Pharmaceuticals and PCPs GWRC activities

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USEPA Workshop on Pharmaceuticals in the Environment

Las Vegas, August 23-25, 2005

Global Water Research Coalition

Global Water Research Coalition

- Network of international water research organisations
- Water supply, sanitation, wastewater treatment and water reuse
- Motto:

Global cooperation for the generation of water knowledge

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The GWRC Members

- Awwa RF
- WERF
- WRF
- Anjou Recherche (Veolia)
- CIRSEE (Suez)
- TZW
- EAWAG
- Kiwa
- STOWA
- UK WIR
- CRC WQT
- WSAA
- WRC – SA

- Coordination of research programs at a (inter) national level
- Urban water cycle (water supply, sanitation, wastewater treatment)

- GWRC partners:

  US Environmental Protection Agency (July 2003)

  Center for Disease Control and Prevention (April 2005)

GWRC Objectives

- Exchange of information, knowledge and know-how
- Development of research strategies for global issues
- Coordination of joint research efforts

Knowledge Management on a global level

GWRC Research Agenda

- Water Quality
  - Algal toxins
  - Origin and fate of water-borne pathogens
  - ***Emerging Hazards***
- Water Quality in Distribution Systems
- Asset Management
- Membrane Filtration
- Wastewater Treatment (o.a. MBR)
- Water Reuse
- Water Concepts of the Future

Emerging Hazards

- Endocrine Disrupting Compounds (2002)
- ***Pharmaceuticals and Personal Care Products (2003)***

- Regular Update
  - new pesticides, nitrosamines, MTBE, perchlorate, …
  - waste of nanotechnology, genes, ….?

- Strategic approach to assessing health risk from water contaminants
  - Copper and Alzheimer, Lead and Cataract
  - Triclosan, Antibiotic Resistant Bacteria
  - THM and stillbirth and birth, Low pressure events and diarrhea
  - ……..

Pharmaceuticals and PCPs

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GWRC Activities

- Nine participating organisations :

  Anjou Recherche, AwwaRF, CIRSEE, EPA, Kiwa, STOWA, TZW, UKWIR and WERF

- Inventory of member activities
- Exchange of information on national and supra-national (EU) programs

GWRC Activities

- Perform international review study
- Research planning workshop
  - Exchange knowledge and know-how by the members
  - Identify knowledge gaps, research needs
  - Conduct high priority research projects

