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Environmental Monitoring of EDCs and POPs in Korea

Junhen YOON

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National Institute of Environmental Research, KOREA



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Backgrounds of concern in Korea

- Debate on detection of Styrene dimer/trimer in the noodle cups made of Polystyrene Resin(1998)
- Detection of Phthalate in Cosmetics and Toys (2005)
- Debate on detection of Phthalate in PC product (2006)
- Concerns of Dioxin, PCBs issue
- Stockholm Convention (2001)



Establishment of Mid and Long-term Research Program on EDCs(1999)

Basic Study

Research Plan (1999-2008)

Risk assessment & management

Study on
Exposure &
Adverse Effect



- Phase 2 is going on right now
- Delay in moving to Phase 3, because of the uncertainty of Endocrine Disrupting Toxicity
- **Conduct of Nationwide monitoring of suspected EDCs** including POPs('99~)





Develop the 'New 5-year(2007-2011) plan for EDCs'

- MoE and related ministries involved
- Promoting the project individually and cooperatively

cooperative project

- Screening methdology
- Risk assessment
- Risk Communication
- Mechanism of the effect of EDCs

Individual project

- Ecological effect of EDs
- Surveying a source & environmental fate
- Base-researches etc.



Major outline of the New 5-year(2007-2011) plan

Classification	Field & Projects	Est. Budget (Mil. USD)
Ministry of Environment (National Institute of Environmental Research)	20 Projects in 6 Fields	13.1
Ministry for Land, Transport and Maritime Affairs (National Fisheries Research and Development Institute)	8 Projects in 3 Fields	13.9
Ministry for Food, Agriculture, Forestry and Fisheries (National Veterinary Research & Quarantine Service)	13 Projects in 5 Fields	2.0
Rural Development Administration	9 projects in 4 fields	4.5
Ministry of Health and Welfare (Food and Drug Administration)	105 Projects in 5 Fields	10.8



- International Cooperation
 - Enhancement of international cooperation in research such as establishing testing/assessing method and development of management tools of EDCs
- Participation in OECD programme
- Korea-Japan cooperation(Joint Symposium) from 2001
- Stockholm Convention related activity
 - POPs data information Warehouse system is East Asia
 - East Asia Pops monitoring project
 - WHO project for Marteral Milk





Main Projects list from 1999

- EDCs Environment Monitoring ('99 ~)
- Biota monitoring ('99 ~)
- Environmental Fate of EDCs ('01 ~ '04)
- Standard Method for bio monitoring ('01)
- Does-response & physiological properties of Crucian Carp ('04 ~ '06)
- Emission and Distribution Ratio assessment of Dioxins ('05 ~ '07)
- Ecological risk assessment of Alkylphenols ('07 ~ '08)
- Toxicogenomic technology for EDCS ('07 ~)



- **POPs Management Acts**
- Enforced from 2008. 1. 27
- Basic legal frame for POPs management

Environment Management

- Establish a Basic Strategy (5year term)
- Preparation of Enforcement plan (every year)
- TDI

(4pg-TEQ/day/kg)

- Environmental
 Standard (Air)
- Monitoring

Banned & Restricted

- •Annex A, B:
 Authorized as
 Banned &
 Restricted
 Chemical
- Impose duty of consent before Exports

discharge facility Management

- Setting up a
 Emission standard
 Dioxin standard for
- environmental media near Steel, Cement, etc
- Effect evaluation of Emission facilities (every 3years)

Waste management

- Define the waste
- Treatment
 Stardard
- Restricted Recycling

Equipment management

- List up and report
- Safety management



POPs Management Status

		Regulation						
Chemicals	Annex	Pesticide control Act	Toxic Chemicals Control Act	POPs Management Act				
Aldrin	Α	Cancel/Ban ('69)	Ban (0.1%) ('99)	Ban(2008)				
Chlordane	Α	Cancel/Ban ('69)	Ban (1%) ('99)	Ban(2008)				
Dieldrin	Α	Cancel/Ban ('70)	Ban (1%) ('99)	Ban(2008)				
Endrin	Α	Cancel/Ban ('69)	Ban (1%) ('99)	Ban(2008)				
Heptachlor	Α	Cancel/Ban ('79)	Ban (6%) ('99)	Ban(2008)				
Mirex	Α	Not registe	Ban(2008)					
Toxaphene	Α	Cancel/Ban ('82)	Ban (1%)('91)	Ban(2008)				
НСВ	Α	Not registe	red as Pesticide	Ban(2008)				
PCBs	Α	Ban ('79)*	Ban (50ppm) ('96)	Ban(2008)				
DDT	В	Cancel/Ban ('69)	Ban (1%) ('91)	Ban(2008)				







