Annex 2-3:
Lecture Materials for Training

2.3.1 Environmental Management

The Capacity Development of Environmental Monitoring at Directorates for Environmental Affairs in Governorates

Basic Environmental Monitoring Course
Lecture-1: Environmental Management

June 2005

The JICA Expert Team

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Training Program of the Basic Environmental Monitoring Course

1. Lecture for Basic Environmental Monitoring
   - -Basic Understanding of Environmental Management & Monitoring
   - -Primary Knowledge and Practical Skills of Chemical Analysis
   - -Introduction of Field Training
2. Field Training in DFEA
   - -Practical Skills of Sampling, Analysis, and Data Management
   - -Planning and Implementation of Environmental Monitoring
3. Follow-up Training
   - -Review of Field Training and Trouble Shooting
   - -Presentation by GCEA and DFEA about Environmental Monitoring
   - -Continuation of Actual Practice

2

Lecture for Basic Environmental Monitoring Lecture-1 to 12

(1)Necessity of Environmental Management (Lecture-1 to 2)
- 1)Lessons of Japan
- 2)Overview of Environmental Management and Monitoring
- 3)Enforcement of Environmental Measures
- 4)Water and Air Monitoring

(2)Basic Theory of Water Quality Analysis (Lecture-3 to 9)
- 1)Equip. & Structure of Monitoring
- 2)Sampling, Analytical Theory and Skills, Lab O/M

(3)Data Management and Public Awareness (Lecture-10 to 11)
- 1)Objectives and Key Points
- 2)Approach to the Project

(4)Summarisation (Lecture-12)
- 1)Discussion, Q and A
- 2)Evaluation
- 3)Certification Conferment

3

Lecture-1: Environmental Management

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Lecture-1: Environmental Management

1. Lessons of Japan
2. Environmental Management Plan
3. Enforcement of Environmental Protection

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Lecture-1: Environmental Management
1. Lessons of Japan

(1)Rapid Economic Growth & Environmental Pollution

1)Changes of Social and Economic Situations
- -after 1955: in the process of high economic growth
- -aggressive public and private investment on heavy industry for export, e.g. chemical industry
- -import raw materials=export final products=a lot of residues of pollution substances

2)Changes of National Land Use for Industry
- -natural resources (air, water, land) consuming type industry
- -strategic location mostly for economic viewpoint (industrial complex, nearby residential area)
- -careless/ignorance of environmental protection

3)Delay of Social Infrastructure Development related to Environmental Pollution
- -low priority on national budget allocation to environmental infrastructure (sewerage pervasion)
- -5.3 % of total national budget (1970)=1/8 that for road construction

6

Lecture-1: Environmental Management
1. Lessons of Japan

(2)Spread over the Pollution

1)Water Quality Pollution=Ecological Impacts=Damage to Human Health

2)Minamata disease, Itai-Itai disease, Niigata Minamata disease, Yokkaichi Asthma

3)Damage on Fishery, Drinking Water Facilities

(3)Socail and Public Response

1)Citizens:
Violent Fight with Polluters by Fishermen=Safety on Human Life and Economic Activities

2)National Government:
Priority on Economic Growth=Harmonization with Industry Development=Reluctant to strong Enforcement on Environmental Protection

3)Local Government:
Dilemma between Inducing Industry and Environmental Protection=No clear National Policy=Ordinances for Pollution Prevention

Lecture-1: Environmental Management
1. Lessons of Japan

(4)Comprehensive Measures against Environmental Pollution (1966)

1)Pollution control based on Environmental Quality Standards

2)National Pollution Control should be integrated with local preventive measures

3)National and Local Governments are responsible for public investment on pollution control

4)Environmental Quality Standards be set each pollutant category for protection of human health and the environment

5)Government organization be established for pollution control policies= M. of Environment (1970) & National Institute for Environmental Research Center (1974)

6)A Law of Pollution Control be enacted to provide the common principles and basic policies for pollution control=Basic Law for Environmental Pollution Control (1970)

Lecture-1: Environmental Management
1. Lessons of Japan

(5)Pollution Session of the Diet (1970)

1)Basic Position of the National Government on Pollution Control
-Deleting "Harmonization Provision"=Pollution Control First from the Basic Law for Environmental Pollution Control

2)More Stringent Control
-Control to be extended to the whole country, not only polluted areas
-Additional pollutions (7) be under control=Air, Water, Soil, Noise, Vibration, Ground subsidence, and Offensive Odor

3)Identification of the Responsibility of Business Enterprises
-Business activities be subject to stringent control
-Enacted the Pollution Control Public Works Cost Allocation Law=pollution control cost be included into plans for new ventures

4)Strengthen the Enforcement Power of Local Government
-Locally specific solution
-More stringent standards and control in addition to the uniform national regulatory standards
-Enforcement authority be almost completely transferred to the local government

Lecture-1: Environmental Management
1. Lessons of Japan

(6)Lessons Learnt-1

1)Victims: Physically handicapped & Socially handicapped Citizens

2)Recognition: Absolute Loss of Human Life of Sacrificed People

3)Momentam: Movement and Accusation by the Local People and Citizens

4)Administration: Initiative by the Local Government

Lecture-1: Environmental Management
1. Lessons of Japan

(6)Lessons Learnt-2

5)Preventive Measures: No Excuse for Enforcement Measures by Delay of Cause Identification

6)Cost Effectiveness of Investment on Countermeasures in the Early Stage:

	Cost of Measures (1989)	Economic Damages (1989)	
-Minamata	$0.123 bil.	$12.6 bil.	(x100 times)
-Jintu river	$0.006 bil.	$2.5 bil.	(x420 times)
-Yokkaichi	$14.8 bil.	$21 bil.	(x1.4 times)
-SOx in total	$480 bil.	$6,000 bil.	(x13 times)

Lecture-1: Environmental Management
2. Environmental Management Plan

"The Environmental Basic Law (1993)"

Shifting from Command & Control to Comprehensive Framework of Environmental Protection=Vision

1)Building a socioeconomic system fostering an environmentally sound material cycle

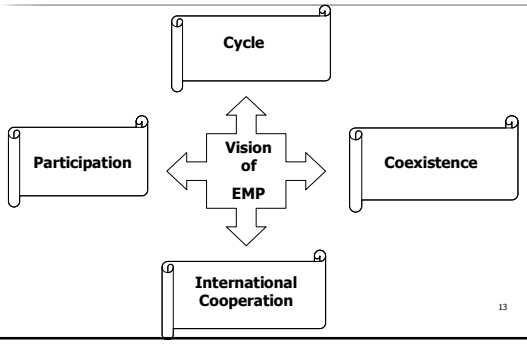
2)Ensuring harmonious coexistence between humankind and nature

3)Achievement of participation by all sectors of society

4)Promotion of international activities

Lecture-1: Environmental Management
2. Environmental Management Plan

Long-term Vision of The Environmental Basic Law (1993)



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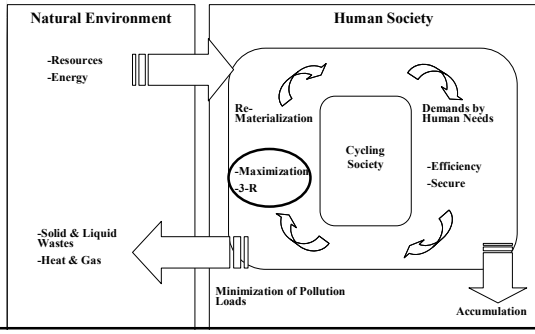
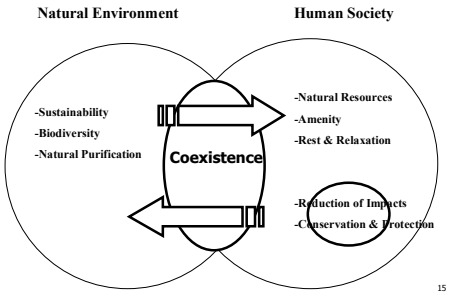
Lecture-1: Environmental Management
2. Environmental Management Plan

Vision of The Cycling Society



Lecture-1: Environmental Management
2. Environmental Management Plan

Vision of The Coexistence



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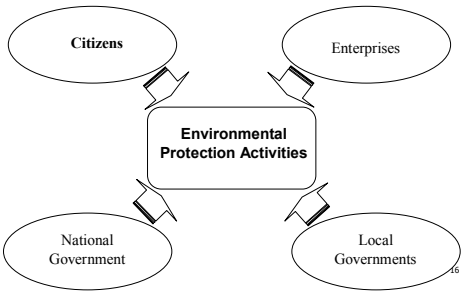
Lecture-1: Environmental Management
2. Environmental Management Plan

Vision of The Fair Participation



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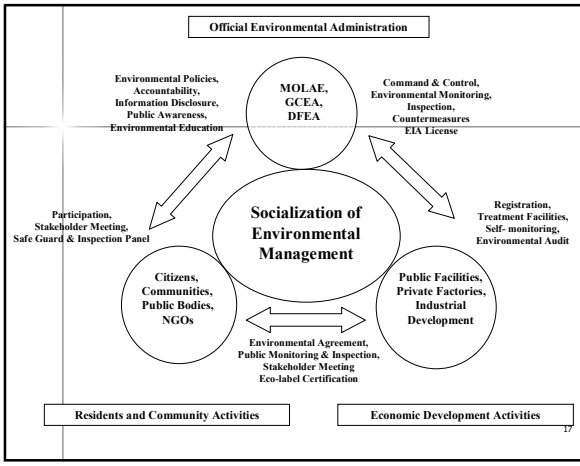

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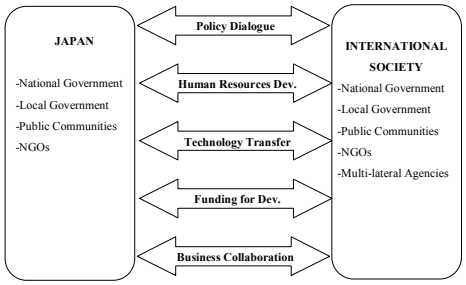
Lecture-1: Environmental Management
2. Environmental Management Plan

Vision of The International Cooperation



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Lecture-1: Environmental Management
2. Environmental Management Plan

Measures in the Basic Environmental Management Plan

(1) Air Environment

1) Global Issues
2) Wide Area Pollution Issues (Acid rain, Photochemical oxidant)
3) Pollution in Mega-city (Heat island, SPM, NOx)
4) Control of Harmful Substances (Organo-chlorinated compound)
5) Regional Amenity (Noise & vibration, offensive odor)
6) Air Quality Monitoring

(2) Water Environment

1) Protection of Water Environment (Quality & Quantity)
2) Reduction of Pollution Loads in Water Use
3) Control of Water Environment in Closed Water Bodies
4) Protection of Marine Environment
5) Compensation to Victims
6) Water Quality Monitoring

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Lecture-1: Environmental Management
2. Environmental Management Plan

Measures in the Basic Environmental Management Plan

(3) Soil and Geological Environment

(4) Solid Waste Management and Recycle

(5) Environmental Risk Management of Chemical Substances

(6) Research and Development on Environmental Technology

(7) Spatial Planning for Coexistence

(8) Wildlife Conservation and Biodiversity

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Lecture-1: Environmental Management
2. Environmental Management Plan

Measures in the Basic Environmental Management Plan

(9) Others

1) Protection and Wise Use of Environment on Regional Development
2) Roles of the Stakeholders
3) Promotion of Self-reliance Activities
4) Environmental Impact Assessment
5) Measures of Command and Control
6) Economic Oriented Measures
7) Development of Social Infrastructure
8) Information System
9) Pollution Control Plan in the Specific Area
10) Public Health and Arbitration of Environmental Disputes

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Lecture-1: Environmental Management
2. Environmental Management Plan

Future Protection of Water Environment by the Environmental Basic Law and the Basic Environmental Management Plan

1)Human health and Environmental biota based on quality standards=Natural diversity and Preservation of water-derived benefit

2)Expanding objectives=From water quality oriented measures to Water flow regime, Waterfront and Reparian areas, Hydrologic cycle of the basin

3)People's awareness of water-derived benefits=Active involvement and sharing of responsibility for a quality of environment by local people

4)Roles of Local Government=Local oriented objectives and plans= Coordination and promotion of environment-related programs beyond the administrative boundaries

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Lecture-1: Environmental Management
3. Enforcement of Environmental Protection

(1)Environmental Standard-1

1)As the Administrative Goal

- **-Aiming at maintaining a desirable set of conditions**
- **-No legal enforcements for local governments and polluters**
- **-Indirect role in reinforcing the legally enforceable effluent standards and advanced measures**

2)Targets for Protection and Conservation by Standards

- **-Different standards for protection of the human health and the living environment**
- **-High priority on the human health=no compromises**
- **-Applying specific conditions for the living environment =classification of water bodies**

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Lecture-1: Environmental Management
3. Enforcement of Environmental Protection

(1)Environmental Standard-2

3)Amendment of Water Quality Standards

- **-New rationales and/or scientific information**
- **-Incorporation of different parameters due to change of pollution sources**
- **-Change conditions of water use**

⇒ **Environmental Monitoring**

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Lecture-1: Environmental Management
3. Enforcement of Environmental Protection

(1)Environmental Standard-3

WQ Standards on Toxic Substances for Protection of Human Health

- **-23 toxic substances (Cd, CN, Pb, Cr^{6+}, As, Hg, PCBs, Org-Chlorinated)**
- **-Unified standard as nationwide minimum criteria**
- **-Ecological concentration of Hg and PCB**
- **-Most stringent considering historical lessons**
- **-Be achieved at once**

parameters	standards	parameters	standards
cadmium	0.01	cis-1, 2-dichloroethylene	0.04
total cyanide	ND.	1, 1, 1-trichloroethane	1.0
lead	0.01	1, 1, 2-trichloroethane	0.006
chromium (VI)	0.05	trichloroethylene	0.03
arsenic**	0.01	tetrachloroethylene	0.01
total mercury	0.0005	1, 3-dichloropropene (D-D)	0.002
alkyl mercury	ND.	thiuram	0.006
PCBs	ND.	CAT (simazine)	0.003
dichloromethane	0.02	thiobencarb	0.02
carbon tetrachloride	0.002	benzene	0.01
1, 2-dichloroethane	0.004	selenium	0.01
1, 1-dichloroethylene	0.02		

*to be evaluated based on annual average value except for total cyanide (maximum value)

Lecture-1: Environmental Management
3. Enforcement of Environmental Protection

(1)Environmental Standard-4

WQ Standards on the Living Environment (normal substances) in Rivers

- **-River: 5 substances**
- **-Criteria by categorized water bodies**
- **-Compliance with more than 75% of total sampling no. /year**
- **-Administrative target to be achieved within 5 years in principle**

1. Rivers

category	water use	standards[1] pH	BOD	SS	DO	CG
AA	Water supply class 1 ; conservation of natural environment, and uses listed in A-E	6.5-8.5	1	25	7.5	50
A	Water supply class 2 ; fishery, class I ; bathing and uses listed in B-E	6.5-8.5	2	25	7.5	1,000
B	Water supply class 3 ; fishery, class 2, and uses listed in C-E	6.5-8.5	3	25	5	5,000
C	Fishery class 3 ; industrial water, class I, and uses listed in D-E	6.5-8.5	5	50	5	—
D	Industrial water class 2 ; agricultural water ; and uses listed in E	6.0-8.5	8	100	2	—
E	Industrial water class 3 ; conservation of living environment	6.0-8.5	10	*	2	—

Lecture-1: Environmental Management
3. Enforcement of Environmental Protection

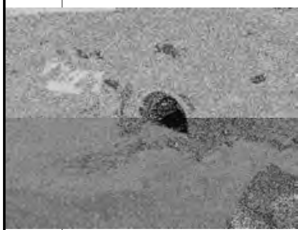
(2)Effluent/ Discharge Control and Standard

1)Setting Effluent Standards
- **-more stringent standards by the local government**
- **-additional substances to be controlled**
- **-setting provisional effluent standards for emergency (N & P)**

2)Discharge Standards for Wastewater Treatment Facilities
- **-setting additional charge on wastewater treatment**

3)Designation and Registration of Specific Factories and Facilities

4)Enforcement
- **-notification to factories for improvement of treatment facilities**
- **-check and inspection of treatment plan and its discharge quality**
- **-punishment of violation**
- **-orders to improve treatment facilities and to suspend operations**



Wastewater in Rakka

Barada River

Lecture-1: Environmental Management
3. Enforcement of Environmental Protection

(3)National Effluent Standard

Table 11-3 National effluent standards and prefectural stringent standards (unit : mg/l except for pH)

Parameters	National effluent standards (Daily average)	Tokyo Metro. Edo and tama river basin 500m³/day or more	Tokyo Metro. Edo and tama river basin 500m³/day or below	Tokyo Metro. Others 500m³/day or more	Tokyo Metro. Others 500m³/day or below	Saitama prefec. 10m³/day or more
pH	5.8~8.6	5.8~8.6(5~9)				5.8~8.6(5~9)
BOD	160(120)	20	25	20	25	25(50)
COD	160(120)	—	—	20	25	160(120)
SS	200(150)	40	50	40	50	60(50)
n-Hexane extracts						
(mineral oil)	5	5	5	5	5	5
(animal fat & vegetable oil)	30	5	5	10	10	30
Phenols	5	1	1	5	5	
Cu	3	1	1	3	3	3
Zn	5	5	5	5	5	5
Notes		50m³/day or more				

(CONTINUED)

Parameters	National effluent standards (Daily average)	Kanagawa prefec. lakes	Kanagawa prefec. rivers	Kanagawa prefec. Tokyo Bay	Chiba prefec. 500m³/day or more	Chiba prefec. 500m³/day or below
pH	5.8~8.6	5.8~8.6			5.8~8.6(5~9)	
BOD	160(120)	5(3)	15(10)	25(20)	10	20
COD	160(120)	5(3)	15(10)	25(20)	10	20
SS	200(150)	15(5)	35(20)	70(40)	20	40
n-Hexane extracts						
(mineral oil)	5	3	3	—	2	3
(animal fat & vegetable oil)	30	3	3	5	3	5
Phenols	5	—	0.005	0.5	0.5	0.5
Cu	3	1	1	1	1	1
Zn	5	1	1	1	1	1
Notes		50m³/day or more			30m³/day or more	

Lecture-1: Environmental Management
3. Enforcement of Environmental Protection

(4)More Stringent Effluent Standards by the Local Government

Table 4-1 More stringent effluent water quality standards by local governments (Kanagawa prefecture and Shiga prefecture)

Parameters	Kanagawa Prefecture 'A' area	Kanagawa Prefecture 'B' area	Kanagawa Prefecture Coastal area	Shiga prefecture	National effluent standards
Cd & its compounds	ND	/	/	0.01	0.1
CN compounds	—	/		0.1	1
Organic phosphorus compounds	ND	0.2	0.2	ND	1
Pb and its compounds	0.08	/	/	0.1	0.1
Cr (VI)	0.05	/	/	0.05	0.5
As and its compounds	0.01	/		0.05	0.1
Hg (total)	/	/		0.005	0.005
Hg (alkyl) compounds	/	/	/	ND	ND
PCBs	/	/	/	0.003	0.003
pH	/	/	5.8~8.6	6.0~8.5	5.8~8.6 (R&L) [illegible] (Sea)
BOD	15 (10)	20 (20)	/	70~100* 50~80#	160 (R&L)
COD	15 (10)	25 (20)	25 (20)	70~120* 50~80#	160 (Sea)
SS	35 (20)	70 (40)	70 (40)	90* 70#	200
n-Hexane extracts (mineral oil)	3	/	/	5	5
do (animal fat & vegetable oil)	3	8	5	20	30
Phenols	0.005	0.5	0.5	1	5
Cu	1	1	1	1	3
Zn	1	1	1	1	5
Dissolved iron	0.3	4	4	10	10
Dissolved manganese	0.3	1	1	10	10
Cr	0.1	/	/	0.1	2
F	0.8	/		8	15
Number of coliform group (/ml)	/	/		3000	3000
(Ni)	0.3	1	1	/	/

