Workshop training SANS/ISO:30500 Supporting Material: Booklet for participants

31 January 2020

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ACKNOWLEDGEMENT

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SECTION A

1. FORMALITIES

1) Introduction to the group and each of the participants
   - Name & Affiliation/Department
   - Background
   - Expectations from completion of course/workshop
2) Safety Procedures
3) Housekeeping: Cell phones, attendance, operational disturbances
   - Participation: it is your course – you need to benefit, ask questions!
   - Break times
   - Attendance Register
4) Introduction to the programme and the speakers

Note: This document is a supporting tool to provide all participants with background knowledge and information in addition to all presentations and discussions during the workshop.

2. PURPOSE & LEARNING OUTCOMES

2.1. Purpose

Towards addressing the gap and achieving basic sanitation facilities for all its citizens, the South African Government has offered housing subsidies towards building improved sanitation facilities. Currently, the most commonly used systems are the Ventilated Improved Pit (VIP) latrines toilets or equivalent. However, it is becoming more and more evident that the VIP systems are not sustainable in terms of sludge management and often they fill up much faster than the planned design time. The regular emptying process pose health-related risks that need to be carefully managed and requires a significant investment from the local municipalities. After the emptying and collection of the sludge, the most challenging aspect remains the safe treatment and disposal of the faecal sludge. The VIP systems are not safe for the most vulnerable such as women and children (especially at night) and there are increasing number of children falling into the pits and losing their lives.

With the growing population and availability of the next generation of non-sewered sanitation technologies, there is a need to enhance the development of standards, testing, and validation of these technologies. The adaptation of newer technologies that provide an improvement over the basic sanitation would lie with the enhancement of the local capacities and strengthening the skills and training on the next generation technologies. Some of the tools that South Africa has adopted to measure the viability of a technology are the standards such as **SANS/ISO 30500** Non-sewered sanitation systems: Prefabricated integrated treatment units – General safety and performance requirements for design and testing; and **ISO 24521**: Activities relating to drinking water and wastewater services − Guidelines for the management of basic onsite domestic wastewater services.

The SANS/ISO 30500 and ISO 24521 standards are complementary, and if correctly implemented, have the potential to improve health, reduce the environmental impact of wastewater treatment, and offer affordable options for users and communities. SANS/ISO 30500 encourages the development of new technologies and solutions that address challenges behind the lack of sanitation, such as poverty, infrastructure and resources, while ISO 24521 focuses on optimizing existing wastewater services. The adoption and promotion of these two standards will assist with reducing cost, minimizing waste and increasing productivity at different levels of the sanitation value chain.

The purpose of this workshop is to: i) introduce the content of SANS/ISO 30500 and ISO 24521 and the process of certification and compliance, ii) identify how these standards fit into the existing Regulatory framework on Water and Sanitation in South Africa, iii) introduce the latest developments in the field in SA and worldwide, and iv) demonstrate how it all fits into the SDG6 and plan the way forward.

It is expected that the knowledge acquired through this workshop will assist various stakeholders in the sanitation value-chain, including policy makers, regulators, manufacturers, suppliers and end-users in creating consensus around sanitation products and solutions and an understanding of how they fit into solving current sanitation challenges.

2.2. Learning outcomes

The learning outcomes from this workshop are:

1) Understanding the urgent importance for fast provision of sustainable non-sewered Sanitation solutions in place.
2) Understanding the role of the South African Water & Sanitation regulations in this process as a driver.
3) Understanding of the importance of different roles played by different stakeholders in the water & sanitation sector.

4) Understanding the position and the progress of SA towards achievement of the Sustainable Sanitation Goal (SDG) 6.
5) Introduction to the scope of SANS/ISO30500, the certification process and compliance.
6) Understanding of the roles of each stakeholder and their responsibilities in the adoption of ISO 30500
   - Regulators and policy makers at national level to understand the requirements and compliance of the standard which will form the national regulatory framework in terms of non-sewered sanitation systems (NSSS) and its enforcement − it will open a market space for local businesses and manufacturers
   - Regulators and policy makers at regional level to understand the requirements and compliance of the standard which will support them in the implementation of the national regulatory framework in terms of non-sewered sanitation systems (NSSS)
   - Manufacturers to improve their understanding in creating a NSSS product that meets the national international standards which will open a market space for their technologies.

3. BACKGROUND

According to the WHO and UNICEF baseline study of 2017, only 39 percent of the global population had access to safely managed sanitation services in 2015. Lack of safely managed sanitation services would lead to burden of illness, school absenteeism, lack of privacy and safety, and economic growth in the poorest countries. As per the General Household Survey of 2017, lack of sanitation has decreased to 3.1 percent in South Africa with 82.2 percent having access to improved sanitation. Many of these facilities are shared between the households and have had problems in the front-end such as poor lighting, inadequate hygiene, and physical safety, lack of hand-wash facilities and long wait time. Such problems arise due to lack of guidelines for the safety, functionality, usability, reliability, manageability and maintainability a non-sewered sanitation facility.

The South African Sanitation Technology Evaluation Programme (SASTEP) is an initiative funded by the Department of Science and Technology (DST) and the Bill & Melinda Gates Foundation (BMGF), with the Water Research Commission (WRC) providing the programme, implementation and support services. SASTEP is aligned to the Department of Trade & Industry's (DTI) Industrial Policy Action Plan (IPAP) strategy to address commercialisation, localisation and manufacturing by bringing on board capable commercial partners to provide an industrial support base for the local and regional markets. The intent of the programme is to support and accelerate the application and uptake of the new sanitation technologies through demonstration, testing and science-based improvements towards localisation and industrialisation.

Central to the SASTEP initiatives are the two new standards – ISO/SANS 30500 and ISO 24521, which are key strategic tools for enabling and regulating the new sanitation technology platforms. Since South Africa is one of the leading countries in the world who have adopted ISO 30500, American National Standards Institute (ANSI) has funded the development of training material and guidelines that will assist create greater awareness of these standards with raising awareness within different groups of stakeholders in the water and sanitation sector in South Africa.

SECTION B

1. HISTORY OF SOUTH AFRICA'S SANITATION

Pre-1994, the National Government in South Africa had no role in providing public water or sanitation services. Wealthy communities had waterborne sewage services with greater quantities of water assigned while poorer and black communities had inadequate water supply and sanitation services making use of the bucket system. The urban black communities together with local black authorities undertook waterborne sewage systems but rural areas had very low level of service provision with a high impact on the health of the population and related environmental and economic costs. **In 1994**, the first post-Apartheid government assigned the **Department of Water Affairs and Forestry** to ensure that all South Africans have **equitable access to water supply and sanitation.**

The history is summarised in Figure 1 and Table 1 below.

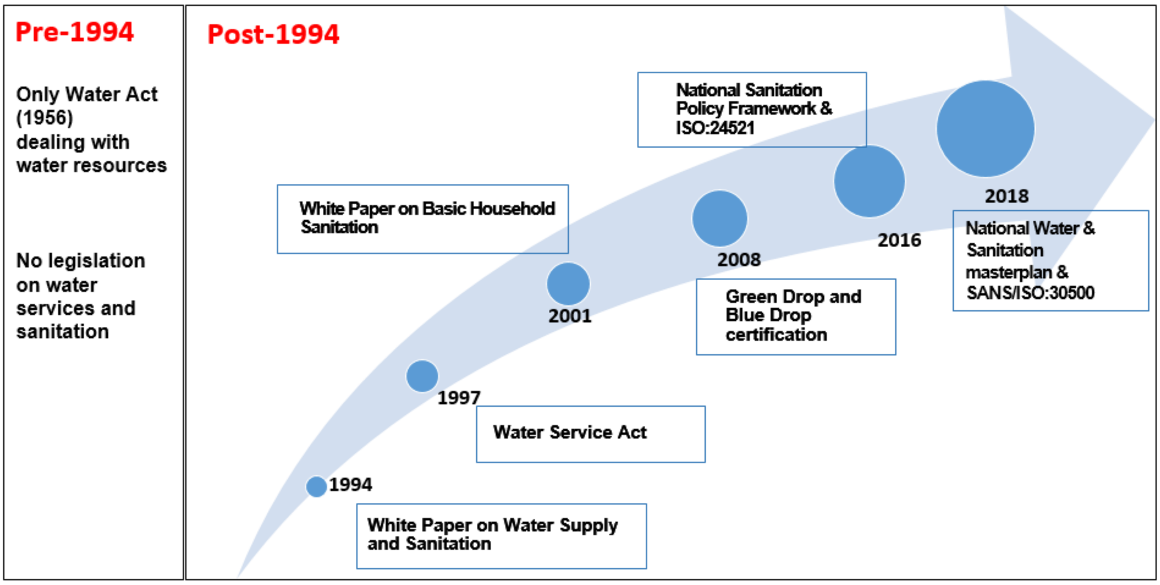


Figure 1: History of important legislation on Sanitation in South Africa

Table 1. Chronological list of important acts and regulations in the WASH sector in South Africa

1994	New South Africa White Paper on Water Supply and Sanitation Policy
1996	Constitution of the Republic of South Africa Section 24: “Everyone has a right to an environment that is not harmful to their health or well-being”
1996	National Sanitation Policy
1997	Water Services Act 108: Main objectives – providing for the “right of access to basic water supply and sanitation”. It sets the institutional arrangements for water services provision and the responsibilities for each of the institutions.
1998	National Water Act No. 36 – provide for fundamental reform of the law relating to water resources; guidelines on water management strategies, protection of water resources, water use and to provide for matters connected therewith. Section 3(1) provides for a right of access to basic water supply and basic sanitation to everyone.
2000	Municipal Systems Act 32 Free Basic Services (FBS) policy: Free basic services for the poor including water supply, sanitation, refuse removal and electricity.
2001	White Paper on Basic Household Sanitation Free Basic Water (FBW) Implementation Strategy Compulsory National Standards (water conservation) Norms and Standards (water tariffs)
2002	Sanitation Technology Options
2003	Strategic Framework for Water Services: *Water is Life Sanitation is dignity.* A Protocol to Manage the Potential of Groundwater Contamination from On-Site Sanitation
2004	National Water Resource Strategy
2005	National Sanitation Strategy National Health and Hygiene education strategy Municipal Public Private Partnership Regulations
2007	Guidelines for the Costing of Household Sanitation Projects Strategy for sanitation services for informal settlements
2008	National Water Services Regulation Strategy
2009	Free Basic Sanitation (FBSan) Implementation Strategy: “providing all citizens with free basic sanitation by 2014”
2011	Revision of the White Paper on Basic Household Sanitation
2013	National Development Plan (NDP) National Water Resource Strategy (update from 2004)
2016	National Sanitation Policy Frame work: considers sanitation policy positions across the entire sanitation value.
2017	IPAP: Promotes development of off-grid sanitation technologies to lower water requirements for sanitation
2018	National Water & Sanitation Masterplan: The purpose of the National Water and Sanitation Master Plan (NW&SMP) is to provide an overall perspective of the situation in the water and sanitation sector and a consolidated plan of actions, to improve the current situation to meet the desired future state of the sector, defined by Government’s vision, goals and targets until 2030 (NDP and SDGs).
2018	SANS/ISO 30500: Specifies general safety and performance requirements for design and testing as well as sustainability considerations for non-sewered sanitation systems (NSSS)

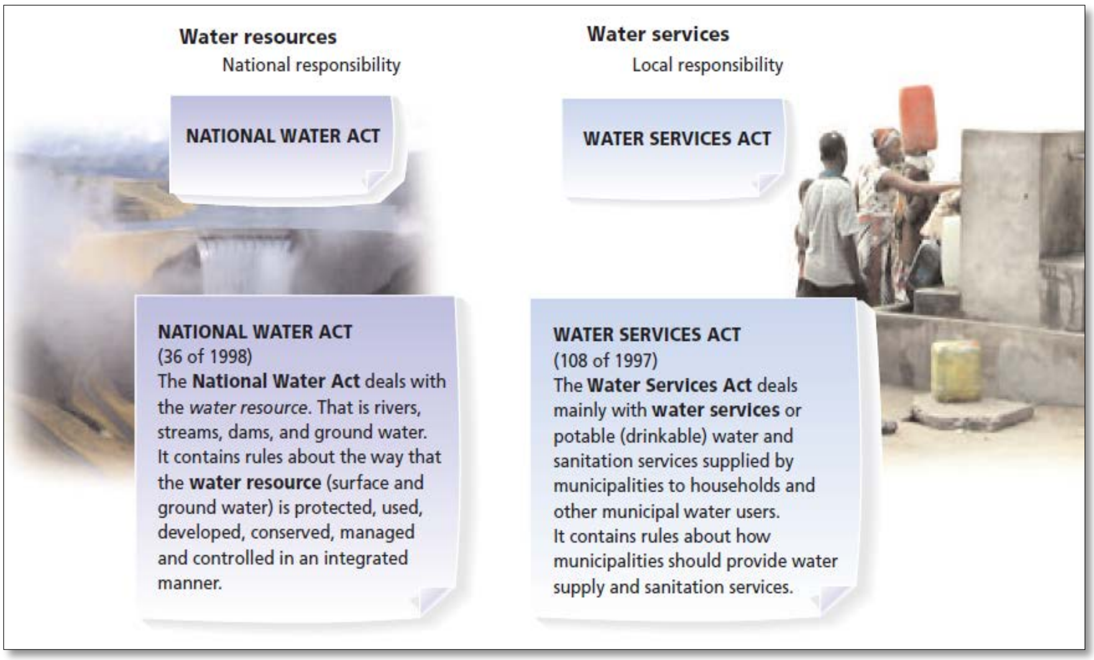


Figure 2: Illustration of Water service Act & National Water Act (Source: Department of Water and Sanitation)

