

# Screening of hazardous substances in the aquatic environment in Lithuania



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# About...

- Project itself
- Screening of HS:
  - scope (substances, sites, samples, budget...)
  - results of the analysis and main principles of evaluation
  - conclusions



# About the project

www.bef.lt

- October 2005 – February 2007
- Goals
  - to investigate occurrence of selected WFD PHS and some other pollutants in wastewater, sewage sludge, surface water and the receiving environment (surface water and sediments)
  - to obtain measurement data on their concentration





# Screening of HS - substances

- **102 substances → 9 groups of substances:**
  - Metals (7)
  - Phenols and their ethoxylates (21)
  - PAH (8)
  - Chloroorganic pesticides (7)
  - VOC (7)
  - Organotin compounds (11)
  - Phtalates (18)
  - Brominated diphenylethers (18)
  - Other: C10-13 chlorinated parafins, pentachlorophenol, chlorpyrifos, cyanides, AOX (5)

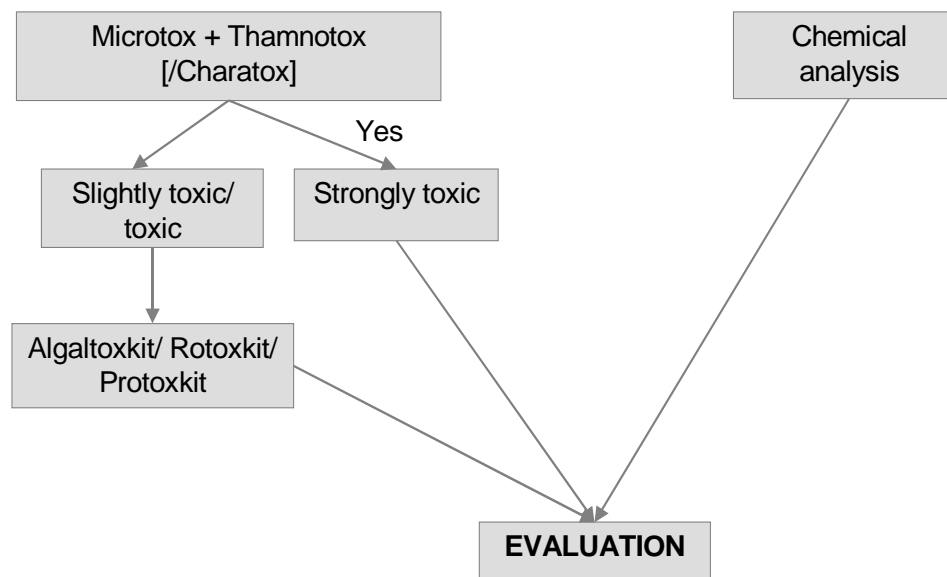
*Note: full list is provided in addition to presentation*



# Screening of HS - ecotoxicity

- Microbiotests:

- *Algaltokit*
- *Thamnotokit*
- *Microtox*
- *Charatox*
- *Rotoxkit*



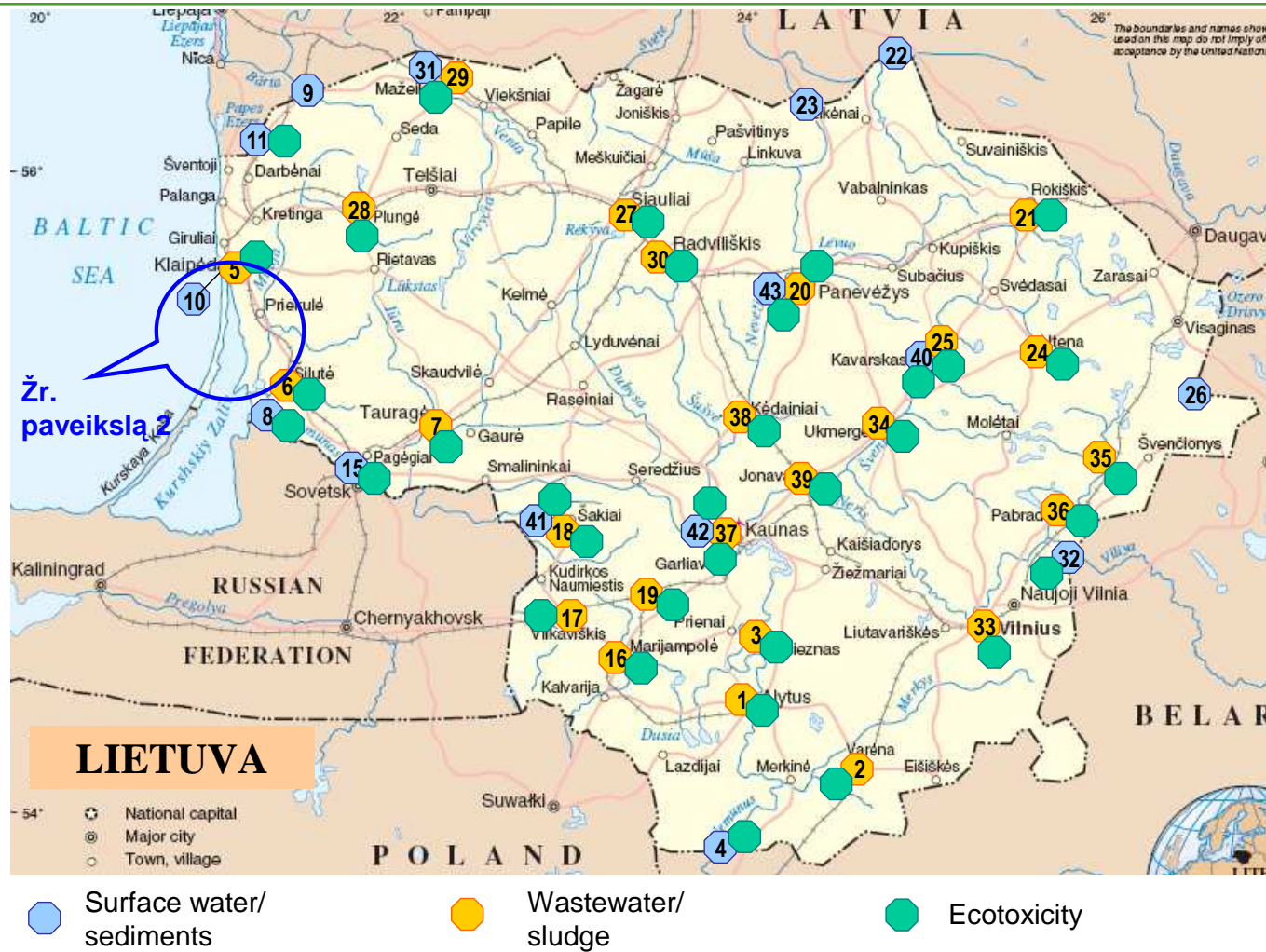


# Screening of HS - sites

- Chemical analysis – **44 sites:**
  - 25 WWTP
  - 19 surface water
- Ecotoxicological analysis – **37 sites:**
  - 25 WWTP
  - 12 surface water