ND: Not detectable; —: Prohibited to discharge by Kanagawa Prefectural Ordinances; /: Corresponding national effluent standard is applied; R: river; L: lake

( ): Daily average (Ni): Regulated by other Kanagawa Prefectural Ordinances

*Wastewater 30~50m³/day #Wastewater >50m³/day

Lecture-1: Environmental Management
3. Enforcement of Environmental Protection

(5)Roles of the Local Government in Water Quality Control

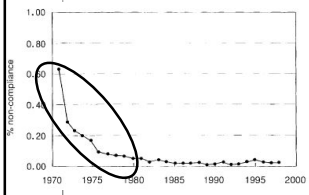
1)Regulating factories based on laws and ordinances,
2)Maintaining and constructing additional sewerage lines and sewage treatment systems,
3)Control of Eutrophication in Rivers and Lakes,
4)Water Quality Improvement in Canals and Creeks, and
5)Controlling Pollution from New High-tech Industries

Table 4-5 Water quality monitoring parameters

Categories	Parameters
Toxic substances	Cd, CN, Pb, Cr (VI), As, Hg (total), Hg (alkyl), PCBs, Trichloroethylene, Tetrachloroethylene, Dichloromethane, Carbon tetrachloride, 1,2-Dichloroethane, 1,1-Dichloroethylene, Cis-1,2-Dichloroethylene, 1,1,1-Trichloroethane, 1,1,2-Trichloroethane, 1,3-Dichloropropene, Thiuram, Simazine, Thiobencarb, Benzene, Selenium and compounds
Parameters for living environment	pH, BOD, COD_{Mn}, SS, DO, Number of coliforms, n-Hexane extracts, Total nitrogen, Total phosphorus
Special parameters involved in living environment parameters	Phenols, Copper, Zinc, Dissolved Iron, Dissolved manganese, Chromium, Fluorine, Nickel, ENP
Other parameters	Ammoniacal nitrogen, Nitrite, Nitrate, Phosphorus, Chloric Ion, Soap, 1,1,1-Trichloroethane, Anionic surfactant, Chlorophyll-a
Physical parameters	Weather, Weather of previous day, Water depth, Sampling depth, Water flow rate, Flow, Atmospheric temperature

Lecture-1: Environmental Management
4. Result of Effectiveness

(1)Compliance Conditions-1

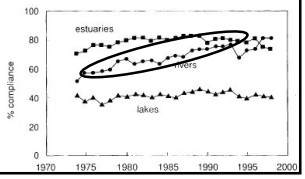


Human Health

-Toxic substances
-Almost 100%
-Historical lessons
-Stringent control
-End of pipe treatment

Living Environment

-Normal substances (BOD & COD)
-Estuaries & Rives>Lakes
-Non-point source/sewerage
-No effective measures

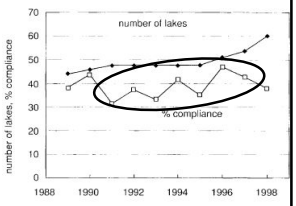


Lecture-1: Environmental Management
4. Result of Effectiveness

(2)Compliance Conditions-2

Lakes

-T-N & T-P Yearly Change
-Closed and Semi-closed Lakes
-Non-point Source
-High Cost for Treatment
-No effective measures



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Lecture-1: Environmental Management
5. Summary

1)Economic Development and Environmental Protection
- **-It should cost and depend on affordability.**
- **-Dynamic balance of investment on environmental protection**
- **-National and Local Government policy**

2)Regional specific issues
- **-Depends on local socioeconomic, cultural, natural conditions**
- **-Issues and solutions with citizens and local people**

3)Local government (DFEA Governorate)
- **-Actual enforcement is concentrated in local government**
- **-Accountability, information disclosure, participation**

4)Roles of the Frontline Staff
- **-Frontline of "Humat Beia"**
- **-Contact point of citizens and local people**

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Thank You

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The Capacity Development of Environmental Monitoring at Directorates for Environmental Affairs in Governorates

Basic Environmental Monitoring Course
Lecture-2: Environmental Monitoring

June 2005

The JICA Expert Team

Lecture for Basic Environmental Monitoring
Lecture-2: Environmental Monitoring

(1)Water Quality Monitoring

(2)Air Quality Monitoring

Lecture-2: Environmental Monitoring
1. Water Quality Monitoring

1.1 Importance of Water Quality Monitoring

- -To implement appropriate regulatory actions to control W-pollution
- -To ensure integrity and comprehensiveness of Ad. enforcement

Thus,

- -to be properly designed and implemented
- -to be continuously monitored
- -to be prepared a monitoring plan both national and local govern't
- -to be shared and disclosed the measurement records
- -to be published the progress of pollution control (accountability)

Lecture-2: Environmental Monitoring
1. Water Quality Monitoring

1.2 Water Quality Standards

1)Standards for the Human Health and the Living Environment

- -Uniform standards for the human health
- -Classified standards for the living environment
- -Type and water use of water bodies
- -Consideration of the existing WQ standards by usage
  - a) Standards for fishery (1965)
  - b) Standards for drinking water (1970)
  - c) Standards for agricultural water (1970)
  - d) Standards for industrial water (1971)

2)Designation of Water Body Classes

- -Prioritization to more serious polluted water bodies
- -Current and future water use
- -Severity and source of pollution
- -Improvement and/or maintenance of the current conditions
- -Compliance period considering pollution control technology

Lecture-2: Environmental Monitoring
1. Water Quality Monitoring

(1)Water Quality Standards on Toxic Substances for Protection of the Human Health

- -23 toxic substances (Cd, CN, Pb, Cr $^{6+}$, As, Hg, PCBs, Org-Chlorinated)
- -Unified standard as nationwide minimum criteria
- -Ecological concentration of Hg and PCB
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arsenic*	0.01	tetrachloroethylene	0.01
total mercury	0.0005	1, 3-dichloropropene (D-D)	0.002
alkyl mercury	ND.	thiuram	0.006
PCBs	ND.	CAT (simazine)	0.003
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*to be evaluated based on annual average value except for total cyanide (maximum value)

Lecture-2: Environmental Monitoring
1. Water Quality Monitoring

(2)Water Quality Standards on the Living Environment in Rivers

- -River: 5 substances
- -Criteria by categorized water bodies
- -Compliance with more than 75% of total sampling no. /year
- -Administrative target to be achieved within 5 years in principle

1. Rivers

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C	Fishery class 3 ; industrial water, class I, and uses listed in D-E	6.5-8.5	5	50	5	—
D	Industrial water class 2 ; agricultural water ; and uses listed in E	6.0-8.5	8	100	2	—
E	Industrial water class 3 ; conservation of living environment	6.0-8.5	10	*	2	—

Euphrates River

Barada River

Lecture-2: Environmental Monitoring
1. Water Quality Monitoring

(3)Water Quality Standards on the Living Environment in Lakes-1

- **-Lakes: 7 substances**
- **-Criteria by categorized water bodies**
- **-Compliance with more than 75% of total sampling no. /year**
- **-Administrative target to be achieved within 5 years in principle**

2. Lakes (natural lakes and reservoirs with 10 million cubic meters of water or more)

a.

category	water use	standards pH	COD	SS	DO	CG
AA	Water supply class 1 ; fishery class 1 ; conservation of natural environment, and uses listed in A-C	6.5-8.5	1	1	7.5	50
A	Water supply classes 2 and 3 ; fishery class 2 ; bathing and uses listed in B-C	6.5-8.5	3	5	7.5	1,000
B	Fishery class 3 ; industrial water class 1 ; agricultural water, and uses listed in C	6.5-8.5	5	15	5	—
C	Industrial water class 2 ; conservation of living environment	6.0-8.5	8	*	2	—

Lecture-2: Environmental Monitoring
1. Water Quality Monitoring

(3)Water Quality Standards on the Living Environment in Lakes-2

- **-Lakes: T-N, T-P for eutrophication & water bloom**
- **-Criteria by categorized water bodies**
- **-Compliance with more than 75% of total sampling no. /year**
- **-Administrative target to be achieved within 5 years in principle**

b.

category	water use	Standards T-N	T-P
I	Conservation of natural environment, and uses listed in II-V	0.1	0.005
II	Water supply classes-I, 2 and 3 (except for special types), fishery class 1, bathing ; and uses listed in III-V	0.2	0.01
III	Water supply class-3 (special types), and uses listed in IV-V	0.4	0.03
IV	Fishery class 2, and uses listed in V	0.6	0.05
V	Fishery class 3, industrial water ; agricultural water ; conservation of living environment	1.0	0.1

Lecture-2: Environmental Monitoring
1. Water Quality Monitoring

(4)Water Quality Standards on the Living Environment in Estuaries-1

- **-Estuaries: 7 substances**
- **-Criteria by categorized water bodies**
- **-Compliance with more than 75% of total sampling no. /year**
- **-Administrative target to be achieved within 5 years in principle**

a.

category	water use	standards pH	COD	DO	CG	NHE*
A	Fishery class 1 ; bathing ; conservation of natural environment, and uses listed in B-C	7.8-8.3	2	7.5	1,000	ND
B	Fishery class 2 ; industrial water and uses listed in C	7.8-8.3	3	5	—	ND
C	Conservation of living environment	7.0-8.3	8	2	—	—

*normal hexane extract

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Lecture-2: Environmental Monitoring
1. Water Quality Monitoring

(4)Water Quality Standards on the Living Environment in Estuaries-2

- **-Estuaries: T-N, T-P for eutrophication & red tied**
- **-Criteria by categorized water bodies**
- **-Compliance with more than 75% of total sampling no. /year**
- **-Administrative target to be achieved within 5 years in principle**

b.

category	water use	Standards T-N	T-P
I	Conservation of natural environment and II, III, IV	0.2	0.02
II	Fisheries class 1, Marine recreation/bathing and III, IV	0.3	0.03
III	Fisheries class 2 and IV	0.6	0.05
IV	Fisheries class 3, Protection of benthic organisms, Industrial water supply	1.0	0.09

1. All the standards are based on annual average values.

Lecture-2: Environmental Monitoring
1. Water Quality Monitoring

1.3 Methodology of WQ Monitoring Survey
"Standard Survey Methods of WQ" by M. of Environment 1971

(1)Parameters and Frequencies

-Toxic sub. **:at least 1time/month, 4times/sampling day**
:at least 1time/month for all substances
:rests be considered previous survey results

-Normal sub. **:at least 1time/month, 4times/sampling day at reference stations and important stations**

:at least 2times/year with 13times/day at 2 hours interval in the stations having daily fluctuation

:at least 4times/year in supplementary surveys

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Lecture-2: Environmental Monitoring
1. Water Quality Monitoring

1.3 Methodology of WQ Monitoring Survey

(2)Survey Timing and Sampling Location-1

-Rivers **:to cover the lowest water level and the time of active water use**

:to include a) near intake, b) before & after of major wastewater discharge points and tributaries, c) others required

:to always include reference stations in the ambient water quality monitoring survey

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Lecture-2: Environmental Monitoring
1. Water Quality Monitoring

1.3 Methodology of WQ Monitoring Survey

(2)Survey Timing and Sampling Location-2

-Lakes **:to cover stagnation and circulation periods including the time adverse effects to be expected on water use**

:to select a day with stable WQ conditions following several successive days of relatively calm weather

:to include a) center of a lake, b) near intake, c) before & after of major wastewater discharge points, d) near river inflow and outlet points

:to always include reference stations in the ambient water quality monitoring survey

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Lecture-2: Environmental Monitoring
1. Water Quality Monitoring

1.3 Methodology of WQ Monitoring Survey

(2)Survey Timing and Sampling Location-3

-Estuaries **:to cover the time adverse effects to be expected on water use**

:to carry out together with the survey on rivers inflow

:to conduct at spring tide on a day with minor influence from rain and wind

:to select stations considering a) topography, b) local current and tide, c) local water use, d) location of major wastewater discharge points and river inflow

:to always include reference stations in the ambient water quality monitoring survey

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Lecture-2: Environmental Monitoring
1. Water Quality Monitoring

1.4 WQ Monitoring Conditions in Japan (1995)

1) 294,491 samples from 5,471 stations for Toxic substances
- **-Rivers: 3,973 stations**
- **-Lakes: 260 stations**
- **-Estuaries: 1,238 stations**

2) 426,701 samples from 6,993 stations for Normal substances
- **-Rivers: 4,533 stations**
- **-Lakes: 428 stations**
- **-Estuaries: 2,132 stations**

3) 10,411 well sites for ground water quality
- **-General survey well sites: 4,357 stations**
- **-Contaminated well sites : 1,659 stations**
- **-Regular monitoring survey well sites : 4,395 stations**

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Lecture-2: Environmental Monitoring
1. Water Quality Monitoring

1.4 WQ Monitoring Conditions in Japan (1995)

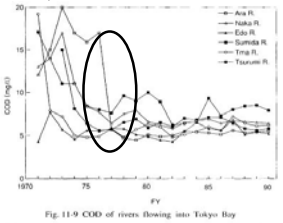

Fig. 11-9 COD of rivers flowing into Tokyo Bay

-Fairly improved from 1975

-Evidence of effectiveness of pollution control measures

-Category C > Category A & B

-Achievement rate increased

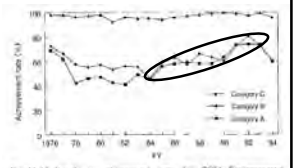

Fig. 11-11 Trends in achievement rate for COD Environmental Quality Standards in Tokyo Bay

Lecture-2: Environmental Monitoring
1. Water Quality Monitoring

1.4 WQ Monitoring Conditions in Japan (1995)

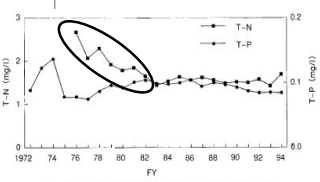

Fig. 11-14 T-N and T-P concentrations in Tokyo Bay

-Decrease T-P by non-P detergents

-No effective measures to remove T-N

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Lecture-2: Environmental Monitoring
1. Water Quality Monitoring

1.5 Monitoring of Discharge/ Effluent Water Quality

(1)General

-Factories and Enterprises are requested for report the quality and quantity (pollution load) of their discharge to Governors

-Governors have right to inspect them checking compliance with effluent standards, and to order them taking necessary measures

-Violation to be punished by the Water Pollution Control Law (imprisonment and/or fine)

-Measurement of discharge/ effluent WQ be done by factories and enterprises themselves

Lecture-2: Environmental Monitoring
1. Water Quality Monitoring

1.5 Monitoring of Discharge/ Effluent Water Quality

(2)Parameters and Frequencies

-Toxic sub. **:at least 1time/month, 4times/sampling day**
:at least 1time/month for all sub.
:rests be considered previous survey results

-Normal sub. **:at least 4times/year**

(3)Survey Timing and Sampling Location

:to decide based on specific effluent conditions
:to sample at outlets of factories and final treatment facilities
:to conduct considering date of the ambient WQ monitoring survey

Lecture-2: Environmental Monitoring
1. Water Quality Monitoring

1.6 Institutional Set-up for Water Quality Control

(1)Establishement of In-factory Pollution Control Organization

-Supervisor for pollution control> Chief pollution control manager > Pollution control manager = to be qualified by the national government (250,000 certified person in 1995)

-Specific registered factories: manufacturing, power plant, etc.

(2)Certified Quality Analysts

-General, Chemical Analysis (air and water), Noise & Vibration

Lecture-2: Environmental Monitoring
1. Water Quality Monitoring

1.7 WQ Monitoring by the Local Government-1

4 Categories of Water Quality Monitoring

1)Monitoring under the Laws and Notifications
-from 1970, supervision by M. of Environment

2)Monitoring contracted with National Government
-chemical sub., soil, groundwater, specific water bodies

3)Specific monitoring, and Research & Development by the Local Government

4)Monitoring for unexpected Incidents
-oil leakage, earthquake, etc.

Lecture-2: Environmental Monitoring
1. Water Quality Monitoring

1.7 WQ Monitoring by the Local Government-2

Frequency of WQ monitoring

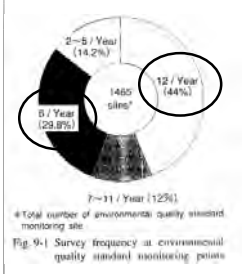

Fig. 9-1 Survey frequency at environmental quality standard monitoring points

-44% are 1 time/month

-30% are 6 times/year

Lecture-2: Environmental Monitoring
1. Water Quality Monitoring

1.7 WQ Monitoring by the Local Government-3

Simulation and Water Quality Moni

-Comparison with simulation data

-Confirmation of effectiveness

-Decision of further pollution control

-Consideration of another control measures

-Setting achievement period

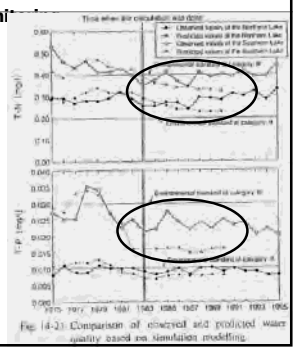

Fig. 14-2 Comparison of observed and predicted water quality based on simulation modelling

Lecture-2: Environmental Monitoring
1. Water Quality Monitoring

1.7 WQ Monitoring by the Local Government-4

Public and Private Sector

-More than half is private

-Development of private sector

-Certified and qualified

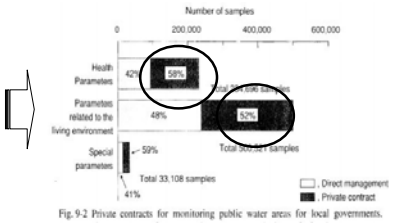

Fig. 9-2 Private contracts for monitoring public water areas for local governments.

Lecture-2: Environmental Monitoring
1. Water Quality Monitoring

1.8 Quality Assurance and Quality Control (QA/QC)

"Standardized QA/QC for Environmental Measurements and Analysis" by M. of Environment since 1975

-To ensure the reliability of data
-To improve the precision of analysis

Designated Organizations (1995)

-governorate institutions:	51
-municipal institutions:	43
-private institutions:	456
Total	550

Lecture-2: Environmental Monitoring
2. Air Quality Monitoring

2.1 Air Quality Pollution

(1) Pollution Sources
-Fixed (public facilities and factories)
-Mobile (vehicles= NOx)

(2) Pollutants
-SOx, NOx, CO, HC, SPM, Dust and Soot, Harmful Pollutants (Cd, HCl, Pb, F)

(3) Detrimental Effects
-Human health, Photochemical smog, Ecosystem, Global warming, Ozone layer, Acid rain

Lecture-2: Environmental Monitoring
2. Air Quality Monitoring

2.2 Air Quality Monitoring Conditions in Japan

(1)Ambient Air (1,711 stations)

a) Fixed source	:NOx, SO2, SPM, Dust Heavy metals	=location of sources and hot spot
b) Amb. condition	:NOx, SO2, CO, SPM, Ox, HC	=normal substances
(2) Mobile Source (416 stations)	:NOx, SO2, CO, SPM, HC	=road sides, impact by vehicles

Lecture-2: Environmental Monitoring
2. Air Quality Monitoring

2.3 Air Quality Standards-1

Item	Syria	Japan
-SO2 (10 min)	500 μg/m3 (0.188 ppm)	-
-SO2 (1 hr)	350 μg/m3 (0.132 ppm)	0.1 ppm
-SO2 (24 hrs)	125 μg/m3 (0.047 ppm)	0.04 ppm
-SO2 (1 yr)	50 μg/m3 (0.019 ppm)	middle-term
physically h'cap person		
-NO2 (1 hr)	200 μg/m3 (0.105 ppm)	0.04-0.06 ppm (24hr)
-NO2 (1 yr)	40 μg/m3 (0.021 ppm)	-
-O3 (1 hr)	160 μg/m3 (0.08 ppm)	0.06 ppm
-O3 (8 hrs)	120 μg/m3 (0.06 ppm)	-

Lecture-2: Environmental Monitoring
2. Air Quality Monitoring

2.3 Air Quality Standards-2

Item	Syria	Japan
-CO (30 min)	60 μg/m3 (51.5 ppm)	-
-CO (1 hr)	30 μg/m3 (25.8 ppm)	-
-CO (8 hrs)	10 μg/m3 (8.6 ppm)	20 ppm
-TSP (24 hrs)	240 μg/m3	-
-TSP (1 yr)	150 μg/m3	-
-SPM10 (1 hr)	-	200 μg/m3
-SPM10 (24 hrs)	100 μg/m3	100 μg/m3
-SPM10 (1 yr)	50 μg/m3	-
focusing SPM10		
-Pb (1 yr)	1 μg/m3	-
-Benzene (1 yr)	20 μg/m3	3 μg/m3

Lecture-2: Environmental Monitoring
2. Air Quality Monitoring

2.4 Air Quality Emission Standards

Item	Syria	Japan
-CO	250-500 mg/m3	-
-NOx	300-3,000 mg/m3	60-900 ppm (75-1,123 mg/m3)
-SO2	1,000-3,000 mg/m3	(SOx equivalent)
-TSP	50-200 mg/m3	30-400 mg/m3
-Pb	2-20 mg/m3	10-30 mg/m3
-Cd	1-5 mg/m3	1 mg/m3
-HCl	10-100 mg/m3	80-700 mg/m3
-F	1-20 mg/m3	1-20 mg/m3

note: Dust, Cd, Pb are set by type and scale of facility, and NOx and SOx are set for Pollution Load Control in Japan.

