"Technical aspects of water safety in hospitals„

Dr. Blacky Alexander

Akkr. Inspection point cleaning, sterilisation and disinfection

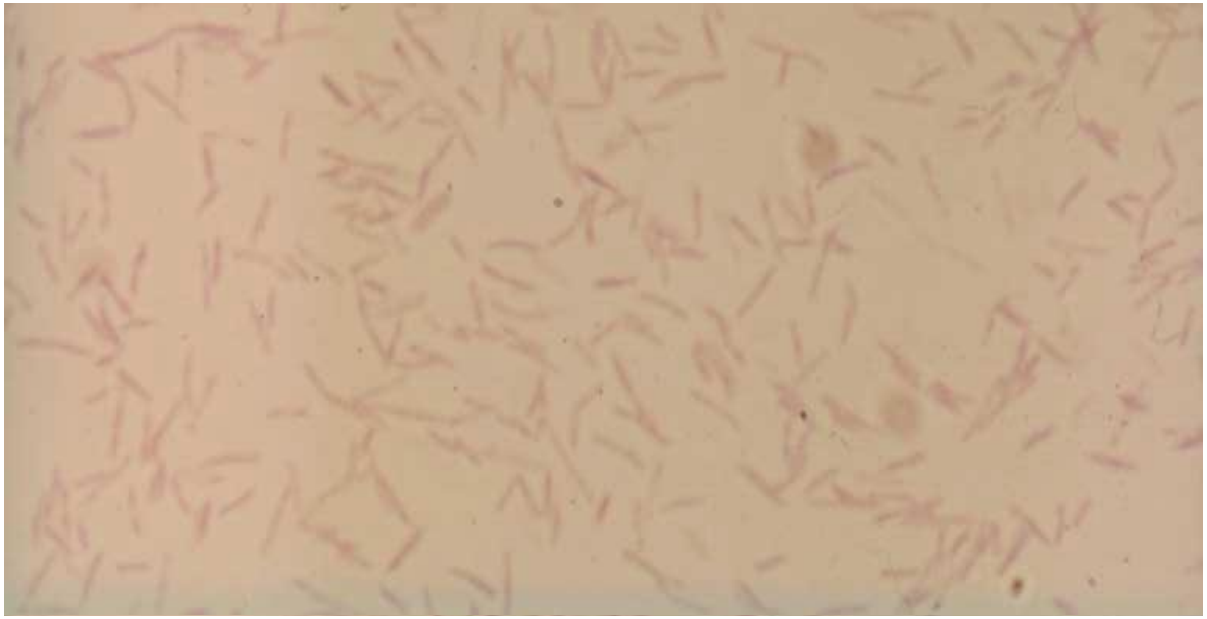
VAMED-KMB

180 persons with pneumonia
27 of which died

CDC-Atlanta insulated a hitherto unknown bacterium from corpse material

legionella

The culprits under the microscope: Legionella



(Gram preparation)

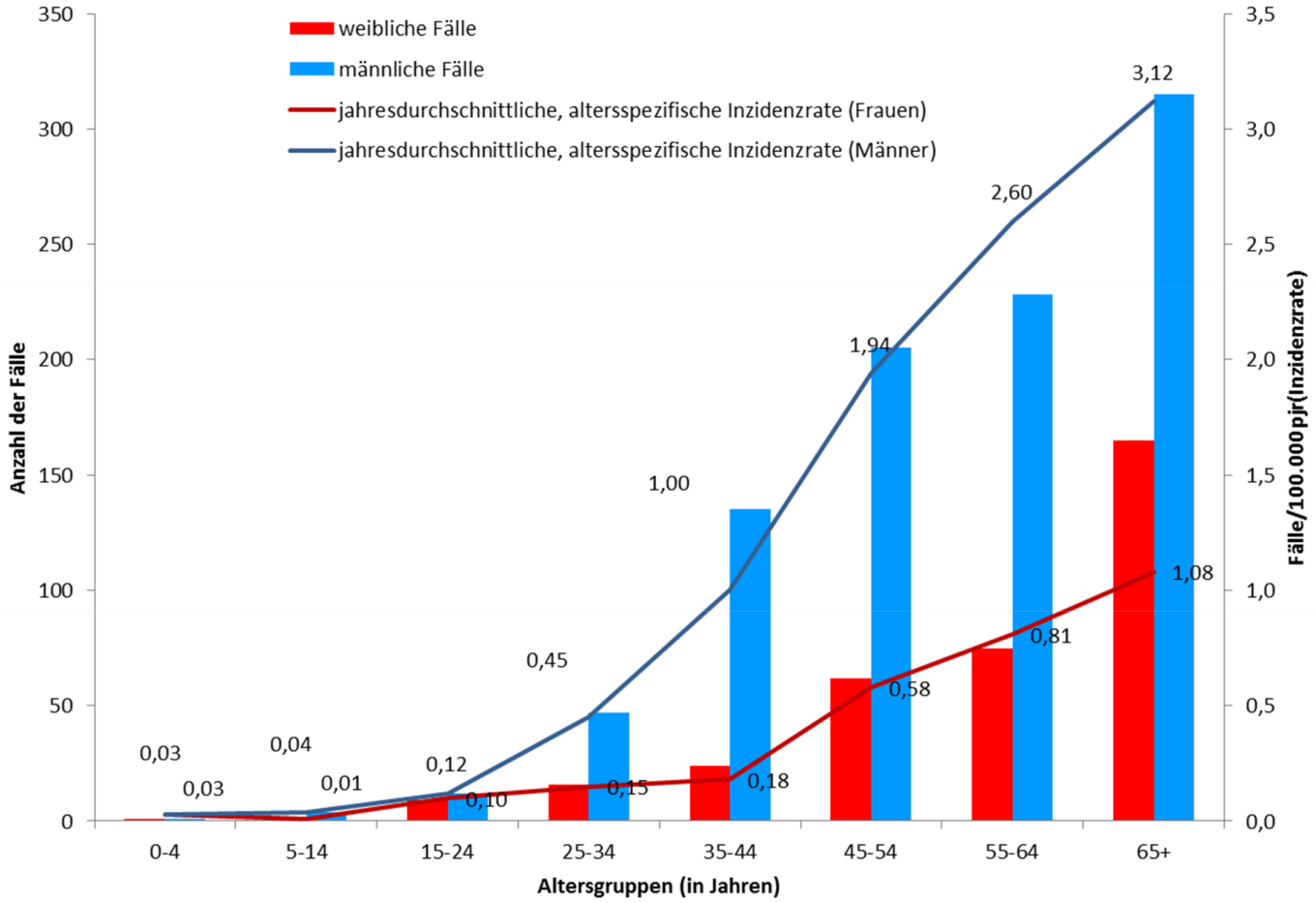
Clinical picture of Legionella - infections

	legionella pneumonia	Pontiac fever
attack rate	low (<1%)	high
incubation period	mostly 2-10 days	24–48h
symptoms	Cough Fever >39°C Diarrhoea Confusion	flu-like symptoms
chest x-ray	infiltrates	inconspicuous
Duration of the disease	weeks	2-5 days
diagnosis	Urinary antigen test culture PCR	urinary antigen test
Therapy	quinolones, macrolides, possibly doxycycline or tigecycline	symptomatically
lethality	approx. 10% of	unincreased
Reporting obligation A/D/CH	**yes**	**no**

Meyer E: Legionella infection prevention: extremely expensive and ineffective. Krankenhhyg up2date 2017;12(02):159-175. doi:10.1055/s-0043-104568

Predisposing factors for Legionella infections

factors	relative risk
men	1,5 - 3
Age (50 - 60 a)	
diabetes mellitus	
smoking	1,9
chronic bronchitis, emphysema	3,7
carcinoma	11
immunosuppression	26
transplant	340



AGES - National Reference Centre for Legionella Infections. Annual report. Address: https://www.ages.at/download/0/0/ad8c-4cf6656f58ca977064095c897c1a338e320e/fileadmin/AGES2015/Topics/Pathogens_Files/Legionella/legionellosis_annual_report_2016__2_.pdf. Last viewed on 2018/04/19.

