Nov 29-30, 2011

International Workshop on Regulatory Standards of Pollutants and Management Systems for Soil and Groundwater Pollution

Taipei, Taiwan

Socrates Chamber, GIS Convention Center
National Taiwan University
B1, No.85, Sec. 4, Roosevelt Rd.
Taipei, Taiwan

Proceedings

- Environmental Protection Administration, ROC (Taiwan)
- Working Group on Remediation for Soil and Groundwater Pollution of Asian Countries
- Taiwan Association of Soil and Groundwater Environmental Protection
- Department of Agricultural Chemistry, National Taiwan University

Opening Address

Distinguished invited government officers and experts from Asian countries, USEPA, CL:AIRE, Ladies and Gentlemen:

It is a great pleasure for me at the opening ceremony of the 2011 International Workshop on Regulatory Standards of Pollutants and management Systems for Soil and Groundwater Pollution. On behalf of the Taiwan EPA and Working Group on Remediation for Soil and Groundwater Pollution of Asian Countries (WG ReSAGPAC), I should like to extend my sincerely welcome all of you, including 22 foreign participants from government officers and scientists from 9 countries members of this working group and also include 2 experts from USEPA, Ms. Nancy Marvel and Ms. Jessica Kao, and one expert from CL:AIRE of United Kingdom, Mr. Philip Crowcroft. Your participations are very welcome, and will contribute a great deal to the success future of our working group to maintain our good environmental quality and human health in this region.

As we know, there are only few countries have the regulatory standard of pollutants and management systems for soil and groundwater Pollution in Asian countries. The regulations of the pollutants are still discussed for different purposes-based evaluation although they have, especially for environmental quality, food safety, human health and risk assessment. Based on the general rules of the working group of ReSAGPAC, the main purposes of this workshop are to promote the country members of WG to develop their regulatory standard of pollutants and management systems for soil and groundwater Pollution sites in the near future.

In the morning session of the workshop of two days, the WG invited three keynote speakers, Mr. Hung-Teh Tsai from Taiwan EPA, Ms. Nancy Marvel from USEPA, and Mr. Philip Crowcroft from CL:AIRE of United Kingdom, to share their experience. The main contents of three keynote speeches include the next 4 years (2012-2015) on soil and groundwater pollution in Taiwan, the hazardous waste management and cleanup Law of USEPA, and the contaminated land management framework and regulations of pollutants in UK.

In the afternoon session of the workshop of two days, the WG invite the experts from India, Indonesia, Korea, Thailand, Vietnam, Philippines and Taiwan, to present their experience and Acts on the development of regulatory standard of pollutants and management systems based on different consideration and risk assessment. Some of them are very serious contamination sites in the Asian countries.

We understand the important of the education and communication of the human health risk assessment for the people community exposure in a contamination site. We know that the risk-based approach remediation techniques should be a very important direction to be followed to develop different remediation techniques for soil and groundwater contaminated sites in the world, especially in the Asian countries.

Finally, I would like to express my grateful thanks to Mr. Hung-Teh Tsai, who is the technical superintendant and executive secretary of the Soil and Groundwater Remediation Fund Management Board of Taiwan EPA and the government officer of the Fund management Board for their strong support for this workshop. I also thank all of you to here to promote our activities of the WG for good environmental quality and health life in the Asian countries. I also hope you have a very good time during the workshop.

Thank you.

Chairman of the Working Group on Remediation for Soil and Groundwater Pollution of Asian Countries (ReSAGPAC) (2011-2014)
Zueng-Sang Chen, Ph.D., signed on Nov 23, 2011

Zueng-Sang Chen

Distinguished Professor
Department of Agricultural Chemistry
National Taiwan University, Taipei 10617, TAIWAN
Email: soilchen@ntu.edu.tw

Agenda

November 29 (Tuesday)		
Time	**Topics**	**Chairman/speaker**
0900-0930	Registration	
0930-0940	Group photo (Foreign Participants only)	
0940-0950	Open Ceremony	Prof. Zueng-Sang Chen (Chairman of WG)
0950-1000	Guest Open Address	Mr. Tzi-chin Chang (Taiwan EPA)
1000-1040	**Keynote Speech:** Future Projects in Next Four Years of Soil and Groundwater Management of Taiwan EPA	Mr. Hung-Teh Tsai (Taiwan EPA)
1040-1100	Break	
1100-1150	**Keynote Speech:** Introduction of the major U.S. Hazardous Waste Management and Cleanup Laws (I)	Ms. Nancy Marvel (USEPA)
1150-1240	**Keynote Speech:** The Contaminated Land Management Framework and Regulations in UK	Mr. Phillip Crowcroft (CL:AIRE, UK) (ERM, UK)
1240-1400	Lunch	
1400-1430	Legal and Legislative Approaches to Find Soil Contamination Sites in Korea	Dr. Yong-Ha Park (Korea)
1430-1500	Development of Soil Control Standards for Organic Pollutants in Taiwan	Prof. Dr. Shian-Chee Wu (Taiwan)
1500-1530	Recent Contamination Cases and Development of Countermeasure Regulations in Thailand	Dr. Chayawee Wangcharoenrung (Thailand)
1530-1550	Break	
1550-1640	Tainan Low Carbon City - Green Remediation Project: Case of An-Shun Site	Dr. Hwang Jen Chang, Director of EPB (Tainan City, Taiwan)
1640-1710	Monitoring of Agent Orange Pollution and a Potential Management Strategy in the Military Base	Mr. Wan Jun (Korea)
1710-1820	General discussion	Prof. Zueng-Sang Chen (Chairman of WG)

ROC (Taiwan) Environmental Protection Administration | Working Group on Remediation for Soil and Groundwater Pollution of Asian Countries | Taiwan Association of Soil and Groundwater Environmental Protection | Department of Agricultural Chemistry, National Taiwan University

International Workshop on Regulatory Standards of Pollutants and Management Systems for Soil and Groundwater Pollution

Nov 29-30, 2011

Taipei, Taiwan

Socrates Chamber, GIS Convention Center, National Taiwan University

Agenda

November 30 (Wednesday)		
Time	**Topics**	**Chairman/speaker**
0900-0930	Registration	
0930-1000	Regulatory Standards of Heavy Metal Pollutants in Soil and Groundwater in Taiwan	Prof. Dar-Yuan Lee (Taiwan)
1000-1030	Ecological Risk Assessment of Heavy Metal Pollution in Watershed nearby Abandoned Metal Mine	Dr. Jae E. Yang (Korea)
1030-1050	Break	
1050-1140	**Keynote Speech:** Introduction of the major U.S. Hazardous Waste Management and Cleanup Laws (II)	Ms. Nancy Marvel (USEPA)
1140-1230	**Keynote Speech:** The Practice of Contaminated Land Management in UK and Case Studies	Mr. Phillip Crowcroft (ERM, UK)
1230-1400	Lunch	
1400-1430	The Conceptual Approach for Control Standard Setting Based on Human Health Risk	Dr. Chih Huang (Taiwan)
1430-1500	Indonesian Regulations Related to the Prevention of Soil and Groundwater Pollutions	Prof. Wisjnuprapto (Indonesia)
1500-1530	Vietnam's Regulation on Management of the Soil and Underground Water Pollution	Ms. Nguyen Hoang Anh (Vietnam)
1530-1550	Break	
1550-1620	Prevention and Control of Soil Pollution: An Indian Perspective	Dr. Rashid Hasan (India)
1620-1650	Environmental Management Policies/Rules and Regulations of the Philippines	Mr. Regidor M. De Leon (Philippines)
1650-1810	General Discussion and Closing Remarks	Prof. Zueng-Sang Chen (Chairman of WG)
1810-1820	Closing Ceremony	Prof. Zueng-Sang Chen (Chairman of WG)

