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Industrial wastewater classification

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Foreword

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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 4, *Industrial water reuse*.

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

Industrial wastewater is produced by many kinds of industries. In some parts of the world, climate change is putting water resources under stress. Treatment of industrial wastewater provides an opportunity for resource recovery, which can help to drought-proof ongoing operations. Reclaiming and reusing industrial wastewater reduces demands on limited freshwater resources, as well as the amount of wastewater and the associated contaminants that are released to the environment. How to process and reuse industrial wastewater efficiently is a great challenge as wastewater characteristics are as complex and varied as the industries that produce these waste-streams. Industrial wastewater contains a wide range of inorganic and complex organic contaminants, with various concentrations and almost as wide a range of potential physical, chemical and biological treatment processes and has specific treated water quality required for reuse. A clear ISO industrial wastewater classification and coding system is needed to assist both industry and government to record the information of wastewater (including industrial type and water quality parameter) and provide some information on identifying best available control technologies and treatment performance capabilities in order to establish reasonable expectations and facilitate the development of universal wastewater treatment technologies in industrial reuse, and promote the information communication during commercial trade, for example, bidding, consultation, and so on.

The industrial wastewater classification system described in this document covers the basic and most important information required to properly characterize industrial process waste-streams to quickly determine the requirement of the appropriate treatment or reuse technology options for specific industries, reduce operating costs for enterprises, and ultimately promote the systematic development of process water treatment and reuse technologies for industrial application. For the government and large corporations, a more important usage of the classification and coding system is to help them with establishment and improvement of standards concerning discharge and reuse of industrial wastewater.

This document provides a wastewater classification framework and coding system, along with a water quality parameter list. The usages of the classification and coding system facing different users, namely the entrepreneur or the government, are provided in Annex A. It is intended that this classification system will help to promote understanding between different business parties, governments, to collaboratively develop wastewater treatment and reuse technologies among different countries, improve the efficiency of industrial wastewater reuse, and save and protect environment. Due to the similar nature, it may also apply for the wastewater treatment concerning discharge.

Industrial wastewater classification

1 Scope

This document specifies the principles, categories, and codes for the classification of industrial wastewater and is applicable to all types and sources of industrial wastewater. It provides a broad framework classifying industrial wastewater into different categories based on industry type and the associated water quality constituents, namely physical, chemical and biological characteristics with a specific code assigned based on both industry type and waste-stream classification.

2 Normative references

There are no normative references in this document.

3 Terms, definitions and abbreviated terms

For the purposes of this document, the following terms and definitions apply.

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

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

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

3.1 Terms and definitions

3.1.1
biochemical oxygen demand
BOD
mass concentration of dissolved oxygen consumed under specified conditions by the aerobic biological oxidation of a chemical compound or organic matter in water

Note 1 to entry: BOD_5: Degradation time = 5 days; Temperature = 20 °C.

[SOURCE: ISO 9408:1999]

3.1.2
chemical oxygen demand
COD
mass concentration of oxygen equivalent to the amount of dichromate consumed by dissolved and suspended matter when a water sample is treated with that oxidant under defined conditions

[SOURCE: ISO 6107-2:2006]

3.1.3
EC_{50}
concentration estimated to cause an effect on a test end-point in 50 % of an exposed population over a defined exposed period

[SOURCE: ISO 16387:2014]

3.1.4
free chlorine
chlorine present in the form of hypochlorous acid, hypochlorite ions or dissolved elemental chlorine

[SOURCE: ISO 7027:1999]

3.1.5
total coliforms
group of aerobic and facultatively anaerobic Gram-negative, non-spore-forming, lactose-fermenting bacteria which typically inhabit the large intestine of man and animals

[SOURCE: ISO 6107-7:2006]

3.1.6
total dissolved solids (TDS)
weight of inorganic and organic matter in true solution per unit volume of water

[SOURCE: ISO 16345:2014]

3.1.7
total hardness
total concentration of calcium and magnesium

[SOURCE: ISO 6059:1984]

3.1.8
total kjeldahl nitrogen
TKN
concentration of organic nitrogen and ammoniacal nitrogen in a sample, determined under specified conditions based on digestion with sulfuric acid

[SOURCE: ISO 6107-8:1993]

3.1.9
total nitrogen
sum of *total kjeldahl nitrogen* (3.1.8) (ammonia, organic and reduced nitrogen) and nitrate-nitrite

