FINAL DRAFT
International Standard

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Smart water management —

Part 2: Data management guidelines

Gestion intelligente de l'eau —

Partie 2: Lignes directrices pour la gestion des données

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Foreword

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

A list of all parts in the ISO 24591 series can be found on the ISO website.

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Introduction

To better manage the entire life cycle of water systems, water system owners and operators continually improve operational efficiency, reduce costs and communicate to stakeholders or other systems. In addition, they address safety, regulatory and public authority requirements. One effective approach to achieving these goals is to take advantage of data generated by water systems.

Information-sharing facilities and models established based on these data can provide optimal solutions for the owner or operator of the water systems to meet stakeholder demand for, e.g. drinking water production, transmission and distribution, asset management, risk management, wastewater collection and sanitation, stormwater management and water resource protection. Over the past few years, advances in digital technologies have enhanced the capabilities of data generation; meanwhile, data-processing capacities have also significantly improved.

With the rapid development of new digital technologies, the data generated from water systems are increasing drastically. This “data explosion” has enabled the delivery of new services that:

— increase the operational efficiency of assets and networks;

— reduce or optimize capital expenditures and operating expenses;

— allow better anticipation and assessment of risks;

— enable a smaller environmental footprint;

— enhance regulatory compliance;

— support oversight and substantive accountability to local or national stakeholders;

— improve the level of service to water system customers.

However, large-scale data also dramatically increase the requirements on data storage and data transfer facilities. In addition, it is important to ensure that large-scale data do not result in negative impacts on the environment. Therefore, data management is a challenge for water system owners and operators.

To ensure that the data and information generated by water systems produce maximal values, proper data management approaches should be applied in organizations that work with water systems, e.g. using consistent nomenclature, specifying ownership rules, performing data validation and applying standardization and normalization.

Smart water management —

Part 2:
Data management guidelines

1 Scope

This document provides a general foundation for data management in services, systems and facilities related to drinking water, wastewater and stormwater. It emphasizes data as an asset and introduces basic rules for efficient data acquisition, storage and processing. It aims to help water system owners and operators manage water facilities more efficiently based on large-scale data.

The following aspects are within the scope of this document:

— management of data as an asset in water systems;

— data management principles and guidelines;

— people organization in relation to data management.

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
data
set of values of qualitative or quantitative variables

[SOURCE: ISO 21378:2019, 3.1]

3.2
artificial intelligence
AI
branch of computer science devoted to developing *data* (3.1) processing systems that perform functions normally associated with human intelligence, such as reasoning, learning and self-improvement

[SOURCE: ISO/IEC/IEEE 24765:2017, 3.234]

3.3
Internet of Things
IoT
infrastructure of interconnected entities, people, systems and information resources, together with services, which processes and reacts to information from the physical and virtual world

[SOURCE: ISO/IEC 20924:2021, 3.2.4]

3.4
data flow
movement of *data* (3.1) through the active parts of a data processing system in the course of the performance of specific work

[SOURCE: ISO/IEC 2382:2015, 2121825, modified — Notes to entry removed.]

3.5
privacy
right of individuals to control or influence what information related to them may be collected and stored and by whom that information may be disclosed

[SOURCE: ISO/IEC TR 26927:2011, 3.34]

3.6
digital twin
digital asset on which services can be performed that provide value to an organization

Note 1 to entry: The descriptions comprising the digital twin can include properties of the described asset, industrial *Internet of Things* (3.3), collected data, simulated or real behaviour patterns, processes that use it, software that operates on it, and other types of information.

Note 2 to entry: The services can include simulation, analytics such as diagnostics or prognostics, recording of provenance and service history.

[SOURCE: ISO/TS 18101-1:2019, 3.9, modified — Example removed.]

3.7
data governance
property or ability that needs to be coordinated and implemented by a set of activities aimed to design, implement and monitor a strategic plan for *data asset* (3.10) management

Note 1 to entry: More information on data governance can be found in ISO/IEC 38505-1.

Note 2 to entry: A strategic plan for data asset management is a document specifying how *data management* (3.8) is to be aligned to the organizational strategy. This term has the same meaning as strategic asset management plan defined in ISO 55000 with a data point of view.

[SOURCE: ISO/IEC 20547-3:2020, 3.7, modified — Note 1 to entry revised, Note 2 to entry removed and Note 3 to entry given as Note 2 to entry.]

3.8
data management
process of keeping track of all *data* (3.1) and/or information related to the creation, production, distribution, storage and use of e-media and associated processes

[SOURCE: ISO 20294:2018, 3.5.4]

3.9
data quality
degree to which a set of inherent characteristics of *data* (3.1) fulfils requirements

[SOURCE: ISO 8000-2:2022, 3.8.1, modified — Note 1 to entry removed.]