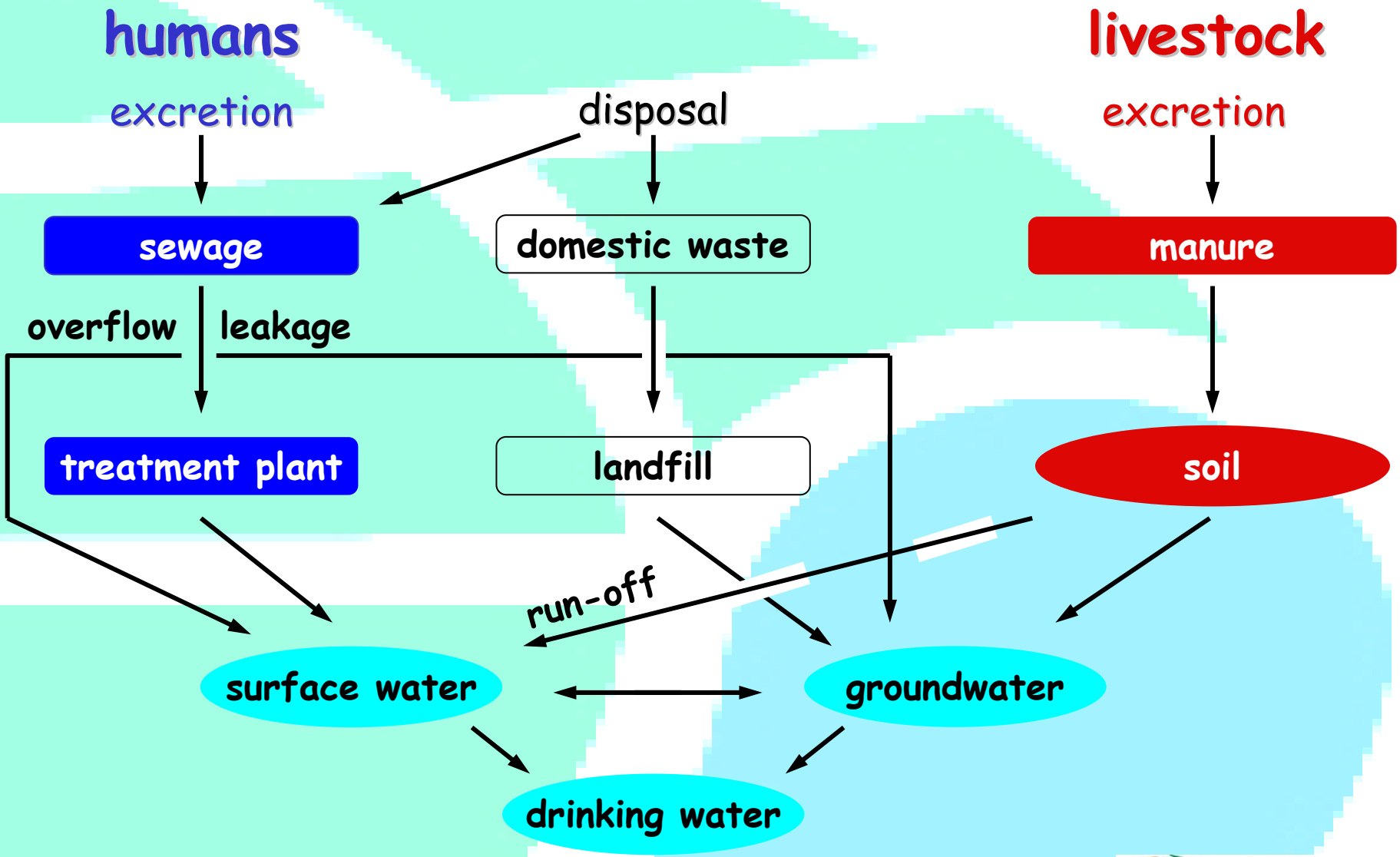
- Reports (GWRC 2004):
  - ***PhACs and PCPs in the Water Cycle: an international review***
  - ***PhACs and PCPs in the Water Cycle: the research strategy workshop***
- Available via AwwaRF (WERF/WRF)

Knowledge and knowledge gaps on PhACs in the water system

Topics:

- Use and Emissions
- Analytical Methods
- Occurrence
- Removal
- Effects

Use and Emission



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Use and Emissions

- No comprehensive information about PhACs use available, but enough to give focus to research activities
- Information on PCPs is limited (musks, triclosan)
- Need for a priority list of Pharmaceuticals
  - Building blocks (model, national lists) are available
  - Will give guidance to monitoring, AC methods and evaluation of water treatment systems activities

