



Sustainable Groundwater Quality Management in Asia

(アジアにおける持続可能な地下水質管理)

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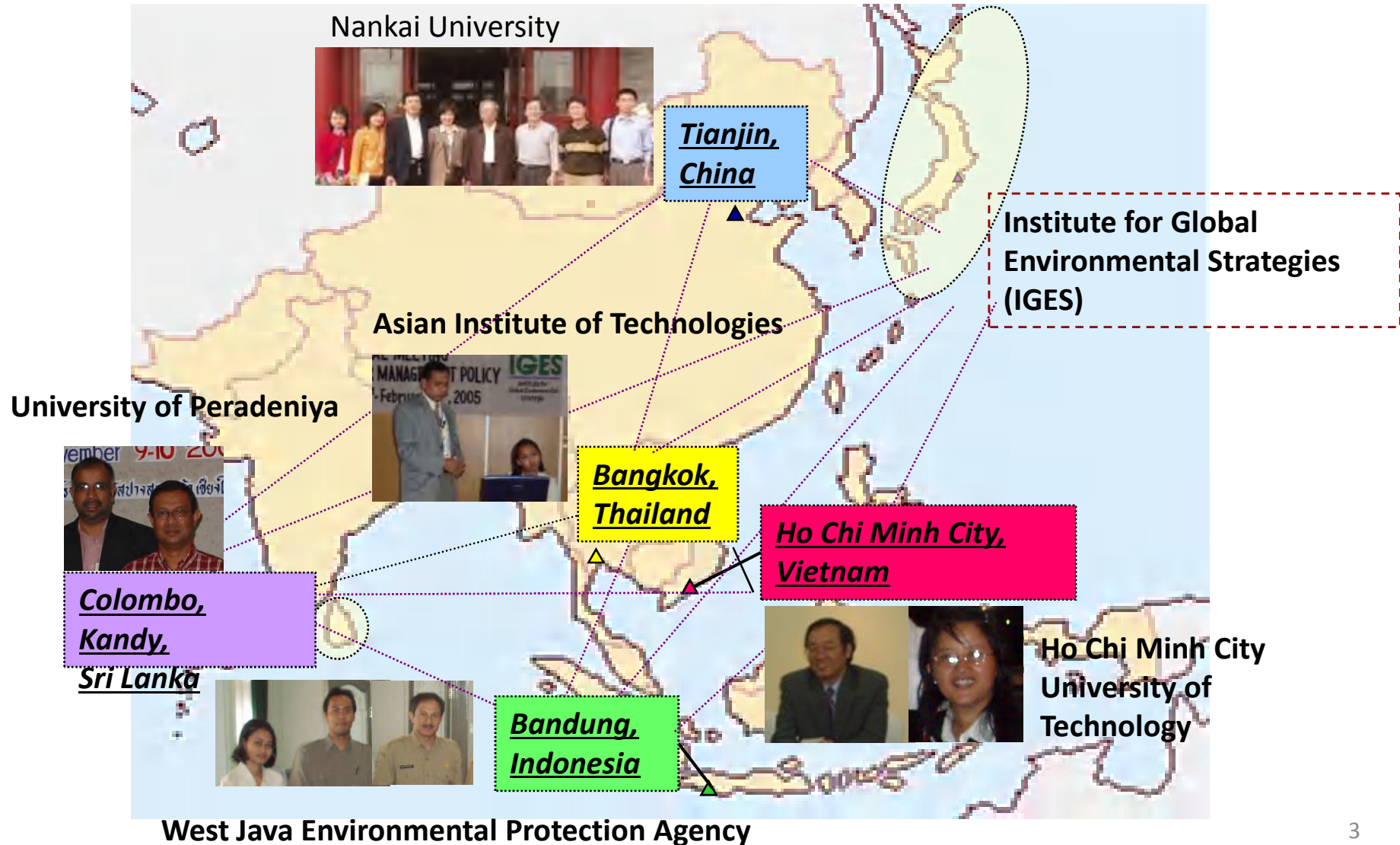
Institute for Global Environmental Strategies

(地球環境戦略研究機関 淡水プロジェクト研究員)

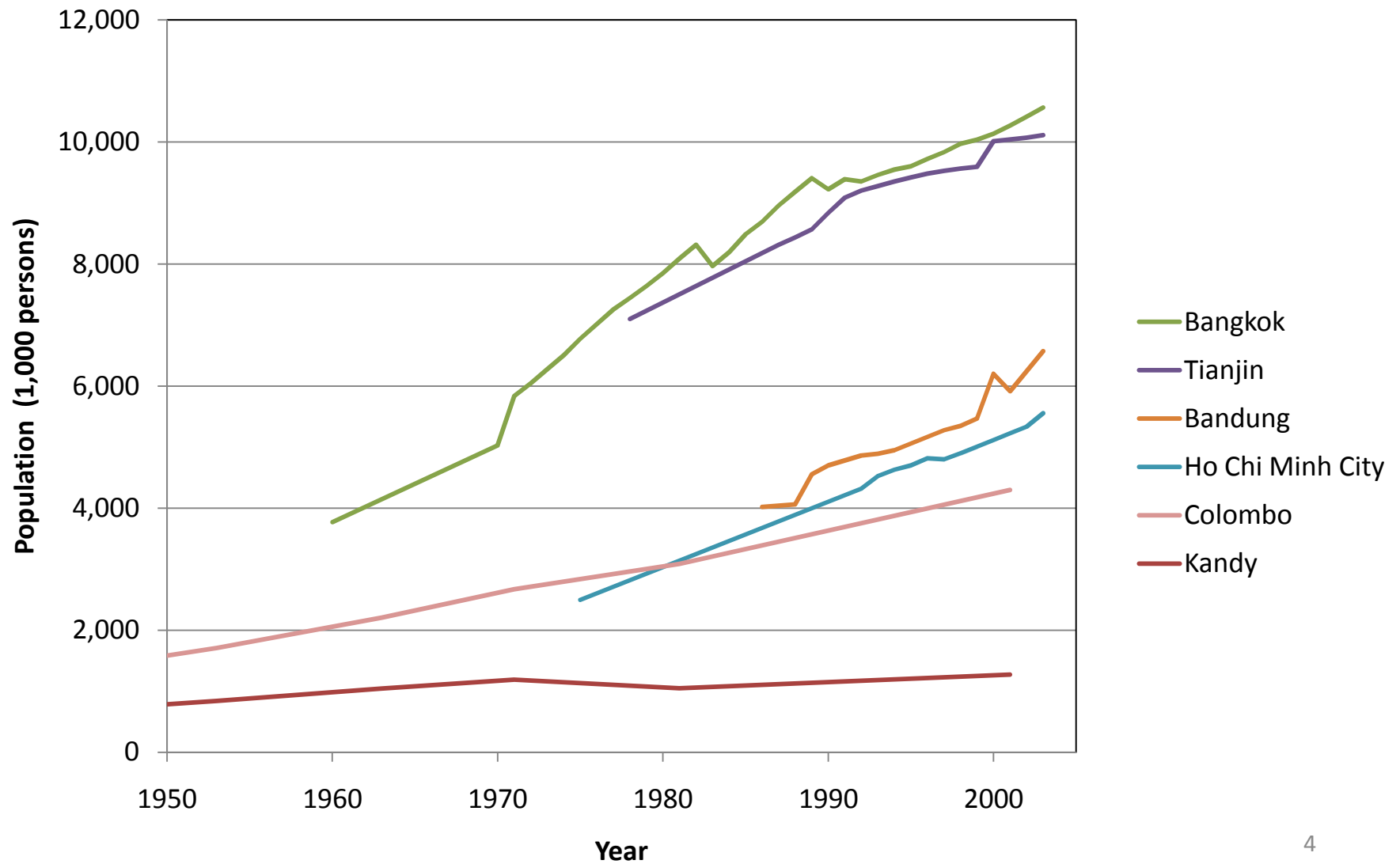
Presentation Outline (発表の概要)

