

VOCATIONAL TRAINING

Environmental Engineering Occupations | Volume 2

Sewage Engineering Technician



Explanatory notes to and practical assistance for the nationally recognised vocational training regulations

Environmental Engineering Occupations • Volume 2

Sewage Engineering Technician

The National Training Regulations

Comments from Occupational Experts

For Instructors, Apprentices and Those Interested

Translation of text from German to English was funded by the German Government through the German Technical Cooperation Water Programme in the Palestinian Territories implemented by Gesellschaft für Technische Zusammenarbeit (GTZ) on behalf of Bundesministerium für Zusammenarbeit und Entwicklung (BMZ).

gtz

Publisher
Federal Institute for Vocational Education and Training
▶ Researching
▶ Advising
▶ Shaping the future

Publisher:

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© W. Bertelsmann Verlag GmbH & Co. KG
Bielefeld, Germany
1st reproduction 2008

Order-No.: E028
ISBN 978-3-7639-3729-5
(German original)

Printers:

W. Bertelsmann Verlag GmbH & Co. KG
Auf dem Esch 4
33619 Bielefeld
GERMANY

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Please note:

This brochure is the English version of the
German Original

**Environmental Engineering Occupations
(EE – Occupations)
Volume 2**

Sewage Engineering Technician

Explanatory notes to and practical assistance for
the (German) Vocational Training Regulations

Publisher:

**Bundesinstitut
für Berufsbildung** **BiBB** ▶
▶ Forschen
▶ Beraten
▶ Zukunft gestalten

Foreword

Vocational training regulations result in close collaboration between occupational training practice and training research. With this, decisions are made on the acceptance or non-acceptance of contents in the training framework plan and their practical and timely classification, which are the result of detailed, specialist discussions.

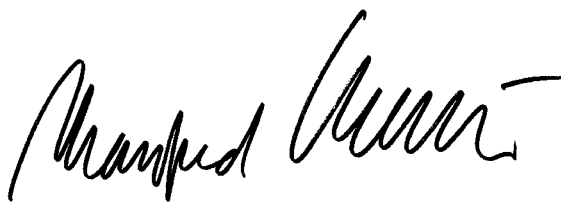
The recognition of these considerations by the "makers of vocational training regulations", their experience from the innovation of occupational practice and the factors which were essential with the decision on content are a significant aid and thus of particular interest for training personnel and instructors in vocational schools with the translation of the new vocational training regulations and the framework curriculum into practice.

With this background those involved have decided to elaborate common explanatory notes and practical assistance for the new vocational training regulations

Within the scope of these explanatory notes, the intentions and results of the new arrangement are presented and commented upon. In addition, operational assistance is offered. With this, one is not concerned with standard specifications but rather with freely applicable help for occupational use, which are also useful for vocational school instruction.

As with vocational training regulations, practice-orientation is the most important development principle with explanatory notes. Therefore they are not created at the conference table but in close collaboration between the Federal Institute for Vocational Education and Training and the specialists who took part in the new regulation process.

I wish this practical assistance a wide distribution both in the circle of occupational training personnel and apprentices as well as instructors in vocational schools and the examiners.

A handwritten signature in black ink, appearing to read 'Manfred Kremer', with a stylized, flowing script.

Manfred Kremer
President
Federal Institute for Vocational Education and Training

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1. Intention of the New Regulations

What is new?

Amended qualification requirements and legal provisions as well as increased environmental sensitivity and also heavy structural changes in the firms required a modernisation of the occupation requiring training for environmental technicians with the specialist fields of water supply, wastewater and waste.

Within the framework of the new regulations four individual occupations were created with the environmental technical occupations, which have the common core qualifications in the first 15 months of the training, 18 months common content at the vocational schools and the same content with the intermediate examination. All four occupations are aimed to be customer and service oriented.

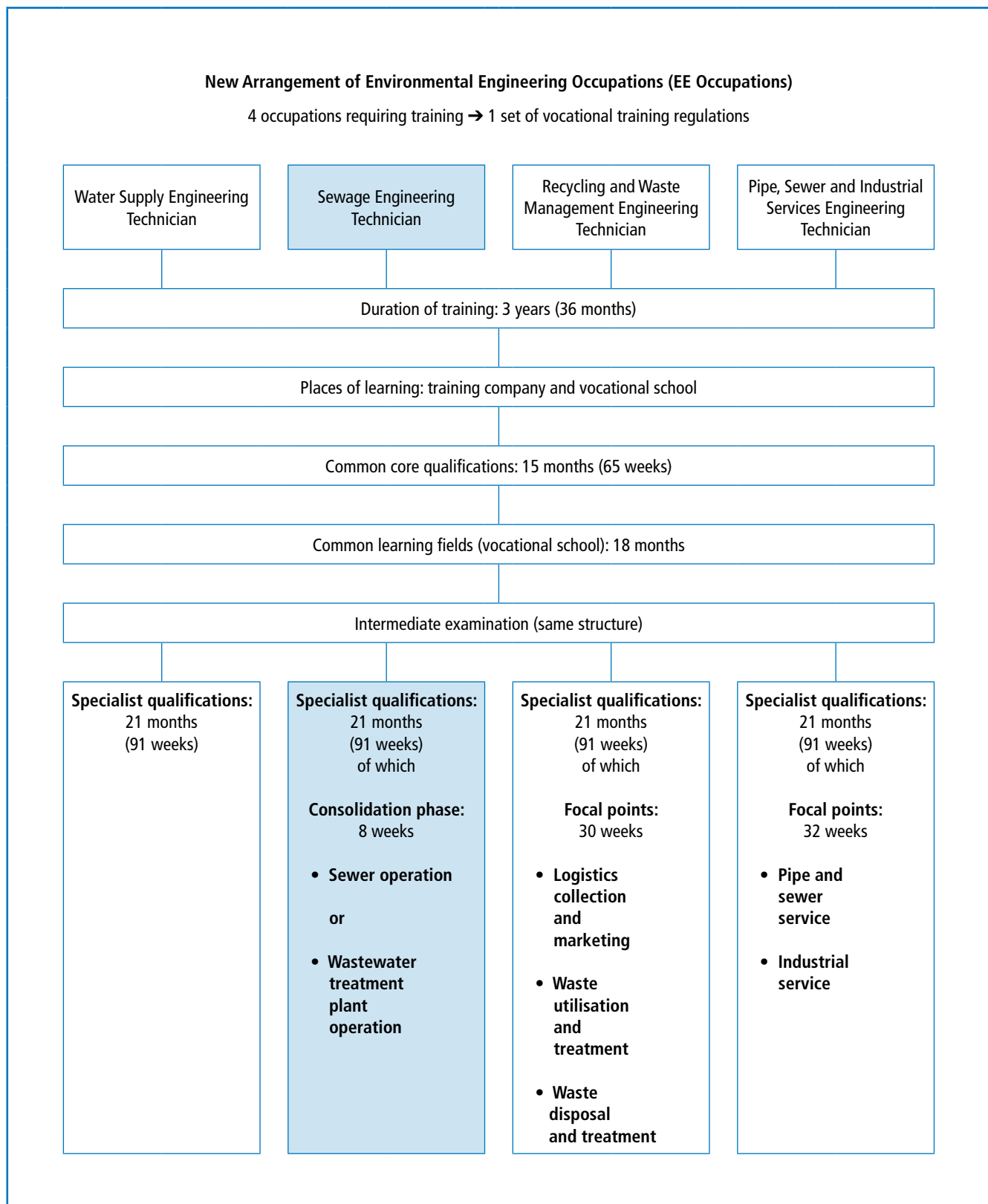
Measures for quality assurance and the application of modern information and communication technologies are also parts of the training.

As one is concerned with environmental engineering occupations requiring training, environmental engineering, ecological cycles and hygiene within the framework of the core qualifications are also part of the intermediate examination. To this belong the causes and interaction of environmental loading of the air, water, soil and environment in the same way as the possibilities for the avoidance and minimisation of environmental loading due to plants and technologies.

The Sewage Engineering Technician has as essential content of training the operation and maintenance of drainage systems and wastewater treatment facilities and sewer operation. In an eight-week intensification phase at the end of training one of the two fields can be gone into in more detail taking into consideration the operational emphases. This satisfies the modified requirements of operations in wastewater engineering with which, in the course of time over recent years, the qualified and demanding activities in sewer operation have increased.

Completely new is the qualification as "electrical engineering authorised person".

Structure of occupational training



2. Occupational Profile and Fields of Activity

Training profile (in the original German in German, English and French)

To support transparency within the European Union the training profile, in which the field of work is described and the occupational qualifications of the occupation requiring training are listed, is issued as annex to the diploma.



Designation of occupation

Sewage engineering technician

Recognized by ordinance of 17 June 2002 (BGBl. I Nr. 43 p. 2335)

Duration of traineeship

3 years

The venues for training are company and part-time vocational school (Berufsschule).

Field of activity

Sewage engineering technicians work in the area of drainage networks as well as sewage and sewage sludge treatment in municipal and industrial treatment plants.

Occupational skills

Sewage engineering technicians carry out their work independently on the basis of technical documents and regulations as well as legal requirements. They acquire information, plan and coordinate their work. They document their performance and take measures to ensure quality, safety, health and environmental protection at work. They are electro-technically qualified personnel.

Sewage engineering technician

- plan, monitor, control and document operational processes
- recognise faults in the operational process and initiate measures to eliminate the fault
- recognise dangers in the operational process and carry out safety measures
- take measurements and carry out analyses for process and quality control
- operate plant and equipment
- inspect, service and maintain machines, equipment, piping systems and structures
- recognise the dangers in dealing with electricity, assess faults and carry out electro-technical work
- collect and evaluate data and optimise processes
- monitor and document compliance with legal requirements
- work in a cost, environmental and hygiene-conscious manner

Part I

Vocational Training Regulations

The occupational training for Sewage Engineering Technician has been laid down in the [German] "Ordinance on occupational training in environmental engineering occupations" in 2002.

In this ordinance the occupation requiring training of Sewage Engineering Technician is regulated together with the occupations requiring training of

- Water Supply Engineering Technician
- Recycling and Waste Management Technician
- Pipe, Sewer and Industrial Service Technician.

In the following part of the explanatory notes the paragraphs of the vocational training regulations for the occupation of Sewage Engineering Technician are explained. These are the common regulations listed in the first part of the ordinance for all four occupations requiring training (§§ 1-3), the regulations for the occupation requiring training for Sewage Engineering Technician listed in the third part of the ordinance (§§ 10-15) and the transitional and final regulations applicable for all four occupations requiring training (§§ 28, 29).

Ordinance text

Explanatory notes on the ordinance

Official [German] Federal Gazette (BGBl.) for 2002, Part I, No. 43 issued in Bonn, Germany, on 02 July 2002

Ordinance on the occupational training in the environmental engineering occupations dated 17 June 2002

- came into force on 01 August 2002
- published on 02 July 2002 in the [German] Federal Gazette
- Public notice together with the framework curriculum in the [German] Federal Official Gazette No. 204 a dated 31 October 2002

On April 1, 2005 the Vocational Training Reform Act (BerBiRefG) came into force which effected certain modifications in the Vocational Training Act (BBiG). The respective training regulation became effective before April 1, 2005 (on June 17, 2002). Hence, all references made are in relation to the BBiG dated August 14, 1969 and subsequent amendments thereto.

Based on § 25, Para. 1 together with Para. 2, Clause 1 of the [German] Vocational Training Act dated 14 August 1969 (BGBl. I, p. 1112), last amended by Article 212, NO. 2 of the Ordinance dated 29 October 2001 (BGBl. I, p. 2785), the German Federal Ministry of Economics and Technology and the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety in agreement with the German Federal Ministry of Education and Research and the German Federal Ministry of the Interior:

Vocational training regulations are based on § 25, Para. 1 of the Vocational Training Act (BBiG). They are issued by the responsible technical ministries – here the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety and the Federal Ministry of Economics and Technology – in agreement with the Federal Ministry of Education and Research and the Federal Ministry of the Interior, as statutory order.

Vocational training regulations regulate, as a standard across the Federal German Republic, the in-firm part of the dual occupational training in recognised occupations requiring training. They are aimed at all those involved in occupational training within the dual system, in particular at firms providing training, at apprentices and training personnel and at **competent bodies**.

The ordinance on occupational training in environmental engineering occupations presented here, was elaborated within the Federal Institute for vocational education and training in collaboration with experts of employee and employer agencies. Vocational training regulations are generally binding as statutory orders. That means,

the occupational training in environmental engineering occupations may take place only in accordance with the provisions of these occupational training regulations.

The dual partner of in-firm training is the vocational school. The instruction in the vocational school takes place on the basis of the agreed framework curriculum. As instruction in vocational schools is in general subject to the responsibility of the Federal German states, these transform the framework curriculum, produced by the Conference of Federal German State Culture Ministers (KMK), into individual framework curricula. Vocational training regulations and framework curricula, with regard to the training content and the point in time of their communication to the firm and vocational school, are to be harmonised.

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Part 1

Common regulations

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- § 2 Duration of training
- § 3 Structure and objective of occupational training

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- § 9 Final examination

Part 3

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- § 28 Transitional regulation
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Annexes

Annex 1: Training framework plan for the occupation requiring training of Water Supply Engineering Technician

Annex 2: Training framework plan for the occupation requiring training of Sewage Engineering Technician

Annex 3: Training framework plan for the occupation requiring training of Recycling and Waste Management Technician

Annex 4: Training framework plan for the occupation requiring training of Pipe-, Sewer and Industry Service Technician

In these explanatory notes only the paragraphs of the common regulations and the paragraphs concerning the occupation requiring training of “**Sewage Engineering Technician**” are commented upon

§ 1**National recognition of the occupations requiring training**

The occupations requiring training

1. Water Supply Engineering Technician
- 2. Sewage Engineering Technician**
3. Recycling and Waste Management Technician
4. Pipe, Sewer and Industrial Services Technician

are nationally recognised. As far as the training takes place within the area of public service, they are public service occupations requiring training. As far as the training takes place within trade and industry they are trade and industry occupations requiring training.

For a nationally recognised occupation requiring training, training may only be carried out in accordance with the vocational training regulations (§§ 28, Para. 1 BBiG). The ordinance presented here thus forms the basis for a standard federal training in firms offering training.

Supervision on this is carried out by the **competent bodies** in accordance with §§ 84 and 75 BBiG. The **competent body** has in particular to monitor the implementation of the occupational training and to support this with advice to apprentices and training personnel. For this purpose it is to provide training advisers (§ 45 BBiG).

§ 2**Duration of training**

Training takes three years.

The duration of training is to be so determined that the training subject matter necessary for a qualified occupation can be communicated to apprentices and makes it possible for them to obtain the required occupational experience (§ 1, Para. 2 BBiG).

Start and duration of occupational training are given in the **apprenticeship contract** (§ 4, Para. 1 BBiG). The occupational training relationship ends with the completion of the training period or the passing of the final examination (§ 14, Paras. 1 and 2 BBiG).

Reduction due to appropriate prior training:

The competent bodies can on application shorten the training time if, for example, an appropriate prior training (educational or operational) allows the expectation that the training objective can be achieved in a shorter period of time (§ 29, Paras. 2 and 4 BBiG).

Reduction due to early admission to the examination. The training period will also be ended prematurely if apprentices, due to appropriate performance before the end of their training period are admitted to the final examination and pass it (§ 40, Para. 1 BBiG).

Extension:

In exceptional cases the training period can also be extended on the request of apprentices, if the extension appears to be necessary in order to achieve the training objective (§ 29, Paras. 3 and 4 BBiG). Exceptional cases are, for example, longer absence as a result of an illness or other periods of inactivity.

The training period must, on request of apprentices, be extended (up to the next examination possibility, maximum one year) if they do not pass the examination (§ 14, Para. 3 BBiG).