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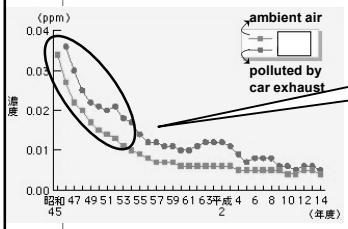
Lecture-2: Environmental Monitoring
2. Air Quality Monitoring

2.5 Monitoring Results of Air Quality-1



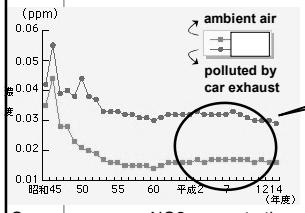
Drastic decrease in the past, but seems to stop decreasing these days

One year average SO2 concentration

32

Lecture-2: Environmental Monitoring
2. Air Quality Monitoring

2.5 Monitoring Results of Air Quality-2



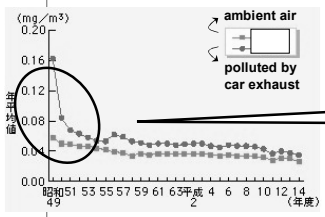
Vehicle exhaust being improved in a slow speed

One year average NO2 concentration

33

Lecture-2: Environmental Monitoring
2. Air Quality Monitoring

2.5 Monitoring Results of Air Quality-3



TSP was drastically improved especially for vehicle exhaust

One year average TSP concentration

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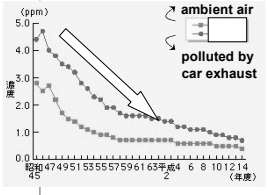
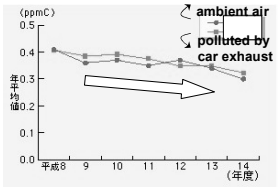
Lecture-2: Environmental Monitoring
2. Air Quality Monitoring

2.5 Monitoring Results of Air Quality-4



One year average CO concentration

Continuously improving over time

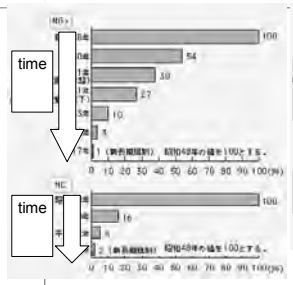


One year average NMHC (non methane hydro-carbon) concentration

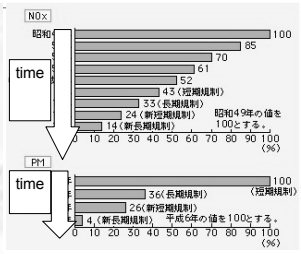
Slow but continuously improving

Lecture-2: Environmental Monitoring
2. Air Quality Monitoring

2.5 Monitoring Results of Air Quality-5



Stricter limits on exhaust of gasoline & LPG cars



Stricter limits on exhaust of diesel cars

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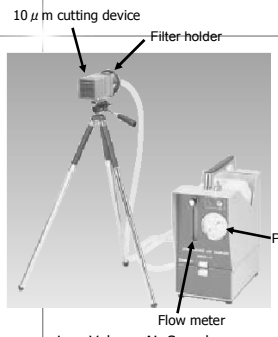
Lecture-2: Environmental Monitoring
2. Air Quality Monitoring

2.6 Equipment to be supplied by JICA

- **(1) High Volume Sampler with Filter : TSP =1 day, Heavy metals**
- **(2) Low Volume Sampler with Filter : SPM(PM10) =1 week, 1 month, long term**
- **(3) Handy Type Sampler with Impinger : NOx, SO2, Ox =1 hour value of gases**
- **(4) Meteorological observation device : W-d and W-v =1 hour value Temp, Humidity**
- **(5) Reagent and Others**

Lecture-2: Environmental Monitoring
2. Air Quality Monitoring



Low Volume Air Sampler

Handy Sampler

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Lecture-2: Environmental Monitoring
2. Air Quality Monitoring

2.7 Mobile Station in Japan

- **(1) Objectives**
  - **-Supplemental data of the fixed stations**
  - **-Coping with the complaints from citizens**
  - **-Consideration of air monitoring system (Nos. of stations, locations)**
- **(2) Measurement items : NOx, SO2, CO, SPM, Ox, HC, W-d and W-v, A. Temp, Humidity, solar radiation**
- **(3) 1-2 cars/Governorate: limited use**
- **(4) Characteristics**
  - **-Advantage : free from place, time, period**
  - **-Disadvantage :no continuous data, electricity, security, high O/M cost**

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Mobile Station

40

Generator

41

Air quality monitoring system

High Volume Air Sampler

42

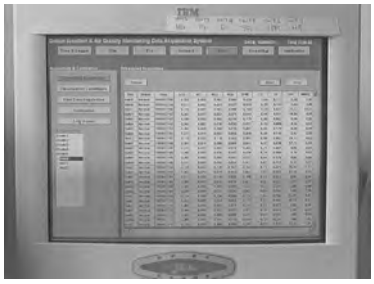
Solar radiation meter

Wind direction anemometer

43

SO_2, NO, NO_2, NOx, SPM, CO, O_3, CH_4, NMHC

Air quality monitoring Station (Fixed Station)



Monitoring data

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Thank You

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Lecture for Basic Environmental Monitoring

Lecture-3: Basic of Water Quality Monitoring (WQM)

June 2005

The JICA Expert Team

1

1. Parameters to be Covered by the Project

14 DFEAs	Damascus, Homs, Aleppo	Damascus DFEA
Basic Water Quality Analysis 1 pH 2 Water Temperature 3 Color 4 TDS 5 DO 6 SS 7 CODcr 8 BOD_5 9 NO_3-N 10 PO_4 11 Cl^- (not Cl_2) 12 NH_3-N 13 EC 14 Turbidity	Basic Water Quality Analysis Air Quality Analysis 1 SOx 2 NOx 3 TSP 4 PM10 5 Pb	Basic Water Quality Analysis Air Quality Analysis Chemical & Biological Water Quality Analysis (Oil, Coliform, Heavy metals, etc.)

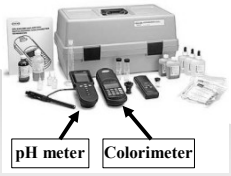
2

2. Equipment and Instrument provided by JICA

pH, Temp., SS, Color, NO_3-N, PO_4, NH_3-N

COD_{Cr} →

BOD_5 →



pH meter | Colorimeter

3

DO ←

Turbidity →

Cl^- ←

EC & TDS →

Reagents, Glassware, Computer, Digital Camera and others

4

1.Introduction of Water Quality Monitoring (WQM)

1) Definition of Water Quality Monitoring

ISO: "The programmed process of sampling, measurement and subsequent recording or signaling, or both, of various water characteristics, often with the aim of assessing conformity to specified objectives.

5

2) Necessity and Importance of WQM

8 Environment tragedies in the word

5 tragedies – air pollution (London, England; 1948-1963; around 10,000 deaths)

**2 tragedies – water pollution (*Mina Mata disease* and *Itai-Itai disease*, Japan; 1930'-70'; around 300 deaths)

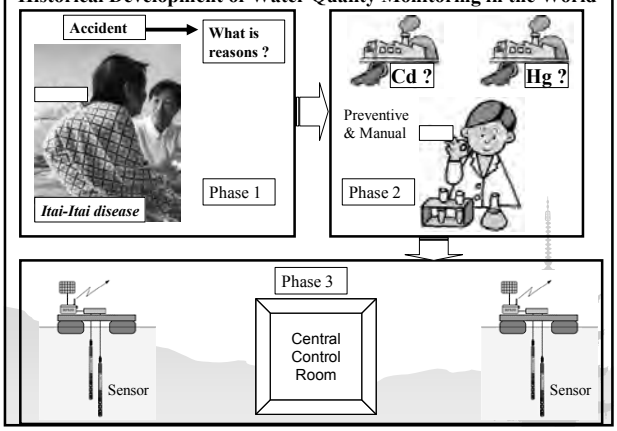
Historical Development of Water Quality Monitoring

Phase 1: **Accident survey** (1950', passive monitoring)

Phase 2: **Pollution sources monitoring** (1960'-70', initiative)

Phase 3: **Water environmental quality monitoring** (1980'~present, automatic monitoring, GIS, RS, GPS)

Historical Development of Water Quality Monitoring in the World

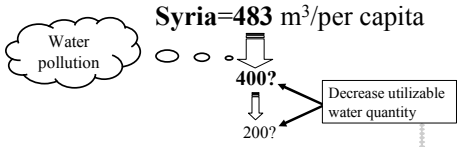


2) Necessity and Importance of WQM

- Freshwater resource:

Average of the world=**7,342** m^3/per capita

Syria=**483** m^3/per capita



- Protect human health
- Evaluation of environmental quality
- Environmental protection policies, plan and management (local and national levels)

WQM: Eye of Water Environmental Protection

8

3) Water Pollution Sources

1) Industry Wastewater (point source)
(acid, alkali, organic substances, heavy metals, toxic substances etc.)

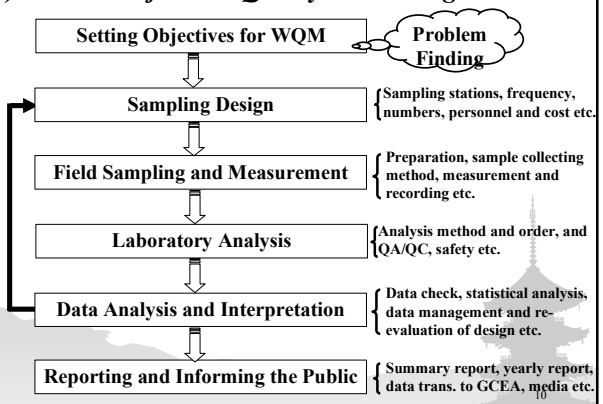
2) Domestic Wastewater (point source)
(organic substances, pathogenic organism etc.)

3) Agricultural Waster (no-point source, runoff)
(fertilizer, pesticides, livestock excreta etc.)

4) Others (hospital wastewater, acid rain etc.)

9

4) Structure of Water Quality Monitoring Plan



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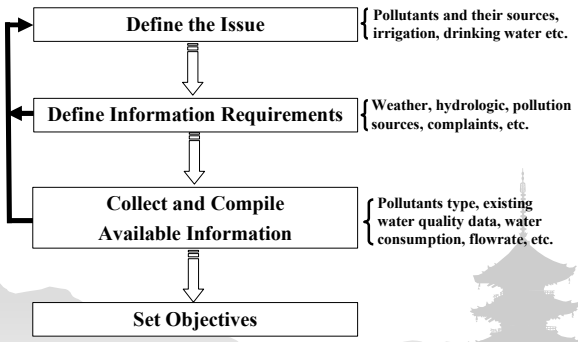
2. Setting Water Quality Monitoring Plan Objectives



11

Objectives of Water Quality Monitoring Plan

1) Protect human health
2) Checking whether effluent from factories comply with industrial wastewater discharge standard
3) Determining whether water bodies meet environmental standards
4) Screening for potential water quality problems
5) Grasping water quality and trends over time
6) Design pollution prevention or control programs
7) Assessing program goals and effectiveness
8) Responding to emergencies
9) Others (e.g. handling of complaints, EIA, educating citizens etc.)

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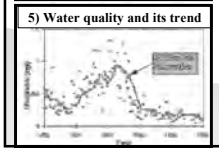
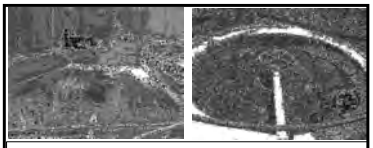
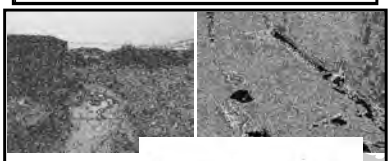
1) Protect human health

5) Water quality and its trend





2) Effluent from factory (water quality and pollutants load)



6) & 7) Design pollution control program and evaluating

Environmental Quality Standard - Rivers, Japan

class	Item: Water use	Standard value: pH	BOD	SS	DO	Total coliform
AA	Water supply class 1, conservation of natural environment and uses listed in A-E	6.5-8.5	1 mg/l or less	25 mg/l or less	7.5 mg/l or more	50 MPN/100ml or less
A	Water supply class 2, fishery class 1, bathing and uses listed in B-E	6.5-8.5	2 mg/l or less	25 mg/l or less	7.5 mg/l or more	1000 MPN/100ml or less
B	Water supply class 3, fisheryclass 2, and uses listed in C-E	6.5-8.5	3 mg/l or less	25 mg/l or less	5 mg/l or more	5000 MPN/100ml or less
C	Fishery class 3, Industrial water class 1 and uses listed in D-E	6.5-8.5	5 mg/l or less	50 mg/l or less	5 mg/l or more	-
D	Industrial water class 2, agricultural water and uses listed in E	6.0-8.5	8 mg/l or less	100 mg/l or less	2 mg/l or more	-
E	Industry water class 3, and conservation of environment	6.0-8.5	10 mg/l or less	Floating matter such as garbage should not be observed	2 mg/l or more	-

Drinking Water Resource | Water Treatment (SS<25) | Actual Condition of Rivers

Swimming (pH6.5-8.5) | Fishery (DO>5) | Agriculture (SS) | Daily Life (odor→BOD 10)

Environmental Quality Standard – Lakes, Japan

This Project ⇨ COD_{Cr}=2 to 3 COD_{Mn}

class	Item: Water use	Standard value: pH	COD	SS	DO	Total coliform
AA	Water supply class 1, fishery class 1, conservation of natural environment, and uses listed in A-C	6.5-8.5	1 mg/l or less	1 mg/l or less	7.5 mg/l or more	50 MPN/100ml or less
A	Water supply class 2, and 3, fishery class 2, bathing and uses listed in B-C	6.5-8.5	3 mg/l or less	5 mg/l or less	7.5 mg/l or more	1000 MPN/100ml or less
B	Fishery class 3, industrial water class 1, agricultural water and uses listed in C	6.5-8.5	5 mg/l or less	15 mg/l or	5 mg/l or more	-
C	Industrial water class 2, and conservation of the environment	6.0-8.5	8 mg/l or less	Floating matter such as garbage not be observed	2 mg/l or more	-

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Environmental Quality Standard – Lakes, Japan

class	Item: Water use	Standard value: Total Nitrogen	Total Phosphorus
I	Conservation of natural environment and uses listed in II-V	0.1 mg/l or less	0.005 mg/l or less
II	Water supply classes 1, 2 and 3 (except special types), fishery class 1, bathing and uses listed in III-V	0.2 mg/l or less	0.01 mg/l or less
III	Water supply class 3 (special types) and uses listed in IV-V	0.4 mg/l or less	0.03 mg/l or less
IV	Fishery class 2 and uses listed in V	0.6 mg/l or less	0.05 mg/l or less
V	Fishery class 3, industrial, agricultural water and conservation of the environment	1 mg/l or less	0.1 mg/l or less

Eutrophication Control

Environmental Quality Standard – Coast, Japan

class	Item: Water use	COD_{Mn} Standard value: pH	COD	DO	Total Coliform	N-hexane Extracts (oil content etc.)
A	Fishery class 1, bathing, conservation of the natural environment, and uses listed in B-C	7.8-8.3	2 mg/l or less	7.5 mg/l or less	1000 MPN/100ml or less	Not detectable
B	Fishery class 2, industrial water and the uses listed in C	7.8-8.3	3 mg/l or less le	5 mg/l or less	-	Not detectable
C	Conservation of the environment	7.0-8.3	8 mg/l or less	2 mg/l or less	-	-

class	Item: Water use	Standard value: Total Nitrogen	Total Phosphorus
I	Conservation of the natural environment and uses listed in II-IV (except fishery classes 2 and 3)	0.2 mg/l or less	0.02 mg/l or less
II	Fishery class 1, bathing and the uses listed in III-IV (except fishery class 2 and 3)	0.3 mg/l or less	0.03 mg/l or less
III	Fishery class 2 and the uses listed in IV (except fishery class 3)	0.6 mg/l or less	0.05 mg/l or less
IV	Fishery class 3, industrial water, and conservation of habitable environments for marine biota	1 mg/l or less	0.09 mg/l or less

Water Quality Standard for Industrial Wastewater Discharging into Public Sewer System – Syria & Japan

No.	Parameter	Unit	Max. Admissible Concentration (Syria)	Max. Admissible Concentration (Japan)
1	pH	pH Unit	6.5 - 9.5	5.0 - 9.0 (5.7 - 8.7)*
2	Water Temp.	℃	35	45 (40)
3	Color	Unit	-	-
4	TDS	mg/l	2,000	-
5	DO	mg/l	-	-
6	SS	mg/l	500	600 (300)
7	COD_{Cr}	mg/l	1,600	-
8	BOD_5	mg/l	800	600 (300)
9	NO_3^-	mg/l	-	-
10	PO_4^{3-}	mg/l	20	(T-P) 32 (20)
11	Cl^-	mg/l	600	-
12	NH_3-N	mg/l	100	(T-N) 240 (150)
13	EC	µS/cm	-	-
14	Turbidity	NTU	-	-

Check it !

* ( ): Applying for manufacturing industry and gas supply industry

18

Epigram for Water Quantity

Before the well runs dry, you never know how precious water is. !

New Epigram for Water Quality

Before the water polluted, you never know how delicious water is. !

19

Lecture for Basic Environmental Monitoring

Lecture-4: Basis of Sampling Design

June 2005

The JICA Expert Team

1

Structure of Water Quality Monitoring Plan

- **Setting Objectives for WQM**
- **Sampling Design** — Sampling stations, frequency, numbers, personnel and cost etc.
- **Field Sampling and Measurement** — Preparation, sample collecting method, measurement and recording etc.
- **Laboratory Analysis** — Analysis method and order, and QA/QC, safety etc.
- **Data Analysis and Interpretation** — Data check, statistical analysis, data management and re-evaluation of design etc.
- **Reporting and Informing the Public** — Summary report, yearly report, data trans. to GCEA, media etc.