- (1) Groundwater Use for Domestic Purpose in Asian Cities
- (2) Groundwater Quality Management in Asian Cities
- (3) Groundwater Contamination in Asian Cities
- (4) Countermeasures taken for Groundwater Contamination
in Asian Cities
- (5) Key Message for Sustainable Groundwater Quality
Management in Asia

Research on Sustainable Water Resource Management Policy (SWMP)



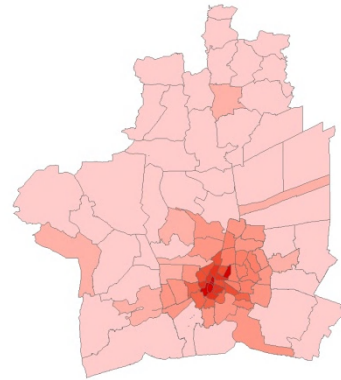
Increasing Population in Asian cities (増加するアジアの都市人口)



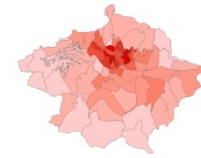
Population Density (都市の人口密度)



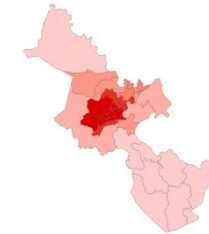
Tianjin
11,919 km²



Bangkok
10,315 km²



Bandung
2,341 km²



Ho Chi Minh City
2,095 km²

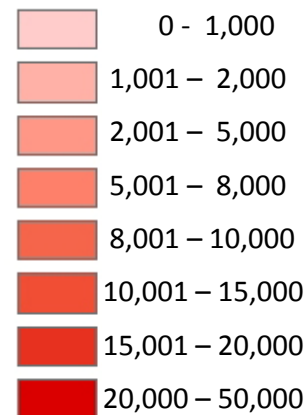


Colombo*
1,575 km²



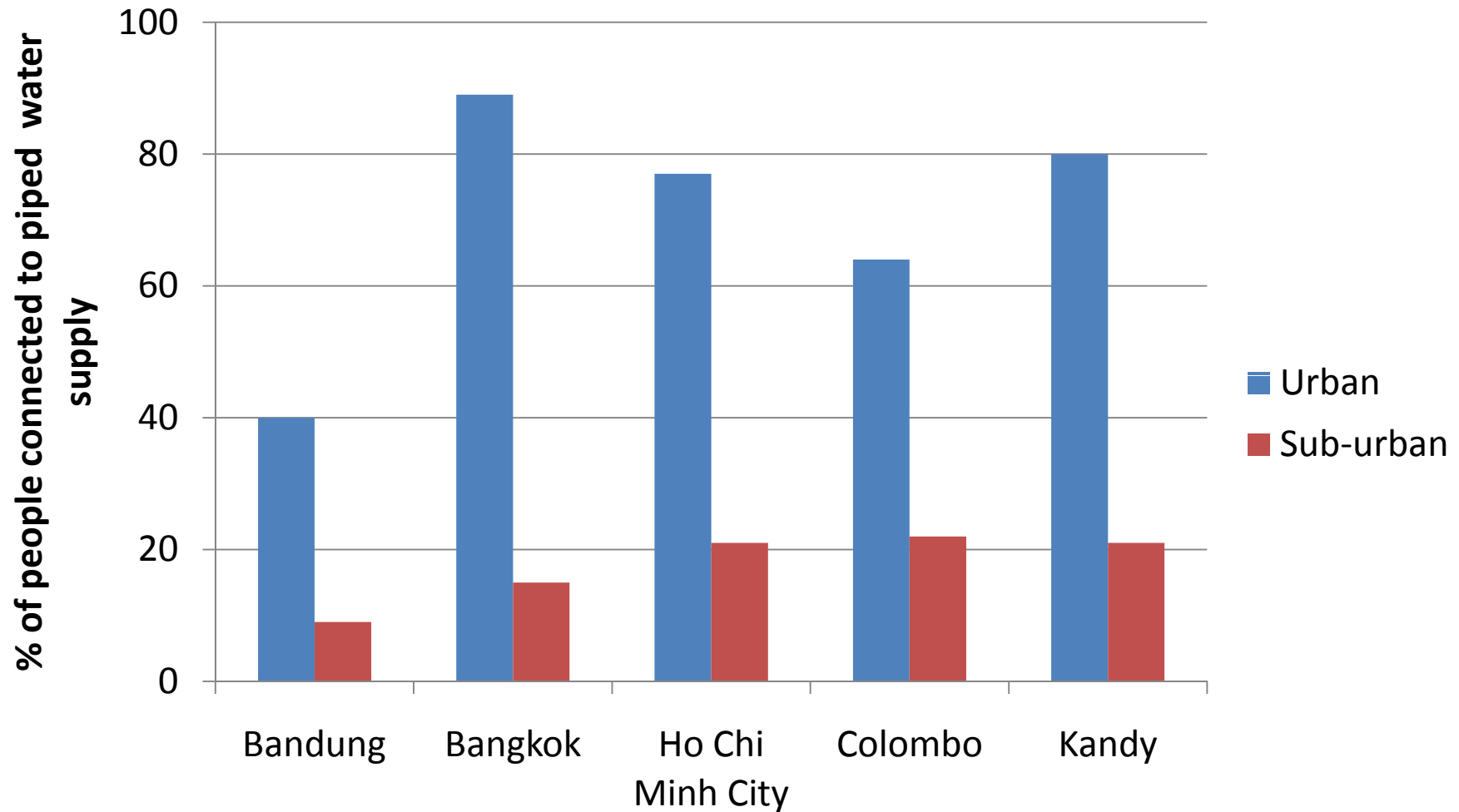
Kandy
322 km²

Population Density (persons/km²)



0 30 60 km

Low coverage ratio in sub-urban area (都市周辺部の低い水道普及率)



Population with access to piped water supply
(水道にアクセスできる人口)