§ 3

Structure and objective of occupational training

(1) The training is divided into:

1. Common core qualifications to be communicated integratively in accordance with § 4 Nos. 1 to 12, § 10, **Nos. 1 to 12**, § 16, Nos. 1 to 12 and § 22, Nos. 1 to 12 for all occupations requiring training
2. specific technical qualifications for each occupation requiring training:
 - a) for Water Supply Engineering Technician, in accordance with § 4, Nos. 13 to 24,
 - b) for Sewage Engineering Technician, in accordance with § 10, Nos. 13 to 22,**
 - c) for Recycling and Waste Management Technician in accordance with § 16, Nos. 13 to 22,
 - d) for Pipe, Sewer and Industrial Services Technician in accordance with § 22, Nos. 13 to 18.

The four environmental engineering occupations have common core qualifications which are communicated in the first 15 months of the in-firm training. They are the subject of the intermediate examination in all four occupations requiring training.

The respective technical qualifications are communicated in the second part of the training.

(2) The skills and knowledge given in this ordinance should be so communicated that the apprentice is enabled to exercise a qualified occupational activity within the meaning of § 1, Para. 2 of the German Vocational Training Act (BBiG) which, in particular, includes independent planning, implementation and monitoring. The enablement described in Para. 1 is also to be verified in examinations according to §§ 8, 9, **14, 15**, 20, 21, 26 and 27.

Comprehensive objective of occupational training is to enable the apprentices to exercise a qualified occupational activity. The trained specialists are to be capable of carrying out the tasks given to them of

- independent planning
- independent implementation and
- independent monitoring.

What is to be understood under this in detail is described by the training framework plan. The scope in which independence can develop is here, as a rule, laid down and limited by the constraints within the firm. Accordingly, for example,

Independent planning means:

- lay down work steps (occupational schedule),
- determine tools and aids,
- take account of substance and material requirements,
- estimate execution times.

Independent implementation means:

- carrying out work without instruction.

Independent monitoring means:

- comparison of work results with specifications,
- determination of whether the specifications have been achieved or which reworking is possibly required.

This concept on occupational qualification is, above all, to express that specialists can make independent decisions within the scope of their work, for example on the process of their work in the firm, on quality assurance as well as on health and environmental protection. Also, in this respect, a trained specialist differs from an untrained or semi-skilled employee.

Part 3 Regulations for the occupation requiring training of Sewage Engineering Technician

§ 10 Description of occupation requiring training

Object of the occupational training are at least the following skills and knowledge:

1. Vocational training, employment and collective bargaining law,
2. Structure and organisation of the firm providing training,
3. Safety and health protection on the job,
4. Environmental protection,
5. Operational processes, work organisation,
6. Information and documentation, quality assurance measures,
7. Environmental protection technology, ecological cycles and hygiene,
8. Fundamental principles of mechanical and process engineering, measurement technology, numerical control engineering and control technology,
9. Dealing with risks posed by electricity,
10. Application of scientific principles,
11. Materials, ancillary materials and dangerous materials, dangerous working substances, materials processing,
12. Storage, tools and equipment,
13. Safety regulations and operating instructions,
14. Operation and maintenance of drainage systems,
15. Monitoring of indirect dischargers,
16. Operation and maintenance of wastewater treatment facilities,
17. Treatment of sewage sludge and utilisation of waste solids from wastewater facilities,
18. Sampling and investigation of wastewater and sludge,
19. Documentation, quality and environmental management,
20. Electrical plant in wastewater engineering,
21. Legal provisions and technical rules and standards,
22. Consolidation phase sewer operation or wastewater treatment plant operation

The description of the occupation requiring training contains the training subject matter collated in summarised form. It basically covers all training subject matter (skills and knowledge), which is required as instrument to attain the qualification as Sewage Engineering Technician. The subject matter belonging to each serial number of the description of occupation requiring training is listed in the training framework plan and is arranged by subject and time

(see § 11). The training subject matter of Positions 1 to 4 is to be communicated integratively during the whole training.

In order to make the arrangement of the occupation description during training the guiding chronological figures are to be listed in a column in the explanatory notes to the training framework plan.

§ 11

Training framework plan

The skills and knowledge in accordance with § 10 are to be communicated in accordance with the instruction on technical and chronological structuring of the occupational training (training framework plan) in accordance with Annex 2. A technical and chronological structuring of the training subject matter deviating from the training framework plan is in particular permitted, insofar as practical in-firm peculiarities necessitate the deviation.

The training framework plan forms the basis for the in-firm training. It lists the training subject matter which is to be communicated in the firms providing training. The training subject matter is to be described in the form of the skills and knowledge to be communicated.

The description of the skills and knowledge to be communicated orients itself on occupational terms of reference and the activities connected with these. The educational objectives thus show a clearly recognisable reference to the occupational actions taking place in the firm. In this way the instructors receive an overview of what they communicate and for what the apprentices are to be qualified.

The sequence of the skills and knowledge of an occupational description position to be communicated, as a rule is based on the work cycle. For apprentices and training personnel this simplifies the overview of the qualifications to be acquired.

The communicating of the training subject matter named in the training framework plan is to be ensured by all firms providing training. In order that firm-related peculiarities can also be taken into account with the training, a so-called **flexibility clause** is

adopted in the vocational training regulations. Through this the communicating of additional training subject matter, whose inclusion can appear to be necessary, is also enabled if, due to technical or labour organisational developments, new requirements on Sewage Engineering Technicians result, which are not named in this training framework plan. A flexibility aspect also lies in that the skills and knowledge to be communicated can, as required, be communicated in cooperation with other firms (combined training) and/or through occasional involvement of inter-firm training centres (see keyword **Training activities outside the training companies**).

It is to be ensured that the core qualifications (training subject matter of the first 15 months, Ser. Nos. 1 to 12) with the intermediate examination and the totality of the training subject matter with the final examination are available.

The training framework plan for the in-firm training and the framework plan for the vocational school education are matched to each other with regard to contents and time. In this respect the training in-school and in-firm is also provided for in step. Accordingly it is recommended that training personnel and instructors in vocational schools meet and confer regularly.

§ 12

Training plan

Training personnel are to produce a training plan for the apprentices based on the training framework plan.

The firm providing training is obliged to produce an **in-firm's training plan** for the apprentices on the basis of the training framework plan. It serves the purpose of applying the skills and knowledge listed in the training framework plan to the existing

conditions in the firms. The **in-firm's training plan** is part of the **apprenticeship contract** and is attached to this as annex, (also for registration at the **competent body**) and delivery to the apprentices at the latest at the beginning of training.

§ 13 Narrative Report

The apprentice is to keep a Narrative Report in the form of a verification of training. He/she is to be given the opportunity to keep the Narrative Report during training. Training personnel are to examine the Narrative Report regularly.

The Narrative Report, which is to be kept by apprentices and is to be examined by the training personnel responsible for in-firm training, represents an important instrument for information on the actual status of the overall training in-firm and in vocational schools for training personnel and instructors in vocational schools up to being prior information for the examining board.

Through the keeping of the Narrative Report is to be ensured that the timely and technical course of training is made verifiable for all those involved – apprentices, training centres, vocational schools and legal representatives of apprentices – in the simplest possible form (details in keywords, possibly in loose-leaf form). Reference to the training framework plan must also be clear from this verification of training.

Following the recommendations of the German Federal Committee for Occupational Training, the verification of training is to be kept at least once a week by apprentices. Training personnel are to examine and sign off the verification of training at least monthly. They are to ensure that the legal representative of the apprentices as well as the vocational school receive information from the verifications of training at suitable intervals and that these can confirm this through their signatures. The Narrative Report can be kept according to the regulations of the **competent bodies**.

Apprentices keep the verification of training during working time. With this it is immaterial whether the Narrative Report is kept at the firm or is kept outside the firm with appropriate reduction of the attendance times at the firm.

The presentation of the Narrative Report is prerequisite for admission to the final examination.

An assessment of the form and content is, however, not possible within the scope of the final examination.

Aim of the Narrative Report is, inter alia, to record, via the monitoring of progress of training, deviations from the orderly course of training in order to be able to influence this correctively.

Fundamentally the Narrative Report can be kept, beyond the function as verification of training, also as technical documentation on the overall training time. For apprentices themselves the Narrative Report could then become an instrument if they have again to consider what they have learned in that they report on this in writing.

Reference: BBiG § 6, Para. 1, No. 4 and § 39, Para. 1, No. 2.

§ 14

Intermediate examination

- (1) An intermediate examination is to be carried out for the determination of the state of training. It is to take place before the end of the second year of training.
- (2) The intermediate examination comprises the skills and knowledge listed in Annex 2 in Section 1 for the first 15 months as well as the subject matter to be communicated in the vocational school instruction according to the framework curriculum, so far as it is important for the occupational training.
- (3) The candidate, in the practical part of the examination, is to carry out a practical task, which can consist of several sub-tasks, in overall a maximum of seven hours. With this, the candidate is to show that he/she can plan work routines economically, determine tools and supplies for the work, document results of work as well as take measures for safety and the protection of health with the work, for environmental protection and for quality assurance. For the practical task the following in particular are considered: processing of materials, assembly, dismantling and maintenance of components or working equipment, taking samples, measurement of physical parameters and execution of investigations and application of technical communication means.
- (4) The candidate in the written part of the examination is to solve practice-related tasks, in a maximum of 180 minutes. Here measures for safety and protection of health with the work, for environmental protection as well as for quality assurance are to be presented. The following, in particular, come into consideration for the tasks, taking into account scientific relationships and occupation-related calculations:
 1. Environmental protection technology, ecological cycles and hygiene,
 2. Plant and mechanical engineering,
 3. Measurement and analysis technology,
 4. Materials, auxiliary and hazardous matter, hazardous substances.

An intermediate examination is to be carried out before the end of the second training year. The date is laid down and promulgated by the **competent body** well in time.

The training company is obliged to enter apprentices in good time and to release them for participation.

Object of the intermediate examination are the core qualifications of the training framework plan and the framework curriculum.

The intermediate examination is, as a rule, carried out first after 18 months of the training.

The intermediate examination is divided into a practical part and a written part.

In the intermediate examination it is to be established whether and to what extent the apprentices have achieved the skills and knowledge to be communicated in this period of training and to be able to verify this under examination conditions. The intermediate examination is a monitoring instrument for training personnel and apprentices. Both are to identify the respective status of training in order, if required, to be able to have a corrective, supplementary and supportive effect on the training.

The outcome of the examination has no legal results for the continuation of the training relationship and also does not pass into the result of the final examination. Nevertheless, participation in the intermediate examination is prerequisite for the admission to the final examination (§ 39, Para. 1, No. 2 BBiG).

§ 15**Final examination**

- (1) The final examination comprises the skills and knowledge listed in Annex 2 and the syllabus communicated in vocational school instruction so far as it is important for the occupational training.
- (2) The examination in the practical part of the examination is to be carried out in a practical task over a maximum of 10 hours, which can be divided into several subtasks. For this the following, in particular are considered:

Operation and maintenance of drainage systems and wastewater treatment facilities including the carrying out of analytical and electro-technical tasks.

With this the candidate is to show that he/she can plan the sequence of work economically, recognise work relationships, monitor and document results of work, take measures for safety and protection of health at work, take measures for environmental protection and quality assurance. The candidate is further to show that he/she can identify possible dangers of electrical current, and can assess electrical tasks and carry them out safely.

- (3) The candidate, in the written part of the examination, is to be tested in the examination fields of wastewater engineering, electrical engineering tasks as well as economic and social studies. In the examination fields of wastewater engineering and electrical engineering tasks the candidate is to show that he/she can solve tasks related to practice with associated labour organisational, technical and mathematical-scientific facts. With this, measures for safety and for the protection of health with work as well as quality assurance measures are to be presented. Taking into account occupation-related calculations, tasks from the following areas are in particular considered:

1. In the examination field of wastewater engineering:

- a) Operation and maintenance of drainage systems,
- b) Operation and maintenance of wastewater treatment facilities,
- c) Sampling processes, analysis processes and analysis equipment.

2. In the examination field of electrical engineering tasks:

- a) Basic elements of electrical engineering,
- b) Electrical plant and components,
- c) Electrical measuring equipment and safety devices.

3. In the examination field of economic and social studies:

general economic and social interrelationships of the occupational and working world.

- (4) The written part of the examination has a maximum duration of:

1. In the examination field of wastewater engineering	180 minutes
2. In the examination field of electrical engineering tasks	60 minutes
3. In the examination field of economic and social studies	60 minutes

- (5) The written part of the examination, at the request of the candidate or at the discretion of the examination committee, is to be supplemented in individual fields by an oral examination if this can be decisive for passing the examination. With the determination of the results for the examination fields tested orally, the previous result and the result of the oral supplementary examination are to be weighted in the ratio 2:1.

- (6) Within the written part of the examination the examination fields are to be weighted as follows:

1. Examination field of wastewater engineering	60 %,
2. Examination field of electrical engineering tasks	20 %,
3. Examination field of economic and social studies	20 %.

Subject of the final examination can be all the training contents (also the core qualifications) to be communicated in accordance with the training framework plan as well as the subject matter to be communicated in the vocational school curriculum as far as it is essential for the occupational training.

Essential component of the final examination is that the candidate, within the scope of the carrying out of a practical task, which can consist of several parts, is to plan, carry out economically the sequences of work and independently monitor the results.

Examination regulations for the carrying out of the final examination: The examination rules are regulated in the BBiG by §§ 34-41.

For the acceptance of the examination the **competent body** sets up at least one examining board. It consists of:

- a representative of the employers,
- a representative of the employees and
- an instructor of a vocational school.

For the carrying out of examinations the respective competent body promulgates examination regulations (§ 41 BBiG). Inter alia, these regulate:

- admission,
- breakdown of the examination,
- assessment standards,
- issue of the examination results,
- results from violations of the examination regulations and
- repeat examination.

An oral supplementary examination is only planned if the examination performance in the written part of the examination as a whole has resulted in no satisfactory performance. The supplementary examination is carried out at the discretion of the examining board or on application of the candidate for one examination field only, if it can be decisive for the passing of the examination but not, however, for the improvement of individual examination grades. The result of this oral examination has half the weight compared with the result of the appropriate written examination field.

(7) The examination has been passed if respectively in the practical and written part of the examination at least sufficient performance has resulted. And if with this, within the practical part of the examination in the examination field of electrical engineering tasks as well as in the written part of the examination in the examination field of wastewater engineering also at least sufficient performance has resulted.

Passing of the final examination:

The written part of the examination and the practical part of the examination receive respectively one grade.

The grade of the written part of the examination is made up as follows:

Wastewater engineering	60 %
Electrical engineering tasks	20 %
Economic and social studies	20 %

The examining board is to inform the candidate on the last day of the examination, whether he/she has passed or not passed the examination. The candidate receives a written confirmation for this from the chairman.

The candidate receives from the **competent body** a certificate of the successfully completed examination, which contains the designation of the training occupation and the results of the written and practical examination.

Final examination Sewage Engineering Technician			
Practical part	Written part		
<p>A practical task, which can consist of several subtasks:</p> <p>Operation and maintenance of drainage systems and wastewater treatment facilities including the carrying out of analytical and electrical engineering tasks</p>	<p>Written tasks:</p>		
<p>The candidate is to show that he/she can:</p> <ul style="list-style-type: none"> ■ plan the sequence of work economically, ■ identify work results, ■ document work results, ■ take measures for safety and for the protection of health at work, ■ take measures for environmental protection, ■ take quality assurance measures, ■ identify possible dangers of electrical current, ■ assess electrical tasks, ■ carry out electrical tasks safely. 	<p>The candidate is to show that he/she can:</p> <ul style="list-style-type: none"> ■ solve practice-related tasks with associated work-organisational, technical and mathematical-scientific contents ■ here measures for safety and protection of health with the work as well as quality assurance measures are to be presented 		
	<p>Wastewater engineering</p> <p>a) Operation and maintenance of drainage systems,</p> <p>b) Operation and maintenance of wastewater treatment facilities,</p> <p>c) Sampling methods, analysis methods and analysis equipment.</p>	<p>Electrical engineering tasks</p> <p>a) Basic elements of electrical engineering,</p> <p>b) Electrical plant and components,</p> <p>c) Electrical measuring equipment and safety devices.</p>	<p>Economic and social studies</p> <p>General economic and social interrelationships of the professional and working world.</p>
Max. 10 hours	Max. 180 minutes	Max. 60 minutes	Max. 60 minutes
	Weighting: 60 %	Weighting: 20 %	Weighting: 20 %
<p>Restrictive function: minimum sufficient performance</p> <p>Examination field electrical engineering tasks: minimum sufficient performance</p>	<p>Restrictive function: minimum sufficient performance</p> <p>Examination field wastewater engineering: minimum sufficient performance</p>		

Part 6
Transition and final regulations

§ 28
Transitional regulation

The previous provisions are to be applied further to occupational training conditions, which are in existence with the coming into effect of this ordinance, unless the parties to the contract agree to the application of the provisions of this ordinance.

