

WATER SAFETY PLANS: GLOBAL EXPERIENCES AND FUTURE TRENDS

Lisbon, Portugal

May 12-14 2008

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Fulfilling Water Safety through
Appropriate Operation and Management of Water Supply System



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Organization

Backgrounds

- ◆ Every year, unsafe water, coupled with a lack of basic sanitation, kills at least 1.6 million children under the age of five years.
- ◆ At the beginning of the Water for Life decade, 1.1 billion people did not have access to an improved source of drinking water.
(Meeting the MDG drinking water and sanitation target, WHO/UNICEF, 2005)
- ◆ To fulfill the MDG drinking water and sanitation target, appropriate combination of operation, maintenance and management of existing water supply and sanitation systems is one of the essential factors.

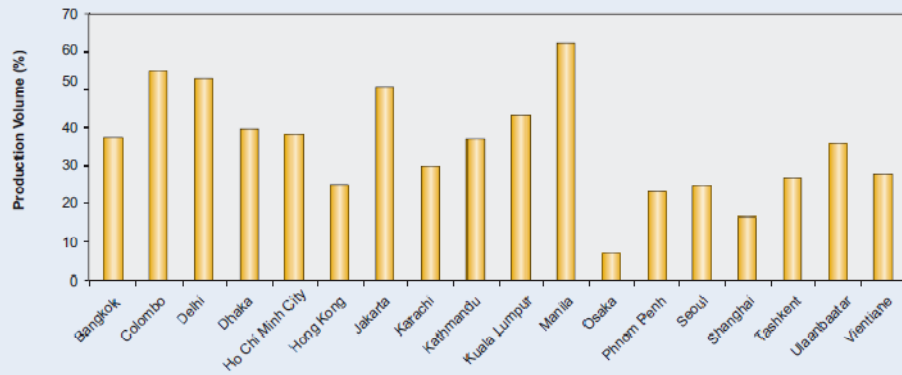


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Non-revenue Water in Asian Cities (2001)



(Asian Development Bank, 2003)

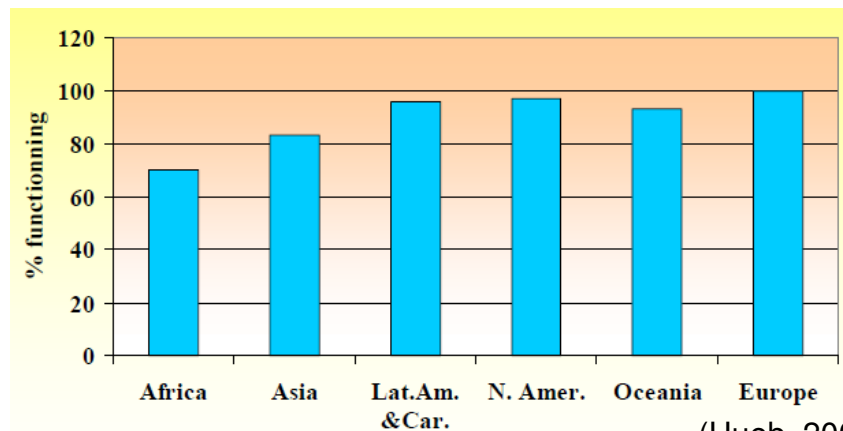
Ratio of non-revenue water in several Asian large cities exceeds 50% or more.



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Median percentage of rural water supplies which are functioning, 1990-2000



(Hueb, 2004)

Some part of the water supply facilities stopped functioning probably due to lack of appropriate operation and maintenance



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CASE STUDIES OF PROMOTING OPERATION AND MAINTENANCE

I. Capacity Building for Water Supply System in Phnom Penh, Cambodia



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Capacity of Phnom Penh Water Supply Authority (PPWSA) in 1993

Year	<i>1993</i>
Duration	10hr/d
Pressure	2m
Coverage area	25%
Connections	26,881
Network	280km (old)
Production	65,000m ³ /d
NRW	72%
Metering	12%
Collection Ratio	48%