High Dependency on Groundwater for Domestic Purpose (家庭用水における地下水の高い依存度)

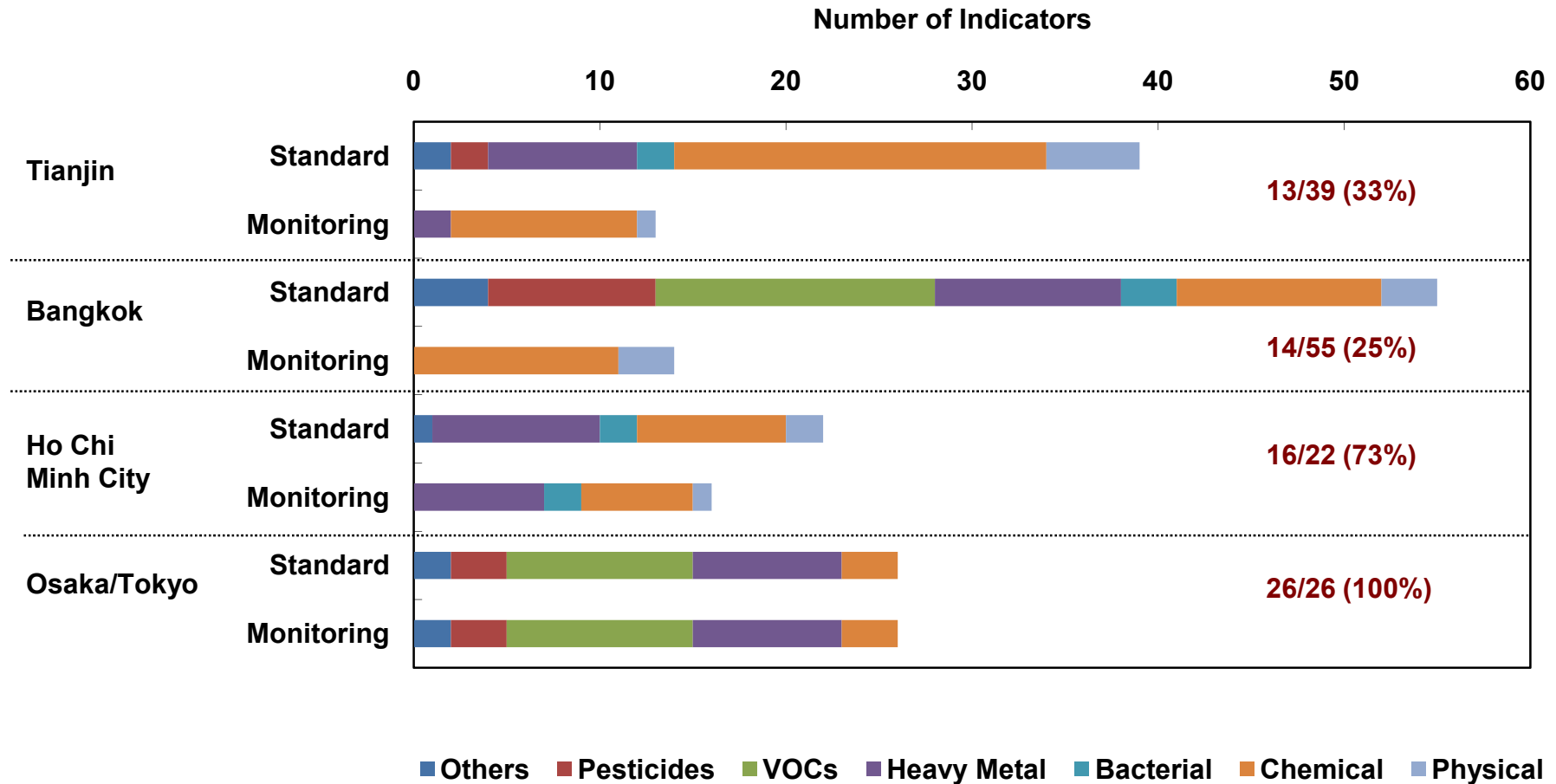
City	Year	Groundwater Use (m ³ /day)	Total Water Use (m ³ /day)	Groundwater Dependency (%)
Tianjin	2004	386,301	846,575	46
Bangkok*	1996	476,438	6,471,973	7
Ho Chi Minh City	2005	226,000	unknown	-
Bandung	2000	394,013	670,501	59
Colombo	2001	234,000	625,399	37
Kandy	2000	41,000	83,225	49

*Chao Phraya and Tha Chin River Basin

Outline of Groundwater Quality Management (地下水質管理の概要)

		Tianjin	Bangkok	Bandung	Ho Chi Min City
Law /Regulation	Name	Law of the People's Republic of China on Prevention and Control of Water Pollution	Enhancement and Conservation of National Environment; Quality Act,1992	Government regulation No82/2001 on water quality management and water pollution control	Law on Environment Protection, 2005
	Content	Pollution control for groundwater	Conservation of public water resources including groundwater	Water quality management and pollution control	Groundwater environment protection
Groundwater quality standard	Name	Quality standard for groundwater (GB/T 14848-9)	Groundwater Quality Standard(Groundwater Quality Standard for Drinking purpose)	Water quality standard (for public water including groundwater)	Groundwater Quality Standard (TCVN5944-1995)
	categories, Parameter	5 categories, 39 parameters	38 parameters	4 categories, 41 parameters	22 parameters
Monitoring	Implementing agency	Tianjin Water Conservancy Department	Department of Groundwater Resources	West Java Mining and Energy Agency	Department of Natural Resources and Environment
	Number of sampling points	unknown	117 (304 wells)	36	40 (86 wells)
	Frequency	unknown	1-3 time/year	unknown	1-4 time/year
	Parameter	13	14	unknown	16

