FRAMEWORK CURRICULUM

for the training occupation

Sewage engineering technician

(resolution of the Standing Conference of the Ministers of Education and Cultural Affairs of the Länder in the Federal Republic of Germany (KMK) of 14 May 2002)

Part I: Preliminary remarks

This framework curriculum for occupationally oriented instruction in vocational schools has been approved by the Standing Conference of the Ministers of Education and Cultural Affairs of the Länder in the Federal Republic of Germany (KMK).

It has been coordinated with the relevant training regulations of the Federation (issued by the Federal Ministry of Economics and Technology or such other ministry as may be competent, and acting in agreement with the Federal Ministry of Education and Research). The relevant consultation procedure is defined by the "Joint Memorandum of 30 May 1972" ("Gemeinsames Ergebnisprotokoll vom 30.05.1972"). In general, the framework curriculum is based on the lower secondary school leaving certificate, and it describes minimum requirements.

For the occupations allocated to it, the framework curriculum is divided into a) basic vocational training of relevance for the entire occupational area involved and b) specialised training that builds on the basic training.

On the basis of the training regulations and the framework curriculum, which define the aims and content of vocational training, training is provided that leads to a formal qualification in a recognized training occupation and – in conjunction with instruction in additional subjects – a leaving certificate from the vocational school. Such training thus provides the key basis for high-quality employment and for entry into continuing vocational education and training, including school-based training.

The framework curriculum does not mandate any methods for instruction. Skill in thinking and acting independently and responsibly, as an overarching training aim, is best achieved by instructional forms that make it part of an overall methodological concept. In general, any methodological approach can contribute to the achievement of that aim. Methods that directly promote individual competence are especially useful and thus should be suitably considered in designing and structuring instruction.

The Länder either adopt the framework curriculum directly or implement it within their own curricula. In the second case, they take care to ensure that the manner in which the curriculum has been coordinated with the relevant training regulations, in terms of subjects and scheduling, remains intact.

Part II: The educational mission of part-time vocational schools

In the dual system of vocational training, part-time vocational schools and training companies fulfil a joint educational mission.

The part-time vocational school is a full-fledged learning venue in its own right. It cooperates, as an equal partner, with the other entities that participate in providing vocational training. Its task is to offer pupils general and occupationally oriented learning content, while giving special consideration to requirements pertaining to vocational training.

Education at part-time vocational schools, which builds on pupils' previously acquired general education, consists of basic and specialised vocational training. Its mission is thus to equip pupils to carry out their occupational tasks and to help shape the workplace and society from a perspective of social and ecological responsibility. In fulfilling this mission, it conforms to the Länder laws pertaining to the school category to which it belongs. In particular, occupationally focused instruction is also oriented to the nationally consistent occupation regulations that have been issued, at the national level, for each state-recognized training occupation:

- the framework curriculum of the Standing Conference of the Ministers of Education and Cultural Affairs of the Länder in the Federal Republic of Germany (KMK)
- the Federation's training regulations for in-company training.

Pursuant to the framework agreement on part-time vocational schools (resolution of the KMK of 15 March 1991), the part-time vocational school has the aims

- "of imparting occupational capabilities that combine specialised competence with general human and social skills;

- of developing flexibility for the management of the changing requirements in the workplace and society, and also with regard to the European integration and fusion;

- of encouraging participation in continuing vocational education and training;

- of promoting the capabilities and willingness that people need in order to act responsibly, both in their individual life choices and in the public sphere."

To be able to achieve these aims, the part-time vocational school

- has to base its instruction on pedagogy that is tailored to its tasks and that emphasizes an orientation to action;

- has to provide overarching qualifications that transcend individual occupations and occupational fields, while still imparting the necessary occupational specialisation;

- has to provide a flexible, suitably differentiated range of education and training that can meet the needs of different people, with their different skills and talents, along with the requirements of the workplace and the needs of society;

- needs to comprehensively support and promote persons with disabilities and disadvantaged persons, within the context of its possibilities and resources;

- needs to call attention to the environmental threats and accident risks associated with the practice of an occupation, and with private life choices, and offer options for preventing and reducing such threats and risks.

