SLOVENSKI STANDARD

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Čistilne naprave za odpadno vodo - 9. del: Kontrola vonja in prezračevanje

Wastewater treatment plants - Part 9: Odour control and ventilation

Kläranlagen - Teil 9: Geruchsminderung und Belüftung

Stations d'épuration - Partie 9: Maîtrise des odeurs et ventilation

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13.060.30 Odpadna voda Sewage water

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Wastewater treatment plants - Part 9: Odour control and ventilation

Stations d'épuration - Partie 9: Maîtrise des odeurs et ventilation

Kläranlagen - Teil 9: Geruchsminderung und Belüftung

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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European foreword

This document (prEN 12255-9:2021) has been prepared by Technical Committee CEN/TC 165 “Waste water engineering”, the secretariat of which is held by DIN.

This document is currently submitted to the CEN Enquiry.

This document will supersede EN 12255-9:2002.

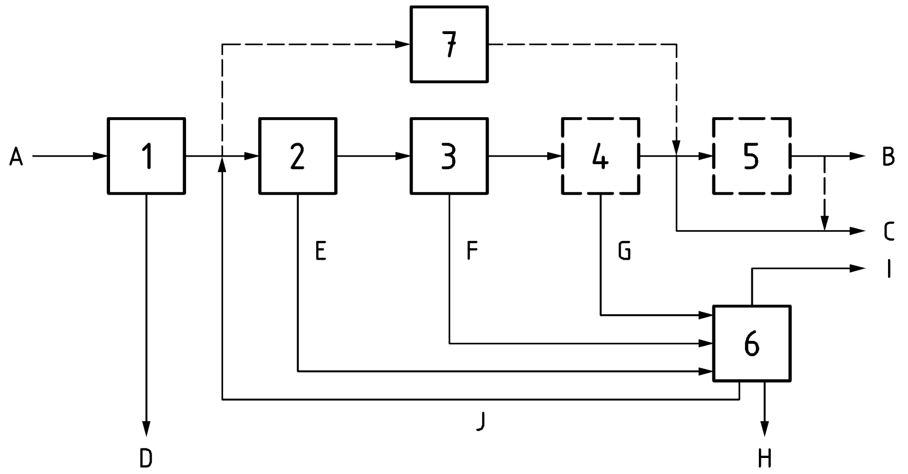
It is the ninth part prepared by Working Group CEN/TC 165/WG 40 relating to the general requirements and processes for treatment plants for a total number of inhabitants and population equivalents (PT) over 50. EN 12255 with the generic title “Wastewater treatment plants” consists of the following Parts:

- *Part 1: General construction principles*
- *Part 3: Preliminary treatment*
- *Part 4: Primary settlement*
- *Part 5: Lagooning processes*
- *Part 6: Activated sludge process*
- *Part 7: Biological fixed-film reactors*
- *Part 8: Sludge treatment and storage*
- *Part 9: Odour control and ventilation*
- *Part 10: Safety principles*
- *Part 11: General data required*
- *Part 12: Control and automation*
- *Part 13: Chemical treatment — Treatment of wastewater by precipitation/flocculation*
- *Part 14: Disinfection*
- *Part 15: Measurement of the oxygen transfer in clean water in aeration tanks of activated sludge plants*
- *Part 16: Physical (mechanical) filtration*

NOTE For requirements on pumping installations at wastewater treatment plants see EN 752, *Drain and sewer systems outside buildings — Sewer system management* and EN 16932 (all parts), *Drain and sewer systems outside buildings — Pumping systems*.

Introduction

Differences in wastewater treatment throughout Europe have led to a variety of systems being developed. This document gives fundamental information about the systems; this document has not attempted to specify all available systems. A generic arrangement of wastewater treatment plants is illustrated in Figure 1 below:



Key

1	preliminary treatment	C	discharged effluent
2	primary treatment	D	screenings and grit
3	secondary treatment	E	primary sludge
4	tertiary treatment	F	secondary sludge
5	additional treatment (e.g. disinfection or removal of micropollutants)	G	tertiary sludge
6	sludge treatment	H	digested sludge
7	lagoons (as an alternative)	I	digester gas
A	raw wastewater	J	returned water from dewatering
B	effluent for re-use (e.g. irrigation)		

Figure 1 — Schematic diagram of wastewater treatment plants

Detailed information additional to that contained in this document may be obtained by referring to the bibliography.