2. INSTITUTIONAL ARRANGEMENT IN WATER AND SANITATION

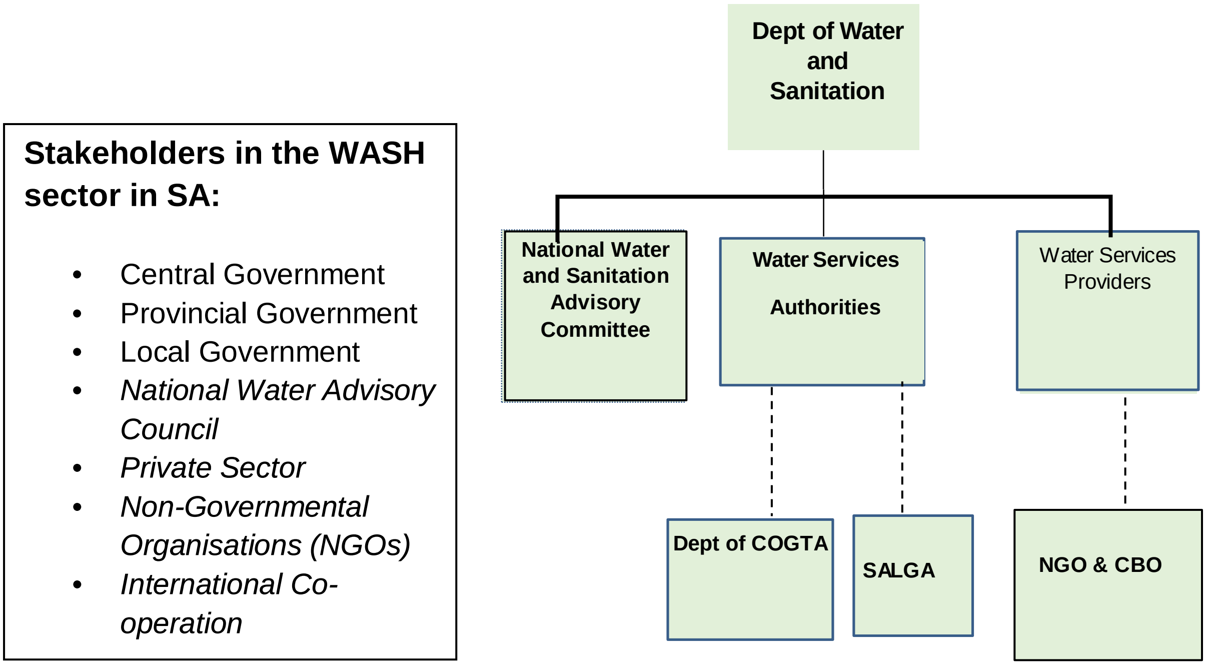


Figure 3: Institutional arrangements in SA (water and sanitation)

2.1. Institutional Arrangements – National Level

(i) The Department of Water and Sanitation (DWS): The water and sanitation sector leader in South Africa. The custodian of SA's water resources, the National Water Act and the Water Services Act.

(ii) The Department of Human Settlements (DHS): The custodian of the national Housing Act and the National Housing Programmes contained in the National Housing Code.

(iii) The Department of Cooperative Governance and Traditional Affairs (CoGTA): The custodian of the Municipal Systems Act and the Municipal Structures. Coordinate and oversee the implementation of the FBS policy.

(iv) The Department of Health (DOH): Coordinate the planning and interventions for health and hygiene behaviour of communities. Create a demand for sanitation services through health and hygiene awareness and education programmes.

(v) National Treasury: In terms of sanitation relates to the funding of the different departments and spheres of government for rollout of programmes.

2.2. Institutional Arrangement – Water Service Institutions

(i) Water Services Authority (WSA)

These are Municipalities that ensure access to water services in the Act. They can act as Water Service Providers. They may form a joint venture with another water services institution. WSAs must prepare a WSDP to ensure effective, efficient, affordable and sustainable access to water services. WSDP is a link between water services provision and water resources management.

(ii) Water Services Provider (WSP)

They provide water services in accordance with the Constitution, the Water Services Act and by-laws of the water services authority. WSAs may perform the functions of the Water Service Provider.

(iii) Water Boards

They are government-owned and play a key role in SA's water sector. They provide technical assistance to municipalities, provide water services to WSAs and report to the Department of Water Affairs. There are 15 water boards in SA. The three largest are: Rand Water, Umgeni Water and Overberg Water.

(iv) Water Research Commission (WRC)

Notes

3. SUSTAINABLE DEVELOPMENT GOAL (SDG) 6

SDG6 seeks to ensure availability and sustainable management of water and sanitation for all. Access to safe water and sanitation and sound management of freshwater ecosystems are essential to human health and to environmental sustainability and economic prosperity (UN, 2019).

In 2015, leaders representing 193 countries adopted the 2030 Agenda for Sustainable Development as a framework to guide global development for the subsequent fifteen years. Many say the SDGs constitute the world's most ambitious set of development goals yet. South Africa was one of the early supporters of the 2030 Agenda for Sustainable Development. This commitment is intertwined with its contribution to setting Africa's long-term development goals.

South African played a leading role in the African Union's (AU) conference held in 2013 with the object to define the eight long-term development ideals for the continent. The ideals were later converted to seven aspirations for the AU's Agenda 2063 where SA was elected to be part of the High Level committee. The committee responsibilities included developing the 'Common African Position' on the post 2015 development Agenda. During the UN General Assembly, SA was elected as a rotating chair of the group for 2015, therefore retaining responsibility of leading the group during international negotiations.

The significant conjunction between SA's National Development Plan (NDP 2030) and the SDG is always emphasized in South Africa. Unpublished analysis conducted by the Department of Planning, Monitoring and Evaluation (DPME) states that 74% of the SDG targets are directly addressed by the NDP and 19% is addressed by the sectoral programmes (DPME, 2019). It is also stated that the SDGs have a great potential to fast-track the realisation of the NDP's vision, through fostering policy coherence and avoiding duplication and inefficiencies. (**Source**: http://www.statssa.gov.za)

SDG6 has eight targets, six of them are to be achieved by 2030, one by 2020 and one has no target date. Each of the targets also has one or two indicators that will be used to measure progress. In total there are 11 indicators for SDG6 (United Nations, 2018). The first three targets relate to drinking water supply and sanitation (United Nations, 2018).

3.1. SDG6 Goals

Target 6.1: Safe and affordable drinking water for all

Goal: By 2030, achieve universal and equitable access to safe and affordable drinking water for all.

Indicators – Proportion of population using safely managed drinking water services.

Target 6.2: End Open defecation and provide access to sanitation and hygiene

Goal: By 2030, achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations.

Indicator – Proportion of population using safely managed sanitation services, including a hand-washing facility with soap and water.

Target 6.3: Improve water, wastewater treatment and safe reuse

Goal: By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally.

Indicator: Proportion of wastewater safely treated

Sources: (United Nations, 2018). "Goal 6 Targets". United Nations Development Programme. *(*Retrieved 17.01.2020*)*

3.2. Progress of SDG6 as of 2019

Billions of people still lack safe water, sanitation and handwashing facilities regardless of the progress that has been made. Data suggests that achieving universal access to even basic sanitation service by 2030 would require doubling the current annual rate of progress. Most countries are unlikely to reach full implementation of integrated water resources management by 2030 (United Nations, 2019).

According to the Sustainable Development Goals Report 2019 (https://unstats.un.org), in 2017 the population lacking basic sanitation services decreased by 26% (from 2.7 billion to 2 billion). The coverage of safely managed sanitation services in rural areas increased from 22% to 43%. Population using safely managed sanitation services increased from 28 to 45%. Fifty-one countries had more than 99% basic sanitation coverage, with 1 in 4 of them close to achieve 'nearly universal' coverage by 2030. Open defecation reduced by half but 9% still practice open defecation (673 million). About 23 countries reduced open defecation rates by more than 1%; 1 in 3 'high burden' countries with open defecation rates > 5% are on track to achieve 'near elimination' (<1%) by 2030.

Source: https://unstats.un.org

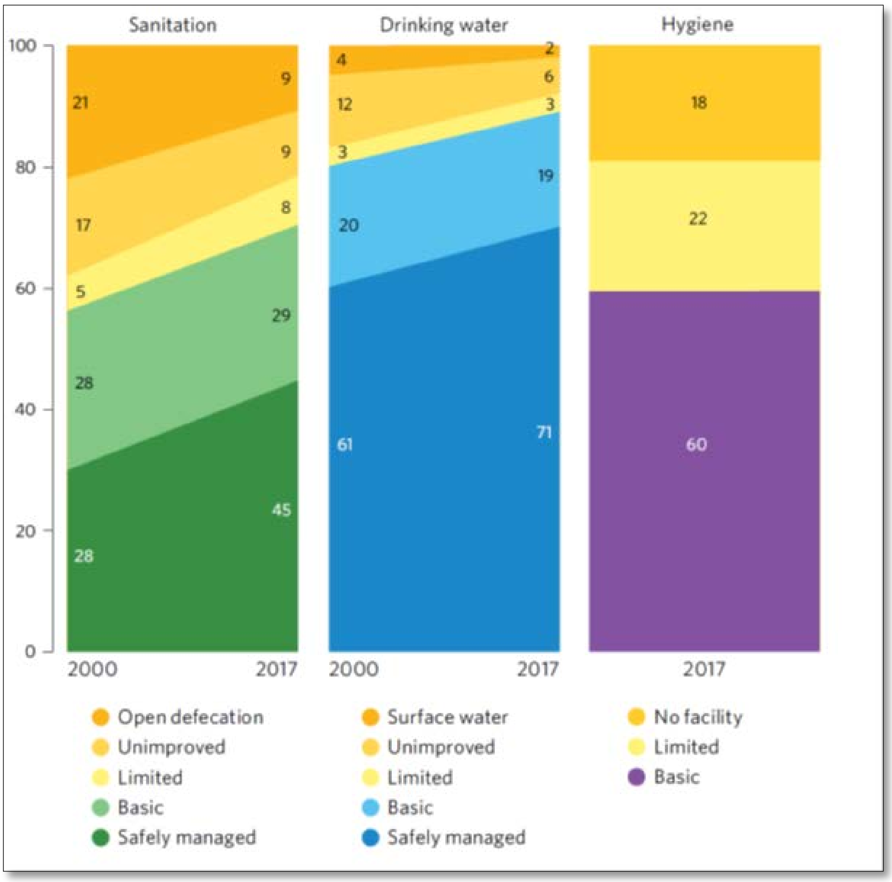


Figure 4: Global coverage of sanitation, drinking water and hygiene services (%) between 2000 and 2017 (Source: https://unstats.un.org)

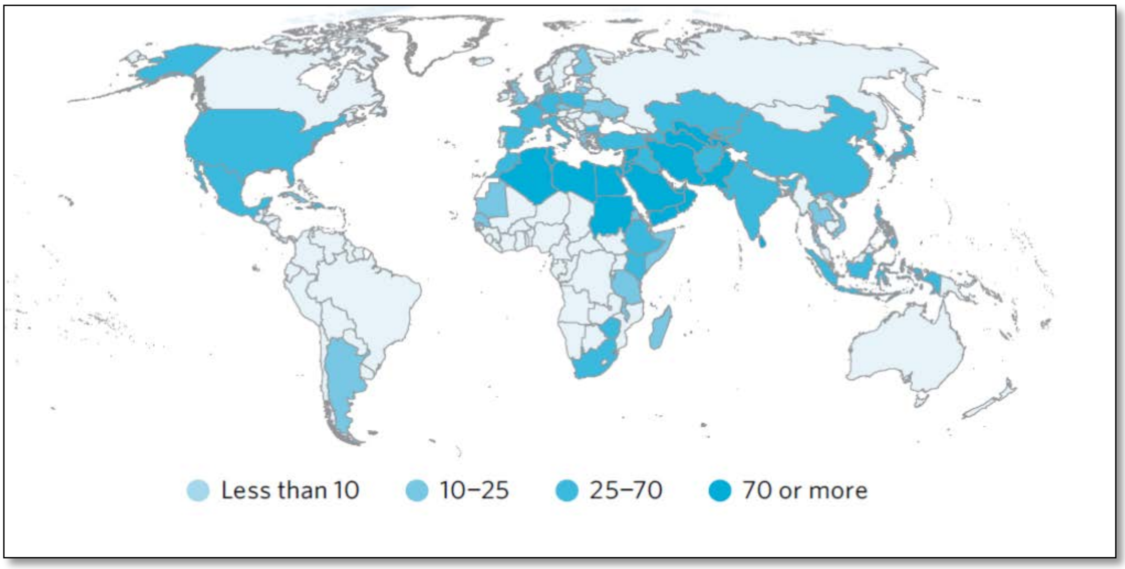
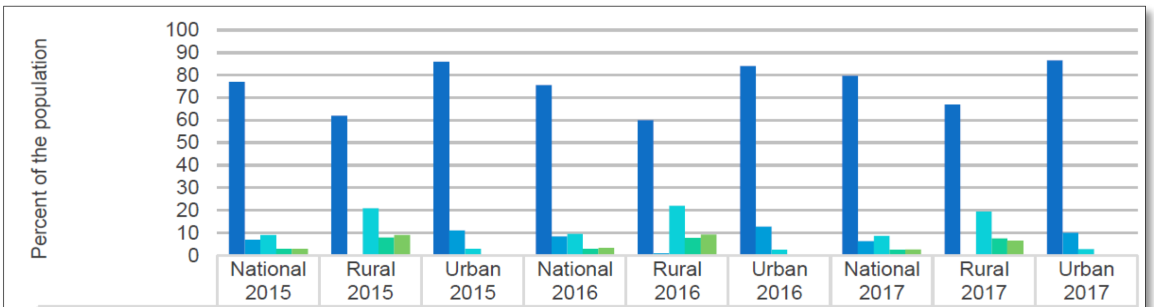


