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Emerging Pollutants: Protecting Water Quality for the Health of People and the Environment

Identifying the Emerging Pollutants in Aquatic Ecosystems: Turkey Example

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unesco
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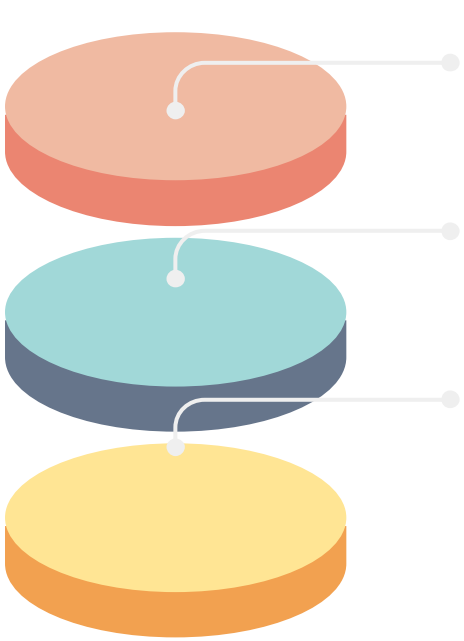
IWRA International Water Resources Association

Outline

- Purpose and scope of the study
- Methodology
- Outcomes
- Conclusions

Purpose and scope of the study



01

Risk assessment

Ecological risk assessment of chemicals occurring in freshwater resources of Türkiye

02

Prioritization

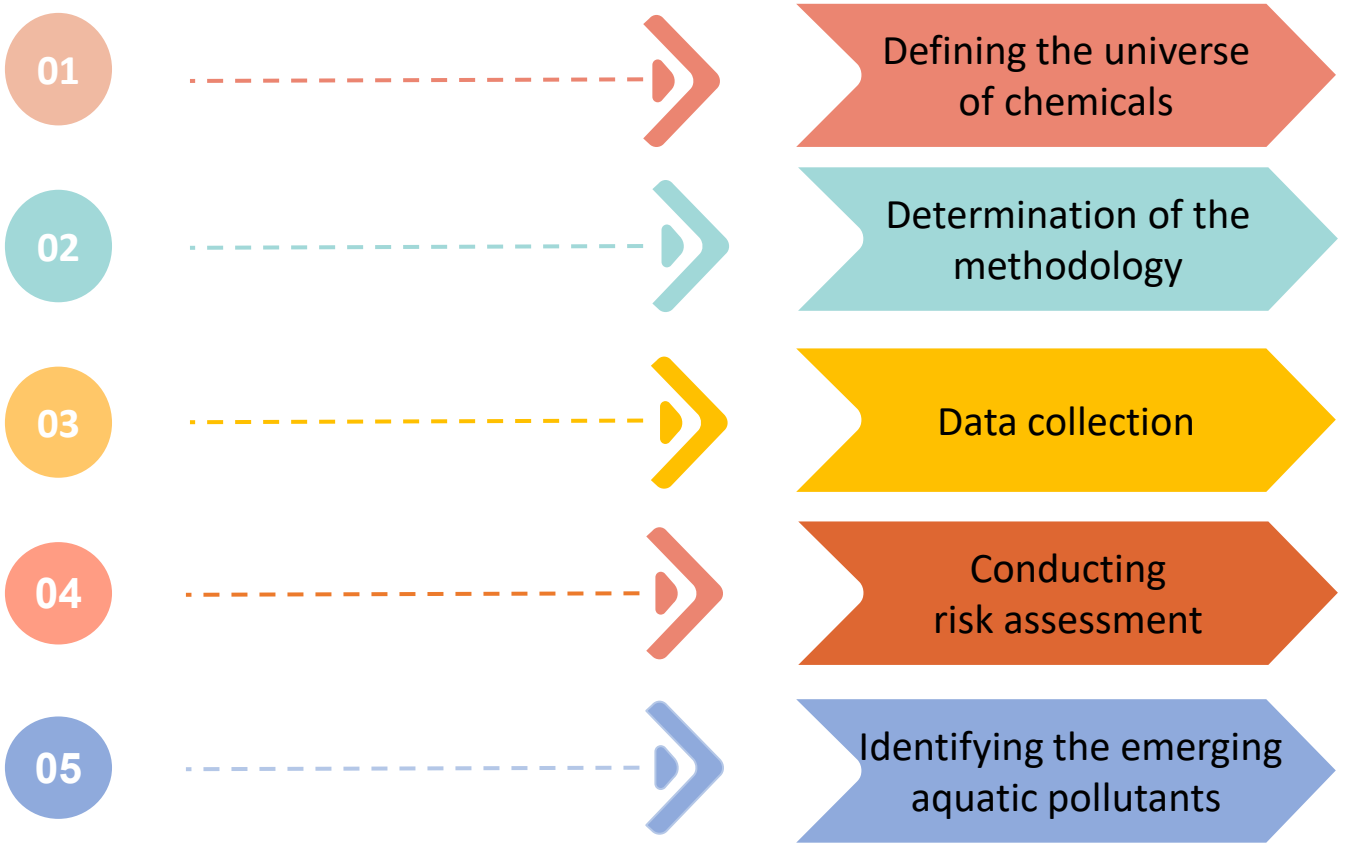
Identifying the emerging aquatic pollutants of Türkiye