ROC (Taiwan) Environmental Protection Administration

Working Grop on Remediation for Soil and Groundwater Pollution of Asian Countries

Taiwan Association of Soil and Groundwater Environmental Protection

Department of Agricultural Chemistry, National Taiwan University

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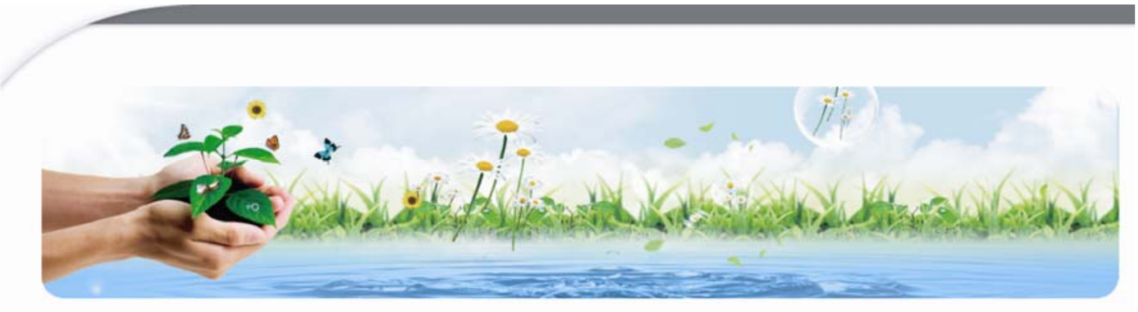
International Workshop on
Regulatory Standards of Pollutants and Management Systems of Soil and Groundwater Pollution

Invited Speakers



Honored Guest

Tzi-chin Chang

Taiwan

Mr. Tzi-chin Chang received his master degree from Institute of Environmental Engineering, National Chiao Tung University. He is the Deputy Minister of Environmental Protection Administration (EPA), Executive Yuan, R.O.C. (Taiwan). He has completed the qualifications of "Senior Professional and Technical Examinations for the Category of Civil Engineering" and "Senior Examination for Civil Service Personnel in the category of Environmental" in 1980.

Chairman of Working Group

Zueng-Sang Chen

Taiwan

Dr. Zueng-Sang Chen received his Ph.D. degree from Department of Agriculture Chemistry, NTU, Taiwan. He is the Distinguished Professor of Department of Agriculture Chemistry, NTU. His specialties are pedology, soil classification and taxonomy, forest ecology, and soil pollution remediation. He has many experiences on planning, design, construction, and operation of soil remediation work.

Speakers and Representative Government Officers

(in alphabetical order)

Nguyen Hoang Anh

Vietnam

Mrs. Nguyen Hoang Anh is the Head for Divison of Soil and Water Environment Pollution Control Department of Pollution Control, Vietnam Environment Agency, Vietnam.

Azimuddin Bahari

Malaysia

Dr. Azimuddin Bahari is the Undersecretary of Minerals & Geoscience Division,
Ministry of Natural Resources and Environment, Malaysia.

Edwin C. Concepcion

Philippines

Mr. Edwin C. Concepcion is the Environmental Management Specialist II of Environmental Management Bureau, Department of Environment and Natural Resources (DENR), Republic of the Philippines.

Phillip Leslie Crowcroft

United Kingdom

Mr. Phillip Leslie Crowcroft is a Partner in the Contaminated Site Management team based in the Leeds and Manchester offices. He has over 30 years experience in dealing with land contamination and brownfield regeneration. This experience has been developed through work as a specialist contractor, an environmental consultant and as a regulator. He has specialised in regulatory issues, keeping abreast of both UK and European legislation and providing advice on liability for landowners and users. A major area of work relates to design and implementation of remediation systems to deal with contaminated soils, soil gas and vapour intrusion into built development. He has also worked extensively on chemical and manufacturing sites in the UK, and MOD sites in the UK and overseas.

Wisjnuprapto Dipl. S.E.

Indonesia

Dr. Wisjnuprapto Dipl. S.E. received his Ph.D degree from Engineering in Biological Wastewater Treatment Process INSA Touluse, France. He is the Faculty of Civil and Environmental Engineering, Institute Teknologi Bandung, Indonesia.

Pham Thi Thuy Hanh

Vietnam

Ms. Pham Thi Thuy Hanh is the Official of Department of International Cooperation and Science - Technology, General Department of Land Administration, Ministry of Natural Resources and Environment, Vietnam.

Rashid Hasan

India

Dr. Rashid Hasan received his Ph.D degree from Aligarh Muslim University (AMU). He had 10 years researching experience about toxicology, and he has worked in government service for 18 years. He has many experiences about pollution control, environmental policy, planning, and law, ecodevelopment, and so on. Now he is the Director of CP Division, Government of India Ministry of Environment and Forests, Republic of India.

Jeng-Ren Ho

Taiwan

Mr. Chien-Jen He received his bachelor degree from Department of Civil Engineering, NCU, Taiwan, and now he is studying at National Taiwan University for his Ph.D. degree in Environmental Engineering. He is the chief of technology evaluation section of Soil and Groundwater Fund Management Board, Taiwan EPA. His specialties are Environmental Planning and Management, Soil Pollution Remediation and Management, and the building and operation management of an incinerator.

Hao-Chun Hung

Taiwan

Dr. Hao-Chun Hung received his Ph.D. degree from Department of Civil and Environmental Engineering, University of Wisconsin-Madison, USA. Currently he is a senior Environmental Technology Specialist of the Soil and Groundwater Remediation Fund Management Board of Taiwan EPA.

Chih Huang

Taiwan

Dr. Chih Huang is the Senior Researcher and Deputy Manager of Sinotech Engineering Consultants, Inc., Taiwan. He has many experiences on groundwater science, environmental site assessment, remediation planning, design, construction and operation of remediation work.