The primary application is for wastewater treatment plants designed for the treatment of domestic and municipal wastewater.

1 Scope

This document specifies design principles and performance requirements for odour control and associated ventilation for wastewater treatment plants serving more than 50PT.

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.

prEN 12255-14:2021, Wastewater treatment plants — Part 14: Disinfection

EN 16323, *Glossary of wastewater engineering terms*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 16323 and the following apply.

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

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

3.1
olfactometry
measurement of the response of assessors to olfactory stimuli

Note 1 to entry: See EN 13725 for details.

[SOURCE: EN 16323:2014-07, term 2.1.3.2]

3.2
odour concentration
number of European Odour Units in a cubic metre of gas at standard conditions

EXAMPLE If a sample has to be diluted by a factor of 300 to reach the detection threshold, the odour concentration of the sample is c_{od} = 300 ou_E/m^3.

Note 1 to entry: The odour concentration has the symbol c_{od} and the unit ou_E/m^3.

Note 2 to entry: The value of the odour concentration is the dilution factor that is necessary to reach the detection threshold. At the detection threshold, the odour concentration of the mixture is 1 ou_E/m^3 by definition.

[SOURCE: EN 13725]

3.3
odorant flow rate; odour emission rate
quantity of odorous substances passing through a defined area per unit time

Note 1 to entry: The odorant flow rate has the symbol q_{od}. It is the product of the odour concentration c_{od}, the outlet velocity v and the outlet area A or the product of the odour concentration c_{od} and the pertinent volume flow rate V. Its unit can be expressed as ou_E/h, ou_E/min or ou_E/s.

Note 2 to entry: Diffuse sources such as unaerated wastewater or sludge surfaces, do not have a defined waste air flow, although they can emit odorants. In these cases, a special sampling procedure is necessary which is discussed in EN 13725 (see Annex A). Odorant flow rates can be used in an analogous fashion to mass flow rates when modelling the impact from a source. All odour sources will have an odorant flow rate, even where no air flow rate is easily identifiable.

[SOURCE: EN 13725:2003-07, term 3.1.42]

3.4
volatile organic compound
VOC
organic compound with an initial boiling point less than or equal to 250 °C measured at a standard pressure of 101,3 kPa

[SOURCE: EU Directive 2004/42/CE]

3.5
capital expenditure
CAPEX
money used to purchase and install and commission a capital asset

[SOURCE: ISO 15663-1:2000, term 2.1.6]

3.6
operational expenditure
OPEX
recurrent expenditure required to provide a service or product

[SOURCE: ISO/TS 55010:2019, term 3.9]

3.7
empty bed residence time
EBRT
total time air is retained in a considered unit in average conditions

Note 1 to entry: The EBRT is calculated as V/Q, where V (m^3) is the total internal volume of the unit and Q (m^3/s) is the air flow rate. The EBRT calculation assumes that the unit is empty, regardless the presence of packings or other solid elements.

3.8
specific ozone demand
required ozone concentration in the odours air (g O_3/m^3 or g O_3/l) to achieve a level of odour reduction

3.9
contact tank
tank for providing the required retention time for certain reactions to take place

[SOURCE: Modified from EN 16323:2014, term 2.3.9.4, to extend to use with gases]

3.10
advanced oxidation process
AOP
chemical process generating hydroxyl or oxygen radicals

3.11
UV efficiency (UV-C radiation conversion efficiency)
ability of a UV-C lamp to convert electrical power into UV-C radiation

Note 1 to entry: The ratio is the UV-C radiation power accounting for the electrical power of the UV-C lamp. The UV-C conversion efficiency of a low pressure UV-C lamp at 253,7 nm is between 25 % and 45 %. The UV-C conversion efficiency should not be less than 30 % in an air disinfection field under all circumstances due to energy consumption of the system.