§ 29
Coming into effect, suspension

This ordinance comes into effect on 01 August 2002. At the same time the Environmental Technician Regulations of 30 May 1984 are suspended (BGBl. I p. 731).

Berlin, 17 June 2002

The German Federal Minister of Economics and Technology

Signed for and on behalf of:
Tacke

The German Federal Minister for the Environment, Nature Conservation and Nuclear Safety

Signed for and on behalf of
Rainer Baake

Part II

Explanatory notes on the training framework plan

1. Description of the occupation requiring training with temporal guidance values (overview)

Ser. No. Training Framework Plan	Description of the occupation requiring training	Temporal guidance value in weeks in the training period	
		1 st – 15 th month	16 th – 36 th month
Core qualifications			
1 2 3 4	Vocational training, employment and collective bargaining law Structure and organisation of the firm providing training Safety and health protection on the job Environmental protection	To be communicated during the complete training	
5	Operational processes, work organisation	4	
6	Information and documentation, quality assurance measures	4	
7	Environmental protection technology, ecological cycles and hygiene	8	
8	Fundamental principles of mechanical and process engineering, measurement technology, numerical control engineering and control technology	19	
9	Dealing with risks posed by electricity	4	
10	Application of scientific principles	10	
11	Materials, ancillary materials and dangerous materials, dangerous working substances, materials processing	12	
12	Storage, tools and equipment	4	
Specialist qualifications			
13	Safety regulations and operating instructions		2
14	Operation and maintenance of drainage systems		18
15	Monitoring of indirect dischargers		3
16	Operation and maintenance of wastewater treatment facilities		20
17	Treatment of sewage sludge and utilisation of waste solids from wastewater facilities		6
18	Sampling and investigation of wastewater and sludge		14
19	Documentation, quality and environmental management		2*
20	Electrical plant in wastewater engineering		16
21	Legal provisions and technical rules and standards		2*
22	Consolidation phase sewer operation or wastewater treatment plant operation		8

*) To be communicated together with other training materials.

2. Information for the implementation of the training framework plan

The training framework plan – introduction for the training

The training framework plan regulates the training in firms, the framework curriculum the instruction in vocational schools (see page 67 et sqq.). Both framework plans together are the basis of the training.

The training framework plan is an introduction to the technical and temporal structure of the company training. In addition to the contents listed in the description of the occupation requiring training, it describes in detail the training objectives (skills and knowledge to be communicated).

The training contents in the training framework plan describe minimum requirements.

The firms providing training, with regard to the depth and breadth of communication of the training subject matter, can instruct beyond the minimum requirements if the individual progress of learning of the apprentices allows this and the firm-specific circumstances allow or even require this.

For the respective contents temporal guidance in weeks is given as orientation for the duration of firms communicating. (Temporal structure, Page 28). The temporal guidance value reflects the significance given to this section of the contents in comparison with other content sections.

The sum of the temporal guidance values is 52 weeks per training year. The temporal guidance values given in the training framework plan are gross times and must be converted to actual training times available operationally (net time). With this, the times for vocational school instruction and **holidays** must be deducted.

According to the following model calculation the guidance values for time given in the training framework plan can be converted into actual, operationally available training times (net time). With this, an estimated value of in total 12 weeks annual vocational school instruction is assumed. (The carrying out of the vocational school instruction is the responsibility of the individual German Federal States).

Gross time (52 weeks = 1 year)	365 days
less 52 Saturdays/52 Sundays	- 104 days
less approx. 12 weeks vocational school	- 60 days
less 6 weeks holiday ¹⁾	- 30 days
less public holidays which fall on days of training in firms ²⁾	- ca. 8 days
Net time	= 163 days

The purely firm-based training time, according to this model calculation, is approx. 163 days per year. This leaves – related to 52 weeks per year – approx. 3 days per week. For every week given in the training outline plan there are thus approx. 3 days of firm's training time available.

How the times for the communicating and consolidation are distributed to the individual learning objectives is up to the teaching personnel. Here they should be guided by the level of training of the apprentices or should place emphasis according to the operational requirements.

Example: "Operation and maintenance of drainage systems (§ 10 No. 14)"

This teaching position is allocated seven learning objectives (a) to (g), for which in total 18 weeks are planned. The distribution of these 18 weeks to the individual learning objectives is a task of training personnel.

The **firms' training plans** are elaborated on the basis of the training framework plan, which regulates the organisational and pedagogical-didactic execution of the training specifically to the firms.

Methodical procedure for the achievement of the training objective

Within the training framework plan the training objectives are described didactically by subject through the training content and deliberately *not* the paths (training methods), which lead to these objectives. Thus the selection of the methods, with which they can put together their training concept for the complete training course, is left open for the teaching personnel. That means that for the individual training sections suitable training methods are to be applied – related to the respective training situation. This openness in the question of training should be seen by the apprentices as a chance which makes it possible for them to proceed flexibly with different training situations.

In § 3, Para 2 of the Vocational Training Regulations an important methodical accent is, however, set with the requirement so to communicate the named training content, "that the apprentices are qualified to carry out a qualified occupational activity within the meaning of § 1, Para. 2 of the Vocational Training Act, which in particular includes independent planning, implementation and monitoring".

Independent action was previously also already the comprehensive objective of training. It is, however, new that the vocational training regulations lay down the promotion of this qualification in the occupational training and to verify this in the intermediate and final examination. In practical training in firms the training objective "independent action" should be continuous principle of training and be systematically communicated.

1) For this compare in detail the legal and collective bargaining rules

2) For this compare with the appropriate rules in the individual Federal State

3. Information and explanatory notes on the learning objectives of the training framework plan

The following statements make no claim to completeness but are rather to serve for illustration of individual learning objectives.

Common core qualifications in accordance with § 3, Para. 1, No. 1

Part of the description of occupation requiring training		Explanatory notes
Skills and knowledge to be communicated		
1. Vocational training employment and collective bargaining law [§ 10 No. 1]		
a) Explain significance of apprenticeship contracts, in particular final examination, duration and termination	To be communicated during the whole training	<ul style="list-style-type: none">• Provisions on the apprenticeship contract in §§ 3, 4, 5 Vocational Training Act• inter alia statements:<ul style="list-style-type: none">- type and objective of the training- start and duration of training- probationary period- remuneration- holidays- conditions for termination
b) Give mutual rights and obligations from the apprenticeship contract		<ul style="list-style-type: none">• Basis for this are, inter alia:<ul style="list-style-type: none">- Vocational Training Act- Vocational Training Regulations- Youth Employment Protection Law- Working Hours Law- Labour and Collective Bargaining Law• Inter-company training• Vocational school attendance• In-firm regulations, e.g. training plan, regulation of tasks, working hours and breaks, right of complaint, contents of Working Hours Regulations
c) Give possibilities of occupational further training		<ul style="list-style-type: none">• Possibilities of adjustment and advancement further training through matching to the technical, economical and social development• Operational further training• Advancement further training, e.g. Master Technician• Possibilities for promotion
d) Give essential parts of the employment contract		<ul style="list-style-type: none">• E.g.:<ul style="list-style-type: none">- description of tasks- working hours- beginning and duration of employment- probationary period

Part of the description of occupation requiring training		Explanatory notes
Skills and knowledge to be communicated		
<i>Serial No. 1 cont.</i>		<ul style="list-style-type: none"> - termination - holidays - in-firm regulations and contracts
e) Give essential provisions of the applicable collective agreements of the firm carrying out training		<ul style="list-style-type: none"> • Parties to collective agreements, applicable area (spatial, technical, personal) of the collective agreements for employees • Application to apprentices • E.g.: <ul style="list-style-type: none"> - pay, salary, apprentice's pay - length of holidays, holiday bonus - working hours, working time regulation - bonuses
2. Structure and organisation of the firm providing training (§ 10 No. 2)		
a) Explain structure and tasks of the firm carrying out training	To be determined throughout the whole of training	<ul style="list-style-type: none"> • Branch affiliation • Legal structure • Objective and range • Structure and process organisation • Interaction of factors on development, on service and on marketing the firm-specific products
b) Explain basic functions of the firm carrying out training, such as procurement, manufacture, sales volume and administration		
c) Give relationships of the firm carrying out training and its employees to economic organisations, trade representatives and unions		<ul style="list-style-type: none"> • Relationships to <ul style="list-style-type: none"> - employers' associations and unions - occupational organisations, occupational associations and competent bodies • Their aims, structure and tasks • Commitment to the rules of a collective agreement
d) Describe basic elements, tasks and methods of operation of the industrial consultation or personnel representation legal organs of the training company		<ul style="list-style-type: none"> • Principles of trusting collaboration between employer and employee representatives as content of the [German] Industrial Constitution Law, [German] Personnel Representation Law • Employee council, personnel committee, youth and apprentice representatives and their information, consultation and codetermination rights; company/employment agreements

Part of the description of occupation requiring training		Explanatory notes
Skills and knowledge to be communicated		
3. Safety and health protection on the job (§ 10 No. 3)		
a) Determine hazards to safety and health in the working place and take steps for their avoidance	To be determined throughout the whole of training	<ul style="list-style-type: none">• Employers duty to ensure welfare• Health and work safety provisions e.g.:<ul style="list-style-type: none">- Labour Protection Law- Working Hours Law- Youth Employment Protection Law- Technical Plant and Equipment Safety Law- Hazardous Substances Ordinance- Technical Standards for Hazardous Substances- Labour Safety Law• Mechanical, biological, chemical , thermal, acoustic and electrical hazards• Hazards and loading due to disregard of ergonomic principles• Hazard symbols and safety markings• Advice and monitoring of firms through external organisations, e.g. supervisory authorities, occupational organisations
b) Apply occupation-related labour protection and accident prevention regulations		<ul style="list-style-type: none">• Advisory leaflets and directives for the prevention of accidents when handling substances and auxiliary materials as well as tool machines and plant• Substances hazardous to health• Behavioural rules for the maintenance of health, personal protection equipment, e.g. protection for the head, eyes, mouth, ears and skin
c) Describe conduct with accidents and introduce initial measures		<ul style="list-style-type: none">• First aid measures and facilities• Emergency call, escape and rescue routes• Work accident notification (duty to report)

Part of the description of occupation requiring training		Explanatory notes
Skills and knowledge to be communicated		
<p><i>Serial No. 3 cont.</i></p> <p>d) Apply regulations for preventative fire protection; describe conduct with fires and take measures for the combating of fires</p>		<ul style="list-style-type: none"> • Provisions for protection against fire and explosion • Rules of conduct in cases of fire • Sources of ignition and easily inflammable substances • Method of operation and areas of employment of extinguishing facilities and auxiliary means • Fire extinguishers and fire blankets
4. Environmental protection (§ 10 No. 4)		
Contribute to the avoidance of operational environmental loads in the occupational area of influence, in particular a) by means of examples explain possible environmental loads due to training operations and their contribution to environmental protection	To be determined throughout the whole of training	<ul style="list-style-type: none"> • Determination and avoidance of environmental loads through, for example, noise, exhaust air, substances hazardous to water and soil • Emissions and immissions • Immission Protection Law
b) apply applicable environmental protection regulations for the firm providing training		
c) use possibilities for economic and environmentally friendly use of energy and material		
d) avoid wastes; pass substances and materials to an environmentally friendly disposal		
		<ul style="list-style-type: none"> • Employment of various energy carriers, e.g. electrical current, oil, coal, gas, air, water and steam • Possibilities for the economic use of energy e.g. avoidance of leakages, optimum lighting and use of heat • Economic handling of working and auxiliary materials • Marking, keeping separate, storage, utilisation, disposal of wastes • Collection, storage and disposal of industrial wastes • Legal consequences of non-compliance

Part of the description of occupation requiring training	Temporal guidance values in weeks in the 1 st – 15 th training month	Explanatory notes
Skills and knowledge to be communicated		
5. Operational processes; work organisation (§ 10 No. 5)		
a) Note efficiency of operational performances	4	<ul style="list-style-type: none">• Range of available services• Availability of resources• Costs and revenues• Basic elements for calculation
b) Describe types of cost and cost centres		<ul style="list-style-type: none">• Types of cost e.g. personnel, equipment, material• Functional accounts chart and its significance• Recording and distribution of costs
c) Carry out own work in a customer oriented manner		<ul style="list-style-type: none">• Quality requirements on services• Discussions and contacts with customers
d) Apply working and organisation means as well as techniques		<ul style="list-style-type: none">• Forms• EDP applications• Working procedures, processes, time planning
e) Plan, process and agree tasks within the team; evaluate results, monitor and present.		<ul style="list-style-type: none">• Team structures• Team ability• Teamwork
f) Collaborate with measures to improve work organisation and the design of the working place		<ul style="list-style-type: none">• Compare/analyse• Weak points/errors• Modifications• Operational proposal system
6. Information and documentation, quality assurance measures (§ 10 No. 6)		
a) Procure, process and evaluate information, use information and communications systems	4	<ul style="list-style-type: none">• Specialist books, journals, catalogues, operating instructions, technical documents, electronic communication means
b) Read technical documents and plans, produce sketches		<ul style="list-style-type: none">• Operating instructions, inventory plans, flow diagrams• Drawing equipment and sketches

Part of the description of occupation requiring training	Temporal guidance values in weeks in the 1 st – 15 th training month	Explanatory notes
Skills and knowledge to be communicated		
<i>Serial No. 6 cont.</i>		
c) Apply organisational instructions		<ul style="list-style-type: none">• Process and work instructions• Service and technical operating instructions
d) Produce work records and reports		<ul style="list-style-type: none">• Recording of measured data• Technical work procedure plans• Operating conditions of plant components• Maintenance verification• Performance records• Logbook and documentation• Acceptance
e) Observe legal regulations for the protection of data		<ul style="list-style-type: none">• Operating specifications• Data security
f) Carry out, document and monitor quality measures		<ul style="list-style-type: none">• Significance of quality assurance, e.g. quality management, operating manuals
7. Environmental protection technology, ecological cycles and hygiene [§ 10 No. 7]		
a) Describe ecological cycles	8	<ul style="list-style-type: none">• Water cycle<ul style="list-style-type: none">- water cycle in nature, precipitation, percolation, runoff, evaporation- drawing of water and water usages- types and qualities of water- geogenic and anthropogenic pollution- types of wastewater: domestic wastewater, precipitation water, industrial wastewater, percolation water- wastewater discharge, wastewater treatment, residues of wastewater treatment- eutrophication, self-cleaning strength of surface waters, water quality• Recycling management, waste management<ul style="list-style-type: none">- avoidance of waste, low waste product design- product, waste- waste for utilisation, waste for disposal- possibilities for utilisation and disposal of wastes- limits of recycling management

