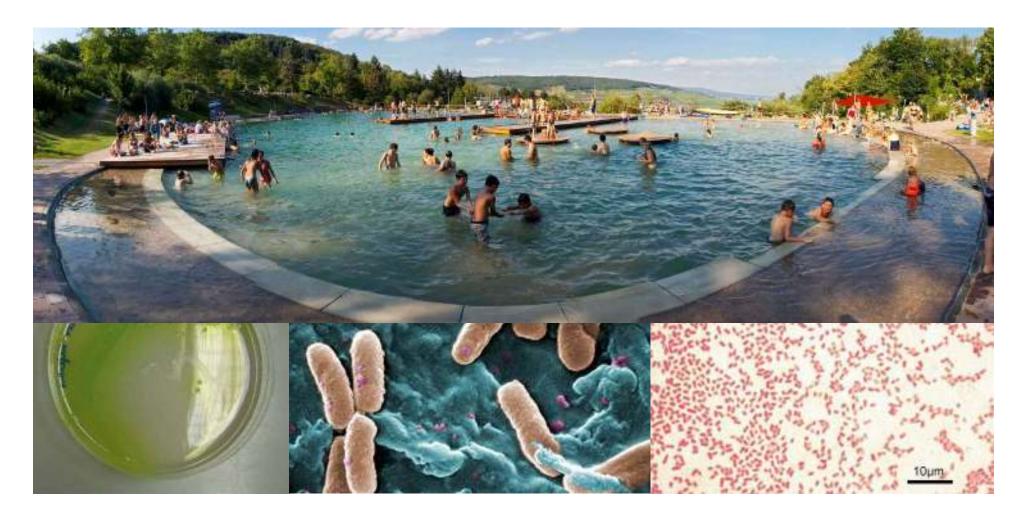
### **PSEUDOMONAS AERUGINOSA IN NATURAL POOLS**

Causes, measures, relevance, test procedures and limits



08/09/2019 **IOB – 10th International Congres Warsaw** Hannes Kurzreuther



# POLYPLAN GmbH 29 years of water

>> LAKES AND URBAN WATERS – Design and Monitoring

>> NATURAL POOLS – Design and Monitoring

>> RESEARCH AND DEVELOPMENT

>> SHRIMPFARMING WITH BIOL. WATERTREATMENT

>> TECNICAL BUILDING EQUIPMENT













### **ARCHIV DES BADEWESENS**



### 04/07

#### Pseudomonas aeruginosa in Naturfreibädern

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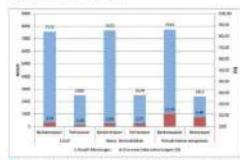
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# TOPICS

- **1.** CHARACTERISTICS
- 2. HYGIENIC RELEVANCE
- **3.** LIMITS
- **4.** MEASURING METHODS
- **5.** ENTRY SOURCES AND MEASURES
- 6. DANA EVALUATION: PSEUDOMONAS AERUGINOSA
- 7. CONCLUSION

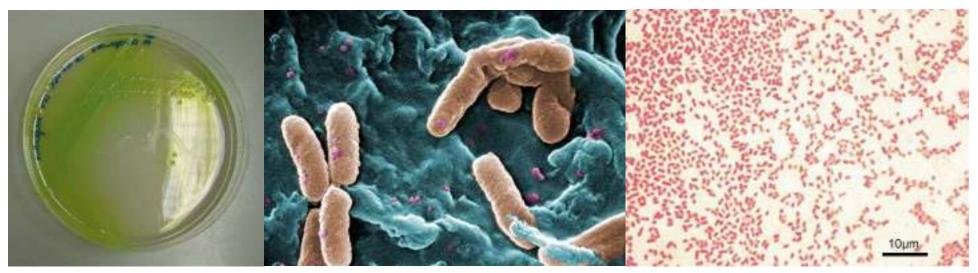




# **1. CHARACTERISTICS**

#### >> Rod bacteria

- >> occurs ubiquitously in surface water, in ground water, in soil and on plants
- >> Optimal growth temperature: 15–30 °C
- >> It is considered a so-called "puddle bacteria" because it is often found in small remnants of **stagnant water**
- >> Has the ability to form **biofilms** and can multiply in **very clean water**



Pseudomonas aeruginosa (https://de.wikipedia.org/wiki/Pseudomonas\_aeruginosa)



# **2. HYGIENIC RELEVANCE**

>> indicator for water-associated pathogens in hospital hygiene and bathing water