2

Introduction of Sampling Design

Sampling Design

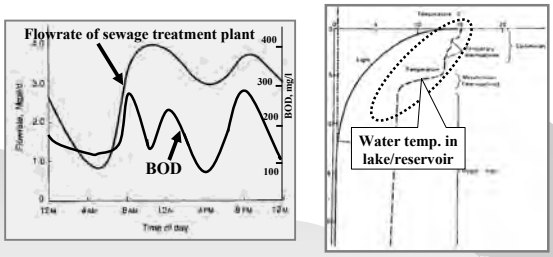
1) Selection of Sampling Stations
2) Determination of Sampling Frequency
3) Determination of Sampling Patterns
4) Determination of Sample Numbers
5) Selection of Measurement Parameters
6) Cost Effectiveness

3

1. Selection of Sampling Stations

Water Quality Heterogeneity:

- **Temporal** (daily or seasonal effects)
- **Spatial** (environmental heterogeneity, pollutants diffusion)



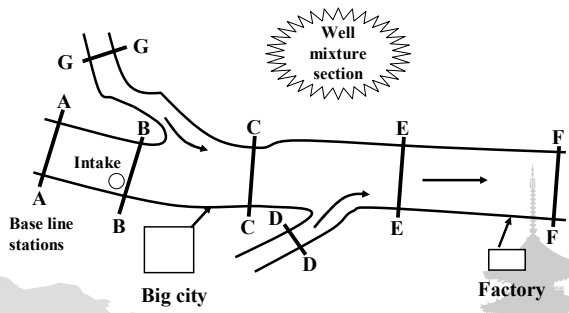
4

1. Selection Criteria of Sampling Stations -River

1) Accessibility (bridges etc.) and safety
2) Source of river to get indication of its baseline quality (A-A section, next slide)
3) Downstream of big cities (C-C section, next slide)
4) Confluence of tributaries and main river (D-D, E-E)
5) Water intake point for community water supply in city (B-B)
6) Location of large/medium or cluster of small water polluting industries (F-F)
7) Place measuring flow-rate easily (G-G)
8) Place for swimming
9) Large section of irrigated area upstream
10) Others (boundaries of national or Governorates)

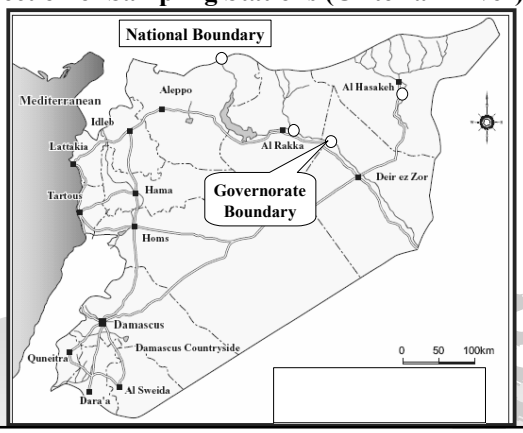
5

1. Selection of Sampling Stations (Criteria - River)



6

1. Selection of Sampling Stations (Criteria - River)

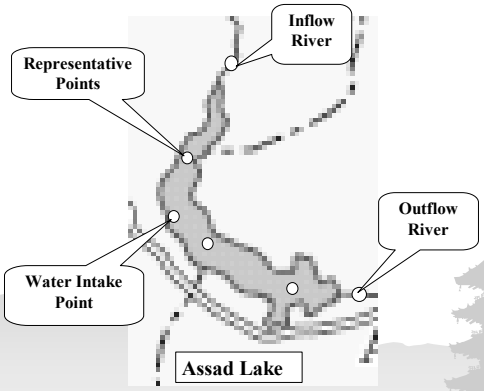


1. Selection Criteria of Sampling Stations - Lake

1) Accessibility and safety
2) Representative points for water quality (next slide)
3) Water intake points (next slide)
4) Inflow rivers (next slide)
5) Outflow rivers (next slide)
6) Place for swimming or recreation
7) Other special requirements

8

1. Selection Criteria of Sampling Stations - Lake



9

1. Selection Criteria of Sampling Stations - Groundwater

1) Drinking water sources located in insanitary conditions and the area being effected easily by sewage pollution (shallow aquifer in vicinity of septic tanks, cess pools, lagoon, solid waste disposal site) – responding complaints

2) Tube-well, hand-pumps or dugwells located in industrial areas and the area being effected easily by industrial wastewater. – monitoring the impact of industrial wastewater

3) Vicinity of solid waste disposal site

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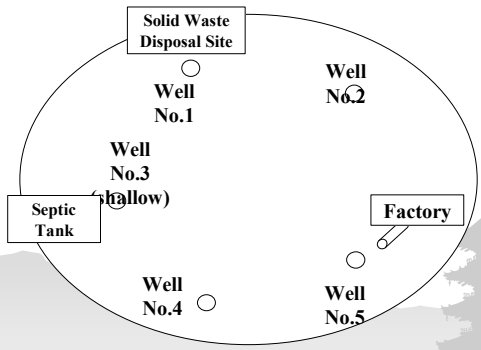
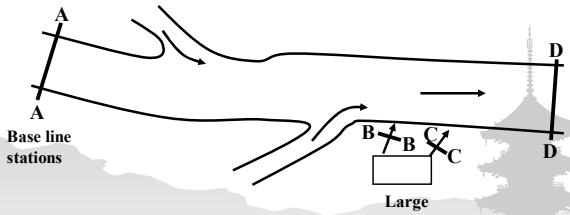
1. Selection Criteria of Sampling Stations - Groundwater



11

1. Selection Criteria of Sampling Stations - Industrial Wastewater

1) Outlets of large polluting factories – checking industrial wastewater quality and pollutants load (? kgSS/d, ? kgCOD/d, ? kgBOD/d) (Load=concentration × flowrate) – B-B, C-C sections
2) Downstream (tens-hundreds meters) of outlets - D-D section



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2. Determination of Sampling Frequency

1) Objectives of monitoring & the type of water body or medium (pollution sources, rivers or lakes, trend monitoring)

2) Water quality variability (higher frequency at stations where water quality varies considerably)

a) River water quality monitoring – depending on parameters being measured (pH, DO), flow variability, seasons.

b) Lake water quality monitoring – low frequency

c) Groundwater – low frequency for deep and confined aquifers; high frequency for shallow and polluted aquifers

d) Industrial wastewater monitoring – depending industrial type and scale

3) Cost and available resources

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2. Determination of Sampling Frequency

Monitoring Target	Sampling Frequency (example)
Rivers	At least 1 time/month
Lakes & Reservoirs	4-12 times/year (for eutrophic lakes/reservoirs: 1 time/month=12 times/year)
Groundwater	1 – 2 times/year (1 time/year for large stable aquifers and 2 times/year for small, shallow aquifers) (for complains, sampling at any time)
Factories' Outlets	1 – 4 times/year (composite sampling is recommended for pollutants load monitoring) (not inform in advance)

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3. Determination of Sampling Patterns

1) Random or catch samples

example → Sites complained from residents

example → Rivers: different sites → Rivers: Fixed monitoring station

2) Composite samples (samples are collected at regular intervals in space or time.)

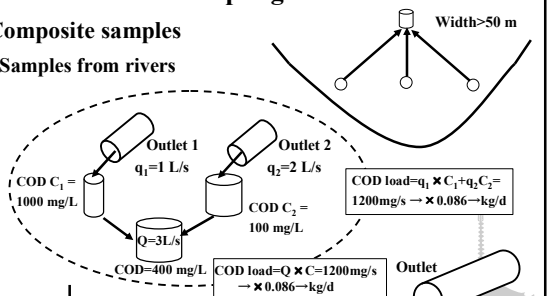
3) Stratified random samples (e.g. for water sampling to measure nutrients [N, P], a lake can be divided into the epilimion [surface] and hypolimion [bottom] water.)

15

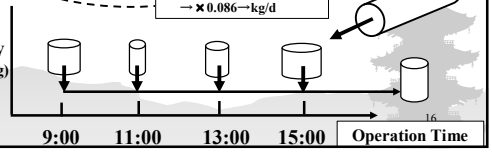
3. Determination of Sampling Patterns

2) Composite samples

♣ Samples from rivers



♣ Samples from factory (load monitoring)



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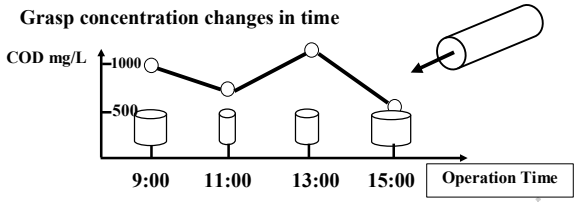
4. Determination of Sampling Numbers

1) Industrial Wastewater:

Grasp concentration changes in time

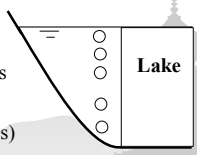


2) Lake/Reservoir:

Grasp concentration changes in depth

Case 1: Surface and bottom – 2 samples (Nitrogen, phosphorus, Fe, Mn)

Case 2: 1 sample/m (temp., DO changes)



5. Selection of Measurement Parameters

Item	Rivers	Lakes	Groundwater	Industrial Wastewater
pH	○	○	○	○
Water Temp.	○	○	○	○
Color	△	△	○	△
TDS	○	○	○	○
DO	○	○	△	△
SS	○	○	△	○
COD	○	○	○	○
BOD_5	○	○	○	○
NO_3^-	○	○	○	○
PO_4^{3-}	○	○	△	○
Cl^-	△	△	○	△
NH_3-N	○	○	○	○
EC	○	○	○	○
Turbidity	○	△	○	△
Flowrate	WRI C ○ Simple method	×	×	○ Simple method

Summary of Sampling Design

Example

	River	Lake/ Reservoir	Ground-water	Industrial Wastewater	Water Quality Accident
Sampleing Station	Accessibility, baseline, intake, pollution sources	Accessibility, intake, inflow & outflow rivers	Complaint & pollution sources	All of outlets	Accident points and surroundings
Sampling Frequency	At least 1 time/month	4-12 times/year	1-2 times/year	1-4 times/year	Depending on type & Num. of accident
Sampling Patters and Numbers	1 sample/time (or 3 points composit)	At least 2 samples in surface & bottom layer	At least 1 sample/time	Composit sample, each 2 hours during operation	At least 1 sample/time
Cost	High	High	Low	High	Low
Parameters	See 5. Selection of measuremnt parameters				Depending on the type of accident

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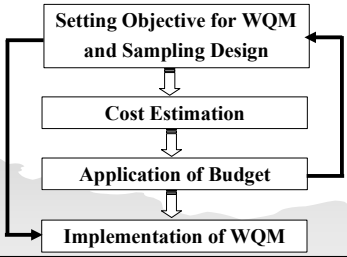
6. Cost Effectiveness

1) The number of sampling stations and sampling frequency
2) The cost of collecting samples (staff, transport, consumables)
3) The cost of analysis (reagents and glassware)
4) The cost of data handling and interpretation (cost of reporting)
5) Others (participation of training course)



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7. Requirements

1) Information collection
   - Pollution sources: location, type, water consumption, existing water quality data (raw materials)
   - Rivers: weather (rainfall etc.), existing water quality data (Ministry of Irrigation, WRIC)
   - Analyzing complaints related water quality (the number and classification of complaints)
2) Pre-discussion on sampling stations and confirmation
3) Preparation of sampling vehicle
4) Preparation of equipment and instrument in laboratory (distilled water unit, cleaning sample bottles)

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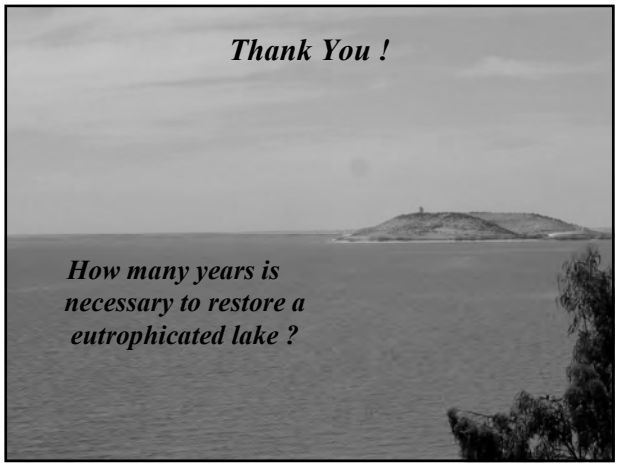


Lecture for Basic Environmental Monitoring

Lecture-5: Field Sampling, Measurement and Observation

June 2005

The JICA Expert Team

1

Introduction of Field Sampling and Measurement

1) Checklist Before Sampling

2) Collecting Water Samples

3) Field Measurement and Observation

5) Sample Labeling

4) Filed Record

6) Sample Preservation and Storage

7) Delivering to Laboratory Staff

2

1. Checklist Before Sampling

1) Document and equipment for recording data

2) Sampling tools

3) Field measurement equipment

4) Others

Checklist for Sampling

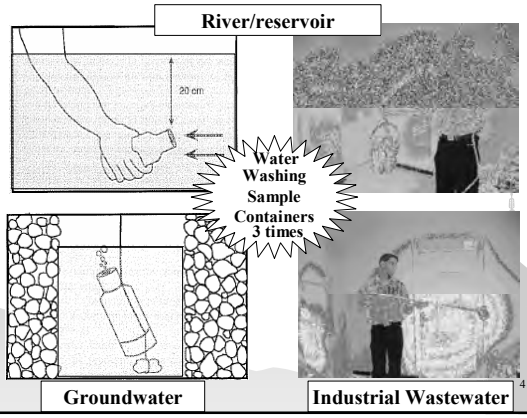
The following is a list of items, which should be checked before going to the field. (use tick i.e.√)

No.	Item	Date				Remarks
Documents and equipment for recording data		___/___/2005				
1	Itinerary for the trip (route, stations to be covered, start and return time)					
2	Area map (including sampling site station map)					
3	Data reach sheets					
4	Filed notebook					
5	SOP and equipment manuals					
6	Digital camera with date					
Sampling Tools						
1	Sampler (long-handled sampler and bucket)					
2	Rope					
3	Ice/box (with ice packs)					
4	Sample bottles					
5	Labels for sample containers					
6	Pen, pencils, marker (waterproof)					
7	Wash bottle within distilled water (for rinsing electrode and equipment)					
8	Knife/scissors					
9	Gloves/gum boots					
10	Tap water for washing hands/towel					
11	Drinking water					
12	portable electric light (especially for sampling during night)					
Field Measurement Equipment						
1	pH meter and calibration standards					
2	EC and TDS meter					
3	DO meter					
4	Check battery in meters, replace if necessary					
5	Check conditions of meters- no dirt etc.					
6	Thermometer					
7	Simple equipment for measuring velocity and flow					
8	Other field measurement kit, as required					
Others						
1	Emergency phone numbers					
2						
3						
4						

Note: 1) Depending on the local conditions, water body, type of pollution source, etc., all items may not be necessary, or other items, not listed, may be required.
2) It is always safer to carry a few numbers in excess.

3

2. Collecting Water Samples



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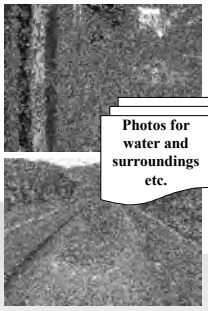
3. Field Measurement and Observation

4. Field Record



Field Measurement and Observation Record

Date: Time: Type of waterbody:

Name of sampling station: Sampling station code:

Longitude: Latitude:

Weather now: Clear/sunny ☐ Overcast ☐ Rain (steady) ☐ Rain (heavy) ☐

Past 24 hours: Clear/sunny ☐ Overcast ☐ Rain (steady) ☐ Rain (heavy) ☐

Width (m): <1 ☐ 1-2 ☐ 3-5 ☐ 6-10 ☐ 11-20 ☐ >20 ☐ ( )

Depth (m): <0.1 ☐ 0.1-0.3 ☐ 0.4-0.6 ☐ 0.7-1.0 ☐ 2-5 ☐ >5 ☐ ( )

Estimated velocity (m/s): <0.2 ☐ 0.2-0.4 ☐ 0.5-0.7 ☐ 0.7-1 ☐ >1 ☐ ( )

Rubbish: None ☐ Little ☐ Moderate ☐ Many ☐

Odor: Absent ☐ Little ☐ Moderate ☐ Strong ☐

Oil slick: None ☐ Little ☐ Moderate ☐ Many ☐

Brief description of site:

Comments:

Parameter	Color	SS	COD	BOD	NO_3	PO_4	Cl	NH_3	Turbidity
Sample Volume (L)									

Observer: Name: Signature:

Sample received by: Name: Signature:

5

3. Field Measurement and Observation

4. Field Record (First year)

Water Quality Results

Parameter	Unit	Sample (No.1) Result	Replicate Sample (No.2) Result	Replicate Sample (No.3) Result	Final Result of the Sample	Name of Analyst	Date of Analysis
Field Measurement							
pH	pH unit	7.5	7.8	7.4	7.6		
Air temp.	°C						
Water temp.	°C						
EC	μS/cm						
TDS	mg/l						
DO	mg/l						
Laboratory Analysis							
Color	Unit						
SS	mg/l						
COD_{Cr}	mg/l						
BOD_5	mg/l						
NO_3-N	mg/l						
PO_4^{3-}	mg/l						
Cl	mg/l						
NH_4-N	mg/l						
Turbidity	NTU						

average value

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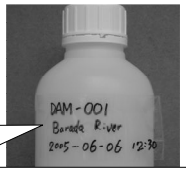
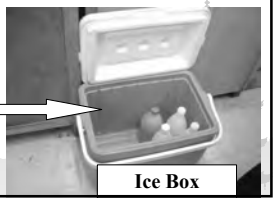
5. Sample Labeling



1) Sample Code: 3 letters-3 numbers
2) Name of river; lakes; well; factory
3) Date and time of sampling

6. Sample Preservation and Storage

Cold Pack



Ice Box

6. Sample Preservation and Storage

Suggested Preservation Methods and Storage Times

No.	Parameter	Recommended Container	Preservation Method	Max. Permissible Storage Time	Comments
1	pH	Plastic*	None, analyze immediately	6 hours	Should be measured on site
2	Water temp.	-	Not applicable	Not applicable	Must be measured on site.
3	EC	Plastic	Refrigeration	24 hours	Should be measured on site
4	TDS	Plastic	Refrigeration	24 hours	Should be measured on site
5	DO	-	None, analyze immediately	Analyze immediately	Must be measured on site
6	Color	Plastic	Refrigeration	48 hours	
7	SS	Plastic	Refrigeration	24 hours	
8	COD_{Cr}	Plastic	Refrigeration	24 hours	Analyze as soon as possible
9	BOD_5	Plastic	Refrigeration	24 hours	Analyze as soon as possible
10	NO_3-N	Plastic	Refrigeration	24 hours	Analyze as soon as possible
11	PO_4^{3-}	Glass**	Refrigeration	24 hours	
12	Cl	Plastic	Refrigeration	7 days	
13	NH_3-N	Plastic	Refrigeration	24 hours	Analyze as soon as possible
14	Turbidity	Plastic	None required	24 hours	Preferably tested in the field

*- Plastic= polyethylene **- Glass is recommended, however plastic containers will be used during first year.

8

7. Delivering to Laboratory Staff

Field Measurement and Observation Record (Including Water Quality Results)

Samples

Laboratory Staff for Analysis

Conducting Analysis in Same Day

9

What is Water Quality Monitoring (WQM) ?

How long does Mina Mata disease need to emerg?