Predisposing factors for Legionella infections

Trip abroad or overnight stay 1-2 days away from home

Occupation (coach) driver was independent risk factor in a Dutch national case-control study

[De Boer JW, Nijhof J, Friesema I. Risk factors for sporadic community-acquired Legionnaires' disease. A 3-year national case-control study. Public Health 2006; 120: 566–571]

Transmission of Legionella to humans

Inhalation of aerosol containing Legionella

e.g. from showers, from water jet regulators, from open cooling towers, from dental units, from whirlpools or in door fountains.

Inhalation of Legionella containing dust e.g. from compost soil

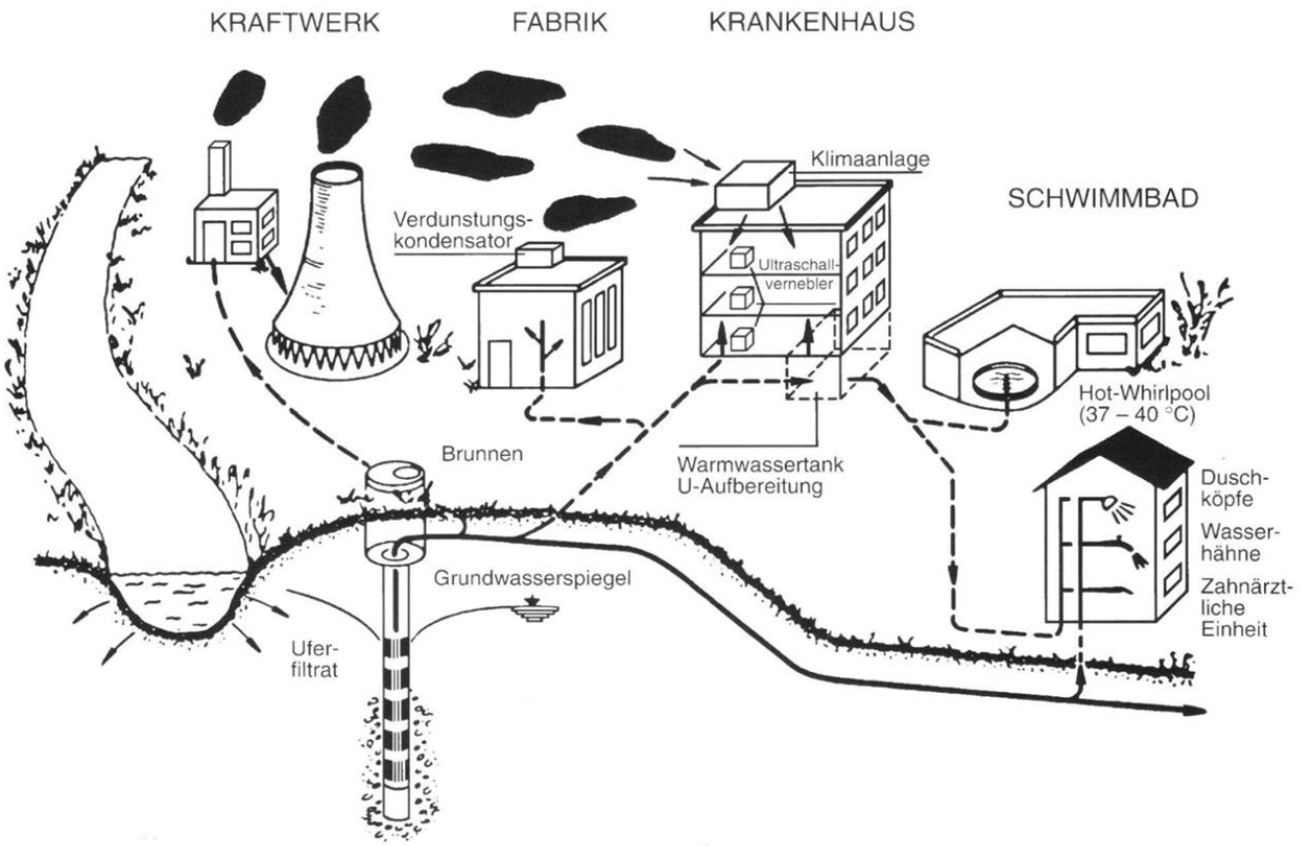
Aspiration of water containing Legionella

No transmission from person to person

2016 for the first time ?

[Correia AM, Ferreira JS, Borges V et al. Probable person-to-person transmission of Legionnaires' disease. N Engl J Med 2016; 374: 497–498].

Sources of Legionella infections



Source: Infection reservoirs of Legionella according to Exner et al. (1987)

Sources of Legionella infections

- **Hot water systems operating at temperatures below 60° C**
- **Cold water stagnating at temperatures above 20° C**
- **Evaporative recooling systems (open cooling towers and cooling units)**
- poorly maintained whirlpools and therapy tubs
- Humidifiers (with aerosol formation), car washes and windscreen washers
- Water attractions in buildings (fountains, waterfalls)
- dental units
- thermal water
- warm surface water
- compost soil
- wastewater treatment plants
- wet fire pipelines

Factors favouring the growth of Legionella in water

Temperatures from 25 - 50° C (optimal 35 - 45° C) Stagnation of the water

Coexistence with other microorganisms, e.g. pseudomonads; formation of biofilms

propagation in amoebae

Presence of organic substances and ferrous salts

Certain plastic surfaces in fittings or pipelines

Legionellen-Antikörper im Blut der Bevölkerung
Vergleich zweier Bevölkerungsgruppen mit unterschiedlicher Exposition durch das hauseigene Warmwassersystem

Gesundheitsamt der Stadt Frankfurt a.M.
Abteilung Umweltmedizin und Hygiene
Braubachstr. 18-22
D-60311 Frankfurt/M
Berichterstatterin: Dr. U. Heudorf
Frankfurt a.M., im September 2000

Health Department Frankfurt: Legionella antibodies in the blood of the population - Comparison of two population groups with different exposure by the in-house hot water system 2000.

The health department in Frankfurt has examined 2 settlements:

On the one hand the 53 inhabitants of the home settlement ("exposed") with frequent positive proofs of Legionella in the central hot water system,

on the other hand 92 inhabitants of the Goldsteinsiedlung ("Controls") with decentralised hot water supply systems without major legionella problems.

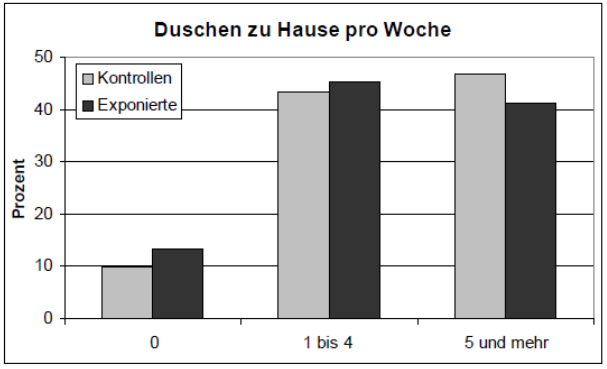
The authors conclude that

Although the Legionella contamination of the hot water in the home settlement has been known for years (and corresponding remediation measures have been taken), no legionella-related illnesses of the residents have been known so far. The investigation did not reveal any evidence of legionellosis among the inhabitants of the home settlement. However, they were more likely to have positive Legionella antibodies.