3.1.10
total organic carbon
TOC
all the carbon present in organic matter which is dissolved and suspended in the water

[SOURCE: ISO 11733:2004]

3.1.11
total phosphorus
sum of all phosphorus compounds that occur in various forms

3.1.12
total residual chlorine
chlorine present in the form of *free chlorine* (3.1.4) or combined chlorine, or both

[SOURCE: ISO 7027:1999]

3.1.13
total solids
TS
sum of dissolved and suspended solids

[SOURCE: ISO 6107-2:2006]

3.1.14
total suspended solids
TSS
weight of particulates, both organic and inorganic, suspended, but not dissolved, per unit of water

[SOURCE: ISO 16345:2014]

3.1.15
turbidity
reduction of transparency of a liquid caused by the presence of undissolved matter

[SOURCE: ISO 7027:1999]

3.1.16
96 h LC_{50}
bioassay determining the dilution of an effluent which causes the death of 50 % (one half) of a group of test animals (typically rainbow trout) after exposure for 96 hours

3.2 Abbreviated terms

BOD_5	biochemical oxygen demand after 5 days
COD	chemical oxygen demand
DO	dissolved oxygen
EC	electrical conductivity
FOG	fat, oil and grease
n.e.c.	not elsewhere classified
SDI	silting density index
TDS	total dissolved solids
TKN	total Kjeldahl nitrogen
TN	total nitrogen
TOC	total organic carbon
TOD	total oxygen demand
TP	total phosphorus
TS	total solids
TSS	total suspended solids

4 Classification of industrial wastewater

4.1 Classification principle and code structure for industrial wastewater classification

4.1.1 Classification principle

Industrial processes, even in the same industry (e.g. pulp and paper), characteristically generate different distinctive waste-streams as a result of differences between production processes.

Consequently, the effectiveness of a particular technology or a group of technologies can be expected to be varied, and require different wastewater treatment processes and reuse technologies.

In this document, hierarchical classification is used to classify different levels of industrial wastewater based on: type of the industry (Level 1) and water quality parameters (e.g. pH, TSS, TDS, COD, TN and TP) (Level 2). The relationship between different levels is shown in Figure 1. Level 1 and Level 2 have a progressive relationship.

This classification system defines the basic and most important characteristics of industrial wastewater from different dimensions. It is intended to guide technology selection and design for industrial wastewater treatment and reuse. Although some reference codes are provided in this document, the relevant and suitable parameters can be selected according to local industrial wastewater quality and technological conditions in different countries or regions.

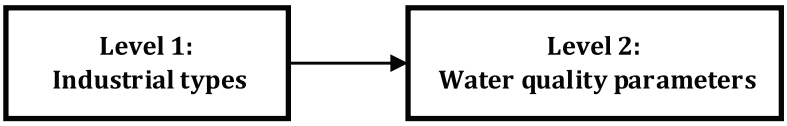

Figure 1 — Relationship between different levels of industrial wastewater classification

4.1.2 Code structure

The code of industrial wastewater classification adopts hierarchical code. The hierarchy corresponding to the classification of industrial wastewater is divided into two levels. The hierarchical code of each level is in an ascending order.

The hierarchy code structure of industrial wastewater classification contains two levels (Figure 2). Level 1 (the first two digits) indicates the classification according to industry types, which uses two letters following the alphabetic order for each letter (from A to Z, then from a to z, which is 52 codes for each digit). Level 2 (the number of digits is determined by the number of water quality parameters included; each parameter has a four-digit-code) indicates the classification according to the water quality of the industrial wastewater. A hyphen is used for distinguishing between each water quality parameter.

For Level 2, if some water quality indexes are irrelevant to the certain industrial type, the corresponding codes should not be included. However, if it is still necessary for considering the requirements or the effects of those water quality indexes with no available value, the value of the parameter should be set as 0a as a default value.