Figure 5: Level of water stress: freshwater withdrawal as a proportion of total renewable freshwater resources, latest available year, 2000-2015 (percentage) (Source: https://unstats.un.org)

3.3. South Africa's Current status on SDG6

3.3.1. Access to safe drinking water

South Africa has substantial water supply infrastructure coverage. The progress in the provision of safely managed drinking-water services between 2015 and 2017 is illustrated in Figure 6. Nationally, 95% of the population had access to water supply infrastructure in 2017. However, the figures of safely managed water in relation to water supply infrastructure coverage were lower. The percentage of the national population that had safely managed water services increased from 77% to 80% between 2015 and 2017. In rural areas there was a 5% increase in safely managed water services, while for urban areas there was just 1% increase. (GHS 2015 2017, *StatsSA*)

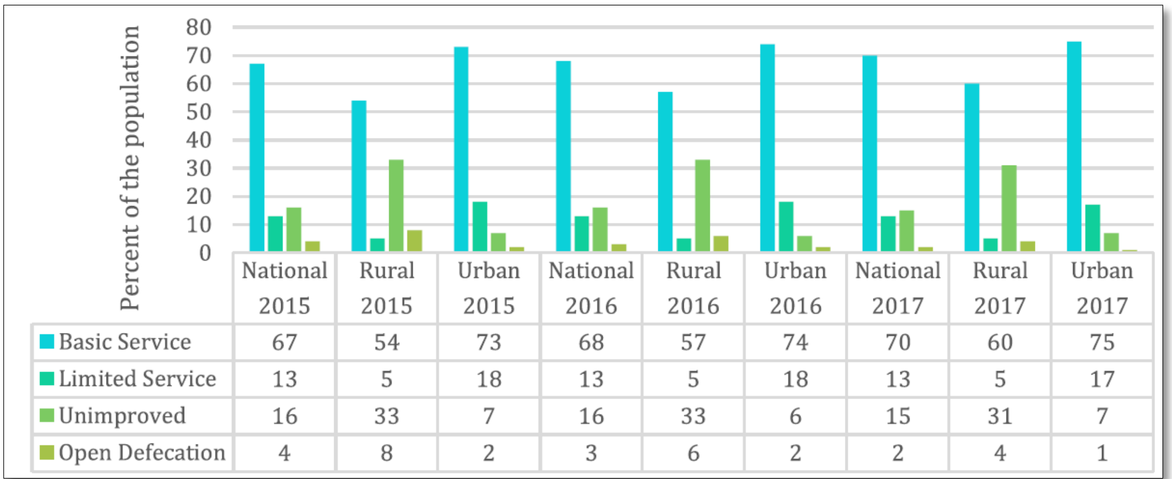


	National 2015	Rural 2015	Urban 2015	National 2016	Rural 2016	Urban 2016	National 2017	Rural 2017	Urban 2017
Safely managed	77	62	86	75	60	84	80	67	87
Basic service	7	0	11	9	1	13	6	0	10
Limited service	9	21	3	10	22	3	9	19	3
Unimproved	3	8	0	3	8	0	3	8	0
No service	3	9	0	3	9	0	3	7	0

Figure 6: Access to safe drinking water services (*Source: GHS 2015 2017,* StatsSA)

3.3.2 Access to basic sanitation services

Nationwide, the access to improved sanitation facilities increased from 80% in 2015 to 83% in 2017 – 70% had access to basic service, while 13% had access to limited service (***Figure 7*** and ***Figure 8***). In 2017 there were still 17% without access to improved sanitation, 2% of them practicing open defecation. The open defecation in urban areas is reported to be at much lower rate – 1%, compared to rural areas where it is reported as 4%. The difference between urban and rural areas demonstrates that urban areas have better access to sanitation services than rural areas. This could be due to better-developed infrastructure and the prevalence of shared sanitation facilities and backyard dwellers in urban areas (GHS 2015 2017, *StatsSA*).



	National 2015	Rural 2015	Urban 2015	National 2016	Rural 2016	Urban 2016	National 2017	Rural 2017	Urban 2017
Basic Service	67	54	73	68	57	74	70	60	75
Limited Service	13	5	18	13	5	18	13	5	17
Unimproved	16	33	7	16	33	6	15	31	7
Open Defecation	4	8	2	3	6	2	2	4	1

Figure 7: Access to basic sanitation services (*Source: GHS 2015 2017,* StatsSA)

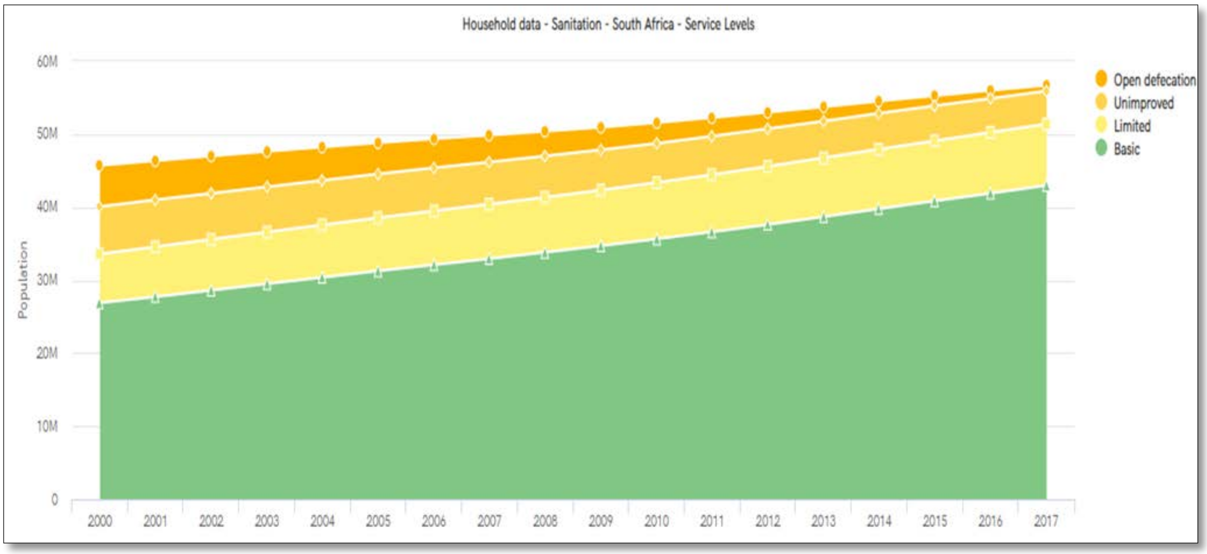


Figure 8: Sanitation Household data in South Africa indicating service levels (Source: *https://washdata.org)*

3.3.3 Access to hygiene services

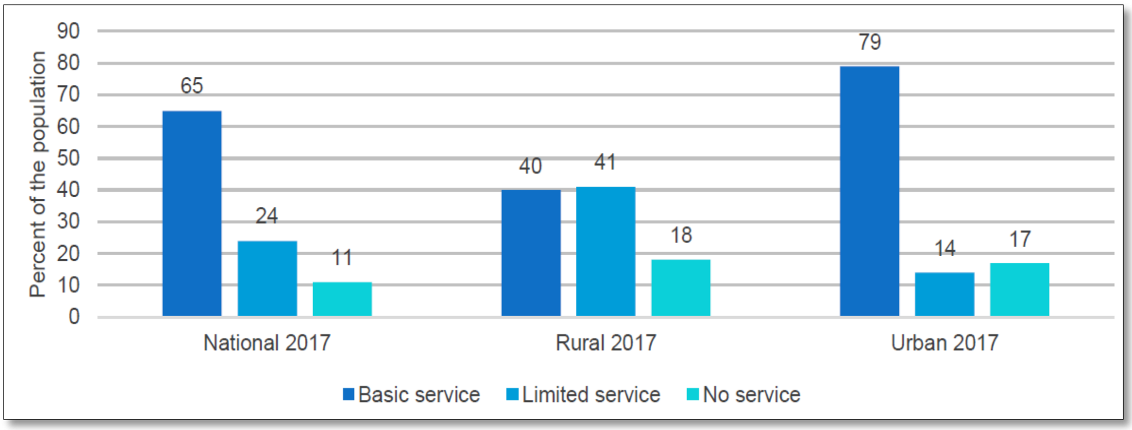


Figure 9: Access to hygiene services (*Source: GHS 2015 2017,* StatsSA)

Figure 9 illustrates that nationally, 65% of the population had access to basic hand-washing facilities on the premises with soap and water in 2017. The inequality between urban and rural areas in terms of provision of basic services is a continuous struggle. This is evidenced by the drastic difference in access to basic hygiene services (i.e. the access to hand washing facilities on the premises and access to soap and water) – 79% in urban areas opposed to only 40% in rural areas.

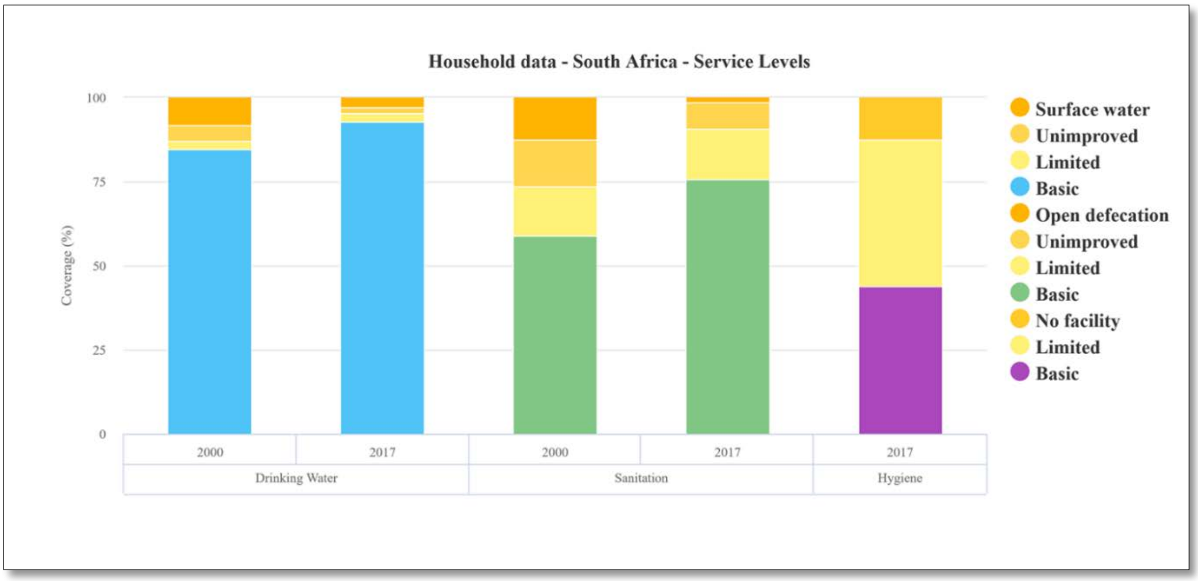


Figure 10: Sanitation Household data in South Africa indicating service levels (Source*:* https://washdata.org)

3.4. SA's policy position (As Indicated in the National Sanitation Framework (2016)

South Africa will pursue achievement of the SDGs, focusing sanitation services provision on ensuring sustainability. The sanitation SDGs are supported, including:

- Achieving access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations
- Improving water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally
- Substantially increasing water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity
- expanding international cooperation and capacity-building support to developing countries in water- and sanitation-related activities and programmes, including water harvesting, desalination, water efficiency, wastewater treatment, recycling and reuse technologies
- Supporting and strengthening the participation of local communities in improving water and sanitation management

Notes

SECTION C

1. HISTORY OF STANDARDS

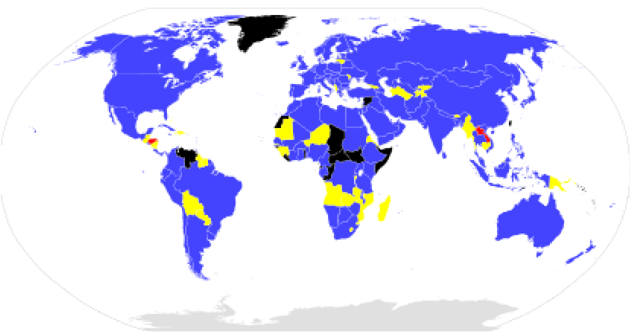
The first set of standards was designed for the Military and Defence force and originated in 1944 during World War II which later developed into the Allied Quality Assurance Purchasing Specifications (AQAPs), launched in 1968.