IEDCs Monitoring

- Monitoring Site: more than 200 site
 - Water 124, Soil 83, Ambient air 48, Sediment 28
 Biota 40 (fish, amphibian, 2 species resp.)
- Target Chemicals: 94 chemicals
 - PCDD/F, Phthalates(8), PCBs(Co-PCBs), Organotins(6), Alkylphenol(8), Chlorinated Pesticides and Metabolite, Other pesticides

■POPs Monitoring

POPs Monitoring (1999-2007)

- Started as an EDCs Projects from 1999
- Target Media: Air, Water (river, reservoir, Discharged water),
 Soil, Sediment, Biota (Fish, Amphibian)
- Target POPs: Dioxins, Furans, PCB (Co-planar PCBs: since 2002), DDT, Aldrin, Endrin, Dieldrin, Chlordane, Heptachlor, HCB,
 - Toxaphene and Mirex are not monitored

POPs Monitoring (2008-)

- Started Base on POPs Act
- Target Media(160 sites): Air, Water (river, reservoir, Discharged water), Soil, Sediment
- Target POPs : 12 POPs



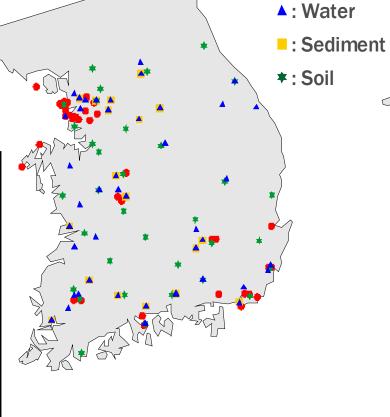
: Air

Sampling:

- Water, Sediment, soil : 2 times/ year

Air: 4 times/ year Monitoring Site

Year	Air	Water	Soil	Sediment	Biota		
1999	26	43	35	11	31		
2000	26	43	35	11	-		
2001	26	43	35	11	31		
2002	33	43	35	11	20		
2003	35	38	33	15	20		
2004	35	41	38	15	20		
2005*	15	24	23	12	4		
2006*	30	24	23	12	4		
2007*	15	24	23	12	4		
2008*	15	38	23	22	20		





*: focus on Industrial zone





Summary of Monitoring results

	′ 99	′00	′ 01	′02	′03	′04	`05	90′
Detected / Total	28/87	32/90	32/94	46/93	35/64	46/67	38/59	28/61

- No annual trend
- Very low concentration level

Continuously detected chemicals from 1999 to 2007

Group	Chemicals
Byproducts(3)	Dioxins, Hexachlorbenzene(HCB), Benzo(a)pyrene
Organo tin (1)	Tributyl Tin
Phthalates(4)	BBP, DBP, DEHP, DEP
Others(3)	Benzophenone, Bisphenol A, Di-2-ethylhexyl adipate

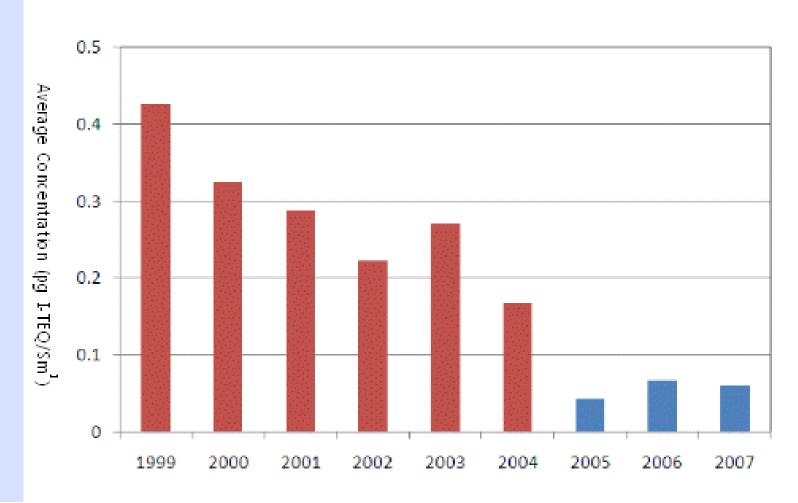


POPs in Environment

- DDT, PCBs, HCBs, Chlordane, Heptachlor
 - → Detected but Trend is not shown
- Dioxins: Decreased in Air
- Other POPs were not detected