>> German Federal Environmental Agency "It is known that this **pathogen can occur in small nutrient-rich bathing lakes** and is not indicated by fecal indicators (E. coli and enterococci). With the installation of technical systems for water teratment in natural pools **potential growth opportunities for P. aeruginosa (biofilm formation**) are created "

- >> Usually no risk to the healthy population. Critical for people with
  - > cystic fibrosis
  - > open wounds
  - > severely immunosuppressed persons treated with immunosuppressants
- >> The following diseases can be induced by P.a.:
  - > Auditory canal inflammation (otitis externa)
  - > Hair follicles (folliculitis) /
  - > Corneal inflammation (keratitis) (especially with contact lens wearers)
  - > chronic wound infections

>> In particular otitis externa and folliculitis / bath dermatitis are well documented as bathwater associated pseudomonas infections

>> Drinking contaminated water or contact with intact skin does not result in transmission



### **3. LIMITS**

>> **Germany:** ≤ 10 CFU/100 ml

>> Lower saxony (Germany) ≤ 100 CFU/100 ml

>> **Denmark** ≤ 50 CFU/100 ml

>> Worldwide < 100 CFU/100 ml (WHO recommendation)

Pseudomanus armejuosa Rearing manipulating of Amahawawa amagiwas is recommended for public and semipublic hor robs and natural apra. It is naggested for public and semi-public essimating people when there is avidence of operational problems (such as failure of disinfectionor problems relating to filters or water pipes), a deterioration in the quality of the poolwater or known health problems. It is recommended that for continuously distributed, proh, operational layers should be <1/100 ml; where named spin operate with norevalual disordirezont, operational levels should be a 10/100 ml; If high counts are found (\$100/100 mll, pool operatore direct surbidity, disofection asidoals and pH, resample, backwash thoroughly, wait our numower and assample. If high levels of P arraginess remain, the pool should be closed and a 26 GILDELINES YOR SAYE RECREATEDRAL BAYER DRVDRDN/OHTS homigh cleaning and disinfection programme initiated. Hot talls should be shut down, drained, cleaned and refilled,

### Guidelines for safe recreational water environments

VOLUME 2 SWIMMING POOLS AND SIMILAR ENVIRONMENTS



POLYPLAN

# 4. MEASURING METHODS DIN Method

#### >> DIN EN ISO 16266

>> Recommendation of the Swimming and Bathing Water Commission (Germany) in the Bundesgesundheitsblatt (2009).

> DIN-method is prmarily for waters with little flora. This can cause measuring problems.

> Until better methods are developed the following methods are recomended:

1. Detection of all P. aeruginosa Colonies with additional measurement. Fluorescent colonies on cetrimide agar are first tested by the acetamide reaction. Ammonia-forming colonies are additionally incubated at 42 °C.

2. Counting of the blue-green (pyocyanin-forming) colonies on cetrimide agar.



NORM | 2008-05

### DIN EN ISO 16266:2008-05

Wasserbeschaffenheit - Nachweis und Zählung von Pseudomonas aeruginosa - Membranfiltrationsverfahren (ISO 16266:2006); Deutsche Fassung EN ISO 16266:2008



### 4. MEASURING METHODS Genetical testing

>> 2014: Quantitative measurements of Pseudomonas aeruginosa with gen probes (Cordes, ASA-Spezialenzyme)

> > Greater accuracy of the gene probe method lower counts of P.a. were detected.

>> 2015: Field trial in Germany, Switzerland, Denmark and Poland.

> > The original assumption that the gene probes detect lower bacterial counts by avoiding incorrect determinations could not be confirmed by the available data. However, it has been found that the gene probe test is less affected by the bacterial accompanying flora compared to the method DIN EN 16266.

> It has also been shown that the results obtained with the use of the modified DIN method can result in falsified results

> Too long or too warm storage of the samples can falsify the results.

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#### Quantitative Bestimmung von Pseudomonas aeruginosa mittels Gensonden

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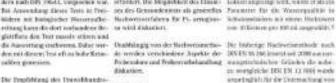
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# 5. ENTRY SOURCES AND MEASURES Fill water

#### Source

>> Waterworks

>> Water supply network

>> In 5,2 % of die buildings studied P. a. was found in the tap water (Kistemann, T. et al. (2010))

> Among other factors, iron pipes in particular were a risk factor.

#### Measures

>> Testing of filling water (almost never done)

>> Take appropriate action if necessary



POLYPLAN

# 5. ENTRY SOURCES AND MEASURES Filter

### Source

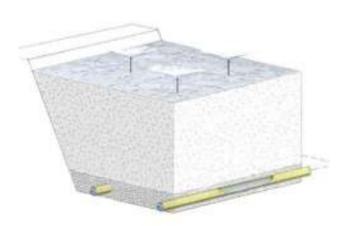
>> Colmated filters.

