



Fit in Wastewater Technology?

Achim Höcherl



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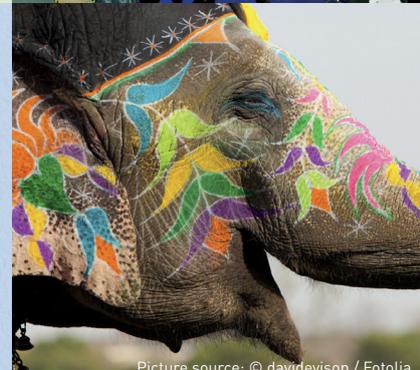
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KORSCHAU



The German Association for Water, Wastewater and Waste (DWA) is strongly committed to the development of secure and sustainable water and waste management. As a politically and economically independent organisation, it is professionally active in the fields of water management, wastewater, waste and soil protection.

In Europe, the DWA is the association with the largest number of members within this field. Due to its professional competence, it holds a unique position with regard to regulatory work, professional training and information of both specialists and the public. The approximately 14,000 members represent specialists and executives from municipalities, universities, engineering offices, authorities and companies.

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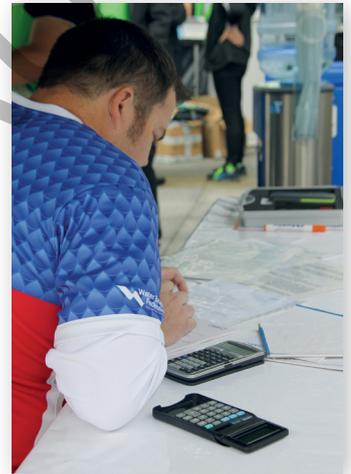
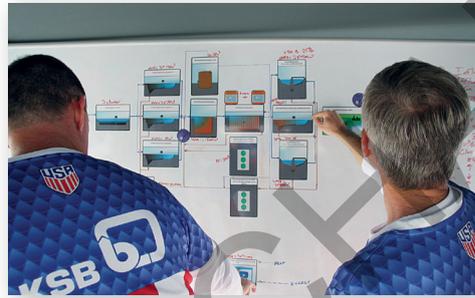
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Fit in Wastewater Technology?

- 3) **Field work** to compare theory and practice at the training treatment plant: here the trainees, supported by their colleagues at the treatment plant, are to test the theoretical questions with respect to their practical application. The rallies provided in the appendix are intended as a compact and guided "practical investigation".
- 4) **Reflection tasks:** they should definitely be discussed and solved together with the trainer. Trainees realise whether they have really understood everything when they have to explain things themselves. The reflection tasks are a good basis for presenting trainers and other trainees with the proposed solution. A discussion on the subject makes everyone smarter and stronger!!
- 5) **"What happens if"** questions for better comprehensive understanding of interrelations: they can be solved independently by the trainees, however, they should certainly be discussed with the trainer afterwards, as complex interrelations are dealt with. The question papers can be flexibly expanded for the trainer by changing or adding parameters.
- 6) The last two chapters provide **exercises** that have already been faced by the trainees and professionals taking part in **professional competitions**.



Photos: DWA

Information for Non-German Users:

“Fit in Wastewater Technology” gives you training and self-learning material which has been developed for the requirements of a German wastewater engineering technician.

The occupational profile “wastewater engineering technician” exists since 1984; it is based on 3 years of dual education (vocational school and practice in a training company) leading to a state-recognised qualification. Wastewater engineering technicians in Germany are eligible to operate wastewater treatment plants and sewer networks up to a size of 10,000 total population and equivalents PT, corresponding to about 1500 m³/d on their own responsibility. This is regulated by the guideline DWA M 1000; 2012. In practice, the wastewater engineering technician is responsible for the operation and maintenance of wastewater treatment components or much larger control rooms of wastewater treatment plants. This machinery and equipment under his responsibility often has a value of several 100,000 EUR. Skilled operation and good maintenance preserve the value of the investment. So the plant manager is particularly keen that his technicians independently and fundamentally accomplish a high standard of work every day, and therefore attaches great importance to the vocational education and further training of his employees.

The DWA, as the publisher of “Fit in Wastewater Technology” is a large German technical scientific association. With its 14,000 DWA members it determines the technical rules for water management. In addition, the DWA is Germany’s biggest provider of training in the field of water and wastewater with more than 30,000 training participants/year and is involved in the vocational training of wastewater engineering technicians and senior wastewater engineering technicians.

“Fit in Wastewater Technology” is intended as training and self-learning material which supplements the “Modular Wastewater Training System”. This training kit consists of magnetic picture cards with wastewater technology components and a set of flashcards with the key associated facts. The Modular Wastewater Training System in combination with “Fit in Wastewater Technology” is a kick-off for all active learning orientation. The Modular Wastewater Training System is now available in various languages. For some issues (wastewater chlorination, use of digester gas) there are supplementary cards. See dwa.de/modular-wastewater-training-system. Further translations are possible at any time in collaboration with the DWA.