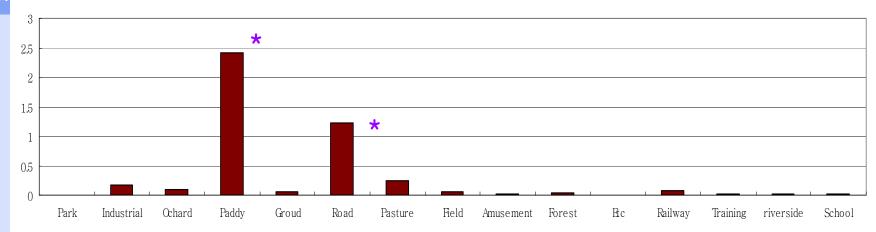


Mean concentration level of Dioxin in Air



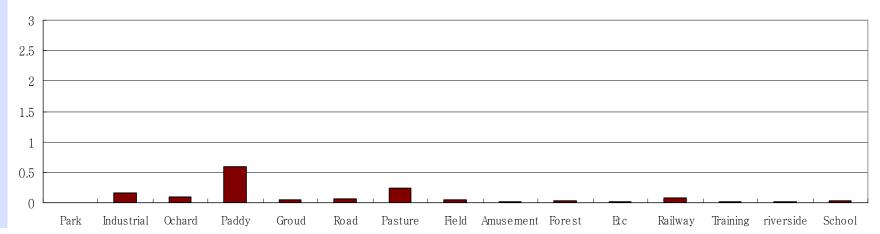
2. Environmental Monitoring

Mean TEQ value of Dioxin in Soil (pg-TEQ/g)