Hwang Jen Chang

Taiwan

Dr. Chang Hwang Jen, Director General of Environmental Protection Bureau of Tainan City Government, got her PhD from Department of Environmental Engineering, National Chung Hsing University, Taiwan. Her major experiences include the Management of Department of Waste Management, Taiwan EPA, in 1987-2000, Director of EPB, Taichung City on 2000-2004, senior executive officer of Tainan City Government in 2004-2006, and Director General of of EPB, Tainan City (2006 to now). Her experts are foucs on air pollution control, water pollution control, soil and groundwater pollution prevention, water and fertilizer processing, waste disposal regulations, wa2ste recycling, and clearance and disposal of waste recycling planning

Wan Jun

Korea

Mr. Wan Jun is the Deputy Director for Soil & Groundwater Management Division, Water Environment Management Bureau, Ministry of Environment
Korea.

Nancy J. Marvel

USA

Ms. Nancy Marvel has been Regional Counsel of the U.S. Environmental Protection Agency, Pacific Southwest Region (Region 9) since 1988. As Regional Counsel, she manages a law office of 70 attorneys and provides counsel to the Regional Administrator and other senior managers of Region 9 on matters arising under all the U.S. environmental laws that EPA administers. From 1983 to 1987, Ms. Marvel served as Air Branch Chief in the same office, specializing in Clean Air Act matters. Ms. Marvel, a graduate of Princeton University, received her law degree from Georgetown University Law Center. She is a recipient of the Senior Executive Service Meritorious Executive Presidential Rank Award for her achievements over the course of her EPA career.

Le Thi Hai LE

Vietnam

Dr. Le Thi Hai Le is the Head of Department of Science – Technology, Ministry of Natural Resources and Environment, Vietnam.

Dar-Yuan Lee

Taiwan

Dr. Dar-Yuan Lee received his Ph.D. degree from University of California, Riverside, USA. He is the Professor of Department of Agriculture Chemistry and Associate Dean of College of Bioresources and Agriculture, NTU. His recent work included applying and developing geostatistical methods for spatial interpolation of soil properties and for delineation of contaminated soils, coupling geostatistical and solute transport models with GIS for the assessment of the fate of chemicals in soils, developing methods for determining the bioavailability of trace elements in soil, and remediation of Cr-contaminated soils using organic matter amendments and phytoremediation.

Regidor M. De Leon

Philippines

Mr. Regidor M. De Leon is the Assistant Secretary for Field Operations, Department of Environment and Natural Resources, Philippines.

Yong-Ha Park

Korea

Dr. Yong-Ha Park is the Chief Senior Researcher for Korea Environment Institute.

Orathai Sukreeyaponge

Thailand

Dr. Orathai Sukreeyaponge is the Director for Land Development Department,
Ministry of Agriculture, Thailand.

Anukoon Suthapan

Thailand

Mr. Anukoon Suthapan is the Director for Industrial Wastewater Division,
Water Quality Management Bureau,
Pollution Control Department,
Ministry of Natural Resources and Environment,
Thailand.

Aep Purnama Tjutju

Indonesia

Mr. Aep Purnama Tjutju is the Divison Head for Facilities, Service and non-Institutional Issues under the Assistant Deputy for Hazardous Waste Management and Contamination Recovery, State Ministry of Environment, Indonesia.

Hung-Teh Tsai

Taiwan

Mr. Hung-Teh Tsai received his Master degree from National Taiwan University. He is the Technical Superintendant and Executive Secretary of Soil and Groundwater Remediation Fund Management Board (SGRFMB), EPA, R.O.C. (Taiwan). He has many experiences in administration, site supervision, and management.

Chayawee Wangcharoenrung

Thailand

Dr. Chayawee Wangcharoenrung is the environmentalist professional level in Industrial Wastewater Division, Water Quality Management Bureau, Pollution Control Department, Ministry of Natural Resources and Environment, Kingdom of Thailand.

Shian-Chee Wu

Taiwan

Dr. Shian-Chee Wu received his Ph.D. degree from Massachusetts Institute of Technology, USA. He is the Professor of Graduate Institute of Environmental Engineering, NTU. His specialties are Environmental Pollutants Fate and Environmental Hazard Assessment.

Zaharah Bt. Yahya Khan

Malaysia

Dr. Zaharah Bt. Yahya Khan is the Principal Assistant Secretary, Minerals and Geosciences Division, Ministry of Natural Resources and Environment (NRE)
Malaysia.

Jae Eui Yang

Korea

Dr. Jae E. Yang received his Ph.D degree from Montana State University. He is the President of International Union of Soil Science (IUSS), and he is also the professor of Soil Environmental Chemistry Department of Biological Environment, Kangwon National University. He has many experiences in environmental site assessment, remediation planning construction, and operation of soil remediation work.

Jin Won Yi

Korea

Ms. Jin Won Yi is the Deputy Director of Soil & Groundwater Management Division, Water Environment Management Bureau,
Ministry of Environment,
Republic of Korea.

Future Projects in Next Four Years of Soil and Groundwater Fund Management Board of Taiwan EPA

Hung-Teh Tsai

Soil and Groundwater Pollution Remediation Fund Management Board, Taiwan EPA

Abstract

The Soil and Groundwater Pollution Remediation Act (herein referred to as the Act) was promulgated and enforced in February 2000, and then amended in February 2010 in accordance with practical law enforcement needs. The Act gave the Environmental Protection Agency (EPA) the authority to investigate, clean up, and monitor pollution control sites and pollution remediation sites. This article provides highlights of EPA's accomplishments of Fiscal Year (FY) 2000-2010, in which the EPA had made significant progress in legislation, conducting site investigation, and other related work during the past 10 years,. The strategic plan for FY 2011-2014 is also presented in this article. With this plan, the EPA is working to protect human health and the environment and to ensure sustainable use of the land and groundwater resources.

Accomplishments of FY 2000-2010

The followings describe highlights of the Fiscal Year (FY) 2000-2010 activities and accomplishments of the Environmental Protection Agency (EPA). The highlights include financial overview, construction of groundwater monitoring well network, site investigation and assessment, remediation and restoration, research and development, education and public outreach, and international exchange and collaboration.

Financial Overview

A major part of the Soil and Groundwater Pollution Remediation Fund (the Fund) come from the remediation fee, which has officially been collected since November 2001. The collection was focused on 6 categories and 125 chemical substances between November 2001 and June 2011, mainly contributed from petrochemical industry (over 90%). After July 2011, the collection has been expanded to 7 categories and 135 chemical substances, as shown in Figure 1. A total of 6.1 billion NT dollars (1.83 billion US dollars) was collected since 2001. The Fund was mainly spent on emergency responses, investigation, and remediation of soil and groundwater (89%), promotion of pollution remediation strategies (8%), and enhancement of technical ability (3%), as shown in Figure 2.

