

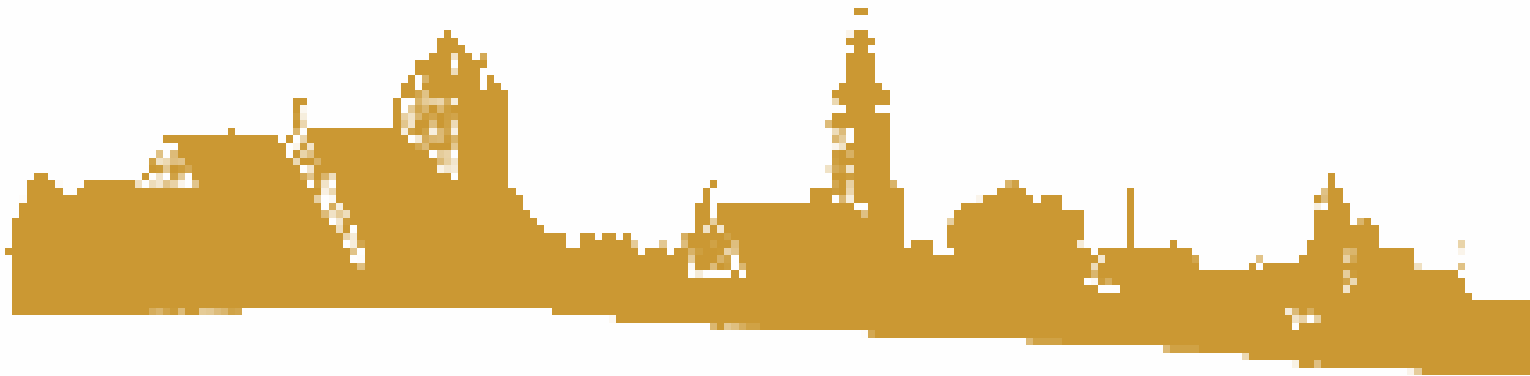


# Experiences with water safety plan in an university hospital over one year

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# Water safety plan/patterns

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- ***Responsibility***  
hospital hygienist and technician (task force water safety)
- ***Purposes***  
prevention of infections  
early risk detection  
immediate decontamination
- ***Predetermination of preventional procedures***
- ***controls before initial startup of new or reconstructed buildings***
- ***hygienic-mikrobiological surveillance of CP and CCP according to sampling plan***  
sample drawing and further analysing according to SOP



# Water safety plan/ Prevention before Initial startup

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- Humidification of the press fit connectors with sterile water or tap water of proven drinking water quality
- Integrity tests by applying compressed air and searching for leaky spots
- First filling with air-water-mixture (special pump with magnetic valve) → „turbulence induced pipe cleaning“, afterwards high chlorination ( $\text{ClO}_2$ ) ( $\sim 20$  ppm) for  $\geq 1$  h, at least 1 week 0.2 ppm  $\text{ClO}_2$



## Water safety plan/ prevention of contamination

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- DIN-filter at point of entrance
- Possibility of flow triggered electrically controlled drinking water disinfection
- Legionella-killing-device (heating up)
- Predetermination of using terminal sterile filters at taps and disinfecting traps
- Identification of rarely used taps, elimination afterwards
- Identification of dead ends



# Water safety plan/ Disinfection in case of exceeding limits

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## high $\text{ClO}_2$ chlorination in cold water circuit

during massive contamination:  $\geq 6$  ppm

Post disinfection period ( $\sim 2$  weeks)  $\leq 0,2$  mg/l

- exp. efficient towards old biofilms and prevention of new formation (Silicon tubes 4 mm  $\varnothing$ , Exner et al.)
- active at pH 4-10
- no generation of trihalomethane, chloramine and chlorphenol
- Neutral in tasting and smelling



# Water safety plan/ Disinfection in case of exceeding limits

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**thermal disinfection in hot water circuit  
at 73 °C for 10 min**

experimentally sufficient: 72 °C  $\geq$  5 min

66 °C  $\geq$  10 min

or 64 °C  $\geq$  15 min

- Safe decontamination
- no toxic reaction products
- no elimination of biofilm
- high power consumption



