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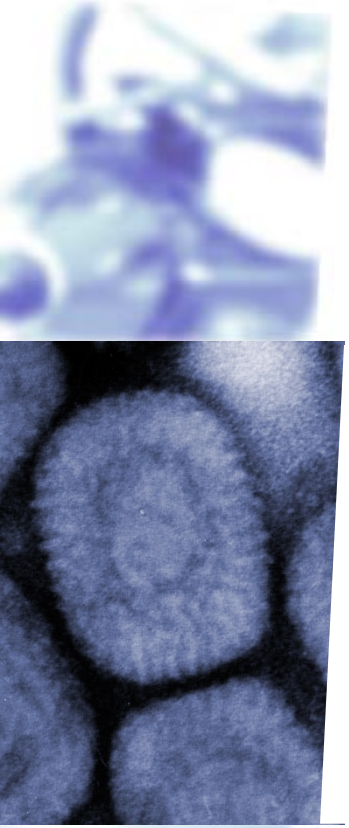

13.12.2012

1st ERNCIP Conference

Water Supply Security

Threat assessment

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History of the Robert Koch-Institut

1891 Royal Prussian Institute for Infectious Diseases

1912 Royal Prussian Institute for Infectious Diseases 'Robert Koch'

1948 Robert Koch Institute for Hygiene and Infectious Diseases

1952 Part of the newly founded Federal Health Office

1994 Robert Koch Institute

The RKI is the central federal institution for disease control and prevention in Germany

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Departments and Units of the RKI

Department of Infectious Diseases

Department of Epidemiology and Health Reporting

Department for Infectious Disease Epidemiology

Centre for Biological Security

- Federal Information Centre for Biological Security
- ZBS 1 Highly-Pathogenic Viruses
- ZBS 2 Highly-Pathogenic Bacteria and Fungi
- ZBS 3 Microbial Toxins
- ZBS 4 Imaging Techniques; Electron microscopy
- ZBS 5 Biosafety-Level 4 Laboratory
- ZBS 6 Proteomics and Spectroscopy of Highly Pathogenic Microorganisms

Project Groups and Junior Research Groups

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Natural bacterial contaminations

Major natural contaminations of drinking water supplies

- 1993 Milwaukee (Wisconsin, USA), 800,000 inhabitants:
  Cryptosporidium: 403,000 cases, 4,400 hospitalizations
- 1996/7 Dushanbe (Tajikistan), 600,000 inhabitants:
  Typhoid fever: 8,901 cases, 95 deaths
- 2000 Walkerton (Canada), 6,000 inhabitants:
  E. coli: 2,300 cases, 18 deaths
- 2003 Torgau-Oschatz, Germany, 95 inhabitants in the street:
  Norovirus: 88 cases (93%)
- 2010/11 Haiti:
  Vibrio cholerae: 519,690 cases, 6,859 deaths