In 1974, the British Standards Institution (BSI) published the first Quality Standard. This developed into BS 5750 by 1979 and at that stage South Africa was the ONLY other country in the world to adopt and create this as a National Standard known as SABS 0157. This was withdrawn and replaced with SANS 9001 (adapted from ISO 9001).

Between 1987 and 1996, various ISO standards for 2nd party and 3rd party auditing were released. The Environmental standard ISO 14001 was published as well as various guide documents such as ISO/IEC Guide 62 and 66 published in 1996 and 1999 respectively to cover the requirements for Bodies operating Assessments and Certification of QMS and EMS.

2. ISO STANDARDS

ISO standards present an approach that has been agreed on by international experts. The standards themselves are a collection of best practices, which promote product compatibility, identify safety issues and share solutions and know-how. ISO standards are technical documents representing an international consensus of experts & countries on design, performance level and operation.



- The International Organization for Standardization (ISO) – founded in 1947
- The world's largest developer of voluntary International Standards (67 original technical committees)
- Unified goal to ensure products and services that are safe, reliable, and of good quality
- Published 22803 International Standards covering almost all aspects of technology

https://www.iso.org

3. PURPOSE OF ISO STANDARDS

ISO standards exist to assist industries to adopt practices that help to straighten out and standardize their internal procedures. At any scale of industrial business, understanding the advantages of standards and the concept of quality management Plan (QMP) can lead to a good number of business advantages, reduction of waste, improved efficiency and lower cost of production. ISO standards help in speaking the same language worldwide. They facilitate dissemination of knowledge and good practices. ISO Standards facilitate innovation and limit duplication of efforts as they define the baseline.

4. CERTIFICATION

Certification to an ISO standard is a mark of quality and robust procedures regardless of a facility's industry or country of origin. ISO guidelines and requirements force a company to initiate, document and meet several complicated organizational standards. Obtaining an ISO certification may help organizations accomplish output goals by forcing the introduction of independently verified operations, quality and management plans. ISO certified organizations also enjoy an increased sense of legitimacy. Certification means that a qualified independent party has reviewed their programmes and certified compliance. In some fields, certification may not be necessary, but in many professional industries, ISO certification is the norm for all customers and competitors.

Notes

SECTION D

1. SANS/ISO 30500 − Introduction

ISO 30500 is a voluntary, international product standard, published in October 2018 for non-sewered sanitation systems (NSSS), that provides general safety and performance requirements for the product design & performance testing as well as sustainability considerations of prefabricated integrated treatment units that are not attached to a network sewer or drainage system. This standard addresses basic sanitation needs and promotes economic, social, and environmental sustainability through strategies that may include minimizing resource consumption (e.g. water, energy) and converting human waste to safe output. The SANS/ISO 30500 standard is applicable to the development of sanitation systems that are not connected to water and electricity networks; it can also be applied to systems that can utilize water mains and/or electricity. It also defines the basic treatable input as primarily human excreta and gives options for extending the range of input substances. Requirements for the quality of the outputs from the sanitation system are given for solid and liquid discharges, odour, air, and noise emissions. SANS/ISO 30500 carries the criteria for the safety, functionality, usability, reliability, and maintainability of the system, as well as its compatibility with environmental protection goals. SANS/ISO 30500 also focuses on cutting the sanitation chain value chain at the containment stage therefore eliminating the emptying and transportation stages and with treatment performed onsite, shown in Figure 11: Demonstration of the role of SANS/ISO 30500 (ISO30500, 2018).

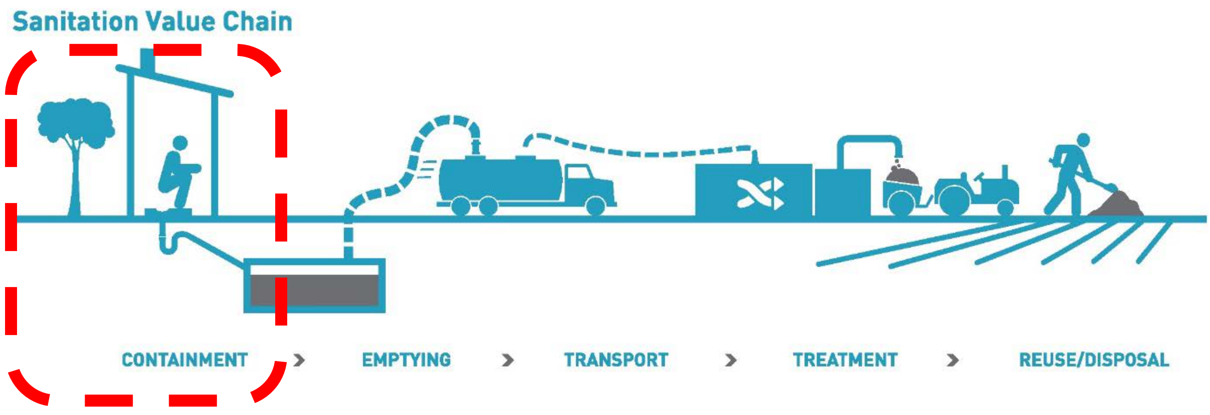


Figure 11: Demonstration of the role of SANS/ISO 30500 and NSSS in the sanitation value chain

ISO 30500:2018 was developed by experts from 32 participating countries and 16 observing countries (members). It has already been adopted by 13 countries, 8 of them in Africa, including South Africa.

On 17 May 2019, the Department of Trade and Industry, South Africa, published the adoption of ISO 30500:2018 as SANS 30500:2019 in their Notice 275 of 2019.

474 No. 42464 GOVERNMENT GAZETTE, 17 MAY 2019

DEPARTMENT OF TRADE AND INDUSTRY

NOTICE 275 OF 2019

STANDARDS ACT, 2008
STANDARDS MATTERS

In terms of the Standards Act, 2008 (Act No. 8 of 2008), the Board of the South African Bureau of Standards has acted in regard to standards in the manner set out in the Schedules to this notice.

SECTION A: DRAFTS FOR COMMENTS

The following draft standards are hereby issued for public comments in compliance with the norm for the development of the South Africa National standards in terms of section 23(2)(a) (ii) of the Standards Act.

Draft Standard No. and Edition	Title, scope and purport	Closing Date
SANS 3001-CO2-7 Ed 1	*Civil engineering test methods Part CO2-7: Initial drying shrinkage and wetting expansion of concrete.* Specifies a method of determining the initial drying shrinkage and wetting expansion of specimens of freshly cast concrete. It is not applicable to matured or hardened concrete or to concrete that contains expansion-inducing agents or to precast concrete products	2019-06-30
SANS 3001-CO2-6 Ed 1	*Civil engineering test methods Part CO2-6: Tensile splitting strength of hardened concrete.* Describes a method of determining the tensile splitting strength of cylindrical, cubical and prismatic test specimens of hardened	2019-06-30

2. Scope of SANS/ISO 30500

This standard specifies general safety and performance requirements for design and testing as well as sustainability considerations for non-sewered sanitation systems (NSSS). A NSSS, for the purposes of this document, is a prefabricated integrated treatment unit, comprising frontend (toilet facility) and backend (treatment facility) components that:

a) collects, conveys, and fully treats the specific input within the system, to allow for safe reuse or disposal of the generated solid, liquid, and gaseous output, and

b) is not connected to a networked sewers or networked drainage systems.

This document is applicable to sanitation systems that are either manufactured as one package, or, manufactured as a set of prefabricated elements designed to be assembled in one location without further fabrication or modification that influences the system function (ISO30500, 2018).

3. The Benefits of adopting SANS/ISO 30500

The adoption of the SANS/ISO 30500 standard has benefits for all the stakeholders involved: (i) regulators/policy makers, (ii) manufacturers, and (iii) users.

(i) Regulators/Policy makers

Regulators and policy makers can rely on global expert opinion to ensure safety of the product for its citizens without spending its own time and money. They can access the constantly updated source of information and experiences from around the world.

(ii) Manufacturers

Manufacturers have a blueprint to use in order to create a product that meets international guidelines, making market entry easier. The Adoption of SANS/ISO 30500 also increases the manufacturing capability to be widely available to market and deploy at places of need.

(iii) Users

The users will have increased confidence in the product, reflecting a consensus of regulators, manufactures, and users from across the world. The users can have a dignified, reliable, safe, hygienic, odour-free experience that may even produce by-products that can be re-used by the community.

4. NON-SEWERED SANITATION SYSTEM (NSSS)

A non-sewered sanitation system (NSSS) is a prefabricated integrated treatment unit with two main components: a front-end component (toilet facility) and a back-end component (treatment facility). The NSSS collects, conveys, and fully treats the specific input within the system, to allow for safe reuse or disposal of the generated solid, liquid, and gaseous output (ISO30500, 2018).

NSS Systems operate without connection to any sewer or drainage network. The NSSS can be either manufactured as one package or manufactured as a set of prefabricated elements designed to be assembled without further fabrication or modification that influences the system function. The prefabricated components of NSSS are intended to require minimal work to be integrated and quickly provide fully functioning sanitation systems (ISO30500, 2018).

The **inputs** entering the NSSS consist of human faeces and urine, menstrual blood, bile, flushing water, anal cleansing water, toilet paper and other bodily fluids/solids. The **outputs** substances exiting the NSSS include the products of the backend treatment process such as solid output and effluent, as well as noise, air, and odour emissions (ISO30500, 2018).

This is illustrated in Figure 12 below, showing the integration of the frontend and backend systems along with the input and output.

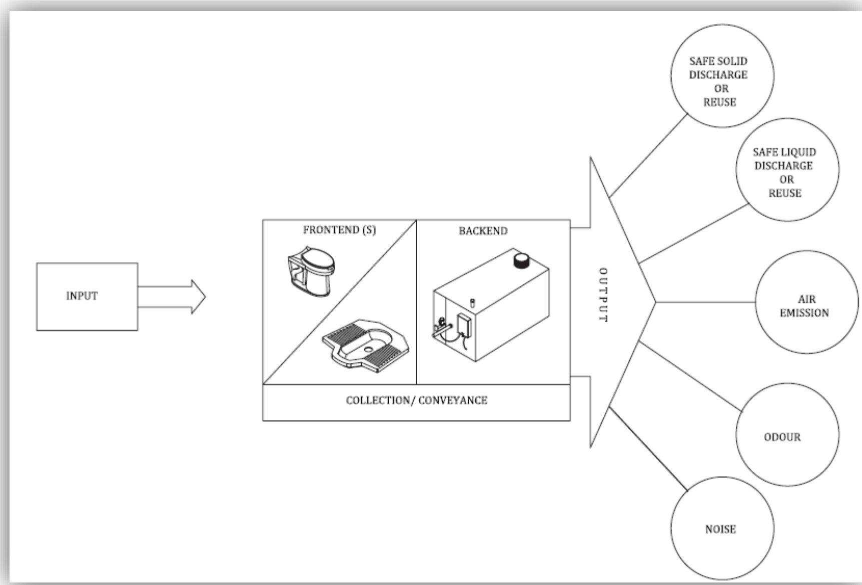


Figure 12: Concept of NSSS (ISO30500, 2018)

4.1 The Components of the NSSS

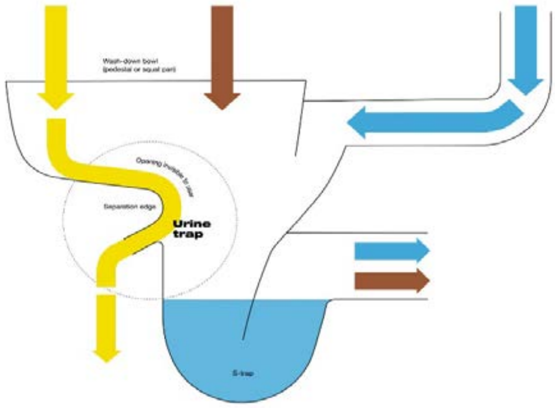
1) Front-End

The frontend includes user interfaces such as a urinal, squatting pan, or sitting pan, which may apply evacuation mechanisms ranging from conventional flush, pour flush, and dry toilets to novel evacuation mechanisms such as those employing mechanical forces requiring little to no water. Conventional and novel evacuation mechanisms may be combined with urine diversion applications (e.g. urine diversion flush toilet, urine diversion dry toilet) (ISO30500, 2018).

(a) **(b)** **(c)**

Figure 13: illustrating (a) Urinal, (b) Squatting pan & (c) Sitting Pan. (Sources: (ISO, 2018); aswesawit.com/asian-toilet/)

Evacuation mechanisms: conventional flush, pour flush and dry toilets to novel evacuation mechanisms employing mechanical forces with little to no water.



