

MONITORING ON POPS IN AQUATIC ENVIRONMENT IN INDONESIA

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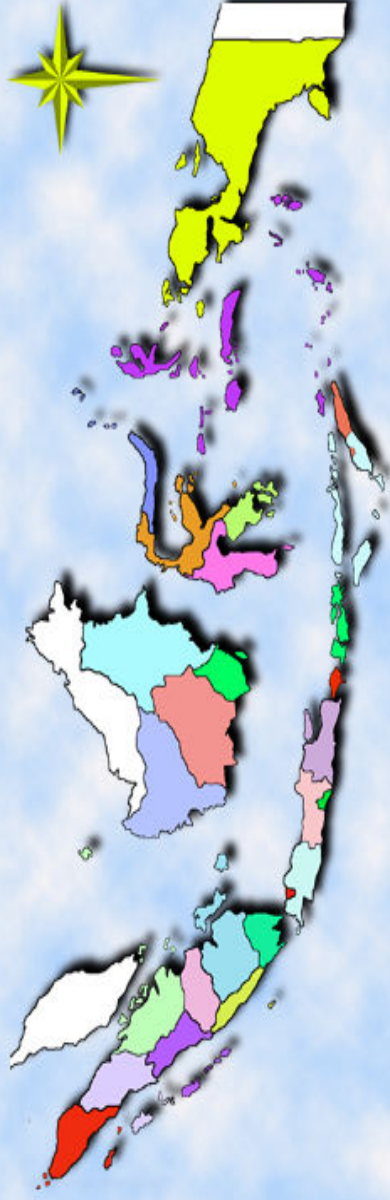
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**ENVIRONMENTAL MANAGEMENT CENTER
(PUSARPEDAL - DEPUTY VII)
MINISTRY OF ENVIRONMENT INDONESIA
2007**



General Information of Indonesia

INDONESIA



- ◆ **Indonesia is along archipelago country, comprises some 17.000 islands forming the largest archipelago in the world.**
- ◆ **Five mayor islands in Indonesia are Sumatera, Java, Kalimantan (third biggest island in the world), Sulawesi and Papua. Total land area ± 1.904.000 square kms.**
- ◆ **Administratively, Indonesia comprise 33 provinces, with their characteristic environment condition.**

◆ **Indonesia's islands fall within the equatorial climatic zone, therefore the climate is rather mild. It has only two season, dry and wet season. Average daily humidity ranges from 60 to 90 %.**

◆ **According to the latest statistic, population of Indonesia in 2005 is 218 869 000 and in 2006 is 222 192 000.**

◆ **About 60% of population concentrated in Java island which has only about 7 % of the total land area.**

◆ **Kalimantan, Maluku & Papua which have size 4 to 5 times Java island only occupied 2 to 5 % from total population.**

Persistent Organic Pollutants (POPs)

4 characteristic :

- ❖ are extremely stable and persist in the environment
- ❖ Bio-accumulate in organisms and food chains
- ❖ are toxic to humans and animals and have chronic effect such as disruption of reproductive, immune and endocrine systems , as well as being carcinogenic
- ❖ Are transported in the environment over long distances to places far from the points of release

The twelve Chemicals in the initial list of the Stockholm Convention on POPs

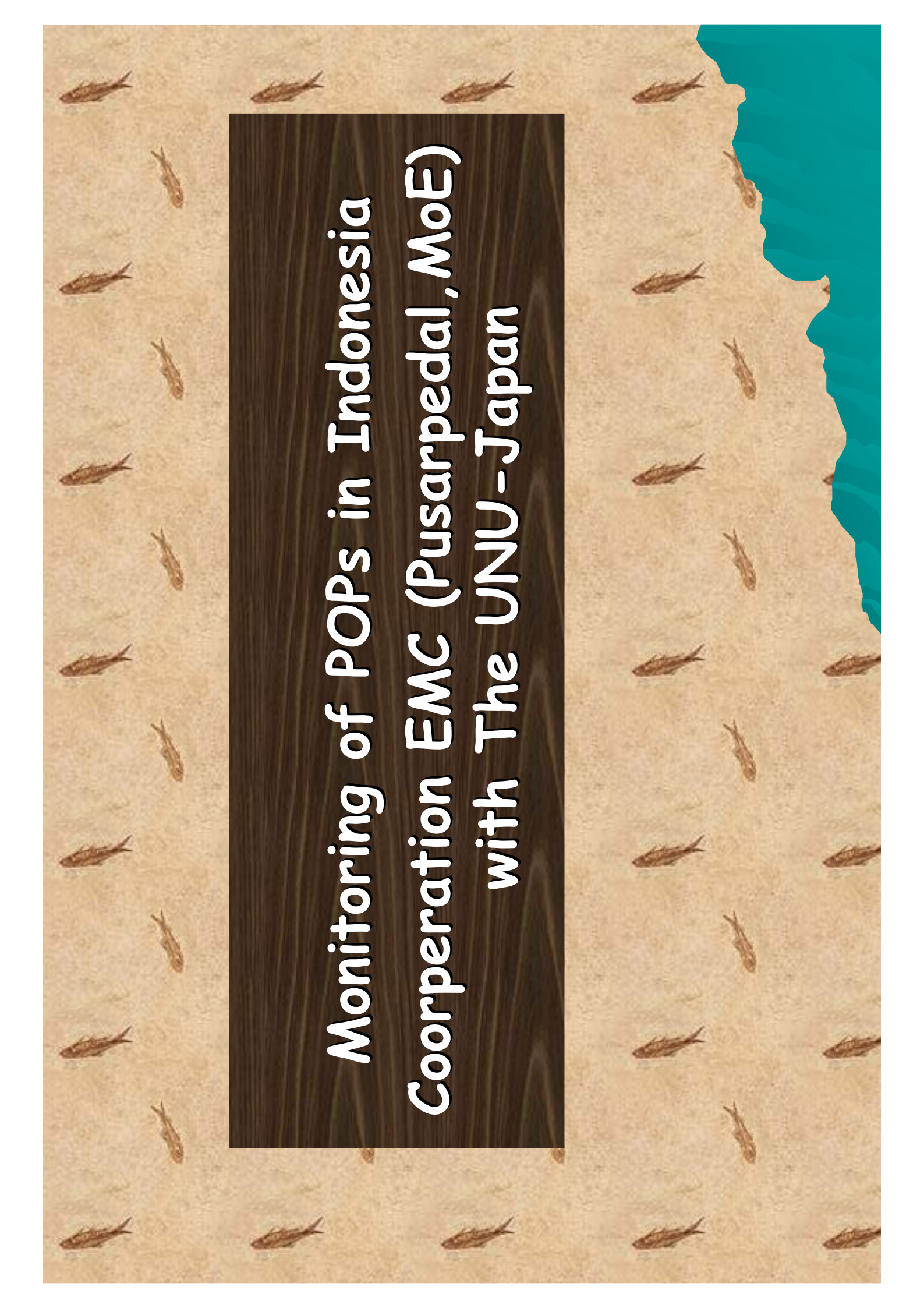
1. DDT
2. Aldrin
3. Endrin
4. Dieldrin
5. Chlordane
6. Heptachlor
7. Hexachlorobenzene (HCB)
8. Mirex
9. Toxaphene
10. PCBs
11. Furans (PCDFs)
12. Dioksin(PCDDs)

Pollutants Source of POPs :

- ❖ **Residue of POPs pesticides application in agricultural area: DDT, aldrin, dieldrin, endrin, heptachlor, mirex, toxaphene, chlordane, HCB**
- ❖ **Residue of POPs pesticides application for controlling malaria vector mosquito : DDT**
- ❖ **Industrial : PCB (used transformer containing PCBs)**
- ❖ **Unintentionally product : Dioksin, Furan (open burning from domestic or industrial waste**

POPs CONDITION IN INDONESIA

- Indonesia has been used POPs chemicals such as Aldrin, Chlordane, DDT, Dieldrin, Endrin, heptachlore, HCB ect. By Government regulation No 74/2004 concerning to the management of hazardous and toxic substances, the used of those POP chemicals have been banned for all purposes.
- Regarding to the negative impact and its persistency, Indonesia also has been signed of Stockholm Convention (23-Mei 2001).
- EMC has duty to support government policy in the field of environment by preparing environmental quality data. Related to the implementation of Stockholm convention, EMC also tried to supply data concerning to the existing of POP in the environment.
- DDT still permitted to be limited used in the field of health specifically for controlling mosquito of malaria vector, and finally banned in 1993.



