Identification of River Basin Specific Pollutants and Derivation of Environmental Quality Standards under Water Framework Directive: Turkish Experience

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Outline

- Hazardous Substances
- Need for Control in Surface Waters
- Legal Framework
- Concept of Hazardous Substances
  - Priority Substances
  - Specific Pollutants
- Way to Control in Water: Environmental Quality Standards
- Studies in Turkey
- Results and Conclusions

Hazardous Substances

- Chemicals used in the industrial activities
- Personal care products
- Pesticides
- Pharmaceuticals
- Detergents
- Metals

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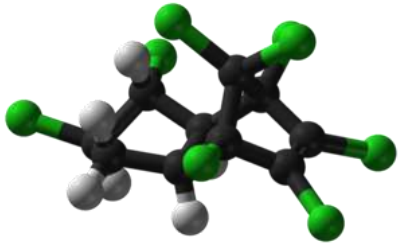
Arsenic
Aluminum
Endosulfan
Aldrin...

PCBs
PFOS
Triclosan...

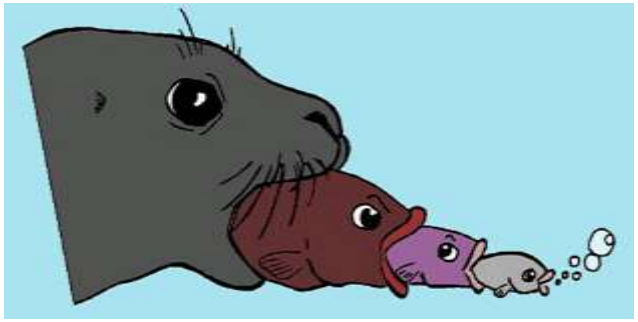


Need for Control in Surface Waters

- **Toxic**
- **Persistent**
- **Bio-accumulative**

PBT!

- Carcinogenic
- Mutagenic
- ..



Legal Framework

EU Legislation

- **Water Framework Directive (WFD, 2000/60/EC)**
- **Environmental Quality Standards Directive (2008/105/EC)**
- **Directive Amending Directives 2000/60/EC and 2008/105/EC as Regards Priority Substances in the field of Water Policy (2013/39/EU)**

Concept of Hazardous Substances

Hazardous substances in water resources:

EU Water Framework Directive

Priority Substances

- **Substances posing significant risk for water environment**
- **Determined by EU Directives and elaborated on EU level**
- **Reaching "good chemical status"**
- **Progressively reducing emissions, discharges and losses**

Specific Pollutants

- **Substances posing risk on water resources due to significant amounts of discharge**
- **Determined by Member States**
- **Either national or river basin level**
- **Reaching "good ecological status"**

Way to Control in Water

EU WFD: Implementation of environmental quality standards for management of priority substances and specific pollutants!

Environmental Quality Standards

Environmental quality standard (EQS);

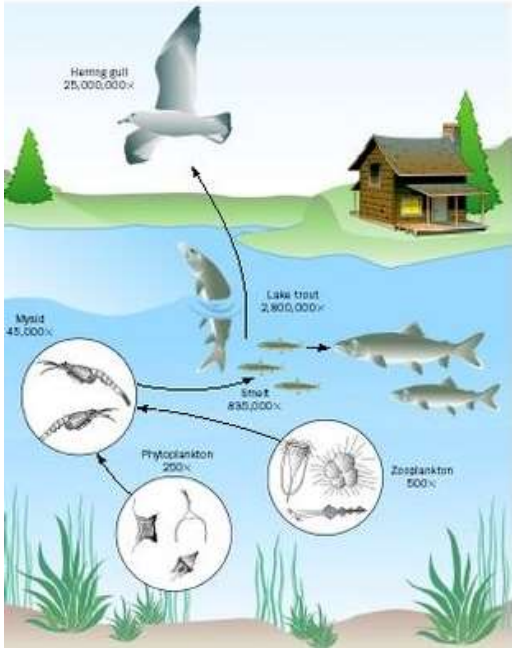
- not discharge standard
- standard not to be exceeded in receiving bodies
- derived for priority substances and specific pollutants