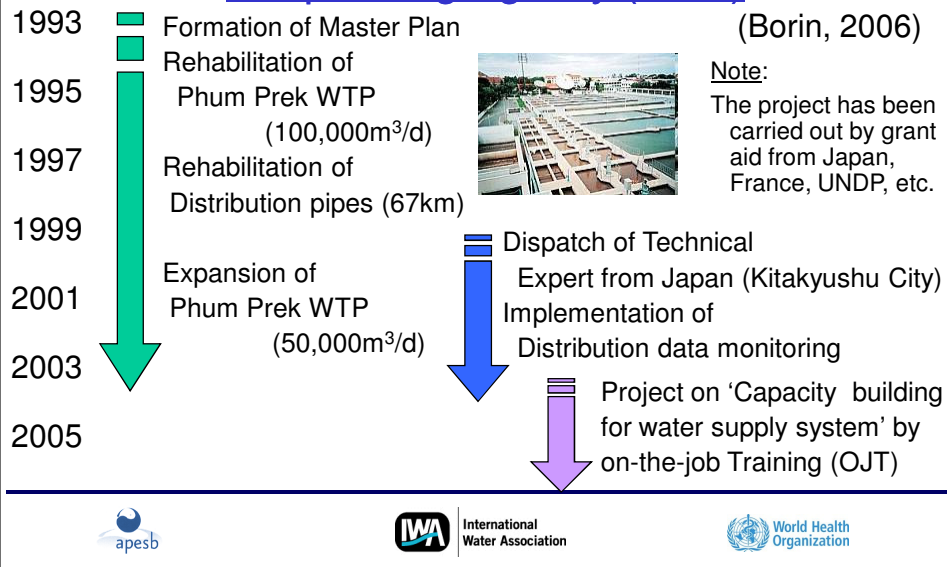
(Chea, 2004)



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Grand waterworks rehabilitation and expansion project by Japan International Cooperating Agency (JICA)



Approach to effective O&M in PPWSA

- Minimize Non-Revenue Water
 - 24hrs Leak Repair System
 - Active Detection of Leakage & Illegal Use
 - Maintenance & Replacement of Qualified Water Meter
- Improvement of Billing System
 - Computerized Customer Management & Billing System
 - Survey for Customer Update
 - Proper Reading of Water Meter
- Improvement of Collection Ratio
 - Supply Stop for Late Payment of Water Bill

(Chea, 2004)



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Rehabilitation and expansion of water supply capacity in PPWSA

Year	<i>1993</i>	<i>2005</i>
Duration	10hr/d	24hr/d
Pressure	2m	25m
Coverage area	25%	95%
Connections	26,881	138,000
Network	280km (old)	1,230km (new)
Production	65,000m ³ /d	235,000m ³ /d
NRW	72%	11%
Metering	12%	100%
Collection	48%	100%

(Chea, 2004)



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CASE STUDIES OF PROMOTING OPERATION AND MAINTENANCE

II. The Project for Safe Water and Support of Community Activities in Senegal



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Background of international cooperation in water supply in Senegal

- Grand aid by Japan on construction and rehabilitation of local water supply facilities for more than two decades
- Need for appropriate O&M of the facilities for sustainable water supply and further improvement of living conditions of the local residents



- 'Project for Safe Water and Support of Community Activities (PEPTAC)' has been conducted from 2003 to 2006 with collaboration of the Department of Operation and Maintenance and JICA