In several tasks, “Fit in Wastewater Technology” refers to the German legal and regulatory framework. In many countries, other rules apply, and in some there are other treatment objectives that require adapted technologies. To allow you to understand and solve the tasks of “Fit in Wastewater Technology” in your country, we have summarized everything that differs significantly from international concepts in the following glossary. There you will also find a brief outline of German laws and regulations. You can easily note the relevant laws and regulations in your country next to them.

a) Concept of total population and equivalents

Wastewater treatment plants are designed on the basis of a standardized unit of daily contamination or wastewater load of 1 inhabitant.

It could be discharged by

- a) 1 inhabitant (population = P) for daily washing, toilet, bathing and kitchen
- b) 1 population equivalent (PE) for load from an industrial or commercial wastewater discharger.
 - Population (P) + Population Equivalent (PE) = Total Population and equivalents (PT)
 - PT, P and PE are measured in the unit „inhabitant“ [I]
 - The standard contamination load of 1 Population [P] = 60 g BOD₅/d

German values of PT		How is your raw water?
Daily load of 1 Population (P)	Daily load of 1 Population Equivalent (PE)	Fill in your raw water data and compare.
60 g/d BOD ₅	60 g/d BOD ₅	
	120 g/d COD	
	11g/d N _{tot}	
	1,8 g/d P _{tot}	
150 l/d	200 l/d	

b) Size classes of wastewater treatment plants

See e.g. chapter 1.1.5 – 1.1.8; 1.4.4; 2.2.14; 2.3.2

The German Wastewater Ordinance (AbwV) classifies treatment plants according to their daily load of BOD₅ in their inflow. According to the size class, different discharge values are required.

Remember: The standard contamination load of 1 population [P] = 60 g BOD₅/d and 150 l/d

Size class	Kg/d BOD ₅ in raw water	Equivalent to load of BOD ₅	Estimated equivalent to hydraulic load
1	< 60 Kg	PT < 1,000 I	< 150 – 200 m ³ /d
2	60 to 300 Kg	PT < 5,000 I	< 750 – 1,000 m ³ /d
3	300 to 600 Kg	PT < 10,000 I	< 1,500 – 2,000 m ³ /d
4	600 to 6000 Kg	PT < 100,000 I	< 15,000 – 20,000 m ³ /d
5	> 6000 Kg	PT > 100,000 I	> 15,000 – 20,000 m ³ /d

How are the treatment plants classified in your county?

c) Cleaning requirements

See e.g. chapter 1.3.6; 2.2.14; 3.4

Treatment requirements on wastewater for the discharge point in Germany depend on the size class of the wastewater treatment plant. The German Wastewater Ordinance (AbwV) Appendix 1 gives the following discharge values:

Size class	1	2	3	4	5
COD [mg/l]	150	110	90	90	75
BOD ₅ [mg/l]	40	25	20	20	15
NH ₄ -N [mg/l]	-	-	10	10	10
N _{tot} [mg/l]	-	-	-	18	13
P _{tot} [mg/l]	-	-	-	2	1

Keep in mind: a qualified random sample or 2-hour composite sample is obligatory.

d) Indirect discharge for industrial wastewater

See chapter 1.4.1

In Germany the municipalities are in charge of wastewater discharge and treatment. Most industries and companies discharge their wastewater into the public sewer system after an in-plant pre-treatment. The municipal operator monitors the industrial wastewater quality at the entrance to the sewer network according to the German Wastewater Ordinance (AbwV). In the Appendix there are specific pre-treatment limits for 53 types of industrial contamination. Further detailed know-how is not needed to work with „Fit in Wastewater Technology“.

e) Water quality classes according to LAWA

See chapter 3.3

In the past the quality of surface water bodies in Germany has been classified by biological features (saprobic system), which build up a typical state of a water body and permit its rating in 4 grades and 3 interstates.

Class I = unloaded to very lightly loaded

Class I-II = lightly loaded

Class II = moderately polluted

Class II-III = critically loaded

Class III = highly contaminated

Class III-IV = extremely contaminated

Class IV = excessively contaminated

Nowadays, the classification is ruled by the EU-Water framework directive (2000/60/EG) using a variety of parameters. Overall objective of water management is a good water body status.