Photo:1971, and the girl died in 1977 (21-years old)

Water ⇐ Patient

You, DFEA Staff ⇐ Doctor

Tools

WQM ⇐ Check

Water Pollution Control Measures ⇐ Medicine

Good Water Quality ☺ ⇐ Recover

10

Video Display

"Sampling for Environment Monitoring"

11

Lecture for Basic Environmental Monitoring

Lecture-6: Water Quality Analytical Theory and Skill-1

June 2005

The JICA Expert Team

Parameters Covered in the Project

Basic Water Quality Analysis
1 pH
2 Water Temperature
3 Color
4 TDS
5 DO
6 SS
7 CODcr
8 BOD5
9 NO3
10 PO4
11 Cl-
12 NH3
13 EC
14 Turbidity

pH

What is it and why does it matter?

pH: a measure of acidity (or alkalinity). Pure water has a pH of 7, acidic solutions have low pH values and alkaline solutions have higher values.

pH

PH = - log [H^+]

Most of PH readings ranges from 0 to 14

Solutions with a higher [H+], then water (PH will be< than 7) are acidic.

Solutions with a lower [H+], then water (PH> 7) are alkaline.

pH

What factors affect pH?

- **Water temperature**
- **Discharge of industrial wastewater**
- **Geology and soils (e.g. acid sulfate soils)**
- **Rainfall**
- **Salinity**
- **Time of day**
- **Others**

pH

Measurement Method?

- **pH indicator paper method**
- **pH meter method (this project, sensION 1 pH meter, unit: pH unit)**

Interpreting Your Results

	Excellent	Good	Fair	Poor	Degraded
pH range	6.0-7.5	5.5-6.0 or <8.0	8.0-8.5	5.0-5.5 or 8.5-9.0	<5.0 or >9.0

Water Temperature

What is it and why does it matter?

Temperature: how hot or cold a substance is.

Temperature

What factors affect water temperature?

- Air temperature
- Groundwater inflows
- Discharge of warmed water from industry and power plants, or cold water from dams
- Types, depth, and flow of waterbody
- Others (exposure to sunlight and amount of shade, vegetation etc.)

Temperature

Measurement Method?

- Glass thermometer method
- Digital meter (used in this project, sensION 1 pH meter, unit: ^{o}C)

Interpreting Your Results

- High temperature is a problem to many aquatic organisms that take their oxygen from the water

Turbidity

What is it and why does it matter?

Turbidity: opacity or muddiness caused by particles of extraneous matter; not clear or transparent.

Turbidity

What factors affect turbidity?

- Rainfall and catchment runoff
- Catachment soil erosion
- Waste discharge
- Excessive algal growth
- Flow
- Others (soil type etc.)

Turbidity

Measurement Method?

- Turbidity tube method
- Turbidity meter (used in this project, 2100P turbidity meter, unit: NTU)

Interpreting Your Results

- High turbidity is a problem to water resources of drinking water
- Changes in ecosystem habitat
- Loss of sensitive species

Electrical Conductivity (EC)

What is it and why does it matter?

EC: the property of a substance which enable it to serve as a channel or medium for electricity.

Electrical Conductivity (EC)

What factors affect EC?

- Geology and soils
- Salinity
- Industrial wastewater discharge
- Groundwater inflows
- Temperature
- Others (soil type etc.)

Interpreting Your Results

Water type	EC (μ s/cm)
De-ionized water	0.5-3
Pure rainwater	<15
Freshwater rivers	0-800
Marginal river water	800-1,600
Brackish water	1,600-4,800
Saline water	>4,800
Seawater	51,500
Industrial waters	100-10,000

Color

What is it and why does it matter?

Color: the indicator for estimating overall water conditions. Appearances of sample water.

Color

What factors affect Color?

- Geology and soils
- Salinity
- pH
- Quantity and characteristics of dissolved substance and suspended solid
- Temperature
- Others (soil type etc.)

Color

Measurement Method?

- Color comparator method
- Digital meter (used in this project, APHA Platinum-Cobalt Method, unit: mg/L Pt Co)

Interpreting Your Results

- Industrial wastewater and sewage can contribute high level of color.
- Iron and manganese in the river/lake sediment contribute high level of color.

Total Dissolved Solids (TDS)

What is it and why does it matter?

TDS: the filterable residue (non-filterable residue correspond to the SS). Used to crosscheck the ion concentration.

TDS

What factors affect TDS?

- Concentration and constitution of all kinds ions (cation and anion)
- pH

TDS

Measurement Method?

- Electrode method
- Digital meter (used in this project, sensION 5 Portable EC and TDS)

Interpreting Your Results

- Use to check the correlation with the measured result of EC
- EC (μ s/cm)÷TDS=0.5 to 0.8 (sensION 5, using 0.5 to measure TDS by EC)

Suspended Solids (SS)

What is it and why does it matter?

SS: undissolved substances suspended in sample water.
Diameter of particles; Normally larger than 1 micron

SS

What factors affect SS?

- Geology and Topography
- Industrial & Domestic wastewater discharge
- Flora and Fauna
- Climate
- Others (soil type etc.)

SS

Measurement Method?

- Photometric method
- Digital meter (used in this project, Hach CEL/890)

Interpreting Your Results

- Oligotrophic lake: < 1 mg/L
- Ordinary lake: < 15 mg/L
- Ordinary river: 25 to 100 mg/L
- Raw sewage: 100 to 350 mg/L
- Industrial wastewater: tens-thousands mg/L

Chloride (Cl^-)

What is it and why does it matter?

Cl^-: usually present in natural waters. Indicator that shows the influences of human activity and/or seawater.

Chloride (Cl^-)

What factors affect Cl^-?

- **Geology and Topography**
- **Industrial & Domestic wastewater discharge**
- **Climate**

Chloride (Cl^-)

Measurement Method?

- **Silver Nitrate method**
- **Digital titrator (this project, Model 16900)**

Interpreting Your Results

- **Non-contaminated surface water: 10 - 20 mg/L**
- **Groundwater: possibility of high Cl- concentration**
- **Raw sewage: 30 – 100 mg/L**
- **Industrial wastewater: tens-thousands mg/L**

How to measure pH, Temperature, Turbidity, EC, Color, TDS, SS, Cl-

Demonstration

Lecture for Basic Environmental Monitoring

Lecture-7: Water Quality Analytical Theory and Skill-2

June 2005

The JICA Expert Team

Dissolved Oxygen (DO)

What is it and why does it matter?

DO: a measure of the quantity of oxygen present in water (not including oxygen atoms within the water molecules).

Dissolved Oxygen (DO)

What factors affect DO?

- **Water temperature**
- **Photosynthesis by aquatic plants**
- **Industrial and domestic wastewater discharge**
- **Breakdown of organic materials in water**
- **Water movement and mixing**
- **Others (altitude, depth)**

Dissolved Oxygen (DO)

Measurement Method?

- **Winkler method (titration)**
- **DO meter (this project, sensION 6 DO meter, unit: mg/L)**

Interpreting Your Results

- **DO<2.0 mg/L: not support fish**
- **DO<3.0 mg/L: stressful to most aquatic animals**
- **At least 5-6 mg/L: for fish growth and activity**

Biochemical Oxygen Demand (BOD)

What is it and why does it matter?

Biochemical Oxygen Demand (BOD) is defined : as the quantity of DO which is able to oxidize the organic components in water with the assistance of microorganisms and under defined experimental conditions

Biochemical Oxygen Demand (BOD)

Importance of BOD measurement

BOD of special importance in assessment of polluted surface water and wastewater.

Indispensable as basic data for sewage works.

Biochemical Oxygen Demand (BOD)

What factors affect BOD?

- Industrial and domestic wastewater discharge
- Temperature
- Toxic matters in the water
- Nitrogen (N) concentration in the water
- Water movement and mixing
- Others

Biochemical Oxygen Demand (BOD)

Measurement Method?

- Dilution method (titration, standard method)
- Manometer (pressure sensor) method (approved in German, used in this project; unit, mg/L)

BOD_5

Reaction time of 5 days is used for measurement of BOD_5.

Biochemical Oxygen Demand (BOD)

Interpreting Your Results

- River: BOD=1 - 3 mg/L (good for fish, bathing)
  BOD=3 - 8 mg/L (fair for industrial or agriculture water use)
  BOD=10 mg/L or more (polluted)
- Raw sewage: BOD=200-300 mg/L (around 20-30 mg/L in effluent of sewage treatment plant)
- Industrial wastewater: BOD=tens - several thousands mg/L

Chemical Oxygen Demand (COD_{Cr})

What is it and why does it matter?

Chemical Oxygen Demand (COD_{Cr}) is defined : as the quantity of oxygen consumed by organic matter from boiling acid potassium dichromate ($K_2Cr_2O_7$)

Chemical Oxygen Demand (COD_{Cr})

Importance of COD measurement

COD of special importance in assessment of polluted surface water and wastewater.

Rapid and frequent monitoring water quality (2 hours)

Indispensable as basic data for sewage works

Chemical Oxygen Demand (COD_{Cr})

What factors affect COD?

- Industrial and domestic wastewater discharge
- Water temperature
- Chloride (Cl^-) concentration in the water
- Organic matter characteristics
- Water movement and mixing
- Others

Chemical Oxygen Demand (COD_{Cr})

Measurement Method?

- Dilution method (titration, standard method)
- Reactor digestion method (approved by USEPA, used in this project ; unit, mg/L)

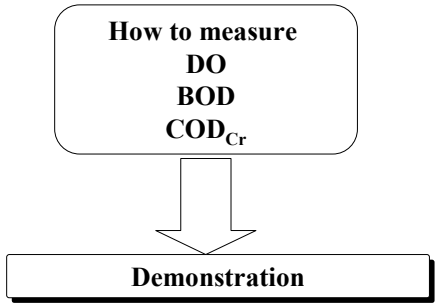
COD_{Cr}

A reaction time of 2 hours (BOD 5 days) is normally used for the measurement of COD_{Cr}

Chemical Oxygen Demand (COD_{Cr})

Interpreting Your Results

- Generally, COD_{Cr} value > BOD value for same water sample.
- Correlate with BOD (COD_{Cr}=1.5 to 3.0 × BOD)
- Raw sewage: COD=300-700 mg/L (around 60-150 mg/L in effluent of sewage treatment plant)
- Industrial wastewater: COD=tens - several thousands mg/L



Lecture for Basic Environmental Monitoring

Lecture-8: Water Quality Analytical Theory and Skill-3

June 2005

The JICA Expert Team

Ammonia-Nitrogen (NH_3-N)

What is it and why does it matter?

Nitrogen (N): an element that is essential for all forms of life

Ammonia-Nitrogen (NH_3-N)

What is it and why does it matter?

The nitrogen compounds are:

- **Organic nitrogen:**
- **Ammonia (NH_3): a product of de decomposition organic waste and can be used as an indicator of the amount of organic matter in the water**
- **Nitrate (NO_3): soluble and easily taken up by aquatic organisms, it is the most meaningful form for water quality agency to test.**
- **Nitrite (NO_2): toxic to humans and other animals.**

Total N=organic-N + NH_3-N + NO_3-N + NO_2-N

Ammonia-Nitrogen (NH_3-N)

What factors affect NH_3-N?

- **Animal and human wastes (sewage)**
- **Industrial wastewater discharge**
- **Nitrogen-containing fertilizers**
- **Soil type**
- **pH (pH>7 NH_3 form; pH<7 NH_4^+ form)**
- **Others (DO, bacteria quantity and type etc.)**

Ammonia-Nitrogen (NH_3-N)

Measurement Method?

- **Titration method (difficult for operation)**
- **Specific-ion electrodes**
- **Colorimetric method (used in this project; unit: mg/L)**

Ammonia-Nitrogen (NH_3-N)

Interpreting Your Results

- **Raw sewage: 10 – 50 mg/L**
- **Industrial wastewater: concentration varies with the type of factory**
- **The natural concentration of ammonia in surface water is typically low (< 1mg/L)**
- **High concentration of ammonia-nitrogen indicates that water may be polluted by sewage or industrial wastewater.**

Nitrate-Nitrogen (NO_3-N)

What is it and why does it matter?

NO_3-N: the most common nitrogen compounds, and actually measured as total nitrogen in water.

Nitrate-Nitrogen (NO_3-N)

What factors affect NO_3-N?

- Animal and human wastes (sewage)
- Industrial wastewater discharge
- N-containing fertilizers
- Soil type
- Seasonal conditions
- Others (DO, bacteria quantity and type etc.)

Nitrate-Nitrogen (NO_3-N)

Measurement Method?

- Zinc reduction (Colorimeter/spectrophotometer) method
- Cadmium (color comparator) method (used in this project, unit: mg/L)

Nitrate-Nitrogen (NO_3-N)

Interpreting Your Results

- Raw sewage: NO_3-N≒0 mg/L (tens mg/L in effluent of sewage treatment plant, because organic-N and NH_3➡NO_3)
- Industrial wastewater: concentration varies with the type of factory
- The natural concentration of NO_3-N in surface water is low (0-tens mg/L)
- Present in freshwaters at higher concentrations than NH_3-N and phosphate.

Phosphate (PO_4)

What is it and why does it matter?

Phosphorus (P): a mineral nutrient that is essential for all forms of life

Phosphate (PO_4)

What is it and why does it matter?

The most common phosphorus compounds are:

- Organic phosphorus:
- Phosphate (PO_4): high concentration of PO_4 in lake/river waters stimulate great increases of the growth of algae

Total P= Organic-P + PO_4-P

Phosphate (PO_4)

What factors affect PO_4?

- Animal and human wastes (sewage)
- Industrial wastewater discharge
- Phosphorus-containing fertilizers
- Soil type
- Seasonal conditions
- Others (DO, bacteria quantity and type etc.)

Phosphate (PO_4)

Measurement Method?

- Reactive, molybdovanadate method
- Reactive, amino acid method (used in this project; unit: mg/L)

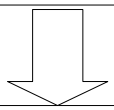
Phosphate (PO_4)

Interpreting Your Results

- Raw sewage: 3–30 mg/L
- The natural concentration of PO_4 in surface water varies from 0- 30 mg/L
- To convert phosphate (PO4) to phosphorus (P), divide by (31+16*4)/31=3

  (i.e. 30 mgPO_4/L is equivalent to only 10 mgP/L

How to measure
NH_3-N
NO_3-N
PO_4



Demonstration

The Capacity Development of Environmental Monitoring at Directorates for Environmental Affairs in Governorates

Basic Environmental Monitoring Course (Lecture-9. Laboratory Operation)

1st Round: 7th June 2005
2nd Round: 14th June 2005

JICA Expert Team

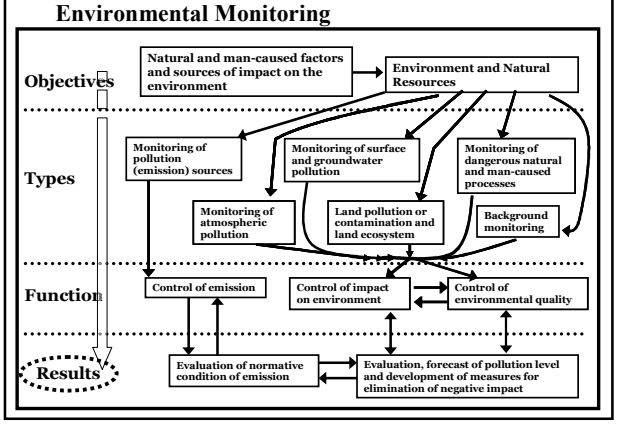
1

Laboratory Operation

1. Scheme of Environmental Monitoring System
2. Reliability of Analyzed Data
3. What to do to ensure accuracy and reliability of analyzed data in laboratory?
   - 3.1 Quality Assurance and Quality Control
   - 3.2 SOP
   - 3.3 Operation and Maintenance of Laboratory

2

1. Scheme of Functioning of the System of Environmental Monitoring



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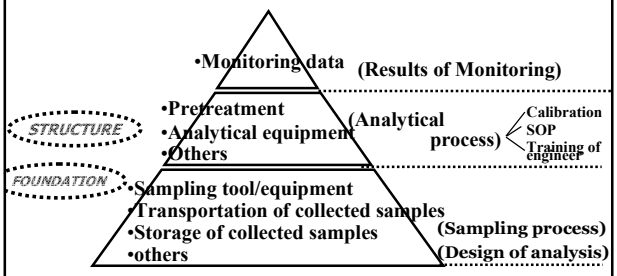
2. Reliability Pyramid of Monitored Data



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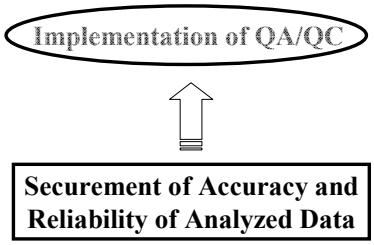
➢ How to Ensure Accuracy and Reliability?



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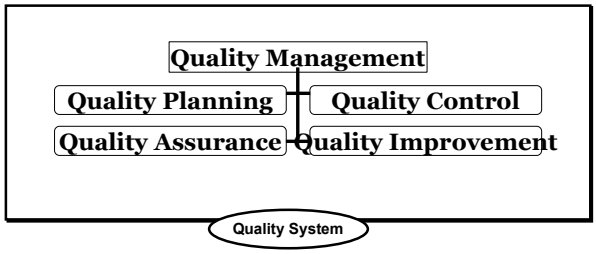
3.1.1 Quality System And Elements of Quality Management



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➢ **What is the Goal of QA/QC?**

► **Implement correct or standardized methodologies in every monitoring processes :**
- **Sampling process,**
- **Analysis process,**
- **Data handling process,**
- **Reporting process**

⇒

GOAL

► **Minimize or avoid the introduction of error in every monitoring processes**

7

3.1.2 Definitions Associated with Analytical Quality Assurance(1)

- **Quality management**

✓**Overall management function** to determine quality policy, objectives and responsibilities, and to implement by means of quality planning, quality control, quality assurance, and quality improvement

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3.1.3 Definitions Associated with Analytical Quality Assurance(2)

- **Quality Control**

✓Part of quality management focused on **fulfilling quality requirements** [ISO9000]

✓Operational techniques and activities to fulfill requirements for quality

✓ "Internal quality control"

⇨ Conducted within a laboratory to monitor performance

✓ "External quality control"

⇨ Leading to comparison with other reference laboratories or consensus results amongst several laboratories

3.1.4 Definitions Associated with Analytical Quality Assurance(3)

- **Quality Assurance**

✓Part of quality management focused on **providing confidence** that quality requirements will be fulfilled [ISO 9000]

✓All planned and systematic activities implemented within the quality system to provide adequate confidence

✓System of documenting and cross referencing management procedures

10

- Objectives of QA

To have clear and concise records of all procedures related to data quality

⇧

Achieved by: Establishing protocols and quality criteria for all aspects of laboratory works

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3.1.5 Components of Q/A

Lab. Works	Actions Taken
• Operation of standard procedure	– Preparation of SOP – Examination of new method
• Maintenance of analytical equipment	– Regular calibration – Supply of consumables
• Securing of validity of analysis	– Securing of quality of reagent – Technical training
• Evaluation of analyzed data	– Recording of analytical condition – Examination of deviation
• Review of management system	– Reporting – Necessary revising

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3.2.1 SOP

What is SOP?

SOP stand for ;

Standard **O**peration **P**rocedure

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3.2.2 What is SOP?