**Monitoring of POPs in Indonesia
Cooperation EMC (Pusarpedal, MoE)
with The UNU-Japan**

Monitoring of POPs in Indonesia

Sampling Location :

- ❖ Five rivers in five cities in Java Island were selected as sampling location ;
- ❖ Ciliwung River located stretched along Bogor to Jakarta city (Western Java)
- ❖ Surabaya river ,Rungkut River and Tanjung Perak Harbor located in Surabaya city (Eastern Java)
- ❖ Banjir Kanal Barat and Banjir Kanal Timur River located in Semarang city (Central Java)

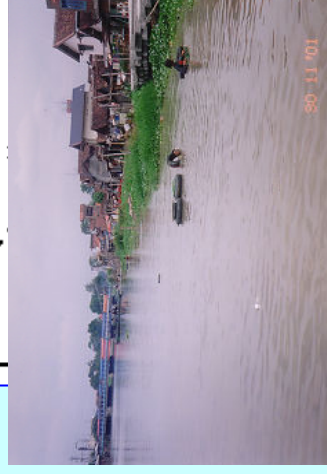
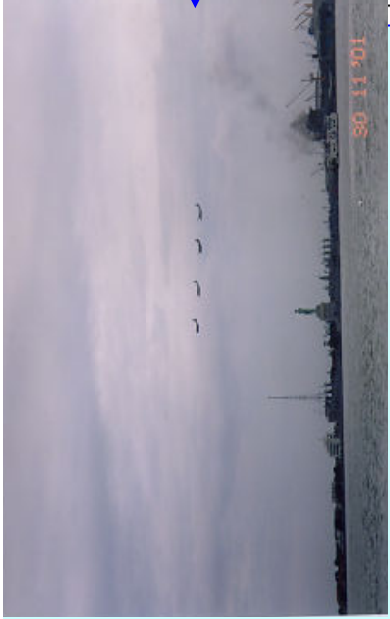
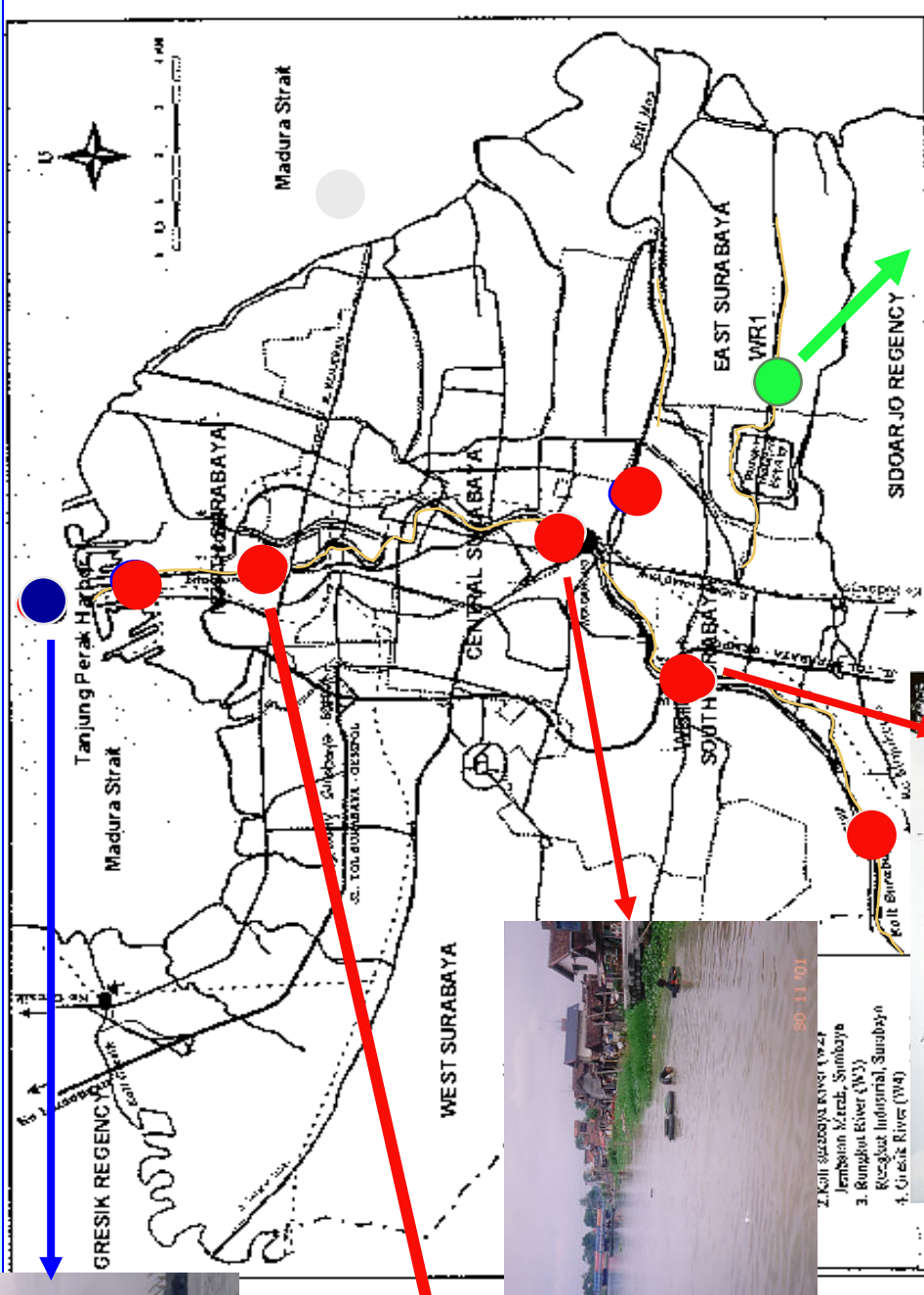
Sampling Frequency

- ❖ Sampling collection were carried out two times a year, representative dry and wet (rainy) season
- ❖ Matrix sampel : water, sediment and soil

MAP OF SAMPLING LOCATION JAWA ISLAND



MAP OF SAMPLING SITE SURABAYA (EMC/Pusarpedal -UNU)

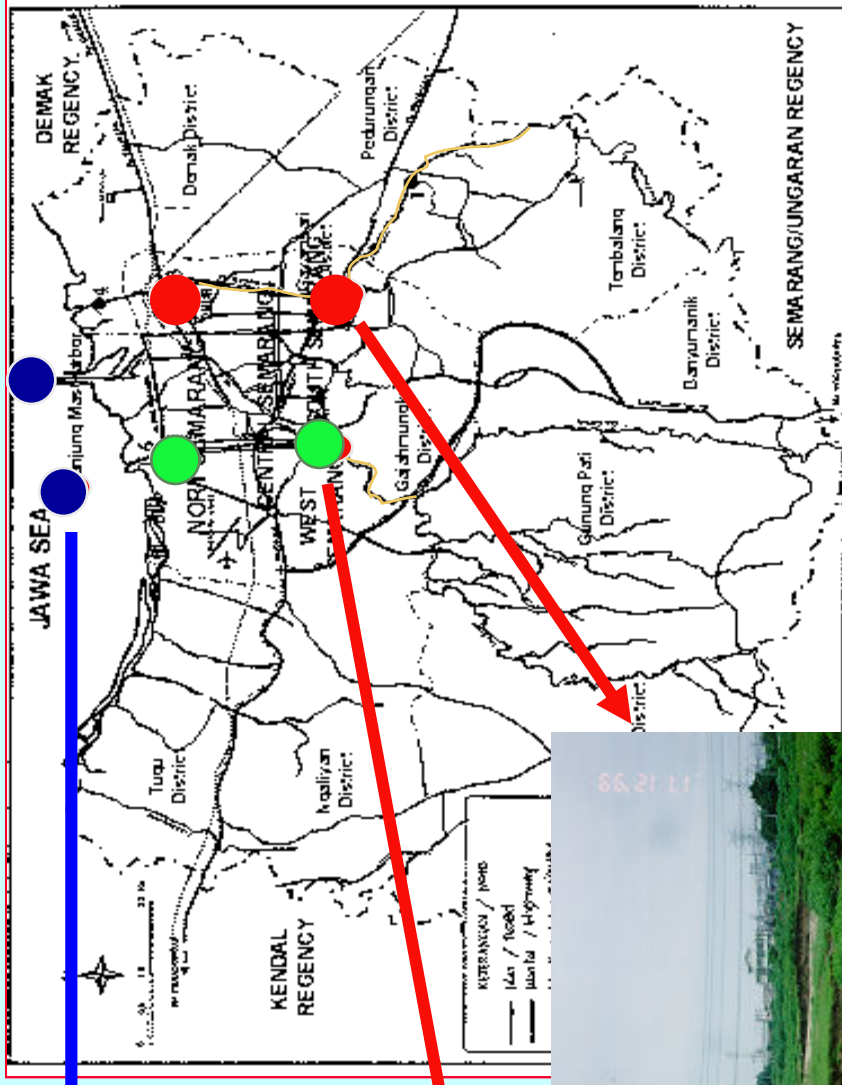


2. Kali Surabaya River (W2)
- Jemberan Kanal, Surabaya
3. Rungkut River (W3)
- Rungkut Industrial, Surabaya
4. Gresik River (W4)



- Tanjung Perak Harbor, Madura Strait
- Surabaya River
- Rungkut River

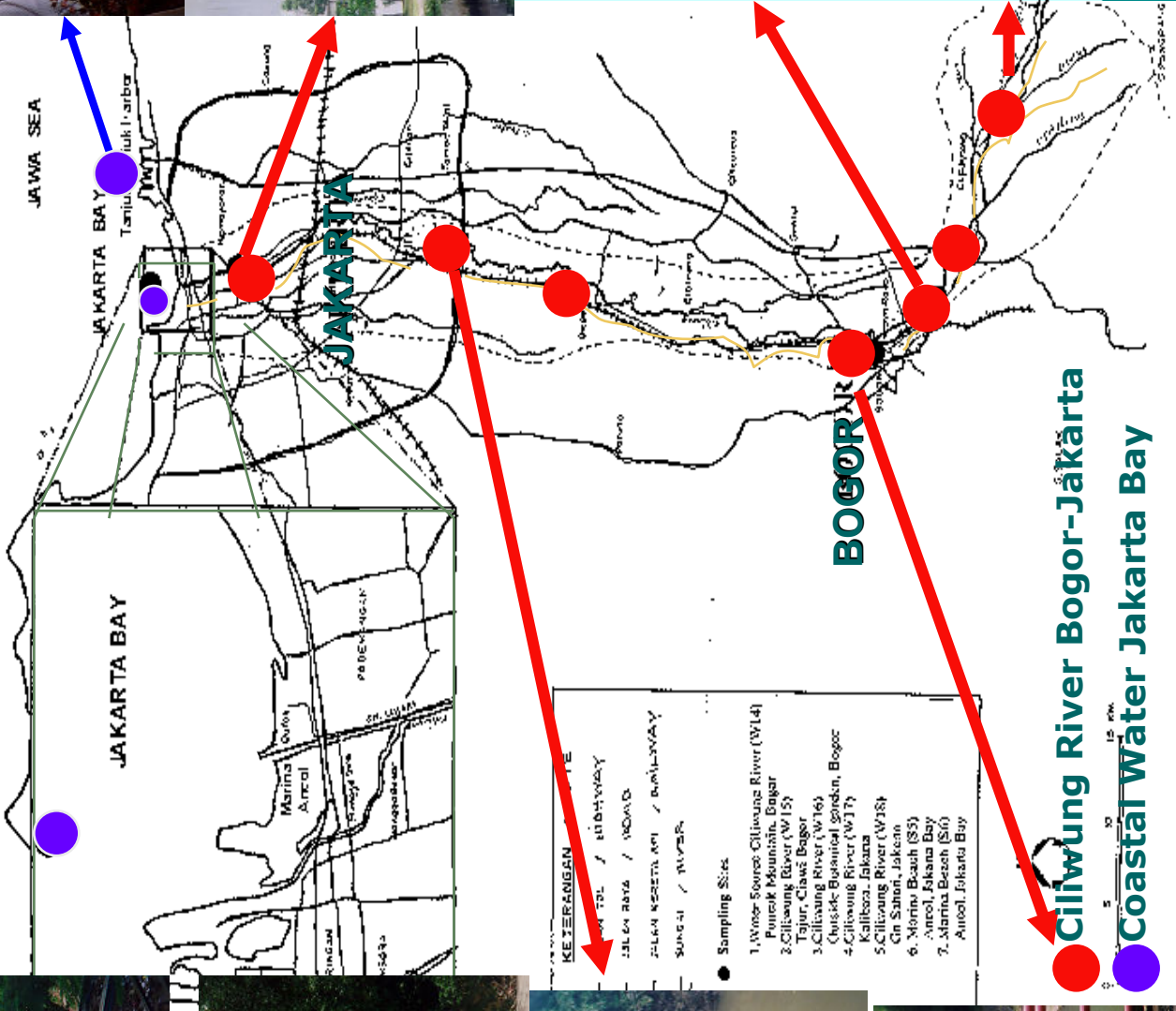
MAP OF SAMPLING SITE SEMARANG (EMC/Pusarpedal-UNU)