Analysis

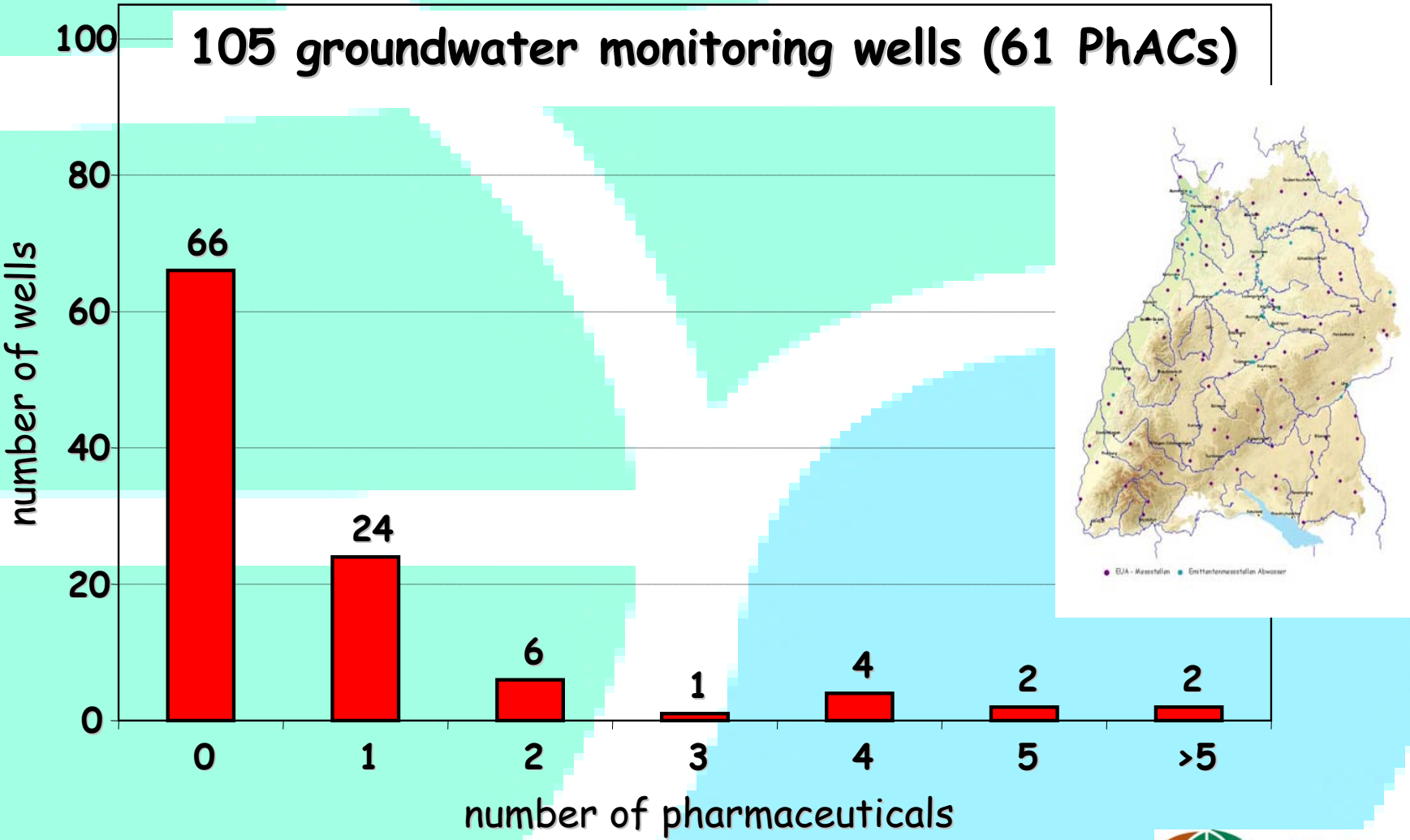
- A good number of analytical methods is available to measure PhACs
  - MDLs ????
  - QA/QC –blanks, replication, etc.
  - No “standard methods” available
  - Analytical standards????

- But need for:
  - exchange of information by experts
  - comparison of methods and round robins
  - harmonization and standardisation

Occurrence

- PhACs are widely present in wastewater influent and effluent and surface water (ng-ug/L level)
- Analgesics (diclofenac, ibuprofen), antibiotics, anti-epileptics (carbamazepine), beta-blockers, lipid regulators, X-ray contrast media, tranquilizers
- In groundwater mainly due to leakage of sewer systems
- Occurrence in drinking water is very limited
- Concentrations at low ng/L level

Pharmaceuticals in groundwater (TZW)