Part of the description of occupation requiring training	Temporal guidance values in weeks in the 1 st – 15 th training month	Explanatory notes
Skills and knowledge to be communicated		
Serial No. 7 cont.		<ul style="list-style-type: none"> • Carbon, nitrogen cycles <ul style="list-style-type: none"> - oxidation and reduction of carbons - conversion of nitrogen compounds • Soil uses <ul style="list-style-type: none"> - application of sewage sludge, wastes and fertilisers - fertilisation of soils - percolation of water - loading of soils - self-cleaning of soils • Air <ul style="list-style-type: none"> - the terms "emission" and "immission" - passing of pollutants into the air - aerosols (e.g. sewer cleaning) - global warming, greenhouse effect
b) Learn about and describe the causes and interactions of environmental loads of the air, of water, of the soil and of the surroundings		<ul style="list-style-type: none"> • Environmental loads with the operation of networks and plants during processing and control • Environmentally relevant content substances of the soil, air and water and their effects on people, animals and plants
c) Note principles and rules of hygiene with the operation of networks, systems and plants		<ul style="list-style-type: none"> • Possibilities for transmission, infection of illnesses through intake, skin contact, inspiration • Preventative measures • Personal protection equipment • Disinfection • Washing of hands • Consumption of food and nourishment • Regulation for the use of working clothes • Hygienic monitoring
d) Describe risks due to pathogens in raw water, wastewater, sludge and waste		<ul style="list-style-type: none"> • Pathogens in water, wastewater, waste • Bacteria, viruses, fungi, toxins, worms, vermin • Conditions for life of pathogens • Typical symptoms of illness

Part of the description of occupation requiring training	Temporal guidance values in weeks in the 1 st – 15 th training month	Explanatory notes
Skills and knowledge to be communicated		
<i>Serial No. 7 cont.</i>		
e) Describe networks and plants		<ul style="list-style-type: none">• Networks and plant systems, e.g. for the processing of water, for wastewater treatment, for waste treatment• Process techniques, machines, equipment, function and/or principles
f) Describe possibilities for the avoidance and minimisation of environmental loads using plants and techniques		<ul style="list-style-type: none">• Techniques and processes for the reduction of environmental loads, e.g. rational employment of energy, sludge utilisation, avoidance of waste
g) Apply legal regulations and sets of rules and standards		<ul style="list-style-type: none">• Build up of sets of rules and standards• Relevant technical regulation
8. Fundamental principles of mechanical and process engineering, measurement technology, numerical control engineering and control technology (§ 10 No. 8)		
a) Apply methods for the combination of substances and the separation of mixtures of substances	19	<ul style="list-style-type: none">• Methods for combination, e.g. mixing, stirring, kneading, gassing• Methods for separation:<ul style="list-style-type: none">- mechanical separation, e.g. settling, centrifuging, sieving, grading, sifting and precipitating- thermal separation, e.g. drying, volatising, distilling- physical, chemical, biological separation, e.g. precipitation, filtration, absorption
b) Employ methods for the conveyance of solids, liquids and gases		<ul style="list-style-type: none">• Basic physical elements of conveyance technology• Conveyance of solids, e.g. lifting, sucking, blowing, displacing• Conveyance of liquids and gases, e.g. pumping, vacuum sucking
c) Assemble and dismantle fittings		<ul style="list-style-type: none">• Structure, employment and function of shut-off devices and control fittings, valves, gate valves, taps and check (clack) valves, hose pipes and pipe connections, seals and expendable parts• Technical installation tasks, e.g. assembly and dismantling of pipeline sections
d) Employ and operate units, in particular pumps, blowers, compressors and electrical motors and combustion engines as well as equipment for heating, cooling and tempering		<ul style="list-style-type: none">• Structure and function:<ul style="list-style-type: none">- electrical motors, combustion engines- pumps, e.g. centrifugal pumps, positive displacement pumps, vacuum pumps- blowers and compressors

Part of the description of occupation requiring training	Temporal guidance values in weeks in the 1 st – 15 th training month	Explanatory notes
Skills and knowledge to be communicated		
Serial No. 8 cont.		<ul style="list-style-type: none"> - heating plant, e.g. hot water heating, heat exchangers, feed and circulation pumps, safety facilities - cooling and tempering, e.g. ventilators, blowers, condensate dryers, air conditioning equipment • Application examples for pneumatics and hydraulics • Pump characteristic curves, system characteristic lines, efficiency • Inspection and maintenance
e) Differentiate methods of measurement, control and regulation, explain structure and function of operation-specific equipment		<ul style="list-style-type: none"> • Methods <ul style="list-style-type: none"> - mechanical, pneumatic, electric and electronic methods of measurement - measurement accuracy, measurement range, scale graduation, sensitivity, reproducibility, response time - differentiation control/regulation - basic terms, e.g. probe, measuring site, measuring transducer, regulator, control device, regulating point, control variable, control loop, actual-set-alignment, block diagram - standard signal, registration technology • Equipment <ul style="list-style-type: none"> - equipment for measuring, for example, temperature, pressure, height level and throughflow - float control - setting of pump switching and control - bimetal regulators
f) Carry out measurement, control and regulation processes under instruction		<ul style="list-style-type: none"> • Operational facilities for regulation of processes • Causes of failures • Measures for the remedying of failures, e.g. switching to manual operation, passage of information
g) Employ energy carriers and types of energy taking account of economic efficiency, efficiency and the hazard potential		<ul style="list-style-type: none"> • Primary energy carriers, e.g. natural gas, coal, oil, water, sun energy • Secondary energy carriers, e.g. steam, electrical current, digester gas and dump gas, fuels, compressed air

Part of the description of occupation requiring training	Temporal guidance values in weeks in the 1 st – 15 th training month	Explanatory notes
Skills and knowledge to be communicated		
Serial No. 8 cont.		<ul style="list-style-type: none">• Storage of energy carriers• Hazard classes of energy carriers
h) Describe methods of energy conversion		<ul style="list-style-type: none">• Power-heat coupling• Combustion• Steam generation and usage• pressure water generation• Biochemical processes• Efficiency
9. Dealing with risks posed by electricity (§ 10 No. 9)		
a) Describe basic quantities and their relationships	4	<ul style="list-style-type: none">• Primary quantities: current, voltage resistance (actual resistance, capacitive, inductive)• Differentiate Ohm's Law and the following dependencies of the individual quantities derived from this• Current (direct current, alternating current, three-phase current)• Build up of a circuit, series connection, parallel connection• Power (real power, apparent power, reactive power)• Efficiency• Generator and motor principles
b) Identify dangers of electrical current at fixed and changing work places		<ul style="list-style-type: none">• Effect of electrical currents on humans• Accidents due to electrical current• Body current and contact voltage• Voltage flashovers• Fixed and movable electrical apparatus• Damaged insulation and connections

Part of the description of occupation requiring training	Temporal guidance values in weeks in the 1 st – 15 th training month	Explanatory notes
Skills and knowledge to be communicated		
<i>Serial No. 9 cont.</i>		<ul style="list-style-type: none">• Protective measures and their effects: e.g. protective extra low voltage, protective insulation, fuse disconnection, residual current circuit breaking• The five safety rules• Types of protection and protective classes• Suitable and approved electrical apparatus
c) Take and arrange protective measures for the avoidance of hazards due to electrical current		<ul style="list-style-type: none">• Accident prevention regulations• First aid with accidents due to electrical current
d) Describe conduct with accidents due to electrical current and introduce initial measures		
10. Application of scientific principles (§ 10 No. 10)		
a) Measure and evaluate physical quantities, determine material properties	10	<ul style="list-style-type: none">• Length, volume, mass, time, temperature, pressure• Material properties: e.g. electrical conductivity, pH value, oxygen content, density, melting point, boiling point• Measuring equipment with various measurement accuracy
b) Take, prepare, mark, conserve and preserve samples following different processes		<ul style="list-style-type: none">• Significance of sampling• Types of sampling• Sampling equipment• Storage, transport, conservation• Sampling protocols
c) Explain relationships of structure and characteristic properties of materials		<p>Chemical symbols and compounds:</p> <ul style="list-style-type: none">• inorganic compounds: e.g. metals, acids, alkaline solutions, salts, oxides• organic compounds: e.g. hydrocarbons, alcohols, carbonic acids, halogenated hydrocarbons, fats and plastics

Part of the description of occupation requiring training	Temporal guidance values in weeks in the 1 st – 15 th training month	Explanatory notes
Skills and knowledge to be communicated		
<i>Serial No. 10 cont.</i>		<ul style="list-style-type: none"> • Homogeneous and heterogeneous substances and mixtures of substances • Details of concentration, blending ratios, percentage by mass and by volume • Process and equipment technology
d) Calculate, produce and separate mixtures of substances; monitor results		
e) Describe reaction processes, in particular precipitation reactions, acid-base reactions and Redox reactions		<ul style="list-style-type: none"> • Reaction processes of metals, acids, bases, salts and other relevant substances • Substance conversions • Neutralisation, precipitation, Redox reaction
f) Carry out qualitative and quantitative determinations and evaluate results		<ul style="list-style-type: none"> • Anionic and cationic detection • Volumetric analysis • Gravimetric analysis • Photometric analysis • Employment of indicators • Handling of reaction products
g) Describe structure types and living conditions of micro-organisms and describe their significance for work in the operation		<ul style="list-style-type: none"> • Aerobic and anaerobic conditions • Influences on micro-organisms, e.g. temperature, pH value, nutrient availability • Micro-organisms in operational processes • Biological working materials and their classification into risk groups
h) Present material cycles and describe microbiological methods of investigation		<ul style="list-style-type: none"> • Significance of micro-organisms in the natural and operational material cycles, in particular nitrogen and carbon cycles • Parameter of microbiological processes • Handling a microscope • Microscopic picture

Part of the description of occupation requiring training	Temporal guidance values in weeks in the 1 st – 15 th training month	Explanatory notes
Skills and knowledge to be communicated		
11. Materials, ancillary materials and dangerous materials, dangerous working substances (§ 10 No. 11)		
a) Select and employ materials and ancillaries taking into account their properties and applicability	12	<ul style="list-style-type: none">Metals, plastic, wood, concreteLubricants and coolantsChemical and physical properties, e.g. expansion behaviour, melting point, flash point, electrical conductivity, elasticity, thermal and chemical resistance, hardness, viscosity, fracture behaviour
b) Recognise hazardous substances and hazardous working materials and employ these taking account of safety regulations and protective measures processes		<ul style="list-style-type: none">Characteristic properties, e.g. corrosive, combustible, potentially explosive, contaminative, irritantHazard symbolsSafety data sheetHazard instructionsPersonal and technical protective measures
c) Handling of tools, machines and equipment for the processing of materials		<ul style="list-style-type: none">Process materials, e.g. measure, scribe, corn, file, drill, saw, grind, burr, bend, reamFlange, screw, welded, hard and soft solder connections, Velcro fastener, turn-lock fastenerWorking principles of component connections (material connection, frictional connection, positive locking)
d) Produce work pieces made from metal and plastics		
e) Describe joining techniques		
f) Shape, join and separate metals and plastics under tension and without cutting		
12. Storage, tools and equipment (§ 10 No. 12)		
a) Store and transport materials and goods according to their physical qualities and material properties	4	<ul style="list-style-type: none">Forms of store, types of store, store facilitiesEconomic store managementStorage conditions
b) Carry out inventory checks and introduce corrections		
c) Operate cranes, elevators and transport facilities		<ul style="list-style-type: none">Industrial trucks, cranes and elevators, e.g. fork-lift trucks, travellers, conveyor belts, cranes, wheel loaders, chain conveyors
d) Employ, inspect, maintain and clean working equipment and facilities		<ul style="list-style-type: none">Tools, equipment and workshop facilitiesoperating instructions
e) Determine faults on working equipment and facilities and take measures for their correction		<ul style="list-style-type: none">Servicing, repair and maintenance instructionsFault indication and fault correction

Occupation-specific specialist qualifications in accordance with § 3 Para. 1 No. 2 Letter b

Part of the description of occupation requiring training	Temporal guidance values in weeks in the 16 th – 36 th training month	Explanatory notes
Skills and knowledge to be communicated		
13. Safety regulations and operating instructions (§ 10 No. 13)		
a) Select and handle personal protective equipment	2	<ul style="list-style-type: none">• General personal protective equipment (PPE), e.g. head, eye, hand, foot protection and general torso/body protective equipment• Special PPE, e.g. protection against drowning, falling, respiratory toxins• Testing of PPE by the user• Obligation to use PPE
b) Operate safety facilities at the work place and maintain their functional capability		<ul style="list-style-type: none">• E.g. welding smoke ventilators, laboratory exhausts, protective grills and safety fences, emergency shower and eye douche, railings and other barriers• Working equipment requiring testing, e.g. life belts, power operated doors and gates, stackers
c) Describe the explosion hazard and take measures for protection against explosion		<ul style="list-style-type: none">• Explosive gases: origination, occurrence, lower and upper explosive limits• Ventilation measures, smoking ban, permits, explosion classes for tools, explosions zone plan• Procedure with explosion alarm
d) Take into account the hazards from pathogens in wastewater and sludge and apply the rules of work hygiene		<ul style="list-style-type: none">• Hazards due to viruses, bacteria, fungi and parasites; rats as disease transmitters• Infection routes via breathing, mouth, skin and injuries• Black/white separation, cleaning of working clothing, disinfection• Basic knowledge of the biomaterial ordinance, distribution into risk groups
e) Comply with rules of conduct with work in enclosed spaces		<ul style="list-style-type: none">• Industrial medical preventative examinations/ vaccinations• Securing of the entry point, ventilation, security against falling• Employment of multiple measuring equipment and test equipment for the verification of hazards through substances, e.g. atmospheres capable of explosion, toxic gases, lack of oxygen• Tasks of supervisors, e.g. security, visual contact

Part of the description of occupation requiring training	Temporal guidance values in weeks in the 16 th – 36 th training month	Explanatory notes
Skills and knowledge to be communicated		
14. Operation and maintenance of drainage systems (§ 10 No. 14)		
a) Describe drainage systems	18	<ul style="list-style-type: none">• Combined systems, separate systems, modified separate and combined systems, pressure and vacuum drainage systems• Percolation facilities and systems, e.g. shaft percolation, swales, infiltration basins, soil filters
b) Operate and maintain installations in particular special structures and pump stations		<ul style="list-style-type: none">• Special structures, e.g. stormwater overflow (SO), stormwater tank with overflow (STO), stormwater holding tank (SHT), sewer with storage capacity and overflow (SSCO), stormwater sedimentation tank (SST), retarding basin (RB), ramp manhole, siphon• Pump station, e.g. dry and wet installation, spiral, reciprocating and centrifugal pumps• Secondary plant and machinery, pressure pipelines, vacuum plants and vacuum pipelines• Inspection and cleaning of special structures and pump stations• Clearance of operating faults
c) Monitor control and regulate operating procedures with the aid of control technology		<ul style="list-style-type: none">• Tasks of process control systems, e.g. visualisation, process control, evaluation, documentation, archiving• Differentiation of analogue value, binary value, characteristic value, metered value, design value, actual value• Handling of process images, e.g. manual operation, commissioning and decommissioning of plant and machinery• Production and evaluation of characteristic curves/lines• Modification of design value specifications and regulator parameters according to process technical requirements• Use and care of maintenance modules• Input of manual measured values• Production of reports, operating logbooks

Part of the description of occupation requiring training	Temporal guidance values in weeks in the 16 th – 36 th training month	Explanatory notes
Skills and knowledge to be communicated		
<i>Serial No. 14 cont.</i>		<ul style="list-style-type: none"> • Evaluation of indicated data • Data transfer to authorities, data security
d) Plan, execute and monitor cleaning, inspection and leak testing taking into account the materials and the rehabilitation measures		<ul style="list-style-type: none"> • In rotation: cleaning, inspection cleaning, cleaning for abnormal occurrences • Cleaning methods, e.g. high pressure cleaning, water surge cleaning, sewer scraper • Sewer inspection, e.g. through visual inspection and reflection, remote sewer inspection • Leak testing: test methods using water, air underpressure, overpressure • Examination of sewer sections, manhole examination, examination of sleeves
e) Determine faults and take corrective measures		<ul style="list-style-type: none"> • Faults, e.g. blockages, sewer collapse, sewer overloading, introduction of hazardous materials • Measures for correction, e.g. flushing, cutting, removal of roots, closures, diversions, removal by suction • Management of abnormal occurrences, reporting system for abnormal occurrences, reporting chain
f) Use network information systems		<ul style="list-style-type: none"> • Basic elements for network information systems, e.g. structural drawings, cadastral plans, site plans, cross-sections, manhole data sheets • Sewer database <ul style="list-style-type: none"> - principle data, e.g. year of construction, diameter, profile, position - damage data, inspection results, damage classification and assessment • As basis for rehabilitation planning, sewer inspection, determination of sewer value, sewer cleaning planning, action planning • Advanced systems: data transfer of online measurements, e.g. rainfall meter, filling level and flow via remote systems to the control point • Operational management system
g) Carry out security measures for work sites in the area of roads		<ul style="list-style-type: none"> • E.g. signing plan, warning clothing, traffic control facilities