Furthermore, in its general instruction, and in its vocationally oriented instruction – to the extent possible – the part-time vocational school needs to call attention to key problems of our time, such as

- the availability of work, and unemployment,
- the challenge of enabling people, peoples and cultures to co-exist peacefully in one world, while preserving their cultural identity,
- the need to protect vital natural resources, and
- the need to safeguard human rights.

The above aims are tied to the development of action competence. In the present context, such competence is understood as the willingness and ability of individuals to act fairly, rationally and responsibly in societal, occupational and private life situations.

Action competence develops within the dimensions of professional competence, personal competence and social competence.

Professional competence refers to the willingness and ability to solve tasks and problems independently, efficiently, objectively and with suitable methods, and on a basis of technical, specialised knowledge and skills.

Personal competence refers to a person's willingness and ability, as an individual personality, to identify, consider and assess development opportunities, requirements and constraints – in family life, the workplace and the public sphere – to develop one's own talents and to make and develop life plans. It comprises personal characteristics such as independence and self-reliance, critical faculties, self-confidence, reliability, responsibility and a sense of duty. It also especially includes the ability to develop well-considered values and to be true, via one's own initiative, to one's values.

Social competence refers to a person's willingness and ability to cultivate and develop social ties, to recognize and understand trust and devotion and tensions and to be able to deal and communicate with others rationally and from a sense of responsibility. It thus especially includes the development of social responsibility and solidarity.

Methodological competence and learning competence grow via balanced development of these three dimensions.

Competence refers to learning success, with regard to the learner's own situation and his or her ability to act independently and responsibly in private, occupational and societal situations. By contrast, "qualification" refers to learning success with respect to usefulness and applicability, i.e. with respect to the relevant demand encountered in private, occupational and societal situations (cf. the German Educational Council (Deutscher Bildungsrat), recommendations of the education commission on the reorganisation of the secondary level II (Empfehlungen der Bildungskommission zur Neuordnung der Sekundarstufe II)).

Part III: Didactic principles

In light of its aims, vocational training instruction has to be oriented to a pedagogy tailored to the tasks of the part-time vocational school, a pedagogy that emphasises action and equips young people for independent, self-reliant planning, execution and assessment of work tasks within the framework of their occupations.

In general, learning in a part-time vocational school is focused on specific occupational actions and on a broad variety of thought processes, including processes for understanding the actions of others. Such learning is tied especially to reflection on the results of actions (execution of action plans, execution of defined procedures, achievement of results). This reflective focus on occupational work provides the basis for learning on and from the job. This implies that a framework curriculum must apply an occupational orientation in describing relevant aims, and in selecting relevant content.

Via a pragmatic approach, and on the basis of findings from learning and didactic theory, it specifies the following orientational principles for the design of action-oriented instruction:

- The didactic references consist of situations of significance to the performance of the relevant occupation (learning for action).

- Actions are the starting point for the learning process – either (ideally) actions that the learner carries out himself or herself or that he or she reflects on (learning via action).

- Relevant actions need to planned, carried out, reviewed, corrected (if necessary) and, finally evaluated – by the learners themselves.

- Actions should promote a holistic perception and understanding of the occupational reality involved; for example, they should take account of its technical, safety-relevant, economic, legal, ecological and social aspects.

- Actions need to be integrated within learners' own experience, and learners need to consider them in terms of their social impacts.

- Actions should also include social processes – such as processes for clarifying interests or managing conflicts.

Action-oriented instruction is a didactic concept that dovetails technical and action-related system structures. It can be implemented via various different instruction methods.