- Banjir Kanal Barat River
- Coastal Water Semarang (Java Sea)
- Banjir Kanal Timur River



MAP OF SAMPLING SITE BOGOR- JAKARTA(EMC/Pusarpedal-UNU)



TARGET OF ANALYSES :

Persistent Organic Pollutants:

Aldrin, Endrin, Dieldrin, HCB, Heptachlor, heptachlor epoxide, Mirex, Cis-Chlordane, DDT and its derivatives (pp'-DDD, pp'-DDE, op'- DDT, pp'-DDT)

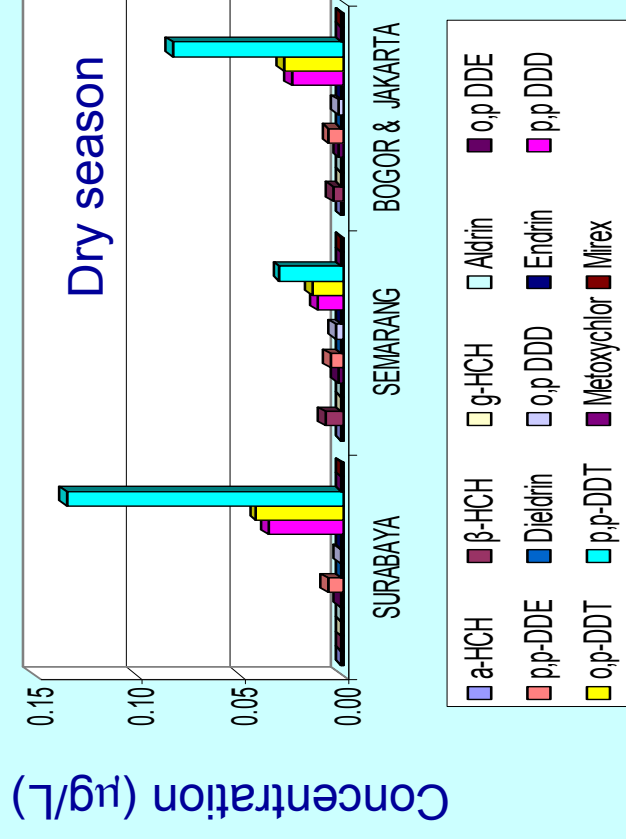
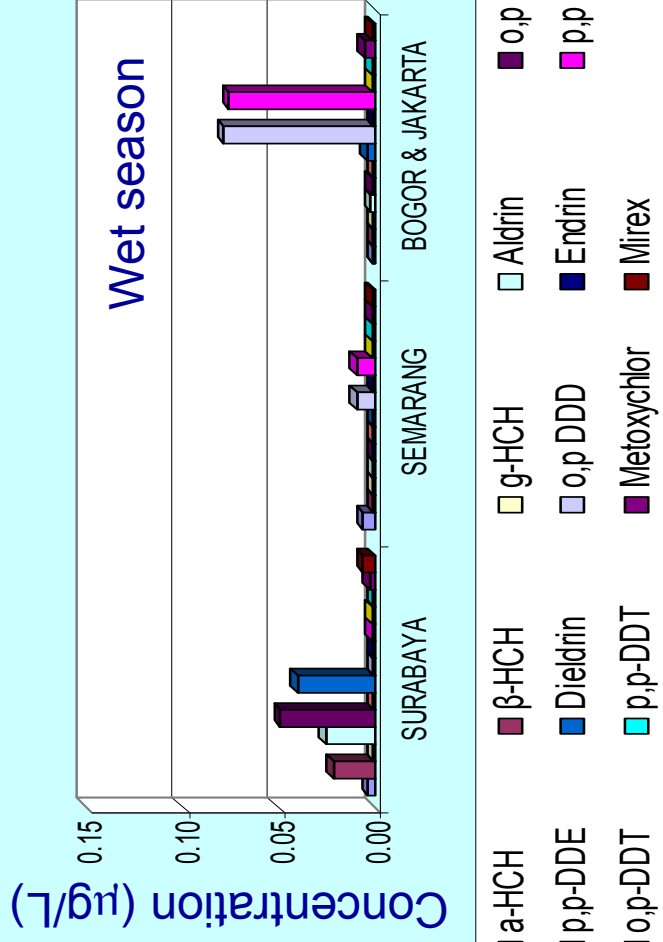
PROCEDURE FOR ANALYSES :

Refer to the UNU procedure for POPs analyses (Standard procedure for all of the participants of UNU project)

SOME of POPs MONITORING RESULT

(EMC/Pusarpedal and UNU)

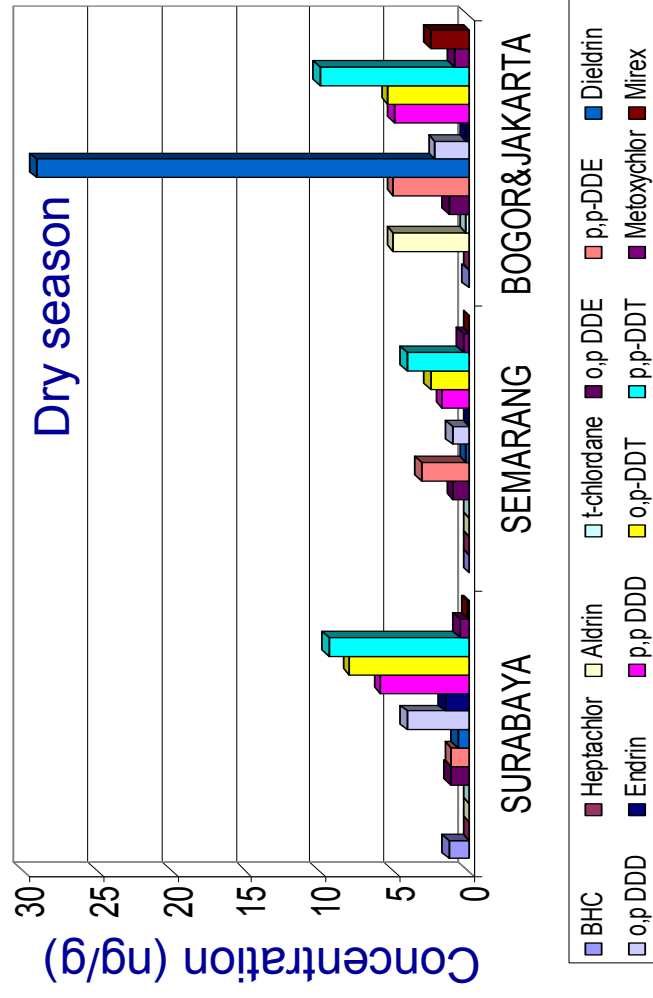
Concentration of POPs and organochlorine in water 2006



- In dry season, *p,p* DDT in water was the higher compared to the other detected compounds with the more than 0.10 ug/L, especially in Surabaya, the lowest concentration were detected in Semarang.