Tab. 2:
Beschreibung der Duschgewohnheiten der Untersuchungsteilnehmer

	Kontrollen n=92 (Goldsteinsiedlung)		Exponierte n=53 (Heimatsiedlung)	
	n	%	n	%
Duschen zu Hause				
nie	9	9.8	7	13.2
1-4 / Woche	40	43.4	24	45.3
≥ 5 / Woche	43	46.8	22	41.5
Duschen am Arbeitsplatz				
nie	90	97.8	49	92.4
1-4 / Monat	1	1.1	2	3.8
≥ 5 / Monat	1	1.1	2	3.8
Duschen in öffentl. Bädern				
nie	75	81.6	47	88.6
1-4 / Monat	8	8.7	3	5.7
≥ 5 / Monat	9	9.7	3	5.7
Duschen in einer Sauna				
nie	63	68.5	45	84.9
1-4 / Monat	24	26.1	7	13.2
≥ 5 / Monat	5	5.4	1	1.9
Duschen im Hotwhirlpool				
nie	87	94.5	52	98.1
1-4 / Monat	4	4.4	1	1.9
≥ 5 / Monat	1	1.1	0	0

Sämtliche Parameter: keine signifikanten Unterschiede



Contrary to popular belief, there is insufficient evidence that showering is a risk factor for the acquisition of Legionella.

The RKI: "In environmental investigations, Legionella was also found on shower heads. However, when showering, there is little aerosol formation, so it is unlikely to be more risky than contact with tap water from a tap."

[Robert Koch Institute (RKI). Legionella. RKI Guide for Doctors2013. On the Internet: ww.rki.de/DE/Content/Infekt/EpidBull/Merkblaetter/Ratgeber_Legionellose.html; Status: 11.09.2018]

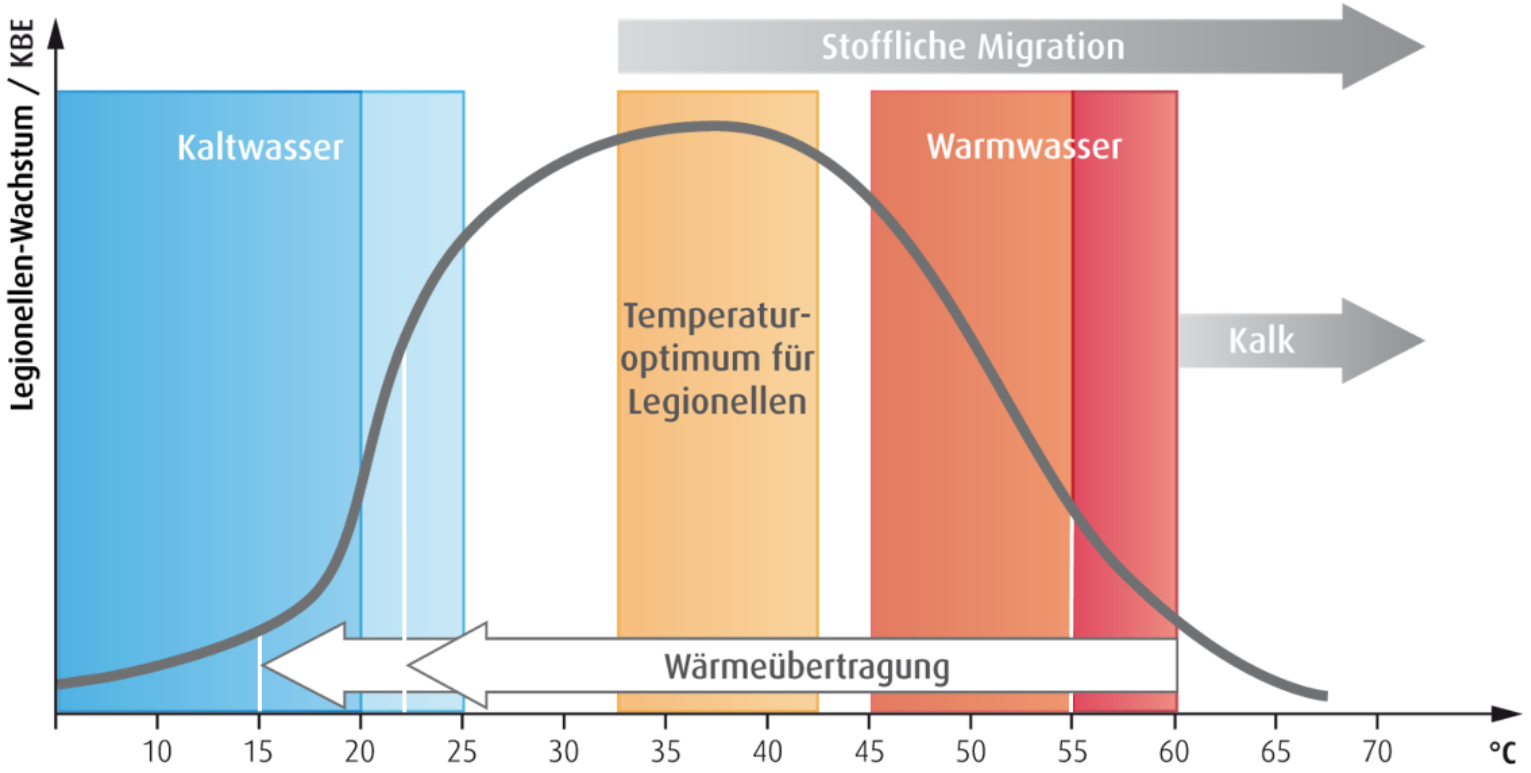
path of infection

An infection usually occurs through the inhalation of aerosols containing Legionella, but also the (micro)aspiration of contaminated water can lead to an infection in rare cases.

In particular, Legionella-containing amoeba particles are of importance for the transmission, since Legionella activate their virulence genes intracellularly.
The infection by Legionella-containing amoeba particles also explains the dose-effect paradox in the occurrence of Legionellosis: missing infections despite contaminated water systems or infections despite minimal contamination.