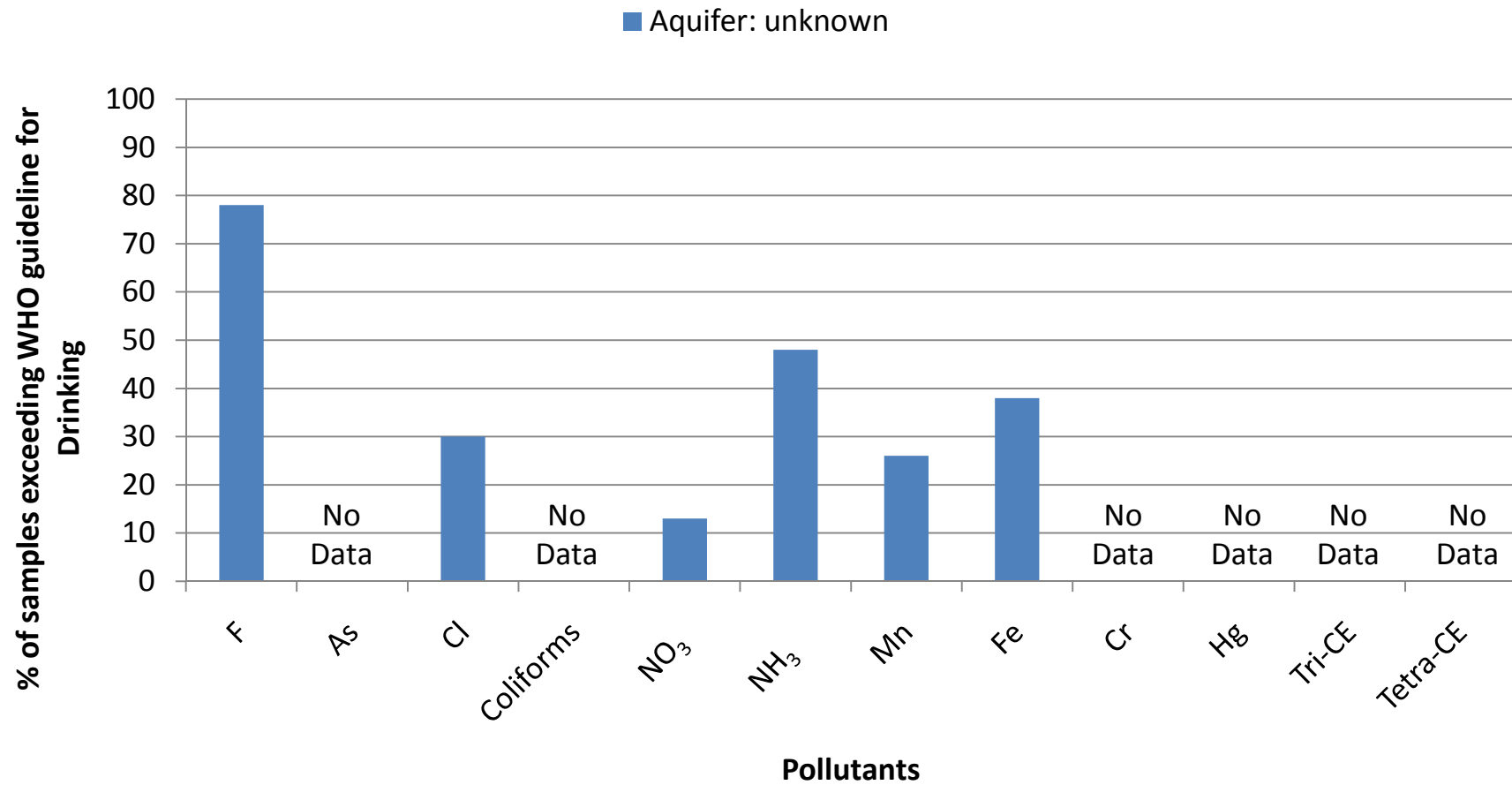
Monitoring Status (モニタリングの状況)



Difference between number of indicators designated in the groundwater quality standard and those actually tested.

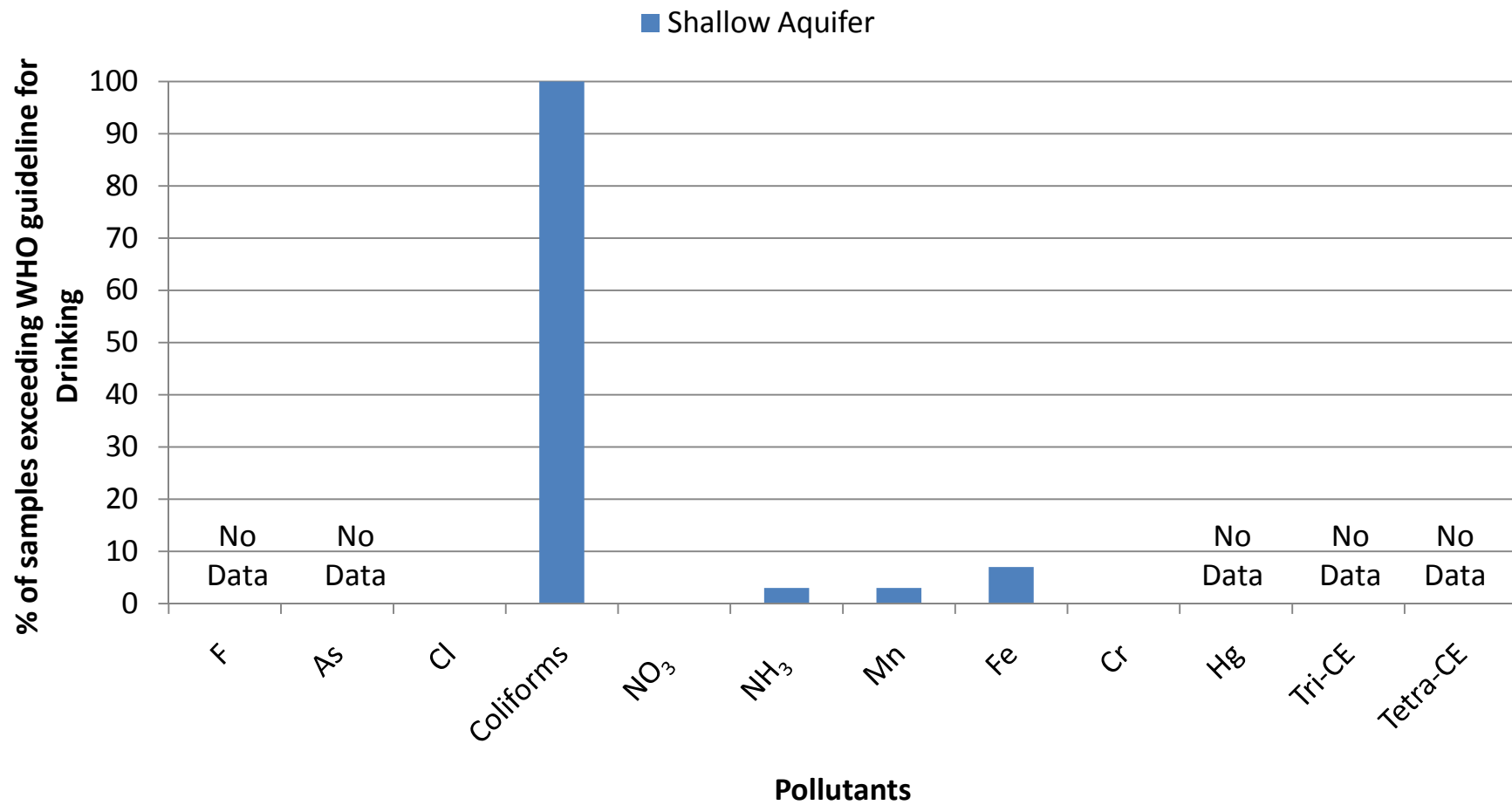
Groundwater Contamination in Tianjin (天津市の地下水汚染の状況)