The educational services of part-time vocational schools are aimed at a diverse range of young people and adults, i.e. at people who differ in terms of their previous education, cultural background and experience gained in training companies. The part-time vocational school can fulfil its educational mission only if it takes account of such differences and promotes and supports pupils – including disadvantaged and especially gifted pupils – in keeping with their specific individual potential.

Part IV: Occupationally oriented preliminary remarks

The framework curriculum for vocational training for the occupation of sewage engineering technician has been coordinated with the Ordinance on Vocational Training in Environmental Technology Occupations (Verordnung über die Berufsausbildung in den umwelttechnischen Berufen) of 17 June 2002 (Federal Law Gazette I, p. 2335).

The part-time vocational school's main course content in the examination subject economics and social sciences is presented on the basis of the "Elements for part-time vocational school instruction, in the area of economics and social sciences, for industrial and technical training occupations" ("Elemente für den Unterricht der Berufsschule im Bereich Wirtschafts- und Sozialkunde gewerblich-technischer Ausbildungsberufe") (resolution of the KMK of 18 May 1984).

The framework curriculum for the training occupation of supplier and disposer (Ver- und Entsorger/Ver- und Entsorgerin) (resolution of the KMK of 20 August 1984) is hereby rescinded.

The framework curriculum for the training occupation of sewage engineering technician has been developed together with the framework curricula for the training occupations of a) water supply engineering technician, b) recycling and waste management technician and c) pipe, sewer and industrial service technician. In keeping with the scope of the common core qualifications that are required for the performance of these occupations, the learning fields 1 through 6 (1st and 2nd year of training) of these four framework curricula are identical and should be taught jointly.

The learning fields 7 through 14 have been designed specifically for the occupation of sewage engineering technician.

The necessary mathematical skills are taught via an integrative approach, in the relevant learning fields.

Part V: Learning fields

Overview of the learning fields for the training occupation of sewage engineering technician				
Learning fields		**Suggested time allocation in hours**		
No.		1st year	2nd year	3rd year
1	Planning of an environmental concept	80		
2	Handling of microorganisms	40		
3	Use of environmental chemicals	80		
4	Operation of pipeline systems	80		
5	Testing of substances in water and waste		60	
6	Operation and maintenance of machines and equipment		80	
7	Operation and maintenance of electrical facilities		40	
8	Operation of drain systems		60	
9	Mechanical cleansing of wastewater		40	
10	Testing of wastewater and sludges			60
11	Biological and chemical treatment of wastewater and sludges			80
12	Connection of electrical equipment			40
13	Maintenance of drain systems, and monitoring of indirect dischargers			60
14	Control and regulation of wastewater treatment facilities			40
	Total (total of 840 hours)	280	280	280

Learning field 1: Planning of an environmental concept	**1st year of training** **Suggested time allocation: 80 hours**

Statement of objectives:

The pupils develop a concept for the operation of an environmental technology facility. To this end, they collect information about the material flows in environmental technology facilities, and they learn about the functioning of supply and disposal facilities and of relevant pipeline, sewage and industrial services. In their planning, they take account of the causes and consequences of the air, water and soil pollution originating in the facility, and they identify pertinent interactions with living organisms. They take account of possibilities for preventing and minimising environmental pollution and stresses. In their concept development, which they carry out via work-sharing, they learn to plan and execute tasks in teams and to consult with each other as necessary. They use information and communications systems efficiently, and they document and evaluate results.

Content:

Ecosystems
Water cycles and water quality
Water pollution: eutrophication, contamination, acidification
Air pollution, soil pollution, biotope destruction
Waste prevention
The structure and functioning of wastewater treatment facilities
The structure and functioning of water supply facilities
The structure and functioning of recycling and waste-management operations
The structure and functioning of facilities for pipeline, sewage and industrial services
Legal provisions, technical regulations and guidelines
Organisation of work
Workplace design
Use of information systems
Data protection provisions
Procurement of work equipment and materials
Accident prevention, occupational safety

Learning field 2: Handling of microorganisms	**1st year of training** **Suggested time allocation: 40 hours**

Statement of objectives:

The pupils create suitable living conditions for microorganisms, and they know how to use microorganisms to carry out substance conversions in facilities. They are aware of the risks that microorganisms can present for their own personal health, and for the health of the general public. They are able to take hygienic measures within the facility and to combat pathogenic microorganisms.