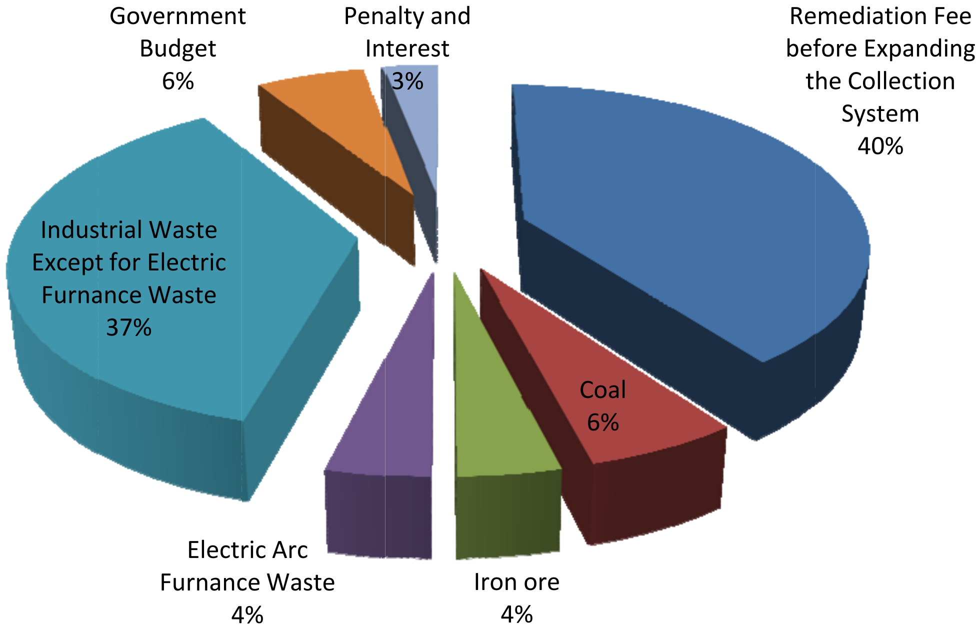


Figure 1 Remediation Fee Levying after Expanding the Collection System

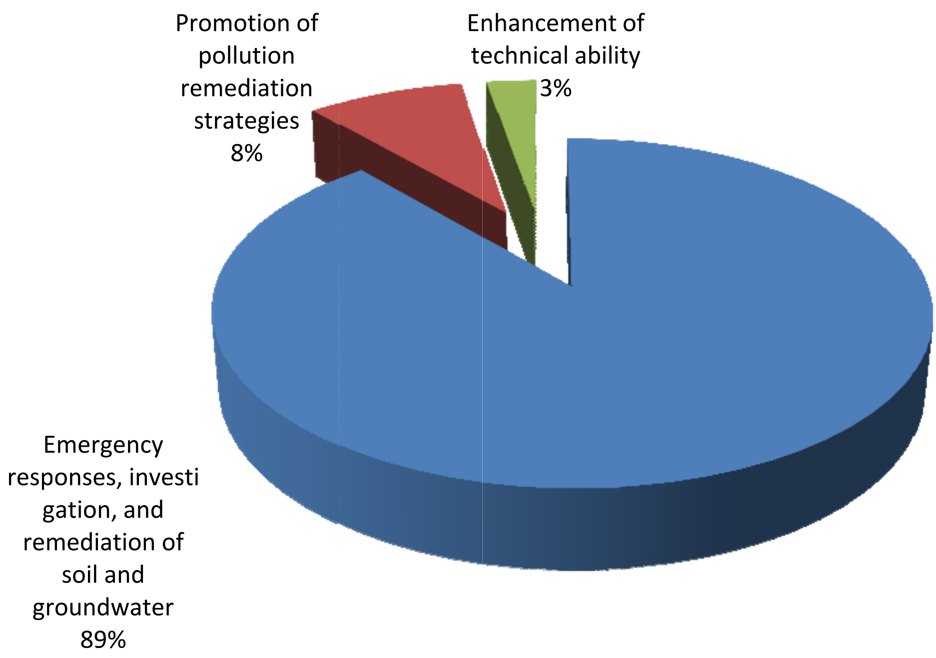


Figure 2 Expenditures of the Fund

Construction of Groundwater Monitoring Well Network

Regional monitoring wells are installed to monitor changes in groundwater quality on a regular basis. Moreover, specific monitoring wells are constructed in certain high pollution potential areas, polluted sites, and polluted areas reported by the public for possible pollution control.

The EPA has started the integration of monitoring information collected by the EPA, Environmental Protection Bureaus, Industrial Development Bureaus, Export Processing Zone Administration, Management Bureau of Science Park, and Water Resources Agency of all counties and cities. By integrating the diversified monitoring information, it will enhance the communication and collaboration among agencies. Furthermore, with the construction of the groundwater monitoring well network, it will enable the EPA to monitor the groundwater quality nationwide to provide protection of groundwater resources and the environment.

Site Investigation and Assessment

During the past 10 years, the EPA has conducted soil and groundwater investigation at numerous sites nationwide, including farmland, industrial sites, illegal dump sites, gas stations and fuel tank farms, and other sites. As of March 2011, a total of 633 pollution control sites and 34 pollution remediation sites has been identified and publicly declared.

Remediation and Restoration – Successful Stories

Yixin Gas Station of Tainan City was identified and publicly declared as a soil and groundwater pollution remediation site in October 2006. After in situ chemical oxidation and excavation performed at the site, the contaminant concentrations were monitored and all below the soil and groundwater pollution control standards. Yixin Gas Station was removed from the regulatory listing of the remediation site in January 2011.

National Petroleum Corporation Renwu Gas Station of Kaohsiung County was identified and publicly declared as a soil and groundwater pollution remediation site in April 2009. Bioremediation and soil vapor extraction with a flow rate of 2,800L/min were used at the site to enhance the degradation of the contaminants. After the 2-year operation, the contaminant concentrations were monitored and all below the soil and groundwater pollution control standards. Renwu Gas Station was removed from the regulatory listing of the remediation site in January 2011.

Research and Development

Soil and groundwater cleanups are complex and diverse in nature, requiring an integration of multi-disciplinary professional skills, such as environmental, civil engineering, chemistry, biology, agriculture, geology, water resources, law and information management. In order to support the science and technology development at the interface of abovementioned fields, in 2010, the EPA funded 20 million NT dollars to assist various organizations to perform fundamental research and pilot-scale studies at the polluted sites.

Education and Public Outreach

Different from traditional practices, the EPA extends its education and training to college and university students in addition to industry, government, and academic bodies. Apart from general courses, laboratory operations and site visits are arranged to allow trainees to achieve a thorough understanding of the issue of polluted sites.

International Exchange and Collaboration

A memorandum of understanding (MOU)[1] was signed on June 24, 2010 between Contaminated Land Applications in Real Environments (CLAIRE) and the EPA. CLAIRE is Britain's most prominent non-profit organization in the field of water and soil contamination. Establishing a long-term, mutually beneficial collaboration mechanism reflects both countries' common concern about the issue of water and soil contamination. The MOU suggests ways for the collaborative development of soil and groundwater remediation and management techniques, including visits by both sides, academic exchanges, and joint holding of specialist conferences. It also calls for using the resources of the two organizations to promote and nurture collaboration with local enterprises in order to gain their assistance in rectifying the soil and groundwater pollution problems that both nations face.