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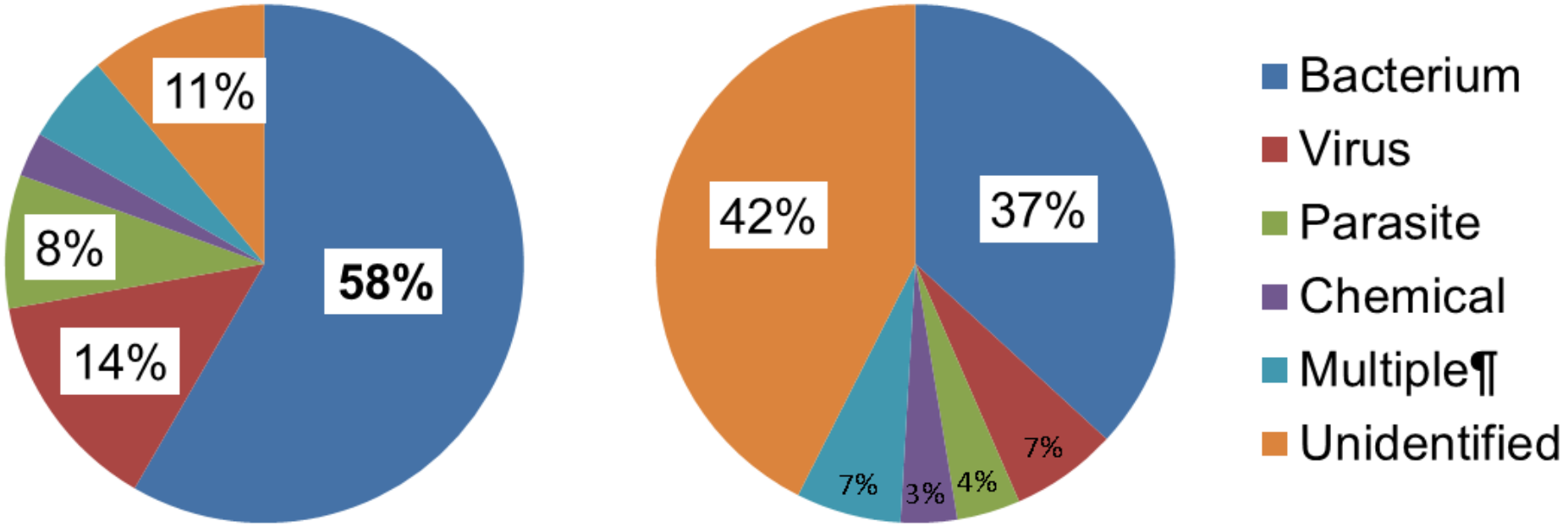
Drinking water contaminations in the USA in 2007/08

outbreaks (n=36): cases (n=4128): agent



Source: CDC

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Persistence in drinking water

Agent	Stability
B. anthracis spores	> 2 years
Brucella	20 - 72 days
Burkholderia mallei	< 30 days
Burkh. pseudomallei	unknown
*C. Tetani spores**	> 10 years
Coxiella burnetii	unknown
Francisella tularensis	< 90 days
*Legionella pneumophila**	> 40 days (24 °C, 100%)
*S. paratyphii**	27-37 days
*S. typhii**	2-93 days
*S. typhimurium**	> 40 days (24 °C, 100%)

Agent	Stability
Shigella	2 - 3 days
V. cholerae	Survives well
Yersinia pestis	16 days
Enterovirus*	50-200 days
Herpesvirus*	15-25 days
Rhabdovirus*	25 days
Variola	unknown
Botulinum toxin	stable
Ricin	stable
Saxitoxin	stable
SEB	Probably
Cryptosporidium parvum	0,01 $\log_{10}$/d (5 °C)

Source: Burrows and Renner, Env. Health Persp., 1999

*** Lacombe, lögd nrw, 1999**

Persistence in drinking water

Bacteria	25 C	5 C
Brucella suis	2 d	14 d
Brucella melitensis	2 d	14 d
Burkholderia mallei	2 d	2 d
Burkholderia pseudomallei	30 d	2 d
Yersinia pestis	21 d	2 d
Francisella tularensis	1 d	1 d (21-30 d by 8 C)

Source: Gilbert et Rose, Lett. Appl. Microb., 2012

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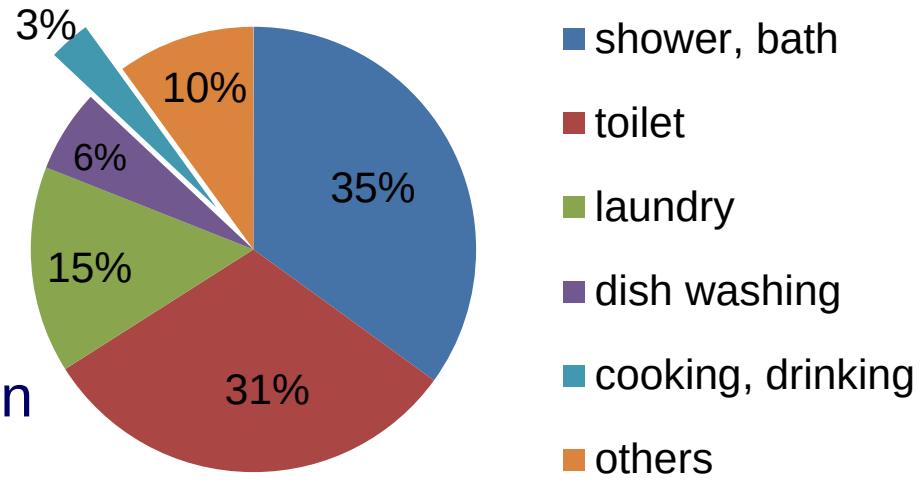
Water systems