Tianjin(2002): Fluoride



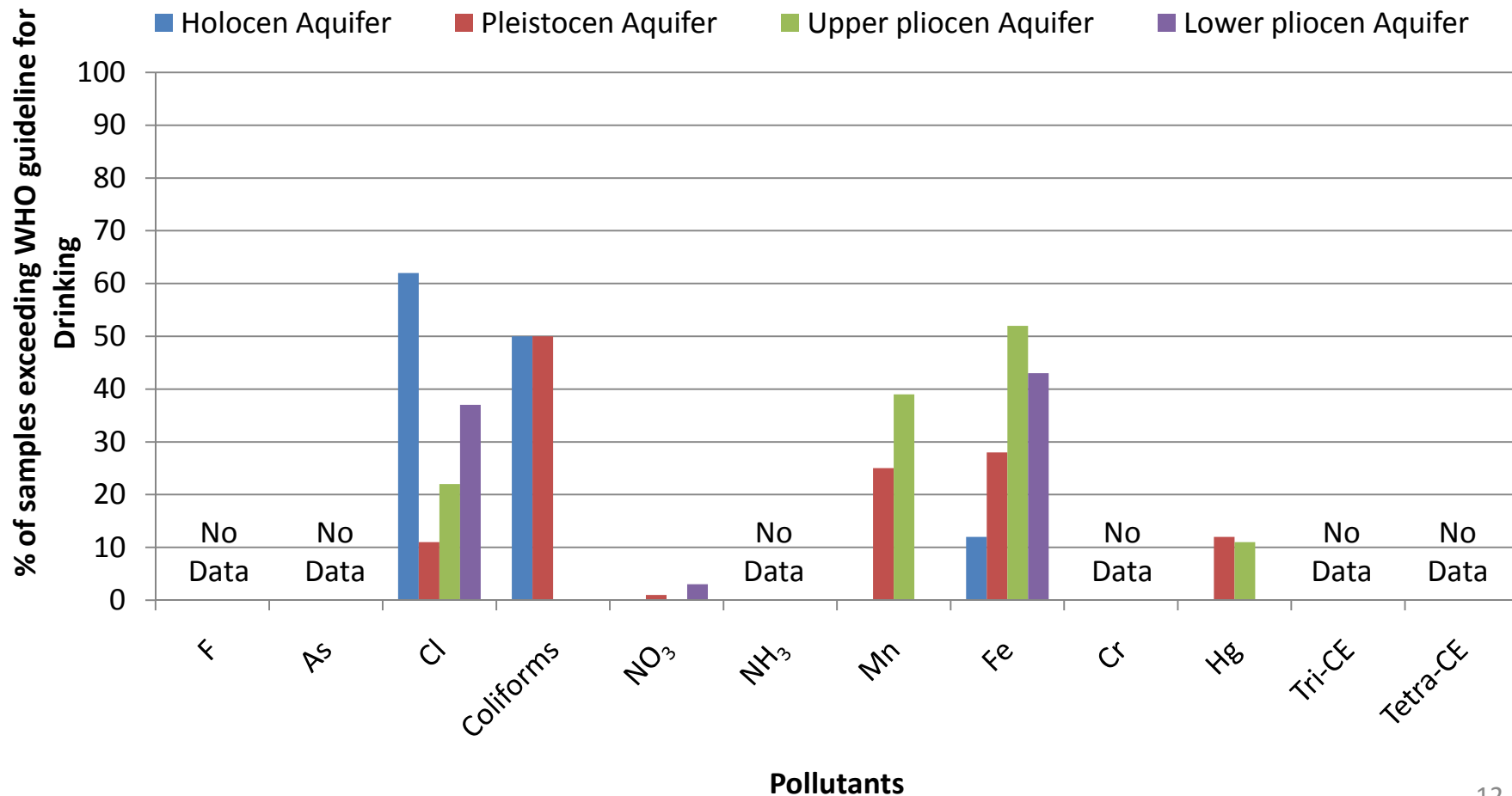
Groundwater Contamination in Bandung (バンドンにおける地下水汚染の状況)

Bandung(2008):Coliform



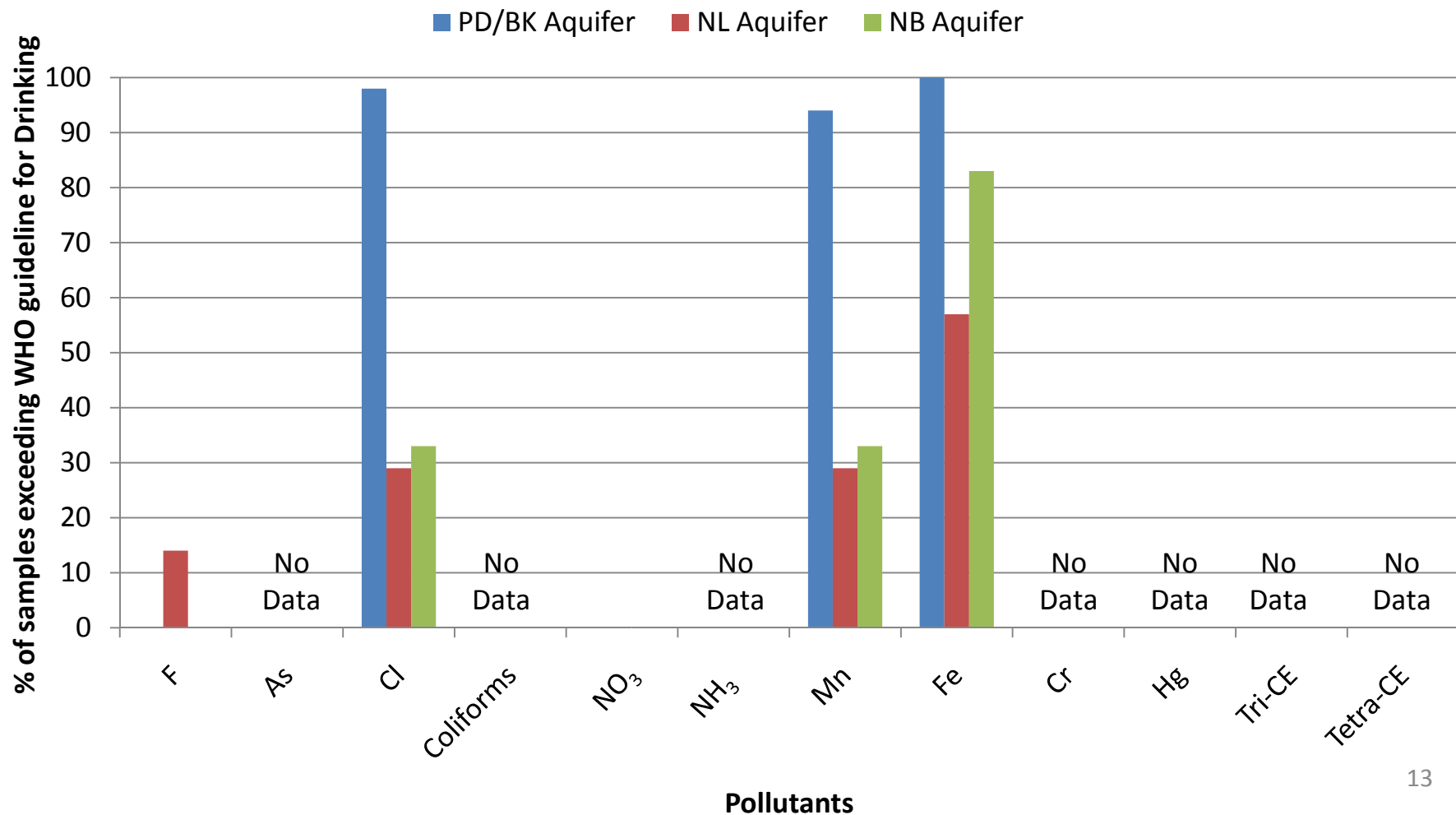
Groundwater Contamination in Ho Chi Minh City (ホーチミン市における地下水汚染の状況)