Strategic Plan for FY 2011-2014

This strategic plan establishes 7 broad, closely interrelated goals to show the vision and fulfilling its statutory mission:

1. Complete management system of soil and groundwater polluted site

   The management system includes pollution prevention, site investigation, risk assessment, remediation, as well as site redevelopment.

[1] www.epa.gov.tw/FileLink/FileHandler.ashx?file=14296

2. Complete related laws and regulations

   The EPA will continue to review the Soil and Groundwater Pollution Remediation Act and related regulations, ordinances, announcements, and administrative rules, and draft in accordance with practical law enforcement needs.

3. Optimize the utilization of the Fund

   The EPA plans to build an estimation model for cost and benefit analysis by 2014, which can be used to optimize the utilization of the Fund.

4. Establish Polluted Land Management and Decision Supporting System

   The EPA plans to use cloud computing services and mobile devices to build soil and groundwater information exchange platform in the Asian area to share the information and resources. The EPA also plans to establish the Polluted Land Management and Decision Supporting System by 2014.

5. Enhance research and development in multi-disciplinary fields

   The EPA will continue to improve the capability to assess environmental conditions and ensure the environmental data are of acceptable quality. The EPA will continue to integrate technological advances to enhance the site investigation capabilities, implement cost-effective remedies, and improve the operation and maintenance of existing remedies.

6. Promote education and public outreach

   In order to increase public awareness of polluted land issues and the importance of knowing the land quality prior to purchasing, the EPA will continue to support the community education and outreach.

7. Maintain the leading position in the Asian regions

   The EPA will continue to evaluate and introduce advanced technologies adopted in the United States or Europe, to convey our experience to our neighbors, the countries in East Asian and Southeast Asia, and to promote the collaboration between Taiwan and Mainland China.

This strategic plan is formulated with the management system of soil and groundwater polluted sites as the core, and uses 6 management supporting tools, including legislation, Fund management, information management, research and development, education and public outreach, as well as international collaboration, to complete the entire framework for the FY 2011-2014, as shown in Figure 3.

Figure 3 The Structure of FY 2011-2014 Strategic Plan

Looking Forward

The EPA is committed to preventing and remediating soil and groundwater pollution, to ensuring sustainable use of the land and groundwater resources, to improving the living environment, and to enhancing public health. Looking forward to FY 2011 and beyond, the EPA will continue to address the worst polluted sites, while maintaining protective remedies and balancing the need to complete response actions across the 633 pollution control sites and 34 pollution remediation sites.


行政院環境保護署
Environmental Protection Administration Executive Yuan R.O.C
Future Projects in Next Four Years of Soil and Groundwater Fund Management Board of Taiwan EPA
Soil and Groundwater Pollution Remediation Fund Management Board
Taiwan EPA
Executive Secretary Hung-Teh Tsai


Agenda
➢ The Organization Structure of The Board
➢ Accomplishments of FY 2000-2010
➢ Strategic Plan for FY 2011-2014
➢ Looking Forward
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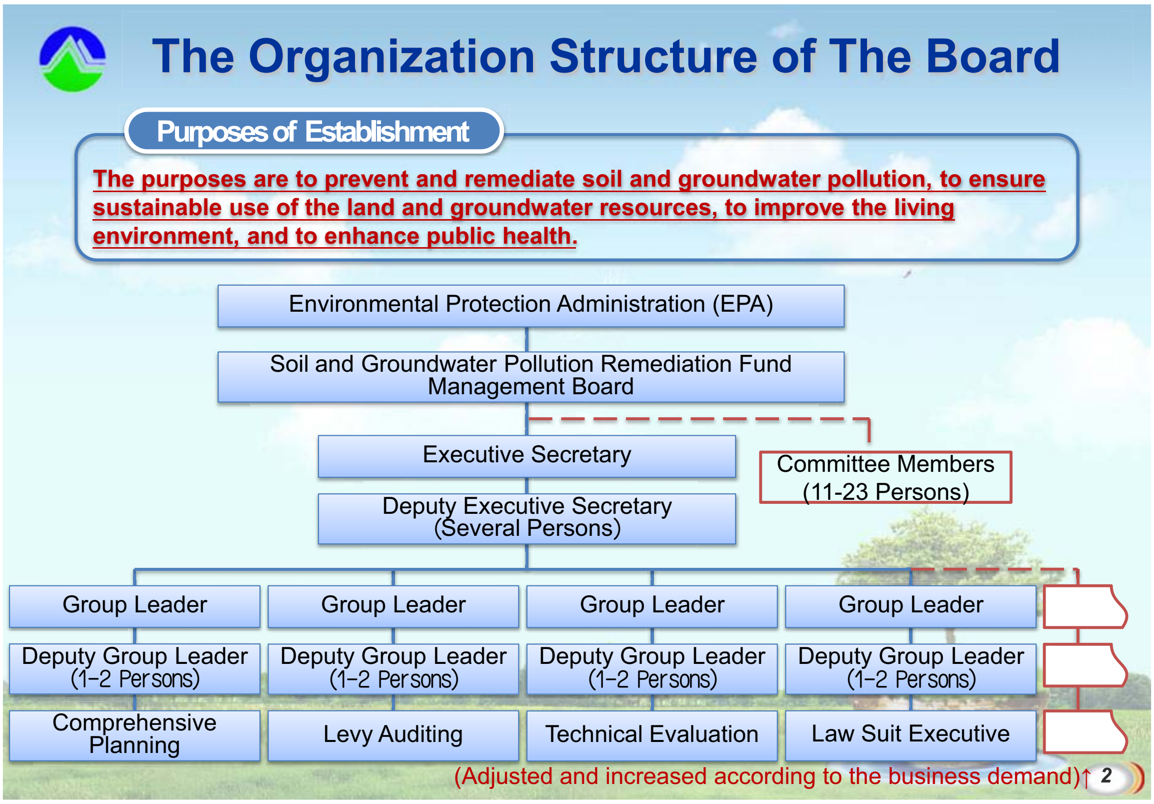
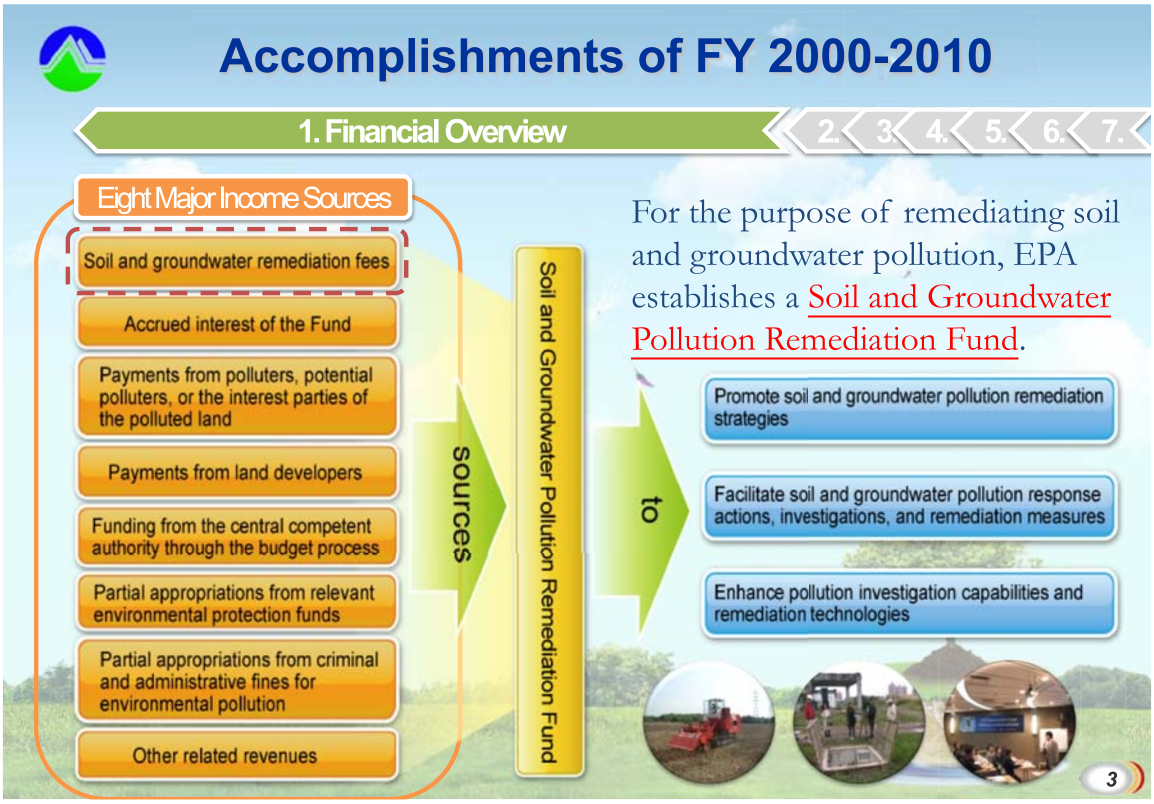
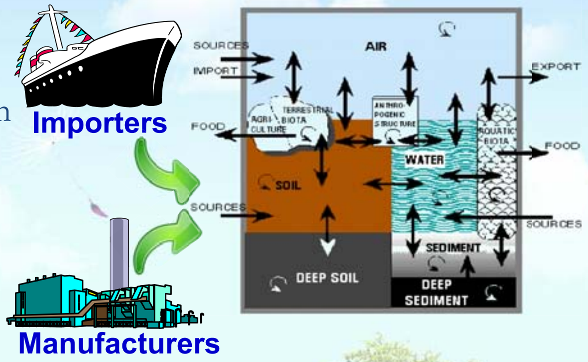

