

FINAL EXAM

Daniele Cervellera

Student of WASH post-graduate diploma (Course Code: PGD002) in The
Strategia Netherlands

Admission number: SN031/06/2018

1. Diarrhea among children under 5 is common in many rural villages. What environmental factors or practices may cause diarrhea in young children? Explain three ways to prevent it

Diarrhea is defined as the situation where a person has frequent loose stools. It is a symptom of many waterborne diseases. Diarrhoeal disease is the second leading cause of death in children under five years old. It is both preventable and treatable.

Each year diarrhea kills around 525 000 children under five. Globally, there are nearly 1.7 billion cases of childhood diarrheal disease every year and it is a leading cause of malnutrition in children under five years old (WHO, 2009).

The waterborne diseases are caused by biological pollution from human bodily wastes from infected people. Fecal matter contains pathogenic organisms that cause waterborne diseases, mostly diarrheal diseases and parasitic worm infections. Some instances of diarrheal and other waterborne diseases and their causes are presented in table below.

Group	Disease	Causative agent
Bacteria	Typhoid fever	Salmonella
	Cholera	Vibrio cholerae
Viruses	Viral gastroenteritis	Rotavirus and others
	Poliomyelitis	Polio virus
	Viral hepatitis	Hepatitis A and E virus
Protozoa	Cryptosporidiosis	Cryptosporidium
	Giardiasis	Giardia
Parasitic worms	Ascariasis	Ascaris lumbricoides

	Schistosomiasis or bilharzia	Schistosoma
--	------------------------------	-------------

Table 1: Examples of waterborne disease.

With a single exception, all the diseases in table above are caused by people ingesting pathogens by drinking or eating contaminated water or food, or they are the consequence from poor hand hygiene. This is fecal–oral transmission which means people are infected with disease when pathogens coming from feces reach their body through the mouth. The exception is schistosomiasis, which is caused by worms penetrating the skin in the cases where people are swimming or washing in water that has been contaminated with excreta from an infected person. There are major health risks associated with water pollution, caused by practices when people use water or food contaminated by feces. Open defecation, improper use of latrines, disposing of feces with solid waste or in fields are among the unhealthy practices that lead to infections. In addition unattended solid waste accumulation encourages flies and rodents to breed and they are also responsible for transmitting disease.

The transmission can be prevented, even if according to the research conducted by Rauyajin and others (1994) some interviewed mothers reported that the prevention of diarrheal diseases is impossible, particularly in children less than 1 year of age. This view shows how the improvement in hygiene has to deal with opinions that are opposite of good practices.

A risk of underestimation of the hygienic practices may lead to diarrheal diseases in young children that can have a prolonged effect on development, cognition and ability to learn at school (Griffiths et al., 2010).

- 2. Think about the possible types of pollution that could be produced from a health center.**
 - a. List the types of pollution that could be produced, giving one example of each type.**
 - b. Describe the two main approaches to pollution management. Outline the pollution management methods that could be used for the pollutants you have listed.**

Health center might produce different types of waste that should be considered with different levels of pollution:

1. food – since there are patients that eat in the health centers, an amount of waste from the food will be produced. This waste is the least polluted.
2. plastic waste – this waste (i.e. plastic film of packed medical material, as they come from factories) is more polluting than the food waste and its management is very important.
3. special medical waste – this is the most critical type of waste. It includes bandages, syringes, needles, gloves, etc. The delicate aspect is not only the nature of the material but also the fact that are things that many times are contaminated with body fluids from patients.

Waste in healthcare facilities is considered critical because new infections can occur in people dealing with the waste if it is not handled safely. Healthcare facilities are usually provided with incinerators that burn the waste at high temperatures to kill pathogens and remove any risk of new infections. Some facilities may have special storage containers for ‘sharps’ (i.e. items such as needles and razor blades), covered placenta pits for anatomical waste (blood, body parts), and open pits for other medical waste.