## Water safety plan / references of surveillance

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- Robert Koch Institut 1994
  - 2 times/year microbiological control of drinking water in hospitals including Legionella in water  $>21$  °C
- further controls depending on results



# Realisation of the HACCP-concept in the Water Safety Plan

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## Critical control points (CCP)

- Incoming temperature in warm water circuit (WWC)  $\geq 60$  °C
- monthly thermal disinfection of the WWC-system
- In case of required chemical water disinfection measurement of concentration (place of addition and most distant outlet) + keeping threshold values after chemical disinfection at outlet
- In case of required thermal water disinfection monitoring of temperature and acting time
- Changing frequency of sterile filters, SOP for processing sterile filters
- Rarely used not eliminatable taps (stagnating water)



# Realisation of the HACCP-concept in the Water Safety Plan

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## Control points (CP)

- exceeding mikrobiological limits (point of entrance, hospital network)
- aeriators



# Limits in drinking water as basis for intervention

Parameter	Limit
<b>Colony count</b> 22 °C, 36°C	~100 cfu/ml
<b>Coliform bacteria</b>	0 cfu/100 ml
<b>E. coli</b>	0 cfu/100 ml
<b>Legionella spp.</b>	0 cfu/100 ml showers, risk areas
	< 100 cfu/100 ml other water taps
<b>P. aeruginosa</b>	0 cfu/100 ml



# appraisal/record

Action	Drinking water regulation (TVO) maintained 0 not maintained 0
0	Processing of aeriators + flushing + re-inspection
0	ClO <sub>2</sub> -decontamination
0	heating + re-inspection
0	sterile filter



# Example of decontamination: aerator + flushing

Result	269 cfu/ml 22°C 430 cfu/ml 36°C	■ processing aerator+ flushing of the tap
1st re-inspection	56 cfu/ml 22°C 65 cfu/ml 22°C	

# Application of terminal water filters in the hospital of the university of Greifswald

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- ICU
- Transplantation units
- Combustion units
- Hematology/Oncology
- Geriatric departments
- Neonatology
- Birth pools
- Kitchen for milk
- Kitchen (water for cold food)
- Preparation of incubators
- Preparation of endoscopes

**63 filters at ~900 beds**

# Instructions for save use of filters

- Keep safety distance to the sink  
 $\geq 35$  cm
- Keep safety distance during hand washing
- Don't touch the filter's outlet
- Don't clean the filter (**instruction board**)
- Don't remove the filter
- Don't damage the filter