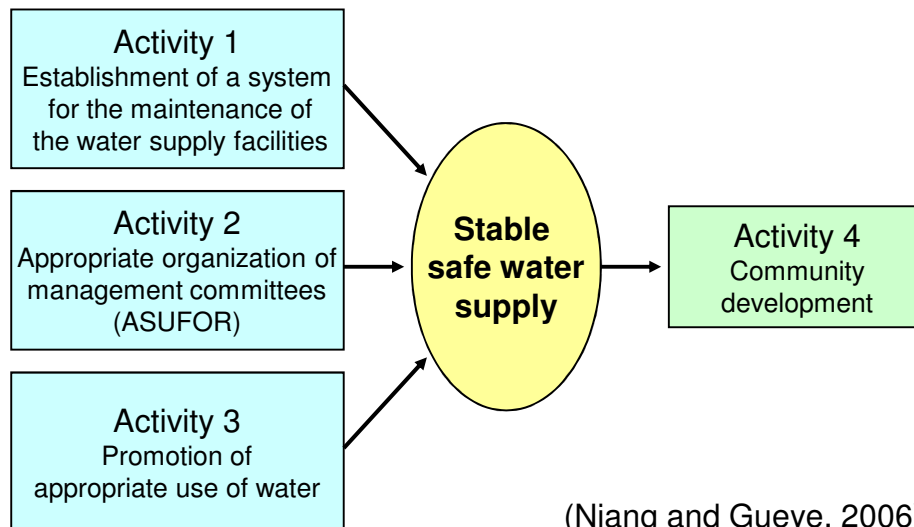
(JICA, 2006)



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Outline of Project for Safe Water and Support of Community Activities (PEPTAC)



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République du Sénégal
Ministère des Mines, de l'Énergie,
et de l'Hydraulique
Direction de l'Exploitation
et de la Maintenance (DEM)

JICA
Agence Japonaise de
Coopération Internationale

**Projet Eau Potable pour Tous
et
Appui aux Activités Communautaires**
01/2003 - 01/2006

Développement institutionnel Sensibilisation et animation
Ressources en eau Développement communautaire
Maintenance des installations
d'alimentation en eau Considération sociale/genre
Développement de l'élevage Développement agricole

JICA Technics Co., Ltd. Earth & Human Corporation
Senegal office

(JICA, 2006 http://project.jica.go.jp/senegal/6421057E0/jj_affiche_01.html)

apesb IWA International Water Association World Health Organization

Results and Effects (1)

- Maintenance of the water supply facilities
 - Elaboration of specific technical documents and operation guidelines for each station
 - Inventory of all the maintenance companies in the region
 - Conclusion of 16 maintenance contracts between the ASUFORs and Local Companies
- Appropriate organization of management committees
 - Acceptance of water sale by volume and saving amount exceeding US\$ 70,000
 - Involvement of the various categories of users and Strengthening of ethnic intermingling and social cohesion
 - Democracy and transparency in management

(Niang and Gueye, 2006)

Results and Effects (2)

- Promotion of appropriate use of water
 - Improvement of hygiene and Awareness of the risk of water related diseases
 - Use of water saving irrigation techniques such as 'Drip irrigation'
 - Monitoring of groundwater resources: quality and quantity
- Community development
 - Reinforcement of the option to promote the water supply system as a "Local Growth Pole"
 - Promotion of the necessary conditions to improve the target populations' living environment
 - Introduction of income generating activities, thus contributing to poverty reduction in some advanced sites to be taken as a model

(Niang and Gueye, 2006)



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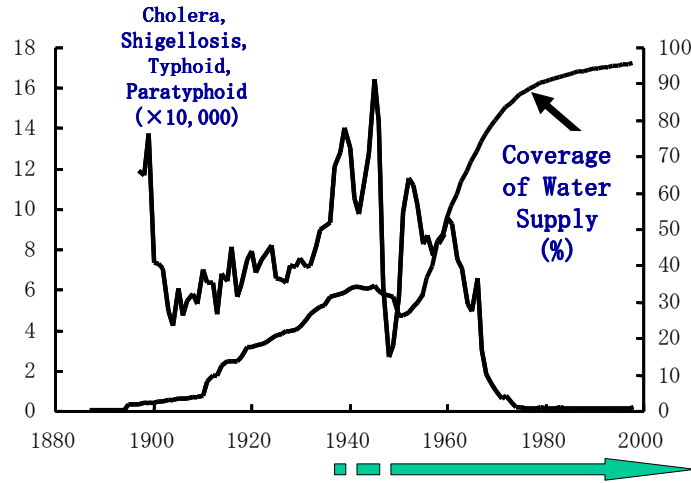
WATER SAFETY PLAN: JAPAN'S APPROACHES



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Patients of waterborne diseases and prevalence of water supply in Japan



Health-related incidents caused by drinking water contamination in Japan

	Water source	Hazard	Cases	Year
1	Well water	<i>E. coli</i> , O157	2 children died	1990
2	Service tank water	<i>Cryptosporidium</i>	461	1994
3	Pipe-supplied water	<i>Cryptosporidium</i>	8,812	1996
4	Well water	Nitrate	1 baby	1996
5	Well water	<i>Shigella</i>	821	1998
6	Well water	Organoarsenic	Some	2003
7	Pipe-supplied water	Norovirus	29	2005

It should be noted that most of the waterborne disease outbreaks could be avoided by appropriate disinfection.