Part of the description of occupation requiring training	Temporal guidance values in weeks in the 16 th – 36 th training month	Explanatory notes
Skills and knowledge to be communicated		
15. Monitoring of indirect dischargers (§ 10 No. 15)		
a) Carry out operational visual inspection	3	<ul style="list-style-type: none">• Recording of operating data, e.g. production processes with wastewater production, wastewater treatment facilities, discharge points, sampling points• Monitoring of treatment facilities, e.g. sludge traps, separators, neutralisation facilities• Monitoring of operating records, e.g. operating logbooks, automatic records• Documentation and evaluation for indirect discharger cadastre (public record), leak testing
b) Monitor indirect discharge points; carry out mobile sampling and on-site measurements		<ul style="list-style-type: none">• Manual and automatic sampling• Employment/installation of measuring equipment• Sewer film examination• Evaluation of measured results
c) Apply indirect discharger cadastre		<ul style="list-style-type: none">• Input and updating of recorded, monitoring and measured data• Planning of controls and sampling intervals
16. Operation and maintenance of wastewater treatment facilities (§ 10 No. 16)		
a) Describe processes of mechanical wastewater treatment and operate and maintain their facilities	20	<ul style="list-style-type: none">• Processes of mechanical wastewater treatment, e.g.<ul style="list-style-type: none">- pump stations, elevator facilities- types of screen, e.g. fine and coarse screens, washing of screenings, dewatering of screenings- sewage acceptance stations- types of grit chamber, treatment of grit chamber trappings- sieves- light density material separators- pre-treatment, tank shapes and clearance systems• Maintenance of structures as well as of mechanical and electrical facilities

Part of the description of occupation requiring training	Temporal guidance values in weeks in the 16 th – 36 th training month	Explanatory notes
Skills and knowledge to be communicated		
<p><i>Serial No. 16 cont.</i></p> <p>b) Describe processes of chemical-biological wastewater treatment and operate and maintain their facilities</p>		<ul style="list-style-type: none"> Processes and facilities of chemical-biological wastewater treatment, e.g. <ul style="list-style-type: none"> aeration tanks, aeration systems and agitators multistage activated sludge plants nitrification, denitrification chemical and biological phosphorus removal secondary settling tanks SBR processes wastewater ponds, helophyte treatment plants trickling filters dimensioning quantities, e.g. volumetric loading, sludge loading, sludge age, surface feeding, return sludge ratios precipitation flocculation Maintenance of structures as well as of mechanical and electrical facilities
<p>c) Take into account relationships of process steps with wastewater treatment</p>		<ul style="list-style-type: none"> Origin and composition of wastewater <ul style="list-style-type: none"> types: wastewater, precipitation water, infiltration and combined water and domestic, commercial and industrial wastewater, landfill water production: specific yield per inhabitant (l) and day (d), population equivalents, total number of inhabitants and population equivalents properties: micro-organisms, biomasses, fixed biological film, activated sludge flocks, nutrients and toxins Wastewater treatment procedures <ul style="list-style-type: none"> basic flow chart of a wastewater treatment plant relationships of mechanical, biological and chemical procedures relationship and interactions between sewer network and wastewater treatment plant
<p>d) Describe special processes of wastewater treatment</p>		<ul style="list-style-type: none"> Special processes for wastewater treatment, e.g. <ul style="list-style-type: none"> flotation filtration membrane processes neutralisation disinfection detoxification adsorption
<p>e) Determine faults and take measures for their clearance</p>		<ul style="list-style-type: none"> Determination of faults in machines and electrical equipment in the field of measurement and control/ M&C) and process technical operation

Part of the description of occupation requiring training	Temporal guidance values in weeks in the 16 th – 36 th training month	Explanatory notes
Skills and knowledge to be communicated		
<i>Serial No. 16 cont.</i>		<ul style="list-style-type: none"> • Take particular measures for the maintenance of optimum operating conditions as a result of inflow of oil, toxin and pH surges, bulking sludge, power failure • Management of abnormal occurrences, reporting system for abnormal occurrences, reporting chain
f) Monitor, control and regulate operating procedures with the aid of process control techniques		<ul style="list-style-type: none"> • Tasks from the process control systems, e.g. visualisation, process control, evaluation, documentation, archiving • Differentiation of analogue value, binary value, characteristic value, metered value, design value, actual value • Handling of process images, e.g. manual operation, commissioning and decommissioning of plant and machinery • Production and evaluation of characteristic curves/lines • Modification of design value specifications and regulator parameters according to process technical requirements • Use and care of maintenance modules • Input of manual measured values • Production of reports, operating logbooks • Evaluation of indicated data • Data transfer to authorities, data security

Part of the description of occupation requiring training	Temporal guidance values in weeks in the 16 th – 36 th training month	Explanatory notes
Skills and knowledge to be communicated		
17. Treatment of sewage sludge and utilisation of waste solids from wastewater facilities (§ 10 No. 17)		
a) Operate and maintain facilities for sludge treatment	6	<ul style="list-style-type: none">• Types of sludge, yield properties• Processes and facilities for sludge treatment<ul style="list-style-type: none">- aerobic and anaerobic stabilisation- digesters, charging of digesters, heating of digesters, stirring, layer of scum, removal of sludge liquor- pre- and post-thickeners, sludge storage- mechanical thickening, e.g. decanter, bar screen- mechanical sludge dewatering, e.g. centrifuges filter presses, band filter presses- conditioning, e.g. flocculation aids, iron, lime• Effects of storage, treatment for dewatering capability• Maintenance of structures as well as machines and electrical facilities
b) Operate and maintain facilities for gas processing and utilisation		<ul style="list-style-type: none">• Gas quantities, compositions, storage including explosion protection• Facilities for gas processing and utilisation<ul style="list-style-type: none">- gas tanks- gas flares, flashback arresters- gas utilisation, gas engines, heating desulphurisation plants• Maintenance of structures as well as mechanical and electrical facilities
c) Monitor, control and regulate operational procedures		<ul style="list-style-type: none">• Process technical processes• Interactions and dependencies of the process stages• Measured values and operating records
d) Feed wastes from to utilisation and disposal		<ul style="list-style-type: none">• Types of wastes and residues, e.g. screenings, oils and fats grit chamber trappings, sewage sludge, sludge from road gullies• Possibilities of utilisation, e.g. composting, agricultural utilisation, thermal utilisation, land filling, washing and drying
e) Determine faults and take measures for their correction		<ul style="list-style-type: none">• Faults with sludge treatment<ul style="list-style-type: none">- causes of faults- safety precautions- countermeasures

Part of the description of occupation requiring training	Temporal guidance values in weeks in the 16 th – 36 th training month	Explanatory notes
Skills and knowledge to be communicated		
18. Sampling and investigation of wastewater and sludge (§ 10 No. 18)		
a) Carry out sensorial tests on various types of wastewater and sludge	14	<ul style="list-style-type: none">• Colour, odour, turbidity
b) Carry out and evaluate the customary physical investigations including sampling in wastewater discharge and wastewater treatment, in particular determine settleable solids, sludge dry substance, ignition loss, sludge index, visibility depth and turbidity		<ul style="list-style-type: none">• Plausibility tests• Implementation of investigation results• E.g. quick tests, field methods, laboratory methods
c) Measure quantities, filling levels, through-flows and concentrations		<ul style="list-style-type: none">• Quantity and flow measurement, e.g. venture flume, overfall weirs, magnetic inductive flow measurement (MIFM)• Filling level measurement, e.g. floats, ultrasonics manometric capsules• Concentration measurement, e.g. solids content, pH value, oxygen content, conductivity
d) Monitor, control and regulate operating procedures with the aid of process control techniques		<ul style="list-style-type: none">• Plausibility tests• Implement results of investigation• e.g. quick tests, field methods, laboratory methods
e) Carry out microbiological examinations		<ul style="list-style-type: none">• Microscopic sludge picture• Identify and select filamentous organisms
f) Differentiate, evaluate and handle, according to possibilities for employment and function, the laboratory equipment necessary for the examination of wastewater and sludge		<ul style="list-style-type: none">• Select measuring equipment of varying accuracy• Maintenance of laboratory equipment
g) Employ and maintain on-line measuring equipment		<ul style="list-style-type: none">• Measuring equipment for the determination of, for example, nitrate, ammonia, phosphate, COD, BOD₅• Servicing of sample preparation facilities• Servicing of on-line measuring equipment, e.g. exchange of consumable items

Part of the description of occupation requiring training	Temporal guidance values in weeks in the 16 th – 36 th training month	Explanatory notes
Skills and knowledge to be communicated		
19. Documentation, quality and environmental management (§ 10 No. 19)		
a) Apply legal and operationally-related specifications of quality and environmental management	2*	<ul style="list-style-type: none">• Standard specifications, sets of rules and standards and operation regulations for quality and environmental management
b) Monitor, document and evaluate working procedures and work results		<ul style="list-style-type: none">• Draw up reports on internal operating specifications
c) Document and safeguard results, in particular in operating logbooks and data bases		<ul style="list-style-type: none">• Keep operating logbooks, produce daily, monthly and annual reports• Use of databases, e.g. position and sewer databanks
20. Electrical plant in wastewater engineering (§ 10 No. 20)		
a) Select and handle measuring equipment and work equipment	16	<ul style="list-style-type: none">• Personal protective equipment• Measuring equipment, e.g. voltmeters, ammeters, ohmmeters, multifunctional measuring equipment, voltage testers• Displays of measured data, e.g. analogue, digital, recording strips
b) Read operationally specific plans		<ul style="list-style-type: none">• Marking of operating equipment• Electrical switching symbols• Electrical circuit diagrams, e.g. installation plan, general plan, current flow plan, plant marking system
c) Test and exchange fuses, sensors, measuring devices, lighting material and signal lamps.		<ul style="list-style-type: none">• Observance of protective and safety measures, rated voltages, rated currents, suitability of tools• Function and marking of fuses, e.g. lead fuses, automatic cut-outs, over-current protection• Assignment of defects to electrical components• Renewal of electrical screwed and clamping joints, simple wiring• Functional testing

* To be communicated together with other training subject matter

Part of the description of occupation requiring training	Temporal guidance values in weeks in the 16 th – 36 th training month	Explanatory notes
Skills and knowledge to be communicated		
<p><i>Serial No. 20 cont.</i></p> <p>d) Assess operating faults, exchange plant components, in particular pumps and motors, and return these to operation</p>		<ul style="list-style-type: none"> • Types of defect, e.g. line break, short circuit, short-circuit-to-frame, short-to-ground, short-to-line, mechanical defects on switching systems • Types of motor, e.g. three-phase asynchronous motors, single-phase motors, direct current motors • Maintenance and servicing of electrical motors, e.g. connections, power transfer, cooling, bearings • Return to service and monitoring : <ul style="list-style-type: none"> - operatability - electrical installation - function of the protective motor switch
<p>e) Exchange immediately releasable electrical components outside control boxes</p>		<ul style="list-style-type: none"> • E.g. initiators, sensors, manual switches, solenoid valves, pressure switches, measuring heads, float switches, level switches not together with complex switching facilities and outside of explosion zones • Observance of the signal type
<p>f) Install and operate alternate power generators</p>		<ul style="list-style-type: none"> • Determination of the required power • Observance of the protective measures, in particular the correct earthing of the unit • Structure, function, positioning • Commissioning and decommissioning • Test runs and maintenance intervals
<p>g) Install, test and maintain battery systems</p>		<ul style="list-style-type: none"> • Structure and method of operation, characteristic quantities, standard specification details of primary elements (dry batteries) • Structure and method of operation, commissioning and maintenance, charging of lead accumulators • Maintenance intervals and safety facilities • Monitoring of the charging status

Part of the description of occupation requiring training	Temporal guidance values in weeks in the 16 th – 36 th training month	Explanatory notes
Skills and knowledge to be communicated		
21. Legal provisions and technical rules and standards (§ 10 No. 21)		
Specialist-related legal provisions and technical rules and standards	2*	<ul style="list-style-type: none">• E.g. Water Resources management Law (in Germany WHG), [German] Federal State Water Laws, Wastewater Charges Law (in Germany AbwAG), self-monitoring ordinances, [German] Indirect Discharger Ordinance, [German] Sewage Sludge Ordinance, wastewater statutes• Sets of rules and standards of associations• Standard specifications• Accident prevention regulations
22. Consolidation phase sewer operation or wastewater treatment plant operation (§ 10 No. 22)		
For the continuation of the occupational training skills and knowledge are to be consolidated in accordance with Serial Nos. 14 and 15 for sewer operation or 16 and 17 for wastewater treatment plant operation, taking into account operationally related focal points	8	<ul style="list-style-type: none">• Consolidation sewer operation or• Consolidation wastewater treatment plant operation

* To be communicated together with other training subject matter

Part III

Keywords from A - Z

1. Advanced vocational training

The advanced vocational training is to enable the maintenance and expansion of knowledge and skills, adjustment to development and occupational advancement.

To advanced occupational development training belong, above all, advanced vocational training courses which are regulated by **competent bodies**. These determine the objective, the requirements, the procedure of examination, the prerequisites for registration and the establishment of examination committees.

2. Apprentice's pay

Those providing instruction must provide apprentices with a fair remuneration (§ 10 BBiG). The amount of the remuneration is to be regulated in the **apprenticeship contract**.

With continuing occupational training it must increase at least annually.

3. Apprenticeship contract

Before the start of occupational training an apprenticeship contract must be concluded between those providing instruction and apprentices (§ 3 BBiG).

The essential content of the apprenticeship contract must be recorded in writing by those providing instruction after agreement, in any case before the start of the occupational training (§ 4 BBiG). The record of the contract is to be signed by those providing instruction, by the apprentices and (for those under age) by their legal representatives (§ 4 BBiG). The contractual record must, at the least, contain details on:

- type and objective of the occupational training, in particular the occupation for which training is to be carried out,
- start and duration of the occupational training,

- **training activities outside the training company**,
- duration of regular daily working time,
- duration of the **probationary period**,
- payment and amount of the **apprentice's pay**,
- duration of **the holidays**,
- conditions under which the apprenticeship contract can be terminated.

4. Competent bodies

According to the Vocational Training Act the following tasks are delegated to the competent bodies: monitoring of the implementation of the occupational training, to support this through consultation with instructors and apprentices through the training advisers appointed for this purpose and, insofar as no regulations exist to regulate the execution of occupational training through legal provisions (e.g. examination rules) (comp. § 45 BBiG).

Sewage Engineering Technician is an occupation requiring training of the public service. So far as the training takes place in trade and industry firms it is an occupation requiring training of trade and industry.

Public service within the meaning of § 1 of the Ordinance on Occupational Training in environmental engineering trades covers all legal persons under public law with all their facilities, which are not legally made independent.

For the area of public service the responsible agencies for the Federal [German] Government are determined by the top Federal Government Authority otherwise through the Federal States (comp. § 84 Para. 1 BBiG). The directory of competent bodies for this can be found on Page 86 in the part "General Information".

If occupational training takes place in trade and industry firms then the respective local Chamber of Commerce and Industry takes over the function as competent bodies.

The responsible agency sets up an occupational training committee (§ 56 BBiG), to which belong representatives of the employers and of the employees as well as – with an advisory capacity – teachers of the vocational school.

The occupational training committee has to adopt the legal provisions to be implemented by the competent body for the execution of the occupational training (e.g. the examination rules) and must be informed of and follow all important matters of the occupational training.

5. Coordination between the training company and the vocational school

The initial occupational training for the Sewage Engineering Technician takes place in the dual system for occupational training.