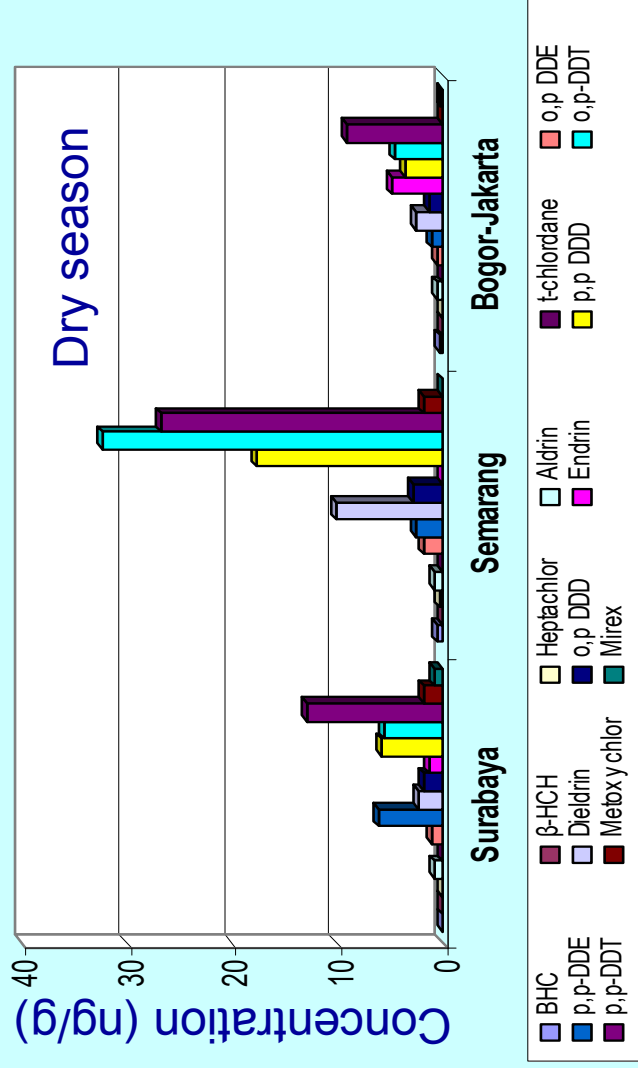
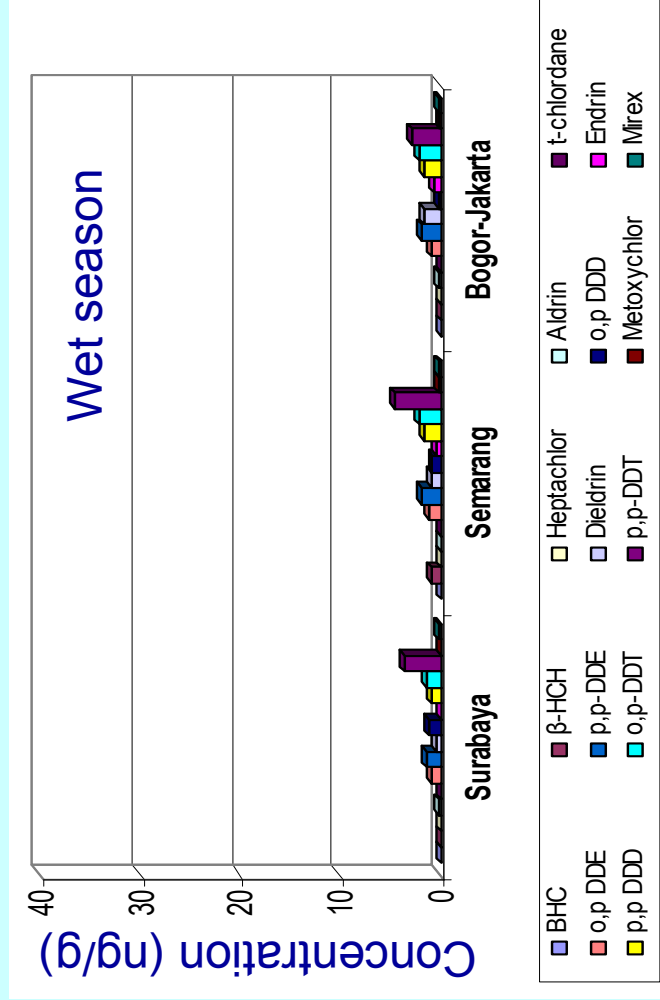
-Some compounds in the wet season such as *o,p* DDD; *p,p*, DDD; *g*-HCH; *o,p* DDE, aldrin and dieldrin were detected at concentration less than 0.1 ug/L. The lower concentration found in the wet season was probably caused by dilution of rain water into the river.

Concentration of POPs and Organochlorine in Sediment 2006



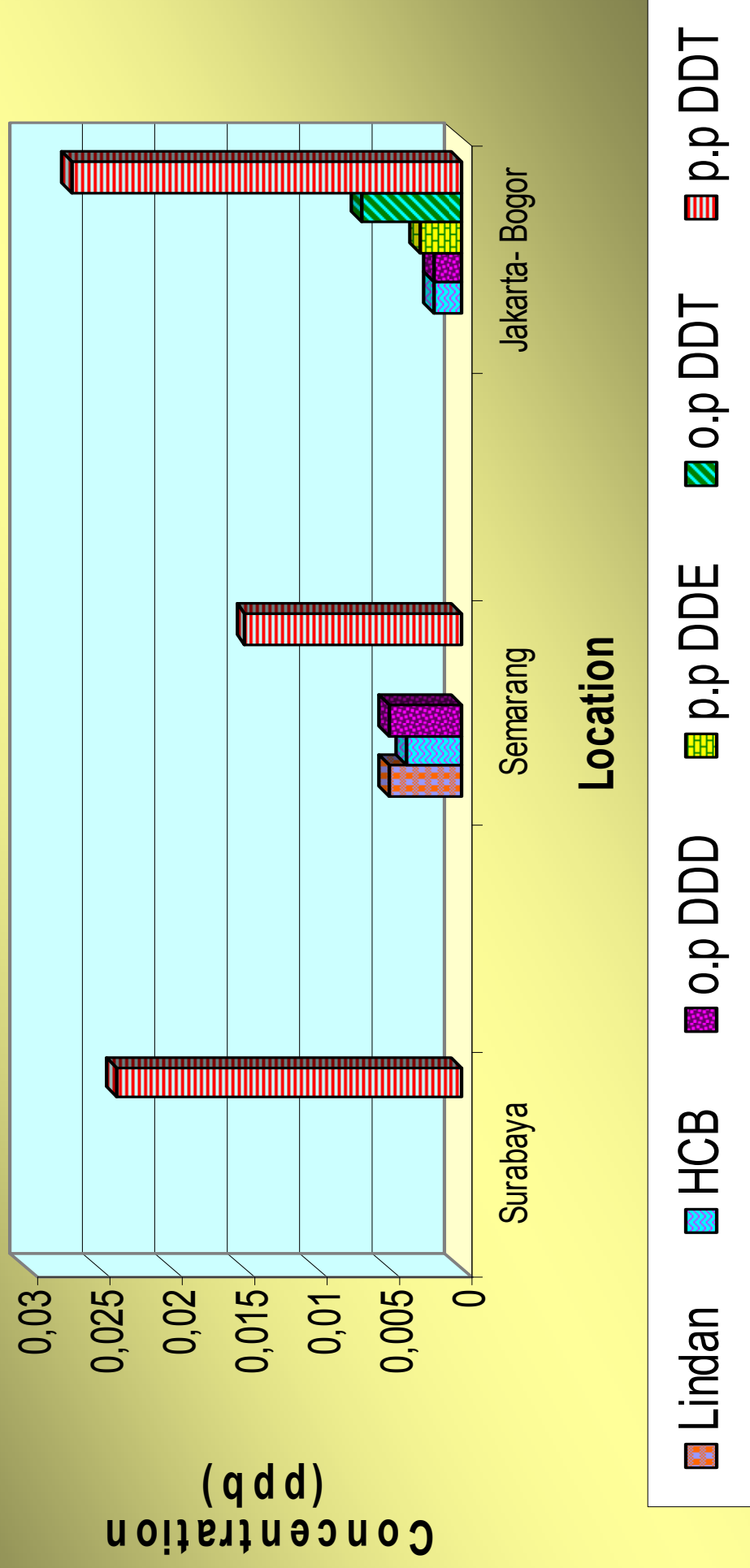
In sediment, some compounds were detected at less than 5 ppb in wet season such as *p,p* DDT; *o,p* DDT; metoxychlor. On the contrary in dry season dieldrin was in the highest concentration (more than 25 ppb), and the other compounds such as *o,p* DDD; *p,p* DDD; *o,p* DDT; *p,p* DDT were also detected at concentration less than 10 ppb.

Concentration of POPs and Organochlorine in Riverbank Soil 2006



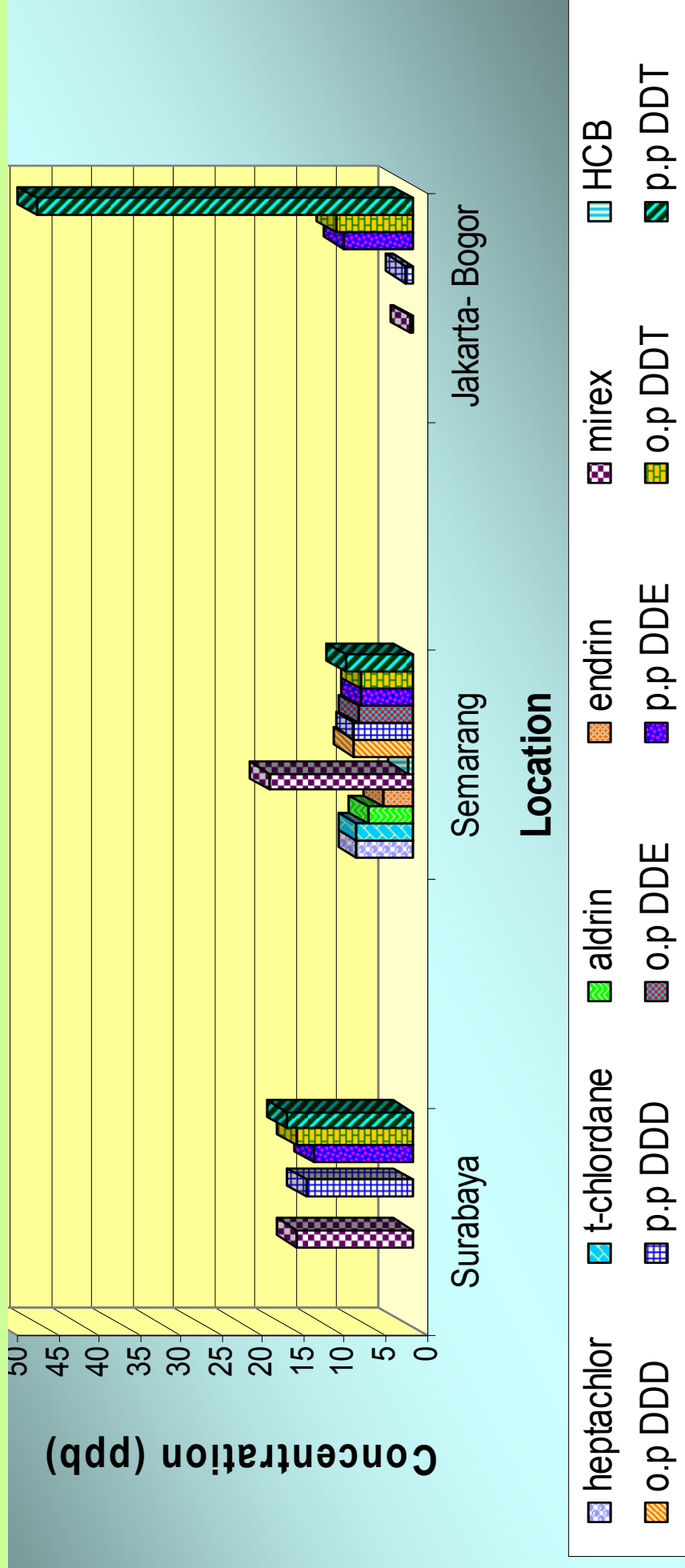
Some compounds were detected at concentration less than 5 ppb in wet season. On the contrary some compounds concentration were more than 5 ppb such as o,p-DDT; pp DDD and dieldrin.