The Organization Structure of The Board
Purposes of Establishment
The purposes are to prevent and remediate soil and groundwater pollution, to ensure sustainable use of the land and groundwater resources, to improve the living environment, and to enhance public health.
Environmental Protection Administration (EPA)
Soil and Groundwater Pollution Remediation Fund Management Board
Executive Secretary
Committee Members (11-23 Persons)
Deputy Executive Secretary (Several Persons)
Group Leader
Group Leader
Group Leader
Group Leader
Deputy Group Leader (1-2 Persons)
Deputy Group Leader (1-2 Persons)
Deputy Group Leader (1-2 Persons)
Deputy Group Leader (1-2 Persons)
Comprehensive Planning
Levy Auditing
Technical Evaluation
Law Suit Executive
(Adjusted and increased according to the business demand)
2


Accomplishments of FY 2000-2010
1. Financial Overview
2.
3.
4.
5.
6.
7.
Eight Major Income Sources
Soil and groundwater remediation fees
Accrued interest of the Fund
Payments from polluters, potential polluters, or the interest parties of the polluted land
Payments from land developers
Funding from the central competent authority through the budget process
Partial appropriations from relevant environmental protection funds
Partial appropriations from criminal and administrative fines for environmental pollution
Other related revenues
sources
Soil and Groundwater Pollution Remediation Fund
to
For the purpose of remediating soil and groundwater pollution, EPA establishes a Soil and Groundwater Pollution Remediation Fund.
Promote soil and groundwater pollution remediation strategies
Facilitate soil and groundwater pollution response actions, investigations, and remediation measures
Enhance pollution investigation capabilities and remediation technologies
3

Accomplishments of FY 2000-2010

1. Financial Overview | 2. | 3. | 4. | 5. | 6. | 7.

- A major part of the Soil and Groundwater Pollution Remediation Fund comes from the soil and groundwater pollution remediation fees, which has officially been collected since November 2001.



- The EPA levies soil and groundwater pollution remediation fees on manufacturers and importers in accordance with the amounts of officially announced chemical substances manufactured and imported by such enterprises.

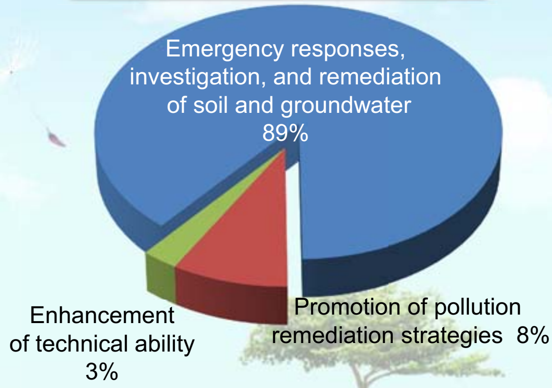
4

Accomplishments of FY 2000-2010

1. Financial Overview | 2. | 3. | 4. | 5. | 6. | 7.

- Starting in July 2011, the collection has been expanded to 7 categories and 135 chemical substances.
- A total of $200 million (NTD 6.1 billion) was collected since 2001. The Fund was mainly spent on emergency responses, investigation, and remediation of soil and groundwater (89%), promotion of pollution remediation strategies (8%), and enhancement of technical ability (3%).

Totaling approximately 1.2 billion NT dollars per year



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Accomplishments of FY 2000-2010

2. Construction of Groundwater Monitoring Well Network

1. 3. 4. 5. 6. 7.

Groundwater Monitoring

- Regional monitoring wells are installed to monitor changes in groundwater quality on a regular basis.
- The EPA has started the integration of monitoring information collected by the EPA, Environmental Protection Bureaus, Industrial Development Bureaus, Export Processing Zone Administration, Management Bureau of Science Park, and Water Resources Agency of all counties and cities.
- By integrating the diversified monitoring information, it will enhance the communication and collaboration among agencies.
- With the construction of the groundwater monitoring well network, it will enable the EPA to monitor the groundwater quality nationwide to provide protection of groundwater resources and the environment.