Content:

Microorganisms: structures, types and properties
The hardiness of microorganisms, and the living conditions they require
The importance of microorganisms for environmental technology occupations
Microorganisms as the most important group of destruents
Substance cycles
Hazards presented by microorganisms: viruses, bacteria, fungi, animal parasites
Hygienic measures
Vaccinations
Identification of microorganisms
Accident prevention and industrial safety
Occupational safety

Learning field 3: Use of environmental chemicals	**1st year of training** **Suggested time allocation: 80 hours**

Statement of objectives:

The pupils plan the use of environmental chemicals for water processing, industrial cleansing and waste/wastewater management. The are familiar with the nature and properties of these substances, and they can assess the hazardousness of their reactive behaviour. The pupils assign chemical agents and hazardous substances to hazard classes and dispose of them responsibly. They store and package hazardous materials and substances properly, and they are familiar with the legal provisions pertaining to transports of hazardous materials and substances. The recognize the health impacts of hazardous materials and substances, and they take suitable protective measures. The pupils help to prepare operational instructions for handling of hazardous substances, and they can respond appropriately to hazardous situations within the facility.

Content:

Mixtures of substances
Nature and properties of substances
Precipitation, acid-base and redox reactions
Substance classes
Stoichiometric calculations
Temperature, conductivity, pH, oxygen level
Mass, volume, density
Classification of hazardous substances
Production/emergence of hazardous substances
Handing of hazardous substances
How hazardous substances can disrupt operational procedures
Dangerous chemical reactions
Proper disposal of hazardous substances
Storage and packaging of hazardous substances
Transports of hazardous materials
Operational instructions
Accident prevention, occupational safety

Learning field 4: Operation of pipeline systems	**1st year of training** **Suggested time allocation: 80 hours**

Statement of objectives:

The pupils read pipework plans and prepare pertinent sketches. They are able to imagine in detail how pipeline sections have been laid or need to be laid. The pupils plan the installation of fittings and pumping equipment, and they select required materials, including sealing material, in light of the media that are to be transported. They carry out calculations relative to the pipeline system involved, and they prepare relevant lists of materials. In the production of pipeline systems, they use various procedures for installing and joining pipeline components, taking account of the characteristics of the different work and process materials involved and of the circumstances and conditions affecting the procedures. The pupils measure relevant sizes and quantities, and they explain relevant methods for converting, transmitting and processing measured values. They evaluate determined values and, in cases of disruptions, initiate measures for the elimination of the disruptions. The pupils make decisions relative to the use of control and regulating systems.

Content:

Pipelines, fittings, seals
Pipe and hose connections
Pipework plans, basic sketches, flow diagrams and piping and instrumentation diagrams
Labelling of pipes and fittings
Linear expansion, mass-flow and volume-flow calculations
Pressure losses in pipelines
Material properties
Work and process materials
Corrosion and corrosion protection
Procedures for measuring temperature, pressure, fill level, volume, flow rate
Measuring transducers
Standard signals
Relay logic and programmable logic control
Continuous and discontinuous controllers, control loops
Relevant legal provisions and technical regulations
Accident prevention, occupational safety

Learning field 5: Testing of substances in water and waste	**1st year of training** **Suggested time allocation: 60 hours**

Statement of objectives:

The pupils take, prepare, preserve and transport samples, for selected purposes, and in keeping with applicable legal provisions. They qualitatively verify the presence of key substances in water and waste. They carry out simple quantitative measurements, check the results for plausibility and interpret and record the results. They are aware of how analytical results affect process sequences, and they are able to initiate measures for process optimisation.