03

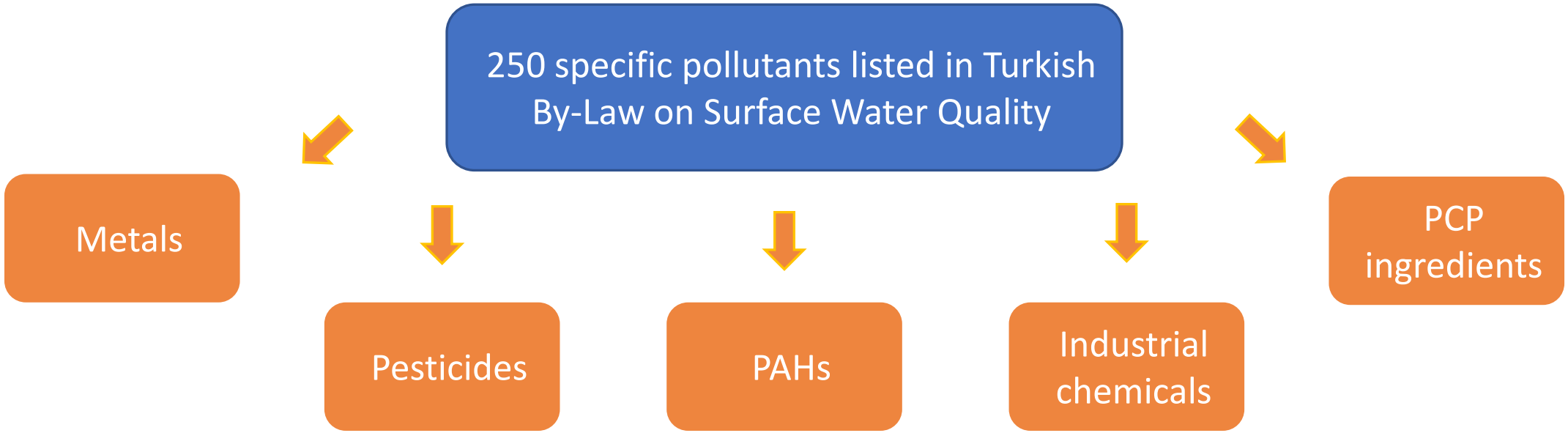
Regulation

Reviewing and updating the specific pollutants listed in the Turkish By-Law on Surface Water Quality

