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# Water Reuse in Urban Areas — Guidelines for reclaimed water treatment: Design principles of a RO treatment system of municipal wastewater

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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. www.iso.org/directives

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For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

This document was prepared by Technical Committee ISO/TC 282, *Water reuse*, Subcommittee SC 2, *Water reuse in urban areas*.

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

Over the past decade, with an increasing demand of high-quality reclaimed water, reverse osmosis (RO) has been widely applied as an important option for municipal wastewater reclamation. RO is a water purification technology that uses a semipermeable membrane to remove ions and dissolved organic micropollutants from feed water. In reverse osmosis, an applied pressure is used to overcome osmotic pressure, a colligative property that is driven by chemical potential differences of the solvent, a thermodynamic parameter. The automatic operation, small footprint and consistent high permeate quality are the advantages of an RO process, which make it widely recognized. The reclaimed water produced by an RO system could be used as boiler replenishing water, water for industrial production and so on.

Compared with seawater and industrial wastewater, municipal wastewater has its distinctive features. The total dissolved solid (TDS) concentration in seawater is mainly in the range of 30,000 to 45,000 mg/l[1], while the TDS concentration in secondary effluent of municipal wastewater ranges from 100 to 3,000 mg/l[2]. Thus, the RO system of municipal wastewater could achieve higher recovery efficiency with much lower operational pressure compared with that of seawater. However, the dissolved organic matter (DOM) concentration in secondary effluent is in the range of 5 to 20 mg/l as dissolve organic carbon (DOC)[2], which is much higher than that in seawater (<2 mg/l)[1]. Furthermore, the components of the DOM in secondary effluent are much more complicated than those in seawater. Long-term operation of the RO system for municipal wastewater reclamation could lead to serious organic and biological fouling. Therefore, in order to provide the stable operation, the distinctive features of municipal wastewater should be taken into consideration in the design of the RO unit as well as the pre-treatment unit. The design experience of the RO system for other water sources (e.g., seawater and industrial wastewater) could not be applied directly to municipal wastewater.

This document provides guidelines for the planning and design of an RO treatment system for water reuse applications in urban areas. This document is applicable to practitioners and regulatory authorities who intend to implement principles and decisions on water reuse in a safe, reliable and sustainable manner.

This document addresses an RO treatment system in its entirety (e.g. reclaimed water sources, pre-treatment process, RO treatment process, post treatment process, performance of RO system, operation and maintenance and monitoring, usage of reclaimed water).

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# Water Reuse in Urban Areas — Guidelines for reclaimed water treatment: Design principles of a RO treatment system of municipal wastewater

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## 1 Scope

This document provides guidelines for the planning and design of a reverse osmosis (RO) treatment system of municipal wastewater. This document is applicable to practitioners and authorities who intend to implement principles and decisions on RO treatment of municipal wastewater in a safe, reliable and sustainable manner. This document addresses RO treatment systems of municipal wastewater in their entirety and is applicable to any RO treatment system component.

This document provides:

— standard terms and definitions;

— a description of the system components of an RO treatment system of municipal wastewater;

— design principles of an RO treatment system of municipal wastewater;

— statements on the feed water quality and technical requirements of an RO treatment system;

— guidance for operation and maintenance of an RO treatment system;

— specific aspects for consideration and emergency response.

Design parameters and regulatory values of an RO treatment system of municipal wastewater are out of the scope of this document.

## 2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 20670:2018, *Water reuse — Vocabulary*

## 3 Terms and definitions

For the purpose of this document, the terms and definitions given in ISO 20670 and the following 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 https://www.electropedia.org/

**3.1**
**assimilable organic carbon (AOC)**
organic carbon which can be used by microorganisms for assimilation

**3.2**
**biodegradable dissolved organic carbon (BDOC)**
organic carbon which can be used by microorganisms for assimilation as well as catabolism

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