INTERNATIONAL STANDARD

ISO 24525

First edition
2022-11

Drinking water, wastewater and stormwater systems and services — Operation and maintenance of on-site domestic wastewater services

Systèmes et services relatifs à l'eau potable, à l'assainissement et à la gestion des eaux pluviales — Fonctionnement et maintenance des services d'eaux usées domestiques sur site

Reference number
ISO 24525:2022(E)

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

Page

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 224, *Drinking water, wastewater and stormwater systems and services*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

0.1 Operation and maintenance

Operation and maintenance (O&M) activities encompass all decisions and actions needed for controlling and maintaining the facilities of an on-site domestic wastewater system (ODWS) to achieve the system's objectives and to ensure the system meets regulatory requirements.

O&M is essential to the long-term performance of ODWS. All system components require regular or routine maintenance when in operation.

O&M service visits can provide early detection of issues that could result in malfunction of ODWS if left uncorrected. Early detection makes it possible to take action before a system becomes a public health hazard, detrimental to the environment or a liability for the property owner.

Operation includes activities taken in the course of normal functioning, such as control of equipment and inspections. Maintenance includes all preventive and corrective work required to ensure that equipment continues to work efficiently and to keep civil works, buildings and the other facilities in an adequate state. Removal of wastewater and sludge (also referred to as septage) is an essential activity to ensure the proper functioning of ODWS and, depending upon the local context, can be regarded either as operation or maintenance.

This document takes into consideration that each system can have different requirements for inspection and maintenance. Therefore, an understanding of the particular design and operational parameters is essential to ensure the O&M is carried out within the applicable regulatory context.

0.2 Global perspective

WHO/UNICEF estimates in *Progress on Drinking Water, Sanitation and Hygiene*[5] indicate that at the time of the report 2,3 billion people lacked access to "improved sanitation". Of these, 892 million people worldwide still practised open defecation.

Globally, the management of wastewater facilities continues to face dramatic challenges requiring innovative solutions caused by the increasing demand for services, diminishing resources, rising service expectations of customers, climate change impacts and increasingly stringent regulatory requirements.

ODWS are prevalent in all countries and are, in general, managed by owner-operators or community-operators, i.e. by the users who are the residents singly or collectively on the property where the unit or infrastructure is installed. In some cases, ODWS can also be managed by public or private operators rather than the owners of the properties.

However, when ODWS are managed by owner-operators or community-operators, it is observed that the associated facilities are often not properly managed, causing health hazards and pollution into the surrounding environment. This is often due to lack of knowledge or resources. Therefore, it is important to train expert operators and establish an O&M management system.

In some countries, maintenance workers are required by law to hold a specified qualification, which can also stipulate the frequency and content of the maintenance operations.

In developing countries and regions, there are many examples of advanced decentralized wastewater treatment facilities installed in commercial facilities, hotels and hospitals. However, it is a common issue that maintenance guidelines and regulations, which the owners and users of these facilities need to comply with, are insufficiently developed. It needs to be kept in mind that the development of such guidelines and regulations based on this document can bring numerous benefits.

0.3 General objectives

ISO 24521 addresses O&M from a management perspective, i.e. that they should be performed and monitored, but does not provide detailed technical instructions of operational and maintenance activities suitable for and appropriate to such systems.

This document addresses in practical terms the essential O&M activities managed by owner-operators, community-operators or other operators, consolidating the basic technical dos and don'ts for O&M.

This document is primarily intended as an aid for responsible entities when developing guidelines and regulations on O&M that are to be followed by owners, users or operators of ODWS.

Drinking water, wastewater and stormwater systems and services — Operation and maintenance of on-site domestic wastewater services

1 Scope

This document provides guidance and specifications for the operation and maintenance (O&M) of on-site domestic wastewater services, using appropriate technologies at any level of development. This document supplements and is intended to be used in conjunction with ISO 24513 and ISO 24521.