Ho Chi Minh City(2004): Chloride, Coliform, Manganese ,Iron

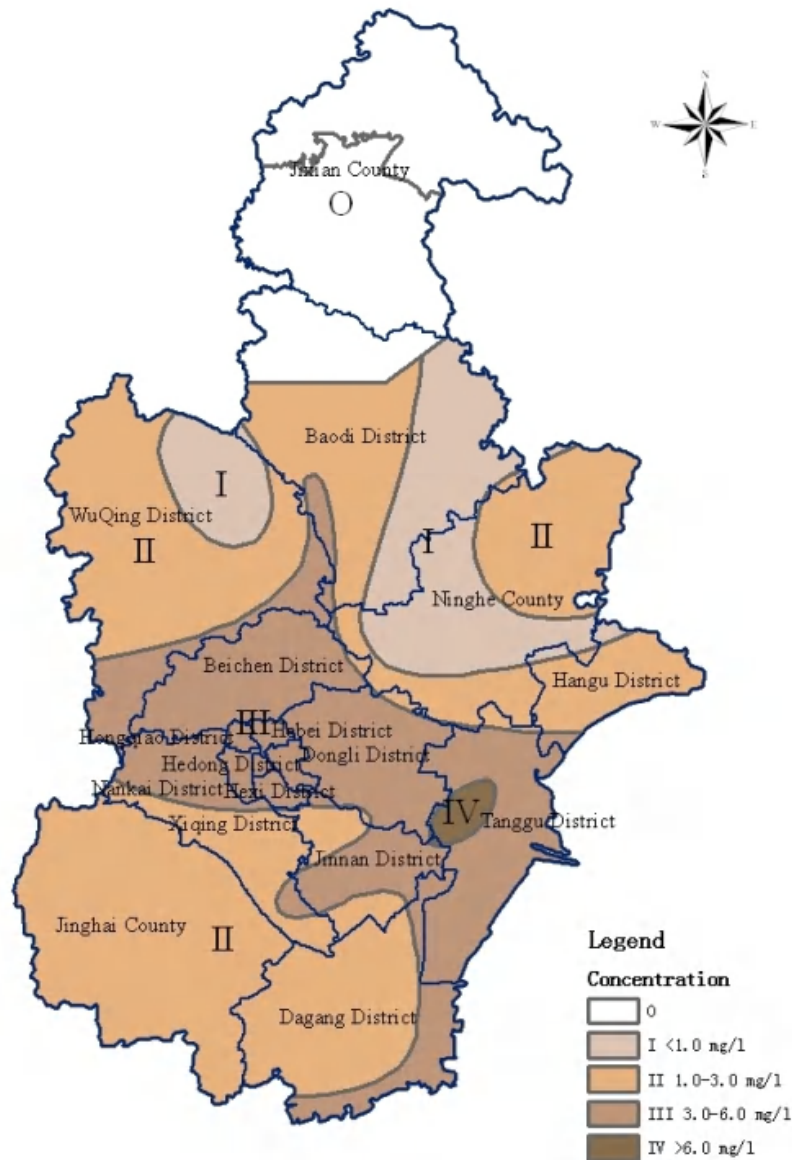


Groundwater Contamination in Bangkok (バンコクにおける地下水汚染の状況)

Bangkok(2001): Chloride, Manganese, Iron



Fluoride Contamination in Tianjin (天津市のフッ素汚染)



Fluoride contamination in Confined Aquifer III

Source:

Report on the Distribution Law and
Formation Mechanisms of the Major
Pollutants in Tianjin Groundwater

Health Impact of Fluoride Contamination in Tianjin (天津市のフッ素汚染の健康への影響)

Morbidity and Dean Index of Dental Fluorosis in Tianjin (1995)

Area	Age	Morbidity (%)		Dean Index	
		Tianjin	National Average	Tianjin	National Average
Urban	12	41	5	1.02	0.13
	15	32	4	0.85	0.13
Rural	12	73	10	1.83	0.24
	15	78	12	1.92	0.27

Countermeasures Taken for Fluoride Contamination in Tianjin (天津市におけるフッ素汚染の対策)

Countermeasures : Treatment of polluted water

(1) Water Improvement and Defluorination Projects in Tianjin Rural Area

- construction of 58 defluorination water-supply stations in 2006-2010
- safe water will be available for 225,300 people

(2) Rural Safe Drinking Water Project in Jin Nan District (88.9 million yuan (13 million USD))

- construction of groundwater treatment plants (46 sites)
- installation of canned defluoridation devices (47 sites)
- safe water will be available for 103,596 people