Methodology



Universe of Chemicals

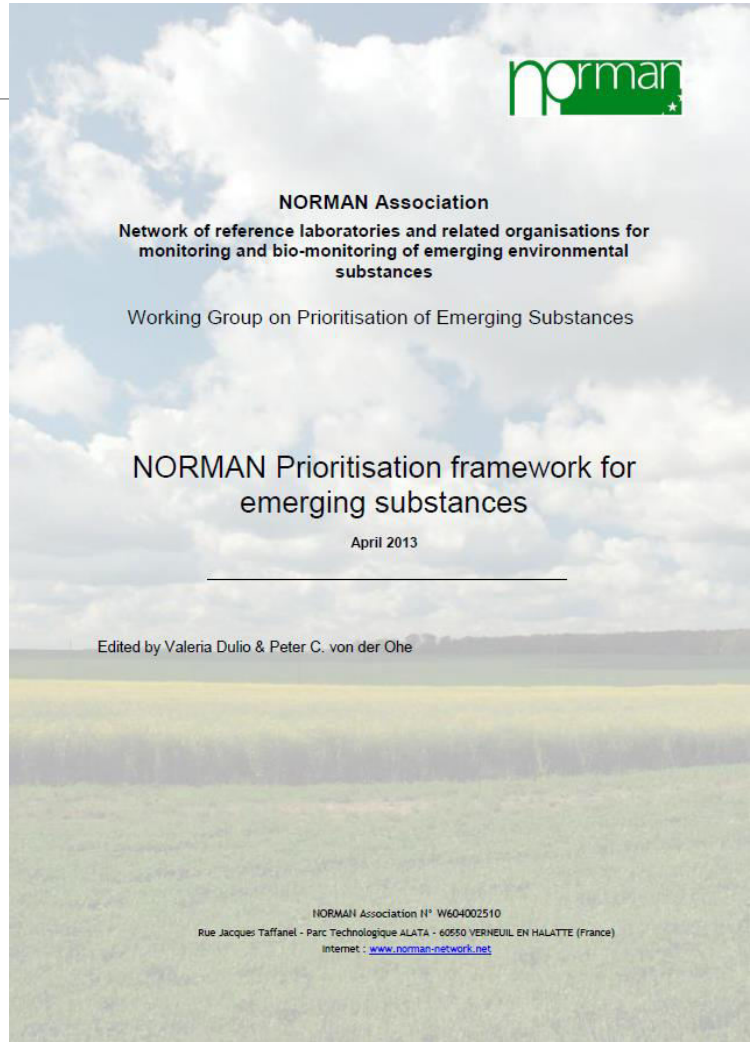


https://www.mevzuat.gov.tr/mevzuat?MevzuatNo=16806&MevzuatTur=7&MevzuatTertip=5

Determination of the methodology

NORMAN Prioritization Framework for Emerging Substances

- Exposure assessment, hazard assessment and risk assessment
- Required data: ambient water monitoring results, annual amount of usage, use pattern, PBT, CMT, ED properties, long range transport potential
- Exposure score, hazard score, risk score and overall assessment score



NORMAN Framework-Exposure assessment

Indicators		Sub-category indicators	Value	Sub-score	Sub-score	Sub-score	Final score
Exposure	Observed Exposure (monitoring data)	A) Frequency of observations with concentration >LOQ	Fraction of analyses >LOQ	= value as a decimal number rounded to two decimals	$EXPO_{observed}$ = (A+B+C+D+E) / 5	$EXPO_{(cat.\ 1,3,6)}$ = ($EXPO_{observed}$ + $EXPO_{predicted}$) / 2 $EXPO_{(cat.\ 2,4,5)}$ = $EXPO_{predicted}$	Final score = EXPO + HAZ + RISK
		B) N° of countries with concentration >LOQ	No. of countries with concentr. >LOQ	Value between 0 and 1 0 countries (or no data) = 0 ≥1 country = 0.10 ≥ 2 countries = 0.20 ≥ 5 countries = 0.50 ≥ 10 countries = 1			
		C) N° of sites with concentration >LoQ	No. of sites with concentration >LOQ	Value between 0 and 1 0 sites (or no data) = 0 ≥1 site = 0.10 ≥ 10 sites = 0.20 ≥ 100 sites = 0.50 ≥ 1000 sites = 1			
		D) Concentration trend	Trend Regression of $MEC_{95/a}$ for > 5 years and > 6 sites	Significant positive trend = 1 Positive trend = 0.5 No trend = 0.25 No data = 0.1 Negative trend = 0			
		E) Observation in groundwater	Yes = 1 No = 0	= value			
	Predicted Exposure (usage)	F) Annual usage	Production in t	< 1 t = 0.1 1 -10 t = 0.2 10-100 t = 0.5 >100 t = 1	$EXPO_{predict}$ = (F+G) / 2		
		G) Use pattern	Used in the environment: 1 Wide dispersive use (diffuse sources and substances in urban wastewater) = 0.75 Non-dispersive use (industrial, controlled point sources) = 0.5 Not known = 0.25 Controlled system (isolated intermediate) = 0.1	= value			

