German Technical Wastewater Reuse Standard and Skilled Staff Training

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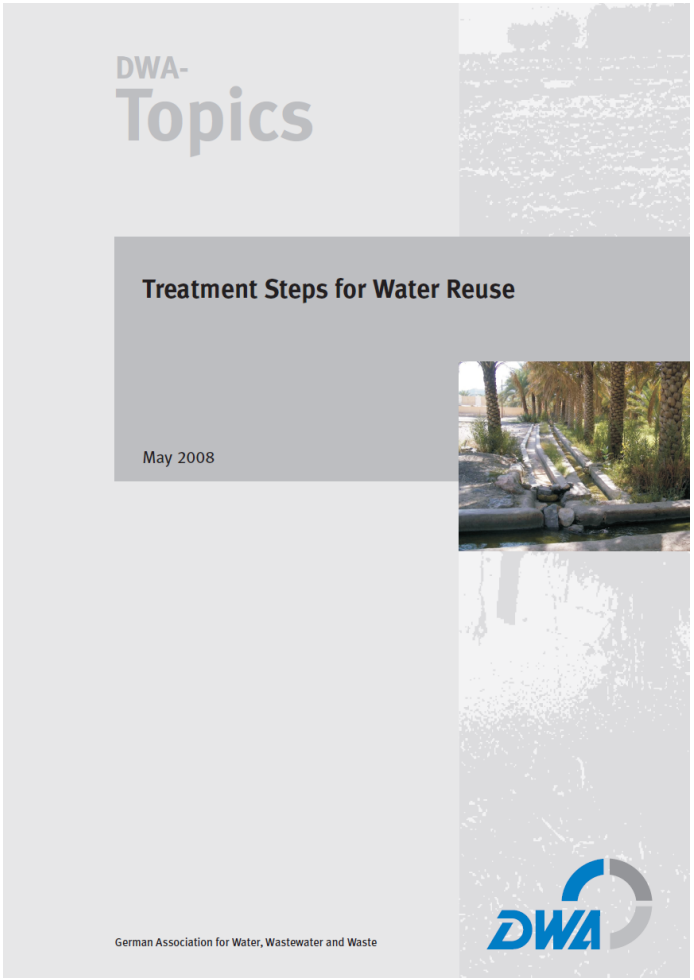
DWA-Topics Treatment Steps for Water Reuse
translated in 6 languages



مراحل فرآیندی تصفیه فاضلاب برای
استفاده مجدد

以水的再利用为目标的
污水处理工艺评估

**Niveaux de traitement pour
le recyclage de l'eau**

مر حل معالجة لمياه لعادمة
بهدف ٍعادة لاستخد م

**Tratamiento de aguas residuales
para su reutilización**

R.Heidebrecht, DWA, 2017

DWA-Topics – Treatment Steps for Water Reuse

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Update on the way

Table 1: Line headings with assessment parameters

Aspect				Line
Health risk	Operating personnel water treatment facility			1
	Users of the reutilised water			2
Economic efficiency	Investment costs	Floor space required		3
		Structural engineering		4
		Mechanical engineering		5
		E+MCR technology		6
	Operating costs	Personnel requirement/costs		7
		Energy requirement/costs		8
		Disposal of residues		9
		Operating resources (precipitants etc.)		10
		Preventative maintenance costs		11
Effects on the environment through operation of the facility	CH_4 emission			12
	Odour nuisance			13
	Sounds/noisiness			14
	Aerosols			15
	Insects (worms, flies etc.)			16
Requirements on the operating personnel	Operability/operating expenditure			17
	Expenditure for preventative maintenance			18
	Required training of operating personnel			19
Plant technology	Degree of mechanisation			20
	Robustness			21
	Process stability			22
	Ability to influence the discharge quality operationally			23
	Discharge quality (treatment performance)	COD/BOD elimination		24
		SS reduction		25
		Nutrient elimination	Ammonium	26
			Nitrate	27
			Phosphorus	28
		Reduction of pathogens	Viruses	29
			Bacteria	30
			Protozoa	31
			Helminths	32
		Colour/Odour		33
		Residual turbidity		34
		Salting-up due to process		35
	Accumulation of residues			36
Irrigation technology	Root irrigation			37
	Trickling irrigation			38
	Sprinkler/Spray systems			39
	Flooding			40
Types of use	Agricultural irrigation			41
	Non-potable water (toilet flushing)			42
	Urban uses (irrigation, water for fire-protection)			43
	Forestry irrigation			44

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Klare Konzepte. Saubere Umwelt.