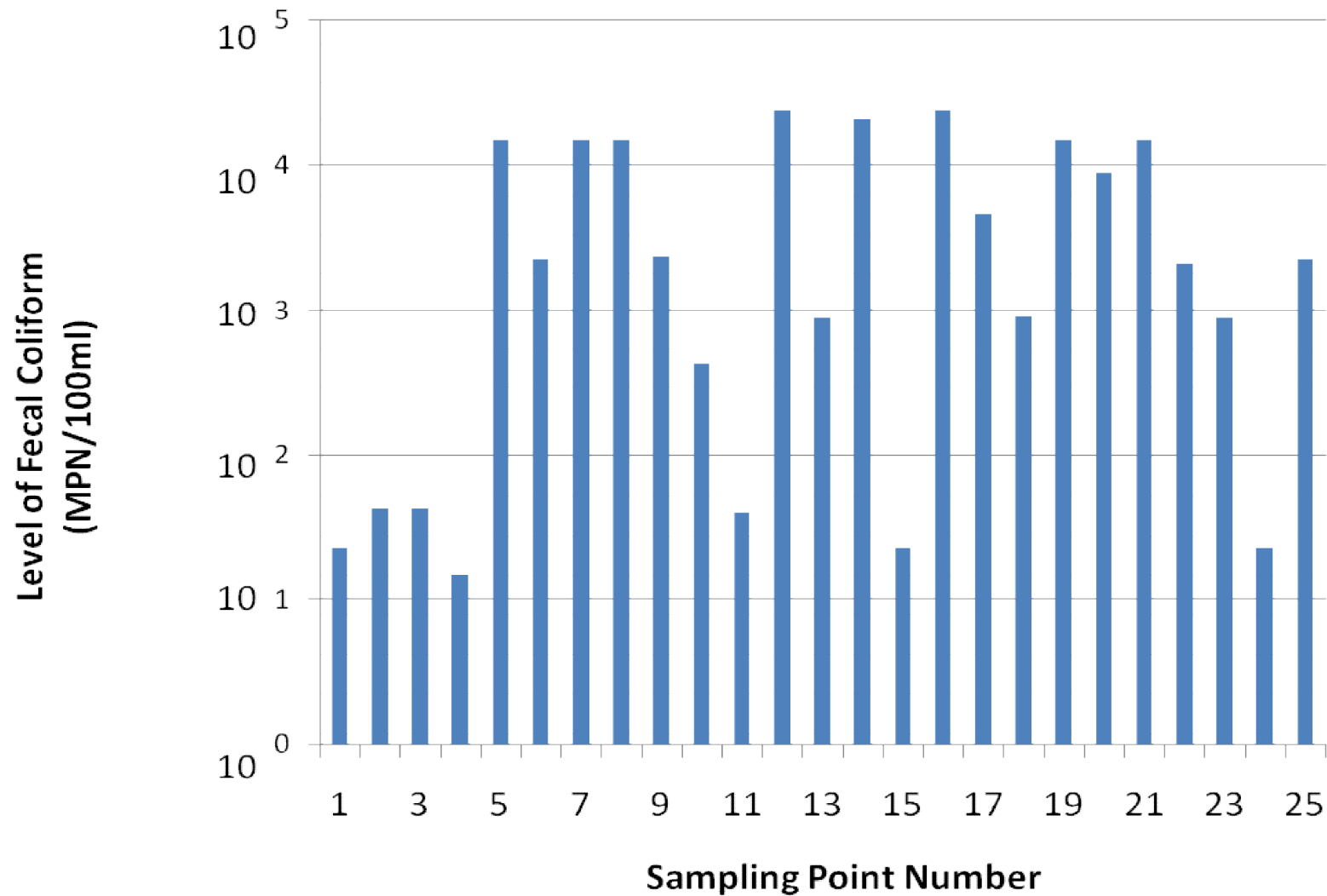


Groundwater treatment plant in Tianjin



Groundwater treatment plant in Tianjin

Fecal Coliform Contamination in Bandung (バンドンにおける糞便性大腸菌汚染)



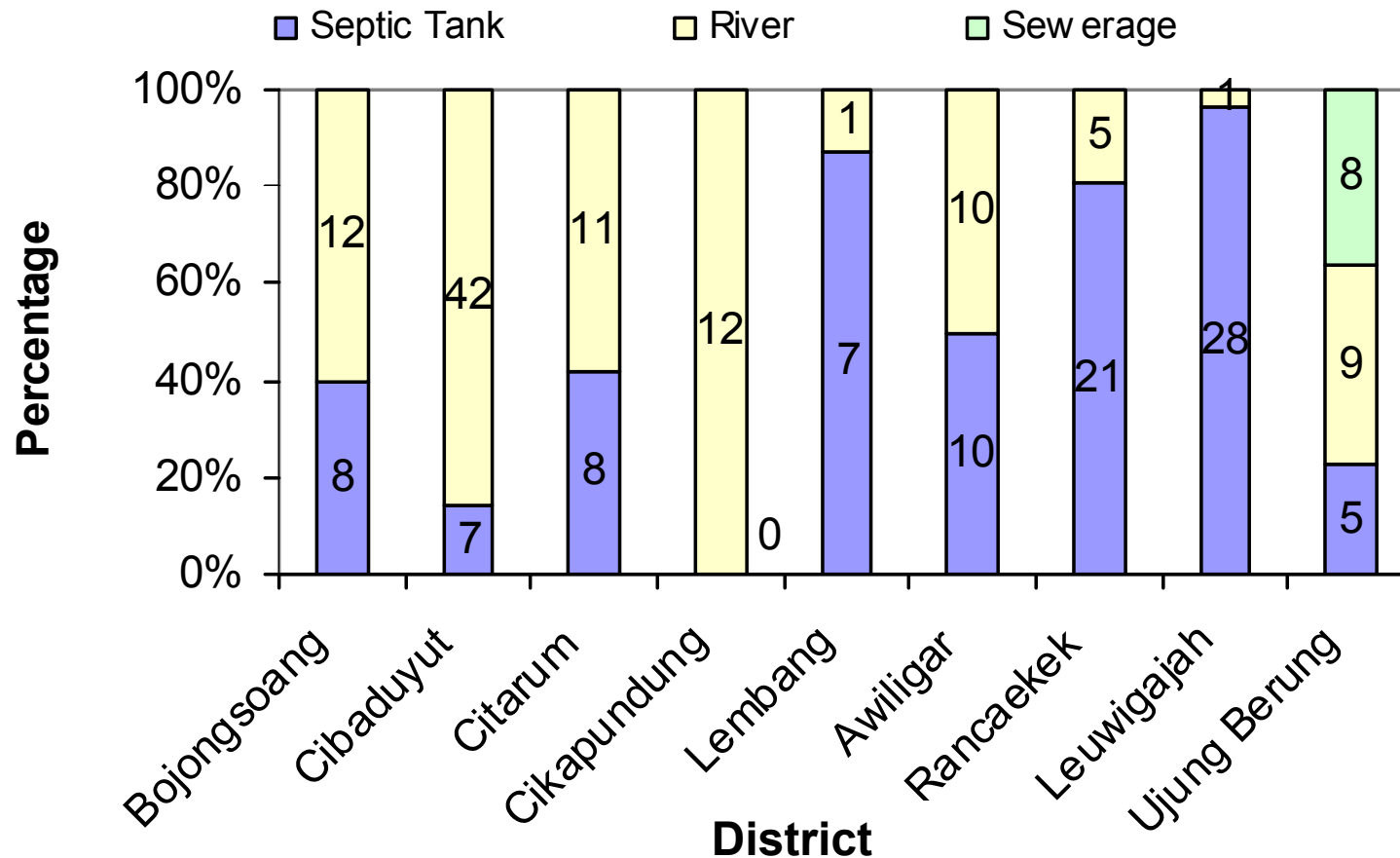
Fecal Coliform Level in Shallow Aquifer (2004)

Situation of Sanitation Facility in Bandung (バンドンにおける衛生施設の状況)

Interview Survey in Bandung (2007)