This document provides assistance to relevant authorities, training organizations, certification bodies and other responsible entities for the development of regulations, plans and manuals, as well as information and training materials addressed to operators and users of on-site domestic wastewater systems (ODWS).

This document is applicable to both publicly and privately operated on-site domestic wastewater (blackwater and greywater) systems for one or more dwellings or other premises where wastewater is generated.

The scope of this document includes the following:

— O&M of ODWS from the operator's perspective;

— O&M of ODWS from the user's perspective;

— training and information aspects;

— environmental, health and safety issues.

The following are outside the scope of this document:

— detailed design of ODWS;

— limits of acceptability for discharge of wastewater or sludge;

— analytical methods;

— management structure of wastewater services' activities for O&M;

— content of contracts or subcontracts.

NOTE 1 Management of ODWS, especially in rural areas and areas under development, is sometimes provided by the owners of the premises where wastewater is generated. In such cases, the owners of the premises carry out the management themselves. In this document, the term "services" includes "self-services" provided by the owners or users of the premises.

NOTE 2 Especially in undeveloped areas, sanitary wastewater is collected in an undiluted form. Sources of sanitary wastewater in this document are domestic, excluding stormwater runoff.

NOTE 3 The designation of activities as operation activities or maintenance activities can differ according to the local context. However, it is important that activities essential for the proper functioning of ODWS are carried out, no matter how these activities are designated.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 24513, *Service activities relating to drinking water supply, wastewater and stormwater systems — Vocabulary*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 24513 and the following apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
back flushing
pumping water into a septic or holding tank to agitate and release solids from the sides and bottom of the tank

3.2
blackwater
black water
wastewater originating from sanitary sources (e.g. toilets, urinals and bidets)

Note 1 to entry: Wastewater from kitchen sinks, food waste grinders or dishwashers can be included, subject to local requirements.

[SOURCE: ISO 20670:2018, 3.10 — definition modified and note to entry added.]

3.3
effluent
wastewater that has been processed through a primary treatment (e.g. settlement unit, septic tank) or a secondary treatment (e.g. wastewater treatment plant)

Note 1 to entry: In the context of wastewater treatment plants, effluent that has been treated is sometimes called secondary effluent or treated effluent.

3.4
soil treatment dispersal area
area where wastewater is distributed through a series of pipes or channels into the soil

3.5
treatment field
soil treatment component of on-site domestic wastewater services

Note 1 to entry: Also referred to as absorption, dispersal, leaching or drainage field.

4 On-site domestic wastewater systems

4.1 General

On-site domestic wastewater systems (ODWS) are widely used throughout the world to treat, dispose of, disperse or reuse domestic wastewater in areas where centralized sewerage systems are not viable or currently not available.

The main objective of an ODWS is to protect public health and the environment.

Any wastewater or effluent entering the groundwater table risks causing severe illness in those who ingest the contaminated water.

High nitrogen and phosphorous loads can enter surface water bodies, causing excess nutrification. This oversupply of nutrients can cause algal blooms or eutrophication, reducing the available oxygen in the water body and causing aquatic life to die off. Algal blooms can also produce toxins that can make the water unsafe for use.

The process of collecting and treating domestic wastewater provides for a reduction in pathogen and bacteria loads, reduction or removal of chemical pollutants, as well as organics, suspended solids (SS) and other contaminants prior to discharge.

ODWS can protect the environment by retaining highly concentrated nutrients (e.g. phosphate, nitrogen). Retention of these resources limits eutrophication and reduces the reliance on alternative sources which are limited (e.g. phosphate) and/or costly (e.g. nitrogen). In addition, disinfection can be used before discharge for more efficient reduction in pathogens (refer also to Annex G).

Proper design, installation and O&M of ODWS are critical to reduce public health issues and/or environmental degradation due to wastewater and effluent. O&M is essential to the long-term performance of ODWS technologies. All system components require regular maintenance. O&M service visits can provide early detection of problems that could result in malfunction of ODWS if not discovered. Early detection makes it possible to take remedial action before a system becomes a public health hazard, a detriment to the environment or a liability for the owner or operator. In order to ensure optimum functionality of an ODWS, any issues should be addressed or faulty components repaired as soon as they are identified.