Instead of just discarding solid waste, a better approach to waste management is to adopt the 3 Rs approach. The 3 Rs stand for reduce, reuse and recycle. These three options can all contribute to improvements in the problems of waste disposal in urban areas. In order of preference, they are:

1. Reduce the amount of waste produced. For example, throw away less food and avoid heavily packaged items.
2. Reuse items many times before throwing them away. Bottles, plastic containers and bags can all be reused, paying attention to the contaminated items that cannot be reused.
3. Recycle wastes by using them to make new items. For example, paper waste can be recycled to make fire briquettes.

There are two approaches to pollution management: pollution prevention and pollution control. The first one is focusing on stopping the production of pollution in the first place or reducing any waste generation at the source. The second one instead considers measures to take control of pollution and wastes after they have been generated or produced. So, if pollution is produced, there should be some measures to control it and minimize the effects on people and the environment.

In the case of the health centers, the pollution prevention should consider the minimization of the food that is wasted, the plastic that is produced and the medical waste that is produced, without reduce the usage that is needed following the hygienic rules: for instance, two needles will not be used twice in order to reduce the waste.

Considering the aspect of the pollution control, in the health centers it is a very important aspect that should be fully in place, since the medical waste is a high-risk pollutant in term of disease transmission. All this waste should be burn in the incinerator to kill all the pathogens, as explained above.

In line with the approach of pollution prevention, Jorgensen (2002) explains that each enterprise should have an environmental management system where there is a reduction of energy and resource consumption, that will lead to reduction of pollution and waste that in some country might reduce the production cost. And for this aspect a health facility can be compared to an enterprise. In order to be able to control the pollution, in the sector of water industry and distribution (the sewers and water mains) the control of the performances of the structures is considered a key aspect. In the UK the development of a catchment management plan can be considered a good solution to have control of the pollution, and if a health center was able to develop something similar it would benefit a lot. In the diagram below there is an example of the phases of a catchment management plan.

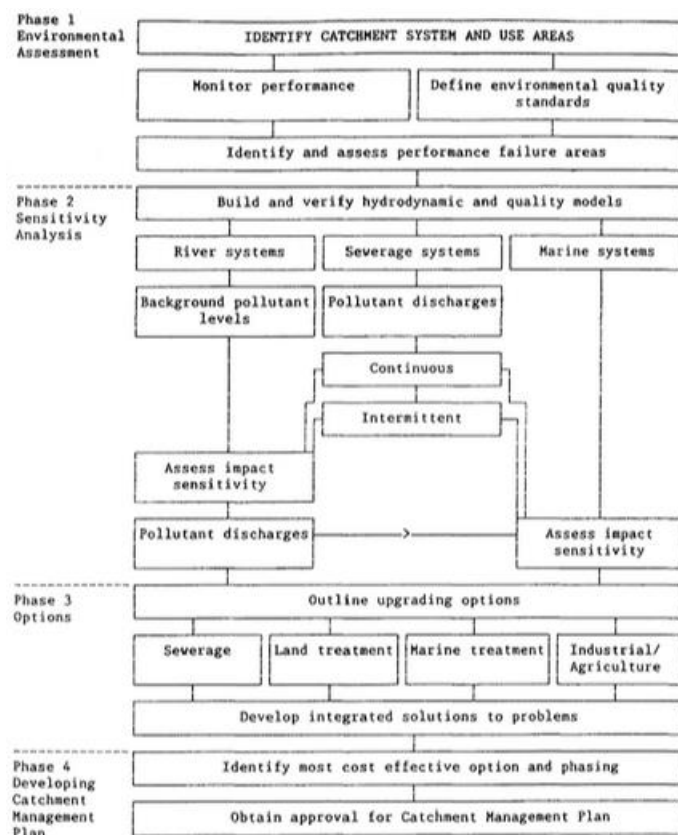


Diagram 1: Catchment management plan flow diagram (Bau et al., 2005)

3. Give three reasons for incorporating plans for M&E during the early stages of a project's development.

Three possible reasons for incorporating plans for M&E during the early stages of a project's development are:

- progress can be checked at key stages of the project to ensure that plans are being followed, budgets spent appropriately and targets on track to be met.
- the impacts of the project can be assessed to find out if the project has been effective and provided value for money.
- identification of any problems or failures and learn from them so that the next project does not make the same mistakes.