Survey Area: 205 households in 9 districts

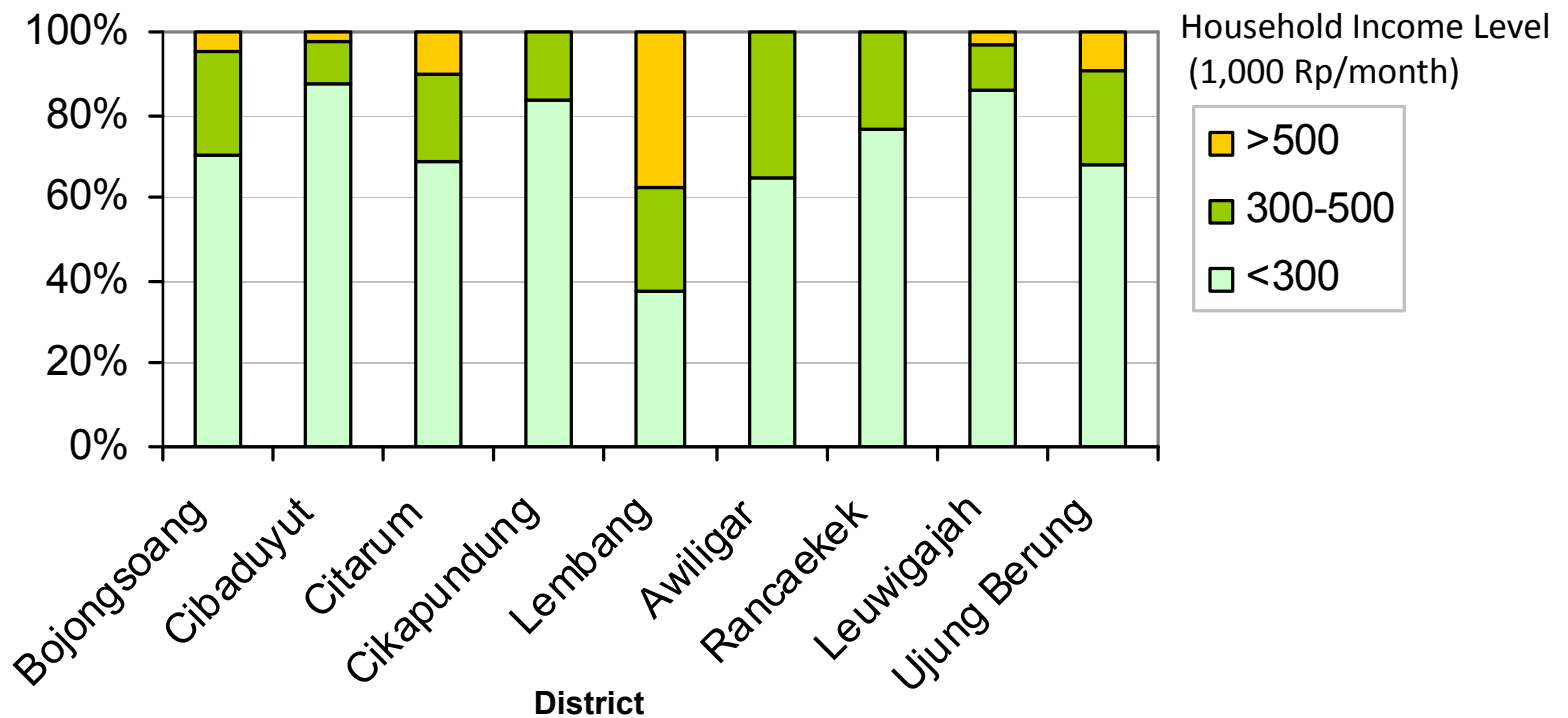
Question : Where is the domestic waste water discharged?



Affordability of Sanitation Facility (衛生施設の支払い負担能力)

Cost for proper septic tank installation (1,600,000 Rp or USD 177) is far more than household income level (< 300,000 Rp or USD 33/month)

→ Immediate improvement of current sanitary condition is difficult due to the low affordability of a proper sanitation facility



House hold Income Level in Survey Area

A Countermeasure Taken for Fecal Coliform Contamination in Household

(家庭における糞便性大腸菌汚染対策)



Storage tank of groundwater in household (Bandung)

Groundwater Contamination in Ho Chi Minh City (ホーチミン市における地下水汚染)

Percentage of Samples exceeding WHO Guideline for Drinking (2004)

Aquifer	pH	Coliforms	Chloride	Nitrate	Mn	Fe
Holocen	63	50	63	0	-	13
Pleistocen	82	50	11	1	25	23
Upper pliocen	78	-	22	0	39	43
Lower pliocen	67	-	37	3	-	40

Countermeasures Taken for Groundwater Contamination in Ho Chi Minh City (ホーチミン市における地下水汚染対策)

- (1) Rural water supply program (UNICEF/EU)
 - construction of 5, 221 boreholes for domestic use
 - installation of 500 iron removal system

- (2) Expansion of piped water to contaminated groundwater area

Countermeasure Taken in a Community (コミュニティにおける対策)



Sand Filtration of Community Groundwater Supply System (Ho Chi Minh City)

Countermeasure Taken at Household Level (1) (家庭における対策)



Groundwater purification system in household (Ho Chi Minh City)

Countermeasure Taken at Household Level (2) (家庭における対策)



Bottle Water (Ho Chi Minh City)

Price of Bottle Water: 61-67 USD/m³

⇔ Price of Tapped Water: 0.1-0.5 USD/m³

Summary (まとめ)

- (1) Domestic groundwater use is high in Asian cities.
アジアの都市では家庭用水に占める地下水利用の割合が高い。
- (2) As identified groundwater pollutants differ from city to city, policy measures taken in each city also differ.
問題となっている汚染物質は都市ごとに異なるため、対応も異なっている。
- (3) Public sectors in each city try to mitigate groundwater contamination. However, they are facing difficulties in implementation. To protect themselves from the risk of groundwater contamination, households have already taken their own countermeasures, such as boiling, installation of purification systems, adding of the chemicals for disinfection, and purchase of bottled water.
各都市の行政機関は地下水汚染を低減しようと試みているが、困難に直面している。一方、一般家庭では自己防衛的に、煮沸、浄水器の設置、消毒剤の添加、ボトル入り飲料水の購入等を行っている。

Key Messages for Sustainable Groundwater Quality Management in Asia (アジアにおける持続可能な地下水質管理へのメッセージ)

Strengthening groundwater quality management is a very important policy agenda, considering that groundwater will be continuously used for domestic purpose in Asian cities as the main source of drinking water or supplementary source of tapped water.

アジアの都市部において、地下水が主要な飲料水源として、また、水道水供給を補完する水源として利用され続けると考えられる。よって地下水質管理の強化は非常に重要な政策課題のひとつである。

Groundwater quality management by public sector is now facing difficulties in implementation. For better groundwater management, a new framework of groundwater quality management should be developed in which all stakeholders such as companies, communities and households are involved.

行政機関による地下水質管理は現在、実施上の問題を抱えている。より良い地下水質管理を実現するためには、企業、コミュニティ、一般家庭といった全てのステークホルダーを巻き込んだ新たな地下水質管理の枠組み作りが必要となっている。

Thank you
ご静聴ありがとうございました