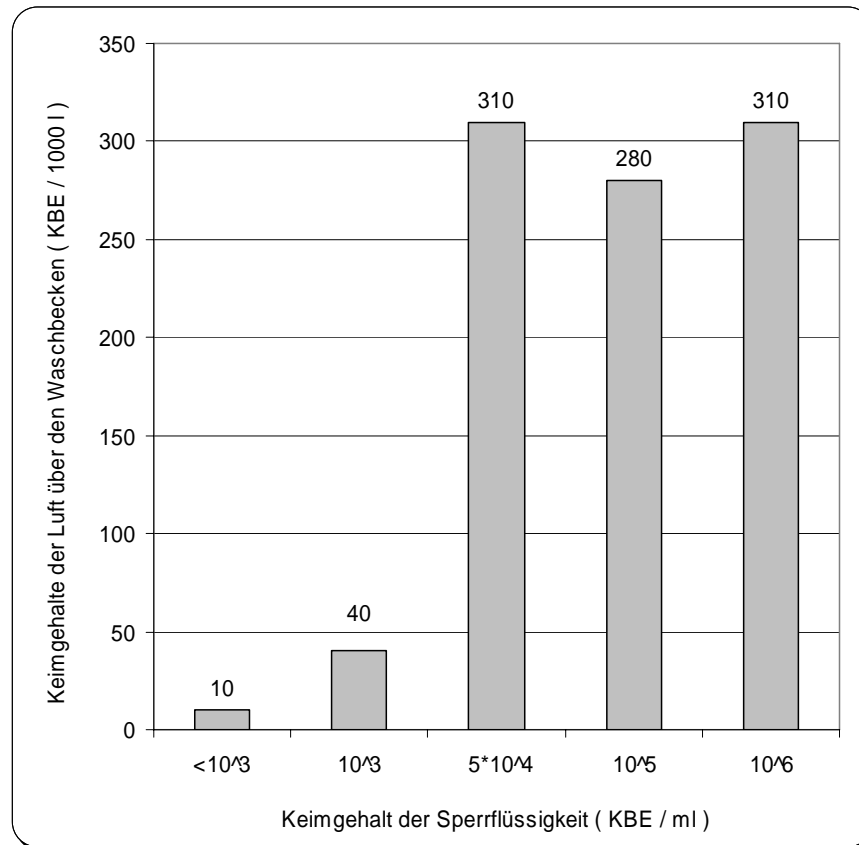


# Bacterial emissions from siphons

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- in 35 – 94 % of the wash basins
- in calmness emission without Filter 4,5  
- cfu/1000l air
- during 1 min running in of water  
183 cfu/1000 l  
(max. 439 cfu/1000 l  
air)

# Emission in connection with bacterial concentration



# Bacterial concentration in Siphons in thermal disinfection

**Intermittent tempering 4 h/day at 85 °C + low frequent vibration + antimicrobial coating of the inner surface**

- July – November: 24 times = 0 cfu/ml  
10 times = 100 cfu/ml  
2 times = 500 cfu/ml
- January – May without Biorec:  
1 time =  $10^4$  cfu/ml  
1 time =  $5 \times 10^4$  cfu/ml  
5 times =  $10^5$  cfu/ml  
1 time =  $10^6$  cfu/ml
- July – January: 12 times = 0 cfu/ml  
2 times = 100 cfu/ml  
2 times = 500 cfu/ml



**Contamination in the disinfecting siphon definitive below emission threshold of  $10^4$  cfu/ml**



# Equipment at the hospital of the University of Greifswald

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- Neonatology
- Transplantation units
- Intensive care units
- Locker built-in wash basins



# Procedure in case of massive contamination (average)

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- calling of the **task force water safety**

hospital hygiene + Dept. of engineering + nursing service management + medical director



**the engagement of the technicians determines success!**

- Initiation of immediate and controlling task force



# Immediate measures

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▶ **until decontamination**

## 1. Hand washing

- avoid hand washing, prefer hand disinfection
- if hand washing is necessary disinfect subsequently

## 2. washing patients

- for washing risk patients use water which has been heated  $> 75\text{ }^{\circ}\text{C}$
- avoid showering
- bottled water for brushing teeth

## 3. patients and staff must not drink tap water

## 4. cleaning: Don't use tap water on surfaces close to patients

## 5. operating theatre:

- Equip completely with sterile end standing filters



# Immediate measures

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- No withdrawal of water during disinfection of the drinking water network, using water-closets is allowed
  - Providing of 2x3 l sterile water/ward in bags by the pharmacy (for patients with incontinence, washing hands and the like, if necessary cooked water as reserve (not as drinking water))
  - Provide mineral water
  - No use of net-loaded soda machines and ice-machines



# Decontamination

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- Day before deinstallation of all aeriators + disinfection
  - Warm water circuit → heating  $> 73\text{ °C}$  at least 10 min
  - Cold water circuit → high chlorination with  $\text{ClO}_2$  ( $\leq 20$  ppm)
- **No water use during disinfection**
- Repeated controls of the concentration in the whole network  
second control of the concentration **after 1 h** at the most distant outlet → **saturation of chlorine  $\leq 50\%$ ! Otherwise repetition**
  - Flushing → at the most distant outlet  $\leq 0,1$  ppm, close outlets in contrary manner + use of all RDG's, dish washer, emergency showers, DM-devices, VE-water
  - Equip soda machines with disconnectable tubes , flush after disinfection