4.2 Description

An ODWS is a self-contained system designed to store, treat and discharge, disperse or reuse wastewater. An ODWS can serve one or more homes or other premises and is usually situated on the same site as the premise or premises it serves and is not connected to a centralized or public sewer system. Cluster wastewater treatment systems are ODWS that serve two or more premises. Cluster systems serving a small number of premises are also referred to as "shared" systems.

An ODWS can be as simple as a privy or more complex, such as a septic system, an aerobic or anaerobic treatment system or similar systems with or without a soil treatment dispersal area.

Some ODWS are designed, installed and operated to treat wastewater prior to discharge, dispersal or reuse. They are also designed to collect sludge in a safe way and to enable the safe removal of sludge for transport and appropriate further handling. The proper design, installation and O&M of an ODWS are fundamental to ensure system performance and longevity while protecting public health and the environment.

The design process involves:

— comprehensive site and soil evaluation, soil testing;

— assessment of the facility or residential occupancy and use;

— knowledge of the raw wastewater characteristics;

— consideration of effluent quality required by relevant discharge standards;

— wastewater flow rates and volume.

Siting the ODWS requires consideration of the location of other utilities, including wells and any other water sources or water bodies adjacent to or on the property being served. ODWS require adequate vertical and horizontal separation from water tables, water sources and water courses in order to protect the environment as required by the relevant authority. They should also ensure that wastewater

and effluent are controlled and dispersed in such a way as to limit contact with humans and domestic animals in order to prevent potential health hazards.

4.3 Components

ODWS can consist of the following components:

— user interface;

— collection;

— removal and transportation;

— treatment;

— disposal, dispersal or reuse.

Further information regarding ODWS components is available in ISO 24521.

4.4 Types

4.4.1 General

On-site domestic wastewater systems (ODWS) vary from basic to advanced technologies and can achieve various levels of treatment, ranging from basic storage to tertiary wastewater treatment.

On-site treatment can be performed either by aerobic or anaerobic processes. These systems can consist of a single treatment unit or a treatment system using a combination of several units, both with an effluent discharge process.

4.4.2 Basic ODWS

The storage of a basic ODWS can consist of a collection unit or holding tank that stores excreta or wastewater, which can be collected at fixed intervals at the place of generation and transported to a dedicated facility, where it is further treated and disposed of. Some of the most basic technologies commonly used for ODWS include improved traditional latrines, ventilated improved pit (VIP) latrines, double-vault compost latrines, bored-hole latrines, pour-flush latrines and holding tanks.

Basic treatment systems can consist of a septic tank (solid-liquid separation process) at the place of generation with the effluent discharging to the environment, either to the soil or to surface water (where allowed). The types of basic ODWS shown in Figure 1 do not describe all options for every user, community or site. The examples provide a range of basic ODWS for different conditions, which can offer solutions to the largest number of users and comply with public health, socioeconomic and environmental requirements.