Matrix topics

- Health risk
- Economic efficency
- Effect on the evironment
- Staff requirements
- Plant btechnology
- Irrigation technology
- Type of use

Excample Matrix – mechanical treatment

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2010

Annex Assessment Matrix of Treatment Steps for Water Reuse

Mechanical treatment

Aspect			Line No	Mechanical treatment: Screening: with precipitation / flocculation		Screening: without precipitation / flocculation		Screening: micro-sieving 10 µm		Sedimentation: with precipitation / flocculation		Sedimentation: without flocculation	
Health risk	Operating personnel water treatment facility		1	high (handling of chemicals)	25	medium	25	low	27	high (handling of chemicals)	28	medium	28
	Users of reused water		2	low (only as pre-treatment stage)	25	low (only as pre-treatment stage)	25	low (disinfection necessary)	27	low (only as pre-treatment stage)	28	low (only as pre-treatment stage)	28
Economic efficiency	Investment costs	Surface requirement	3	low	25	low	25	low	27	low (0.04-0.06 m²/PT)	6	low (0.02-0.04 m²/PT)	6
		Structural engineering	4	medium (400-1000 €/(m³/h) + flocculation)	2	low (400-1000 €/(m³/h))	2	low	27	medium (250-1000 €/PT settling tank + 1-80 €/PT precipitation)	3	medium (250-1000 €/PT für settling tank)	3
		Mechanical engineering	5	low	25	low	25	medium	27	low	34	low	34
		E+MCR technology	6	low	25	low	25	low	27	low	34	low	34
	Operating costs	Personnel requirement / costs	7	low	25	low	25	low	27	low	34	low	34
		Energy requirement / costs	8	medium (0.0117-0.017 kWh/m³)	27	medium (0.009-0.013 kWh/m³)	27	low	27	low (~0.002 kWh/m³)	5	low (~0.001 kWh/m³)	5
		Dispcsal of residues	9	high	25	medium	25	low	27	high	34	medium	34
		Operating resources (precipitant etc.)	10	high	25	low (no operating resources)	25	low	27	high	34	low (no operating resources)	34
		Preventative maintenance costs	11	low	25	low	25	low	27	low	34	low	34
Effects on the environment through operation of the facility	CH_4-Emission		12	none	25	none	25	none	27	low (only with long sedimentation times slight methane formation through anaerobic degradation process possible)	30	low (only with long sedimentation times slight methane formation through anaerobic degradation process possible)	30
	Odour nuisance		13	high	29	high	29	low	27	low	29	medium	29
	Sounds / noisiness		14	low	29	low	29	low	27	low	29	low	29
	Aerosols		15	low	29	low	29	medium	27	low	29	low	29
	Insects (worms, flies, etc.)		16	high	29	high	29	low	27	medium	29	low	29
Requirements on operating personnely	Operability /operational expenditure		17	medium	31	low	25	medium	31	medium	31	low	31
	Preventative maintenance expenditure		18	medium	31	low	25	medium	31	medium	31	low	31
	Required training for operating personnels		19	medium	29	low	29	medium (trained personnel required)	27	medium	29	low	29
Plant technology	Degree of mechanisation		20	low / medium	25	low	25	high	27	medium	27	low	27
	Robustness		21	high	25	high	25	medium	27	medium	27	high	27
	Process stability		22	high	25	high	25	medium	27	high	27	high	27