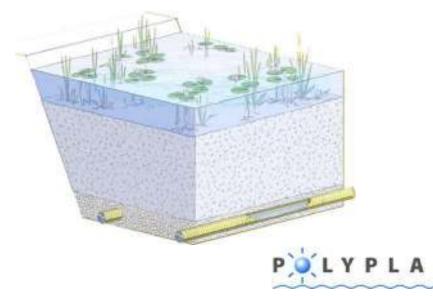
>> Anaerobic conditions in a filter

### Measures

>> Check for puddles on filtersurface and check redox potential (filter infllow and outflow)

>> Adapt flowrate and remove colmations.





# 5. ENTRY SOURCES AND MEASURES Biofilm from pool walls

### Source

- >> Biofilm on the ground and the wall of the pool.
- >> Tear off of biofilm fragments from the wall and the groud (during clenaing or if biofilm growth is high)

### Measures

- >> Regular cleaning of biofilm
- >> Take samples with sufficiant lag to clenaing (fragments of biofilm should be cleaned manualy or by filter)











# 5. ENTRY SOURCES AND MEASURES Wind

### Source

>> Organic and anorganic particles with P.a. can enter the pool by the wind

>> First hints were found during experiments in a natural pool in Herrenberg (Germany) P.a. was found in a control vessel

>> Expermients in a natural pool in Dortmund (Germany) showed no results jet beacaus P.a. did not show up at all during the pahse of the expermient. The experiments will be continued.

### Measures

>> High flowrate in filter.

>> Sufficient P.a. reduction by filter.





# 5. ENTRY SOURCES AND MEASURES Rain

### Source

- >> Rain can come in contact with air particles on which bacteria settle (leaching effect)
- >> No studies avalable at the moment.

### Measures

>> High flowrate in filter.