Water systems are critical infrastructures for the maintenance of many vital public services

- Human consumption
  - drinking
  - cooking
  - personal hygiene
  - domestic use
  - emergency decontamination
- Industry, industrial hygiene
- Fire fighting
- Power generation
- …



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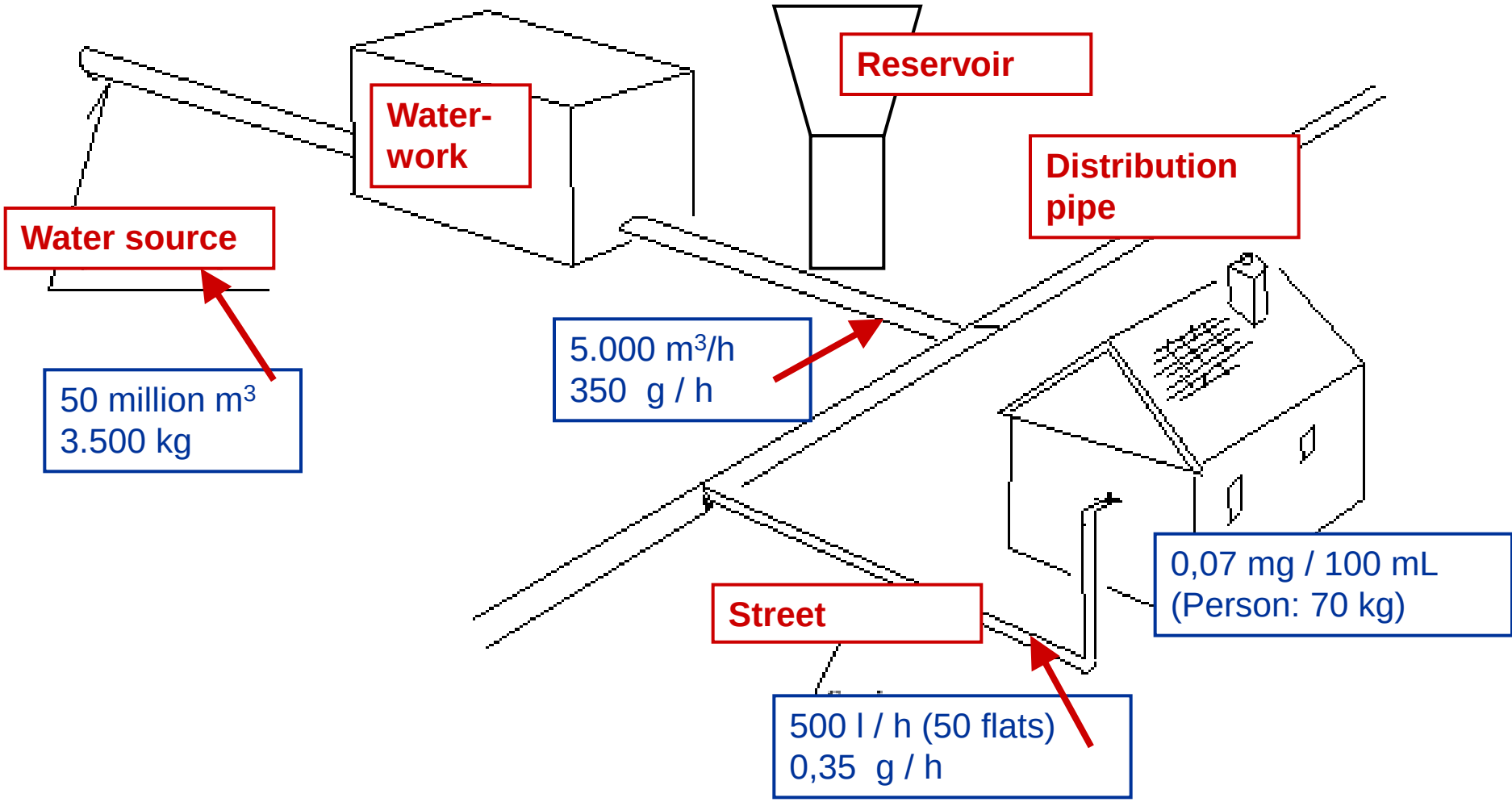
Vulnerability of water supplies