Monitoring is the incessant observation and tracking of a project or a programme performance during development intervention. Its nature is descriptive, focusing majorly on the recording of key indicators, activities, inputs, and outputs of the project.

Evaluation is the process of formation of judgements, measuring the changes in planned results to which the specific project or programme may have contributed. Jointly considered, monitoring and evaluation can let development workers to continue the production of feedback about the advancement and challenges during the duration of a development intervention, which will also generate best practice lessons for future change (Laws et al., 2013).

Another possibility that can be considered is a participatory M&E: this differentiate from the traditional way of conducting it because it involves the stakeholders and the beneficiaries in the process and during the design, elicitation, analysis and utilisation of the M&E information (Cramb & Purcell, 2001).

In the following table it is possible to compare the two methodologies:

	Conventional	Participatory
Who	External experts	Farmers, project staff, facilitators
What	Predetermined indicators of success, e.g. production, income	People identify own indicators of success
How	Focus on scientific objectivity; distancing of evaluators from other participants; uniform complex procedures; delayed, limited access to results	Self-evaluation; simple methods adapted to local culture; open, immediate sharing of results through local involvement in evaluation processes
When	Usually upon completion; sometimes also mid-term	Merging of monitoring and evaluation, hence frequent small-scale evaluations
Why	Accountability, usually summative, to determine if funding continues	To empower local people to initiate, control and take corrective action

Table 2: A comparison of conventional and participatory evaluation (Cramb & Purcell, 2001).

4. Explain four factors that are important when choosing a sanitation technology

The construction of latrines or any other sanitation technology is not only a matter of building a structure but it involves a broader area of considerations that needs to be done.

The choice of the best sanitation technology has to ponder the social and economic aspects of that, together with the technical part. Since sustainability is one of the key characteristic of any project, the use of construction materials and abilities that are locally available is the best option.

The economic cost that someone has to face for accessing to a sanitation technology is very important since if it is not affordable, the possibility that a technology is embraced is very low.

Another factor that falls within the social environment is the accessibility of the facility with reference to how it is constructed: not only adults should have the chance to use it and access physically, but special arrangement should be in place in order to allow the children to use it without any risk, as well as the elder people that cannot have the same capacities and mobility of younger people. The social aspect includes the assessment of the cultural beliefs on sanitation and its technologies: in some contexts, it is even impossible to talk about to talk about handling excreta because it is a taboo (UNESCO, 2010). So, in these cases, before the actual construction a comprehensive and deep discussion with the community is necessary to understand the chances that are there.

Considering the type of sanitation facility to be most appropriate in a place, it has to be considered the geology of the area. The type of technology matters for the liquid waste percolating into the ground. In the case, for instance, where there is a water source nearby, the distance of a latrine should be considered in order to avoid contamination.

Another factor is the local climate: since heavy rains and the nature of the soil may lead to high chance of floods, all the natural factors have to be considered from the moment of planning the construction of any sanitation facility. The building of a pit latrine with a mound should be considered with the scope of guarantee that water does not enter. The design should include also raised footrests in case of latrine building in order to help the users in case of darkness.

Here after Koottatep et al. (2019) presented some technologies existing in sanitation and the respective input/output materials:

Existing Sanitation Technologies	Input/Out Materials
Wet mixed blackwater and greywater with off-site treatment technology	Blackwater mixed with greywater Faecal sludge
Wet mixed blackwater and greywater with on-site treatment technology	Blackwater mixed with greywater Faecal sludge
Wet blackwater technology (blackwater separated from greywater)	Blackwater Faecal sludge Greywater
Wet urine-diversion technology	Urine/yellow-water Brownwater mixed with greywater Faecal sludge
Dry greywater-separate technology	Excreta Greywater
Dry urine- and greywater-diversion technology	Urine Faeces Greywater
Dry all mixed technology	Excreta mixed with greywater

Table 3: Overview of sanitation technologies and the input/output materials

5. Define Sustainability. Explain four factors that can be used to foster sustainability in WASH projects.

b. Giving reasons explain 5 conditions that will help in improving the water supply situation in your country.