>> Sufficient P.a. reduction by filter





# 5. ENTRY SOURCES AND MEASURES Bathers

### Source

>> Contaminated tab water  $\rightarrow$  Shower  $\rightarrow$  bather

>> Contaminated soil particles  $\rightarrow$  (puddles)  $\rightarrow$  bather

#### Measures

>> Check water supply net

>> Showering before swimming





# 5. ENTRY SOURCES AND MEASURES Swimming toys

### Source

>> P.a. can be found on plastic swimming toys if not maintained well

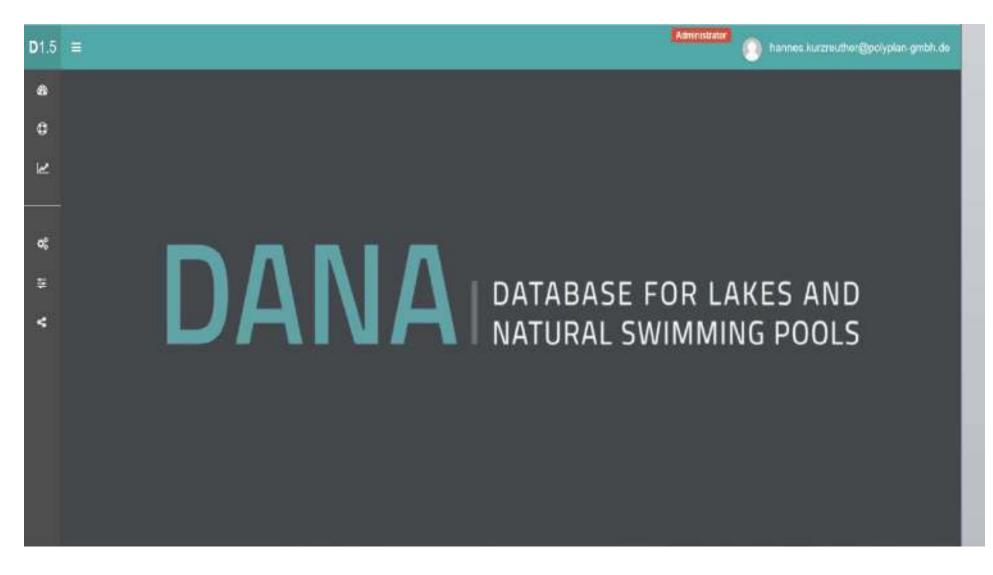
#### Measures

>> Clean and dry properly

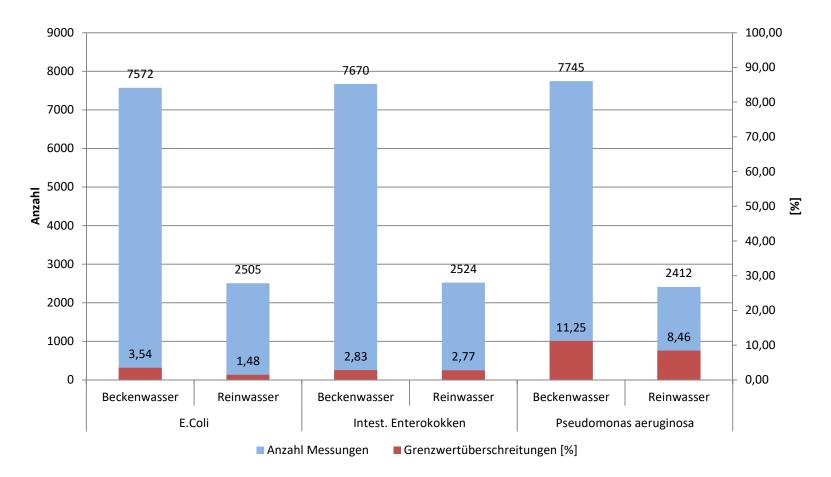
>> Store dry





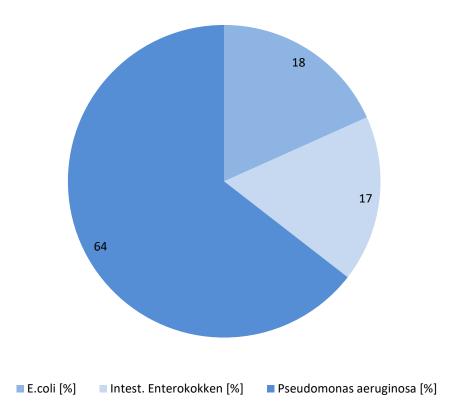






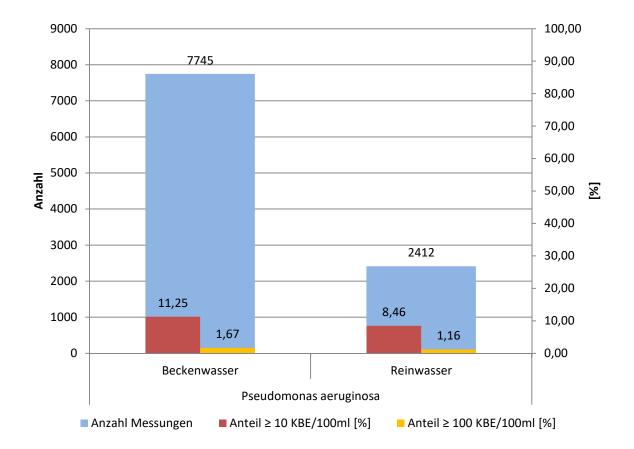
*Pool- and Clearwatervalues und Reinwasserwerte* (Number of measurements and percentage of limit violations): *E.coli, Intest. Enterokokken, Pseudomonas aeruginosa; Number of pools: 43; Years: 2005-2018; Source: Datenbank Naturfreibäder (DANA)* 





Percentage of limit exceedances for pool water and pure water values : E.coli, Intest. Enterokokken, Pseudomonas aeruginosa; Number of pools: 43; Years: 2005-2018; Source: Datenbank Naturfreibäder (DANA)





Becken- und Reinwasserwerte Pseudomonas aeruginosa (Anzahl der Messungen und prozentualer Anteil der Messwerte ≥10KBE/100ml + ≥100KBE/100ml ); Anzahl Bäder: 43; Zeitraum: 2005-2018; Quelle: Datenbank Naturfreibäder (DANA)



# 7. CONCLUSION

>> Looking at

>The difficulties in measuring P.a.

- >The difficulties in finding the causes for P.a. and accordingly to find propper measures
- >The different assessments regarding the limits

... it seems reasonable to question the limit of the German Federal Environmental Agency /FLL of 10 CFU/100ml.

>> An addoption of the maximum limit proposed by the WHO (100 CFU/100ml) would eliminate 85% of the limitoverruns of P.a.. This would mean a lot less trouble for natural pool operators.

>> Assuming that the limit values specified by the WHO are harmless, the majority of the limit value exceedances would be hygienically irrelevant.

>> It would be necessary to examine what determines the different limits and whether an adaption to the international WHO standard is justifiable from a hygienically perspective.

>> Additionally it should be examined whether a different assessment of pool and pure water, as well as first, second and third sampling is to be made.



### **THANK YOU FOR YOUR ATTENTION!**