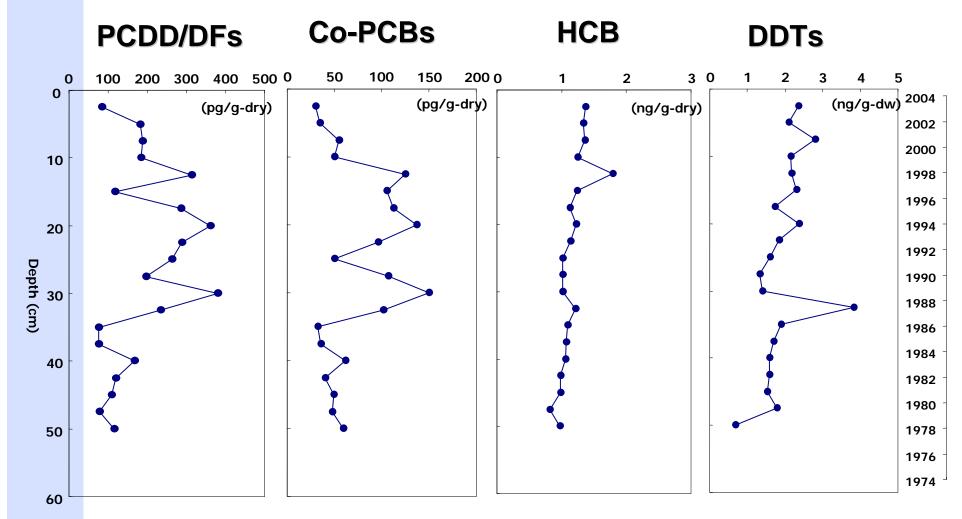


* : affected by specific samples

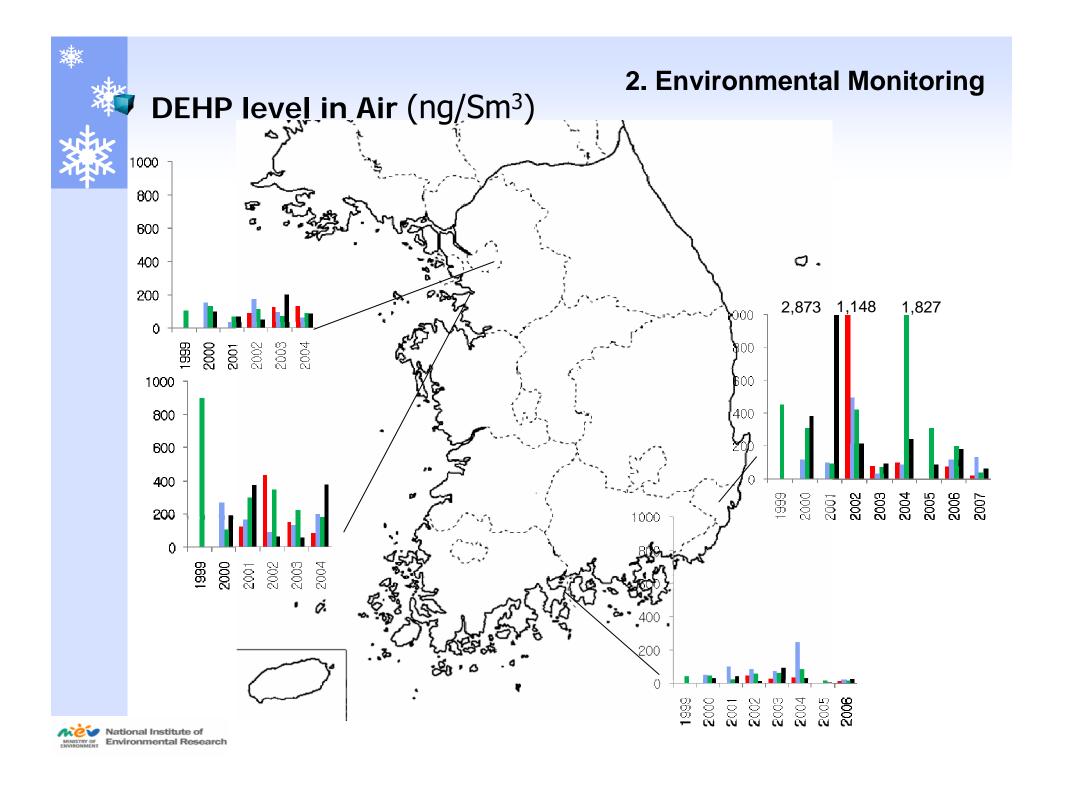


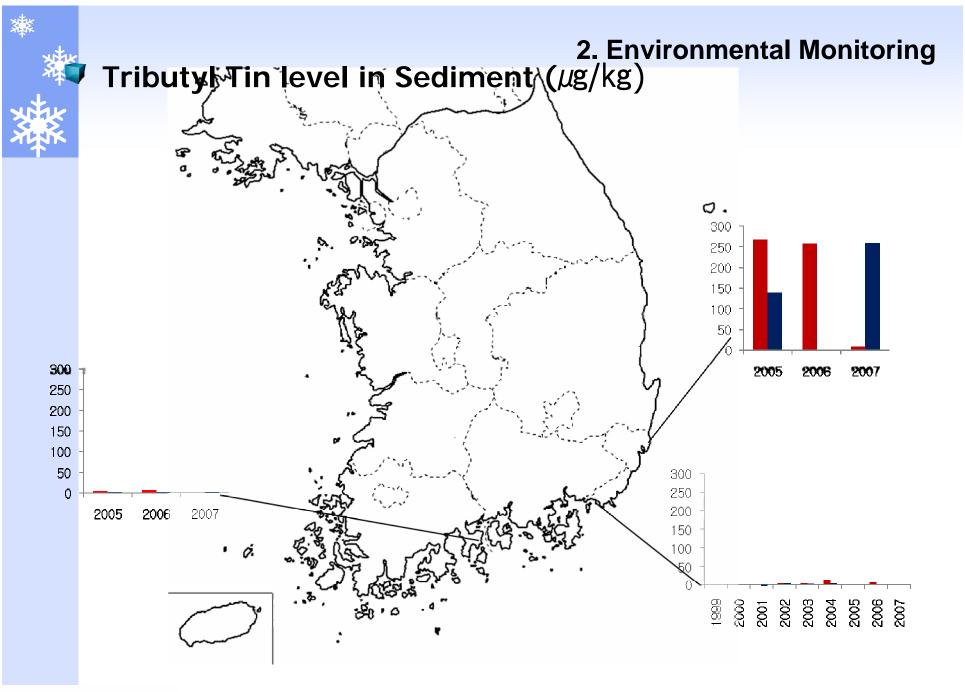


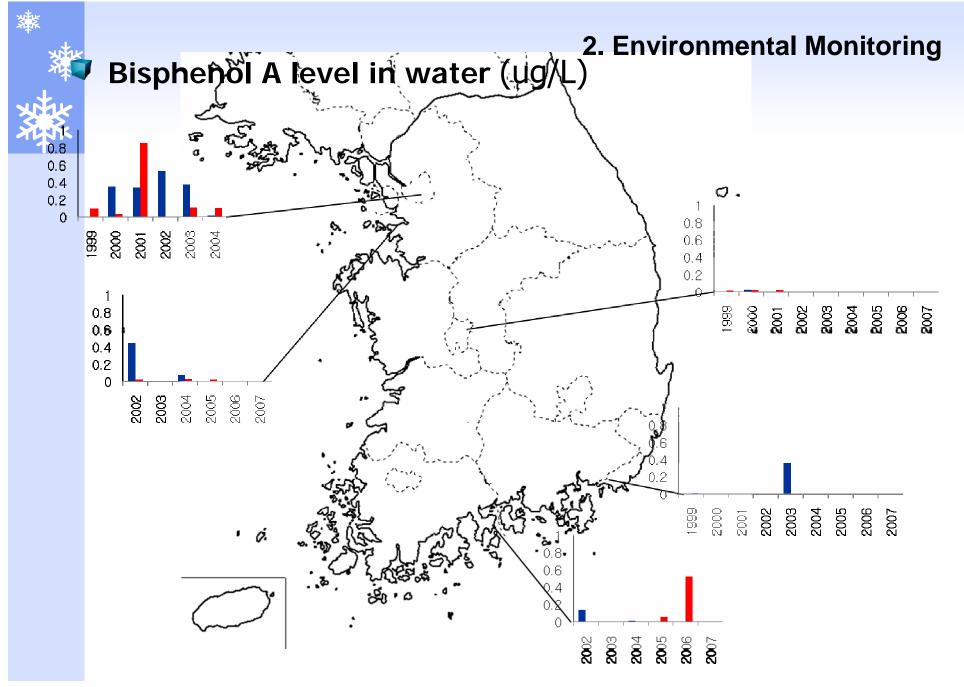
Vertical concentration level of POPs in Han river sediment