Note 2 to entry: The measurements of the output shall be performed by the manufacturer in accordance to ISO 15727.

[SOURCE: ISO 15727:2020, term 3.6]

3.12
UV radiation demand
sum of the UV output (W) at 254 nm from all the lamps of an UV reactor, divided by the odorous air flow rate (m^3/h)

required UV radiation/UV dose to achieve a level of disinfection

Note 1 to entry: Measured according to ISO 15727.

4 Symbols and abbreviations

AOX	adsorbable organohalogens
AOP	advanced oxidation process
CAPEX	capital expenditure
C_{OD}	concentration (in ppm) resulting by the sum of all the measured odorants
EBRT	empty bed residence time
FFKM	perfluoroelastomer, defined in ASTM D1418 (equivalent to FFPMs defined in ISO 1629)
FKM	fluorocarbon, defined in ASTM D1418 (equivalent to FPM defined in ISO 1629)
FRP	fibre-reinforced plastic (sometimes referred to as fiber-reinforced polymer, or fiber-reinforced plastic)
H_2S	hydrogen sulphide
NH_3	ammonia
ou_E	European odour units
OPEX	operating expenditure
P_{254}	the emitted UV output at 254 nm and P_{in} (W)
PE	polyethylene
P_{in}	the power input to the lamp (W)
PP	polypropylene
PTFE	polytetrafluoroethylene
UV	ultraviolet, electromagnetic radiation with wavelength 100 nm to 400 nm
UV-C	ultraviolet electromagnetic radiation with wavelength 100 nm to 280 nm
VOC	volatile organic compounds
W	Watts

5 Design principles

5.1 General

Given the nature of wastewater it is not possible to guarantee that a wastewater treatment plant will be totally odour free. A well-designed plant minimizes the potential for odour problems.

The potential for odour generation shall be considered at the earliest stages in the design of wastewater treatment works. The likelihood of odour emission, its impact and ease of treatment shall be considered in all aspects of design, especially:

a) septicity of the raw wastewater – e.g. by considering the sewerage system;

b) process selection – e.g. if septic wastewater is anticipated, possibilities to minimize odour include:

- minimizing the retention time of the sludge in the primary settlement tank;
- having no primary settlement (thus avoiding a major source of odour) and applying extended aeration;

- selecting a covered process;

c) location of the major sources of odour – e.g. wherever possible, site these away from the most sensitive locations surrounding the plant taking into account the direction and speed of winds local to the installation;

NOTE Situations with light wind or no wind and stable atmospheric conditions are most unfavourable for the dispersion of odours. Thus, if these situations happen very often, then the local wind direction during these situations is relevant instead of the generally prevailing wind direction.

d) co-location of unit processes – e.g. it may be possible to use a single abatement process to treat more than one source of odour or to use the odorous air from one process as process or combustion air in an adjacent process. Any decision to treat odorous air will require a process to be covered and ventilated with the vented air ducted to treatment. Covering, venting and treatment shall be designed as an integrated package.

Where treatment plants are not covered or housed in buildings and the effect of odour is difficult to quantify prior to commissioning designs should allow for covering and/or ventilation at a later date. Further general design requirements are given in EN 12255-1.

When tanks or processes are covered careful consideration is required of:

e) explosion risk;

f) corrosion prevention;

g) health and safety of operators;

h) access for maintenance.

5.2 Sources and nature of odours

Odour is generated during the conveyance and treatment of wastewater due to the degradation of organic matter by microorganisms under anaerobic conditions. Industrial wastewater can also contain characteristic odorous constituents. The onset of septicity can be accelerated by elevated temperatures, high BOD concentration and presence of reducing chemicals. The range of odorous constituents is very wide and includes:

- hydrogen sulphide;
- ammonia;
- organic sulphur compounds; thiols (e.g. mercaptans);
- organic compounds with nitrogen as amines; indole and skatole;
- volatile fatty acids;
- other Volatile Organic Compounds (VOC).

The features that typically cause odours to occur are:

- unfavourable conditions in the sewage systems (e.g. long retention times, poor maintenance, industrial discharges);
- long pressure mains;