- **For the control of acute effects**: Maximum allowable standards (MAC-EQS)
- **For the control of chronic effects**: Annual average standards (AA-EQS)

Environmental Quality Standards

EQS sediment

To protect benthic species against pollutants



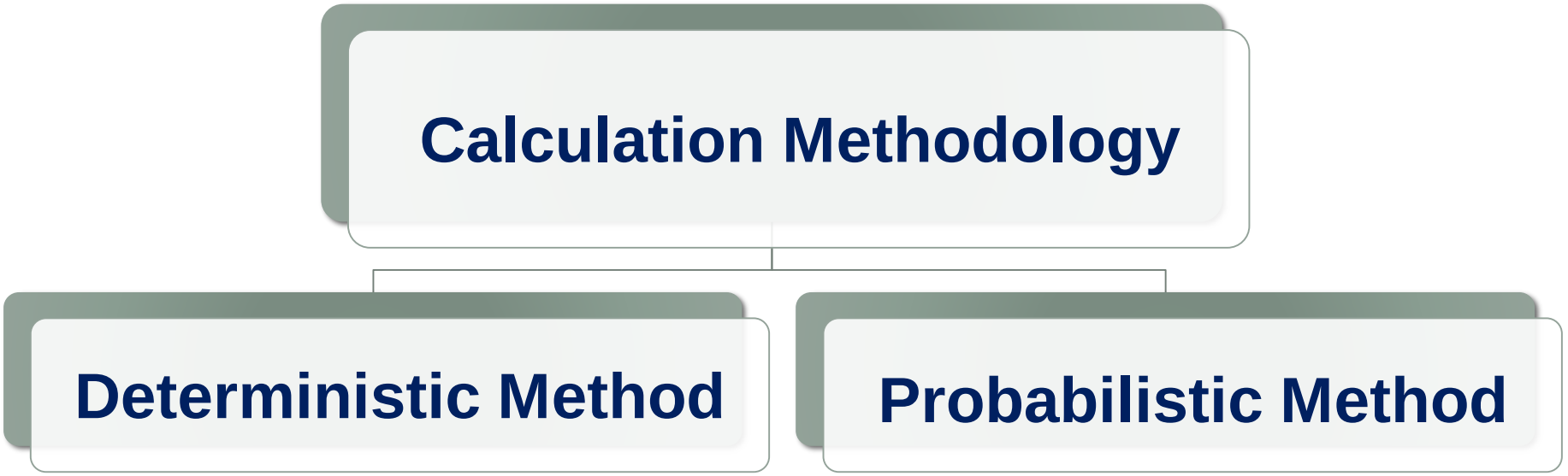
EQS biota

To protect humans from the effects of foods contaminated with chemicals

To protect predators against secondary poisoning risk

Environmental Quality Standards

The methodology to be used depends on the number and variety of toxicological data available in literature.



Studies in Turkey

Legislative actions

(Harmonization of EU environmental acquis)

Projects on identification of specific pollutants in surface waters

Revision of legislations

(Specific pollutants, priority substances and EQSs)

Legislative Actions in Turkey

- **By-Law on Surface Water Quality**

  (No: 28483, Date: 30.11.2012)
- **By-Law on Monitoring of Surface & Ground Waters**

  (No: 28910, Date: 11.02.2014)

Harmonization of parts of EU legislation regarding water quality and classification is achieved to a considerable extent.