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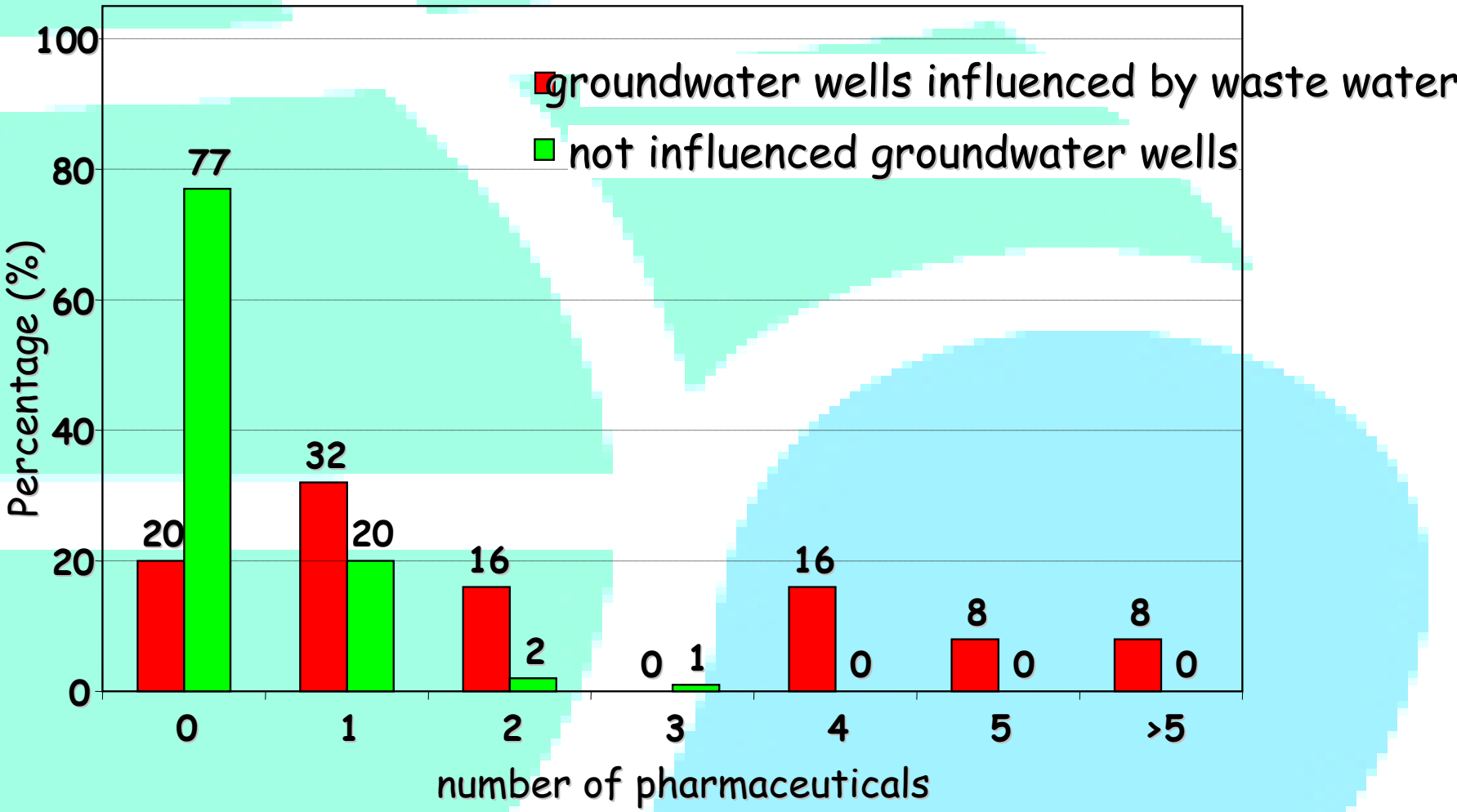
Pharmaceuticals in groundwater (TZW)