[Robert Koch Institute (RKI). Legionella. RKI Guide for Doctors2013. On the Internet: ww.rki.de/DE/Content/Infekt/EpidBull/Merkblaetter/Ratgeber_Legionellose.html; Status: 11.09.2018]

Factors favouring the growth of Legionella in water



Factors favouring the growth of Legionella in water – no wonder …

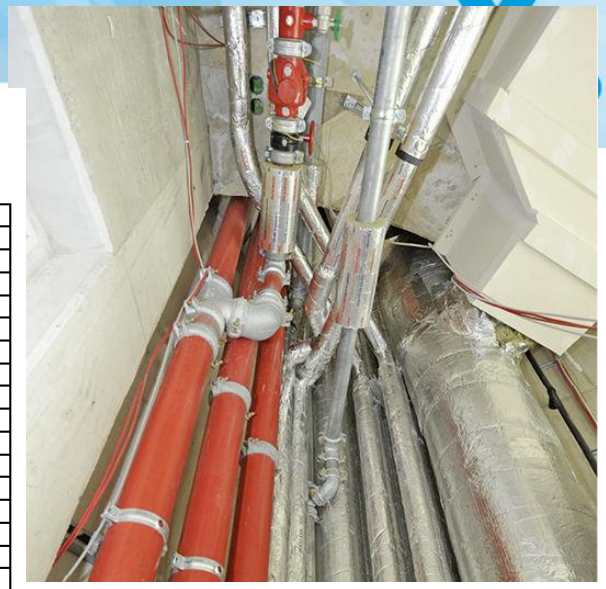
Climate change: Legionella in cold water

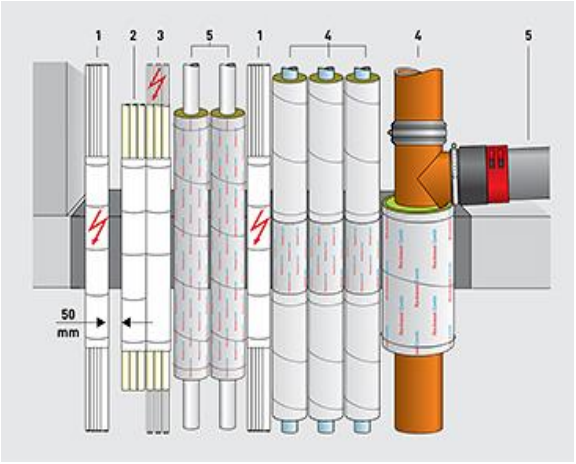
Credit: © Kwest / Fotolia

temperature controls

KW-Monitoring AN5330 - Fühlerwerte mit Stand 20.06.2018 7 08:00 Uhr

TechnicalDescription	Name	State	Value	InAlarm
BT23'Ebene 10'Raum 041 Gang'KW- Versorgung BT31 EB10+11+12'Kaltwassertemperatur	KHNC535:KHN'SA23'Flr10'R041'Mon1'TChw	°C	27,1	22,0
BT31'Ebene 10'Raum 012 Gang'BT 31 EB 10 Personalumkleiden Damen & Herren'Kaltwassertemperatur	KHNC535:KHN'SA31'Flr10'R012'Mon1'TChw	°C	29,8	22,0
BT31'Ebene 11'Raum 440 Geräte'Zentrum Allgemeinchirurgie/Gynäkologie u. Geburtsh./Kinderheilk.'Kaltwassertemperatur	KHNC535:KHN'SA31'Flr11'R440'Mon1'TChw	°C	31,4	22,0
BT31'Ebene 12'Raum 012 Gang'Interventionelle Tagesklinik Ost, 31_12_011 - GANG, 31_12_600 - 'Kaltwassertemperatur	KHNC535:KHN'SA31'Flr12'R012'Mon1'TChw	°C	30,2	22,0
BT31'Ebene 12'Raum 110 U/B-Raum'Interventionelle Tagesklinik West, 31_12_110 - U/B-RAUM'Kaltwassertemperatur	KHNC535:KHN'SA31'Flr12'R110'Mon1'TChw	°C	28,5	22,0
BT32'Ebene 10'Raum 523'Personalumkleiden Damen, 32_10_501'Kaltwassertemperatur	KHNC535:KHN'SA32'Flr10'R523'Mon1'TChw	°C	27,2	22,0
BT32'Ebene 11'Raum 006 Gang'Multidisziplinäre Erstversorgung Süd, 32_11_130 - PR'Kaltwassertemperatur	KHNC535:KHN'SA32'Flr11'R006'Mon1'TChw	°C	31,2	22,0
BT32'Ebene 11'Raum 010 Gang'Notfallstation, 32_11_550 - 1-BETTZIMMER 'Kaltwassertemperatur	KHNC535:KHN'SA32'Flr11'R010'Mon1'TChw	°C	33,9	22,0
BT32'Ebene 11'Raum 011 Gang'Multidisziplinäre Erstversorgung West, 32_11_600 - U/B RAUM 'Kaltwassertemperatur	KHNC535:KHN'SA32'Flr11'R011'Mon1'TChw	°C	30,9	22,0
BT32'Ebene 11'Raum 012 Gang'Multidisziplinäre Erstversorgung Ost, 32_11_680 - U/B RAUM 'Kaltwassertemperatur	KHNC535:KHN'SA32'Flr11'R012'Mon1'TChw	°C	30,1	22,0
BT32'Ebene 11'Raum 021 Gang'Multidisziplinäre Erstversorgung Nord, 32_11_831 - TRIAGE LIEGEN'Kaltwassertemperatur	KHNC535:KHN'SA32'Flr11'R021'Mon1'TChw	°C	34,9	22,0
BT32'Ebene 11'Raum T33'KW-Versorgung BT32 EB11'Kaltwassertemperatur	KHNC535:KHN'SA32'Flr11'R033'Mon1'TChw	°C	24,7	22,0
BT32'Ebene 11'Raum 500'Notfallstation, 32_11_521 - NASSZELLE'Kaltwassertemperatur	KHNC535:KHN'SA32'Flr11'R500'Mon1'TChw	°C	34,2	22,0
BT32'Ebene 11'Raum 820 WC-PAT'Multidisziplinäre Erstversorgung Nord, 32_11_820 - WC-PAT'Kaltwassertemperatur	KHNC535:KHN'SA32'Flr11'R820'Mon1'TChw	°C	30,4	22,0
BT32'Ebene 12'Raum 15 Gang'Operation mit zentralem Einleitungsraum Nord-West, 32_12_015 - G'Kaltwassertemperatur	KHNC535:KHN'SA32'Flr12'R15'Mon1'TChw	°C	36,4	22,0
BT32'Ebene 12'Raum 100'Operation mit zentralem Einleitungsraum Süd-West, 32_12_100 - VO'Kaltwassertemperatur	KHNC535:KHN'SA32'Flr12'R100'Mon1'TChw	°C	33,6	22,0
BT32'Ebene 13'Raum 011 Magistrale'32_13_140 - OMBUDSSTELLE'Kaltwassertemperatur	KHNC535:KHN'SA32'Flr13'R011'Mon1'TChw	°C	29,9	22,0
BT32'Ebene 13'Raum 011 Magistrale'33_13_130 - VR'Kaltwassertemperatur	KHNC535:KHN'SA32'Flr13'R011'Mon2'TChw	°C	30,4	22,0
BT32'Ebene 13'Raum 030 Gang'Ausgussbecken OP-Zentrale, 32_13_310 - HKLS-INSTALLATIONSFLAECHE'Kaltwassertemperat	KHNC535:KHN'SA32'Flr13'R030'Mon1'TChw	°C	41,7	22,0
BT32'Ebene 13'Raum 030 Gang'Ausgussbecken OP-Zentrale, 32_13_300 - HKLS-INSTALLATIONSFLAECHE'Kaltwassertemperat	KHNC535:KHN'SA32'Flr13'R030'Mon2'TChw	°C	40,6	22,0
BT33'Ebene 11'Raum 003 Gang'Notfallstation, 33_11_120 - VR (WC-PAT-D)'Kaltwassertemperatur	KHNC535:KHN'SA33'Flr11'R003'Mon1'TChw	°C	32,1	22,0
BT33'Ebene 11'Raum 300 Warteraum'Radiologische Diagnostik, 33_11_310 - SPUELE 'Kaltwassertemperatur	KHNC535:KHN'SA33'Flr11'R300'Mon1'TChw	°C	36,2	22,0
BT33'Ebene 11'Raum 710 WC-BEH'Multidisziplinäre Erstversorgung Nord, 33_11_741 ENTWESUNG / KLE'Kaltwassertemperatur	KHNC535:KHN'SA33'Flr11'R710'Mon1'TChw	°C	31,2	22,0
BT33'Ebene 12'Raum 016 Gang'Operation mit zentralem Einleitungsraum Nord-Ost, 33_12_510 - PE'Kaltwassertemperatur	KHNC535:KHN'SA33'Flr12'R016'Mon1'TChw	°C	33,0	22,0
BT33'Ebene 12'Raum 020 Gang'Intensivmedizin Süd, 33_12_181 - ENDOSKOPIEREINIGUNG UR'Kaltwassertemperatur	KHNC535:KHN'SA33'Flr12'R020'Mon1'TChw	°C	35,2	22,0
BT33'Ebene 12'Raum 101 VR'Operation mit zentralem Einleitungsraum Süd-West, DUSCHE Persona'Kaltwassertemperatur	KHNC535:KHN'SA33'Flr12'R101'Mon1'TChw	°C	31,7	22,0
BT33'Ebene 12'Raum 222'Operation mit zentralem Einleitungsraum, 33_12_151 - WC-PAT'Kaltwassertemperatur	KHNC535:KHN'SA33'Flr12'R222'Mon1'TChw	°C	35,2	22,0
BT33'Ebene 13'Raum T31'KW-Versorgung BT32+33+34 EB12+13 (OP-Bereich) 'Kaltwassertemperatur	KHNC535:KHN'SA33'Flr13'R031'Mon1'TChw	°C	45,2	22,0
BT33'Ebene 13'Raum 560'Ausgussbecken OP-Zentrale Nord, 33_13_560 - HKLS-INSTALLATIONSFL'Kaltwassertemperatur	KHNC535:KHN'SA33'Flr13'R560'Mon1'TChw	°C	34,7	22,0
BT33'Ebene 13'Raum 560'Ausgussbecken OP-Zentrale Süd, 33_13_560 - HKLS-INSTALLATIONSFLA'Kaltwassertemperatur	KHNC535:KHN'SA33'Flr13'R560'Mon2'TChw	°C	38,1	22,0
BT34'Ebene 10'Raum 003 Gang'Laboratoriumsmedizin, 34_10_210 - ROHRPOSTZENTRALE'Kaltwassertemperatur	KHNC535:KHN'SA34'Flr10'R003'Mon1'TChw	°C	30,8	22,0
BT34'Ebene 10'Raum 310'Laboratoriumsmedizin, BT35 EB10+11+12, BT36 EB10+11+12+13'Kaltwassertemperatur	KHNC535:KHN'SA34'Flr10'R310'Mon1'TChw	°C	30,9	22,0
BT34'Ebene 11'Raum 003 Gang'Radiologische Diagnostik Süd, 34_11_140 - WC-PAT-H'Kaltwassertemperatur	KHNC535:KHN'SA34'Flr11'R003'Mon1'TChw	°C	32,9	22,0
BT34'Ebene 11'Raum 005 Gang'Radiologische Diagnostik West, 34_11_180 - EINF. DIAGNOSTIK (SON'Kaltwassertemperatur	KHNC535:KHN'SA34'Flr11'R005'Mon1'TChw	°C	34,4	22,0
BT34'Ebene 11'Raum 014 Gang'Radiologische Diagnostik Nord, 34_11_740 - PERS.AUFENTH + TK'Kaltwassertemperatur	KHNC535:KHN'SA34'Flr11'R014'Mon1'TChw	°C	32,1	22,0
BT34'Ebene 11'Raum 603'KW-Versorgung BT33 EB11 + BT34 EB11'Kaltwassertemperatur	KHNC535:KHN'SA34'Flr11'R603'Mon1'TChw	°C	31,9	22,0
BT34'Ebene 12'Raum 016 Gang'Operation mit zentralem Einleitungsraum Nord-West, 34_12_016 - G'Kaltwassertemperatur	KHNC535:KHN'SA34'Flr12'R016'Mon1'TChw	°C	33,9	22,0
BT34'Ebene 12'Raum 112 Dusche'Operation mit zentralem Einleitungsraum Süd-West, DUSCHE Persona'Kaltwassertemperatur	KHNC535:KHN'SA34'Flr12'R112'Mon1'TChw	°C	32,8	22,0
BT34'Ebene 13'Raum 030 Gang'Ausgussbecken TGA-GANG Nord, 34_13_030 - TGA-GANG'Kaltwassertemperatur	KHNC535:KHN'SA34'Flr13'R030'Mon1'TChw	°C	32,9	22,0
BT34'Ebene 13'Raum 030 Gang'Ausgussbecken TGA-GANG Süd, 34_13_310 - TGA-GANG'Kaltwassertemperatur	KHNC535:KHN'SA34'Flr13'R030'Mon2'TChw	°C	38,6	22,0