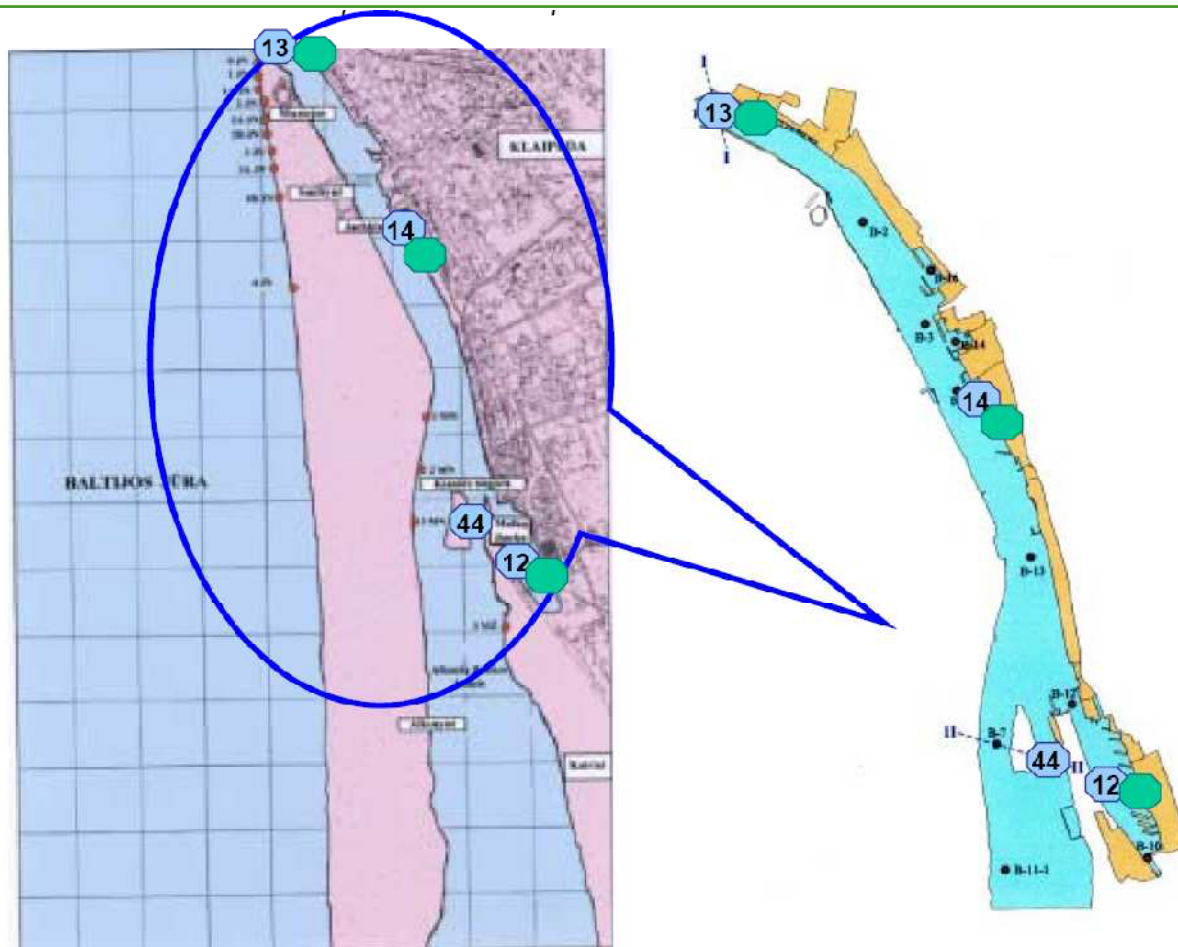


# Screening of HS - sites





# Screening of HS







# Screening of HS - samples

- **870 samples** (excluding duplicates, series of the ecotoxicity tests are considered as one sample)

**Sampling** – Regional environmental protection boards

**Analysis:**

- **EPA laboratory:** metals, PAH, chloroorganic pesticides, VOC, pentachlorophenol in water and wastewater, Microtox<sup>R</sup>, Algatoxkit F, Thamnotoxkit F<sup>TM</sup>
- **GALAB laboratory:** phenols and their ethoxylates, organotin compounds, phthalates, brominated diphenylethers, C10-13 chloralkanes, pentachlorophenol in sludge and sediments, cyanides, chlorpyrifos, AOX, some Hg
- **Institute of Botany:** Thamnotoxkit F<sup>TM</sup>, Charatox, Rotoxkit F<sup>TM</sup>



# Screening of HS - budget

Total for analysis ~96000 Eur

- Chemical ~78000 Eur
- Ecotoxicity ~18000 Eur

Glassware and transportation ~1000 Eur

Sampling costs (fuel, perdiem) ~2500 Eur

Analytical/ sampling accessories ~5000 Eur



# Screening of HS – evaluation principles

## Year 2006

- No clear MAC for the HS discharged to the environment or in the environment
- MAC expressed as AA-MAC,  $MAC \leq 2AA-MAC$
- Not all MAC are available/set
- MAC for IPPC companies as stated in BAT
- Available Lithuanian MAC
- EQS from the proposal for EQS under WFD
- EQS for bottom sediments



# Screening of HS – evaluation principles

Environmental Quality Standards (EQS) Substance Data Sheet

Source screening of priority substances under the WFD

Guidance No 19 - Surface water chemical monitoring

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<http://circa.europa.eu/Public/irc/env/wfd/home>



# Screening of HS – evaluation principles

Discrepancies between Lithuanian standards (AA-MAC and  $MAC=2 \times AA-MAC$ ) for surface water and upcoming AA-EQS, MAC-EQS