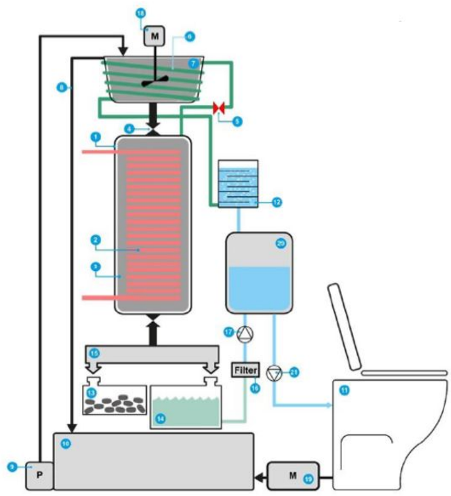
a

b

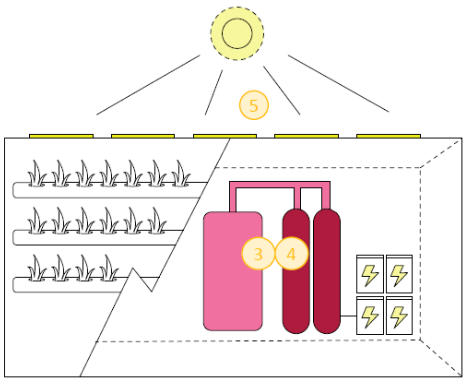
Figure 14: a. Urine diverting flush toilet

2) Backend Treatment Technologies

The Backend treatment technologies and processes of NSSS can range from biological or chemical to physical unit processes (e.g. anaerobic and aerobic digestion, combustion, electrochemical disinfection, membranes). Some systems use only one of these technologies or processes while others apply various unit processes in combination through several treatment units (ISO30500, 2018). Some examples of backend technologies are provided below.



Hydrothermal carbonisation backend system with high temperature and high pressure processing where the final products are energy converted into electricity, clean water for reflush and fertilizer (Source: https://sanitation.ansi.org)



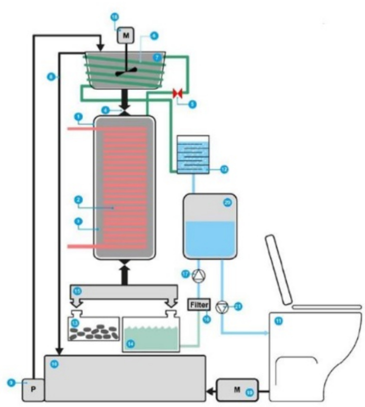
Backend processing technology with combined biological and physico-chemical processing to convert waste into clean water, renewable energy and fertilizer nutrients, where: 3. Liquid Processing; 4. Solids Processing; 5. Power System (Source: https://sanitation.ansi.org)

4.2. Classes of the NSSS

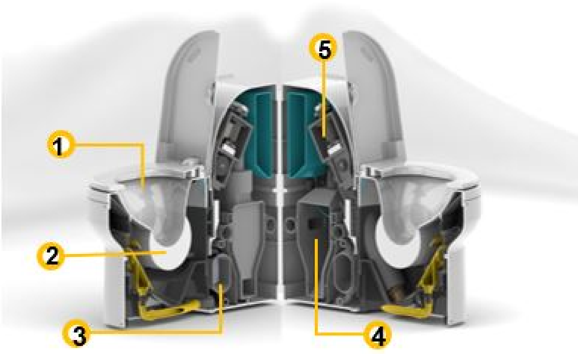
NSSS Classification:

- Class 1: one front-end and non-biological back-end
- Class 2: one front end and back-end with one or more biological treatment process
- Class 3: multiple front-end with one or more biological or non-biological back-end

1) Class 1: Consist of one front-end and Non-biological back-end

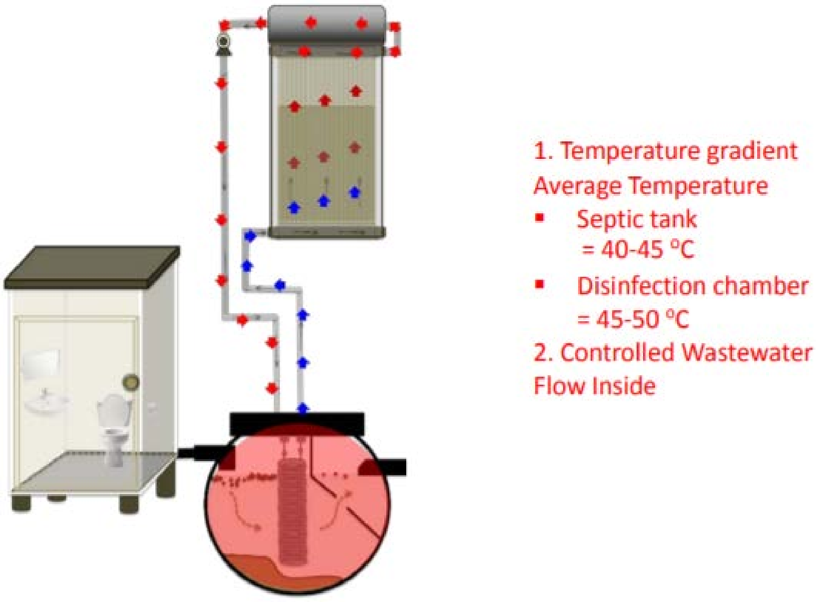


Hydrothermal carbonisation unit, connected to a vacuum flush system, serving a household unit of up to 10 users per day (Source: https://sanitation.ansi.org)



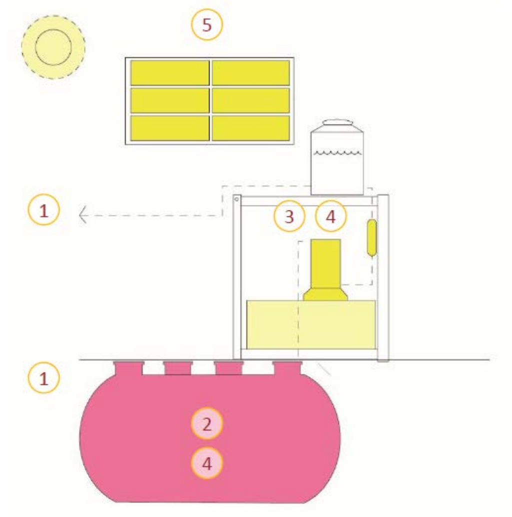
Waterless household with swiping flush mechanism. In the backend, solids are extracted by a specifically designed screw, then dried and combusted, while liquids are preheated and purified with a hydrophobic membrane. 1. Frontend; 2. Urine/Faeces separation; 3. Liquid processing; 4. Solid processing; 5. Power system (Source: https://sanitation.ansi.org)

2) Class 2: Consists of one front end – back-end includes one or more biological treatment process



Solar septic tank

3) Class 3: Consists of more than 1 front-end, with one or more Biological or non-biological backend



Backend processing technology with combined anaerobic digestion of solids and an electrolysis system to convert waste into water, hydrogen, and solid fertilizer. 1. Frontend; 2. Urine/Faeces Separation; 3. Liquid Processing; 4. Solids Processing; 5. Power System (Source: https://sanitation.ansi.org)

Notes

5. SANS/ISO 30500 CERTIFICATION PROCESS

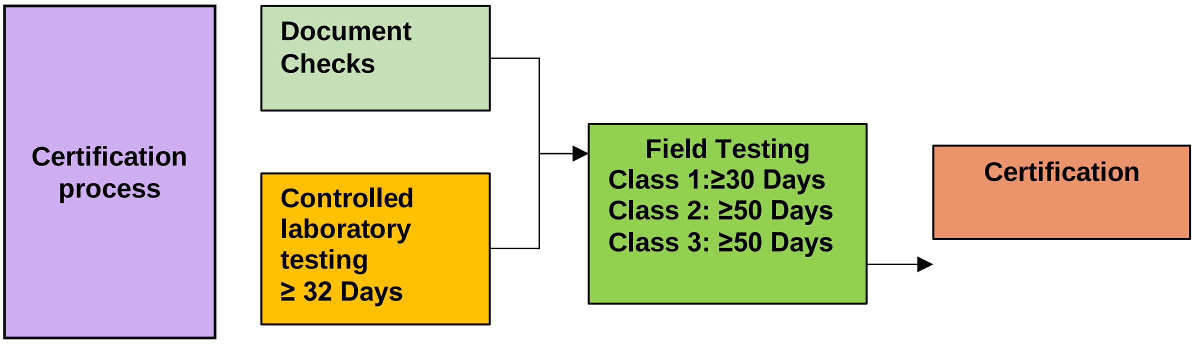


Figure 15: Stages of the SANS/ISO 30500 Certification process

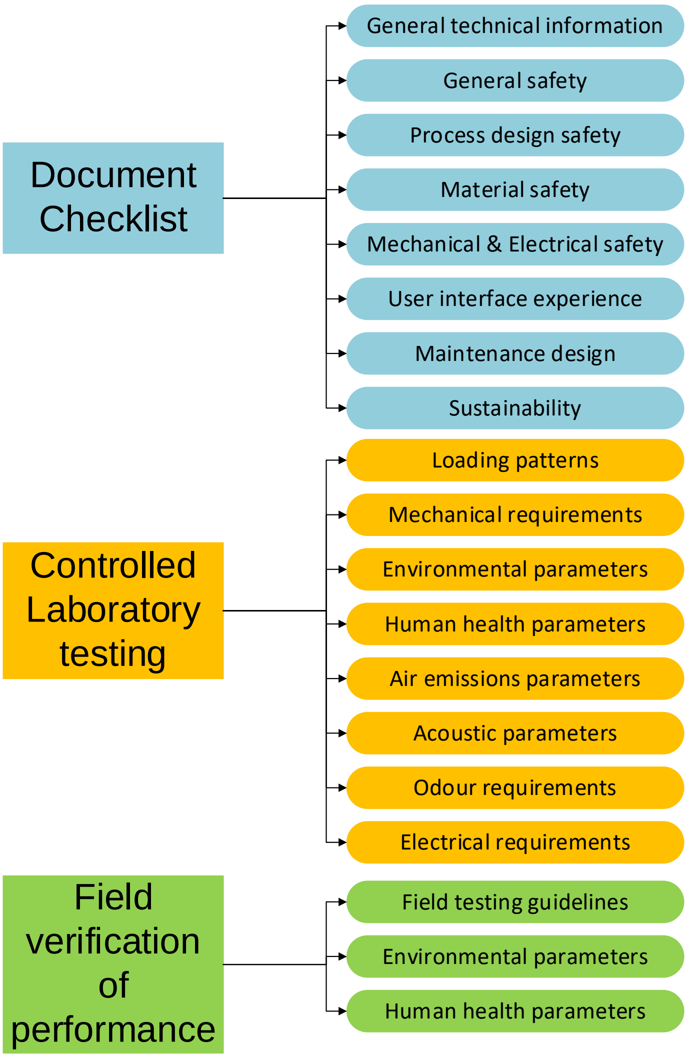


Figure 16: Overview of the SANS/ISO 30500 Certification process (*Source: ISO 30500, 2018)*

5.1. Document Checklist

NOTE: The paragraph numbering subset (1-12) following this note up to page 44 all refer to main paragraph 5.1 of the booklet

1 General Technical Information

1.1 User requirements

The NSSS shall be designed in such a way as to ensure that the users can use the system safely and in the manner intended by the manufacturer. Additional requirements for specific users, such as persons with disabilities and small children, need to be provided (ISO, 2018).

1.2 Metric system

Design and construction of NSSS shall be specified in International System of Units of measurement.

1.3 Expected design lifetime

NSSS shall be designed for a serviceable life of a minimum of 10 years at the loading rates or frequency stipulated by the manufacturer. Assuming use and maintenance according to the manufacturer's specifications.

1.4 Design capacity

(i)Treatable input

NSSS shall be capable of treating, at minimum, human faeces and urine, menstrual blood, bile, flushing water, anal cleansing water, toilet paper, and other bodily fluids/solids. Manufacturers may identify additional categories of input as acceptable for treatment, such as water from hand washing, menstrual hygiene products, and/or organic household waste (ISO30500, 2018).

(ii)Treatment capacity

The design capacity with regard to human faeces and urine shall be indicated as expected uses per day (faecal uses/day and urine uses/day). The average amount of faeces (kg/use) and urine (l/use) per use shall be determined as the basis for capacity calculations and shall be clearly indicated. The expected daily capacity for further input (such as water, menstrual hygiene products and organic waste) shall be indicated by the manufacturer (in units such as kg/day or l/day) (ISO30500, 2018).

(iii) Menstrual hygiene products

The provisions and instructions for the safe operation and maintenance of the disposal mechanism or device shall be provided. Cultural norms, existing practices and aspirations regarding the disposal of menstrual hygiene products shall be considered (ISO, 2018).

(iv) Overload protection

A reasonable safety factor shall be incorporated into the design and indicated by the manufacturer in order to prevent overload. In order to indicate when the system is nearing maximum capacity (design capacity plus safety factor) the system shall be equipped with a visual and/or audible mechanism indicating to the user that the system is overloaded and therefore not usable. Should overload occur, the system shall enter into a safe state that prevents any hazards due to overload (ISO30500, 2018).