f) German laws and regulations

	Abbreviation	Main relevant message	Used in chapter	Fill in the corresponding regulation in your country
Sewage Sludge Ordinance	AbfKlärV	Targets the control of nutrient loads from sewage sludge within the meaning of good practice and restricts the entry of inorganic and organic pollutants to an agronomic and environmental safe level. Prescribes limits and defines regular soil and sludge tests as well as criteria for supervising laboratories.	2.4.7	
Wastewater Levy Act	AbwAG	Regulates the obligation to pay a water tax for the discharge of sewage (waste water, rain water). (§3)The amount of levy is oriented to the harmfulness of the waste water.	2.4.7	
Wastewater Ordinance	AbwV	Regulates the minimum requirements that should be fixed for permits for discharging wastewater into water bodies. 53 different appendixes give specific pre-treatment limits for types of industrial and municipal wastewater. It also specifies the analysis and measurement methods.	2.4.7	
Civil Code § 839	BGB §839	§ 839 deals with the breach of [official] duties by civil servants	3.9	
Fertilizer Ordinance	DüV	Provides for the approval and labelling of fertilizers. Binding requirements for the use of sludge in agriculture	2.4.7	
Basic Law Art. 10	GG Art. 10	Constitutional law of the Federal Republic of Germany. Article 10 deals with telecommunications secrecy and inviolability of the mail	3.9	
Penal Code § 324	StGB § 324	§ 324 deals with water pollution: (1) Whoever contaminates a water body or alter its properties without authorization, is punished with imprisonment for up to five years or a fine. The attempt is punishable. Imprisonment for up to three years or a fine in case of negligence	3.9	
Road Traffic Regulation	StVO § 324	Only 53 paragraphs!	3.9	
Self-Monitoring Ordinance	SÜwV	Determines the form and frequency of self-monitoring for municipal wastewater treatment plants operation and their discharge. Includes measurements and sample points, documentation in operating logbook and reporting. Self-monitoring is randomly checked by the water authority.	1.4.3; 2.4.7	

Fit in Wastewater Technology?

	Abbreviation	Main relevant message	Used in chapter	Fill in the corresponding regulation in your country
Water Resources Act	WHG	Main part of German water law with the provisions on the protection and use of surface- and groundwater, as well as regulations on water planning and flood protection. § 54: Sewerage includes collecting, draining, treatment, discharge, filtrate, dilute and trickling of wastewater and dewatering of sludge in connection with sewage; including the elimination of the waste of small wastewater treatment sludge.	1.1.10; 2.4.7	
Drainage Statute		Community statute which defines the requirements for discharge in public sewer systems (population and indirect discharge for Industrial wastewater). Includes water quality, monitoring, financing, required Pre-treatment, prohibited substances and other aspects.	2.4.7	

Information for Trainers

This is a translation of German training material for wastewater engineering technicians. Before using it in other teaching contexts, adaptation to national circumstances is strongly recommended

Terminology is a key for learners and teachers. Careful translation is indispensable for training materials. For this translation, technical terms were used in accordance with CEN and www.arabterm.org. Every translation is a challenge. Please send your ideas and suggestions to info@dwa.de.

Teachers are encouraged to design new tasks in line with the present sample. You are welcome to send your designs to the DWA. In this way, knowledge and experience from different countries can enrich future editions of "Fit in Wastewater Technology".

Curriculum vitae of the author, Achim Höcherl

Professional experience

1994 – today
 City of Bonn
 Head of the Wastewater Treatment Department
 Trainer for environmental engineering professions

Activities

Since 1996, various lecture activities at the TÜV-Academy Neuwied, Koblenz Chamber of Industry and Commerce and the DWA

Member of the examination committee in Rhineland-Palatinate for senior wastewater engineering technicians (2001-2012)

Member of the special committee for Occupational Health and Safety DWA (2009-2011)

Member of the examination committee in North Rhine-Westphalia for senior wastewater engineering technicians

Member of the DWA special committee BIZ-3 "Skilled worker/master" (since 2011)

2010

Development of the modular training system "Wastewater Technology" Commendation for the modular training system "Wastewater Technology" in the context of the DWA's Ernst-Kuntze Award.

2017

Ernst-Kuntze Award of the DWA for QR code wastewater technology

Education

1986–1989
 Training as an environmental technician, wastewater sector

1991-1994
 Degree at the University of Applied Sciences in Cologne, Municipal Environmental Protection

1996 – 1997
 Advanced training as a state-certified Senior Wastewater Engineering Technician



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This workbook was written by professionals for professionals. It is not a classic textbook.

Achim Höcherl, an experienced trainer and expert, developed „Fit in Wastewater Technology“ based on his idea of the Modular Wastewater Training System. The aim of the tasks is - as with the Modular Training System - to achieve holistic learning. That means learning with all senses - with head, heart and hand. That way success comes faster and it stays.

This workbook is aimed at both trainers and trainees on their way to becoming a wastewater engineering technician.

As an instructor, you will receive valuable help to prepare your trainees for exams and practice.

You will get ideas for a lively design of the in-house lessons and for an effective use of the Modular Wastewater Training System.

As a trainee, you get a good feeling for what you already know and what you have to practice again. You will become more familiar with „your“ wastewater treatment plant and - hopefully - have more fun learning for the exam and for your professional life. In any case, we wish you a lot of success!

VORSCHAU

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