- cadmium, mercury, tributyltin, benzo[ghi]perylene, indeno[1,2,3-cd]pyrene, pentachlorophenol and pentabromodiphenylether - Lithuanian limits were at least 5-10 times higher
- anthracene, benzene, di-2-ethylhexyl phthalate, C10-13 chloralkanes and chlorpyrifos – at least 5-10 times lower
- slight difference (Lithuanian limits are higher) for nonylphenols and octylphenols, benzo(b)fluoranthene, benzo(k)fluoranthene, fluoranthene, heksachlorobenzene



# Screening of HS - results

- Most problematic substances

- Phtalates

- Analysed in wastewater, sewage sludge, sediments, surface water
    - Detected: wastewater - 22 WWTP from 25; sewage sludge – all 25, surface water – most sites, sediments – most sites
    - Most common: dibutylphtalate, diisobutylphtalate, diisononylphtalate and di-2-ethylhexylphtalate
    - DEHP in wastewater - 0-53,2 µg/l, surface water – nearly all sites exceeded limits 0,13-3,85 µg/l
    - DBP – detected in most sites for surface water 0,07-1,25 µg/l



# Screening of HS - results

- Most problematic substances
  - **Organotin compounds**
    - Analysed in wastewater, sewage sludge, sediments, surface water
    - Detected:
      - TBT, DBT, MBT in **sewage sludge**, but not wastewater
      - **TBT (>MAC)**, DBT, MBT in surface water
      - **TBT, DBT, MBT in sediments (river) >>>EQS**
      - **!!! TBT, DBT, MBT in sediments at sea shore >>>EQS, MAC**
    - + triphenyltin, octyltins (sediments, sludge, Nevėžis river)



# Screening of HS - results

## Other substances of concern:

### – Phenols and their ethoxylates

- iso-nonylphenol, 4-t-pentylphenol, 4-t-octylphenol, nonylphenolmonoethoxylate, nonylphenoldiethoxylate and octylphenolmonoethoxylate, octylphenoldiethoxylate
- **Iso-nonylphenol:** wastewater in 9 WWTP (till 1,84 µg/l)
- **4-t-octylphenol:** wastewater of 6 WWTP and 7 sites in the surface water but much <MAC
- **Nonylphenolmonoethoxylate:** wastewater of 2 WWTP
- **Octylphenolmonoethoxylate:** wastewater of 1 WWTP
- **Nonylphenols and their ethoxylates** (iso-nonylphenol, 4-t-pentylphenol, 4-t-octylphenol, nonylphenolmonoethoxylate, nonylphenoldiethoxylate and octylphenolmonoethoxylate, octylphenoldiethoxylate) in the sludge of 23 WWTP
- **Iso-nonylphenol** In sediments at 2 sites >>>EQS





# Screening of HS - results

## Other substances of concern:

### – Brominated diphenylethers

- Tetrabrombisphenol A (TBBPA): surface water + wastewater (6-83,7 µg/l).
- Tetrabromdiphenyl ether (PBDE-47): sediments – 6,3 µg/l and wastewater – 18,2 µg/l
- Pentabromoiphenyl ether (PBDE-99): wastewater of 3 WWTP (5,1-29,5 µg/l)
- Decabromdiphenyl ether (PBDE-209) – wastewater of 2 WWTP in VERY high concentrations



# Screening of HS - results

## Other

- SCCP: not detected
- Metals: in line with requirements except Zn+Cu
- PAH: not exceeding limits, except 1 case of anthracene
- Chloroorganic pesticides: heksachlorbenzene in 1 site sediments
- VOC: not exceeding limits except chloroform in 1 case with very high conc. In surface water
- PCP: sludge in 1 WWTP
- Chlorpyrifos: not detected



# Conclusions

- Consider HS in permitting, review existing permits, enhance control
- Guidance needed for permitting/controlling institutions, WWTP, industry
- Include DEHP, OT, NP/OP into monitoring programme
- New methods of analysis
- Utilisation of sewage sludge – new criteria related to PBT substances



# Report of HS screening

- Legal background - existing legislation and a new framework
- Practices of monitoring and screening of hazardous substances in Lithuania 1992-2005
- Selection of the hazardous substances, sampling sites and matrixes
- Quality assurance and methods used in the HS screening
- Results of the analysis
- Potential sources of hazardous substances
- Findings and recommendations