Content:

Sampling
Sensory analysis and pertinent quantities
Physical parameters
Single, group and sum parameters
Laboratory equipment
Qualitative determination of relevant cations and anions
Quantitative measurements – titrimetric, gravimetric, instrumental
Operational logs, performance levels
Accident prevention and industrial safety
Occupational safety
Precision
Accident prevention, occupational safety

Learning field 6: Operation and maintenance of machines and equipment	**2nd year of training** **Suggested time allocation: 80 hours**

Statement of objectives:

The pupils operate different types of machines, and they make decisions on use of such equipment in keeping with the relevant situation, as well as on an understanding of the machines' working principles. With the help of instruction manuals, they can carry out inspection and maintenance of machines typically used in their occupational area. They use relevant modern resources to keep records of such inspection and maintenance work. In cases of operational disruptions, they determine the underlying causes, with the help of technical drawings and instruction manuals. In all such activities, they apply up-to-date knowledge of technically based environmental protection. They plan the environmentally compatible storage and disposal of the operating materials the machines require, and they take an active role in making decisions regarding allocations of consumables. The pupils are familiar with methods for combining and separating materials, and they can describe and differentiate such methods in terms of their working principles. They are able to use solid, liquid and gaseous fuels, and electrical energy, properly and efficiently, in keeping with operational circumstances. The pupils select electrical equipment by applying an understanding of basic electrical quantities. In the process, they remain attentive to potential electrical hazards, and they take the necessary protective measures.

Content:

Electric motors and combustion engines
Pumps, blowers and compressors
Selection, use and applications of equipment
Assembly and disassembly of operational equipment and facilities
Maintenance of operational equipment and facilities, card files, logs
Lifting devices and transport equipment
Material storage and planning
Avoidance and minimisation of the environmental pollution and stresses caused by work equipment
Technical documents
Combination and separation of materials
Fuels
Equipment for heating and cooling
Basic electrical quantities
Voltage generators, transformers and motors
Protective measures, proper behaviour in connection with accidents involving electricity
Accepting responsibility
Accident prevention and industrial safety
Occupational safety

Learning field 7: Operation and maintenance of electrical facilities	**2nd year of training** **Suggested time allocation: 40 hours**

Statement of objectives:

The pupils operate electrical equipment and systems. To that end, they read circuit diagrams, prepare relevant freehand sketches, measure electrical quantities and assess the pertinent measurements. They check safety equipment and, in cases of disruptions or other problems, initiate steps to restore proper operation and condition. They are familiar with the effects of electricity, and they are aware of the potential hazards presented by electrical systems and equipment. They inform themselves regarding applicable VDE regulations (VDE = Association for Electrical, Electronic & Information Technologies), and they take the necessary measures to protect persons and equipment.

Content:

Effects and dangers of electricity
Safety rules and regulations
Relevant symbols
Circuit diagrams
Direct current, alternating current, three-phase alternating current
Capacitance, inductance
Protective measures with and without protective conductors
Types of networks
Measurement of voltage and current
Legal provisions, technical regulations – such as VDE 0100
Accident prevention, occupational safety

Learning field 8: Operation of drain systems	**2nd year of training** **Suggested time allocation: 60 hours**

Statement of objectives:

The pupils help prepare a concept for drainage of wastewater from a drainage area. They select a drain system in keeping with the applicable legal regulations and the local circumstances. They select pipelines, equipment and structures in keeping with the wastewater characteristics, wastewater quantities involved, the local geography and the operational requirements. The pupils plan the monitoring, control and maintenance of drain systems, pumping stations and rainwater overflow facilities. They detect disruptions and take measures to eliminate them. They are aware that the operation, inspection and maintenance of stormwater management facilities are of great significance with regard to protection of water bodies. In planning and execution of their work, the pupils take account of all potential hazards, in order to protect themselves and the other members of their working group.