Characteristic for the dual occupational training is that the apprentices acquire the skills and knowledge, required for the practice of an occupation, within a training company and in a vocational school.

The duality is also evident in the different vocational training regulations:

- Basis for the training carried out in the firm are the standard nationally applicable vocational training regulations issued as legal ordinance.
- Basis for the curricula of the vocational schools are the framework curricula of the Conference of [German] Federal State Culture Ministers, which represent a recommendation.

Vocational training regulations and framework curricula therefore differ both in their legal quality and in their area of application.

The firm carrying out training and the vocational school must complement each other and agree in the training in order that the dual system works in a sensible and helpful way for all those involved. Such a collaboration cannot be prescribed.

Training practice for the occupational training as Sewage Engineering Technician on a framework training plan can fall back on a training framework plan, which is agreed with the framework curricula of the Conference of Culture Ministers. With this the prerequisites for the collaboration between training companies and the vocational schools are met.

The successful conversion of the new vocational training regulations is essentially dependent on a constructive agreement between the two places of learning: school and firm.

6. End of training/giving of notice

A giving of notice can take place at any time from the apprentices or instructors during the **probationary period**. Notice requires to be in the written form. During the **probationary period** no reasons have to be given.

After the **probationary period** the training relationship can be terminated only with good reasons, i.e. if for one side it is unreasonable to continue the training relationship. When an important reason exists has to be decided in the individual case. The reasons are to be given.

Another possibility of giving notice exists if the apprentice wishes to be trained in another occupation requiring training. Here the training relationship can be terminated with four weeks notice. Notice must be given in writing and must contain the reasons for the termination.

For those who have not yet reached their majority notice can only be given if the legal representative agrees. If minors are given notice the termination must be discussed with the legal representatives.

7. Flexibility clause

The **in-firm's training plan** can deviate from the training framework plan with regard to its content and timely structure due to practical business characteristics. This fact designated as flexibility clause can be derived from § 11 of the ordinance.

The skills and knowledge listed in the training framework plan are to be communicated by the final examination.

8. Holidays

Apprentices have the right to paid holidays. The legal minimum holidays are laid down:

- for young persons in the [German] Youth Employment Protection Law (JarbSchG) and
- for adults in the [German] Federal Holidays Law.

For young persons the duration of the holidays is scaled according to age. Annually it is:

- at least 30 working days if the young person is still not 16 years of age at the beginning of the calendar year

- at least 27 days if the young person is still not 17 years old at the beginning of the calendar year

- at least 25 days if the young person is still not 18 years old at the beginning of the calendar year (JarbSchG).

For the year in which they become 18 years old young persons still have holidays in accordance with the Youth Employment Protection Law. Those who are 18 years old at the beginning of the calendar year receive adult holidays. Adult holidays are a minimum of 24 working days a year.

9. In-firm's training plan

For the individual training process the firm providing training produces the in-firm training plan for the apprentices. This is handed out and explained to the apprentices at the start of training; in the same way the vocational training regulations are also to be made available.

A technical and temporal breakdown of the training subject matter is in particular admissible if operationally practical peculiarities make this necessary (**Flexibility Clause**, § 11 of the Ordinance). It is to be noted that training subject matter of the training framework plan is not lost. The minimum requirements are laid down in the training framework plan.

Additional skills and knowledge can be additionally communicated depending on the requirement.

With the production of the training plan the following are to be taken into account:

- the personal qualifications of the apprentices (e.g. different educational background)
- the circumstances of the training company (e.g. operational structures, personnel and technical installations, regional peculiarities)
- the carrying out of training (**training activities outside the training company**, blocking of the vocational school instruction).

The temporal guidance values are to be calculated to firm requirements. In addition an arrangement of the training blocks for fixed months in the training year must also take place. With this block training, **holidays** and, if required, **training activities outside the training company** are to be taken into account.

With a larger number of apprentices the elaboration of a transfer plan is recommended.

If, during the course of training, a decrease or increase of the contractual training time results, then it is recommended undertaking well in time an adjustment of the training plan to the changed course of training.

10. Occupational capacity to act

Objective of the training is the occupational capacity to act. It is to enable apprentices to independently plan, execute and monitor qualified occupational activities within the meaning of § 1 Para. 2 BBiG (comp. § 3 Para. 2 of the ordinance).

In order to achieve this objective technically-related and interdisciplinary qualifications (skills, knowledge and competence) are communicated in the training and, within this framework, expertise is supported which can be realised in precise activities.

Professional competence
enables certain tasks in occupational relationships to be processed to meet the objective.

Methods expertise
covers strategy, organisation, structure and arrangement of an activity.

Social competence/personal competence
enables the mastery of occupational activity also in social relationships.

These qualification components and expertise are basically not isolated within the training but are communicated and supported together using complex tasking.

Professional competence, methods expertise and social competence are to be placed at the same level in the personality development of the young persons during training. Appropriate qualifications are to be included in the training framework plan.

11. Probationary period

The occupational training relationship starts with the probationary period. It must be at least one month long and may be a maximum of three months (§ 13 BBiG).

As the probationary period already belongs to the occupational training the complete obligations of the instructors and the apprentices also stand. During the probationary period the instructors are obliged to examine carefully the suitability of apprentices for the trade to be

learned. The apprentices must also examine whether they have made the right selection.

During the probationary period the occupational training relationship can, at any time, be terminated in writing both by the instructors and also by the apprentices without giving reasons and without any time limit (§ 15 BBiG).

12. Qualified electrical engineering person

The term "qualified person" is anchored in the [German] Labour Protection Law. If tasks can be carried out only with observance of certain protective measures without prejudice to health the suitability of the employee concerned for the execution of this measure belongs to the labour protection requirements with such work.

Therefore the law obliges the employer to pay attention with the transfer of the tasks, that those employed are physically and mentally in a position to understand the protective equipment and carry out protective measures relevant for the tasks. From this formulation it is to be derived that for work on electrical plant and operating means

certain skills are absolutely necessary. The electrician is the qualified person for these activities.

The technical qualification of an electrician as a rule is acquired through the completion of technical training, for example as electrical master technician/-electrical technician.

Equally, training in a firm for a certain area of work in electrical engineering can communicate the necessary knowledge and skills. This is the case with the sewage engineering technician.

13. Suitability as instructor

In accordance with the [German] Vocational Training Act (BBiG) only those persons may carry out instruction who are personally and technically qualified. Technically qualified to carry out occupational training are those who possess the skills and knowledge as well as the occupational and labour pedagogic knowledge (§ 20 BBiG). Further information is provided in the ordinance on the occupational and labour pedagogic suitability for occupational training - The [German] Ausbildereignungsverordnung (AEVO) – dated 16 February 1999. According to this, training personnel for occupational training have to verify occupational and labour-pedagogic knowledge in a special examination (§ 21 BBiG).

The specialist qualification is given in detail in § 76 BBiG. Here you will also find an exception ruling which allows for the recognition of the specialist qualification of specialists without recognised final examination following consultation by the **competent body**.

The **competent body** are to see that the personal and specialist qualification of instructors is available (§ 23 BBiG).

The new occupation requiring training demands from training personnel basic pedagogic skills. It is not just “demonstrators” that are required but rather more the guidance and advisory function and thus the urging of apprentices towards independent learning.

14. Suitability of the training company

Apprentices may only be engaged if the training company, according to type and equipment, is suitable for the occupational training, and the number of apprentices is in a reasonable relationship to the number of training places and the technicians employed.

The suitability of a training facility in which the laid-down occupational skills and knowledge cannot be communicated completely exists if suitable **training activities outside the training company** can be carried out (§ 22 BBiG).

The determination of the suitability takes place through the **competent body** (§ 22 BBiG).

It is necessary to develop a high degree of flexibility with the assessment of the suitability of firms providing training.

It is undisputable that that the legal requirements on the training company have to be met without limitation. However, collaborative training ventures and co-operations increase possibilities for negotiation.

15. Training activities outside the training company

If firms carrying out training are too specialised to be able to cover all parts of the training or if the firm is too small to ensure all technical and personnel prerequisites there is a possibility of balancing out such deficits through training activities outside the training company.

To this belong training measures in

- **inter-company vocational training centres**
(comp. § 22 BBiG)

and in the

- **collaborative training venture.**

Inter-company training vocational centres:

In order to relieve the pressure on training operations inter-company vocational training centres can be offered. Information on this is given by the **competent bodies**.

Collaborative training venture:

A collaborative training venture exists if different firms combine to plan and, based on the division of labour, carry out occupational training together. The apprentices then complete certain parts of their training not in the training company but rather in one or more partner firms.

In practice four variants of collaborative training ventures have developed, also in combined form:

- leading firm with partner firms

- consortium training companies

- operational training association

- operational contracted training

The following legal conditions are to be observed with a collaborative training venture:

- the training company within whose responsibility training is carried out must cover the major part of the description of the occupation requiring training.

- The instructors can only finalise conditions for taking on part of the training when it is guaranteed that the quality of the training in the other training company is equally assured.

- The training company must be able to influence the appointment of the training personnel.

- The **apprenticeship contract** may contain no limitations of the legal rights and responsibilities of the instructors and apprentices. The agreements of the partner firms concern only the relationship between each other.

- Fundamentally, the **in-firm's training plan**, it must be shown which training contents are being communicated at which point in which training facility (cooperative training company).

General Information

1. Check lists

Check list 1:

What is to be done before start of training

• Is the firm recognised by the competent body as a firm providing training?	<input type="checkbox"/>
• Are the legal prerequisites for training present, i.e. does the technical and personal suitability in accordance with § 20 BBiG exist? Has the trainer or one of the instructors determined by him/her obtained the necessary training qualification?	<input type="checkbox"/>
• Are, in addition to the responsible instructors, sufficient specialists in the individual training places/areas available for the instruction of the apprentices?	<input type="checkbox"/>
○ • Has an instructor been named to the competent body?	<input type="checkbox"/>
• Which actions have to be started in order to present the concern as attractive training company for those interested in training (e.g. making contact with the responsible labour exchange, place advertisements in daily newspapers or youth magazines, present firm on potential trainee days, industrial placements)?	<input type="checkbox"/>
• Are firm selection processes (employment tests) as well as selection criteria for apprentices laid down?	<input type="checkbox"/>
• Who directs the job interviews with the applicants and decides on employment?	<input type="checkbox"/>
• Is the apprenticeship contract formulated and signed by the instructor and the apprentices?	<input type="checkbox"/>
• Is the firm in the position to communicate all technical contents of the vocational training regulations? Are all training locations/areas necessary for this available? Can or must one fall back on additional training activities outside the training company (inter company vocational training centres, collaborative training venture)?	<input type="checkbox"/>
• Has a in-firm's training plan been produced (technical and temporal structure as annex to the training contract)?	<input type="checkbox"/>
○ • Has the concluded apprenticeship contract including the in-firm's training plan been made available to the apprentice(s) as well as the competent body?	<input type="checkbox"/>
• Is the apprentice registered with the vocational school?	<input type="checkbox"/>
• Are the training regulations, the training framework plan, if required the framework curricula as well as an example of the Vocational Training Act and of the Youth Employment Protection Law available in the firm?	<input type="checkbox"/>
• Is the first day already completely planned? (Check list 4)	<input type="checkbox"/>

Check list 2:
Obligations of the training company/of the instructors

	• Observe the legal constraints, e.g. of the Vocational Training Act, Youth Employment Protection Law, firms agreements and apprenticeship contract as well as the provisions for labour safety and accident prevention.	<input type="checkbox"/>
○	• Conclusion of a apprenticeship contract with the apprentice(s).	<input type="checkbox"/>
	• Release for vocational school and examinations.	<input type="checkbox"/>
	• Apprentice's pay, if necessary observation of collective bargaining agreements.	<input type="checkbox"/>
	• Significance and duration of the probationary period.	<input type="checkbox"/>
	• Conversion of the vocational training regulations and the training framework plan as well as technical and temporal structuring into working practice, above all through the production of training and transfer plans.	<input type="checkbox"/>
	• Configuration of a "training work place" according to the training subject matter and the free provision of all necessary training means.	<input type="checkbox"/>
	• Communication of skills and knowledge.	<input type="checkbox"/>
	• Observation of the training responsibility.	<input type="checkbox"/>
○	• Assessment of apprentices.	<input type="checkbox"/>
	• Production of a training report at the end of training.	<input type="checkbox"/>

Check list 3:
Obligations of the apprentices

<input type="radio"/>	• Obligation to attend.	<input type="checkbox"/>
	• Active acquiring of all skills and knowledge which are necessary to complete the training successfully.	<input type="checkbox"/>
	• Attending the vocational school.	<input type="checkbox"/>
	• Production of verification of training (Narrative Report).	<input type="checkbox"/>
	• Sitting of intermediate and final examinations.	<input type="checkbox"/>
<input type="radio"/>		

Check list 4:
The first day

- | | |
|--|--------------------------|
| • How is the day structured? Are all responsible persons, including specialists, informed that new colleagues are joining the firm? | <input type="checkbox"/> |
| • Which actions are planned? (Examples: presentation of the firm, its organisation and internal structure, how it sees itself, the persons responsible for training; if required carry out a tour of the firm). | <input type="checkbox"/> |
| • Which rights and responsibilities result from the apprenticeship contract for the apprentices as well as for the instructors and the firm? | <input type="checkbox"/> |
| ○ • Handing out of working clothing and protective equipment. | <input type="checkbox"/> |
| • Information on the greatest hazards in the firm. | <input type="checkbox"/> |
| • Which regulations on work safety and for the prevention of accidents apply in the company? | <input type="checkbox"/> |
| • Familiarisation with the social rooms. | <input type="checkbox"/> |
| • Which working time regulations apply for the apprentices? | <input type="checkbox"/> |
| • Explanation of the in-firm's training plan. | <input type="checkbox"/> |
| • Which special work equipment is available for the training? | <input type="checkbox"/> |
| • How is the verification of training to be carried out? (Form, time intervals: day, week, month). | <input type="checkbox"/> |
| ○ • Explain significance of the Narrative Report for admission to the examinations. | <input type="checkbox"/> |
| • Which vocational school is responsible?
Where is it and how does one get to it?
Is the instruction in block training or on individual days of the week?
Must the apprentices come to work in the firm after school? | <input type="checkbox"/> |
| • Examinations: explain the role of the intermediate and final examination, discuss timings, explain the contents of the examinations. | <input type="checkbox"/> |
| • With which health insurance are the apprentices insured against illness? | <input type="checkbox"/> |
| • What has to be observed in case of illness? | <input type="checkbox"/> |
| • Significance of the probationary period. | <input type="checkbox"/> |
| • Firm's holiday regulations. | <input type="checkbox"/> |
| • Firm's additional services/apprentice's pay. | <input type="checkbox"/> |

Check list 5:

What has to be observed with the registration for the intermediate examination?

<input type="radio"/>	• Have the apprentices registered in time with the responsible agency for the intermediate examination?	<input type="checkbox"/>
	• How are the apprentices prepared in-firm for the intermediate examination?	<input type="checkbox"/>
	• Do the apprentices know the location, structure and duration of the intermediate examination?	<input type="checkbox"/>
	• Have the apprentices had the content of the intermediate examination explained to them?	<input type="checkbox"/>
	• Has the training subject matter for preparation for the examination been repeated and consolidated?	<input type="checkbox"/>
<input type="radio"/>		

Check list 6:

What has to be observed with the registration for the final examination?

<input type="radio"/>	• Have the apprentices been registered in time with the competent body for the final examination?	<input type="checkbox"/>
	• How are the apprentices prepared in-firm for the final examination?	<input type="checkbox"/>
	• Do the apprentices know the structure of the final examination (e.g. written, practical parts)?	<input type="checkbox"/>
	• Have the apprentices had the content of the final examination explained to them?	<input type="checkbox"/>
	• Has the training subject matter for preparation for the examination been repeated and consolidated?	<input type="checkbox"/>
	• Do the apprentices know the time, location, structure and duration of the final examination?	<input type="checkbox"/>
	• Check Narrative Report for completeness.	<input type="checkbox"/>
<input type="radio"/>		

2. Framework Curriculum for the vocational school instruction

Framework Curriculum

for the occupation requiring training of

Sewage Engineering Technician

[Decision of the Conference of Culture Ministers of a 14 May 2002]

Part I: Preliminary remarks

This framework curriculum for the occupation related instruction of the vocational school has been decided by the permanent Conference of Culture Ministers and Senators of the [German] Federal States.

