INTERNATIONAL STANDARD

ISO 16075-4

Second edition
2021-05

Guidelines for treated wastewater use for irrigation projects —

Part 4: **Monitoring**

Lignes directrices pour l'utilisation des eaux usées traitées en irrigation —

Partie 4: Surveillance

Reference number
ISO 16075-4:2021(E)

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Published in Switzerland

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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 282, *Water reuse*, Subcommittee SC 1, *Treated wastewater reuse for irrigation*.

This second edition cancels and replaces the first edition (ISO 16075-4:2016), which has been technically revised.

The main changes compared to the previous edition are as follows:

— editorial update.

A list of all parts in the ISO 16075 series can be found on the ISO website.

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.

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Introduction

The increasing water scarcity and water pollution control efforts in many countries have made treated municipal and industrial wastewater a suitable economic means of augmenting the existing water supply, especially when compared to expensive alternatives such as desalination or the development of new water sources involving dams and reservoirs. Water reuse makes it possible to close the water cycle at a point closer to cities by producing "new water" from municipal wastewater and reducing wastewater discharge to the environment. The reuse of treated wastewater could be also a beneficial solution to improve water body's quality, such as for example avoiding wastewater treatment plants discharge upstream sensitive areas (shellfish aquaculture area, swimming area).

An important new concept in water reuse is the "fit-to-purpose" approach, which entails the production of reclaimed water quality that meets the needs of the intended end-users. In the situation of reclaimed water for irrigation, the reclaimed water quality can induce an adaptation of the type of plant grown. Thus, the intended water reuse applications should govern the degree of wastewater treatment required, and inversely, the reliability of wastewater reclamation processes and operation.

Treated wastewater (TWW, also referred to as reclaimed water or recycled water) can be used for various non-potable purposes. The dominant applications for the use of TWW include agricultural irrigation, landscape irrigation, industrial reuse and groundwater recharge. More recent and rapidly growing applications are for various urban uses, recreational and environmental uses and indirect and direct potable reuse.

Agricultural irrigation was, is and will likely remain the largest TWW consumer with recognized benefits and contribution to food security. Urban water recycling, in particular landscape irrigation, is characterized by fast development and will play a crucial role for the sustainability of cities in the future, including energy footprint reduction, human well-being and environmental restoration.

The suitability of TWW for a given type of reuse depends on the compatibility between the wastewater availability (volume) and water irrigation demand throughout the year, as well as on the water quality and the specific use requirements. Water reuse for irrigation can convey some risks for health and environment, depending on the water quality, the irrigation water application method, the soil characteristics, the climate conditions and the agronomic practices. Consequently, public health and potential agronomic and environmental adverse impacts need to be considered as priority elements in the successful development of water reuse projects for irrigation. To prevent such potential adverse impacts, the development and application of international guidelines for the reuse of TWW is essential.

The main water quality factors that determine the suitability of TWW for irrigation are pathogen content, salinity, sodicity, specific ion toxicity, other chemical elements and nutrients. Local health authorities are responsible for establishing water quality threshold values depending on authorized uses and they are also responsible for defining practices to ensure health and environmental protection taking in account local specificities.

From an agronomic point of view, the main limitation in using TWW for irrigation arises from its quality. Treated wastewater, unlike water supplied for domestic and industrial purposes contains higher concentrations of inorganic suspended and dissolved materials (total soluble salts, sodium, chloride, boron, heavy metals), which can damage the soil and irrigated crops. As dissolved salts are not removed by conventional wastewater treatment technologies and appropriate good management, agronomic and irrigation practices should be used to avoid or minimize potential negative impacts.

The presence of nutrients (nitrogen, phosphorus and potassium) can become an advantage due to possible saving in fertilizers. However, the amount of nutrients provided by TWW along the irrigation period is not necessarily synchronized with crop requirements, and the availability of nutrients depends on the chemical forms.

This document provides guidance for healthy, hydrological, environmental and good operation, monitoring and maintenance of water reuse projects for unrestricted and restricted irrigation of agricultural crops, gardens and landscape areas using treated wastewater. The quality of supplied

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TWW should reflect the possible uses according to crop sensitivity (health-wise and agronomy-wise), water sources (the hydrologic sensitivity of the project area), the soil and climate conditions.

This document refers to factors involved in water reuse projects for irrigation regardless of size, location and complexity. It is applicable to intended uses of TWW in a given project, even if such uses will change during the project's lifetime; as a result of changes in the project itself or in the applicable legislation.

The key factors in assuring the health, environmental and safety of water reuse projects in irrigation are:

— adequate monitoring of TWW quality to ensure the system functions as planned and designed;

— design and maintenance instructions of the irrigation systems to ensure their proper long-term operation;

— compatibility between the TWW quality, the distribution method and the intended soil and crops to ensure a viable use of the soil and undamaged crop growth;

— compatibility between the TWW quality and its use to prevent or minimize possible contamination of groundwater or surface water sources.

This document is not intended to prevent the creation of more specific standards or guides which are better adapted to specific regions, countries, areas, or organizations. If such documents are published, it is recommended to reference this document to ensure uniformity throughout the treated wastewater use community.

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Guidelines for treated wastewater use for irrigation projects —

Part 4: Monitoring

1 Scope

This document provides recommendations regarding:

— monitoring the quality of treated wastewater (TWW) for irrigation;

— monitoring irrigated plants;

— monitoring the soil with regard to salinity;

— monitoring natural water sources in neighbouring environments;

— monitoring the quality of water in storage reservoirs.

It puts emphasis on sampling methods and their frequency. Regarding the methods of analysis, this document refers to standard methods or, where not available, to other bibliographical references.

NOTE In cases where a monitoring plan already exists, these recommendations can be integrated into this plan. This is notably the case when a broader approach of risk management is implemented, such as the water safety plans (serving as a model for sanitation safety plans) developed by WHO[16].

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 20670, *Water reuse — Vocabulary*

ISO 16075-1, *Guidelines for treated wastewater use for irrigation projects — Part 1: The basis of a reuse project for irrigation*

3 Terms definitions, and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 20670 and ISO 16075-1 apply.

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

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

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

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