Sinks - Rinsing

Sinks - Rinsing

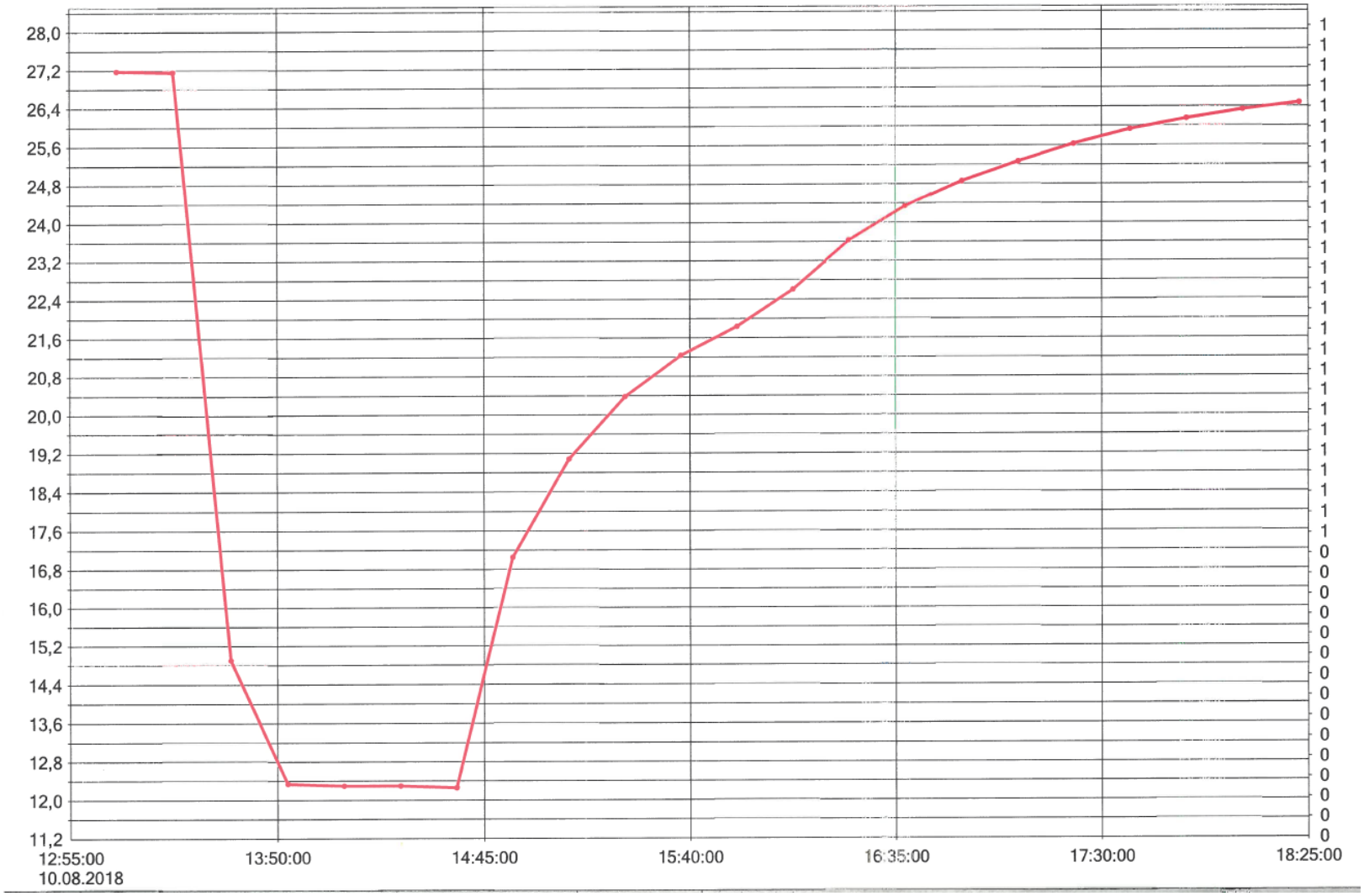
11_14_220
22.06.2018 (Früh / Vormittag)
KW-Temperaturverlauf mit Zeit
(am Tag davor war dort KW mit einer Temp. von ca. 16°C => Erwärmung über Nacht).