(v) Continuous use

The sanitation system shall allow continuous use without unreasonable waiting times between uses, which should be specified by the manufacturer in the user manual or as part of the equipment label or data plate.

(vi) Operability following non-usage

The system shall remain operable after a period of system non-usage of 60 h without causing malfunctions or requiring additional efforts to resume operation that exceed normal operating procedures.

(vii) Operability following short-term shut down

Following restart after a short-term shut down (i.e. 60 h or less) specified by the manufacturer, the system shall be able to immediately accept input and return to normal operating state.

(viii) Operability following long-term shut down

The sanitation system manufacturer shall provide precise instructions for preparing the system for long-term shut down (i.e. more than 60 h). The instructions shall describe the procedures for achieving safe and stable system shut down conditions. Following restart after long-term shut down, the sanitation system shall be able to immediately accept input and be capable to return to normal operating state within the time specified by the manufacturer (ISO30500, 2018).

(ix) Safe state

Means of indication (visual or audible) or instruction to determine if the system is in a safe state shall be provided by the manufacturer.

2. General Safety

2.1 Secure design

To prevent theft or tampering, critical accessible components of the NSSS shall be assembled or affixed in such a way as to deter removal or dismantling by unauthorized parties.

2.2 Operating conditions

2.2.1 Ambient temperature range

NSSS shall operate safely and reliably in environments with ambient temperatures at a minimum range from 5°C to 50°C, the requisite primary range for all systems complying with this document. Technologies designed to operate outside the primary range shall additionally demonstrate their capability to operate safely and reliably in these expanded ambient temperature ranges (ISO30500, 2018)).

2.2.2 Ambient air humidity

Operate safely and reliably in ambient air humidity conditions at a minimum range from 20% to 100%. Technologies designed for use in air humidity below 20% shall additionally demonstrate their capability to operate safely and reliably in these expanded ambient air humidity ranges (ISO, 2018).

2.3 General safety design requirements

2.3.1 Safety of edges, angles, and surfaces

Surfaces and parts of NSSS with which users or service personnel can come into contact shall be free from rough or sharp edges or unnecessarily sharp points.

2.3.2 Fire and explosion protection

2.3.3 Structural integrity

2.3.4 Underground systems

2.3.5 External impacts

2.3.6 Safety assessment

The manufacturer of a NSSS shall carry out either an iterative risk assessment or an equally effective assessment capable of demonstrating proven safety of NSSS. The safety assessment shall: (i) determine the particular health and safety requirements that apply to the product, (ii) determine risk-mitigating measures to be taken, and (iii) demonstrate the safety of the product by documenting the results of the safety assessment. This assessment should be carried out during the design process; however, the assessment may be carried out after the design process (ISO30500, 2018).

3 Requirements for sanitation system components

3.1 General requirements

Critical materials, equipment, components, connections, and joining elements of the NSSS that are indispensable to the proper operation of the system shall be selected based on their suitability for sanitation applications (ISO30500, 2018).

3.2 Hygienic design

NSSS shall be designed in such a way as to mitigate any risk of infection due to potential pathogens from human urine or faeces or the intermediate and residual products of the sanitation system. The NSSS shall minimize the entry of insects and vermin to the subsystems (ISO30500, 2018).

3.2.1 Prevention of contact with unsafe effluent and reuse

Sanitation systems that are designed for intentional effluent reuse (rather than safe discharge to the environment) shall meet the necessary requirements for the type of reuse (e.g. irrigation, flushing and handwashing). The systems that do not meet effluent requirements for flushing or handwashing shall prevent this type of internal (or within the system) reuse in the design of the system through reasonably practicable means (ISO, 2018).

3.3 Reliability of conveyance devices

The mechanical and hydraulic design of conveyance devices (e.g. internal pipework, connections and screws) shall prevent back flows, blockage, and surcharging during normal operation (ISO, 2018).

3.4 Water seal

If input is evacuated from the frontend through a trap with a water seal, this seal shall be a minimum depth of 20 mm (ISO, 2018).

4 Material safety

4.1 Cleanability of surfaces

4.2 Chemical and biological additives

4.3 Durability of materials

4.3.1 Fire resistance of materials

The NSSS shall be resistant to fire. Materials shall not ignite, progressively glow, smoulder, or show evidence of being functionally impaired when exposed to a source of ignition. Materials should conform to ISO 10295 (all parts) or equivalent (ISO, 2018).

4.4 Connections and joining elements

5 Mechanical & Electrical Safety

5.1 Mechanical Requirements

5.1.1 Pressurized or vacuum equipment

5.1.2 Pipes, hoses and tanks

5.1.3 Moving and rotating parts

5.1.4 Backflow prevention

If the sanitation system is connected to the water supply system, then backflow shall be prevented. The test method should be in accordance with ASME A112.1.2 or an equivalent national or international standard (ISO, 2018).

5.2 Requirements for Radiation

5.2.1 High temperatures of parts and surfaces

Accessible parts or surfaces of the sanitation system that exceed the temperature of 60°C shall be equipped with protection measures or fixed guards sufficient to prevent burn injuries.

5.2.2 Low temperatures of parts and surfaces

Accessible parts or surfaces of the sanitation system that fall below the temperature of -20°C shall be equipped with protection measures or fixed guards sufficient to prevent injuries due to low temperatures (ISO, 2018).

5.2.3 Other radiation emissions

Undesirable radiation emissions from the sanitation system shall be suitable to meet safe levels.

6. Electrical and electronic equipment

6.1 Safety and reliability of electrical and electronic equipment

Electrical equipment such as pumps, drives, fans, or control systems shall be durable, require minimal maintenance, be adequately protected from any aggressive environment, and be capable of being easily serviced (ISO30500, 2018).

7 User interface experience

7.1 Aspirational and ergonomic design

NSSS should be designed not only for functionality but also for comfort, aesthetic satisfaction and sensory appeal. The designers should strive to evoke cleanliness in the appearance and user experience of the front-end (ISO30500, 2018).

7.1.1 Information and warnings

Information and warnings on NSSS shall be provided through clear and unambiguous symbols or pictograms to ensure the user's comprehension. Information and warnings on NSSS shall also take into account user requirements. Written information and warnings shall be composed at the reading level of the users and shall incorporate all information specified in this standard. Information shall be provided in the official language(s) of the country of use. Warnings shall clearly indicate the extent of the safety risk (ISO30500, 2018).

A data plate or label visible to the user in the vicinity of the frontend and near to the failure signal shall include, at a minimum – (i) expected number of users and uses per day (users/day and uses/day) and manufacturer defined wait time between uses; (ii) expected daily capacity for additional input such as water, menstrual hygiene products, and organic waste (kg/day or l/day); (iii) common items that shall not be added to the system; (iv) instructions for obtaining service and contact information and (v) minimum and maximum operating temperature.

When a backend is supplied without a frontend, a data plate or label, consisting of the information listed in the previous step, shall be provided by the manufacturer such that it can be placed securely in the vicinity of the frontend by the site owner or operator (ISO30500, 2018).

If the effluent of the system does not meet drinking water requirements a data plate or label, which is placed in a location visible to the user in the vicinity of the backend warning the user that the effluent is not drinkable (ISO30500, 2018).

If the system is designed to produce treated output suitable for reuse, the manufacturer shall: (i) specify the intended purpose/application of solid output, effluent and/or off-gas, and (ii) provide information on the quality of the reusable output (e.g. nutrient content) in the form of a data plate or label placed in a location visible to the user in the vicinity of the backend (ISO30500, 2018).

7.1.2 Marking and labelling

NSSS shall have permanent and legible data plates. The information shall be provided in the official language(s) of the country of use. Data plates shall include, at a minimum: (i) manufacturer's name and address; (ii) model number; (iii) serial number; (iv) date of manufacture; (iv) total unit weight when operational; and (v) parameters of primary electric circuits including voltage and amperage (ISO30500, 2018).

7.2 Transitions from the backend

Process transitions such as vibrations, shock cold or heat produced by the backend shall not provoke sensations of discomfort for the user nor result in hazards to the system's integrity. When tested in accordance with ISO 20816-1, the vibration level in the XYZ-axis at any possible area of the frontend user interface of NSSS shall not exceed 0.5 m/s^2.

8 Requirements for the frontend

8.1 Use and Operation of the frontend

8.1.1 General usability requirements

The design of the frontend shall meet ergonomic requirements of the users. Anthropometric data of the users should be used for the design of all areas and parts accessed by the users, in accordance with ISO 7250 (all parts) (ISO30500, 2018).

The sanitation system shall be easy to use. The frontend shall meet the usability needs of the users. Designers shall ensure that: (i) the users regard the system controls as intuitive, (ii) the actions required to control operations follow a logical sequence, and (iii) complexity is minimized with respect to control panel signals.

The system shall achieve these usability conditions: (i) self-descriptiveness and intuitive design (look-and-feel), (ii) controllability, (iii) conformity with user expectations, and (iv) user or maintenance error tolerance (ISO30500, 2018).

The manual control elements such as hand levers, pedals, switches and indicators shall be chosen, designed, realized, and arranged, so that: (i) they are easy to access and locate according to user expectations, (ii) neutral positions of the manual control elements are automatically reset after triggering, (iii) the movement of the manual control elements to activate the flush functions correspond to the intended effect or to common practice, whenever possible, and (iv) the activation forces are comfortable for the users (ISO30500, 2018).

8.2 Requirements for ease of cleaning of the NSSS

The frontend and connected installations that are accessible to the user (e.g. pipes and chutes) shall be designed in such a way as to ensure that the degree of cleaning necessary after use is no greater than that of conventional flushing toilets. Frontend surfaces shall have curves with a radius sufficient to allow thorough cleaning with common cleaning methods and without requiring the use of specialized chemical cleaning agents. If specialized cleaning tools are required, they shall be addressed in the user manual and supplied with the system.

8.3 Requirements for ease of operation

The design and realization of the NSSS shall minimize demands on the user with respect to the performance of periodically recurring operational activities needed to keep the sanitation system safe and operational. These operational activities shall meet usability requirements defined in the section 8.1.1. If relevant, clear instructions for performing operational activities shall be addressed in the user manual.

8.4 Cultural requirements

The design of the frontend shall anticipate and reflect cultural preferences and common practices. The design of the frontend should aim to accommodate preferences and practices prevalent in the cultural setting for which the sanitation system is designed, including: (i) mode of operation (water use, dry), (ii) seating/squatting position, and (iii) personal cleansing material (washers/wipers). If changes to common practices of users are inevitable in order to ensure improved sanitation, these demands on the user should not exceed reasonable levels and should be clearly explained by user manuals provided by the manufacturer.

9 Maintenance design

9.1 Maintenance

9.1.1 Reasonable configuration, adjustment, and maintenance activities

NSSS shall be designed in such a way that frequency and complexity of configuration, adjustment, and maintenance activities be performed by the user and the professional service personnel are reasonable with respect to the expectations, technology and level of professional training present in the setting of users.

See handout on the suitability of a sanitation system for a given location and users regarding frequency and complexity of configuration, adjustment, and maintenance activities.

9.1.2 Location and access of configuration, adjustment, and maintenance points

To prevent contamination and minimize the risk of infection, configuration, adjustment, and maintenance points should be located separate from any hazardous areas.

Removal of system blockages, when necessary, should be processed from the outside of the sanitation system and should not necessitate any disassembly.

NSSS shall be designed in such a way as to ensure that components requiring service can be accessed and if sanitation system access is required, re-configuration can be performed safely.

Configuration, adjustment, and maintenance should not unnecessarily involve contact with input materials, intermediate process products, or residual products.

9.1.3 Discharge and cleaning

Cleaning and regular maintenance activities conducted by the user shall not require discharge of partially treated materials. Discharge of partially treated materials may be necessary for maintenance activities conducted through service personnel. If maintenance activities require discharging partially treated materials, either solid, liquid, or gas, these partially treated materials need not meet the requirements for outputs to the environment specified in this document.

The service personnel shall be responsible for appropriate disposal of the partially treated material. Discharge of partially treated material for maintenance shall not be a substitute for treatment by the system. It is intended to ensure that systems deliver full on-site treatment (as far as practicable) and as such the partially treated materials, needing to be disposed of should be minimized. The manufacturer should provide clear instructions to service personnel to deposit discharged partially treated material in a way that minimizes risk for health, safety and environment.

9.2 Tools and devices

If specialized tools are required for emptying and maintaining the NSSS, then these specialized tools shall be addressed in the user manual and supplied with the system.

9.3 The user manual

A user manual with clear and definitive instructions to users and service personnel for configuration, adjustment, and maintenance of the NSSS shall be provided. At a minimum, the user manual shall clearly define all necessary procedures, activities, and schedules for configuration, adjustment, and maintenance that are essential to keeping the system safe and operational.

9.4 Handling and transport of the sanitation system

NSSS, including primarily mobile systems, shall be capable of safely withstanding handling and transport to another location and, if required, withstanding storage safely and without incurring damage. The manufacturer shall clearly indicate which ambient conditions the sanitation system can withstand during handling and properly secured transport if the values differ from those specified. When transported, systems shall not produce sudden movements or unintended discharge of tanks, pipes, or any instability-related hazards. If required, appropriate attachments for lifting gears or fixation points shall be provided to ensure the safe transport of the system.