- **A set of written instructions** followed by a laboratory
- Kind of unified instruction or manual for analysis
- SOPs **describe both technical and administrative operational elements** under a work plan or a Quality Assurance (QA) Project Plan

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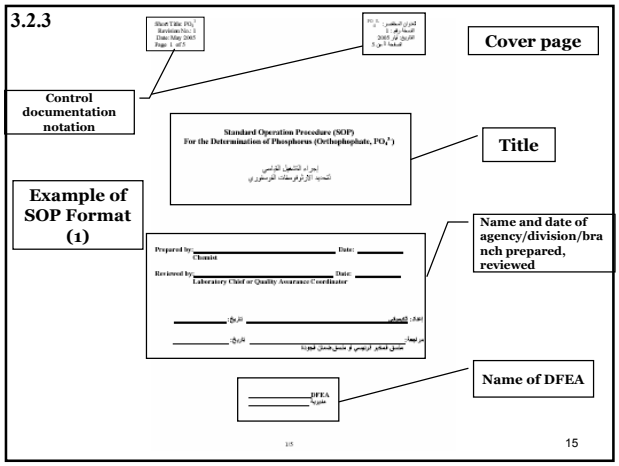
3.2.3



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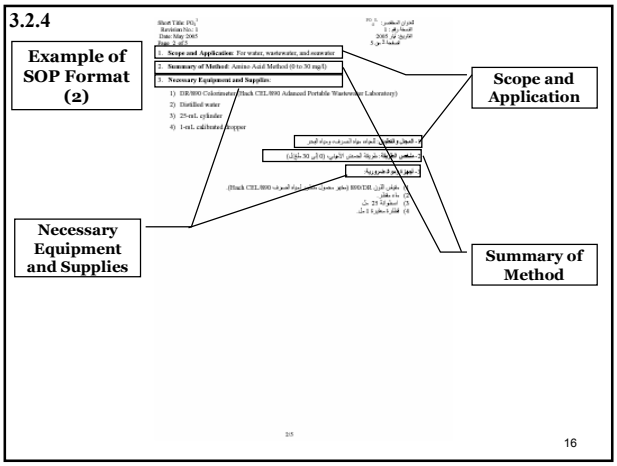
3.2.4



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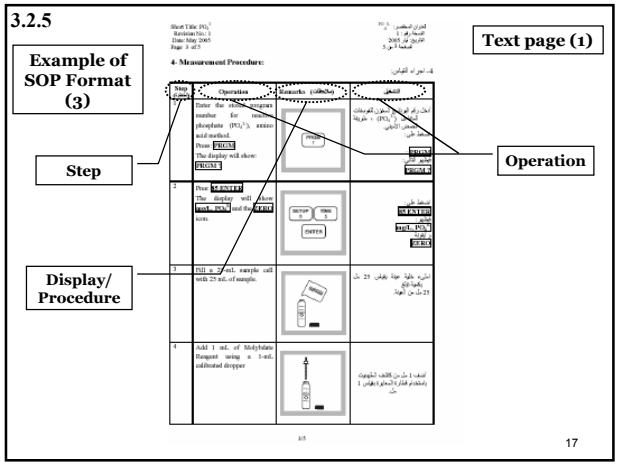
3.2.5



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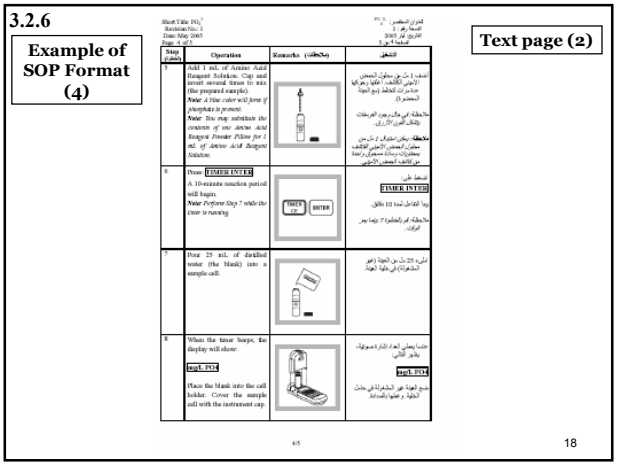
3.2.6



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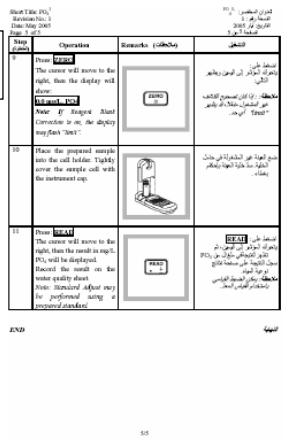
3.2.7

Example of SOP Format (5)



Text page (3)

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3.2.8 What is the purpose of SOP?

- **Standardization** of every analysis-related procedures to avoid or minimize error caused by analysts and equipment
- To **facilitate consistent conformance** to technical and quality system requirements
- To support data quality
- To maintain their quality control and quality assurance processes, and
- To ensure compliance with regulations

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3.2.9 What is the benefit of having SOP?

- **Integral part of a successful quality system** as it provides analysts with the information to perform a job properly
- Facilitation of **consistency in the quality and integrity** of a product or end result
- A part of a **personnel training** program
- **Reduction of work effort** along with improving data comparability, credibility, and legal defensibility
- Person with limited experience or limited knowledge can **reproduce the analytical procedures without supervision**

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3.2.9(2) Indirect Result of SOP

- **Decrease in mistakes during monitoring performance**
- **Proper layout of equipment and facilities**
- **Improvement of safety of work**
- **Improvement, maintenance and succession of techniques**

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3.2.10 How much detail needs to be included in SOP?

- No one 'correct' format
- Vary with each laboratory and with the type of SOP
- Written with sufficient detail with a basic understanding

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3.2.11 Writing Styles of SOPs

- In a concise, step-by-step, easy-to-read format
- Not be unambiguous and not overly complicated
- Active voice and present verb tense
- Not be wordy, redundant, or overly lengthy

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3.2.12 Who should write a SOP?

- ❑ Prepared by analysts knowledgeable with the analytical performance and the laboratory's internal conditions
- ❑ Subject-matter experts who actually perform the work or use the process
- ❑ A team approach for multi-tasked processes

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3.3.1 Operation and Maintenance of Laboratory

1) Attitude to Accurate Analysis
2) Ensuring Safe Operation
3) Management and Handling of Reagents
4) Management & Maintenance of Facilities & Instrument

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1) Attitude to Accurate Analysis

① Overall Understanding of Background to the Environmental Analysis
② Cleaning up and Tidying of the Laboratory
③ Appropriate Solid Waste Treatment
④ Collection and Disposal of Liquid Waste

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2) Ensuring Safe Operation

①Storage of Dangerous Chemicals
②Electrical Wiring in Laboratory
③Handling of High Pressure Gases

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3) Management and Handling of Reagents

① Grasping the Stock Amount of Reagents
② Reagent Storage and Management Ledger (Inventory Control)
③ Storage of Standard Reagents and Maintenance of Accuracy
④ Safety Measures
⑤ Reagents Required Special Care for Storage

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4) Maintenance/Management of Facilities and Instrument

① Maintenance and Management of Facilities
- **a. Air conditioners**
- **b. Ventilation system**
- **c. Electrical equipment**
- **d. Wastewater treatment plant**

② Maintenance and Management of Equipment/Instruments
- **a. Maintenance of equipment/instruments under normal status**
- **b. Management of equipment/instruments under abnormal condition**
- **c. Management of spare parts and consumables**

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5) Other Key Factors

① **Standard Operating Procedure (SOP)**

② **Management of Analysis Records**

③ **Handling of Analysis Data**

- **a. Unit and Significant figures**
- **b. Anomalous value**
- **c. Accuracy management**

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☐ Unit for Water Pollution Indicator

✓ Expression of Analyzed Data

NO_3-N : 7mg/L ◄·····► NO_3 : 31mg/L

✓Meaning of Analyzed Data

⟹ Understanding of analytical method adopted

✓Unit of Expression

μg/L, mg/L, kg/L, … (weight/volume)

%, ppm (parts per million), ppb, ..(ratio)

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☐Significant Figures

pH=6.23 → 2 decimal places

pH=6.234 → 3 decimal places

pH=6.2 → 1 decimal place

Minimum detection limit : 0.01

pH=6.234 → pH=6.23

pH=6.2 → pH=6.15 – pH=6.24

→ pH=6.15, 6.20, 6.23, ….

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Thank You for Your Kind Attention

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Lecture 10: Data Management

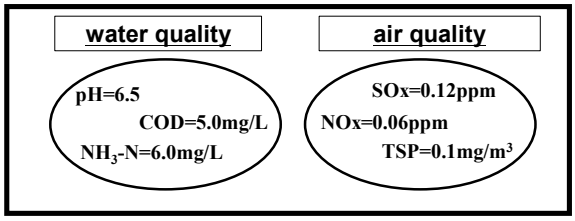
Data Management
- What, Why and How? -

June 2005

JICA Expert Team

What is "data"?

- "Data" : Figures with a specific unit in a specific form collected by the monitoring to indicate water/air quality.



What is "Data Management"?

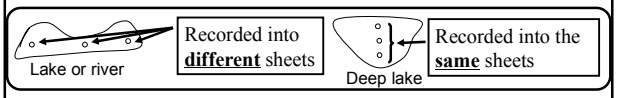
- Process the data into a "unified form"
  - ✓ **Unify the unit for each item**
  - ✓ **Unify the essential digit for each item (usually "two")**

unified unit	unified essential digit
ex)	ex)
NH_3-N → mg/L	NH_3-N → 6.0 or 6.04
COD → mg/L	COD → 5.0 or 5.04
SOx → μ g/m^3 or ppm	SOx → 0.12 or 0.123

→make it easier to accumulate data at DFEA and GCEA, and to process it further

Continue...(1)

- Record data in a Chronological order
- Record data of Horizontally and Vertically different points in a rational way
  - ✓ **Horizontally different points of the same water body**
  - ✓ **Vertically different points of the same horizontal points**



→identify changes over time
→practical laws/standards, and quick actions for emergency incidences (ex. spills or explosions)

Continue...(2)

- Accumulate data at regional and national centers

→enables to review past data in a easy way

- Issue environmental reports

→explain citizens about the degradation and improve environmental awareness

→encourage citizens to complain about environmental degradation

→strengthen the cooperation between citizens and authorities

Goal of Data Management

- to identify pollutants to deal with
- to take countermeasures
- to verify effects of the countermeasures
- to publish environmental reports

Data management from the view point of monitoring objectives

At Regional Level

1. characterize and identify changes or trends in water/air quality over time;
2. identify specific existing or emerging water/air quality problems;
3. punish violators of laws and effluent/emission standards;

Continue…

4. design laws and standards to prevent or remediate pollutions;
5. analyze effects of the laws and standards; and
6. evaluate the necessity of new laws and standards.

At National Level

Bridging Role between Regional monitoring objectives and National monitoring objectives

Procedures of Data Management

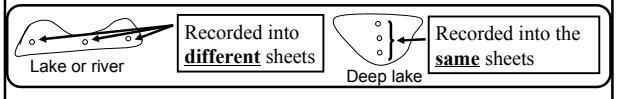
1. Prepare the unified recording format by a versatile software (i.e. excel) and use the same format among all DFEA

Key words: good and enough Directions for correct Form Entry, Unit, Method, Essential Digit

see "Example of Recording Format"

Procedures of Data Management

2. Form entry of monitoring data in a chronological order using excel sheets.



Key words: Chronological Order, Obedience to the Format

see "Example of Recording Format again"

Procedures of Data Management

3. Form entry of useful relevant data such as weather and monitoring site description.

Key words: Relevant Data, Weather, Site Description

see "Example of Recording Format again"

Procedures of Data Management

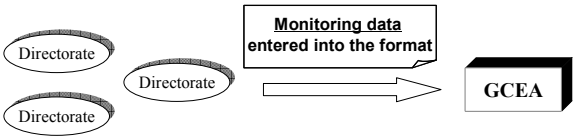
4. Analyze and evaluate the accumulated data at DFEA before sending to GCEA.

   Deal with citizens' complaints or punish violators based on the results.

Key words: Evaluation of Data at Regional Level (DFEA)

Procedures of Data Management

5. Send the data entered into the format from DFEA to GCEA and accumulate all data at GCEA



Procedures of Data Management

6. Analyze and evaluate the accumulated data at GCEA and confirm DFEA.

Key words: Communication between GCEA and DFEA

7. Evaluate whether the selection of monitoring sites is appropriate for monitoring of ambient water/air quality or pollution sources.

Key words: Evaluation of Monitoring Sites

Evaluation of monitoring sites

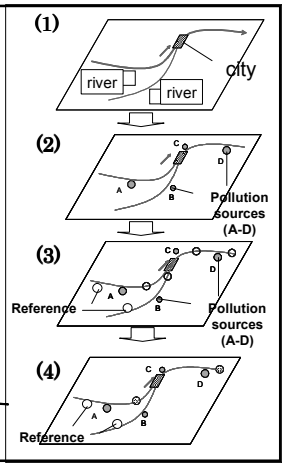
(2) Identify pollution sources

(3) Set reference sites and preliminary typical sites of surrounding env.

(4) Select representative sites of surrounding env.

Always consider points where complaints occurred

○Preliminary typical sites of surrounding env.
○Representative sites of surrounding env.



Procedures of Data Management

8. Continue monitoring at the same sites for a long time to identify trends and changes in water/air quality

Key words: Continuation

Procedures of Data Management

9. Formulate the environmental laws and standards to control pollution sources or to remedy existing pollutions

Key words: Formulation of Laws and Standards based on the Monitoring Results

Japanese Experience

- how to set standards on living environment -

- Too strict
  ⇒ **standards will lose substance**
- Too loose
  ⇒ **standards are meaningless**

Appropriate standards considering compliance conditions.

Procedures of Data Management

10. Issue an environmental report at national level periodically to open to the public

Key words: Publication of environmental reports

Summary of Procedures

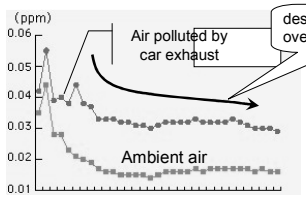
1. **Prepare the unified recording format**
2. **Form entry of monitoring data in a chronological order**
3. **Form entry of useful relevant data**
4. **Analyze and evaluate the data at DFEA**
5. **Send the data from DFEA to GCEA**
6. **Analyze and evaluate the accumulated data at GCEA**
7. **Evaluate the monitoring sites**
8. **Continue the monitoring at the same sites over time**
9. **Formulate or modify the environmental laws/regulations based on the monitoring results**
10. **Issue an environmental report periodically to open the monitoring results to the public**

Output of Data Management - environmental report -

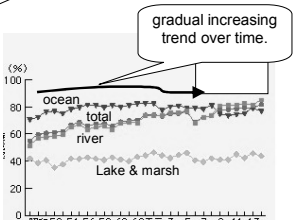
Environmental Report at national level

Environmental Report at regional level

Environmental Report - What the result shows (1) -

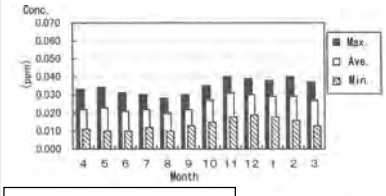


One year average NO2 concentration



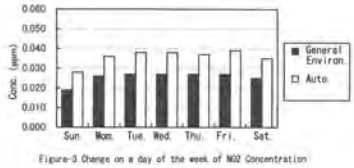
Percentage of compliance with BOD/COD regulation

Environmental Report - What the result shows (2) -

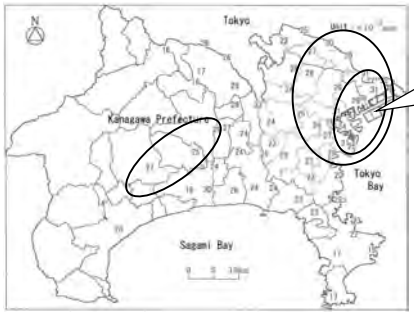


Weekly Average NO_2 concentration

Monthly Average NO_2 concentration



Environmental Report
- What the result shows (2) -



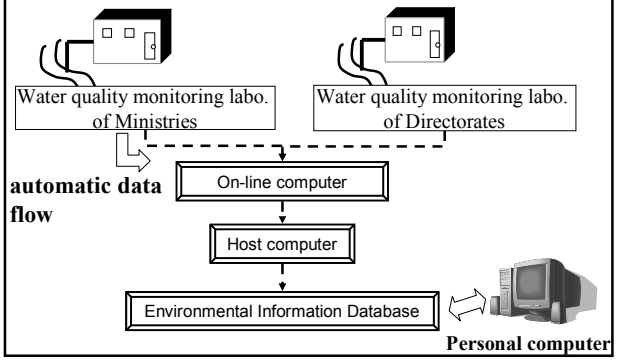
Plot of NO_2 Concentration in map (one year average)

Output of Data Management
- environmental report -

Environmental report for children

This picture painted by a child was selected by the contest

In the future, …
Data Management Network in Japan



A proposal for Environmental Education (E.E) in Syria

June 15, 2005
JICA Expert Team

Outline

- My presentation focuses on:
  - History and Concept on E.E.
  - Japanese Experience on E.E.
  - Proposals for E.E. in Syria

History & Evolving Concept of E.E. (1)

- UN Conference on the Human & Env. 1972
  - Consensus building on E.E.
- UNESCO-UNEP International E.E. Program
  - Belgrade Workshop, 1975 (at Yugoslavia)
    - Draft concept and a vision for E.E.
  - Tbilisi Conference, 1977 (at Georgia)
    - Identify the role, objectives, characteristics of E.E.
    - Serve as a guideline for E.E.

History & Evolving Concept of E.E. (2)

- UNCED in Rio, 1992 focuses on:
  - Public education;
  - Awareness and training;
  - Stress the importance of E.E.;
- UNESCO Thessaloniki Declaration (1997) establish a concept for
  - education for sustainable development
- WSSD in Johanesburg, 2002
  - Capacity Development in Environment (CDE)
  - Eco Initiative for Sustainable Development (Eco-ISD)

Concept for E.E.

- Tbilisi declaration stated:
  - Goal
  - Objectives
  - Characteristics:
    of Environmental Education.

Goal of E.E.

- To foster clear awareness of, and concern about economic, social, political and ecological interdependence in urban and rural area;
- To provide every person with opportunities to acquire the knowledge, values, attitudes, commitment and skills needed to protect and improve the environment;
- To create new patterns of behaviour of individuals, groups and society as a whole towards the environment

(Source): Tbilisi Declaration (1977)

Objectives of E.E.

- **Awareness**
  - To help **social groups** and **individuals** acquire an **awareness and sensitivity** to the total environment and its allied problems.
- **Knowledge**
  - To help **social group** and **individuals gain a variety of experience** in, and acquire a basic understanding of, the environment and its associated problems
- **Attitude**
  - To help **social groups** and **individuals** acquire **a set of values** and **feelings of concern** for the environment and **motivation** for actively participating in **environmental improvement and protection**
- **Skills**
  - To help **social groups** and **individuals** acquire **the skills** for identifying and solving environmental problems.
- **Participation**
  - To provide **social groups** and **individuals** with **an opportunity to be actively involved** at **all levels** in working toward resolution of environmental problems

(Source): Tbilisi Declaration (1977)

Social Groups/Stakeholders

- There are many social groups or stakeholders for E.E., like…
  - Pre-school children
  - School Children
  - Student at higher education
  - Adults
  - Scientists and technicians
  - Business & Industry
  - Interested Groups, like NGO
  - Community

Principles (1)

- Consider the environment in its totality: - natural and built, technological and social (economic, political, cultural-historical, moral and aesthetic);
- Be a continuous lifelong process, beginning at the pre-school level and continuing through all formal and non formal stages;
- Be interdisciplinary in its approach, drawing on the specific content of each discipline in making a holistic and balanced perspective;
- Examine from local, national, regional and international point of view so that students receive insights into environmental conditions in other geographical areas;
- Focus on current and potential environmental situations while taking into account the historical perspective;
- Promote the value and necessity of local, national and international cooperation in the prevention and solutions of environmental problems;

(Source): Tbilisi Declaration (1977)

Principles (2)

- Explicitely consider environmental aspects in plans for development and growth;
- Enable learners to have a role in planning their learning experiences and provide an opportunity for making decisions and accepting their consequences;
- Relate environmental sensitivity, knowledge, problem-solving skills and values clarification to every age, but with special emphasis on environmental sensitivity to the learner's own community in early years;
- Help learners discover the symptoms and real causes of environmental problems.
- Emphasis the complexity of environmental problems and thus the need to develop critical thinking and problem-solving skills
- Utilise diverse learning environments and a broad array of educational approaches to teaching/learning about and from the environment with ude stress on practical activities and first-hand experience

(Source): Tbilisi Declaration (1977)

Japanese Experience on E.E.