3.10
data asset
set of *data* (3.1) items, or data entities, that have a real or potential benefit for an organization

4 Data as an asset

4.1 General

Effective use of data can create significant value. Therefore, data should be considered as an intangible asset which should be managed in a manner consistent with the principles of ISO 55001 to maximize the value to the organization.

Although data acquisition, storage and display devices are physical assets, data is immaterial and can be easily copied, modified or corrupted. As a consequence, data should be effectively stored, maintained and protected to prevent the following:

— misinformed decisions with potential social, environmental and economic impact;

— misinterpretation of asset behaviour and misalignment of asset maintenance timing with actual needs;

— an inability to effectively harness benefits from automation or other digital technologies.

Before implementing a process of data collection, the requirements for this data should be clearly stated (e.g. precision, timestep, freshness, storage duration, environmental impact). It is recommended that only the necessary data is collected and stored.

Data flows with no use case should be avoided. A good practice is to pre-process the data close to the data source before generating new data flows and storing the data.

The data life cycle should also be considered. The end-of-life data should be destroyed properly. Retention time of collected data should be considered in order to organize data destruction when required.

For water systems, the same data asset can be required by different stakeholders. One effective practice to deal with this situation is to catalogue and share data, which will prevent other stakeholders from organizing and capturing the same data again. Cataloguing data is a way to inform stakeholders that the data is available without needing to share it automatically.

4.2 Data quality

High-quality data can improve production efficiency and drive the company's business to a higher level. The information about the quality of the data is valuable for making decisions on the practical application of the data. For water systems, high-quality data is beneficial for enhancing system performance, reducing operational costs and making strategic decisions. Therefore, data quality in smart water systems should be analysed and measured.

Data quality control is part of data governance. According to the application practice, the requirements of data quality control should be assessed and the procedures to implement data quality assessment should be defined and applied. The data quality control and validation process can be conducted automatically or manually. Figure 1 shows an illustration of a data quality check process.

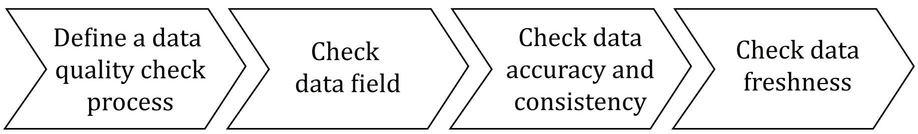

Figure 1 — Example of a data quality check process

The consistency of the data compared with other values of the time series or consistency with other related parameters should also be checked.

During the data quality check process, experts can also be consulted to confirm the validity of the data.

Before data is used in engineering or management practices, quality checks should be performed based on the quality requirements and the defined data quality check procedures. According to the quality check results, proper data quality filtration or data processing methods should be applied to the downstream analysis and applications.

5 Data management

5.1 General

Data management rules and data governance should be defined and implemented across the organization from top management to field operations, with active involvement from the senior management team. This also means setting a clear data strategy with regular reviews and action plans. Clear rules should be implemented across the organization to ensure data accuracy and consistency, data validation and curation, and data integrity and security. Some rules are given in 5.4.

The data flow should be monitored and maintained for the different users of the data (humans or machines).

5.2 Data governance

Digital technologies can be applied in all entities of water companies or organizations and the data generated by these digital technologies are important assets. Therefore, a strategy should be defined at the top level of the organization (e.g. executive committee). Someone can be appointed to be responsible for this, such as a chief data officer (CDO). This person can interact with all departments of the organization, including the information technology (IT) department, to implement the data governance strategy. More information about people organization can be found in Clause 6.

Data governance of smart water systems should be consistent with the overall data governance of the organization. Effective data governance is necessary to ensure that data ownership is clear and the data management strategies are consistent across all departments of the organization. The key aspects of data governance are as follows:

— Data ownership: the definition of ownership roles should start with the appointment of a manager to take accountability within the organization for the accuracy, quality and management of the data. Based on this, other roles for data accountability can be defined.

— Data strategy: the data strategy should outline the policies and guidelines for all aspects of data management in the organization, from data generation to disposal. The protocols for regular review of the data strategy should also be established.

— Data rules: clear rules, supporting the data strategy, should be defined to ensure data accuracy, consistency, validation, curation, integrity and security. Examples of these rules are provided in 5.4.

5.3 Data value chain

Effective data management is an essential element for extracting maximum value from the data. To make the value extraction process more effective, data management should be implemented at all levels of the organization.

For a smart water management organization, data collected by different sectors should be made accessible to other sectors when necessary, and aggregated data should be made available to administrative sectors. It is important to ensure data security is checked during the data access process.

The data collected locally can be used spatiotemporally at the collection site and at upper levels of consolidation for real-time calculation or data analysis spanning various time frames. It can also be processed (possibly combined with data from other sources) and potentially used under different spatiotemporal scenarios. Data value can be augmented with data transfer and data transformation to fit different use cases (see Figure 2).