WSP: Japan's approaches

- **Introduction into drinking water quality management in Japanese water supplies**
 - A research study on WSP application in municipal water supplies (FY2004-2006)
 - Development of guidelines on WSP application (FY2005-2007)
- **Dissemination to foreign countries through international cooperation**



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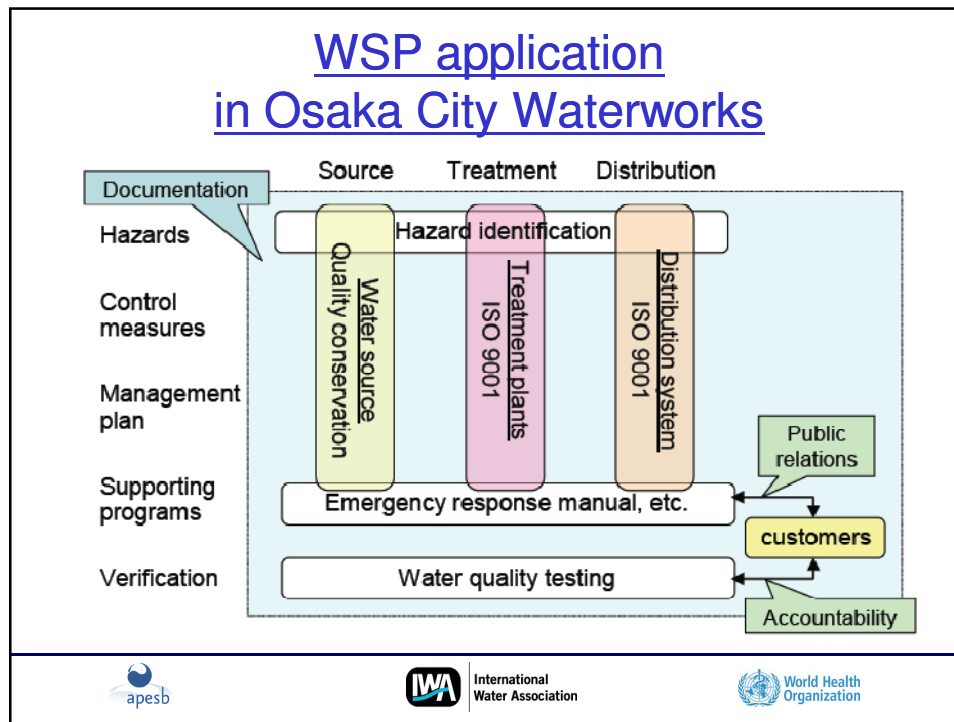
A research study on WSP application

- Research period of FY2004-2006
- Funded by a grant of MHLW
- Case studies on WSP application to drinking water quality management in municipal water supplies; Tokyo, Yokohama, Osaka and Kobe
- Contribution to streamlining and upgrading their current drinking water quality management procedures



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Development of guidelines on WSP application