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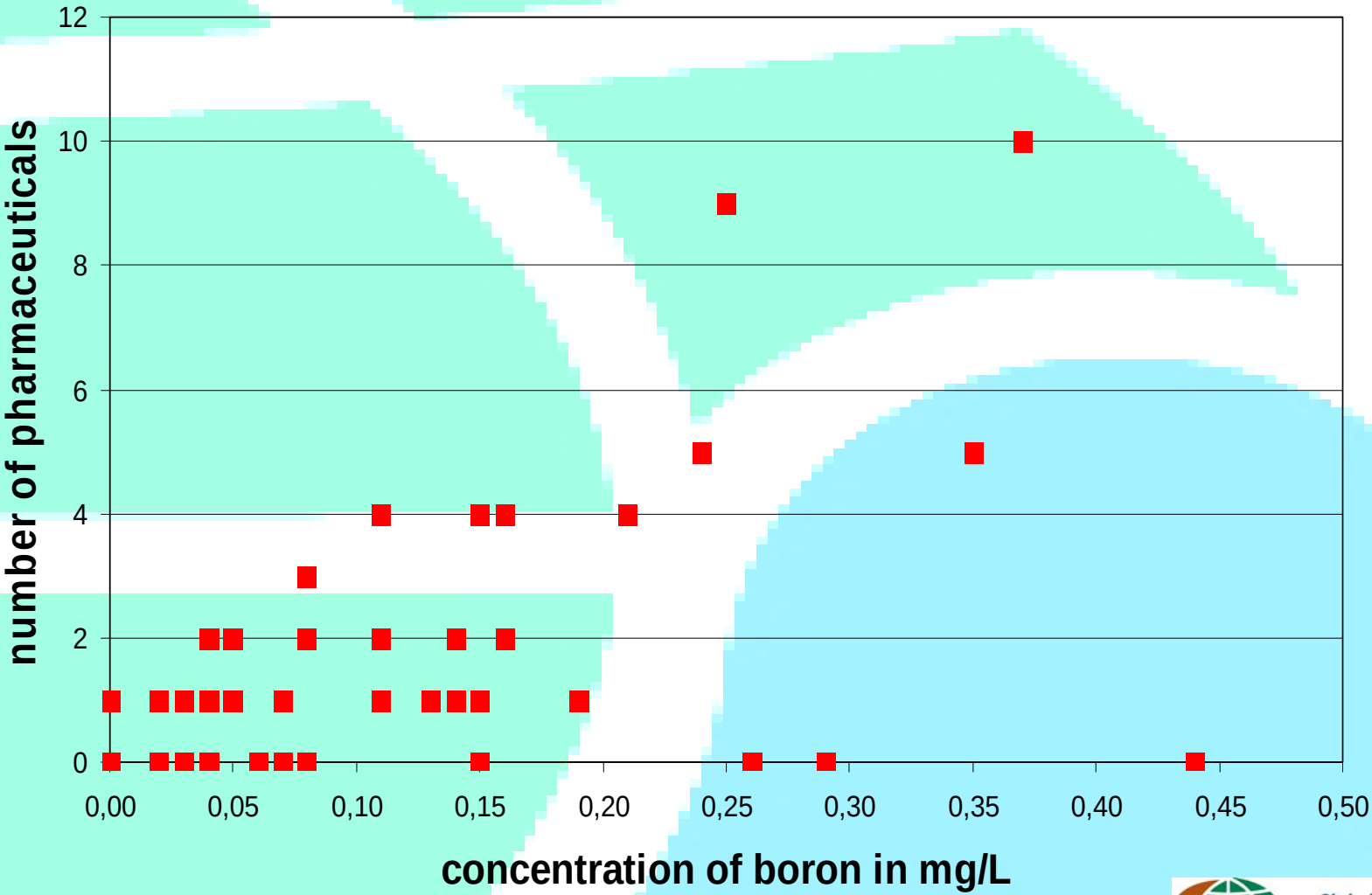
Correlation to boron concentration



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Removal

- Conventional wastewater treatment: - variable
- Advanced WWT is promising (ozone, PAC, MF)

- Advanced drinking water treatment systems are effective to remove PhAC …. if needed
  - Removal depends on compound structure
  - RO>AOP>GAC>Ozone>Chlorine>UV

- Treatment considerations
  - Balance treatment goals
  - How low do we need to go? Health effects
  - Cost of water