Projects in Turkey

TMKK (2011-2013)

Pollution from point sources in inland surface waters

KIYITEMA (2012-2014)

Pollution from point sources in coastal and transitional waters

BIKOP (2012-2014)

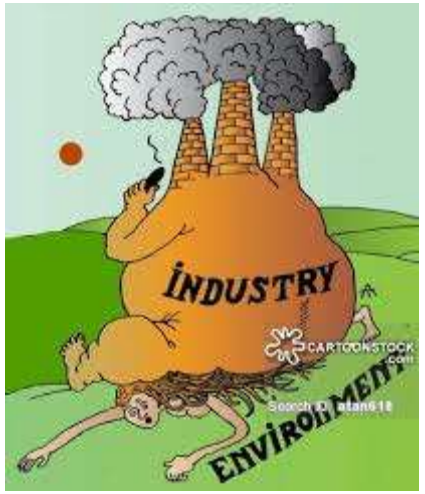
Pollution from diffuse sources in inland surface, coastal and transitional waters

Studies in pilot regions representing country's industrial and agricultural profile…

Projects in Turkey

TMKK-KIYITEMA-BIKOP

- An interdisciplinary and multi-stakeholder approach
- Identification of hazardous substances occurring in surface waters due to urban, industrial and agricultural activities
- Preparation of sectorial inventory of hazardous substances originating from point sources
- Monitoring campaigns in surface waters and effluents of industrial plants
- Determination of national specific pollutants
- Derivation of EQS values for specific pollutants



117 specific pollutants from point sources
133 specific pollutants from diffuse sources

Determination of Specific Pollutants

Introducing a candidate list

(3762 chemicals)

Literature survey, related national & international legislation/conventions, questionnaires, chemicals produced or imported more than 1 tone annually

Data collection & pre-evaluation

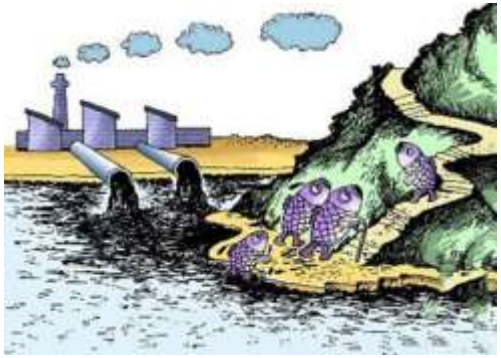
(2957 chemicals removed)

Chemical databases, EPA EPISUIT Program, ECHA website, EPA ECOTOX etc.

Final assessment

(805 chemicals)

Prioritization based on PBT properties; COMMPS, THS etc.



Specific Pollutant List: 250 chemicals !

Determination of Specific Pollutants

COMMPS Method:

(Combined Monitoring-Based and Modeling-Based Priority Setting)

- Physicochemical properties
- Eco-toxicological properties
- Monitoring data (lack of data in Turkey)
- Total amount used and use pattern
- Methodology applied for identification of first 33 priority substances

THS Method:

(Total Hazard Score)

- Physicochemical Properties
- Eco-toxicological Properties

Determination of Specific Pollutants

Final Assessment Considerations:

- Is chemical being used or still in use in Turkey?
- What are the processes of chemical use? (closed system, potential to pass into wastewater, etc.)
- Is chemical being detected in surface waters during monitoring studies?
- Is it possible to analyze the chemical? If so, are the detection and quantification limits (LOD and LOQ) low enough?
- Does chemical have PBT properties?
- Are derived EQSs applicable or not?

Bridging science and policy in water management ☺

River Basin Specific Pollutants

Identification of the NACE (activity) codes of the urban and industrial facilities in each river basin

Listing of pollutants originating from each sector (based on NACE codes)