The framework curriculum is aligned with the appropriate federal vocational training regulations (promulgated by the German Federal Ministry of Economics and Technology or the otherwise responsible specialist ministry in mutual agreement with the German Federal Ministry of Education and Research. The process of coordination is regulated through the "Joint minutes dated 30 May 1972". The framework curriculum fundamentally builds on the German Certificate of Secondary Education (Hauptschulabschluss) and describes the minimum requirement.

With assigned occupations the framework curriculum is structured into an basic training spanning the combined occupational field and specialist training which builds on this.

On the basis of the vocational training regulations and of the framework training plan, which regulate the objectives and contents of the occupational training, the final qualification in an occupation requiring training as well as – joint with instruction in further subjects – the graduation from the vocational school are imparted.

With this, important prerequisites for a qualified employment as well as for the entry into educational and occupational advanced and further education courses are achieved.

The framework curriculum contains no methodical determinations for the instruction. Independent and responsibly conscious thought and action as global objective of the training is preferably communicated in such teaching forms, in which it is part of the overall methodical concept. With this, fundamentally every methodical procedure can contribute to the achievement of the aim. Methods which directly support the occupational capacity to act are particularly suitable and should therefore be suitably taken into account in the structuring of the teaching.

The [German] Federal States take over the framework curriculum directly or convert it into their own curriculum. In the second case they ensure that the result of the technical and temporal agreement with the respective vocational training regulations taken into account in the framework curriculum are retained.

Part II: Training contract of the vocational school

The vocational school and the training companies fulfil a common apprenticeship contract in the dual training occupational training.

With this, the vocational school is an independent place of learning. It functions as equal partner with those others involved in occupational training. It has the task of communicating occupational and general training teaching matter to the students taking particular account of the requirements of the occupational training.

The vocational school has basic and technical occupational training as the objective and expands the previously gained general education. With this, it wants to enable the fulfilment of the tasks in the occupation as well as helping to structure occupational life and society in social and ecological responsibility. Here it aligns itself in accordance with the regulations of the national educational law applicable for this type of school. In particular the occupation-related instruction orientates itself additionally to the resources of national standard occupational regulations officially recognised for each occupation requiring training:

- framework curriculum by the Permanent Conference of [German] Culture Ministers and Senators of the Federal States (KMK)

- vocational training regulations of the [German] Federal Government for in-firm training.

In accordance with the General Agreement on Vocational Schools (Decision of the KMK dated 15 March 1991) the vocational school has as objective:

- "to communicate an occupational ability which combines the specialist competence with general abilities of a humane and social type;

- to develop occupational flexibility for the mastery of the changing requirements of occupational life and society also with regard to the coalescence of Europe;

- to kindle the willingness for continuation and further occupational training;

- to encourage the ability and readiness to behave with a sense of responsibility with the creation of individual life styles and in public life."

To achieve these objectives the vocational school must

- align the teaching to a theory of education specific to its tasks, which emphasises action-orientation;

- to communicate interdisciplinary occupational and occupational field qualifications taking into account the required specialisation;

- to ensure a differentiated and flexible range of training in order to meet different abilities and talents as well as the respective requirements of occupational life and society;

- to support and encourage those who are handicapped or disadvantaged within the scope of their capabilities;
- to draw attention to the threats and dangers of accidents associated with the exercising of the occupation and with the private life style and to indicate possibilities for their avoidance or reduction.

In addition, the vocational school, as far as is possible within general instruction and within the scope of occupation-related instruction, is to go into the core problems of our time such as, for example:

- work and unemployment,
- peaceful coexistence of people, nations, and cultures in a world with the observance of cultural identity,
- maintenance of the basic elements of life and
- guarantee of human rights.

The listed objectives are aimed at the development of the occupational capacity to act. Here these are understood to be the willingness and ability of individuals to behave in social, occupational and private situations correctly, thoughtfully as well as individually and socially responsibly.

Occupational capacity to act develops into the dimensions of occupational competence, personal competence and social competence.

Professional competence stands for the willingness and ability, on the basis of technical knowledge and skills, to solve problems objective-oriented, appropriately, methodically and independently and to evaluate the results.

Personal competence stands for the willingness and ability, as individual personality, to clarify, to consider thoroughly and to assess the chances for development, the demands and the limitations; to develop one's own talents as well as to formulate and further develop schemes for life. It covers personal characteristics such as independence, critical faculty, self-assurance, reliability, responsibility and sense of duty. To this belongs in particular also the development of well-considered moral concepts and the self-determined commitment to values.

Social competence stands for the willingness and ability to live and form social relationships, to detect benefits and pressures, to understand others and to discuss rationally and responsibly with them and to advise them. To this belongs in particular also the development of social responsibility and solidarity.

Competence in method and learning grows from a balanced development of these three dimensions.

Competence stands for the success in learning with regard to the individual learner and his/her qualification for self-dependent dealings in private, occupational and social situations. In opposition to this, under qualification is to be understood the success in learning with regard to usability, i.e. from the aspect of the demand in private, occupational and social situations (comp. Deutscher Bildungsrat [German Central Advisory council for Education] Recommendations of the Education Commission for the Reorganisation of the Secondary Level II).

Part III: Didactic principles

The objective of occupational training requires that the instruction is directed towards an education tailored to the tasks of the vocational school, which emphasises action-orientation and which enables young people independently to plan, execute and assess working tasks within the framework of their occupational activity.

Learning in the vocational school takes place fundamentally related to concrete occupational action as well as in a wide range of intellectual operations, also the intellectual comprehension of the actions of others. This learning is above all tied to the reflection of the execution of the action (of the action plan, of the procedure, of the results). With this mental inspiration of professional work the prerequisites are created for the learning within and outside work. This signifies for the framework curriculum that the description of the objectives and the selection of the content takes place related to the occupation.

On the basis of learning theoretical and didactic knowledge, in a practical approach for the formation of action-oriented instruction, the following orientation points are given:

- didactic reference points are situations which are significant for the exercising of the occupation (learning for action).
- the starting point of learning is formed by actions, as far as possible carried out or intellectually understood independently (learning by doing).
- actions must, as far as possible, be planned, executed, checked, if necessary corrected, and finally evaluated independently by those learning.
- actions should support a holistic comprehension of professional reality, e.g. include technical, security, economic, legal, ecological aspects.
- actions must be integrated into the experiences of those learning and must be reflected with regard to their social effects.
- actions are also to include social processes, e.g. declaration of interests or mastering of conflicts.

Action-oriented instruction is a didactic concept, which brings together systematic technical and activity structures. It can be realised through various teaching methods.

The range of instruction of the vocational school depends on young persons and adults who differ, according to previous education, cultural background and experiences from the firms carrying out training. The vocational school can only fulfil its apprenticeship contract when it takes account of these differences and encourages students – also those disadvantaged or particularly talented – according to their individual possibilities.

Part IV: Occupation-related preliminary remarks

The above framework curriculum for the occupational training of the Sewage Engineering Technician is harmonised with the [German] Ordinance on Occupational Training in Environmental Engineering Occupations, dated 17 June 2002 (BGBl. No. 43, p. 2335).

For the examination area of economic and social science, important subject matter of the vocational school is communicated on the basis of "Elements for instruction of the vocational school in the field of economic and social science of commercial-technical occupations requiring training" (Decision of the Conference of Culture Ministers (KMK) dated 18 May 1984). The framework curriculum for the occupation requiring training, Environmental Technician (Decision of the KMK dated 20 August 1984), is rescinded.

The framework curriculum for the occupation requiring training, Sewage engineering technician, was developed together with the framework curriculum for the occupations requiring training, Water Supply Engineering Technician, Recycling and Waste Management Technician and Pipe, Sewer and Industry Service Technician. In view of the scope of the common core qualifications, which are necessary for the pursuit of these occupations, the learning fields 1 to 6 (1st and 2nd Training Years) of these four framework curricula are identical and should be taught together.

Learning fields 7 to 14 are designed specifically for the occupation of Sewage Engineering Technician. The communicating of mathematical knowledge takes place integrative in the appropriate learning field.

Part V: Learning fields

Summary of the learning fields for the occupation requiring training Sewage Engineering Technician

Learning fields		Time guidance values		
Serial No.		1 st year	2 nd year	3 rd year
1	Planning of an environmental concept	80		
2	Handling of micro-organisms	40		
3	Employ environmental chemicals	80		
4	Operate pipeline systems	80		
5	Examination of the content substances of water and waste		60	
6	Operate and maintain machines and installations		80	
7	Operate and maintain electrical plant		40	
8	Operate drainage systems		60	
9	Treat wastewater mechanically		40	
10	Investigation of wastewater and sludge			60
11	Treat wastewater and sludge biologically and chemically			80
12	Connect electrical equipment			40
13	Maintain drainage systems and monitor indirect dischargers			60
14	Control and regulate wastewater treatment facilities			40
	Sum (in total 840)	280	280	280

Learning Field 1: Planning of an environmental concept

1st Training Year

Time guidance value: 80 hours

Formulation of the objective:

Students design a concept for the operation of an environmental engineering concern. For this they collect information on material flows in environmental engineering systems and make themselves familiar with the method of function of supply and disposal facilities as well as of the pipe, sewer and industrial services. With their planning they take into account causes and results of environmental loading of the air, water and soil which originate from the facilities and determine

interactions with living creatures. They take into account possibilities for the avoidance and minimisation of environmental loads. With the concept development of work sharing they learn in a team, to plan, mutually process and jointly agree tasks. They apply information and communication systems to meet objectives, document results and evaluate these.

- Contents:
- Eco-system
 - Water cycle and water quality
 - Water pollution: eutrophication, contamination, acidification
 - Air pollution : soil pollution, biotope destruction
 - Avoidance of waste
 - Development and function of wastewater disposal facilities
 - Development and function of water supply facilities
 - Development and function of recycling and waste management operations
 - Development and function of facilities of pipe, sewer and industrial services
 - Legal requirements, technical rules and standards
 - Labour organisation
 - Work place layout
 - Use of information systems
 - Data protection regulations
 - Procurement of work equipment
 - Accident prevention, labour protection

Learning Field 2:**1st Training Year****Handling of micro-organisms****Time guidance value: 40 hours****Formulation of the objective:**

Students create suitable living conditions for micro-organisms and can employ micro-organisms for the conversion of matter in systems. They are made aware which hazards for their personal health and also

for the health of the population emanate from micro-organisms. They are in a position to take hygienic measures in practice and to combat pathogenic micro-organisms.

Contents:

- Structure, types and characteristics of micro-organisms
- Conditions for life and resistance of micro-organisms
- Significance of micro-organisms for environmental engineering occupations
- Material cycles
- Hazards due to micro-organisms: viruses, bacteria, fungi, animal parasites
- Hygiene measures
- Vaccinations
- Identification of micro-organisms
- Prevention of accidents and protection against accidents
- Work safety

Learning Field 3:
Employ environmental chemicals**1st Training Year****Time guidance value: 80 hours****Formulation of the objective:**

Students plan the employment of environmental chemicals for the processing of water, industrial treatment, wastewater and waste disposal. They know the properties and the build-up of these substances and assess the danger of the reaction. Students arrange the working materials and hazardous materials into hazard classes and carry out deliberate measures for disposal. They store and pack hazardous substances

correctly and know the legal basis for the transport of hazardous goods. They identify the effects of hazardous substances and take suitable protective measures. The students participate with the production of operational instructions for the handling of hazardous materials and can react suitable to hazardous situations in the firm.

- Contents:
- Mixtures of substances
 - Material structure and properties
 - Precipitation, acidic, base and Redox reactions
 - Classes of substances
 - Stoichiometric calculations
 - Temperature, conductivity, pH value, oxygen
 - Mass, volume, density
 - Classification of hazardous substances
 - Creation of hazardous substances
 - Handling of hazardous substances
 - Disruption of operational procedures due to hazardous substances
 - Dangerous chemical reactions
 - Disposal of hazardous substances
 - Storage, packaging of hazardous substances
 - Transport of dangerous goods
 - Operating instructions
 - Accident prevention, labour protection

Learning Field 4: Operate pipeline systems

1st Training Year

Time guidance value: 80 hours

Formulation of the objective:

Students read pipeline plans and complete sketches. They notionally carry through the production of pipeline sections. The students plan the installation of fittings and conveyance facilities and, taking account of the medium to be transported, select the required materials and sealing materials. Here they carry out calculations on pipeline systems and produce material lists. They employ processes for the sealing of pipeline components with the production of pipeline systems taking

into account the different materials and ancillaries and the technical process conditions. Students take measurements and explain the methods of converting, transferring and processing of measured values. They evaluate the measurements taken and introduce measures for the correction of defects. Students decide upon the employment of control and regulating facilities.

- Contents:
- Pipelines, fittings, seals
 - Pipe and hose connections
 - Pipeline plans, basic-, process and RI flow diagrams
 - Markings of pipes and fittings
 - Linear expansion, mass and volume flow calculations
 - Pressure loss in pipelines
 - Characteristics of materials
 - Working materials and ancillaries
 - Corrosion and corrosion protection
 - Temperature, pressure, filling level, volume and flow measurement methods
 - Transducers
 - Standard signals
 - Connection handler and stored-program control
 - Continuous and discontinuous controllers, control cycles
 - Legal provisions, sets of technical rules and standards
 - Accident prevention, labour protection

Learning Field 5:

2nd Training Year

Examination of the content substances of water and waste

Time guidance value: 60 hours

Formulation of the objective:

For selected conditions, students carry out preparation and sampling as well as the conservation and transport of samples according to the applicable regulations. They verify qualitatively important content substances of water and waste. They carry out simple quantitative determi-

nations check the results for plausibility, interpret and document these. They are aware of the effects of analysis results on the progress of processes and can introduce measures for process optimisation.

Contents:

- Sampling
- Sensor values
- Physical parameters
- Individual, group and summation parameters
- Laboratory equipment
- Qualitative determination of relevant cations and anions
- Quantitative determination, volumetric, gravimetric, instrumental
- Operating logbooks, performance picture
- Accident prevention and protection against accidents
- Work safety
- Accuracy
- Accident prevention, labour protection

Learning Field 6:**2nd Training Year****Operate and maintain machines and installations****Time guidance value: 80 hours****Formulation of the objective:**

Students operate various mechanical installations and decide upon employment to meet the situation whereby they understand the functional principle of the machines. With the aid of instructions they can carry out the inspection and servicing of mechanical installations typical for their occupation. The inspection and servicing tasks are documented with the aid of the application of current ancillaries. They ascertain the causes of operating faults with the help of technical drawings and instructions. With all activities they apply current knowledge of technical environmental protection. They plan the environmentally friendly

storage and disposal of the operating resources for the machines and take part actively in decisions on the disposition of consumable materials. Students know the methods for bringing together and separating of substances and can describe and differentiate these according to their function. They are in a position to employ solid, liquid and gaseous energy carriers and electrical energy correctly taking into account the operating conditions. Students use their knowledge of basic electrical parameters for the selection of electrical facilities. Here they take note of the hazards of electrical current and take protective measures.

Contents:

- Electrical motors and combustion engines
- Pumps, blowers and compressors
- Selection, employment and application of work equipment
- Assembly and dismantling of operational facilities
- Maintenance of operational facilities, card files, protocols
- Lifting equipment and transport facilities
- Storage and disposition
- Avoidance and/or minimisation of environmental loads due to operating equipment
- Technical documents
- Bringing together and separation of substances
- Energy carriers
- Equipment for heating and cooling
- Basic electrical parameters
- Voltage generators, transformers and motors
- Protective measures, conduct with accidents due to electrical current
- Responsibility
- Prevention of accidents and protection against accidents
- Work safety

Learning Field 7:

2nd Training Year

Operate and maintain electrical plant

Time guidance value: 40 hours

Formulation of the objective:

Students operate electrical plant. For this they read circuit diagrams, make sketches measure electrical parameters and evaluate the measured values. They check safety installations and with faults take steps for the correction of the fault. They recognise the effects of electrical

current and are aware of the dangers which emanate from electrical plant. They make themselves familiar with VDE (Association of German Engineers) Regulations and take measures for the protection of persons and facilities.