	Ability to influense the discharge quality operationally		23	medium	25	low	31	low	31	medium	31	low	31
	Discharge quality (treatment perfor-mance)	COD / BOD eliminationy	24	medium (maximum 60 %)	25	low (maximum 25 %)	25	low (> 10 % or < 60 mg/l)	27	medium / high (55-75 % COD; 45-80 % BOD)	6	medium (25-35 % COD; 30-35 % BOD)	6
		SS reduction	25	high (maximum 95 %)	25	high (85 %)	25	medium (> 30 % or < 10 mg/l)	27	medium / high (60-90 %)	6	medium (55-65 %)	6
		Nutrient elimination: ammonium	26	low (ca. 10 %)	34	low (ca. 10 %)	34	low	27	low (<30 %)	6	low (<30 %)	6
		Nutrient elimination: nitrate	27	no influence (0 %)	25	no influence (0 %)	25	low	27	no influence (0 %)	34	no influence (0 %)	3
		Nutrient elimination: phosphorus	28	high	25	low (< 10 %)	25	low	27	high (75-90 %)	6	medium / low (<35 %)	6
		Reductions of pathogens: viruses	29	low	34	low	34	no detail	27	low (1 - 2 log steps)	1	low (0 - 1 log steps)	1
		Reductions of pathogens: bacteria	30	low	34	low	34	no detail	27	low (1 - 2 log steps)	1	low (0 - 1 log steps)	1
		Reductions of pathogens: protozoa	31	low	34	low	34	no detail	27	low (1 - 2 log steps)	1	low (0 - 1 log steps)	1
		Reductions of pathogens: helminths	32	low	34	low	34	no detail	27	medium (1 - 3 log steps)	1	low (0 - <1 log steps)	1
		Colour / odour	33	no influence	25	no influence	25	no influence	27	low with longer sedimentation times odour through anaerobic degradation processes possible)	30	low with longer sedimentation times odour through anaerobic degradation processes possible)	30
		Resicual turbidity	34	low	25	medium	25	low	27	low	34	medium	34
		Salting up due to treatment	35	medium (salting through precipitation chemicals)	25	no influence	25	no influence	27	high (salting through precipitation chemicals)	30	no influence	30
	Accumulation of residues		36	medium (country-specific; 15-70 l/(PT·a))	27	medium (country-specific; 15-60 l/(PT·a))	27	low	27	high (730-2500 l/(PT·a) un-stabilised, liquid or 40-110 l/(PT·a) dewatered sludge)	6	low (330-730 l/(PT·a) un-stabilised, liquid or 15-40 l/(PT·a) dewatered sludge)	6
Irrigation technology	Root irrigation		37	not suitable	25	not suitable	25	suitable	27	not suitable	10	not suitable	10
	Trickling irrigation		38	not suitable	25	not suitable	25	suitable	27	not suitable	10	not suitable	10
	Sprinkler / spray systems		39	suitable (requires disinfection	25	not suitable	25	suitable	27	suitable (requires disinfection	10	suitable (requires disinfection	10
	Flooding		40	suitable	25	suitable	25	suitable	27	suitable	10	suitable	10
Types of use	Agricultural irrigation		41	possible	29	not recommended	29	recommended	27	possible	29	possible	29
	Non-potable water (e.g. toilet flushing)		42	not recommended	25	not possible	25	possible	27	not recommended	29	not possible	29
	Urban uses (e.g. irrigation, water for fire-protection)		43	not recommended	25	not possible	25	possible	27	not recommended	29	not possible	29
	Forestry irrigation		44	possible	25	possible	25	recommended	27	possible	29	possible	29