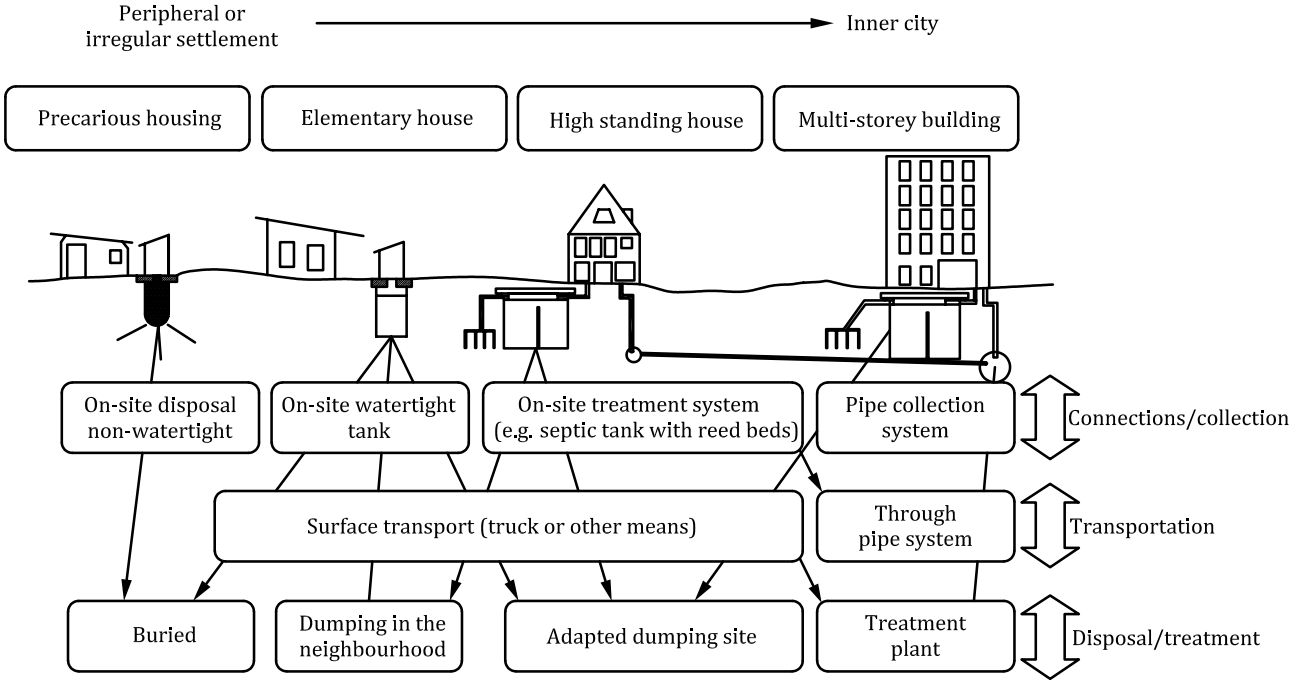

Figure 1 — Overview of components of wastewater systems

4.4.3 Alternative ODWS

Alternative ODWS is a general term for wastewater treatment systems using an aerobic or anaerobic treatment process that is different from basic ODWS. The term alternative ODWS encompasses a broad range of technologies that vary widely in treatment performance and space requirements, referring to a complete treatment system or just one component within a system.

The introduction of alternative ODWS can improve the occupational safety of workers, public health and the protection of the environment.

Alternative anaerobic systems can include reuse systems, such as anaerobic digesters, anaerobic filters and anaerobic baffled reactors, which can encourage investment in sanitation and be a response to issues in some countries. Most of them allow the use of biogas as cooking gas, for lighting or for the generation of electricity and, where culturally and legally accepted, digested sludge can be used as fertilizer following additional treatment.

Sludge from ODWS can be used as a fertilizer on land while treated greywater or wastewater can be used to flush toilets and for irrigation.

Alternative treatment processes can include aerobic treatment systems, such as media filters, membrane bioreactors, aerobic treatment units (ATUs), constructed wetlands and similar systems. The treatment capabilities vary among these processes. Consideration should be given to the desired outcomes.

The use of alternative treatment processes can be necessary when the site conditions of the native soil do not facilitate complete wastewater treatment. Secondary treatment removes the contaminants of concern and facilitates usage of the site for removal of the remaining contaminants from the effluent. Alternative on-site wastewater treatment systems typically utilize a separate treatment device after the pre-treatment tank followed by a soil treatment dispersal area (field or seepage bed).

Where discharge into surface water bodies is permitted, the use of alternative systems is advisable to ensure good water quality. Treatment processes utilizing an effective disinfection process do not necessarily require a treatment field and the treated effluent can potentially be reused.