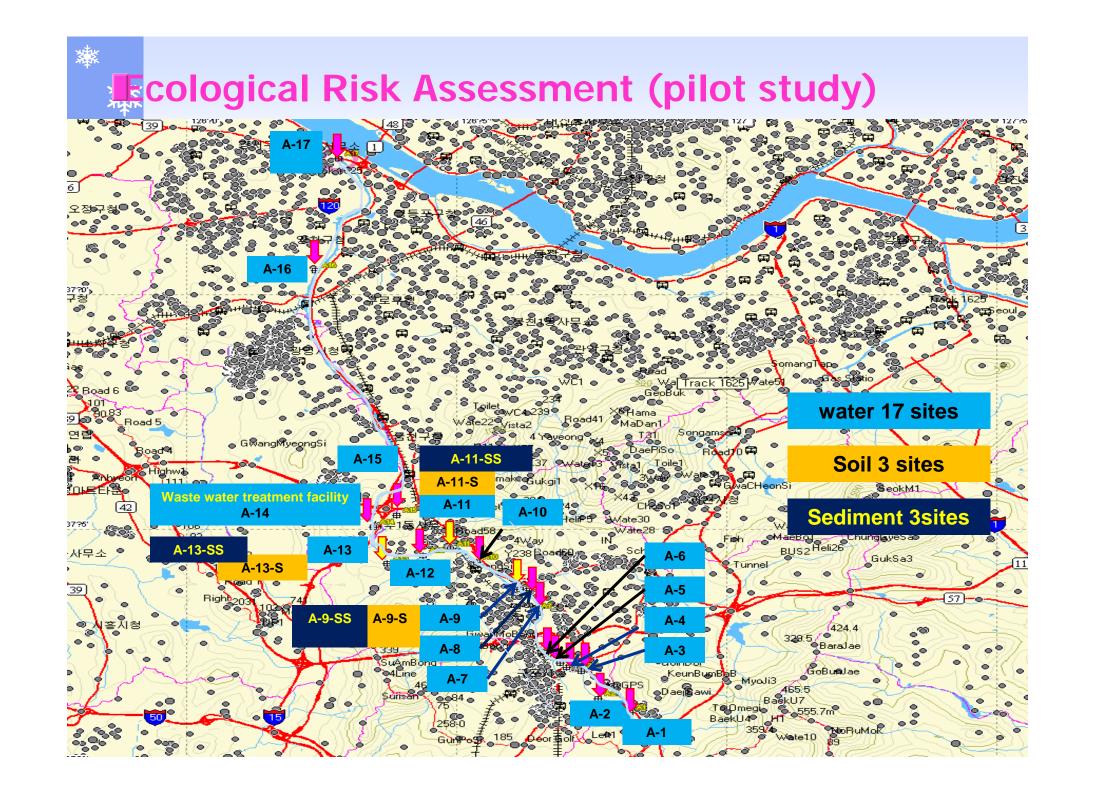














risk assessment results

	Water	Sediment
PNEC	1.6 µg/L (EDC effect)	31 µg/L (Chronic Toxicity)
PEC	ND ~ 0.099 μg/L	ND ~ 3.329 µg/kg
PNEC/PEC	> 0.06	> 0.11