The word Sustainability is a common work in the development world. The notion of “sustainable development” was introduced in the political agenda by the World Commission on Environment and Development in 1987. Even if the exact definition was not given, it is referred as “a development that meets the needs of the present without compromising the ability of the future generations to meet their own needs” (WCED, 1987). It is a concept that can be used in different areas, and customized differently: for example, in economics Neumayer (2003) reports the most common definition is “economic development is sustainable if it does not decrease the capacity to provide non-declining per capita utility for infinity”.

The moments where the sustainability have to be considered are all the ones where you can support or compromise it. The first moment is the planning phase where there are some methodologies that can help, like participatory planning, the choice of technologies and designs that are socially inclusive.

Then during the implementation of the activity, the promotion of sustainability should pass through its consideration in the decision-making process, taking care of the quality of the activities, the efficiency and other specific factors that differs according to the type of project.

Last but not least, after the end of the major activities the management, operation and maintenance and governance are all factors that are fundamental to sustain the improvement and the changes that the project brought.

Then the importance of the location where the project is implementing matters: the intensity of social accountability awareness in a town will have a great influence in defining the sustainability of WASH facilities and services. Strong social accountability ensures that resources are allocated to address the most urgent needs of a community and are utilised effectively for the intended purpose.

There are some conditions that can contribute in the creation of a good supply water system: the financial possibilities, and the capacity in the delivery of the service. There are different types of capacity, like the human, technological, managerial, institutional and infrastructural capacities. These capacities are required at all level, from the highest level (national) to the single individual. The human capacity refers to the engagement of the local people, their skills, the social norms and the chance of expressing opinions to all. The technological capacity is not only the possibility to use the most recent one because the chosen one should be the most user-friendly, giving the possibility to the users to access easily.

The institutional capacity refers to the coordination and collaboration between the different sectors that are involved in WASH: health, water, environment, agriculture, energy. This point is related to the managerial capacity since the good management is linked to and it includes the involvement of all stakeholders, from the local government staff to the national level. Where the skills are found not adequate, trainings should be organized to empower the staff.

The infrastructural capacity refers to the infrastructures that are in place and allocated for the scopes. This point is related with the financial possibilities that are available, because without proper funding the structures will not be enough in quantity or quality. Due to this, the research or allocation of funds is a key aspect of the sector and can give or not sustainability to the supply system.

6. What are the key factors to be considered when planning a new landfill in small and medium-sized towns? List at least four factors.

b) Explain how incineration differs from open burning

Siting a landfill is a difficult and important task. The goal of a landfill site selection process is to “establish a systematic approach to identify sites that possess the natural features to meet the regulatory requirements, are acceptable to the public, reduce environmental risks and are still financially viable” (American Planning Association, 2006). In the process of planning a new landfill in small and medium-sized towns there are some factors that need to be considered:

1. Soil type and geology of the selected area
2. Presence of groundwater underground
3. Distance to the town to be served from the location of the landfill
4. Available land that can be assigned
5. Dimension of the area necessary to serve the population of the town according to the estimated waste production, and considering the present data and the future
6. Location of rivers or other water sources, in order to avoid its pollution
7. Social aspects: the opinion of local authorities and the people of the selected area
8. Traffic impacts
9. Site accessibility

Looking at the siting process of selection where the above criteria are used, commonly the following steps are followed (Marinos et al., 1997):

- Definition of the needs of a geographical region
- Identification of candidate areas and candidate sites within these areas
- Comparison of candidate sites and identification of the preferred site

- Detailed investigation of the preferred site
- The licensing process starts, if the conclusion of the investigation is positive

Incineration, as opposed to open burning, is the combustion of waste material in an enclosed container with an air supply and ideally fitted with a chimney. The furnace enclosure provides a controlled environment for the combustion process in the incinerator system. Without the furnace enclosure the combustion process would be “open burning” (Niessen, 2002). The materials of the incinerator furnace enclosure traditionally are:

- Non-metals: refractories, as firebrick walls and roofs
- Metal: plate, tubes, pipe
- Refractory-covered metal: castable or firebrick refractory lining or coatings, 3 to 25 cm thick

The combustion process can be controlled to some extent so less pollution is produced and a chimney helps to reduce the impact by sending product gases upwards into the atmosphere.