Concentration of POPs and OCs in Water 2007



DDT and its derivatives were still dominant POPs detected in water with the concentration less than 0.03 ppb. DDT detected in water samples still below Indonesia environment water quality standard (2 $\mu\text{g/L}$) regarding to Indonesia government regulation no. 82/2001.

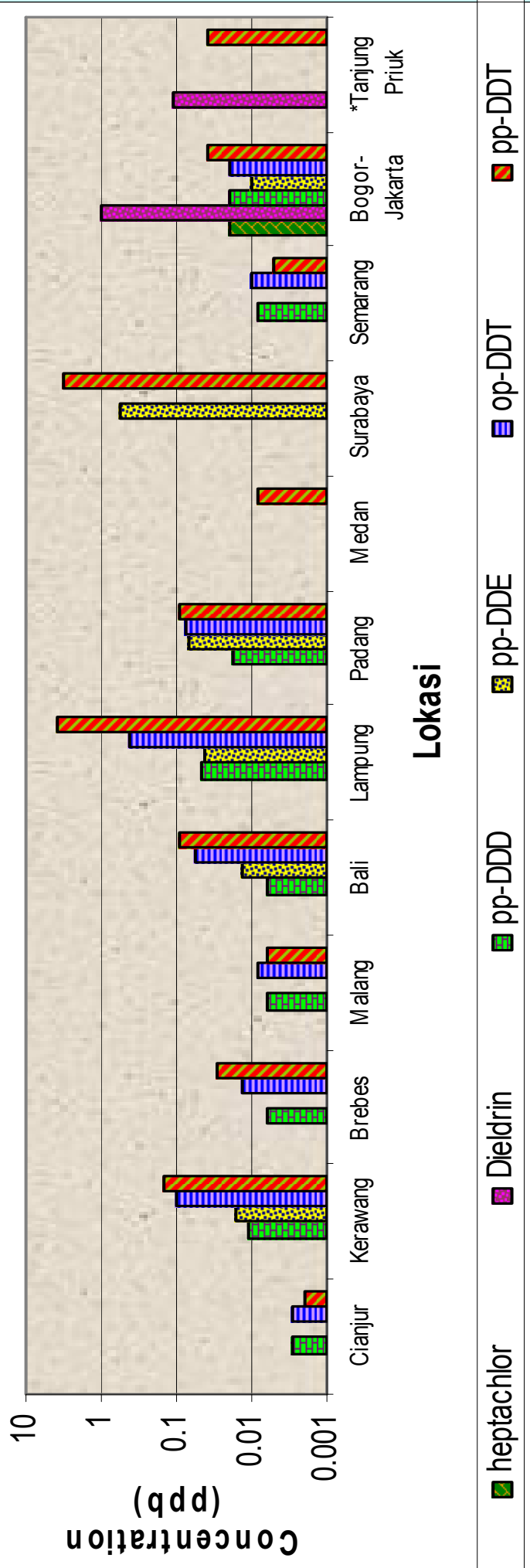
Maximum Concentration of POPs and OCs in Sediment 2007



Mostly POPs were detected in sediment at concentration less than 15 ppb except for pp-DDT in Jakarta (downstream of Ciliwung river) detected with the concentration 45.8 ppb

POPs Monitoring Result in Several Locations in Indonesia (Pusarpedal activities)

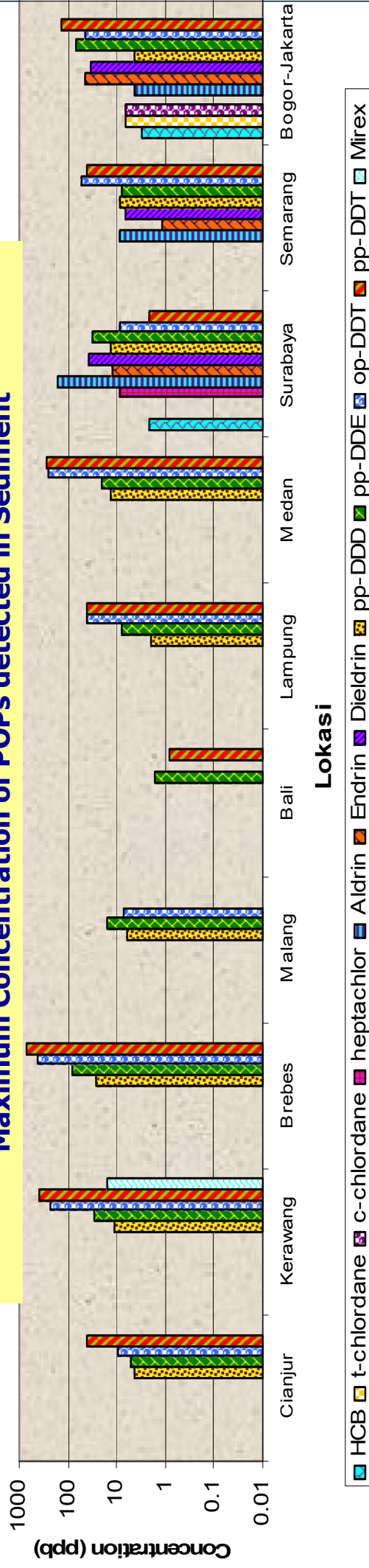
Maximum Concentration of POPs detected in Water



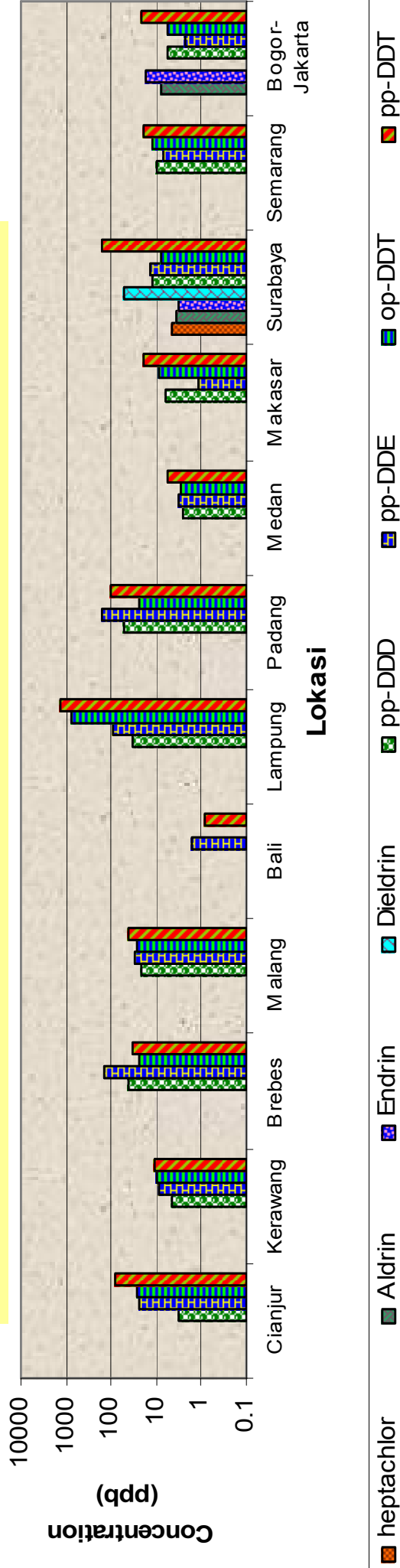
DDT and its metabolites was the main POPs compounds detected in water (agricultural and urban area).

