INTERNATIONAL STANDARD

ISO 16075-1

Second edition
2020-11

Guidelines for treated wastewater use for irrigation projects —

Part 1: The basis of a reuse project for irrigation

Lignes directrices pour l'utilisation des eaux usées traitées dans les projets d'irrigation —

Partie 1: Les bases d'un projet de réutilisation pour l'irrigation

Reference number
ISO 16075-1:2020(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).

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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 01, *Treated wastewater use for irrigation*.

This second edition cancels and replaces the first edition (ISO 16075-1:2015), which has been technically revised. The main changes compared to the previous edition are as follows:

— updating the subject of public and private gardens irrigation by treated wastewater (TWW);

— added Annex A (New)- Examples of means to improve TWW quality.

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 option for augmenting the existing water supply, especially when compared to 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.

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 treated wastewater 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.

An important new concept in water reuse is the "fit-for-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 to the type of plant grown. Thus, the intended water reuse applications are to govern the degree of wastewater treatment required and, inversely, the reliability of water reclamation processes and operation.

Agricultural irrigation was, is, and will likely remain the largest reused water consumer with recognized benefits and contribution to food security. Urban water recycling, landscape irrigation in particular, 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 treated wastewater 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, the public health and potential agronomic and environmental adverse impacts are 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 guidelines for the use of treated wastewater is essential.

The main water quality factors that determine the suitability of treated wastewater for irrigation are pathogen content, salinity, sodicity, specific ion toxicity, concentration of heavy metals, 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 into account local specificities.

From an agronomic point of view, the main limitation in using treated wastewater 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 the irrigated crops. Dissolved salts are not removed by conventional wastewater treatment technologies and appropriate good management, agronomic and irrigation practices are intended to 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 treated wastewater along the irrigation period is not necessarily synchronized with crop requirements and the availability of nutrients depends on the chemical forms.

This guideline 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 treated wastewater has to reflect the possible uses according to crop sensitivity (health-wise and

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agronomy-wise), water sources (the hydrologic sensitivity of the project area), the soil, and climate conditions.

This guideline refers to factors involved in water reuse projects for irrigation regardless of size, location, and complexity. It is applicable to intended uses of treated wastewater 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 the following:

— 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 1:
The basis of a reuse project for irrigation

1 Scope

This document contains guidelines for the development and the execution of projects intending to use treated wastewater (TWW) for irrigation and considers the parameters of climate and soil.

The purpose of this document is to provide guidance on all elements of a project using TWW for unrestricted and restricted irrigation, including design, materials, construction, and performance, when used for the following:

— irrigation of agricultural crops;

— irrigation of public and private gardens and landscape areas, including parks, sport fields, golf courses, cemeteries, etc.

These guidelines are intended to provide assistance for the benefit of users of TWW for irrigation. The guidelines relate to the widespread and common ranges of water quality rather than exceptional or unique ones and are intended for the use of professionals, such as irrigation companies (designers and operators), agricultural extension officers or advisors, water companies (designers and operators), local authorities and water utilities. The use of these guidelines by users might require additional specifications.

None of the parts of this document are intended to be used for certification purposes.

These guidelines suggest the parameters of TWW quality. These parameters include the following:

— agronomic parameters: nutrients (nitrogen, phosphorus and potassium), salinity factors (total salt content, chloride, boron, and sodium concentration) and heavy metals' concentration;

— pathogen presence.

Each of these parameters can have possible impacts on the crops, soil, and public health. The guidelines discuss the possibility of preventing the contaminants' addition during wastewater production and the ability to remove them during the course of treatment.

Contaminants of emerging concern (such as pharmaceuticals and personal care product residuals) are outside the scope of this document since up to day, there is no evidence of adverse effects on human health or environment via irrigation with TWW or via the consumption of crops irrigated with TWW.

The project should be designed in accordance with the sanitary quality of the TWW in order to avoid disease transmission by the pathogens in the water.

The use of these guidelines is encouraged to ensure consistency within any organization engaged in the use of treated wastewater.

These guidelines provide the basis for a healthy, hydrological, environmental and agronomic conscious design, operation, monitoring, and maintenance of an irrigation system using treated wastewater.

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