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Berlin

Daily consumption

Population + guests:	57.000.000 L / day
Hospitals and health care facilities:	3.772.500 L / day

Water distribution

Pipes	7830 km
Waterworks	9

-> Sensor placement?

Some tools like

- Threat Ensemble Vulnerability Assessment
- optiMQ-S

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Early warning systems

Requirements :

- reliable
- sensitive and specific
- reproducible and verifiable
- wide spectrum of agents, live and dead
- real time available

Technologies:

- microchip array
- immunologic techniques
- microrobots
- optical technologies
- flow cytometry

Preventive measures

Technical:

- Physical barrier, door locks, irruption detector
- Water quality testing, treatment, pretreatment
- Securing of power supply (generators for computers, electronics, automated systems etc.)
- Strategies for emergency water distribution
- Mobile pumps, mobile disinfection equipment, pipes,…

Preventive measures

Organisational:

- Emergency plans for technical support
- Continuous inspection, security patrols
- Restricted access, security checked personnel
- Establishment of crisis management group
- Improvement of fault clearance service
- Telephone list (intern, extern)
- Information material for the public
- Replenishment of water reservoirs, disinfections

Summary

Potential threat of bioterror attacks on water supply

- Equipment is currently not sufficient to analyze most water threats
- Monitoring programs are managed for peacetime compliance
- First evidence of such an attack will likely be casualities at the clinic

Preparations are mandatory, although an attack is most unlikely

- Very complex and complicated
- Limited to local areas

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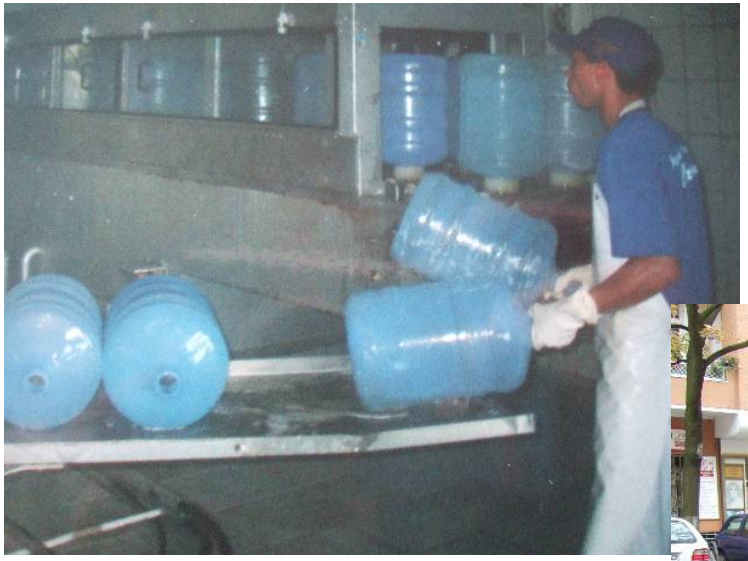

Ozonisation of bottled water, Brazil

Street well in Berlin

Fotos: RKI

Thank you!
Questions?

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