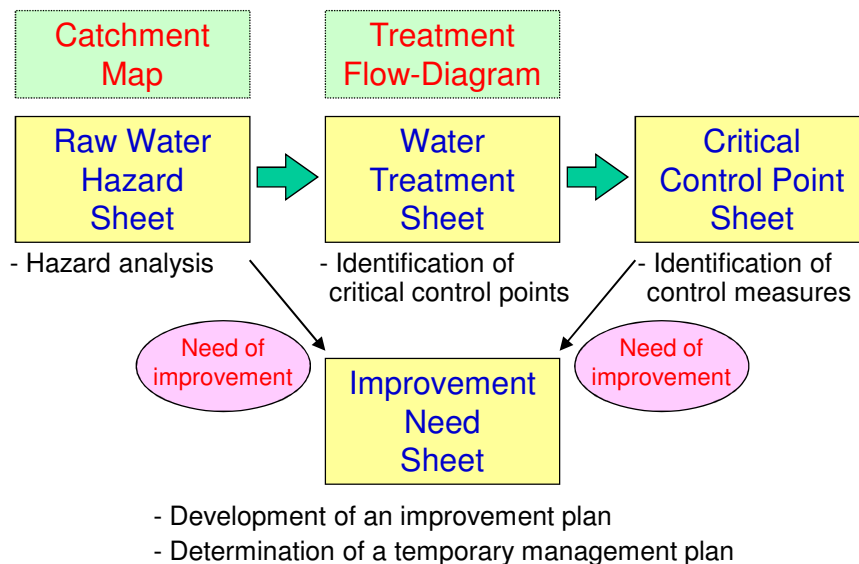
- ◆ Guideline development in FY2005-2007 Provision of a fund by MHLW
- ◆ Organization of a committee for guideline development in JWVA
- ◆ **Small water suppliers as main target**
- ◆ **Guidelines being simple, user-friendly and easy to improve**

Importance of WSP application to small water supplies

- Inadequate facility maintenance
- Necessity of limited source prioritization
- Insufficient operation manuals
- Inadequate record keeping
- Necessity of existing system improvement
- Need of operator's awareness raising



(Draft) Simplified WSP worksheets for small water supplies



(Draft) Example of a Raw Water Hazard Sheet
<Surface water>

Item	<i>E. coli</i>	<i>Crypto</i>	Pesticide	NO ₃	As	Oil	Remarks
Source							
<u>Households</u>							
-On-site	o	o					Sites
-Off-site	o	o					Sites
<u>Industries</u>					o	o	Contents
<u>Agriculture</u>							
-Runoff			o	o			Pesticide
-Livestock	o	o		o			Number
<u>Others</u>							
-Waste landfill	o	o		o			Dom./Ind.
-Accidents						o	
-Wild animals	o	o					
-Natural sources					o		
Contamination level	High	High	?	Low	Low	?	
Treatment need	o	o				x	

From a Catchment Map

Water Treatment Sheet

Improvement Need Sheet

(Draft) Example of a Water Treatment Sheet
<Rapid sand filtration system>

From a Raw Water Hazard Sheet

Process or facility	Hazard		Note:
	<i>E. coli</i>	<i>Crypto</i>	
Intake			1) The number of critical control points may not exceed two for one hazard. 2) Priorities should be given to: - chemical dosing, - filtration, and - those with frequent failures.
Receiving well (Pre-chlorination system)	o		
Polyaluminum chloride dosing	o	⊙	
Rapid mixing	o	o	
Flocculation	o	o	
Sedimentation	o	o	
Rapid sand filtration	o	⊙	
Post-chlorination	⊙		

From a Treatment Flow-Diagram

⊙: Critical control point

(Draft) Example of a Critical Control Point Sheet

Item	Hazard		
	<i>E. coli</i>	<i>Crypto</i>	
Process	Post-chlorination	PAC dosing	Rapid sand filtration
Control parameter	Residual chlorine	Pump operation	Turbidity
Control limit	0.5-0.8mg/l	No disorder	<0.1unit
Calibration	Weekly	Monthly	Weekly
Monitoring /Recording	Monitoring	○	○
	Alarming	○	○
	Recording	○	-
Factors of deviation and its preventive measures <Examples>	Insufficient dose → Dose increase	Pump failure → Inspection/ Maintenance	Fluctuation of raw water pH → pH adjustment
Remedial actions when the limit is exceeded	Treated water reservoir	Additional chlorination	Water transmission interruption and reservoir cleaning
	Distribution reservoir	Additional chlorination	(Not applicable)
	Consumer	Boiling	Boiling

From a Water Treatment Sheet

Those given a sign of "x" should be referred to in a Improvement Need Sheet.