Content:

Technical communications
Water cycles, water-body protection
Types, quantities and composition of wastewater
Systems for mixing, separation and seepage of rainwater
Gravity sewers, pressure drainage systems, vacuum sewer systems
Building and property drainage
Reading of site maps, construction drawings and piping and instrumentation diagrams
Shafts, intake structures, connecting structures, drop-level structures, junctions
Rainwater overflows
Rainwater management and treatment facilities
Clearing and spraying systems
Measurement of precipitation, water level, flow rate
Management of sewer networks
Requirements pertaining to sewer networks
Corrosion
Gradients
Wastewater conduits, materials, cross-sections, connectors, fittings
Control valves, isolation valves, safety fittings
Relevant legal provisions and technical regulations
Accident prevention, occupational safety

Learning field 9: Mechanical cleansing of wastewater	**2nd year of training** **Suggested time allocation: 40 hours**

Statement of objectives:

Working on the basis of the physical composition of wastewater, the pupils plan the removal of suspended substances in wastewater using mechanical separation processes. They evaluate alternative approaches, and derive from such evaluation measures for cost-effective, operationally reliable wastewater treatment. The pupils are able to operate and maintain facilities for mechanical wastewater treatment. They are able to recover residues (for use), or dispose of them (as necessary), in an environmentally compatible manner. They record operational data and work results, visualise them with software commonly used in the industry and interpret the results.

Content:

Physical processes
Lifting systems
Raking and sieving systems
Sand traps
Light-material separators
Treatment and disposal of residues
Settling basins
Flotation basins
Combined facilities
Assessment principles, specific types of calculations for the area involved
Monitoring of operations, records of operations
Relevant legal provisions and technical regulations
Accident prevention, occupational safety

Learning field 10: Testing of wastewater and sludges	**3rd year of training** **Suggested time allocation: 60 hours**

Statement of objectives:

The pupils take wastewater and sludge samples, prepare them suitably and prepare sampling logs. They test samples taken from indirect dischargers, or from components within the facility, for the parameters specified in applicable legal provisions. From the results of such testing, they draw conclusions for process control and regarding the quality of the wastewater and sludges tested.

Content:

Sampling
Microscopic images
Dry matter content, dry residue, loss on ignition, residue on ignition
Sludge volume, sludge volume index
Proof of aerobic sludge stabilisation – for example, TTC test, breathing activity
Lime reserve, acid capacity, organic acids
Gas measurements, gas yield
Determination of physical parameters such as conductivity, turbidity, pH, coloration, oxygen
Filtratable substances, settleable solids
Individual parameters, such as phosphorous, nitrogen
Nitrogen balance: Total N, nitrate N, nitrite N, ammonium N
Sum parameters, such as COD, BOD_5, TOC, methylene blue test
Luminescent bacteria test
Precipitation and flocculation tests
Neutralisation tests
Monitoring of indirect dischargers
Recording of weather data
Water-quality determination
Analytical quality assurance
Accident prevention, occupational safety

Learning field 11: Biological and chemical treatment of wastewater and sludges	**3rd year of training** **Suggested time allocation: 80 hours**

Statement of objectives:

The pupils carry out biological and chemical procedures for treatment of wastewater. On the basis of the key data and the flow chart for the wastewater-treatment facility, they learn about wastewater-treatment and sludge-treatment processes and about gas recovery and use. From these insights, they derive measures for operation and maintenance of the facility. The pupils optimise operational procedures with the help of process-control systems, with a view to ensuring compliance with the required outflow quality values and to preventing unnecessary operational costs. They carry out maintenance work in keeping with operational instructions, manufacturers' data and the relevant maintenance and inspection files. The document all work results, monitor the work of outside companies and coordinate work procedures. In team meetings, they analyse the various work procedures and define future approaches.