POPs Monitoring Result in Several Locations in Indonesia (EMC- activities)

Maximum Concentration of POPs detected in Sediment



Maximum Concentration of POPs detected in Soil



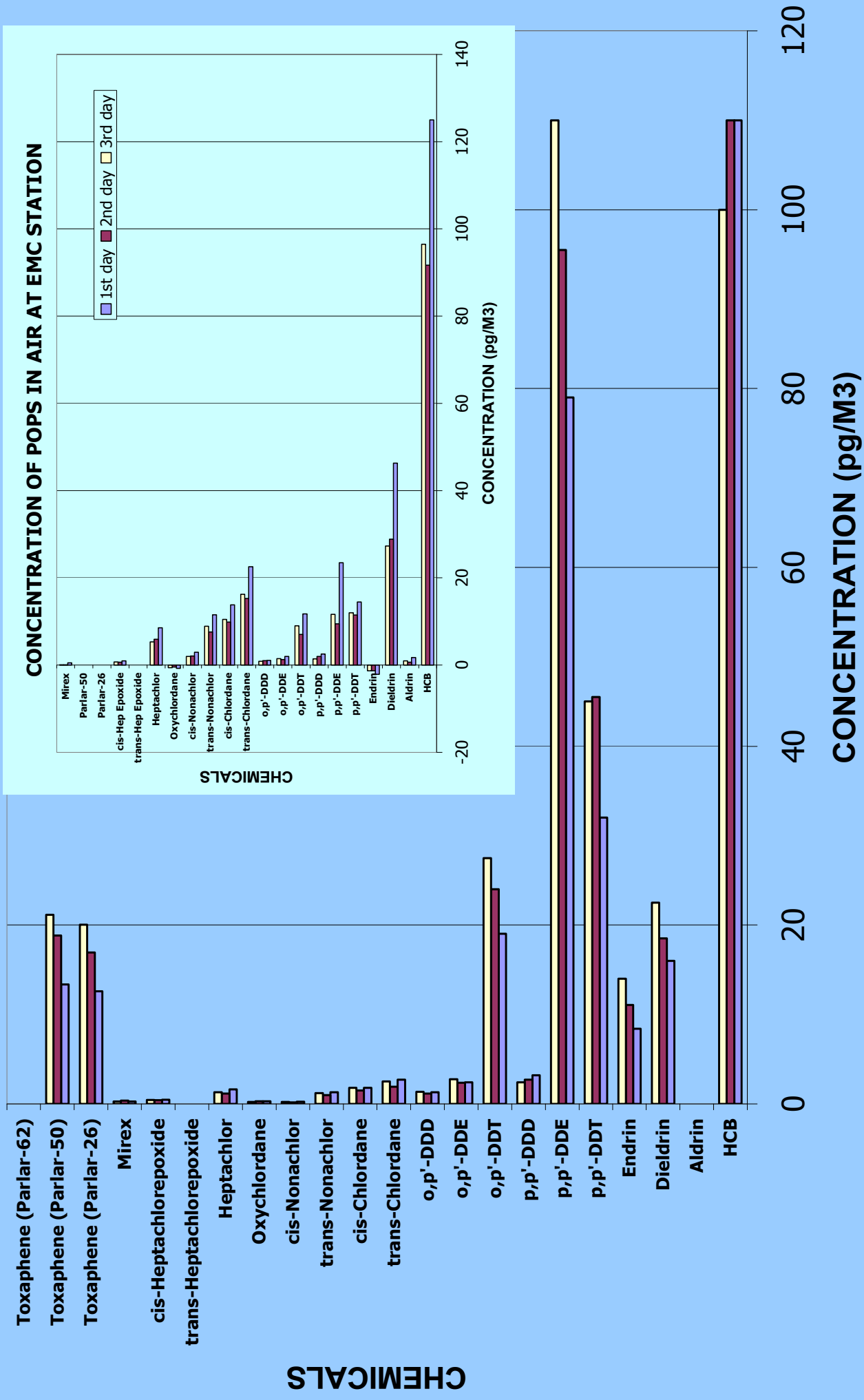
DDT and its metabolite were also the main POPs compounds detected in sediment collected from agriculture area (Cianjur, Kerawang, Brebes, Malang, Bali, Lampung, Padang, Medan and Makassar). Sediment collected from urban area (Surabaya, Semarang and Jakarta) contain more kind of POPs

TRIAL AIR MONITORING OF POPS IN INDONESIA

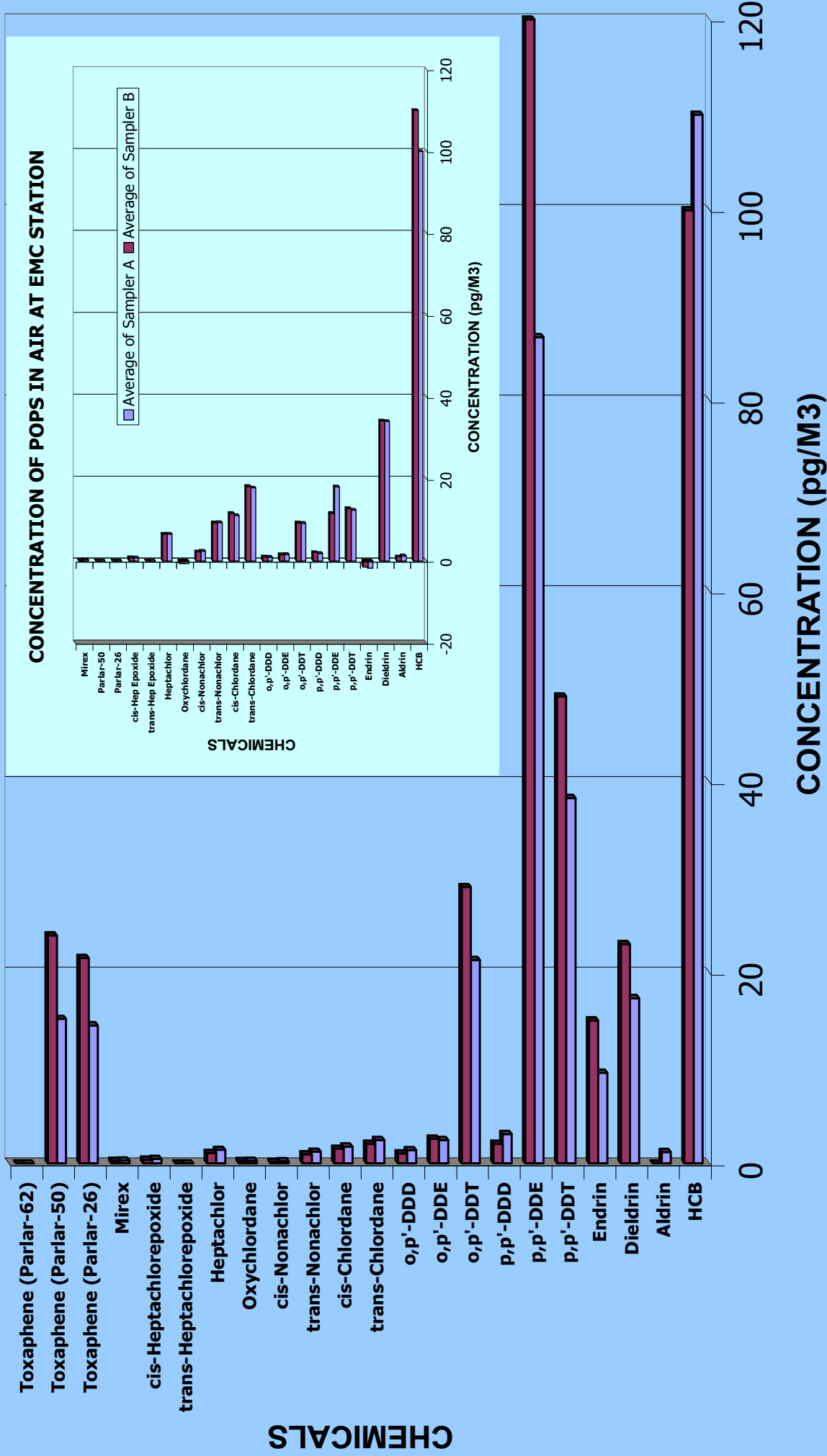
2005

- ◆ **Sampling station**
 - Brastagi, North Sumatera
 - EMC/Pusarpedal Serpong Java
- ◆ **Monitoring Result**
 - Toxaphene was detected in Brastagi Station and no detection on EMC Station
 - HCB was detected extremely high both in Brastagi and EMC
 - p,p'-DDE (derivate of DDT) was also detected extremely high only in Brastagi station

CONCENTRATION OF POPS IN AIR AT BRASTAGI STATION



CONCENTRATION OF POPS IN AIR AT BRASTAGI STATION



Conclusion

- ◆ From several POP chemicals have been investigated, majority DDT or its derivatives were still detected in the environment.
- ◆ **DDT and its derivatives was the main of POPs compounds detected in the environment, especially in the agricultural area.** As its characteristic, the existent of DDT in river sediment or river bank soil were hundred times higher than in water samples
- ◆ All of DDT concentration detected in water samples were lower than environmental water quality standard (2 ug/L) regarding to Indonesia Government Regulation No. 82/2001
- ◆ The existence of DDT in urban area has possibility that those compound was residual impact from the used of DDT for controlling mosquito in urban area in the past.

SUGGESTION

- ◆ Need to expand POPs monitoring especially for DDT contamination in agricultural soil or in area which used to be applied DDT for controlling malaria diseases.
- ◆ PCBs was also necessary to be monitored and controlled , there is no specific treatment for used transformer containing PCBs in Indonesia.
- ◆ Continuous monitoring is still necessary to be carried out, in order to get more representative data of POPs pollution in the environment.
- ◆ Upgrading the capacity in dealing with dioxin, furans, toxaphene
- ◆ Need to expand research concerning to the reduction /elimination of POPs
- ◆ Increasing public awareness concerning to the risk and negative impact of POPs including Dioxin and pollutant source of Dioksin (open burning)
- ◆ Public education to the farmer in order to avoid illegally used of POPs pesticides.
- ◆ Need to build colaboration and coordination among various stakeholder in order to manage POPs