NORMAN Framework-Hazard assessment

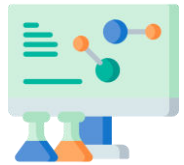
Indicators		Sub-category indicators	Value	Sub-score	Sub-score	Sub-score	Final score
Hazard	Environmental Hazardos	H) PBT /vPvB	Overall PBT/vPvB score = [(P + B + T) individual scores + (PBT/vPvB) score] / 4	See Table 9 and Table 10 in Annex II	HAZ = (H+I+J+K + L) / 5	HAZ	
		I) LRAT (long range air transport)	Half-life ($t_{1/2}$) in air >2 days and Vapour Pressure (VP) < 1000 Pa	$t_{1/2}$ in air >2 days and VP <1000 Pa = 1 $t_{1/2}$in air ≤2 days and /or VP ≥ 1000 Pa = 0			
		J)Non-standard endpoints	Examples: hatch size	Non standard endpoints present = 1 Under examination = 0.5 Not examined = 0.25 Evaluated and classified not toxic = 0			
	Human Health Hazards	K) CMR = Max («Carcinogenicity», «Mutagenicity», «Reprotoxicity »)	The CMR final score is then derived as the highest value between the individual carcinogenicity, mutagenicity and reprotoxicity scores.	CMR, category 1 = 1 CMR, category 2 = 0.75 CMR, categorie 3 = 0.5 Under examination = 0.5 Examined and info not suff. = 0.25 Not examined = 0.25 Examined and not classified = 0			
		L) Endocrine disrupting properties		Proven ED = 1 Suspect ED = 0.5 Not examined = 0.25 Not proven ED = 0			

NORMAN Framework-Risk assessment

Indicators		Sub-category indicators	Value	Sub-score	Sub-score	Sub-score	Final score
Risk	Spatial frequency of exceedance	M) Spatial frequency of exceedance of Lowest PNEC	= number of sites where MEC_{site} >Lowest PNEC divided by total number of sites, where the substance was measured –for category 1, 3, 6 (recent data) –for category 2, 4, 5 (all data = all years)	= value as a fraction rounded to two decimals	RISK = (M + N) /2	RISK	
	Extent of exceedance	N) Extent of exceedance of Lowest PNEC	$=MEC_{95}$ / Lowest PNEC –for category 1, 3, 6 : $MEC_{95(recent\ data)}$ –for category 2, 4, 5 : $MEC_{95(all\ data,\ i.e.\ all\ years)}$	MEC_{95}/Lowest PNEC <1 = 0 MEC_{95}/Lowest PNEC ≥1≤10 = 0.1 MEC_{95}/Lowest PNEC >10≤100 = 0.25 MEC_{95}/Lowest PNEC >100 ≤1000 = 0.5 MEC_{95}/Lowest PNEC >1000 = 1			

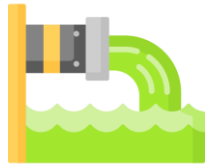
Data Collection

- Ambient surface water monitoring data from 13 projects and regular monitoring studies conducted by DSİ between the years 2011-2020



- PBT and CMT properties from CompTox Chemicals Dashboard of US EPA

- ED properties from TEDX List of Potential Endocrine Disrupters & ECHA Endocrine Disrupter Assessment List