10 Sustainability

10.1 Recovery of Nutrients

The nutrients of interest are those that facilitate plant growth such as phosphorus, nitrogen, and potassium. The manufacturer of the sanitation system shall specify the type, subtypes, concentrations, and amount of nutrients contained in the final solid output and/or effluent (in units such as mg/l or mg/kg dry mass and mg per user and day). The manufacturer shall specify the assumptions used for these calculations.

10.2 Water consumption and reuse of effluent

10.2.1 Calculations

To facilitate comparison across systems as well as determination of suitability for a given location, sanitation system water use shall be calculated and indicated as both per-flush and per user per day, in units such as l/flush and l/user per day. Water use calculations do not need to consider related activities such as hand washing that do not directly involve operation of the sanitation system. The manufacturer shall specify the assumptions used for these calculations.

10.2.2 Water consumption

The manufacturer shall indicate the amount and the quality of water required to operate the sanitation system and the water consumption of the sanitation system shall be minimized.

10.2.3 Reuse of effluent

The manufacturer shall indicate the proportion of the system’s water requirements that can be met with effluent stemming from the sanitation system. If the system requires dilution of the treated effluent before reuse, the manufacturer shall indicate the necessary amount and quality of the freshwater and the reuse water as input. The reuse of treated effluent within the sanitation system shall be maximized to a reasonably practicable extent.

***Reuse of effluent within systems may not be protective of public health unless saprozoic pathogens (such as *Legionella*) are considered, treated, and monitored.

11 Energy consumption and energy recovery

11.1 Calculations

To facilitate comparison across systems as well as determination of suitability for a given location, sanitation system energy consumption and recovery shall be calculated and indicated in units such as kJ or kWh per volume or mass and kJ or kWh per user per day.

11.2 Energy consumption

The manufacturer shall indicate the energy required to operate the sanitation system. The energy consumption of the sanitation system shall be minimized to a reasonably practicable extent.

11.3 Direct and indirect energy recovery

Sanitation systems shall maximize direct energy recovery to a reasonably practicable extent. The manufacturer shall indicate the quantity of energy directly recovered as energy supply for the operation of the sanitation system. Indirect recovery of energy through output products that are not used for the operation of the sanitation system shall be maximized to a reasonably practicable extent. The manufacturer shall indicate the energy content of these output products and indicate the relationship between energy consumption and direct/indirect energy recovery through an energy-balance diagram.

11.4 Life Cycle Assessment

A life cycle assessment of the sanitation system should be conducted based on ISO 14040 and ISO 14044.

12 Recurring operational requirements

The manufacturer shall convey along with the product the relevant information specified below for the NSSS, considering the treatment capacity of the system:

(i) Recommended configuration, adjustment, and maintenance activities, including the identification of parts and components expected to require periodic replacement and the estimated frequency within which such parts and components will be replaced. The information shall be provided in a summarizing table. The complexity of the task should be described;

(ii) Estimated annual net energy consumption (in units such as kWh/year);

(iii) Estimated annual freshwater input, if any (in units such as l/year); and

(iv) Estimated annual consumption (amount/number) of other resources such as chemical and biological additives and specialized cleaning and maintenance tools.

Notes

5.2. Controlled Laboratory Testing

NOTE: The paragraph numbering subset (1-8) following this note up to page 51 all refer to main paragraph 5.2 the booklet

All three Classes of NSSS that can be installed in the laboratory shall be subjected to control laboratory testing. The assembly, installation, operation and maintenance of the NSSS system shall be done according to the manufacturer's instruction. The duration of the testing period shall be no less than 32 days and may be extended beyond the suggested 32-day schedule to accommodate backend processes that require more time. The testing schedule shall be determined before testing commences (ISO30500, 2018).

Controlled Laboratory testing takes into account loading pattern, mechanical pattern, environmental parameters, human health parameters, air emission parameters, acoustic parameters, odour requirements and electrical requirements (ISO30500, 2018).

1 Loading Pattern

1.1 Normal loading pattern

While testing, specified treatment capacity with all additional system input specified by the manufacturer is considered. Loading of the system shall be performed as a percentage of daily load (kg/day of faeces, l/day of urine). Loading shall be conducted at the corresponding timing: (i) 35% from 6 am to 9 am, (ii) 25% from 11 am to 2 pm, and 40% from 5 pm to 8 pm (ISO30500, 2018).

1.2 Stress loading pattern

Stress loading pattern indicates the sanitation system is loaded with treatment capacity + 80% of the difference between maximum capacity and treatment capacity. Loading shall be conducted at the corresponding timing: (i) 35% from 6 am to 9 am, (ii) 25% from 11 am to 2 pm, and 40% from 5 pm to 8 pm (ISO30500, 2018).

1.3 Diarrhoea test day

Fifty percent (50%) of the normal faeces loading shall be 'diarrhoea input' instead of solid faeces.

The NSSS should be housed in a super structure, (i) according to the manufacturer's instructions, (ii) satisfying the requirements of the ISO standard, (iii) specifications of the superstructure to be included in the test report, and (iv) noise tests to be done without the superstructure if the NSSS comes without the superstructure and to be indicated in the test report.

2 Mechanical pattern

2.1 Visibility of faeces

The frontend shall ensure a visual barrier to prevent the user from seeing an accumulation of deposited faeces from previous users when looking directly into the frontend squatting or seat pan with a viewing angle perpendicular to the floor (ISO30500, 2018).

2.2 Evacuation performance

NSSS frontends may employ evacuation mechanisms such as conventional flush, pour flush, and dry flush, to novel evacuation mechanisms. These evacuation mechanisms should comply with relevant international or national standards, to conform to the requirements of ISO 30500. If no relevant international or national standards exist, the flushing mechanisms shall meet the requirements for the adapted testing facilities (ISO30500, 2018).

2.3 Integrity against external impacts

The frontend shall reliably resist mechanical loads incurred during transport, installation, normal operation, and maintenance (ISO30500, 2018).

2.4 Slipping, tripping or falling

Frontend of the NSSS shall be designed to prevent slipping, tripping, or falling on, or off these areas and where appropriate, fitted with handholds (ISO30500, 2018).

2.5 Tightness

Water tightness is tested at the appropriate component parts including water supply systems and containers. Leaks are tested in the system at appropriate pressures, time, vacuum and volumes. Technical tightness is assessed for mechanical integrity of system tightness such as for potentially dangerous gases, etc. (ISO30500, 2018).

2.6 Evacuation mechanism

Evacuation mechanism test protocols are adapted from EN 997, IS 2556-3 and IS 2556-14 based on industrial best practice. Frontend components such as flushing cistern, pour flush, evacuation mechanism for a dry toilet, or novel evacuation mechanisms are tested for its evacuation mechanism (ISO30500, 2018).

3 Environmental Parameters

Effluents from the NSSS should be within the range as below as be ISO 30500 for the key parameters.

Table 2: illustrating the environmental parameters (ISO30500, 2018).

Parameters	**Test Methods**	**Category A usage: Threshold for unrestricted urban uses**	**Category B usage: Threshold for discharge into surface water or other restricted urban uses**	**Minimum load reduction percentage**
Total nitrogen	APHA 4500-N C			70%
Total phosphorus	APHA 4500-P ISO 6878			80%
pH	APHA 4500-H+ A	6-9	6-9	
COD	APHA 5220 B	≤ 50	≤ 150	
TSS	APHA 2540D EN 872	≤ 10	≤ 30	

4 Human Health Parameters

Table 3: Illustrating human health parameters (ISO, 2018).

Parameters	**Surrogates**	**Test Methods**	**Max. conc. solids [number/g (dry solids)]**	**Max. concentration in liquids (number/l)**
Human enteric bacterial pathogen	*E. coli*	APHA 9221, APHA 9222 and APHA 9223	100	100
Human enteric Helminths	*Ascaris suum* viable ova	Methods for microbiological analysis of sewage sludges, SOP Helminth Test (Ascaris, Trichuris and Taenia), etc.		
Human enteric viruses	MS2 *coliphage* or somatic *coliphage*	EPA 1602 For large samples use EPA 1601 or ISO 10705-1	10	10
Human enteric Protozoa	*Clostridium perfringens*	Solids: ISO 7937 Liquid: ISO 14189	< 1	< 1

Table 4: illustrating Solid and liquid output validation thresholds and log reduction values (LRVs) for human health protection (ISO, 2018).

Parameters	Surrogates	Max. concentration in solids [number/g (dry solids)], OR Max. concentration in liquid [number/L]	Overall LRV for solid OR liquid
Human enteric bacterial pathogen	*E. coli*	100	≥ 6
Human enteric Helminths	*Ascaris suum* viable ova	< 1	≥ 4
Human enteric viruses	MS2 *coliphage* or *somatic coliphage*	10	≥ 7
Human enteric Protozoa	Clostridium perfringens	<1	≥ 6

5 Air emission parameters

Potential air emissions from NSSS can be classified as pollutants or explosive gases. The NSSS shall be designed in such a way as to ensure that air pollutants released indoors and outdoors do not exceed the thresholds. CO and CO_2 shall only be tested if the NSSS applies combustion in its treatment processes. The manufacturers should document the GHG emissions. Indoor and outdoor air emission thresholds are detailed below:

Table 5: Indoor & Outdoor air emissions threshold *(ISO, 2018).*

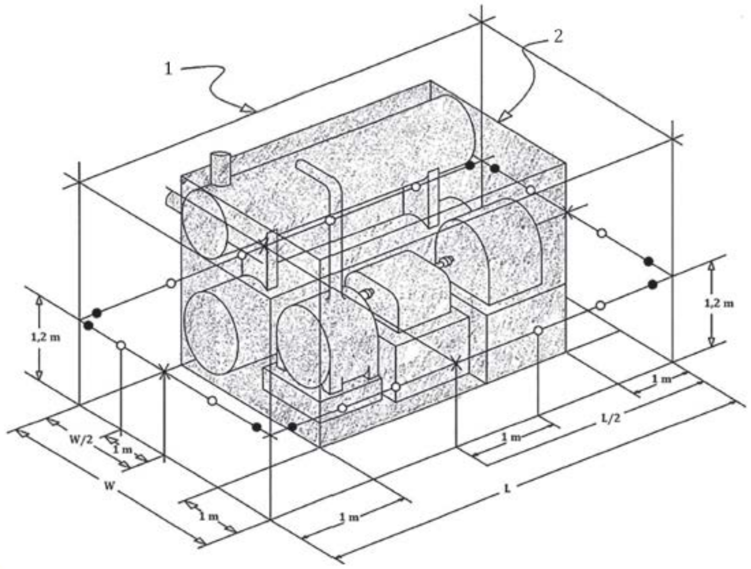
Parameter	Test method	Emission thresholds (average levels over indicated timeframe)	Sampling method
CO (ppmv)	ISO 4224 NIOSH 6604	1 h: 28	Continuous analysis Grab sampling
NOx (ppbv)	ISO 7996	1 h: 99	Continuous analysis
SO_2 (ppbv)	NIOSH 6004	1 h: 6,8	Grab sampling
CO_2 (ppmv)	ISO 16000-26 NIOSH 6603	1 h: 1 000	Continuous analysis Grab sampling
H_2S (ppbv)	NIOSH 6013; OSHA6 ID 141, 1008	30 min: 4,6	Grab sampling
VOCs (ppbv)	ISO 16000-5	1 h: 187	Grab sampling
PM2,5 ($\mu g/m^3$)	NIOSH 0500	1 h: 25	Grab sampling
NH_3 (ppmv)	NIOSH 6015 NIOSH 6016	1 h: 25	Grab sampling

Table 6: Outdoor air emissions from the stack

Parameter	Test method	Emission thresholds (1 hr average)	Sampling method
CO (ppmv)	EN 15058, US EPA, Method 10	80	Continuous analysis Grab sampling
NOx (ppbv)	EN 14792, US EPA, Method 7E	195	Continuous analysis
SO_2 (ppbv)	EN 14791, US EPA, Method 6C	68	Grab sampling
PAH	VDI 3874, US. EPA Compendium method TO-13A	0,001	Continuous analysis Grab sampling
H_2S (ppbv)	VDI 3486 Bl. 2, NIOSH 6013; OSHA6 ID 141, 1008	1,9	Grab sampling
VOCs (ppbv)	EN 12619, US EPA, Method 25A	12	Grab sampling
PM2,5 ($\mu g/m^3$)	VDI 2066 Bl. 10, US EPA, Method 5I; Method 201A	10	Grab sampling
O_2	EN 14789, US EPA, Method 3A		
NH_3 (ppmv)	US EPA CTM-027	50	Grab sampling
Volume flow	ISO 16911-1, US EPA, Method 2		
Moisture content	EN 14790, US EPA, Method 4		

6 Acoustic parameters

Controlled noise test with at least one sound-reflecting surface on or near the location of the NSSS testing site. NSSS tested under isolated conditions to provide acoustic conditions close to the free field condition. For NSSS with superstructure will have the noise level test done both inside the superstructure and externally. For NSSS without a superstructure, noise tests carried out without any superstructure and only at the external points. Noise level tests to be carried out under reproducible, and should represent the loudest operations involved under normal operation. Noise tests inside the superstructure to be done at a location 1.2 meters above the frontend user interface. External unit noise measurement at specific points as shown in Figure 17.