The dimension and the design of the incinerators depend on the location where it will be installed: in structure like schools or hospital, while other lower-cost incinerators may be considered to be constructed in less concentrated contexts.

7. List and briefly describe the measures by which the success or otherwise of a public–private partnership providing water supply services can be assessed.

The choice of implementation of a public-private partnership (PPP) in the water supply services is usually taken with the purpose of increasing the efficiency and the quality of the service.

There are some criteria that are usually considered as aspects that assess how the PPP is performing, where some are more related to the financial part, others more on the performance:

1. Since the service should reach the greatest or the whole population, the cost of the water that a household needs should be affordable and not exceed the 5% of the its income
2. The cost of providing the water should be received by the private part from the users, recovering the cost that it met
3. The population should be able to access the service, in terms of distance from the water point and the extent of the coverage should be as high as possible
4. The quality of the water should be in line with the required national standards
5. The efficiency of the service should guarantee sufficient litres per capita and enough hours of water supplied per day

Other data that are important to assess are the “water treatment loss” and the “non-revenue water”, since they are indicators that measure the quality of the services and help to understand the financial sustainability (Mehta 2001).

Urio (2010) reports that according to the 2006 UNDP Human Development Report insists on “the impossibility of establishing a mechanical correlation or between the participation of a private partner and the success of a water-supply distribution system in terms of equity and sustainable development”. Urio continues stating that at the same time nothing proves that PPP are less able

to do so than traditional public procurement. Therefore, the only solution remains a case by case assessment and evaluation of feasibility, equity, economy, security and sustainability.

8. What are the possible interventions to manage the solid waste in an emergency situation?

Explain at least three actions that could be taken.

The emergency is a peculiar situation where actions have to be taken in the shortest possible time. This factor pushes the decision in a direction that may not be the one that someone will take during non-emergency time, or in a development context.

The first action to be taken in an emergency situation is the mobilization of the community, raising the awareness about the risks of a wrong management of solid waste and organize a first cleaning of the area.

Then secondly all the community should have the opportunity to access to containers where to collect and dispose the solid waste directly on-site.

After the collection the waste should be moved to the disposal site for burial and ensure the waste pit is covered with soil.

In the long term, the arrangement of a service that collects regularly the solid waste should be arranged.

During humanitarian crisis, the waste that can be produced can be classified as (Klumpp et al., 2015):

- Debris caused by the catastrophe that can have natural or man-made origin and it is usually called Disaster Waste
- Waste of humanitarian aid packaging (blankets, kitchen set, etc...)
- Waste produced from everyday refugee camp activities (paper, plastic, food, organic, excreta)

Waste management plays a fundamental role in the problem of sanitation and hygiene.

Solid waste can attract disease vectors if not properly managed (Townes et al., 2018). Sphere Handbook (2011) is indicating the following waste indicators:

- All household have access to garbage receptacles that are emptied twice per week at minimum.
These receptacles should be no more than 100 meters from a communal waste pit.
- All waste of those living in settlements is removed from the living environments at least twice a week.
- At least one 100-liter refuse receptacle is available per ten households, where domestic refuse is not burned.
- There is timely and controlled safe disposal of solid waste from the environment.

9. What are the most important questions you would need to address in a rapid assessment of an emergency?

In situations like an emergency the timing of response is extremely important, but the speed of the response should not leave behind its quality.

That is why procedures like the implementation of a rapid assessment should be used to understand well the situation and to give the best response in a short time. Giving an example, looking at the flood happened in Pakistan in 2011, the rapid assessment of the situation should have taken place within 48 hours from the disaster onset (House, 2012).

In order to respond promptly to emergencies, it is also important to identify the local programs and services that can be extended quickly, and those technical, managerial and logistic gaps that need to be filled to support these efforts (WHO, 1999).

The questions that will be asked in the rapid assessment should be meaningful and relevant for the achievement of the scope of the work.