Sinks - Rinsing

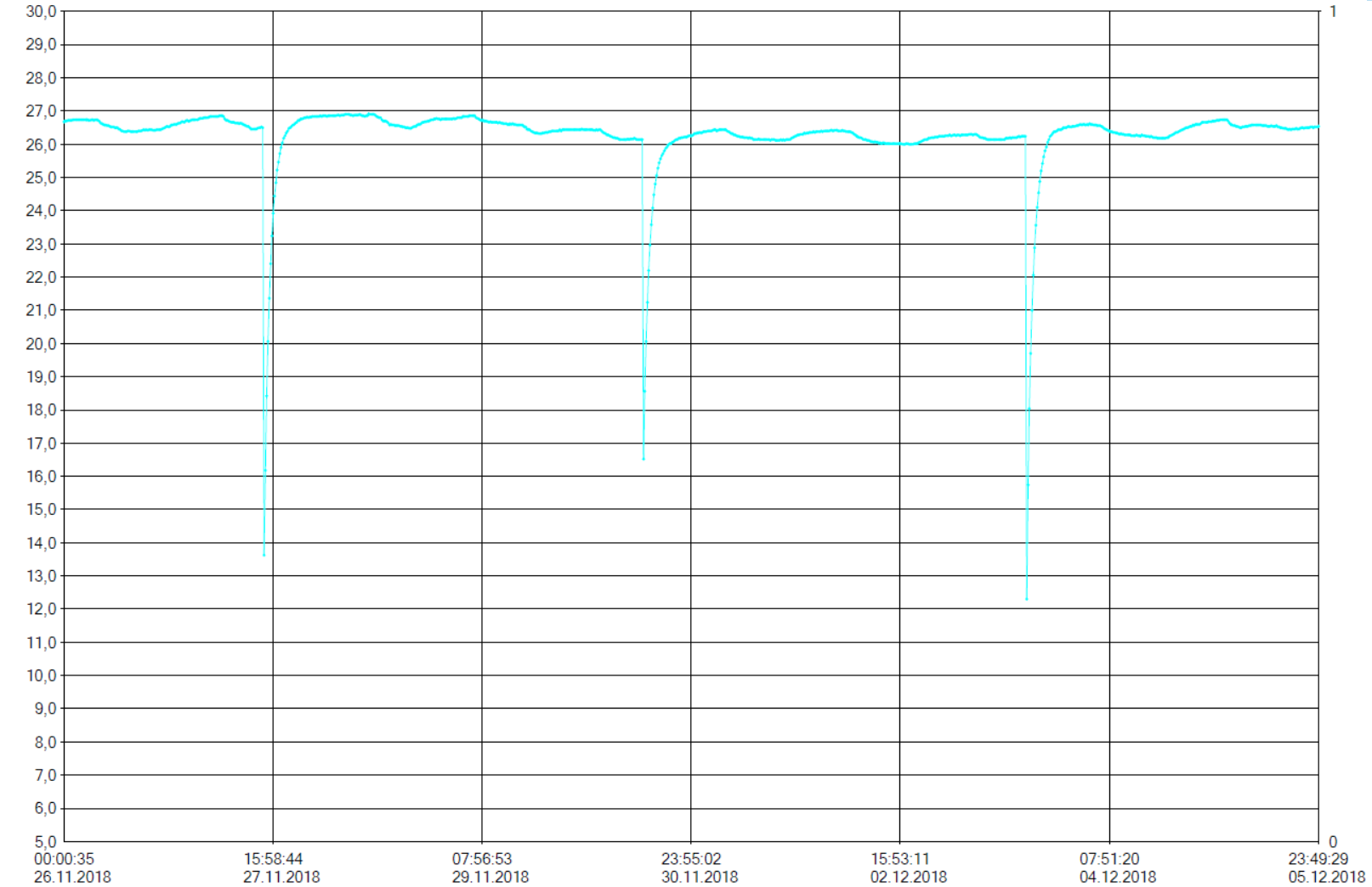
11_13_560
22.06.2018 (Früh / Vormittag)
KW-Temperaturverlauf mit Zeit
(am Tag davor war dort KW mit einer Temp. von ca. 16°C => Erwärmung über Nacht).