NOTE This supports target 6.3 of the UN Sustainable Development Goals: "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", especially regarding indicator 6.3.2, "Proportion of bodies of water with good ambient water quality." (https://sdgs.un.org/goals/goal6).

5 Aspects of preparation and implementation relating to operation and maintenance

5.1 General

In order to ensure efficient and cost-effective O&M of ODWS it is necessary to consider the prerequisites and requirements of O&M when preparing and implementing ODWS.

Aspects of preparation and implementation relating to O&M include:

— design aspects;

— manufacturing aspects;

— construction and installation aspects;

— aspects relating to existing systems.

In addition, the management organization for O&M of ODWS should be taken into consideration. Examples of management models are presented in Annex A.

5.2 Design aspects

The correct design of an ODWS is necessary to ensure effective performance, longevity and protection of public health and the environment. ODWS need to be designed so that their effluent conforms with the water quality required by effluent discharge standards.

The design needs to pay attention to O&M aspects, including:

— ease and safety of O&M and their costs;

— accessibility for wastewater or sludge pumping and maintenance activities;

— septic tank, holding tank or another container located to ensure that vacuum trucks have ready access for servicing, for example near a roadway or driveway.

Prior to construction, drawings of the site and system should be prepared. It is recommended that these documents include a materials list and information on the site (including location of drinking water sources and drinking water pipelines) and soil analysis that was performed. As-built drawings and documentation should be provided to enable proper O&M.

Additional information on design aspects is given in Annex B.1.

5.3 Manufacturing aspects

Prefabricated ODWS shall perform for the design purpose and be produced uniformly. It is recommended that certified products are introduced and a testing or certification system established for the products where none exists. Regulations can exist regarding the use of uncertified products.

Additional information on manufacturing aspects is given in Annex B.2.

5.4 Construction and installation aspects

An ODWS shall be constructed and installed according to the design drawings or the instructions of the manufacturer. As-built drawings and documentation should be provided.

It is important that an ODWS (either comprising individual components or a packaged plant) be installed for proper and easy operation and regular maintenance.

After completion of construction and installation, the ODWS and its components shall be checked for proper functioning.

Additional information on construction and installation aspects is given in Annex B.3.

5.5 Aspects relating to existing systems

The location and identification of existing systems is important for persons not familiar with ODWS who newly arrive in areas not served by a centralized or public sewer system.

In those regions with consistent recordkeeping practices, copies of the ODWS design and its components are usually available from the local regulatory authorities. In some cases, inspectors and service providers do not have information on existing systems. If no information is available, it will be necessary to locate and identify an ODWS locally. Modern systems have covers for servicing that are visible and accessible at-grade; however, older systems can have all their covers and components buried. The following actions are strongly recommended:

— modify the structure of existing facilities to enable easy access;

— prohibit the new installation of ODWS that cannot be accessed or are difficult to access for maintenance.

In some countries, components of the system are buried under houses, decks or other structures. In such cases, locating the components is a difficult task, particularly as records of the ODWS are often missing. This can require the use of professional services.

Equipment is available to locate the ODWS using cameras or ground-probing equipment. The system can usually be located most simply by following the plumbing piping as it exits the building. The immediate area along the route of the pipe can be carefully checked by probing the surface with appropriate tools until a component of the system (such as the septic tank) is located. This area can then be excavated by digging to expose the top of the unit and therefore the lid of the access opening. Care should be taken not to damage pipes and other underground infrastructure.

Soil treatment or dispersal areas can be more difficult to locate as they can be many metres away from the other system components. Failing areas can be located by visible ponding or saturation at the surface or by the appearance of brighter green vegetation over the soil treatment dispersal area, as effluent rising to the surface brings nitrogen to the root zone.

6 Operation

6.1 General

Operation refers to the activities involved in the actual delivery of services. Operational plans should define the sequences of all essential operations required for the systems to collect, transport and treat the domestic wastewater and sludge properly. Clear operational procedures together with written, figurative and visual instructions are important to ensure the proper implementation of individual activities.