education/Short-courses/Online-courses/Ecological-Sanitation

CD information:

"An ecological approach to sanitation in Africa" by Peter Morgan, Harare-Zimbabwe

"Water & Cities" by UN-HABITAT for the 3rd World Water Forum

"State of the cities report 2004" by South African Cities network

"Fire and water/A healthy city for all/Trail of two cities" by City of Cape Town

"A new governance from below. Cape Town, South Africa" by Slum Dwellers International

"Beyond the track. Mumbai India" by Slum Dwellers International.

"Will push come to shove? Old Fadama, Accra, Ghana" by Slum Dwellers International

"All in the name of development. Kibera, Nairobi, Kenya" by Slum Dwellers International

"Middle East and Mediterranean regional day" by the World Bank

"A journey in the history of water" by Watervideo.com

"Introduction to a legal framework to pollution management" by Deloitte&Touche, WRC

"Best practices of water & waste water management in Kathmandu" Action Aid-Nepal

"Management report 2003" by ANA= National Water Agency, Brasilia-Brazil

"Water demand management" by IUCN and Sida IDRC

"Wastewater management and public-private partnership" Japan Sewerage Com for 3rd WWF

"Guidelines for management of sewerage facilities in DC" Japanese Gov, Infrastructure Dev

"Working towards unlocking the water potential of agriculture" by FAO, Rome

"The state of the world's children 2005. Childhood under threat" by UNICEF

Films:

"Human excreta index" by Waste-Holland

"Lesser humans" by Navsarjan Trust, Ahmadabad-India

"A journey in the history of water"

"Casting a cement UD-toilet" by Espacio de Salud-Mexico

"How to use and look after/change vaults/empty UD-toilet" by Ethikweni City-South Africa

"Sulabh sanitation movement" by Sulabh International, New Delhi-India

"Enviro options" by Enviro loo, South Africa

"The del Agua kit" by Robens Institute, Surrey-UK

Utube: http://www.youtube.com/watch?v=XgKCfuKPE6s

Access and use of this material

Intro 17

- This material is free for use and citation
- It is available on the internet and can be downloaded as pdf-files and PowerPoint-files
- Copyright is shared between Swedish University of Agricultural Sciences, Uppsala, Swedish Institute for Infectious Disease Control, Solna, and *Vatema* capacity building consultant, Sweden
- The material has been produced with the kind support of Vatema Capacity Building Consultant. It is based on the international training programme *Ecological Alternatives in Sanitation* funded by Sida.

The ***silent sanitation crisis*** is both indefensible and illogical. More than two-and-a-half billion people lack access to so-called safe sanitation and, as a result, 5,000 children under the age of five die every day. But strong words will not make this human health tragedy go away. The most important question remains the most simple: What can be done now? The scale and history of failure in the sanitation sector, and its deleterious impacts on development and the environment, would seem to justify a pessimistic outlook. Learning lessons from these failures, however, gives us reason for optimism. The training material draws on successful local activities and research. A lot more can and will be done to invest in and improve sanitation, health and hygiene in the 21st century.

No miracles are expected in the coming years, should we continue thinking in terms of linear resource flows in our homes and cities. The experiences of environmental damage caused by poor sanitation have increased our awareness. A strong political agenda in combination with emerging technical arrangements provides the realistic hope that individuals and communities can introduce feasible solutions. It is not only international organisations such as UNICEF, WHO and UNEP that are concerned about this issue. Recently, a high-ranking Vatican official, Archbishop Girotti, expressed the Church's concern over new sins and condemned "ecological" offences as modern evils (*The Mercury*, South Africa, 13/02/08).

This PowerPoint material provides approaches to develop hands-on recommendations for what can be done in the short term as well as the long term. The information is easy to download and is free of charge.

References:

Boot, M. and S. Cairncrosss (eds). 1993. *Actions Speak. The study of hygiene behaviours in water and sanitation projects*. The Hague, IRC (International Water and Sanitation Centre).

Ilbury, C. and C. Sunter 2001. *Games Foxes Play*. Human & Rousseau. South Africa.

Study Guides and Strategies 2010. Available at http://www.studygs.net/pbl.htm 2010-08-16

Wikipedia. http://en.wikipedia.org/wiki/Problem-based_learning 2010-08-16