Key
1 measurement parallelepiped
2 reference parallelepiped
W width
L length
X key measurement points
○ measurement points
● points nearest to the corners to be discarded

Figure 17. Acoustics measurements

7 Odour requirements

Sanitation systems for which a superstructure is not part of the manufactured product shall be tested with a superstructure satisfying the requirements. Class 1, 2 and 3 of the sanitation systems shall meet the requirements specified in Table 7 for NSSS with superstructures.

Table 7: Odour requirements *(ISO, 2018).*

	Maximum percentage of observations reported as "unpleasant"	**Maximum percentage of observations reported as "unacceptable"**
Normal odour day (Within superstructure)	10%	2%
Simulant odour day (Within superstructure)	10%	2%
Normal odour day (Vicinity)	10%	2%
Simulant odour day (Vicinity)	10%	2%

8 Electrical requirements.

8.1 Energy supply

Testing procedure for systems with electrical energy as primary source. Separate and isolate the sanitation system from its energy supply through the specific safety device. Energy remaining or stored in the system that poses a potential hazard shall be discharged. If a backup source of energy is provided, check and record the capacity of the backup source of energy. If the primary energy source is non-electrical, test the functioning of reliability and safety measures according to their intended use (ISO, 2018).

5.3. FIELD TESTING

NOTE: The paragraph numbering subset (1-3) following this note up to page 52 all refer to main paragraph 5.3 of the booklet

1 Field Testing Guidelines

During field testing, the NSS system shall be in use by the users at its specified treatment capacity. In order to pass field testing requirements, at least **75%** of all test results for environmental parameters illustrated in Section B (environmental parameters) and **100%** of all test results for maximum bacterial, viral, helminth, and protozoa human health related parameters shall satisfy the requirements defined. **Results shall not be averaged** (ISO, 2018).

Additionally, during and after testing, the following elements shall be observed and recorded: (i) any fractures, cracks, and permanent deformations of the sanitation system, (ii) any back flows, blockages, and surcharging of conveyance devices, (iii) any ruptures or leakages, and (iv) all safety or overload shut downs and process malfunctions (ISO, 2018).

1.1 Class-1 sanitation systems:

Class 1 sanitation systems **(see Figure 3)** shall be subject to field testing for a minimum duration of 30 days. A minimum of one sanitation system identical to the model subjected to controlled laboratory testing shall be selected. Environmental solid output and effluent parameters and human health related solid and liquid parameters shall be tested weekly (ISO, 2018).

1.2 Class-2 and Class-3 sanitation systems

Class 2 and Class 3 sanitation systems **(Figure 3 & Figure 4)** that incorporate biological treatment processes shall be subject to field testing as follows: (i) a minimum of one sanitation system, identical to the model subjected to controlled laboratory testing, shall be selected for field testing for a **minimum duration of 5 months**, (ii) if the defined operating conditions cannot be achieved within 5 months using only one sanitation system, either several systems shall be tested under varying operating conditions simultaneously, or the timeframe of 5 months shall be extended (ISO, 2018).

2 Environmental parameters

Table 8: Illustrate the environmental parameters that the NSS systems need to comply with *(ISO, 2018).*

Parameters	**Category A usage: Threshold for unrestricted urban uses**	**Category B usage: Threshold for discharge into surface water or other restricted urban uses**	**Minimum load reduction percentage**
Total nitrogen			70%
Total phosphorus			80%
pH	6-9	6-9	
COD	≤ 50	≤ 150	
TSS	≤ 10	≤ 30	

3 Human Health Parameters

Table 9: Illustrate the human health parameters that the NSS systems must comply with *(ISO, 2018).*

Parameters	**Surrogates**	**Max. conc. solids [number/g (dry solids)]**	**Max. concentration in liquids (number/l)**
Human enteric bacterial pathogen	*E. coli*	100	100
Human Enteric Helmiths	*Ascaris Suum viable Ova*		
Human enteric viruses	*MS2 coliphage* or somatic *coliphage*	10	10
Human enteric Protozoa	*Clostridium perfringens*	< 1	< 1

Table 10: Solid and liquid output validation thresholds and log reduction values (LRVs) for human health protection *(ISO, 2018).*

Parameters	Surrogates	Max. concentration in solids [number/g (dry solids)], OR Max. concentration in liquid [number/L]	Overall LRV for solid OR liquid
Human enteric bacterial pathogen	*E. coli*	100	≥ 6
Human enteric Helminths	*Ascaris suum* viable ova	< 1	≥ 4
Human enteric viruses	*MS2 coliphage* or somatic *coliphage*	10	≥ 7
Human enteric Protozoa	*Clostridium perfringens*	< 1	≥ 6

Notes

5.4. PERFORMANCE SAFETY REQUIREMENTS

NOTE: The paragraph numbering subset (1-4) following this note up to page 57 all refer to main paragraph 5.4 of the booklet

1 Solid, Liquid and effluent output requirements

Solid output and effluent shall be fully treated within the sanitation system allowing for safe reuse or disposal. Solid and effluent output shall meet the requirements specified in Table 11 to Table 13 at all times.

Table 11: Solid output performance thresholds addressing human health parameters for safe disposal and all reuse purposes are given *(ISO, 2018).*

Parameter (Pathogen class)	Human enteric bacterial pathogens	Human enteric viruses	Human enteric Helminths	Human enteric Protozoa
Surrogate	using *E. coli* as surrogate, measured in CFU or MNP	using MS2 Coliphage as surrogate, measured in PFU	using *Ascaris suum* viable ova as surrogate	using viable *Clostridium perfringens* spores as surrogate, measured in CFU
Max. concentration in solids [number/g (dry solids)]	100	10	< 1	< 1
Overall LRV for solida	≥ 6	≥ 7	≥ 4	≥ 6

a. Log-reduction values (LRVs) were derived from a quantitative microbial risk assessment (QMRA) as described by WHO 2016, assuming 1 g of faecal solids contains approximately the same range of reference pathogens as in 1 l of liquid effluent (for LRVs derived in Table 2). For further information

b. *E. coli* strain KO11 (ATCC 55124) is used because it is chloramphenicol resistant. Therefore, this antibiotic may be added to the plating medium to suppress the growth of other, interfering bacteria.

Table 12: Liquid effluent validation thresholds and log-reduction values (LRVs) for human health protection *(ISO, 2018).*

Parameter (Pathogen class)	Human enteric bacterial pathogens	Human enteric viruses	Human enteric Helminths	Human enteric Protozoa
Surrogate	using *E. coli* as surrogate, measured in CFU or MPN	using MS2 Coliphage as surrogate, meas-ured in PFU	using *Ascaris suum* viable ova as surrogate	using viable *Clostridium perfringens spores* as surrogate, measured in CFU
Max. concentration in liquids (number/l)	100	10	< 1	< 1
Overall LRV for liquid[a]	≥ 6	≥ 7	≥ 4	≥ 6

a. Log-reduction values (LRVs) were derived from a quantitative microbial risk assessment (QMRA) as described by WHO 2016. For further information, see Reference [61] and Reference [72].

b. *E. coli* strain KO11 (ATCC 55124) is used because it is chloramphenicol resistant. Therefore, this antibiotic may be added to the plating medium to suppress the growth of other, interfering bacteria.

Table 13: Effluent performance thresholds for environmental parameters *(ISO, 2018).*

	Category A usage: Threshold for unrestricted urban uses	Category B usage: Threshold for discharge into surface water or other restricted urban uses
COD (mg/l)	≤ 50	≤ 150
TSS (mg/l)	≤ 10	≤ 30

2 Odour

In order to minimize odour emissions from the sanitation system, the requirements in Table 14 and Table 15 shall be met.

** Potential origins of odour emissions from the sanitation system include faecal odours (faeces and urine, and aging of faeces and urine), and process odours such as those emerging during drying, pyrolysis, combustion, and discharge of output.

Table 14: Maximum allowable percentage of observations reporting odour within system superstructure as unpleasant or unacceptable *(ISO, 2018).*

	Maximum percentage of observations reported as "unpleasant"	Maximum percentage of observations reported as "unacceptable"
	%	%
Normal odour day	10	2
Simulant odour day	10	2

Table 15: Maximum allowable percentage of observations reporting odour in the vicinity of system as unpleasant or unacceptable *(ISO, 2018).*

	Maximum percentage of observations reported as "unpleasant"	Maximum percentage of observations reported as "unacceptable"
	%	%
Normal odour day	10	2
Simulant odour day	10	2

NOTE 1: Unpleasant refers to odour that is not enjoyable and is mildly offensive, but does not meet the criteria of unacceptable.

NOTE 2: Unacceptable refers to odour that is severely offensive, nauseating, and/or sufficiently unpleasant to cause one to avoid using the sanitation system.

3 Air emissions

Potential air emissions from NSSS can be classified as pollutants or explosive gases. Air pollutants from the NSSS released indoors and outdoors shall not exceed a level that poses risks to the health of the user. The sanitation system shall meet the requirements specified in Table 6 for Indoor air emission and Table 7 for outdoor emission thresholds.

The design of the NSSS (frontend and backend) shall be such that emissions of bio-aerosols and endotoxins are minimized. For NSSS with a backend that discharges directly in the indoor environment, and where bio-aerosol and/or endotoxins can reasonably be expected, testing for pathogenic bio-aerosols and for endotoxins is recommended.

Table 16: Indoor air emission thresholds *(ISO, 2018).*

Parameter	Emission thresholds (average levels over indicated timeframe)
CO (ppmv)	1 h: 28
NO_x (ppbv)	1 h: 99
SO_2 (ppbv)	1 h: 6,8
CO_2 (ppmv)	1 h: 1 000
H_2S (ppbv)	30 min: 4,6
VOCs (ppbv)	1 h: 187
PM2,5 (μg/m^3)	1 h: 25
NH_3 (ppmv)	1h: 25
NOTE 1 NO_x is the sum of NO and NO_2. Measurement values are given as NO_2. NOTE 2 ppmv is parts per million by volume, ppbv is parts per billion by volume.	

Table 17: Outdoor exhaust or vent air emissions thresholds *(ISO, 2018).*

Parameter	Emission thresholds (1 h average)
CO (ppmv)	80
SO_2 (ppmv)	68
NO*x* (ppmv)	195
VOC (ppmv)	12
H_2S (ppmv)	1,9
PAH (ppmv)	0,001
PM2,5 (mg/m^3)	10
NH_3 (ppmv)	50
NOTE 1 NO*x* is the sum of NO and NO_2. Measurement values are given as NO_2. NOTE 2 There is no internationally recognized threshold value provided for ambient PM2,5. The recognized percentage of total PM that is made up of PM2,5 is approximately 15% (for combustion processes without the use of a dust filter technology). NOTE 3 ppmv is parts per million by volume	

4 Noise emissions

Noise emissions from the NSSS shall not pose risks to the health and psychological wellbeing of the user, the sanitation system shall meet the requirements specified. When installed according to the manufacturer's instructions in a test site that meets the requirements of as below:

- Any noise source associated with system operation (such as treatment, evacuation mechanism, or mechanical components), measured at 1 m from the system in shall not exceed an average of 60 dBA (*L*EX,24h) over the course of 24 h,
- And shall not at any time exceed 85 dBA (*L*pA, max) during testing.

NOTE 1: *L*EX, 24 h represents daily system noise levels, equivalent to the system noise level averaged over a period of 24 h.

NOTE 2: *L*pA, max represents the maximum A-weighted sound pressure level.

NOTES

SECTION E

Concluding Remarks

1. Benefits of identical adoption of the standard

- Engage directly in markets that have identically adopted ISO 30500
- Abide by agreed-upon human and environmental safety standards recommended by global experts
- Rely on ISO review of ISO 30500 every 5 years (save time and money)
- Contribute to UN SDGs: 1, 3, 4, 5, 6, 8 , 9, 10, 11, 14, 15
- Already identically adopted by:

2. The benefits of adopting SANS/ISO 30500 Standard

- Saves on Cost of building new infrastructure and maintaining existing infrastructure
- Off-sets the cost for new sewers
- The adoption of the standard can act as a catalyst for industrialisation of sanitation in South Africa
- Potential to create new jobs and contribute to the GDP
- Market space for innovative and sustainable alternatives to existing sanitation solutions
- Mass production will make the NSSS affordable and sustainable alternative solutions
- Not only a business investment, it is a social wellness and improved health investment
- For every US$ invested in Sanitation, there is a return of 5.5US$ in lower health costs, increased productivity and fewer premature deaths (WHO, 2012)
- Worldwide cost of poor sanitation nearly $223 billion in 2015 (Oxford Economics)

3. Constraints

- Cost for certification – mechanism for funding it
- No laboratory capacity for SANS/ISO:30500 in place yet – need to develop mechanisms and regulatory framework

- No defined framework yet on how to achieve the certification fast and benefit from it in the best possible way

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