Standard Monitoring Wells

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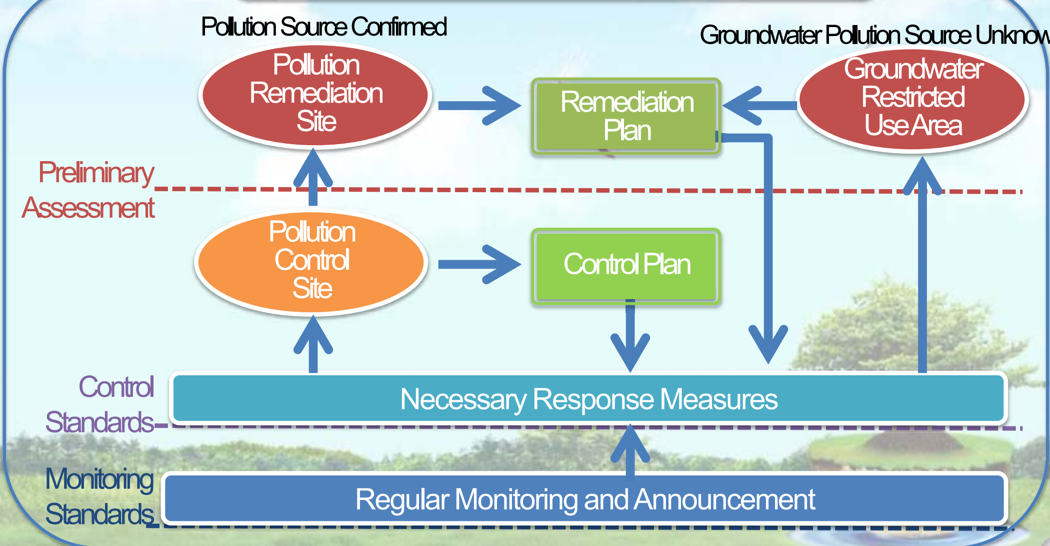
Accomplishments of FY 2000-2010

3. Site Investigation and Assessment

1. 2. 4. 5. 6. 7.

Double Threshold Mechanism



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Accomplishments of FY 2000-2010

3. Site Investigation and Assessment

1. 2. 4. 5. 6. 7.

Site Investigation


Farmland


Gas Stations


Fuel Tank Farms


Illegal Dump Sites


Industrial Sites


Others

8

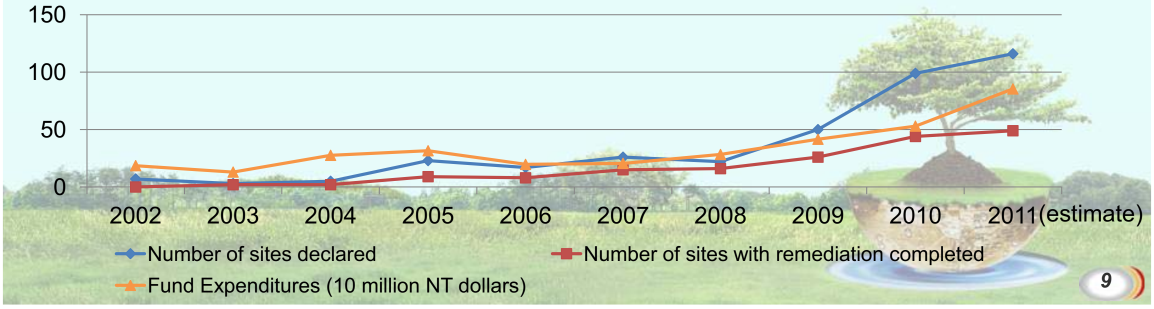
Accomplishments of FY 2000-2010

3. Site Investigation and Assessment

1. 2. 4. 5. 6. 7.

(As of November 21, 2011)

Site Type	Total Discovered Sites		Sites Being Corrected		Sites Need to Be Corrected	
	Number	Area (Hectare)	Number	Area (Hectare)	Number	Area (Hectare)
Farmland	2, 148	487	1, 757	410	391	77
Gas Stations	153	31	57	12	96	19
Storage Tanks	15	212	7	40	8	171
Industrial Sites	220	848	85	96	135	751
Illegal Dump Sites	29	19	10	5	19	14
Others	81	128	15	8	66	120
Subtotal	2, 646	1, 725	1, 931	571	715	1, 152



9

Accomplishments of FY 2000-2010

4. Remediation and Restoration Successful Stories 1. 2. 3. 5. 6. 7.

Successful Stories - Yixin Gas Station of Tainan City

Origin of Case	Yixin Gas Station was identified and publicly declared as a soil and groundwater pollution remediation site by the EPA in October 2006.
Achievements	After in situ chemical oxidation and excavation performed at the site, the contaminant concentrations were monitored and all below the soil and groundwater pollution control standards. Yixin Gas Station was removed from the regulatory listing of the remediation sites in January 2011.



10

Accomplishments of FY 2000-2010

4. Remediation and Restoration Successful Stories 1. 2. 3. 5. 6. 7.

Successful Stories - National Petroleum Corporation Renwu Gas Station of Kaohsiung County

Origin of Case	Renwu Gas Station of Kaohsiung County was identified and publicly declared as a soil and groundwater pollution remediation site in April 2009.
Achievements	Bioremediation and soil vapor extraction with a flow rate of 2,800L/min were used at the site to enhance the degradation of the contaminants. After the 2-year operation, the contaminant concentrations were monitored and all below the soil and groundwater pollution control standards. Renwu Gas Station was removed from the regulatory listing of the remediation sites in January 2011.



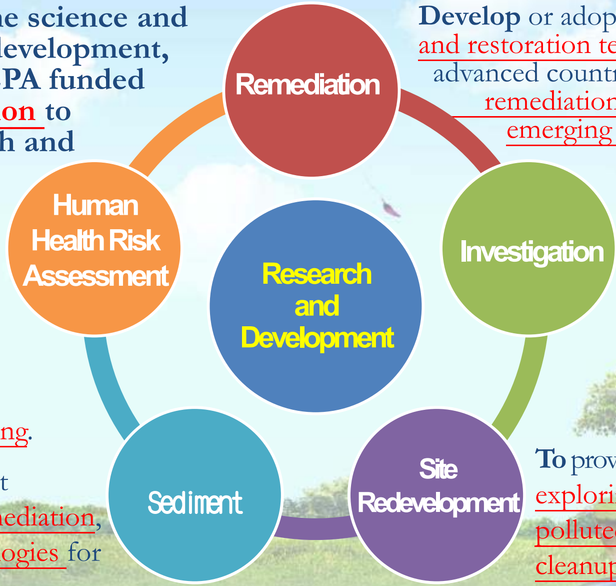
11

Accomplishments of FY 2000-2010

5. Research and Development

1. 2. 3. 4. 6. 7.

To support the science and technology development, in 2010, the EPA funded NTD 20 million to assist research and pilot-scale studies.