Sinks - Rinsing

Sinks - Rinsing

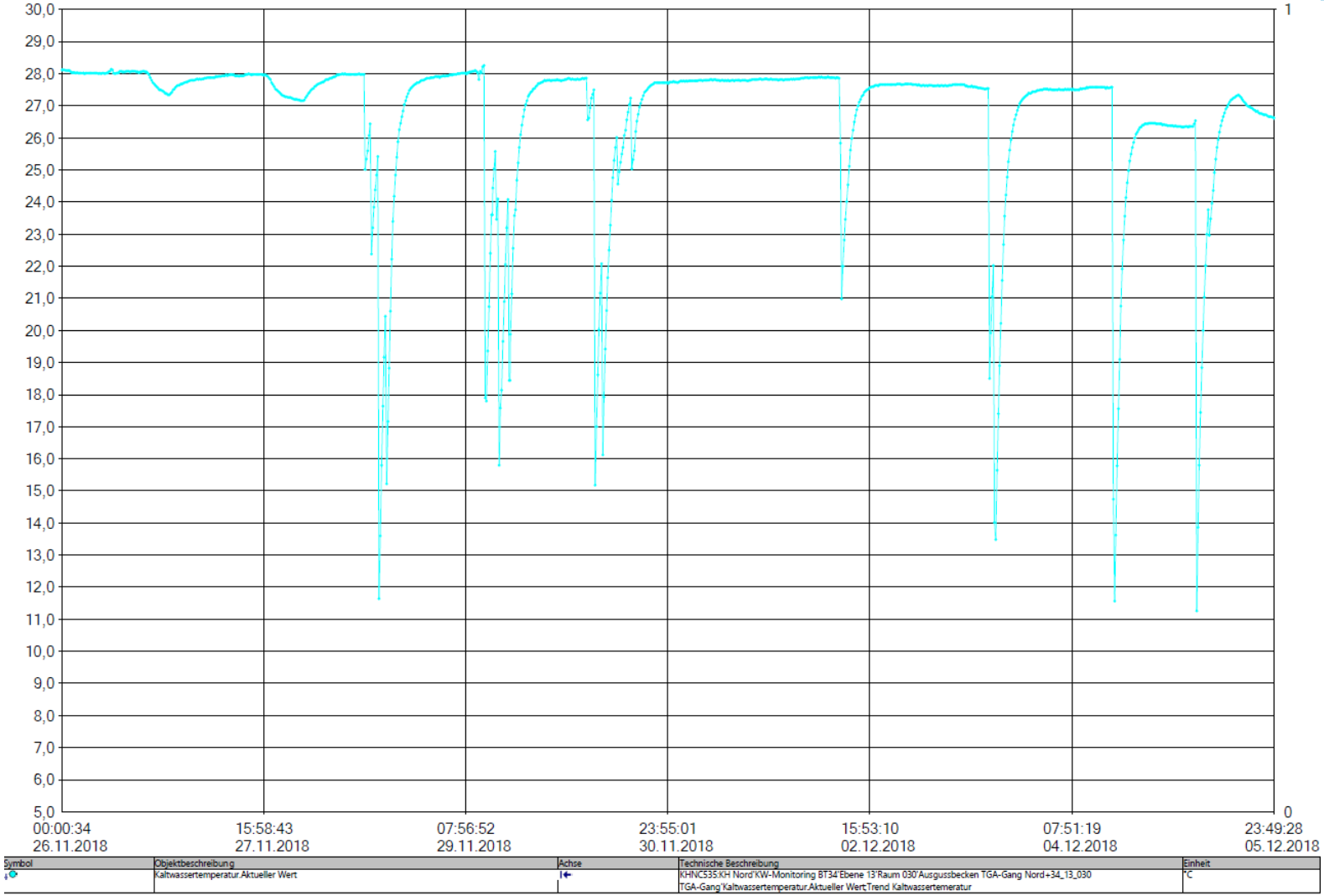


Sinks - Rinsing



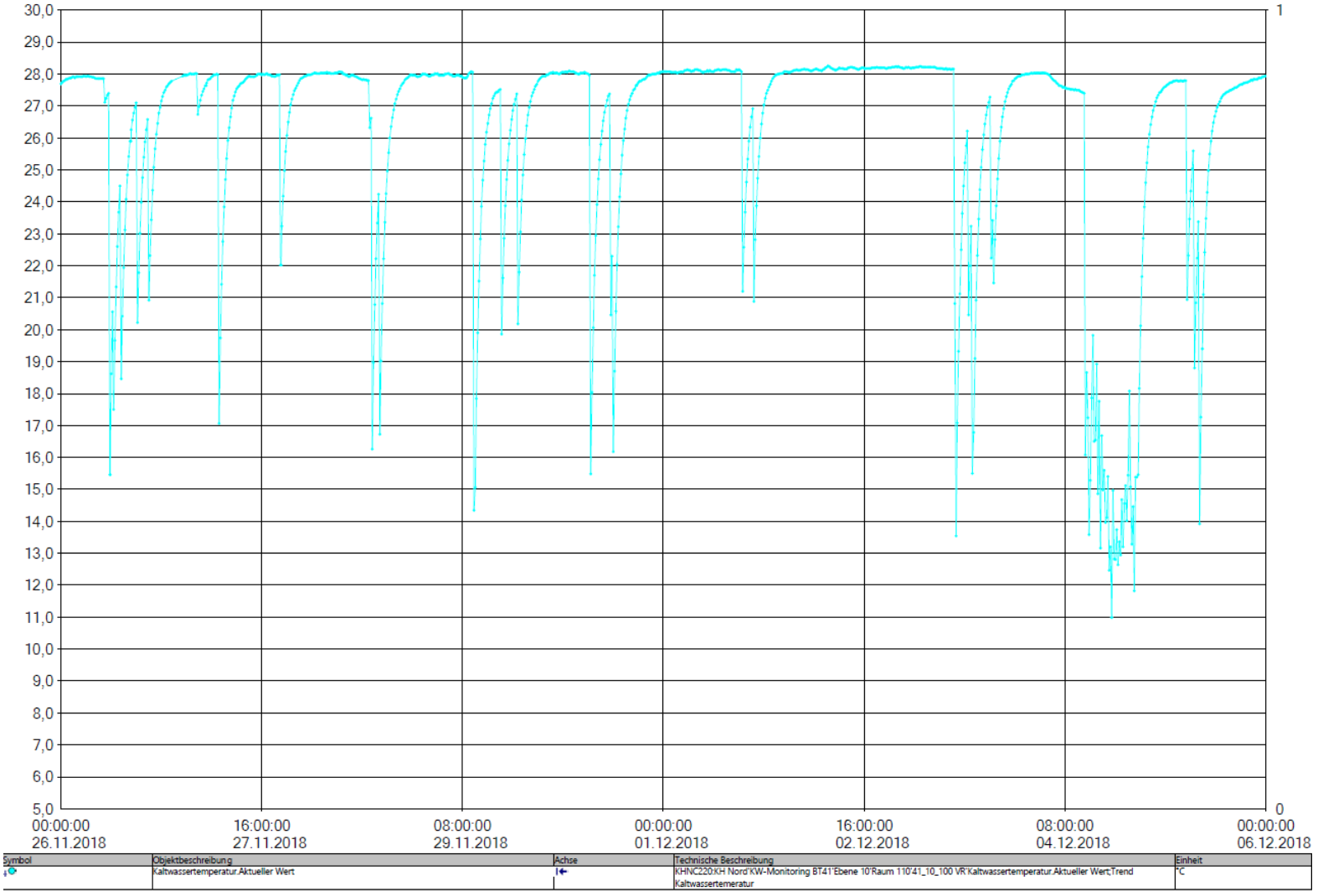
Symbol	Objektbeschreibung	Achse	Technische Beschreibung	Einheit
	Kaltwassertemperatur.Aktueller Wert		KHNC535:KH Nord'KW-Monitoring BT34'Ebene 10'Raum 003'34_10_210 Rohrpostzentrale'Kaltwassertemperatur.Aktueller Wert;Trend Kaltwassertemeratur	°C