Establishment of point-sourced pollutant inventory at river basin scale

Identification of agricultural product pattern in each river basin

Listing of plant protection products used in agriculture

Establishment of pesticide inventory at river basin scale

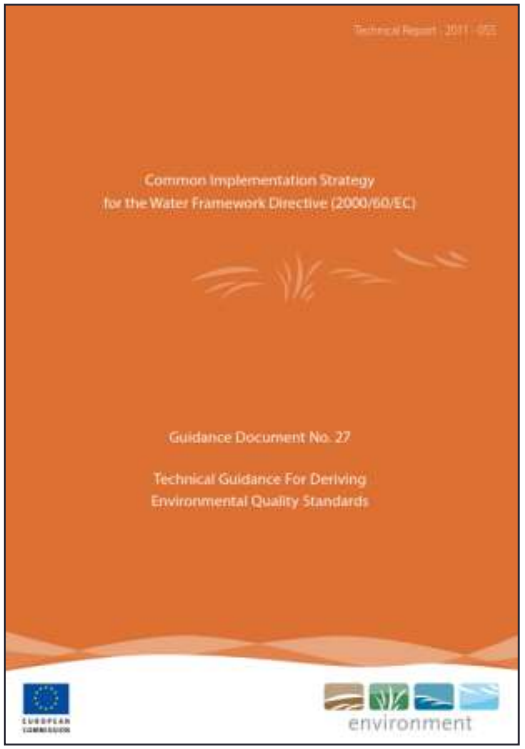
River Basin Specific Pollutants of 25 river basins in Turkey ☺

Derivation of EQSs

Calculation of AA-EQS and MAC-EQS for surface waters

- **Acute toxicological data (LC_{50}, EC_{50})**
- **Chronic toxicological data (NOEC, EC_{10})**
- **Base set = 3 trophic levels (daphnia magna, fish, algae)**
- **Deterministic and probabilistic method based on the number and variety of data**

Source



Derivation of EQSs

Deterministic method

- Collect toxicological data (LC_{50}, EC_{50}, NOEC, EC_{10})
- Designate the lowest value
- Find the assessment factor (AF) → (1-10000)
  - # of data, type of data, receptor organisms
  - Different for freshwater and salt water
  - Guidance Document No. 27 of 2000/60/EC Water Framework Directive
- AA-EQS= lowest NOEC value/AF
- MAC-EQS= lowest LC_{50}/AF or EC_{50}/AF

Derivation of EQSs

Probabilistic method

- # of data for 3 trophic levels ≥ 10
- ETX 2.0 Software
- Log-normal distribution of data
- Calculate hazardous concentration (HC_5)
  - threshold level that represents a safe concentration of the substance which thereby protects most organisms (typically 95%)
- Determine AF ⟶ (1-5)
- EQS = HC_5/AF

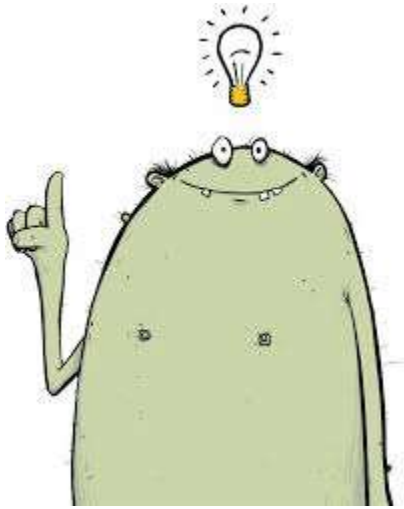
Number of Data	AF
10-15	5
16-20	4
21-25	3
26-30	2
> 30	1

Results and Conclusions

- **250 specific pollutants were determined with their EQS values on national level.**
- **RBSPs were identified in consideration of urban, industrial and agricultural profiles of each basin.**
- **Specific pollutant list includes heavy metals, halogenated organics, EDCs, aromatic hydrocarbons and pesticides.**
- **Extend of monitoring and inventory studies for chemicals should be enhanced so that more reliable and realistic assessments can be obtained in future.**

Results and Conclusions

- **EU priority substances, specific pollutants and their EQSs in water column were incorporated into national legislation in 2016.**
- **According to the legislation, EQSs must be met by the end of 2019.**
- **Currently, efforts are being made to monitor these substances in surface waters and reveal the measures to achieve EQSs in each river basin accordingly.**

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