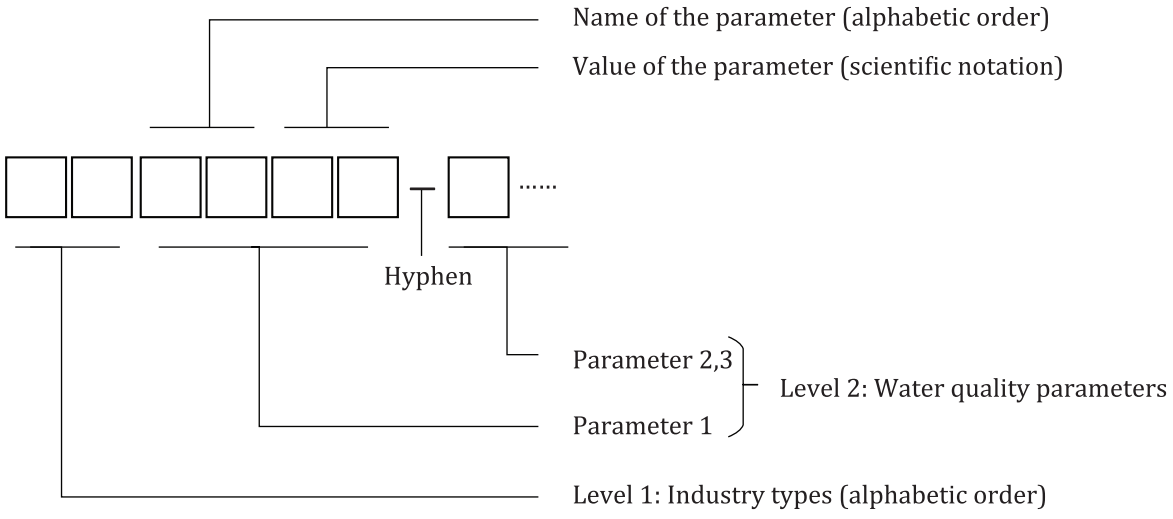

Figure 2 — Code structure of industrial wastewater classification

4.2 Classification of industrial wastewater based on industrial types (Level 1)

Wastewater generated from different industries may have distinct water qualities. On this level, wastewater is classified according to industrial types in the areas of mining and quarrying, manufacturing, electricity, gas, steam and air conditioning supply, water supply, construction and the like. A recommended list of code vs. category of industrial wastewater according to industrial types is shown in Table 1, which mainly follows the International Standard Industrial Classification of All Economic Activities[10], added up with special wastewater including laboratory wastewater, nuclear and radioactivity wastewater, and mixed wastewater that come from more than one industry category included in this level[11][12]. Each type of industrial wastewater is given a two-letter code following alphabetic order (for each letter, from A to Z, then a to z if necessary). A total of 207 types of industrial wastewater were included, among which 34 big categories are coded as "*A" (* means a character), and shown as bold font in the table.

For the plants manufacturing products which belong to different industrial types, or in other situations that the wastewaters are mixed before reuse or discharge, if two types belong to the same big category, e.g. a mine produces both iron ore and rare earth, the mixed wastewater should be classified following the big category name, so does the code; if two types belong to different big categories, several possible mixed sub-categories are listed under the category of "mixed wastewater" (g*).

Governments, regional administrations, industrial sectors, and other users can edit and modify the information according to the specific situations. For the types of industry that are not included or newly appeared, the table can also be extended accordingly, or the wastewater can be classified as "other industrial wastewater" (hA). If there are modifications of the corresponding list, an illustration of the coding system should be provided in the document when applying.

Table 1 — Category and code for industrial wastewater based on industrial types

Code	Category name
AA	**coal and lignite mining wastewater**
AB	hard coal mining wastewater
AC	lignite mining wastewater
BA	**crude petroleum and natural gas extraction wastewater**
BB	crude petroleum extraction wastewater
BC	natural gas extraction wastewater
CA	**metal ores mining wastewater**
CB	iron ores mining wastewater
CC	non-ferrous metal ores mining wastewater
DA	**other mining and quarrying wastewater**
DB	stone, sand and clay quarrying wastewater
DC	chemical and fertilizer minerals mining wastewater
DD	peat extraction wastewater
DE	salt extraction wastewater
DF	other mining and quarrying wastewater n.e.c.
EA	**food products manufacturing wastewater**
EB	meat processing and preserving wastewater
EC	fish, crustaceans and molluscs processing and preserving wastewater
ED	fruit and vegetables processing and preserving wastewater
EE	vegetable and animal oils and fats manufacturing wastewater
EF	dairy products manufacturing wastewater
EG	grain mill products, starches and starch products manufacturing wastewater
EH	grain mill products manufacturing wastewater