Here below it is presented a list of questions that could appear in a rapid assessment in WASH:

1. Which are the current practices on the most important hygiene behaviors, for instance hand washing after defecating?
2. Which method is in place for the disposal of children feces?
3. How is the community disposing of their solid waste?
4. Which part of the population is the most affected?
5. Which are the common practices of the affected population related to health?
6. Which are the practices regarding the storage and handling of water and food?
7. Does the people have water containers and other tool for hygienic behavior and proper water and food management?

Looking at the purpose of the rapid assessment, this list of question will help for the identification of the gaps and for the understanding of the current situation.

The first question helps to understand which the current situation in a delicate aspect as the hygiene is: action like hand washing may be affected by the new situation and its absence can seriously increase the risk of contamination.

The second question is related with the previous one because the children feces are one of the major sources of contamination. The third question is also focusing the attention on the sources of contamination and exploring if the solid waste is a source of infection.

The fourth and the fifth question are connected because they have both the scope of understanding how the situation is changed from the time before the emergency occurred.

The sixth one is tackling the special topic of storage and handling: too many times the risk of contamination deriving from these practices is underestimated, instead many times these are source of infections.

The last question falls within the topic of storage with the additional focus on the tools that are necessary to manage properly the food and water.

10. Filtration and disinfection are important water treatment processes. Briefly describe each of these processes and explain their role in making water safe to drink

b. List the five factors that make a water source ideal to use.

Filtration is the process where solids are separated from the liquids. In water treatment, the solids of the water that remain in the sedimentation tank are removed thanks to beds of sand and gravel where the water flows. Considering amount of water per area, a common rate of water passing through rapid gravity filters is from 4m^3 to 8m^3 per m^2 of filter surface per hour.

When the filters are full of trapped solids, they are backwashed. The process of backwashing is the one where to dislodge the trapped solids clean, water and air are pumped backwards reaching the filter, and the water collecting the filth is pumped in the sewerage system, if there is one. In case this last option is not applicable, it may be emitted into the source river after a settlement stage to remove solids in a sedimentation tank.

After the process of sedimentation, the water is disinfected to eradicate any balance of pathogenic micro-organisms. The disinfection is a crucial barrier against human exposure to disease-causing pathogenic microorganisms, like viruses, bacteria and protozoan parasites. Bitton (2014) states that disinfection of drinking water is probably the most significant preventive measure of human history. The most commonly used chemical disinfectant is chlorine, frequently in the form of a liquid, such as sodium hypochlorite, NaOCl , or a gas. It does not require a great investment of money and simple to use. When this product is combined to water it reacts with the present pollutants, including micro-organisms, over a given period of time, called the “contact time”. The amount of chlorine left after this is named residual chlorine. This does not disappear before

entering in the distribution mains or flowing, protecting the water from any micro-organisms that might enter it, until it reaches the consumers.

World Health Organization Guidelines (WHO, 2017) suggest a maximum residual chlorine of 5 mg/l of water. The residual chlorine level should not go beyond 0.5 mg/l of water after 30 minutes' contact time. The explained one is not the only method of disinfection, there are others like using the gas ozone, or ultraviolet radiation but these do not protect it from microbial contamination after it has left the water treatment plant. After disinfection, the treated water can reach the distribution system.

Water sources are important for the provision of drinking water that is sufficient in quantity, safe, accessible, acceptable, affordable and reliable (Dinka M.A. 2018). As a criterion, an ideal water source is providing adequate, clean and safe drinking water available for various users in enough quantity. In case of groundwater the consumption rate should not go beyond the replenishment. Moreover, water has to be accessible for all, including children, elders and disabled ones. The water is considered available when is enough in terms of quantity and reliability of service provisions. Adequacy refers to both the quantity and quality of water. Reliability refers to continuity of the service provision for the current and future generation, which is covered under the principle of sustainability, system robustness and resilience. Accessibility to water refers to the accessibility to a reliable supply of water on a continuous basis close to the point of demand: within everyone's reach: home, school, work, public places. It is related to the distance of water source from the point of demand (30 minutes walking or 200 m). Acceptability states the esthetic qualities of water: the satisfactory appearance, odor and taste of water. It is a parameter that can personal view about it and largely depends critically on the perceptions of the local ecology, culture,

education and experience and hence, there is no set clear and objective global acceptability standards.