Thank you

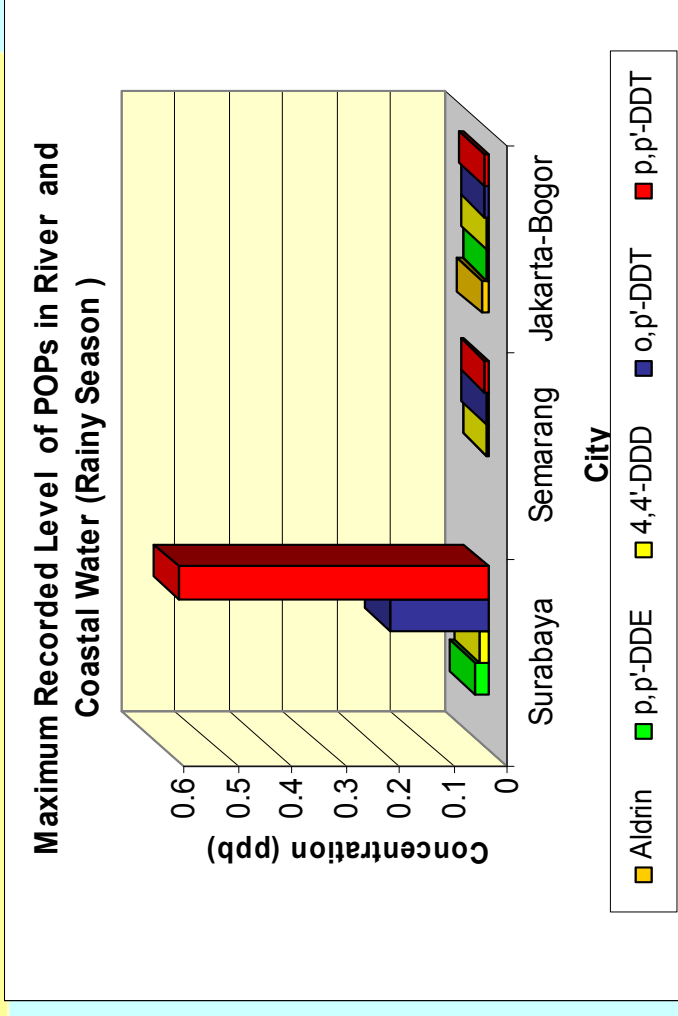
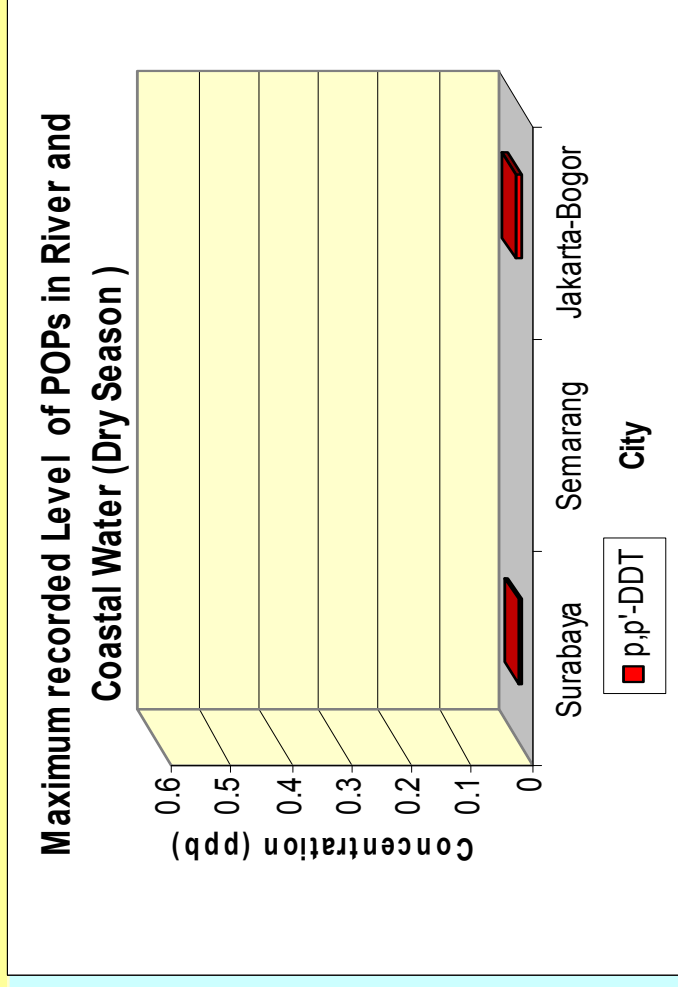


River Water Quality Criteria for POPs Regarding to Indonesia Government Regulation No. 82/2001

Parameter	Unit	Maximum Allowable Concentration Based on Class Category			
		I	II	III	IV
Aldrin / Dieldrin	µg/L	17	(-)	(-)	(-)
Chlordane	µg/L	3	(-)	(-)	(-)
DDT	µg/L	2	2	2	2
Heptachlor and Heptachlor epoxide	µg/L	18	(-)	(-)	(-)
Endrin	µg/L	1	4	4	(-)
Toxaphane	µg/L	5	(-)	(-)	(-)

Category	Relevant Purpose
I	Drinking water sources
II	Water recreation, fishery, live stock farming, irrigation
III	Fishery, live stock farming, irrigation
IV	Irrigation.

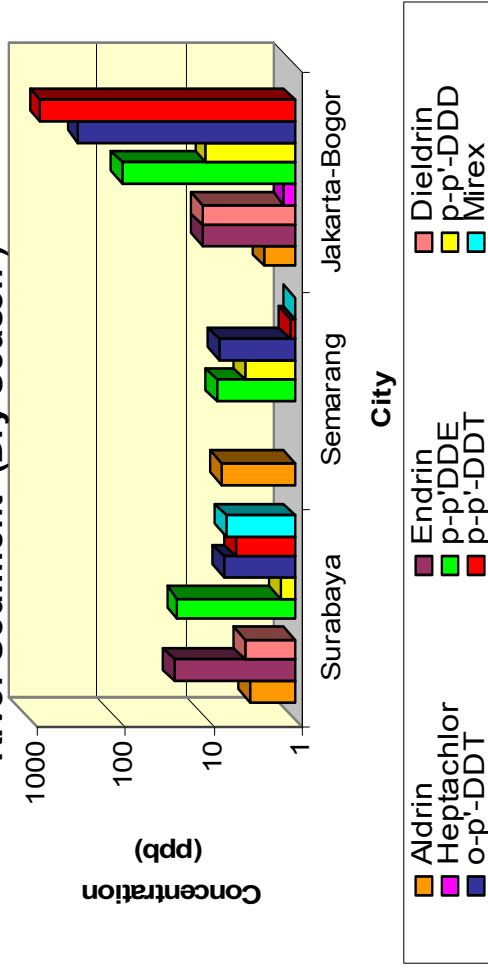
POPs RESULT IN WATER INDONESIA 2004



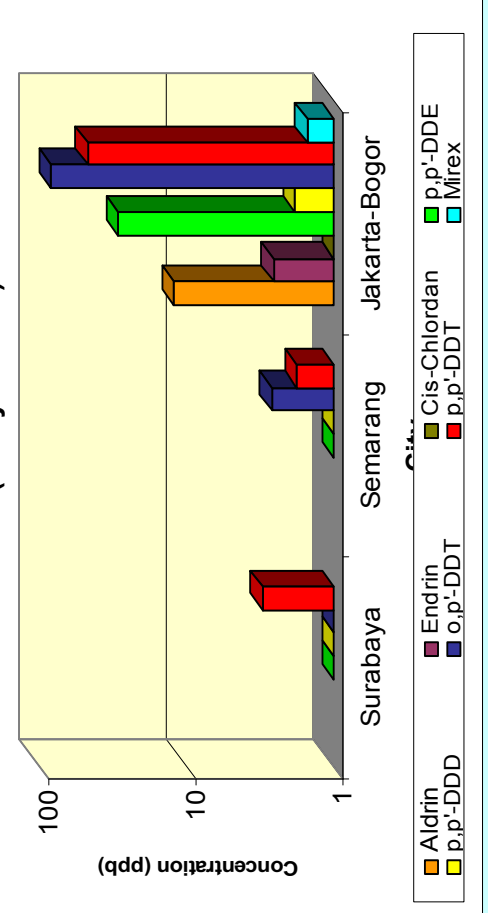
- In dry season only p-p' DDT was detected in some water sample collected from Surabaya and Bogor-Jakarta with low concentration (0.01 µg/L)
- In rainy season DDT and its derivate were detected scattered with the highest concentration detected for pp' DDT in coastal water Tanjung Perak Harbor Surabaya (0.57 µg/L). Maximum concentration of DDT and its derivate majority were detected in Surabaya.
- DDT detected in water samples still below Indonesia environment water quality standard (2 µg/L) regarding to Indonesia government regulation no. 82/2001.

POPs RESULT IN RIVER SEDIMENT 2004

Highest Concentration of POPs Detected in River Sediment (Dry Season)