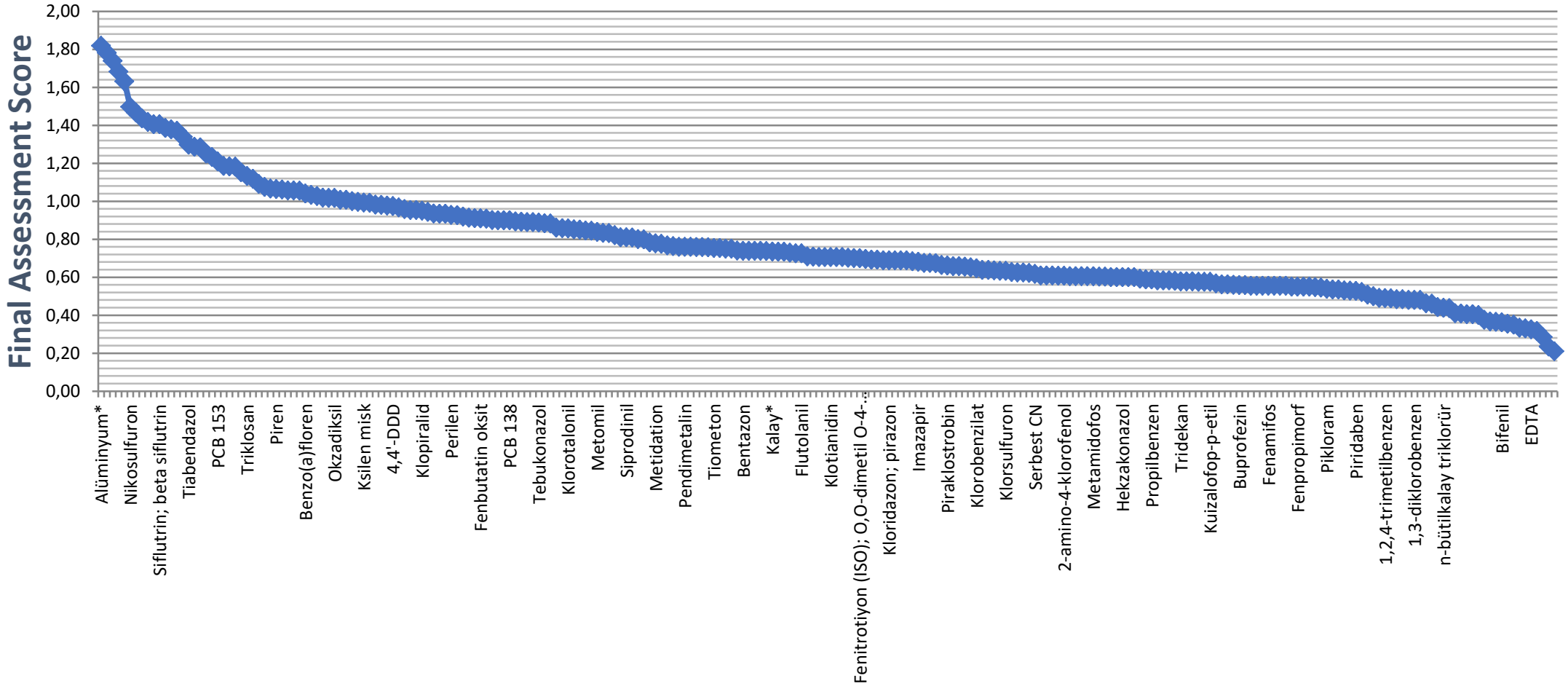


- Annual use data from national inventories and use pattern from literature

Outcomes

- Exposure, hazard, risk and overall assessment score
- Maximum score: 1.82 (aluminum)
- Minimum score: 0,21 (demeton) (based on monitoring data)
- Standard deviation: 0.29
- Arithmetic mean: 0.77
- Median: 0,71

Outcomes


Final Assessment Score
2,00
1,80
1,60
1,40
1,20
1,00
0,80
0,60
0,40
0,20
0,00
Alüminyum*
Nikosulfuron
Siflutrin; beta siflutrin
Tiabendazol
PCB 153
Triklosan
Piren
Benzo(a)floren
Okzadiksil
Ksilen misk
4,4'-DDD
Klopiralid
Perilen
Fenbutatin oksit
PCB 138
Tebukonazol
Klorotalonil
Metomil
Siprodinil
Metidation
Pendimetalin
Tiometon
Bentazon
Kalay*
Flutolanil
Klotianidin
Fenitrotiyon (ISO); O,O-dimetil O-4-...
Kloridazon; pirazon
Imazapir
Piraklostrobin
Klorobenzilat
Klorsulfuron
Serbest CN
2-amino-4-klorofenol
Metamidofos
Hekzakonazol
Propilbenzen
Tridekan
Kuizalofop-p-etil
Buprofezin
Fenamifos
Fenpropimorf
Pikloram
Piridaben
1,2,4-trimetilbenzen
1,3-diklorobenzen
n-bütilkalay triklorür
Bifenil
EDTA

Conclusions

- 45 pollutants were proposed to have higher risk.
- Study must be developed using more comrehensive monitoring data.
- Risk assessment methodologies can be improved by integrating multimedia fate models.

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