BIBLIOGRAPHY

- American Planning Association, 2006. *Planning and Urban Design Standards*. Hoboken: John Wiley and Sons, Inc.
- Bau J., Ferreira J.P.L., Henriques J.D., Raposo J.O., 2002. *Integrated approaches to water pollution problems*. Essex: Elseviers Science Publisher Ltd.
- Bitton G., 2014. *Microbiology of Drinking Water: Production and Distribution*. Hoboken: John Wiley & Sons.
- Cramb R.A. & Purcell T., 2001. *How to Monitor and Evaluate Impacts of Participatory Research Projects: A Case Study of the Forages for Smallholders Project*. Cali: International Centre for Tropical Agriculture.
- Dinka M.O., 2018. *Safe Drinking Water: Concepts, Benefits, Principles and Standards*. In *Water Challenges of an Urbanized World*. Doi: <http://dx.doi.org/10.5772/intechopen.71352>
- Griffiths J., Maguire J. H., Heggenhougen K., Quah S.R., 2010. *Public Health and Infectious Diseases*. Oxford: Elsevier.
- House S., 2012. *Effectiveness Review: Pakistan Flood Response 2011/12*. Available on: <https://oxfamlibrary.openrepository.com/bitstream/handle/10546/247836/er-pakistan-flood-effectiveness-review-091012-en.pdf;jsessionid=63FD346BB0FDDD98BCD6D77A452ADEFA?sequence=2>
- Jorgensen S. E., 2002. *A Systems Approach to the Environmental Analysis of Pollution Minimization*. Boca Raton: Lewis Publishers.
- Klumpp M., de Leeuw S., Regattieri A., de Souza R., 2015. *Humanitarian Logistics and Sustainability*. London: Springer.
- Koottatep T., Cookey P.E. & Polprasert C., 2019. *Regenerative Sanitation: A New Paradigm For Sanitation 4.0*. London: IWA Publishing.

- Laws S., Harper C., Jones N., Marcus R., 2013. *Research for development – second edition. A practical guide*. London: SAGE.
- Marinos P.G., Koukis G.C., Tsiambaos G.C., Stournaras G.C., 1997. *Engineering Geology and Environment*. Rotterdam: A.A. Balkema Publishers.
- Mehta A., 2011. *Toolkit for Public–Private Partnerships in Urban Water Supply for the State of Maharashtra State*. Mandaluyong City: Asian Development Bank.
- Neumayer E., 2003. *Weak versus Strong Sustainability: Exploring the Limits of Two Opposite Paradigms*. London: Edward Elgar Publishing.
- Niessen W.R., 2002. *Combustion and Incineration Process*. New York: Marcel Dekker Inc.
- Rauyajin O., Pasandhanatorn V., Rauyajin V., Na-nakorn S., Ngarmyithayapong J. & Varothai C., 1994. Mothers' Hygiene Behaviours and their determinants in Suphanburi, Thailand. *Journal of diarrhoeal disease*. 12 (1): 25-34.
- Sphere Project, 2001. *Sphere Handbook: Humanitarian Charter and Minimum Standards in Disaster Response*. available at: <https://www.refworld.org/docid/4ed8ae592.html>
- Townes D.A., Gerber M., Anderson M., 2018. *Health in Humanitarian Emergencies*. Cambridge: Cambridge University Press.
- UNDP, 2006. *Human Development Report*. New York: Palgrave Macmillan.
- UNESCO, 2010. *Desalination and Water Resources: Environmental and Health Aspects of Water Treatment and Supply*. United Kingdom: Eolss Publishers.
- UNICEF/WHO, 2009. *Diarrhoea: Why children are still dying and what can be done*. Geneva: WHO publications.
- Urio P., 2010. *Public-Private Partnerships: Success and Failure Factors for In-Transition Countries*. Plymouth: University Press of America.
- WHO, 1999. *Rapid Health Assessment Protocols for Emergencies*. Geneva: WHO Library.

WHO, 2017. *Guidelines for Drinking-Water Quality: Fourth Edition Incorporating the First Addendum*. Geneva: World Health Organization

World Commission on Environment and Development, 1987. *Brundtland Report*. New York: Oxford University Press.