- Kids' Eco-Club
- Environmental Councilors.
- E.E. Promotion Law (2004)

Kids' Eco-Club

- History:
  - started in 1995. 10 years experience.
  - Currently, 4320 clubs, 83200 kids are involved.
- Framework
  - Establish a Eco-Club.
    - Comprising of several to up to 20 members
    - school children at primary or secondary schools
  - Select an adult supporter
  - Registre a Eco-Club to the secretariat of Eco Club (1year expiration, renewal possible)
  - When the club is registered, an activity kit is to be distributed to each member of the club.

Kids' Eco-Club Materials

Pocket Book

Stickers

Badge

Newsletter for members

Binders

These materials are provided from the Coordination Body of Kids' Eco-Club, when the Eco-Club is established

(Source)
http://www.env.go.jp/kids/ecoclub/

Kids' Eco-Club

- Activities:
  - The members of the Eco-Club themselves decide the environmental-related activities by themselves, at their registration.
  - Wide variety of activities, like
    - Aquatic habitat survey;
    - Water quality sampling/monitoring;
    - Recycling activities;
    - Factory tour;
    - Nature watching
  - Activity report to the Secretariat of Kids' Eco-Club, it will be introduced to the newsletters, Web pages

Kids' Eco-Club Materials

- This certification card is provided to all the member of Kids' Eco-Club, when they carried out a 1 year continuation of activities.

- Silver-type bagde is provided when they continues activities for 3 year,
- Gold-type badge is provided when they continues activities for 6 years..

Kids' Eco-Club Cross-Fertilisation Events

- Wall poster contest is carried out, and best EcoClubs in each prefecture are invited to the Cross Fertilisation Events
- Every year at differenent Place

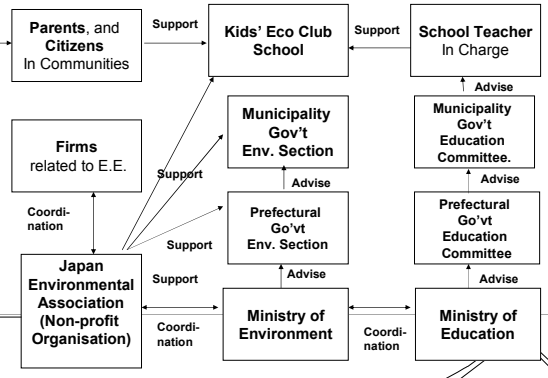
(Source)
http://www.env.go.jp/kids/ecoclub/

Contest/Events

- Picture Contest
- Wall paper contest
- Outstanding works are awarded and use a cover page of the White Paper on Environment

(Source)
http://www.env.go.jp/kids/ecoclub/

Implementing Scheme of Eco-Club



Environmental Counselors

- History: Established in 1996
- Definition: A specialist who can
  - provide an consultation activities to citizens or firms in terms of environmental conservation activities at voluntary basis.
  - support the Environmental Conservation activities
  - Coordinates the activities
- Registration System
  - Persons that have qualifications for E.E. capability can register themselves as a environmental counselors. MoE issues a certificate.
- Number of Environmental Counselors
  - Corporate Section: 2163
  - Citizen Section: 1443
  - Both: 222
  - Total: 3398

E.E. Promotion Law

- Background:
  - Environmental Issues
  - WSSD EcoISD Initiative
    - Capacity Development for Environment
  - New Curriculum Introduced (1998): Holistic approach at Teacher could not find the right person who can help the E.E. activities at schools.
- History:

Dec, 1999:Verdict on E.E. by Central Environmental Council
Aug, 2002 :Prime Minister stress the capacity development on environment at WSSD
Jul,2003: The law was promulgulated.
The draft law was proposed by the assembly member

Contents of the E.E. Law

Sustainable Society

Environmental Conservation Activity

Awareness Raising For Environmental Conservation

Trainer's Training w/ Private Initiative

Environmental Education

Define the role of E.E. for
•Local Go'vt (Provincial/Municipal)
•Private Firm

Lessons Learned from Japanese Case

- Inter-Ministerial Coordination
  - E.E. Law is jointly mandated by MOE and MEXT
  - Role of Ministry of Environment in Japan:
    - Support the E.E. activities of the civil society
    - Coordinate w/ formal education, and other stakeholders
- Focus on partnership
  - Especially on primary school-community tie
  - -> This offers an forum at community level.
- Focus on Trainer's Training by private initiative
  - -> This overcomes the bottleneck of trainers supply

Proposals for E.E. in Syria

Milestones for E.E. in Syria

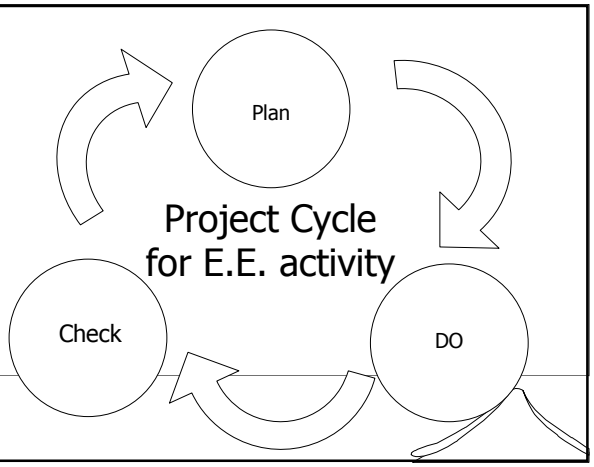
- Development of a national framework for E.E.;
- Raising the profile of E.E.;
- Better coordination of E.E. activities;
- Greater access to quality materials;
- More professional development opportunities for teachers in the formal education sector;
- More integration of E.E. principles into mainstream education (i.e. higher education and vocational training)
- Better resoucing of community organisations involved in E.E.

Options for interventions

- Youth awards
- Training for educational professionals (Trainer's training)
- Material preparation
- Linkages with internal and external experts

Proposals for E.E. in Syria

- Focus on Primary Education
  - Needs Involvement of Ministry of Education
- Networking and Partnership
  - Target groups: School children
- Focus on Hands-on Activity
  - This points represents a principle of concept of practicability
  - Simple water quality monitoring as an after-school activities by school children
- Focus on Awareness Raising on Citizens
  - Use of mass-media and media events



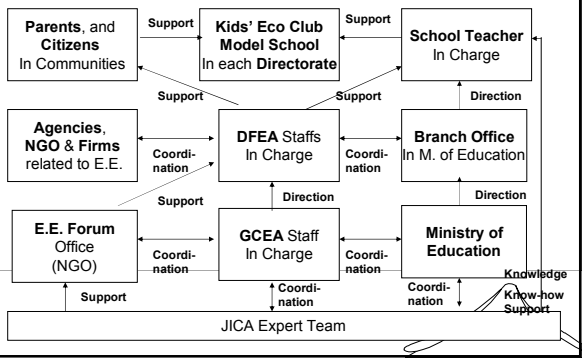
Tentative Framework for Activity

Phase	Activity	Timeframe
Survey	Environmental Consciousness Survey ->Target Identification Key Person Inventory	Jan- Feb 2005
Year 1		
Plan	Framework set-up Model Area selection	Jun – Jul. 2005
Do	Trial Hands-on Activity (Example) water quality monitoring water pollution mapping wall paper contest	Summer vacation
Check/Plan	Evaluate Hands-on activity Feedback to Year 2 activity	Sep? 2005

Tentative Framework for Activity

Phase	Activity	Timeframe
Year 2		
Do	Trial Hands-on Activity (Example) water quality monitoring wall paper contest	2006
Check/Plan	Evaluate Hands-on activity Feedback to Year 3 activity	2006
Year 3		
Do	Hands-on Activity	2007
Check/Plan	Evaluate Hands-on activity Feedback to Year 4 activity	

A model of Networking/Partnership Framework



Networking/Partnership

- The role of MOLAE:
  - Focal Point for E.E.
    - Regional focal points would be DFEA
    - Coordination w/ Regional Office of MOE
  - Support the educational staffs, like good quality materials
  - Linkage with internal external experts
  - E.E. in Non-formal Education
- Role of MOE:
  - E.E. in Formal Education

An Example of After-school activities
Water quality Monitoring Activity

- Targets: School Children
- Activities:
  - Formation of Eco Club. Its OK for using the existing groups.
  - Water quality sampling w/ support from Experts
  - Presentation at the ceremony
  - Replicate activities to other schools.
  - How about to start a pilot activity, as a extra-curricular activity, during a summer vacation ?

Tentative Plan for Seminars on E.E.

Objective	Technology transfer on the method of (a) awareness raising, and (b) E.E.
Organiser	Co-organised by DFEA and JICA Expert Team
Presenter	- DFEAs IEC (Information, Education, and Communication) Officer - JICA Expert for Environmental Education Core members of the E.E. Forum
Audience	IEC Officers at DFEAs, School Teachers
Frequency	Twice a year

Tentative Plan for Media Events

Objective	Awareness raising for (a)citizens, and (b) entreprises
Organiser	Organiser: GCEA MOLAE Supporter: JICA Expert Team
Presenter	Information & Communication Officer JICA Expert Team Core members of the E.E. Forum Related Environmental NGO Kids' Eco-Club Member (school children)
Audience	Citizens, School Children, Mass Media
Frequency	Five times during the project

Tentative Plan for Media Events

Round	Expected Date	Tentative Theme of Media Event
Round 1	June, 2005	Tentative title: Environmental Issues in Damascus Intention of the Media Event: Introduction of the project and the JICA expert team Awareness raising for Air and Water Quality Pollution 、
Round 2	January, 2006	Tentative title: A way to Doctor on Water Quality Intention of the Media Event: - Introduction to the activities of - Eco-Club Launch Program
Round 3	June, 2006	Tentative title: What can we do to stop the environmental pollution? Intention of the Media Event: Introduction to the results of Environmental Pollution Survey Introduction to the Environmental Monitoring
Round 4	January, 2007	Tentative title: Kids' Eco-Club Festival Intention of the Media Event: - Introduction to the activities of Kids' Eco-Club - Awarding Ceremony for Best Kids' Eco-Club Contents: - Presentation by the Best Kids' Eco-Club on their voluntary monitoring activities - Wall poster Session by the Kids' Eco-Club
Round 5	June, 2007	Tentative Title: Who owes the environmental pollution? Intention of the Media Event: - Awareness raising of the citizens in terms of environmental pollution)

Thank you for your attention !

Lecture 11
Public Awareness and Environmental Education

June 15, 2005
JICA Expert Team

Today's Topic

- Concept of "Risk Communication"
- Tools for Risk communication
- (Environmental Education)

Concept of "Risk Communication"

What is a Risk Communication?

- Definition:
  - a process of:
    - (a) informing people about hazard/risk deriving from the chemical substances
    - (b) Sharing information among stakeholders, establishment, citizens, and government about the risk.

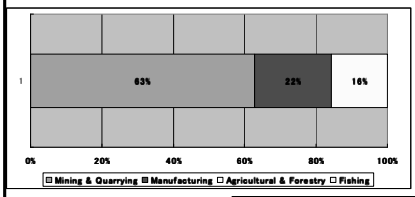
What is a Risk Communication?

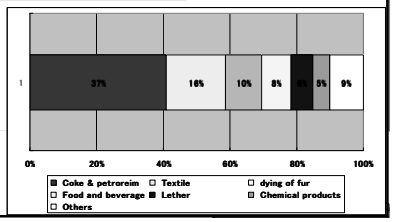
- Risk:
  - the possibility that undesirable to human health might happen.
  - Objective Risk:
    - calculated by scientist based on research
  - Subjective Risk:
    - public perceived to be hazard, which is affected by:
      - Issues of familiarity
      - Dread,
      - Fairness
      - avoidability
- Communication:
  - It comprises of two-way communication:
    - Disseminate information
    - Gather information from the public

Why Risk Communication?

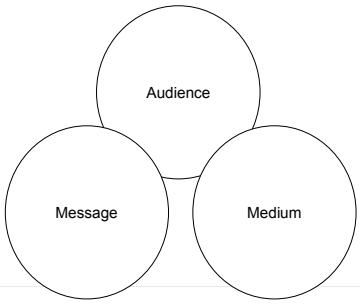
- Economic growth and trade might trigger environmental hazards that might damage to human body
  - Excessive Pesticide Use;
  - Untreated effluents from factories;
- People are more concerned about environment, human health, and safety
- It is necessary to disseminate information, to prevent disaster through making aware of the risk.

Leading Trade Industries in Syria





Key Components of Communication

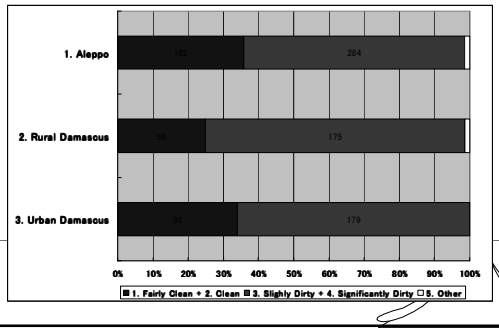


Message Development

- Factor to be considered for developing message
  - Level of Understanding
    - Awareness Level:
      - Short message. Visual might be more impact.
    - Understanding Level
      - More complicated message
    - Action Level: change an attitude or behavior
  - Types of Information:
    - Word, Photo, Visual Images, etc…
- Important is to meet the information needs of the citizens
  - What information is likely to be of greatest interest to the audience?

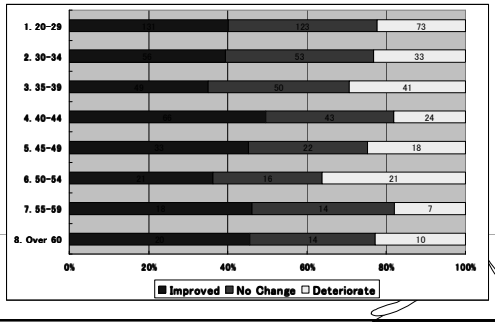
Awareness on Environmental Situation

Question: What is the environmental status on rivers/lakes/ street near your house?



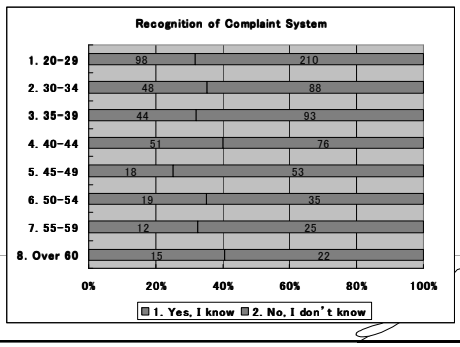
Awareness on Environmental Degradation

Question: Comparing to 5 years before, has the environment improved?



Recognition of Complaint System

Question: Do you know that DFEA accepts the complaint on the pollution on air or water etc.?



Knowledge/Behavior of Complaint

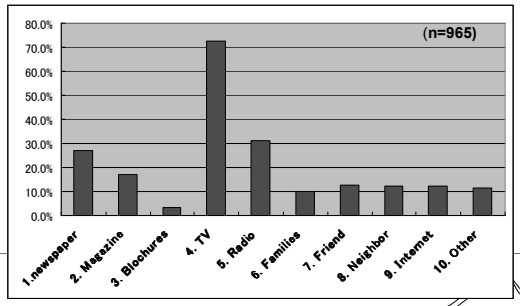
Have you complain? / Do you know the system?	1.Yes	2. No	Total
1. Yes	52 (5.5%)	253 (26.6%)	305 (32.1%)
2. No	21 (2..2%)	578 (60.8%)	599 (63.1%)
N.A.	2	44	46
Total	75 (7.9%)	875 (92.1%)	950 (100%)

Medium

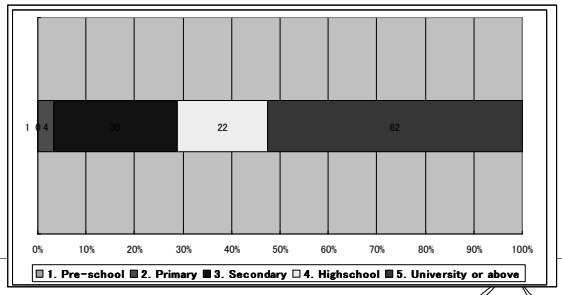
- There are several types of media,
  - Newspaper
  - Radio
  - TV
  - Magazines, Newsletters
  - School Education
- When choosing media, you must consider:
  - Types of Information (Visual, Written)
  - Cost
  - Level of Messaging
  - Social Background of Audience

Choosing media

Question: Where do you get your environmental information?



Social Background of Internet User



Audience

- Audience should be changed, according to the goal
  - Local Decision Maker
  - Educator and Students (Schools
  - Special Interest Groups like, Trade Association and Establishment
  - Community Groups
  - Health Organisation and Clinic
  - Schools
  - Day care centre
  - Health department:
- Priority should be placed on the Vulnerable Groups
  - Elderly
  - Pregnant Women
  - Children

Procedures of Risk Communication

- Setting the Goal
- Targeting Audience
- Profiling your target audience
- Developing a message
- Selecting media
- Delivering a message
- Feedback from citizens

Seven Cardinal Rule of Risk Communication?

- Accept and involve the public as a partner
- Plan carefully to evaluate your efforts
- Listen to the publics' specific concerns
- Be honest, frank, and open
- Work with other credible sources
- Meet the needs of the media
- Speak clearly and with compassion

Tools for Risk Communication

Tools for Two-Way Communication

- Tools for Two-way communication can be classified into two categories:
  - Tools for Information Dissemination
  - Tools for Information Gathering & Exchange

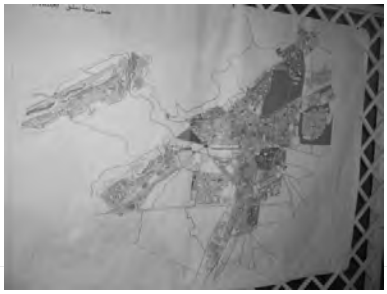
Tools for Information Dissemination

- Exhibits
- Maps
- Internet
- Indexing Techniques
- Mass Media
- Special Events
- Modelling

Exhibits at Damascus DFEA

Exhibits at Homs DFEA

Maps



If we combine into GIS, it could be more effective

Internet/Maps- Air Quality

(Source): http://www2.kankyo.metro.tokyo.jp/bunpu1/air/mapmenu.asp

Internet/map- water quality

(Source): http://www1.river.go.jp/cgi/SelectMapSite.exe

Indexing

- Index is a method that monitoring data translated in a way that public can understand.
- Range of index should be into 1-10 or 1-100 scale.

Special events

Periodical Facility Tour

Objective	To raise an awareness of the facility operation
Organiser	Facility Operator
Target Stakeholders	- School children for environmental education - Neighborhood community people - Mass Media (i.e. TV and radio) - Officials at other cities in northwest region
Activity	- Collect the participants by mass media - Explain the facility operation, in accordance with tour route - Hands on activity are preferable, like fact sheet, visual display, and presentation -Question and Answer time after facility tour
Merit	- Expected to remove the unreasonable fear of the stakeholders

Tools for Information Gathering & Exchange

- Poll Surveys / Awareness Survey
- Telephone Hotline
- Community Interview
- Focus Group Discussion

Poll Survey/ Awareness Survey

- Definition: to collect information on attitude/awareness of citizens on a regular basis, for a particular environmental issues,
- Procedure:
  - Planning (target area, schedule, cost, surveyor, method of sampling selection)
  - Questionnaire Development
  - Pre-test
  - Training of Surveyors
  - Questionnaire Collection
  - Database Development
  - Analysis
  - Report Preparation

Telephone Hotline

Objective	To answer the questions/queries, and complaints from the citizens
Organiser	DFEA
Target Stakeholders	Neighboring community
Activity	Hotline is a toll-free telephone line, though which people can ask queries, complaints and information. - Assign the hotline staffs - Get the hot line phone number - Distribute contact number and the name of contact person - Keep a logbook (date/time, contents, action taken etc.)
Merits	Citizens will have a good feeling that the facility operator sincerely accept the request or queries

Community Interview

Objective	To grasp a level of public concern on the facilities
Organiser	Project Owner
Target Stakeholders	- Neighborhood community
Activity	- Identify the interviewees of community interview - Pre-notification to interviewees on the date of call - Training of interviewers - Carry out community interview - Issue a thank you letter after finishing interview
Merits	Easy to grasp the level of public concern quickly and correctly, because of the face-to-face communication with interviewees

Focus Group Discussion

Objective	To grasp a level of public concern on the facilities
Organiser	Project Owner in collaboration with DFEA
Target Stakeholder	- Neighborhood community
Activity	- Determine the date and venue convenient for participants - Prepare a topic of discussion - Select a 'facilitator' - Formulate small discussion group
Merits	- Ensure a two-way communication - grasp to a detailed level of concern of residents

Thank you for your attention!