Effects

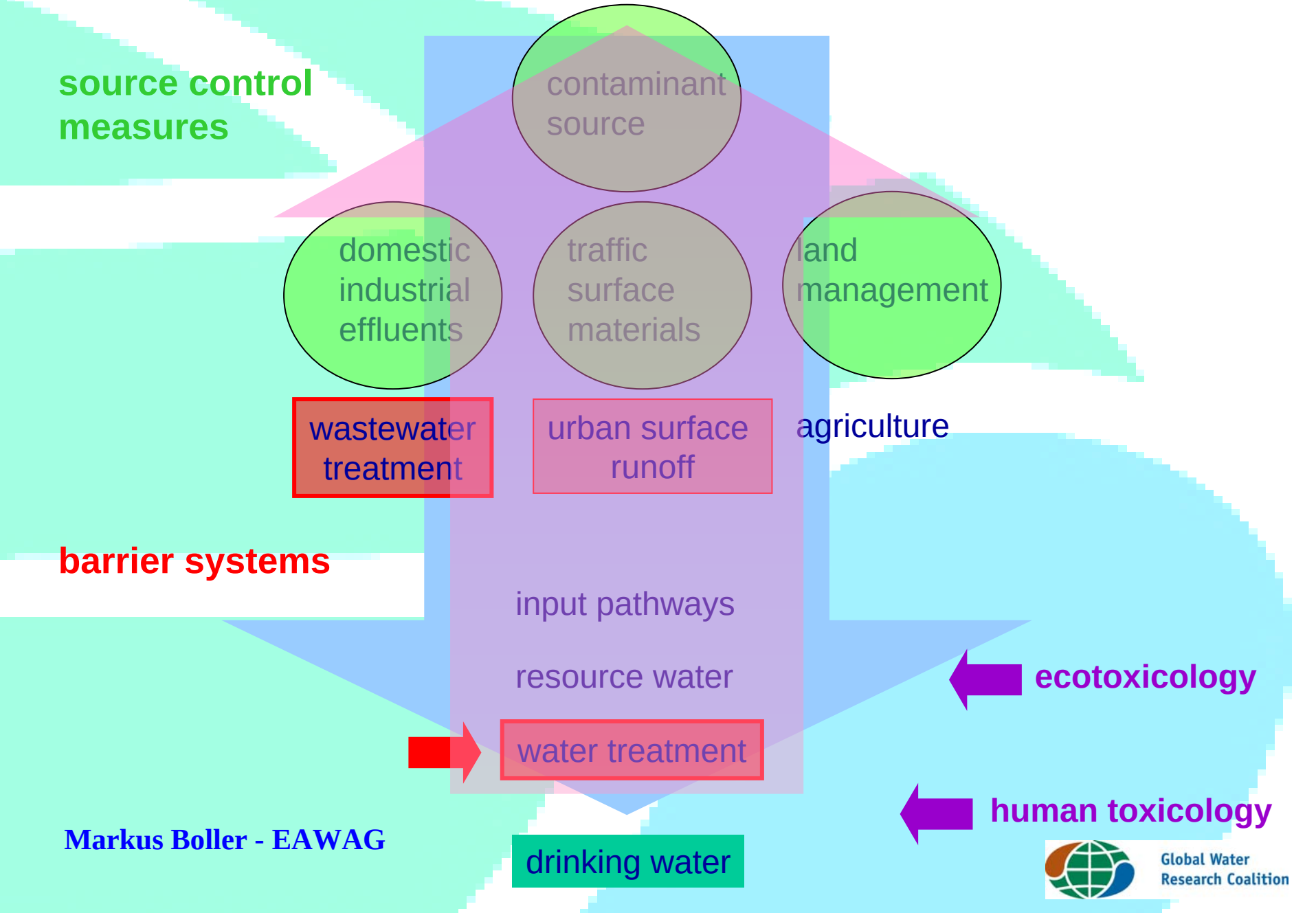
- Public Health
  - Concentrations in drinking drinking water << No Adverse Effect Level (RIVM, 2003)
  - Lifetime intake (70y, 2L) < 5% of one (1) daily therapeutic dose (Mons, 2004)
  - Communication / public perception is the issue!

- Environmental impact
  - Limited data available, but very likely (2L⇔ 24h/day)
  - More information/fundamental research is needed

Ongoing and next activities

- Priority list of Pharmaceuticals (*AwwaRF*)
  - Guidance to monitoring, AC methods and evaluation of water treatment systems activities
  - Building blocks (model, national lists) are available
- Evaluation of Analytical Methods (*CIRSEE/TZW*)
- Efficiency of Wastewater Treatment (*UKWIR*)
- From ***end of pipe*** solutions towards ***prevention***!