Content:

Biological and chemical processes
C, N and P compounds as nutrients
Carbon elimination
Nitrogen elimination
Phosphorous elimination
Wastewater treatment processes modelled after natural processes
Small wastewater-treatment plants
Trickling-filter and rotating-biological-contactor processes
Activation processes
Special process types, such as SBR processes
Industrial wastewater treatment
Anaerobic wastewater treatment
Relevant machines and equipment
Relevant quantities for assessment, application-specific calculations
Types of sludge, sludge production, sludge quality
Sludge treatment processes
Sludge dewatering
Sludge use and disposal
Gas treatment and use, explosion prevention
Strategies for problem-solving
Monitoring of operations, records of operations
Quality-assurance measures
Legal provisions, technical regulations
Accident prevention, occupational safety

Learning field 12: Connection of electrical equipment	**3rd year of training** **Suggested time allocation: 40 hours**

Statement of objectives:

The pupils read circuit diagrams, isolate electrical systems from the network, carry out maintenance work and reconnect equipment, taking account of all safety regulations. In cases of disruptions of electrical systems and equipment, they carry out measurements in keeping with VDO guidelines, assess the measurements, detect operational disruptions and initiate necessary repairs. They can replace defective parts of equipment, using properly selected materials. The pupils understand the responsibility that they assume by working on electrical equipment and facilities. They apply regulations for prevention of electrically triggered explosions.

Content:

Connection and disconnection of electric motors and pumps
Types of connection
Torque behaviour
Rating plate
Motor soft starters
Clamping board
Types of motors, and their behaviour:
    such as shunt motors, series motors, AC universal motors, rotary current induction motors
Replacement of electrical components
    such as fluorescent lamps, cables, switches, fuses, contactors, emergency generators
Measurements, measurement results, operational disruptions
Test reports
Legal provisions, technical regulations – such as VDE 0100
Accident prevention, occupational safety

Learning field 13: Maintenance of drain systems, and monitoring of indirect dischargers	**3rd year of training** **Suggested time allocation: 60 hours**

Statement of objectives:

The pupils organise the cleaning, repair, inspection and maintenance of conduits, shafts and special structures. They familiarise themselves with the relevant potential hazards, and they take notice of such hazards in the preparation and execution of their work. In keeping with the pertinent situation, they select personal safety equipment, rescue equipment and measurement and warning equipment, and use such equipment responsibly. They help plan and monitor repair and modernisation measures, and they take account of such measures' impacts on sewage operation. The pupils help to prepare an indirect-discharger cadastre, and they are able to use it locate illegal wastewater discharges. In cooperation with staff of commercial and industrial companies, they review possibilities for cooperation, reach suitable agreements and monitor compliance with such agreements.

Content:

Technical communications
Securing of work areas within the public traffic infrastructure
Climbing into shafts
Working in enclosed spaces
Hygiene and health protection
Measurement and warning equipment
Protective, safety and rescue equipment
Accident-prevention regulations, safety regulations, pertinent instruction sheets
Physical, biological and biochemical processes taking place in sewers
Sewer cleaning – procedures, equipment
Inspection and maintenance of sewers, shafts and special structures
Keeping of records, and archiving and processing of data
Leakage testing
Damages, causes of damage, consequences of damage
Documentation, condition classification and condition assessment
Repair procedures
Pre-treatment facilities
Light-material separators
Small wastewater-treatment plants
Wastewater registry, indirect-discharger cadastre
Requirements pertaining to wastewater discharges
Sampling equipment
Relevant legal provisions and technical regulations

Learning field 14: Control and regulation of wastewater treatment facilities	**3rd year of training** **Suggested time allocation: 40 hours**

Statement of objectives:

The pupils simulate the control of a drainage network and of equipment for wastewater and sludge treatment. To that end, they analyse the pertinent control and regulation systems, and the impacts of system changes on operations. They detect disruptions that occur during process control, and they eliminate the causes of such disruptions. The pupils discuss their work results, and they record them in an experience report.

Content:

Simulation models
Regulation principles
Measurement, control and regulation systems
Process-control systems
Documentation