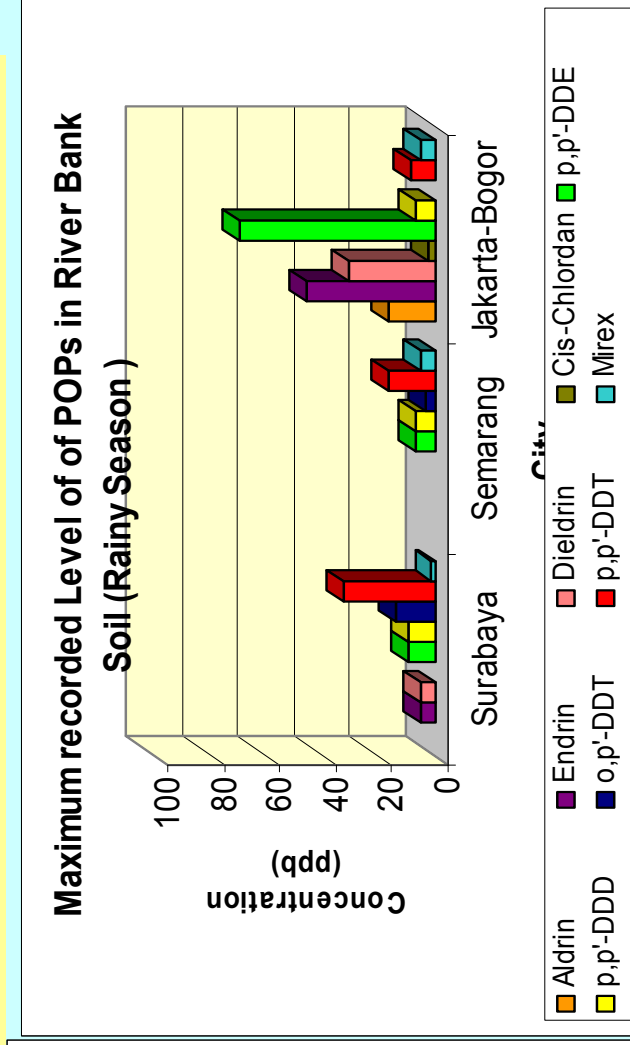
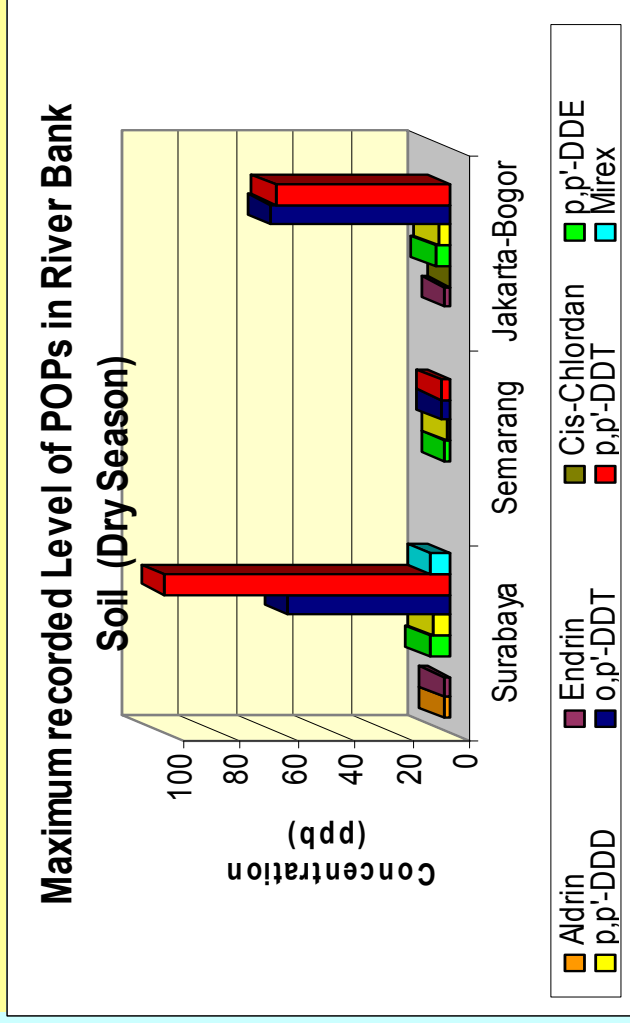


Highest Concentration of POPs Detected in River Sediment (Rainy Season)



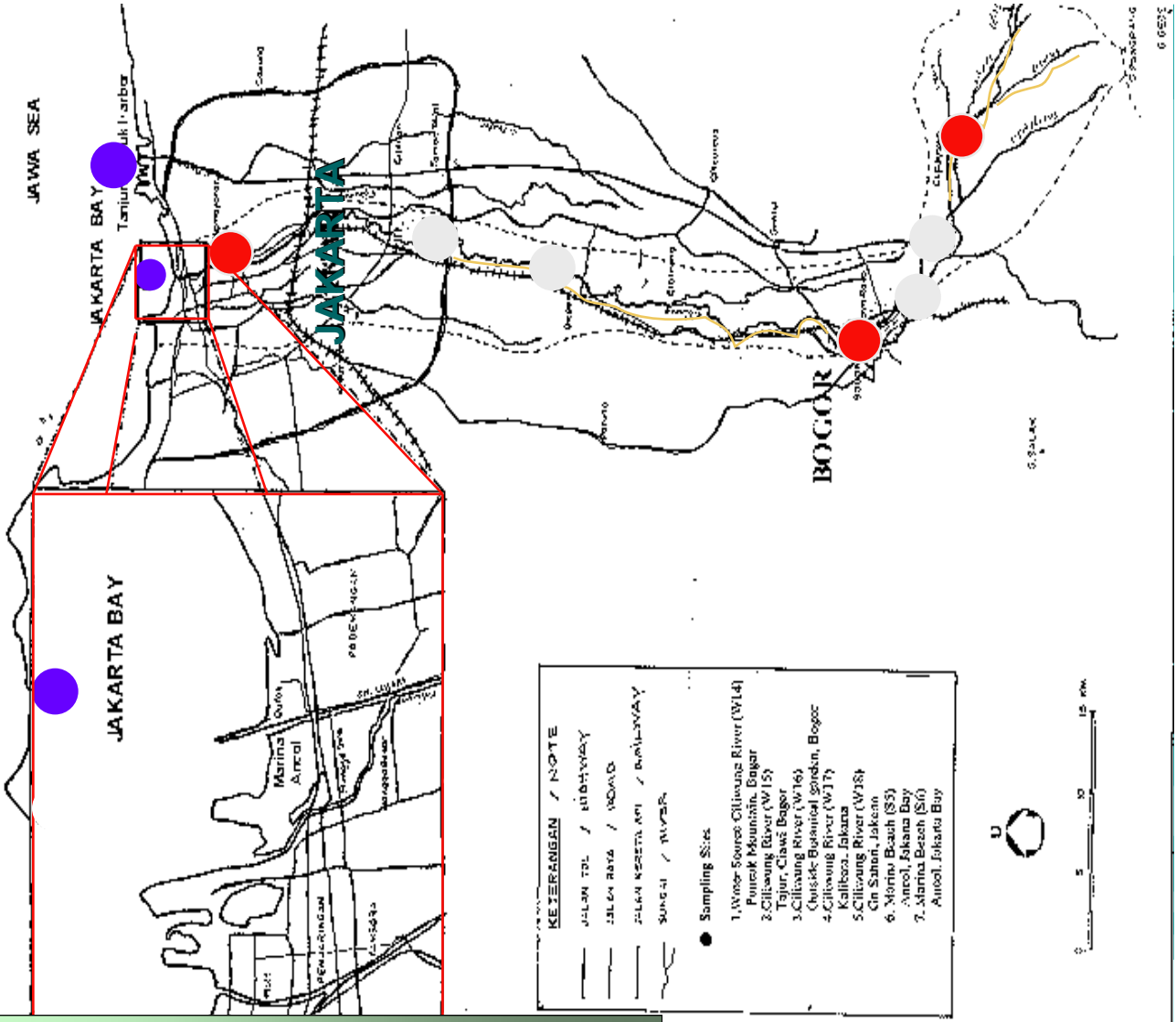
- More POPs and higher concentration of POPs were detected in river sediment during dry season than rainy season. Maximum concentration of POPs detected in dry season have concentration range 1.42 to 22.6 ppb in Surabaya; 0.93 to 7.53 ppb in Semarang and 0.22 to 715 ppb in Bogor-Jakarta meanwhile in rainy season has concentration range 0.05 to 3.07 in Surabaya; 0.69 to 1.78 ppb in Semarang and 0.79 to 84.7 ppb in Bogor Jakarta.
- Sediment samples collected from Ciliwung River located in Jakarta either in dry or rainy season have higher maximum concentration of DDT and its derivatives than sediment from Semarang and Surabaya.

POPs RESULT IN RIVER BANK SOIL 2004

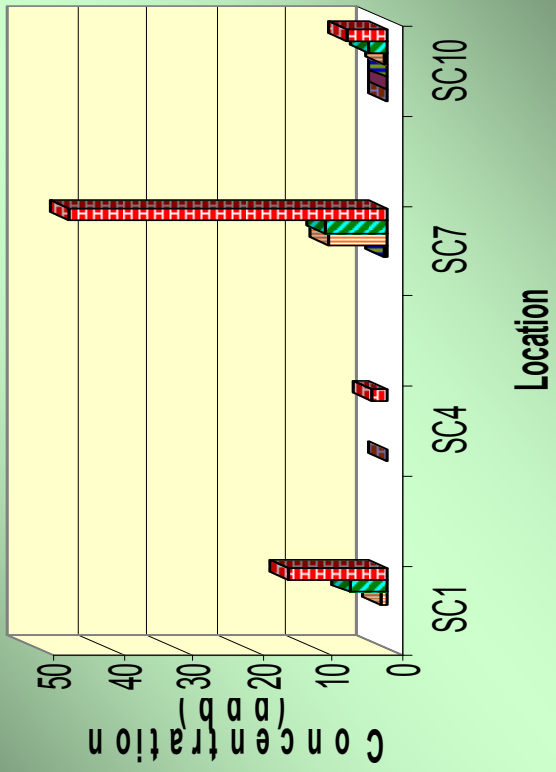


- For river bank soil, maximum concentration of pp-DDT and op-DDT in Surabaya and Bogor-Jakarta were detected higher in rainy season than in dry season, but maximum concentration of pp-DDE, Dieldrin, Endrin and Aldrin were detected higher in rainy season specifically in river bank of Ciliwung River Jakarta.
- Maximum concentration of POPs in soil detected in dry season has range 2.16 to 184 ppb in Surabaya; 1.76 to 3.46 in Semarang; 2.12 to 61.5 in Bogor-Jakarta, meanwhile in rainy season has range 1.18 to 32.9 ppb in Surabaya; 3.56 to 17 ppb in Semarang and 0.08 to 47.7 ppb in Bogor-Jakarta.

POPs Concentration in Sampling Sites Bogor-Jakarta 2004



Concentration of POPs in Sediment Bogor-Jakarta 2007



B

- Ciliwung River sampling sites
- Sea water sampling sites

Effects of POPs on Health and Environment

■ **Conclusive evidence :**

Bird of prey population declined caused by DDE

DDT disturbs sexual development and behaviour in bird such as gulls

Strong indications that :

- The capacity of the immune system is impaired by DDT

- Lactation in women can be impaired by DDT/DDE

- Children in northern Quebec region of Canada who have had significant exposure to PCBs, dioxin and furans through breast milk also had a higher incident of middle ear infections than children who had been bottle fed.