Contents:

- Effect and dangers of electrical current
- Safety rules
- Symbolic representation
- Circuit diagrams
- Direct, alternating and three-phase current
- Capacitance, inductance
- Protective measures with and without protective ground wiring
- Network configurations
- Measurement of voltage, measurement of current
- Legal provisions, sets of technical rules and standards, e.g. VDE (Association of German Engineers) 0100
- Accident prevention, labour safety

Learning Field 8: Operate drainage systems

2nd Training Year

Time guidance value: 60 hours

Formulation of the objective:

Students cooperate in the production of a concept for the discharge of wastewater of a drainage area. According to the legal regulations and the local conditions they select a drainage system. Taking into account the characteristics of the wastewater, the geographic conditions, the quantity of wastewater and the operational requirements they determine the pipelines, equipment and structures. Students plan the monitoring, control and maintenance of drainage systems, pumping

stations and stormwater overflow facilities. They identify faults and take measures for their correction. They are aware that the operation, inspection and maintenance of stormwater overflow structures have a great significance for pollution control. With the planning and implementation of the tasks students prudently take into account the hazards in order to protect themselves and the other members of the working group.

- Contents:
- Technical communication
 - Water cycle, pollution control
 - Types, quantities and composition of wastewater
 - Combined, separate systems, percolation of precipitation
 - Gravity sewers, pressure and vacuum drainage systems
 - Domestic and private property drainage
 - Read site plans, structural drawings and RI flow diagrams
 - Manholes, inlet, connection, drop and crossing structures, stormwater overflows
 - Stormwater overflow and stormwater treatment facilities
 - Clearance and spray facilities
 - Measurement of precipitation, water level and flow
 - Sewer network management
 - Requirements on the sewer system
 - Corrosion
 - Gradients
 - Drains, materials, cross-sections, connections, fittings
 - Regulating, cut-off, safety valves/fittings
 - Legal provisions, sets of technical rules and standards
 - Accident prevention, work safety

Learning Field 9:
Treat wastewater mechanically

2nd Training Year

Time guidance value: 40 hours

Formulation of the objective:

Based on the physical composition of the wastewater students plan the removal of suspended wastewater content matter with the aid of mechanical separation methods. They evaluate alternative possibilities for solution and derive from these measures for the economical and operationally secure treatment of wastewater. Students are in a posi-

tion to operate and maintain facilities for the mechanical treatment of wastewater. Solid residues produced can be utilised or disposed of in an environmentally friendly manner. They record operating data and results of the work, present these using normal software for the branch and interpret the results.

- Contents:
- Physical procedures
 - Lifting facilities
 - Screen and sieving facilities
 - Grit chambers
 - Light matter separators
 - Treatment and disposal of residues
 - Settling tanks
 - Rotation tanks
 - Combination facilities
 - Dimensioning principles, specialised calculations
 - Operational monitoring, operating records
 - Legal provisions, technical rules
 - Accident prevention, work safety

Learning Field 10:**3rd Training Year****Investigation of wastewater and sludge****Time guidance value: 60 hours****Formulation of the objective:**

Students take samples of wastewater and sludge, prepare these and complete sampling protocols. They examine the samples taken with indirect dischargers or concern-internal plant components for the

parameters laid down in legal provisions and from the results of the examination derive statements on the process control as well as on the quality of the wastewater and sludge investigated.

Contents:

- Sampling
- Microscopic picture
- Dry substance content, dry residue, ignition loss, ignition residue
- Sludge volume, sludge index
- Verification of aerobic sludge stabilisation
e.g. TTC test, respiration activity
- Lime reserve, acid capacity, organic acids
- Gas measurement, gas yield
- Determination of physical parameters e.g. conductivity, turbidity, pH value, coloration, oxygen
- Filterable matter, settleable solids
- Individual parameters e.g. phosphorus, nitrogen
- Nitrogen balance: N_{total}, nitrate-N, nitrite-N, ammonium-N
- Summation parameters
e.g. COD, BOD₅, TOC, methylene blue test
- Luminescent bacteria test
- Precipitation and flocculation tests
- Neutralisation tests
- Monitoring of indirect dischargers
- Recording of weather data
- Determination of water quality
- Analytical quality assurance
- Accident prevention, work safety

Learning Field 11:

3rd Training Year

Treat wastewater and sludge biologically and chemically

Time guidance value: 80 hours

Formulation of the objective:

Students follow biological and chemical processes for the treatment of wastewater. They inform themselves using the system's characteristic data and the wastewater treatment plant flow diagram on wastewater and sludge treatment processes and the utilisation of gas. From this they derive measures for the operating and maintenance of the system. The students optimise operating procedures with the aid of process control systems in order to maintain securely the discharge values

and to avoid unnecessary operating costs. They carry out maintenance tasks according to operating instructions, manufacturers' details, maintenance files and inspection files. They document the results of work, monitor the work of outside firms and coordinate the sequence of work. The working procedures are analysed and the future procedures are laid down in team meetings.

- Contents:
- Biological and chemical procedures
 - C-N-P compounds as nutrient supply
 - Removal of carbon
 - Removal of nitrogen
 - Removal of phosphorus
 - Near-natural wastewater treatment processes
 - Small wastewater treatment plants
 - Trickling filter and biological contactor processes
 - Activated sludge processes
 - Special forms e.g. SBR processes
 - Industrial wastewater treatment
 - Anaerobic wastewater treatment
 - Mechanical engineering equipment
 - Dimensioning parameters, specialist calculations
 - Types, yield and properties of sludge
 - Sludge dewatering
 - Sludge utilisation and disposal
 - Gas treatment and utilisation, explosion protection
 - Strategies for the solution of problems
 - Operational monitoring, operating records
 - Quality assurance measures
 - Legal provisions, technical rules
 - Accident prevention, work safety

Learning Field 12: Connect electrical equipment

3rd Training Year

Time guidance value: 40 hours

Formulation of the objective:

Students read circuit diagrams separate electrical equipment from the mains network, carry out maintenance tasks and reconnect the equipment observing the safety rules. With faults in electrical systems they carry out measurements in accordance with VDE directives, evaluate the measured values, identify operating faults and attend to their

correction. They are able to replace defective components selecting suitable material. Students are aware of the responsibility which they take on through work on electrical installations. They apply the regulations for electrical explosion protection.

- Contents:
- Connecting and disconnecting electrical motors and pumps
 - Types of connection
 - Torque behaviour
 - Performance plate
 - Starting switch gear
 - Terminal board
 - Types of motor and performance
e.g. shunt motor, inverse-speed motor, alternating current universal motor, three-phase asynchronous motor
 - Exchange of electrical components
e.g. fluorescent lamps, cables, switches, fuses, contactors, standby generators
 - Measurements, measured results, operating faults
 - Test protocols
 - Legal provisions, technical sets of rules and standards e.g. VDE 0100
 - Accident prevention, work safety

Learning Field 13:

3rd Training Year

Maintain drainage systems and monitor indirect dischargers

Time guidance value: 60 hours

Formulation of the objective:

Students organise the cleaning, servicing, inspection, maintenance of sewers, manholes and special structures. They familiarise themselves with possible hazards and take note of these with the preparation for and implementation of tasks. They select personal protective equipment, rescue equipment, measurement and warning equipment to fit the situation and handle these conscientiously. They collaborate with the planning and monitoring of rehabilitation measures and take into

account the effects of these measures on sewer operation. The students collaborate with the production of a register of indirect dischargers and can apply this to detect illegal discharges of wastewater. Together with colleagues from commercial and industrial concerns they examine the possibilities of collaboration, hold meetings and monitor their observance.

Contents:

- Technical communication
- Securing of working places in the public transport area
- Climbing into manholes
- Working in closed spaces
- Hygiene and health protection
- Measuring equipment, warning equipment
- Protection, safety and rescue equipment
- Accident prevention regulations, safety rules, advisory leaflets
- Physical, biological, biochemical procedures in the sewer
- Sewer cleaning, methods, equipment
- Inspection and maintenance of sewers, manholes and special structures
- Protocols, archiving of data, processing of data
- Leak testing
- Damage, causes of damage, results of damage
- Documentation, status classification and assessment of condition
- Rehabilitation processes
- Pre-treatment plants
- Light substance separators
- Small wastewater treatment plants
- Wastewater register, indirect discharger register
- Requirements on the discharge of wastewater
- Samplers
- Legal provisions, technical rules

Learning Field 14:**3rd Training Year****Control and regulate wastewater treatment facilities****Time guidance value: 40 hours****Formulation of the objective:**

Students simulate the control of a drainage network as well as the technical installations for the treatment of wastewater and sludge. For this the control and regulation systems are analysed and the effects of

changes in the operating case are evaluated. They identify faults which occur during process control and remove their causes. The students discuss the results of work and document these in a field report.

Contents:

- Simulation models
- Control principles
- Measuring, control and regulation facilities
- Process control systems
- Documentation

3. Literature/Training materials

Specialist books

- **Handbuch für Umwelttechnische Berufe (Ver- und Entsorger)**
[Handbook for Environmental Engineering Occupations
(Environmental Technician)]
Hirthammer Verlag München
Vol. 1: Grundlagen für alle Fachrichtungen [Basics for all specialisations], ISBN 3-88721-071-9
- Vol. 2: Wasserversorgung [Water supply], ISBN 3-88721-072-7
- Vol. 3: Abwasser [Sewage]
ISBN 3-88721-073-5
- Vol. 4: Kreislauf- und Abfallwirtschaft
[Recycling and waste management]
ISBN 3-88721-074-3
- **Klärwärter-Taschenbuch**
[Environmental Technician's (wastewater treatment plant)
Manual]
Hirthammer Verlag München
ISBN 3-92188-09-6
- **Abwasser in Frage und Antwort**
[Wastewater in questions and answers]
Hirthammer Verlag München
ISBN 3-88721-068-9

Specialist technical journals

- KA – Wasserwirtschaft, Abwasser, Abfall [Korrespondenz Abwasser – Water management, wastewater, waste]; GFA Verlag, Hennef, Germany including the supplements „KA-betriebes-Info“ and „Gewässer-Info“ further information via DWA Homepage

Further training media and materials

- **German Association for Water, Wastewater and Waste (DWA)**
Info-materials for students and individuals on areas of activity as well as advanced and further training offers
www.dwa.de
- **Training and occupation**
Rights and responsibilities during occupational training inter alia
German Federal Ministry of Education and Research
www.bmbf.bund.de

- **KURS** – The database for training and further training of the German Employment office
www.arbeitsagentur.de
- **Federal Institute for Vocational Education and Training (BIBB)**
annually issues the handbook "Lieferbare Veröffentlichungen [Deliverable publications]" in which comprehensive material on all subjects of occupational training are to be found. This summary which also appears as a CD-Rom can be obtained directly from the BIBB.
www.bibb.de

foraus.de: virtual BIBB Forum for Training Personnel

The Federal Institute for Vocational Education and Training (BIBB), together with Thinkhouse GmbH has developed a forum in the internet under the address: **www.foraus.de**.

foraus.de offers its visitors not only information, an instructors' library and online further training. With membership (free registration) in foraus.de, in addition to a personalised communication platform there are available many additional functions for discussion, research and exchange of experiences. Furthermore, one is informed per E-mail on the latest developments in the field of vocational training and on current events in foraus.de.

4. Addresses

■ **ver.di – Vereinte Dienstleistungsgewerkschaft**
[United Services Union]
Bundesverwaltung
Paula-Thiede-Ufer 10
D-10179 Berlin
Tel.: +49 (0) 30/69 56-0
Fax: +49 (0) 30/69 56-39 56
Internet: www.verdi.de
E-mail: info@verdi.de

■ **Deutsche Vereinigung für Wasserwirtschaft, Abwasser und Abfall e.V.**
[German Association for Water, Wastewater and Waste]
(DWA)
Theodor-Heuss-Allee 17
D-5373 Hennef
Tel.: +49 (0) 22 42/8 72-0
Fax: +49 (0) 22 42/8 72-1 35
Internet: www.dwa.de
E-mail: info@dwa.de

■ **Bundesinstitut für Berufsbildung**
[Federal Institute for Vocational Education and Training]
(BIBB)
Robert-Schuman-Platz 3
D-53175 Bonn
Internet: www.bibb.de
E-mail: zentrale@bibb.de

■ **Bundesministerium für Bildung und Forschung**
[Federal Ministry of Education and Research] (BMBF)
Heinemannstr. 2
D-53175 Bonn
Tel.: +49 (0) 18 88/57 -0
Fax: +49 (0) 18 88/57-36 01
Internet: www.bmbf.bund.de
E-mail: information@bmbf.bund.de

■ **Bundesministerium für Wirtschaft und Technologie**
[Federal Ministry of Economics and Technology]
(BMWi)
Scharnhorststr. 34-37
D-10115 Berlin
Villemombler Str. 76
D-53123 Bonn
Tel.: +49 (0) 18 88/61-50
Fax: +49 (0) 18 88/57-36 01
Internet: www.bmwi.bund.de
E-mail: info@bmwi.bund.de

■ **Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit** [Federal Ministry for the Environment, Nature Conservation and Nuclear Safety]
(BMU)
Alexanderplatz 6
D-10178 Berlin
Tel.: +49 (0) 30/18 305-0
Fax: +49 (0) 30/18 305-4375
Robert-Schuman-Platz 3
D-53175 Bonn
Tel.: +49 (0) 2 28/99 305-0
Fax: +49 (0) 2 28/99 305-3225
E-mail: info@bmu.bund.de
Internet: www.bmu.bund.de

■ **Sekretariat der Ständigen Konferenz der Kultusminister der Länder in der Bundesrepublik Deutschland** [Secretariat of the Permanent Conference of the Culture Ministers of the Federal States of the Federal Republic of Germany] (KMK)
Lennéstr. 6
D-53113 Bonn
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Fax: +49 (0) 2 28/5 01-7 77
Internet: www.kmk.org
E-mail: berufsbildung@kmk.org

Competent bodies

For the occupational training in environmental occupations

■ Baden-Württemberg

Regierungspräsidium Karlsruhe
Referat 12d
D-76247 Karlsruhe
E-mail: poststelle@rpk.bwl.de

■ Bayern

Bayerische Verwaltungsschule (BVS)
Ridlerstraße 75
D-80339 München
E-mail: info@bvs.de

■ Berlin

Senatsverwaltung für Inneres und Sport
ZS B11MO
Klosterstraße 47
D-10179 Berlin
E-mail: poststelle@sennin.sport.berlin.de

■ Freie Hansestadt Bremen

Der Senator für Finanzen - 33/6 -
Doventorscontrescarpe 172, Block B
D-28195 Bremen
E-mail: office@finanzen.bremen.de

■ Freie und Hansestadt Hamburg

Senat der Freien und Hansestadt
Hamburg
Zentrum für Aus- und Weiterbildung
Zuständige Stelle nach § 73 Berufsbildungsgesetz
Steckelhörn 12 (Gotenhof)
D-20457 Hamburg
E-mail: poststelle@personalamt.hamburg.de

■ Niedersachsen

Niedersächsischer Landesbetrieb für Wasserwirtschaft, Küsten- und
Naturschutz (NLWKN)
Zuständige Stelle für die Berufsbildung
An der Scharlake 39
D-31135 Hildesheim
E-mail: poststelle@nlwkn-hi.niedersachsen.de

■ Nordrhein-Westfalen

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Postfach 30 08 65
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■ Rheinland-Pfalz

Aufsichts- und Dienstleistungsdirektion
Zuständige Stelle – Ref. 12
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■ Saarland

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■ Sachsen

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■ Schleswig-Holstein

Verwaltungsakademie Bordesholm
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■ Thüringen

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