The Capacity Development of Environmental Monitoring at Directorates for Environmental Affairs in Governorates

Basic Environmental Monitoring Course
Lecture-12: Summary and Discussion

June 2005

The JICA Expert Team

1

Lecture-12: Summary and Discussion

Lecture-1: Environmental Management and Monitoring
Lecture-2: Air and Water Quality Monitoring
Lecture-3: Basic Water Quality Analysis

Lecture-4: Sampling Design
Lecture-5: Sampling and Field Measurement
Lecture-6: Analytical Theory and Skill-1

Lecture-7: Analytical Theory and Skill-2
Lecture-8: Analytical Theory and Skill-3
Lecture-9: Laboratory Operation

Lecture-10: Data Management
Lecture-11: Public Awareness

2

Lecture-12: Summary and Discussion

Environmental Monitoring as "*Humat Beia*"

1. Why is it necessary?
   - -to protect citizens from environmental hazard and to contribute for better environment
   - -to fulfill your mandates and roles defined by the law with accountability
2. What must be done?
   - -to evaluate effects of policies and countermeasures
   - -to decide next plans and countermeasures
   - -to disclose information and to deal with complaints from citizens
3. When is it started?
   - -to take preventive and quick actions in advance
   - -to react as soon as possible
   - -to begin together with policy and commitment

3

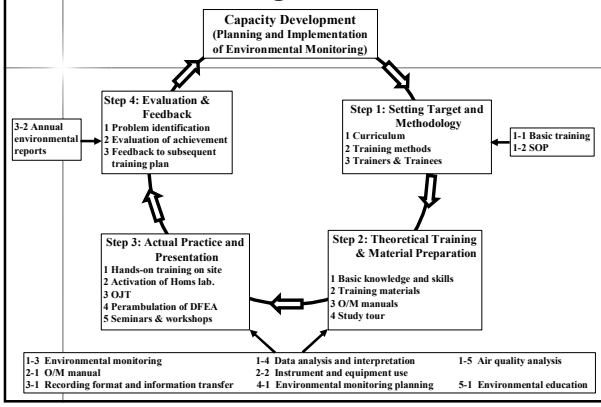
Lecture-12: Summary and Discussion

Environmental Monitoring as "*Humat Beia*"

4. Where is it conducted?
   - -the stations for understanding current conditions and assessing future situations
   - -the stations for recognizing trend and level of pollution
   - -the stations for checking human livings and natural resource use
5. Who is in charge?
   - -the Frontline Staff of DFEA and GCEA in cooperation with citizens and enterprises
   - -the Frontline Staff should be supported by laws, ministers and governors, citizens, and enterprises
6. How is it implemented?
   - -to be strategically, effectively, and comprehensively
   - -to be broad participation of stakeholders and information disclosure
   - -to be better cost performance
   - -to be proud of your duties

4

Lecture-12: Summary and Discussion
Procedure of Training



Training Program of the Basic Environmental Monitoring Course

1. Field Training in DFEA
   -June 23 - July 18 (Planned)
2. Follow-up Training
   -July 20 - July 24 (Planned)

6

Thank you very much

7

محاضرة حول المراقبة البيئية الأساسية

المحاضرة - 3: مراقبة جودة المياه الأساسية

حزيران 2005

By Matsue Ryunan

(فريق خبراء جايكا)

1

1) المعايير التي سيغطيها المشروع

مديرية دمشق	دمشق، حمص، حلب	14 مديرية
تحليل أساسي لجودة المياه	تحليل أساسي لجودة المياه	تحليل أساسي لجودة المياه 1 pH 2 درجة حرارة الماء 3 Color 4 TDS 5 DO 6 SS 7 CODcr 8 BOD5 9 NO3 10 PO4 11 Cl- 12 NH3 13 EC 14 العكارة
تحليل جودة الهواء	تحليل جودة الهواء 1 SOx 2 NOx 3 TSP 4 PM10 5 Pb	
تحليل كيميائي&بيولوجي لجودة المياه (الزيوت، الكوليفورم، المعادن الثقيلة ، الخ)		

التفاصيل في محضر الاجتماع في 24 آذار 2004 والمرفق 2 في التقرير الأولي

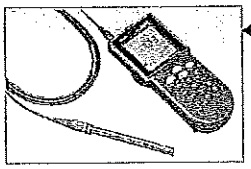
2- الأجهزة والأدوات المقدمة من قبل جايكا

pH, Temp., SS, Color, NO_3-N, PO_4, NH_3

COD →

BOD →

3



← مقياس DO

مقياس العكارة →

← Cl-

EC & TDS مقياس →

كواشف، أدوات زجاجية، كومبيوترات وأخرى

4

1- تقديم مراقبة جودة المياه (WQM)

1) تعريف مراقبة جودة المياه

ISO: عملية الاعتيان المبرمجة والقياس ثم التسجيل، أو الإشارة إليها أو كلاهما، لخصائص المياه المتنوعة، بهدف تقدير مطابقتها مع أهداف معينة.

5

2) ضرورة وأهمية مراقبة جودة المياه

8 مآسي بيئية في العالم

5 مآسي تلوث الهواء (لندن – انكلترا، 1948 – 1963 ، حوالي 10،000 حالة وفاة)

مأساتين – تلوث مياه (مرض مينامانا ومرض إيتاي إيتاي، اليابان، 1930 – 70، حوالي 300 حالة وفاة)

التطور التاريخي لمراقبة جودة المياه

المرحلة 1: مسح الحوادث (1950، مراقبة غير فعال)

المرحلة 2: مراقبة مصادر التلوث (1960 – 70، مبادرة)

المرحلة 3: مراقبة الجودة البيئية للمياه

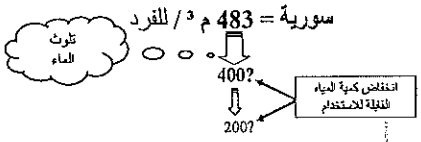
(1980~ الوقت الحاضر، مراقبة أوتوماتيكية، GIS, RS, GPS)

2) ضرورة وأهمية الـ (WQM)

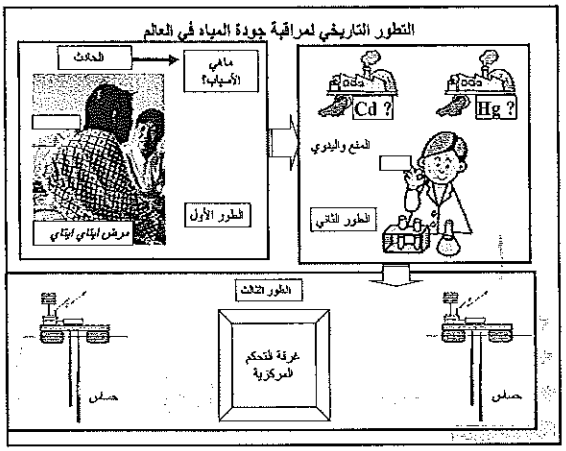
- موارد المياه العذبة:

معدل العالم = 7،340 م³ / للفرد

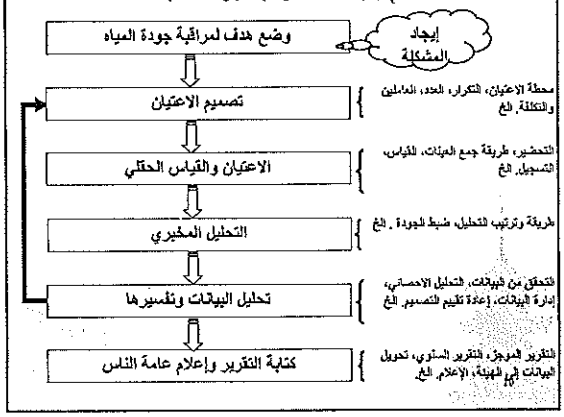
سورية = 483 م³ / للفرد



- سياسات وبرامج حماية البيئة
- إدارة موارد المياه
- ضبط العناصر الملوثة



3) بنية خطة مراقبة جودة المياه



3) مصادر تلوث المياه

(1 مياه الصرف الصناعية (نقطة المصدر)
(الحموض، القلويات، المواد العضوية، المعادن الثقيلة، المواد السامة، الخ)

(2 مياه الصرف المحلية (نقطة المصدر)
(المواد العضوية، العصيات الجرثومية، الخ)

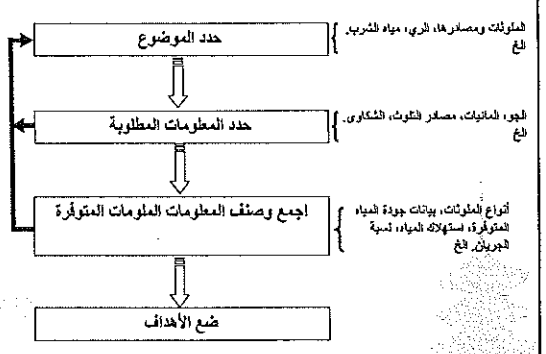
(3 مياه الصرف الزراعي (مصدر غير محدد، تغذية)
(الأسمدة، المبيدات، مخلفات الأشجار، الخ)

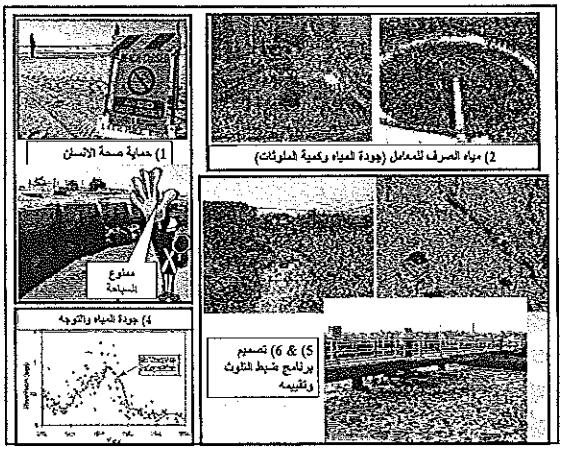
(4 غيرها (مياه صرف المشافي، الأمطار الحامضية، الخ)

أهداف خطة مراقبة جودة المياه

1) حماية صحة الإنسان
2) تحديد ماإذا كان الصرف من المعامل يطابق مقاييس مياه الصرف الصناعي
3) تحديد ما إذا كانت أجسام المياه تطابق المقاييس البيئية
4) عرض المشاكل المحتملة لجودة المياه
5) استيعاب مفهوم جودة المياه وتوجهات التعامل مع هذا المفهوم عبر الزمن
6) تصميم برامج منع أو ضبط التلوث
7) تقييم أهداف البرنامج وفعاليته
8) الاستجابة للطوارىء
9) أخرى (التعامل مع الشكاوي، تقييم الأثر البيئي، تعليم المواطنين. الخ)

2- وضع أهداف خطة مراقبة جودة المياه





مقاييس الجودة البيئية ـ الأنهار، اليابان

class	Item: Water use	Standard value: pH	BOD	SS	DO	Total coliform
AA	Water supply class 1, conservation of natural environment and uses listed in A-E	6.5-8.5	1 mg/l or less	25 mg/l or less	7.5 mg/l or more	50 MPN/100ml or less
A	Water supply class 2, fishery class 1, bathing and uses listed in B-E	6.5-8.5	2 mg/l or less	25 mg/l or less	7.5 mg/l or more	1000 MPN/100ml or less
B	Water supply class 3, fisheryclass 2 and uses listed in C-E	6.5-8.5	3 mg/l or less	25 mg/l or less	5 mg/l or more	5000 MPN/100ml or less
C	Fishery class 3, Industrial water class 1 and uses listed in D-E	6.5-8.5	5 mg/l or less	50 mg/l or less	5 mg/l or more	-
D	Industrial water class 2, agricultural water and uses listed in E	6.0-8.5	8 mg/l or less	100 mg/l or less	2 mg/l or more	-
E	Industry water class 3, and conservation of environment	6.0-8.5	10 mg/l or less	Floating matter such as garbage should not be observed	2 mg/l or more	-

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مقاييس الجودة البيئية ـ البحيرات، اليابان

class	Item: Water use	Standard value: pH	COD	SS	DO	Total coliform
AA	Water supply class 1, fishery class 1, conservation of natural environment, and uses listed in A-C	6.5-8.5	1 mg/l or less	1 mg/l or less	7.5 mg/l or more	50 MPN/100ml or less
A	Water supply class 2, and 3, fishery class 2, bathing and uses listed in B-C	6.5-8.5	3 mg/l or less	5 mg/l or less	7.5 mg/l or more	1000 MPN/100ml or less
B	Fishery class 3, industrial water class 1, agricultural water and uses listed in C	6.5-8.5	5 mg/l or less	15 mg/l or	5 mg/l or more	-
C	Industrial water class 2, and conservation of the environment	6.0-8.5	8 mg/l or less	Floating matter such as garbage must be observed	2 mg/l or more	-

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مقاييس الجودة البيئية ـ البحيرات

(النتروجين والفوسفور الإجمالي)

class	Item: Water use	Standard value: Total Nitrogen	Total Phosphorus
I	Conservation of natural environment and uses listed in II-V	0.1 mg/l or less	0.005 mg/l or less
II	Water supply classes 1, 2 and 3 (except special types), Fishery class 1, bathing and uses listed in III-V	0.2 mg/l or less	0.01 mg/l or less
III	Water supply class 3 (special types) and uses listed in IV-V	0.4 mg/l or less	0.03 mg/l or less
IV	Fishery class 2 and uses listed in V	0.6 mg/l or less	0.05 mg/l or less
V	Fishery class 3, industrial, agricultural water and conservation of the environment	1 mg/l or less	0.1 mg/l or less

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مقاييس الجودة البيئية ـ الساحل، اليابان

class	Item: Water use	Standard value: pH	COD	DO	Total Coliform	N-hexane Extracts (oil substances)
A	Fishery class 1, bathing, conservation of the natural environment, and uses listed in B-C	7.8-8.3	2 mg/l or less	7.5 mg/l or more	1000 MPN/100ml or less	Not detectable
B	Fishery class 2, industrial water and the uses listed in C	7.8-8.3	3 mg/l or less fo	5 mg/l or less	-	Not detectable
C	Conservation of the environment	7.0-8.3	8 mg/l or less	2 mg/l or less	-	-

class	Item: Water use	Standard value: Total Nitrogen	Total Phosphorus
I	Conservation of the natural environment and uses listed in II-IV (except fishery classes 2 and 3)	0.2 mg/l or less	0.02 mg/l or less
II	Fishery class 1, bathing and the uses listed in III-IV (except fishery class 2 and 3)	0.3 mg/l or less	0.03 mg/l or less
III	Fishery class 2 and the uses listed in IV (except fishery class 3)	0.6 mg/l or less	0.05 mg/l or less
IV	Fishery class 3, industrial water, and conservation of habitable environment for marine life	1 mg/l or less	0.09 mg/l or less

مقاييس جودة مياه الصرف الصناعي في شبكة الصرف العامة ، سورية & اليابان

No	Parameter	Unit	Max Admissible Concentration (Syria)	Max Admissible Concentration (Japan)
1	pH	pH Unit	6.5 - 9.5	5.8 - 9.0 (5.7 - 8.7)*
2	Water Temp.	℃	35	45 (40)
3	Color	Unit	-	-
4	TDS	mg/l	2,000	-
5	DO	mg/l	-	-
6	SS	mg/l	500	600 (300)
7	COD_{Cr}	mg/l	1,500	-
8	BOD_5	mg/l	800	600 (300)
9	NO_3^-	mg/l	-	-
10	PO_4^{3-}	mg/l	20	(T-P) 32 (20)
11	Cl	mg/l	600	-
12	NH_3-N	mg/l	100	(T-N) 240 (150)
13	EC	μS/cm	-	-
14	Turbidity	NTU	-	-

تلخصها

* ( ): Applying for manufacturing industry and gas supply industry

18


حكمة حول كمية المياه
لن تعرف كم الماء نفيس
قبل أن يجف البئر
حكمة حول نوعية المياه
لن تعرف كم الماء شهي
قبل أن يجف البئر
19

Sampling site description:							weather:							
City:				Town:			River:		☆Code:					
Year:														
sampling date (day/month)					/	/	/	/	/	/	/	/	annual average	
sampling time(hh:mm)					:	:	:	:	:	:	:	:		
	Item ☆	Method ☆	Unit	Depth ☆										
Basic Water Analysis for 14 Directorates	water depth at sampling point	manual	m											
	flow velocity at sampling point	manual	m/s											
	odor	manual	--											
	pH	portable colorimeter	--	0m	☆									
			-	10m										
			-	20m										
	Temp	portable colorimeter	℃	0m										
			℃	10m										
			℃	20m										
	Color	portable colorimeter	-											
	Total dissolved solids (TDS)	portable EC/TDS meter	mg/L											
	DO	portable DO meter	mg/L											
	Total suspended solids (SS)	portable colorimeter	mg/L											
	COD_{Cr}	colorimeter	mg/L											
	BOD_5	culture	mg/L											
	NO_3^-	portable colorimeter	mg/L											
	PO_4^{3-}	portable colorimeter	mg/L											
	Cl^-	Digital Titrator	mg/L		~~0.0~~	⇒	ND							
	NH_3-N	portable colorimeter	mg/L											
	Electrical Conductivity	portable EC/TDS meter	μS/cm											
	Turbidity	portable turbidity meter	NTU											
	Item	Method	Unit											
Chemical & biological water Analysis only for Damascus	water depth at sampling point	manual	m											
	flow velocity at sampling point	manual	m/s											
	odor	manual	--											
	pH	Labo pH meter	--											
	Temp	portable colorimeter	℃											
	Color	portable colorimeter	-											
	Total dissolved solids (TDS)	Labo EC meter	mg/L											
	Total suspended solids (SS)	Filtrate weigh	mg/L											
	COD_{Cr}	potassium dichromate	mg/L											
	NO_3^-	Ion Select Electrobe	mg/L											
	PO_4^{3-}	Spectral photometric	mg/L											
	Cl^-	Ion Select Electrobe	mg/L											
	NH_3-N	Spectral photometric	mg/L											
	Oil & grease	Solvent Hexane extract	mg/L											
	Settleable solids	Filtrate weigh	mg/L											
	Fluorides	Ion Select Electrobe	mg/L											
	Sulfide-S	Ion Select Electrobe	mg/L											
	Surfactants	Spectral photometric	mg/L											
	Total count of the colony group	colony counter	-											
	Cyan (CN)	Ion Select Electrobe	mg/L											
	Item	Method	Unit											
Basic Air Analysis for Damascus, Homs & Allepo	wind direction	wind direction meter	-											
	wind speed	wind speed meter	m/s											
	SOx	manual	$\mu g/m^3$											
	NOx	manual	$\mu g/m^3$											
	Pb	HV sampler	$\mu g/m^3$											
	TSP	HV sampler	$\mu g/m^3$											
	PM10	LV sampler	$\mu g/m^3$											

you can fix the essential digit of each item in advance by setting the style of cell

ND stands for Not Detected