Sinks - Rinsing

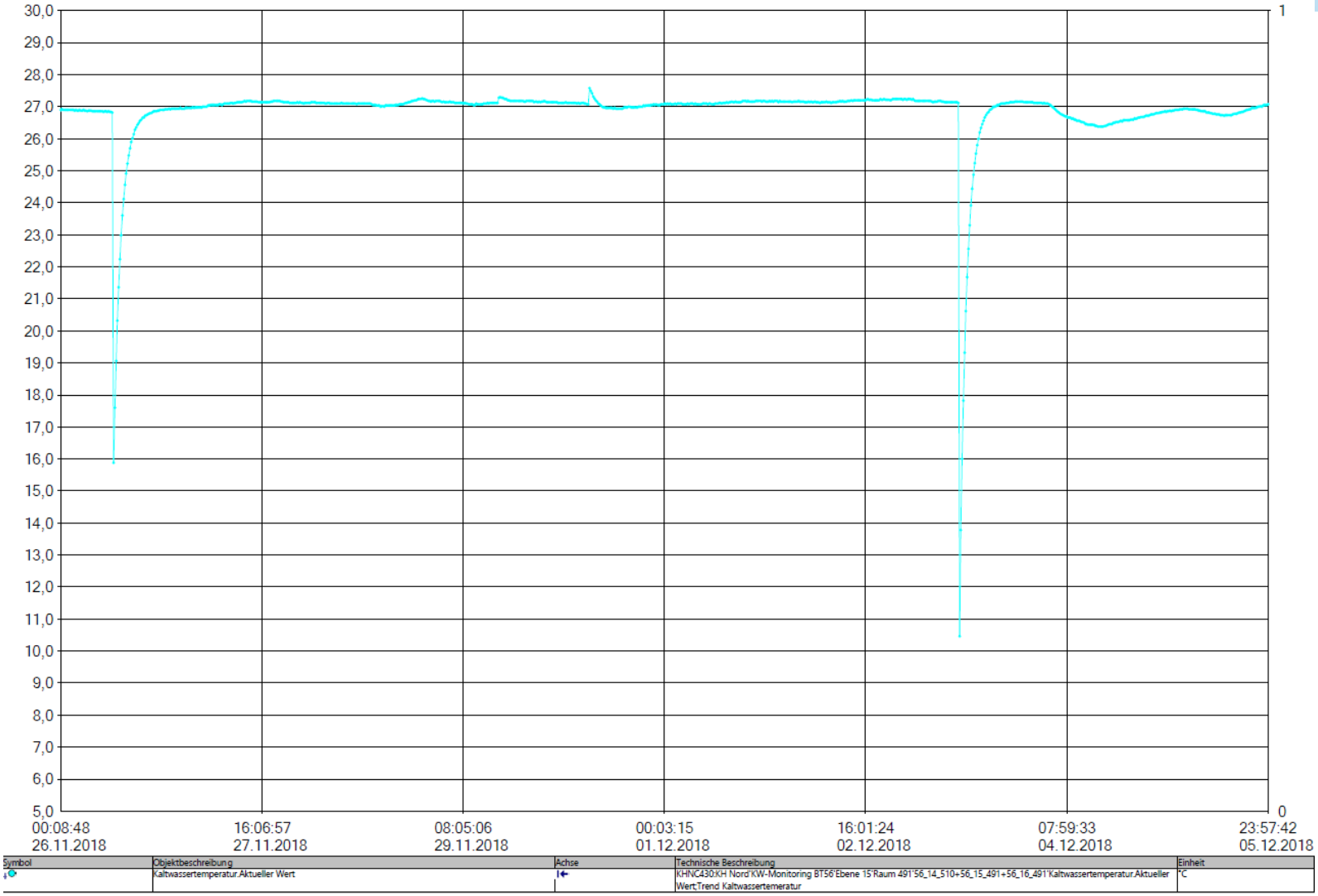


Symbol	Objektbeschreibung	Achse	Technische Beschreibung	Einheit
	Kaltwassertemperatur.Aktueller Wert		KHNC535.KH Nord'KW-Monitoring BT34'Ebene 13'Raum 030'Ausgussbecken TGA-Gang Nord+34_13_030 TGA-Gang'Kaltwassertemperatur.Aktueller Wert;Trend Kaltwassertemeratur	°C

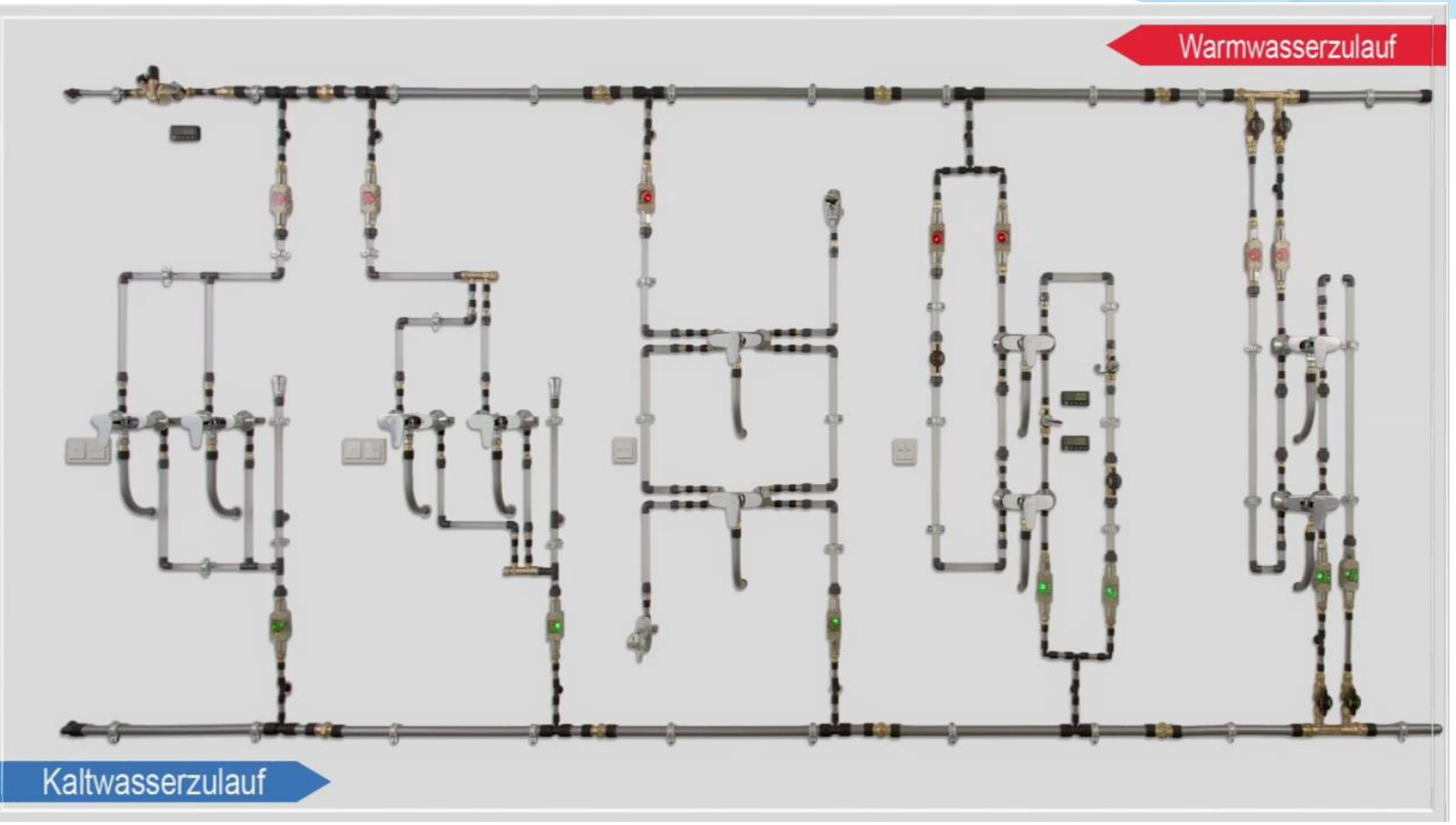
Sinks - Rinsing



Sinks - Rinsing



possible new ways: looping through



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Nursing Homes

Laboratories

Research Facilities

VAMED Today

- International market leader with headquarters in Austria
- About 850 health care projects successfully implemented worldwide
- In more than 80 countries on five continents
- Strategic partnership with 6 leading university clinics
- Providing services for round 670 hospitals – with 153,000 beds worldwide
- PPP-pioneer in health care: 25 PPP-models implemented in Austria and Germany
- Leader in Austrian health tourism and medical wellness market
  (VAMED Vitality World: ~ 3,2 million guests, 9 resorts in Austria & Hungary)
- Leader in the Austrian private rehabilitation sector

Thank you !

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create. health. manage. care. enjoy. vitality.