From barrier systems to source control



Markus Boller - EAWAG

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Prevention – Source Control

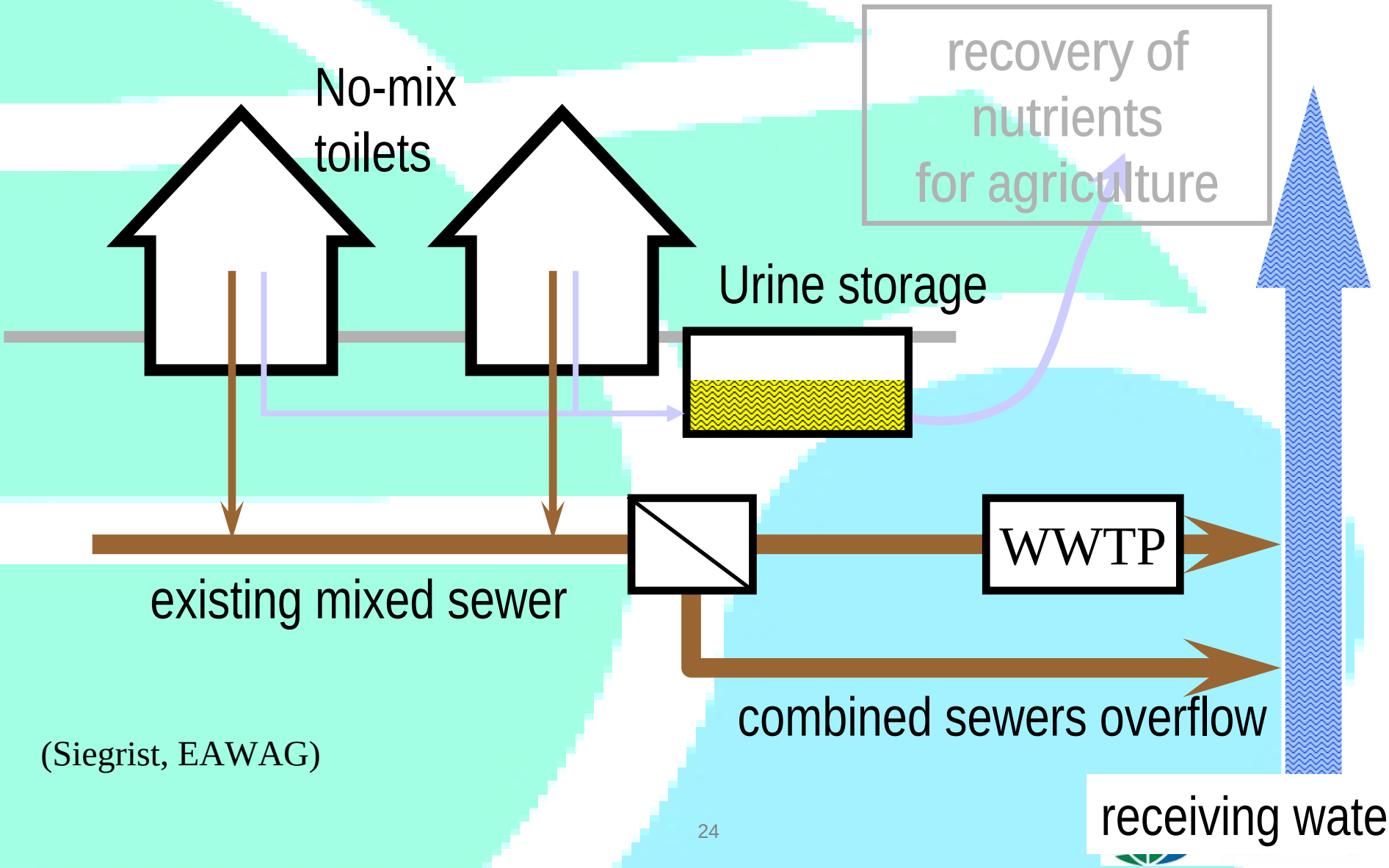
- Prevent dilution of the pollutants (PhAC)
- Treatment at the source
  - Hospitals, elderly homes, ….
  - Livestock (CAFOs), aquaculture, ….
- Separation of wastewater flows
  - Dark => brown and yellow
  - Urine separation (90% of PhAC)

Urine Separation

- Development of concepts and technologies ongoing

- Pilot projects:
  - EAWAG (CH), STOWA (NL), WRC (SA), WKB (Ger)
  - Japan, Sweden, ….

Local Urine Separation



(Siegrist, EAWAG)

No-mix toilet

AwwaRF Resources

- **2642:** *Assessment of waters for Estrogenic Activity* (Report 90940F)
- **2788**: Occurrence and Removal of Contrast Media
- **2902**: Evaluation of Triclosan Reactivity in Chlorinated and Monochloraminated Waters
- **2758**: Evaluation of Conventional and Advanced Treatment Processes to Remove Endocrine Disruptors and Pharmaceutically Active Compounds
- **2617**: Occurrence Study of Pharmaceutically Active Compounds

AwwaRF Resources

- **2897:** Impact of UV and AOPs on Toxicity of EDCs in Water
- **3071**: P/PCPs and EDCs – Occurrence, Fate and Transport in the Great Lakes Water Supplies and the Effect of Advanced Treatment Processes on their Removal.
- **3085**: Toxicological Relevance of EDCs and Pharmaceuticals in Drinking Water
- **3033**: Comprehensive Review of Methods, Occurrence, and Treatment of EDCs and P/PCPs in Drinking Water
- **3136**: Removal and Fate of EDCs and PPCPs in Bank Filtration Systems

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