Occurrence ratio of Testis-Ova in fish and Amphibian

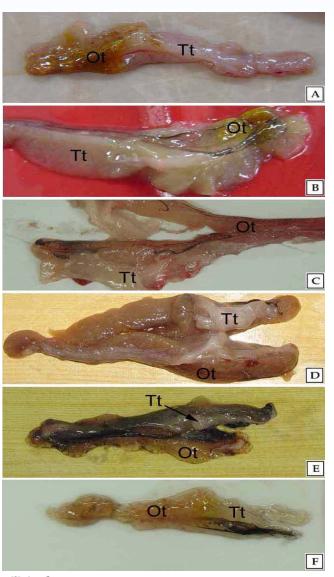
Biota	1st	2nd	3rd	4th	5th
Crucian Carp	0.85%	0.38%	4.75%	5.25%	4.75%
Bull frog	0.53%	0.28%	0.75%	1.38%	1.88%

Nationwide monitoring: 1999~2004





Testis-Ova tissue in fish



A: female (Han river tributary)

B: female (Han river tributary)

C: male (Keum river)

D: female (Keum river)

E: female (Keum river)

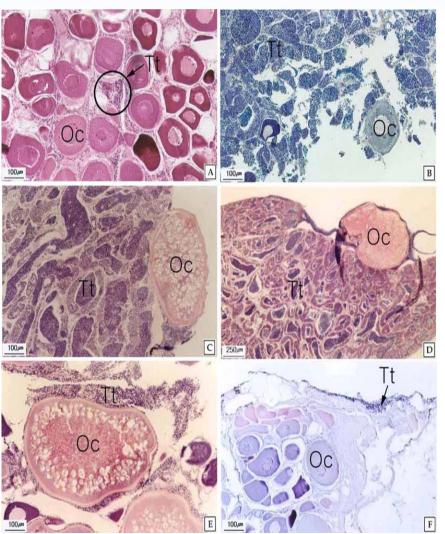
F: female (Nakdong river)

Tt: testicular tissue

Ot: ovarian tissue



Histological evidence of inter-sex in fish



A : female (Han river)

B: male (Han river)

C: male (Han river tributary)

D: male (Han river tributary)

E: female (Han river

tributary)

F: female (Nakdong river)

Tt: testicular tissue

Ot: ovarian tissue



Relationship between intersex and Concentration level

Sitres	섟	VTG (µg/Ml)	Inter -sex	Dioxins (pg-TEQ/g)	Co-PCB (pg-TEQ/g)	DDT (µg/kg)	DEHA (μg/kg)	Phthalates (#g/kg)	Alkyl phenol s (#g/kg)	Bisphenol A (µg/kg)	Organo tin (#g/kg)
Bokha (Han river Tributary)	М	105.8	0	0.012 (TCDF)	0.135 (co-P) 2.40 (ho-P)	0.58	14.2	ND	ND	ND	6.69
Oekwan	М	177.9	Х	0.020 (TCDF)	0.456 (co-P)	1.42	ND	4.9 (DEP)	ND	0.3	5.43
(Nakdong river)	М	18.9	Х	1.138 (PeCDF)	3.53 (ho-P)	1.42	ND	49.2 (DBP)	ND	0.5	3.43
Koreong (Nakdong river)	М	56.4	Х	ND	0.553 (co-P) 0.07 (ho-P)	0.64	22.1	5.5 (DEP)	ND	ND	3.66
Nam river	М	16.1	Х	ND	0.053 (co-P) ND (ho-P)	0.27	ND	54.0 (DEP) 25.6 (DBP)	ND	ND	2.16
Muan (Youngsan river)	M	67.9	Х	ND	0.144 (co-P) 2.19 (ho-P)	0.97	ND	23.3 (DEP)	ND	ND	3.85





Conclusion





Environmental Concentration of most EDCs & POPs are very low level and did not shown any trend

- Need to change the monitoring strategy
 - Hot spot base monitoring
 - Issue base survey
 - Others
- Relationship between Environmental exposure and ecological effects also is not clear
 - Need to more study related to physiological properties and EDCs effects
 - Others(Complex mixture effects....





Thank you for attention