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Example Irrigation

5.3.7 Lines 37-40 “Irrigation Technology”

In the case of a utilisation as irrigation water, it is stated for each treatment process, whether the treated water can be employed using the given irrigation technologies.

Generally the solid matter concentration (e. g. expressed through the DS content) for irrigation facilities with very fine elements or spray nozzles (as in the case of root or trickling irrigation), has to be very small and therefore a filtration is recommended or is necessary.

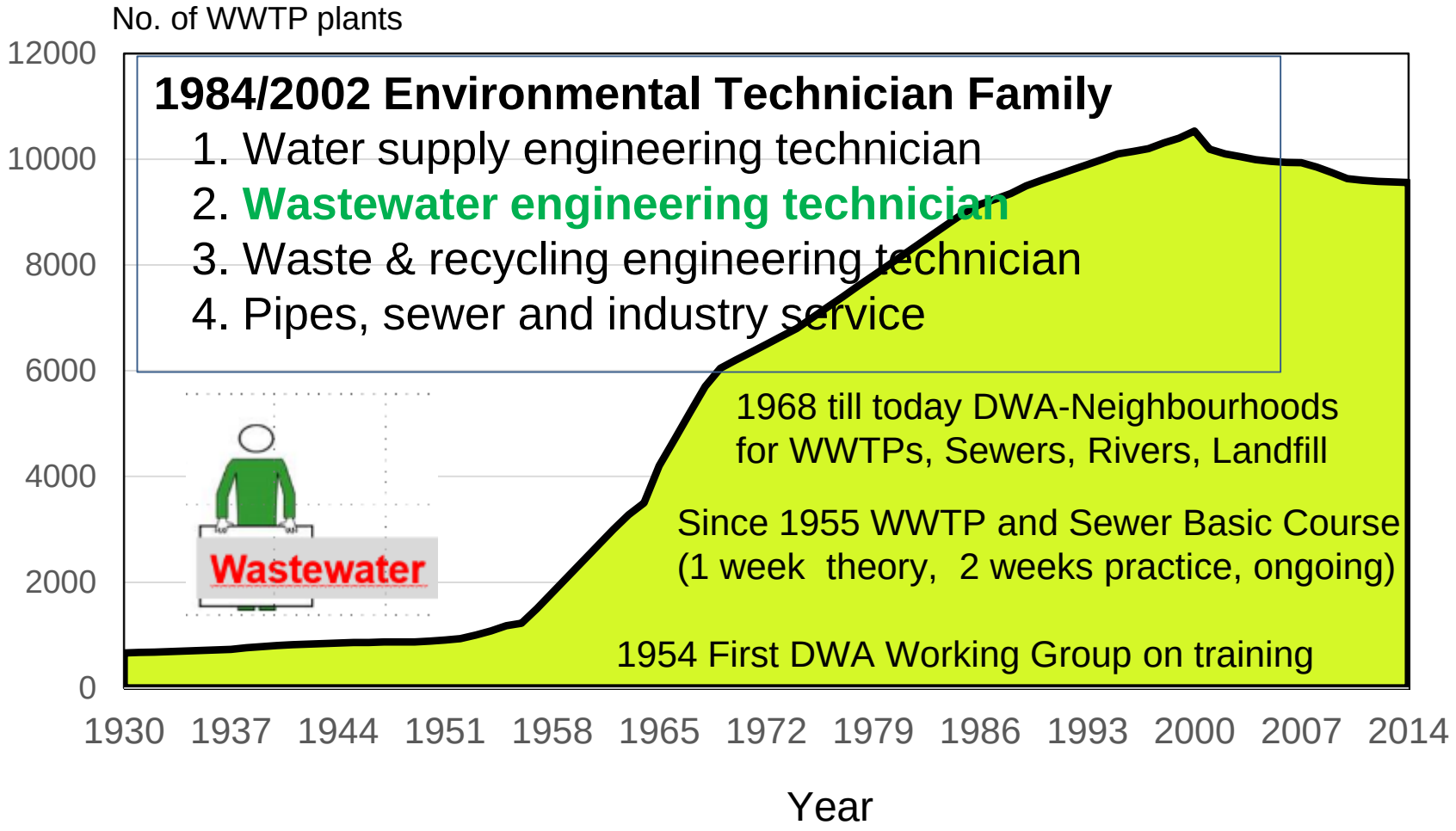
For irrigation technologies with which a development and distribution of fine droplets and aerosol particles occurs (e. g. through sprinkler systems), the treated water should additionally be disinfected in order to minimise health risks, e. g. for field workers and neighbouring inhabitants.

Category	Remarks
suitable	possibly, however, limitations due to necessary filtration or disinfection
less suitable	requires filtration
not suitable	---
not relevant	e. g. if employment as pre-treatment only takes place

Trained Staff
Wastewater Technician

3 years dual training
since 1984

Germany: Qualification & Construction of Wastewater Treatment Plants (WWTP)



Scource: Basic data from KA magazin, Nov. 2000 Page 183 Manfred Fischer, www.dwa.de
New data added and graph created by Rüdiger Heidebrecht, DWA, 2014

Training of Jordan Experts (GIZ)

The 10 days in class training was combined with field trips around Brunswick and Berlin, Germany and took place in autumn 2016

BIZ 11.4 „Water reuse“ delivered state of the art technical content modules and experiences