Develop or adopt novel remediation and restoration technologies from advanced countries, such as green remediation, pollution controls, emerging technologies, etc.

Develop or adopt novel investigation technologies from advanced countries, such as screening tools, investigation methods for explosives, and forensics, geophysical survey, etc.

To provide case studies on exploring future uses of the polluted sites before the cleanup remedy is implemented.

Such as human health risk assessment, contaminant transport modeling.

Develop or adopt investigation, remediation, and reuse technologies for sediment.

12

Accomplishments of FY 2000-2010

6. Education and Public Outreach

1. 2. 3. 4. 5. 7.

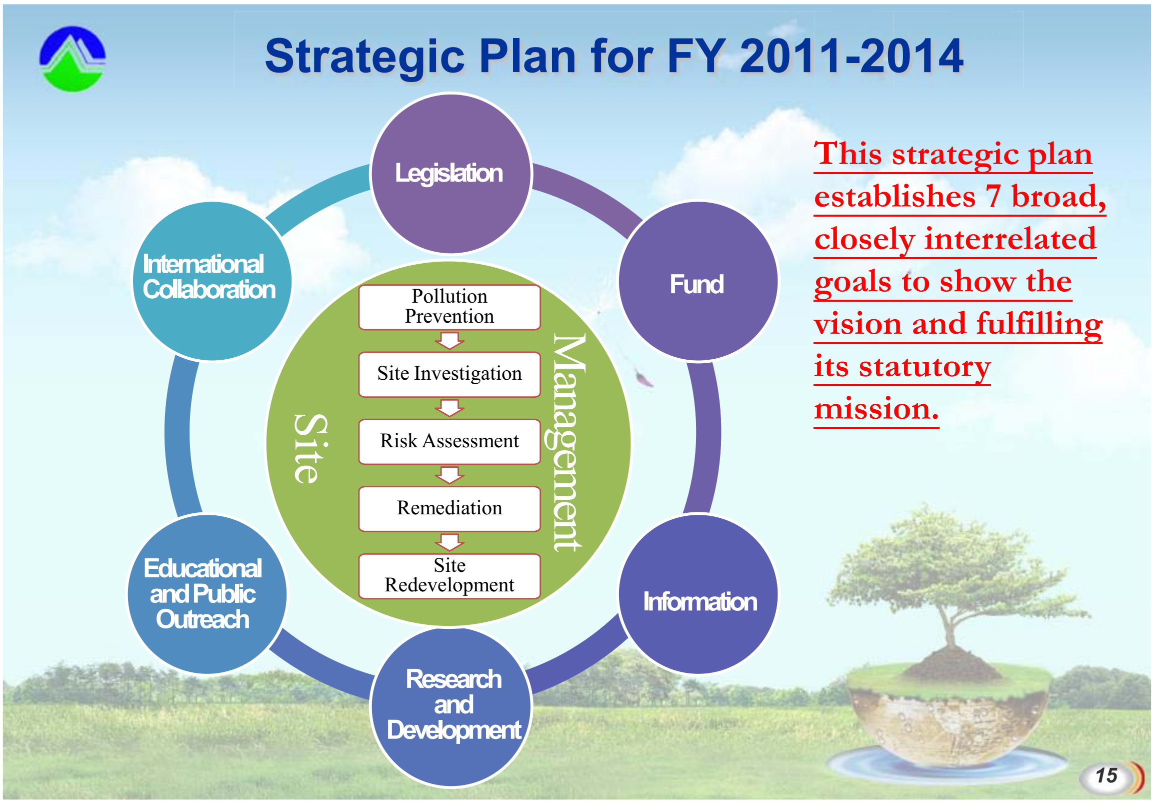
Different from traditional practices, the EPA extends its education and training to college and university students in addition to industry, government, and academic bodies. Apart from general courses, laboratory operations and site visits are arranged to allow trainees to achieve a thorough understanding of the issue of polluted sites.

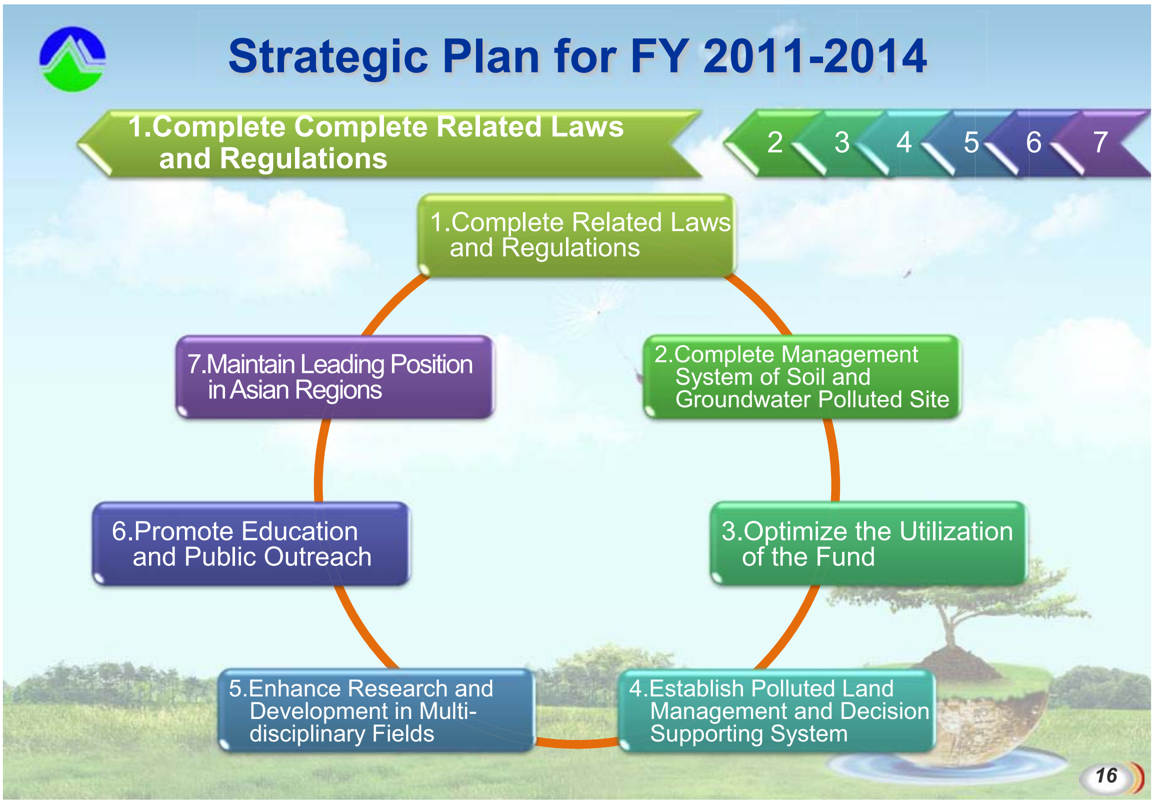


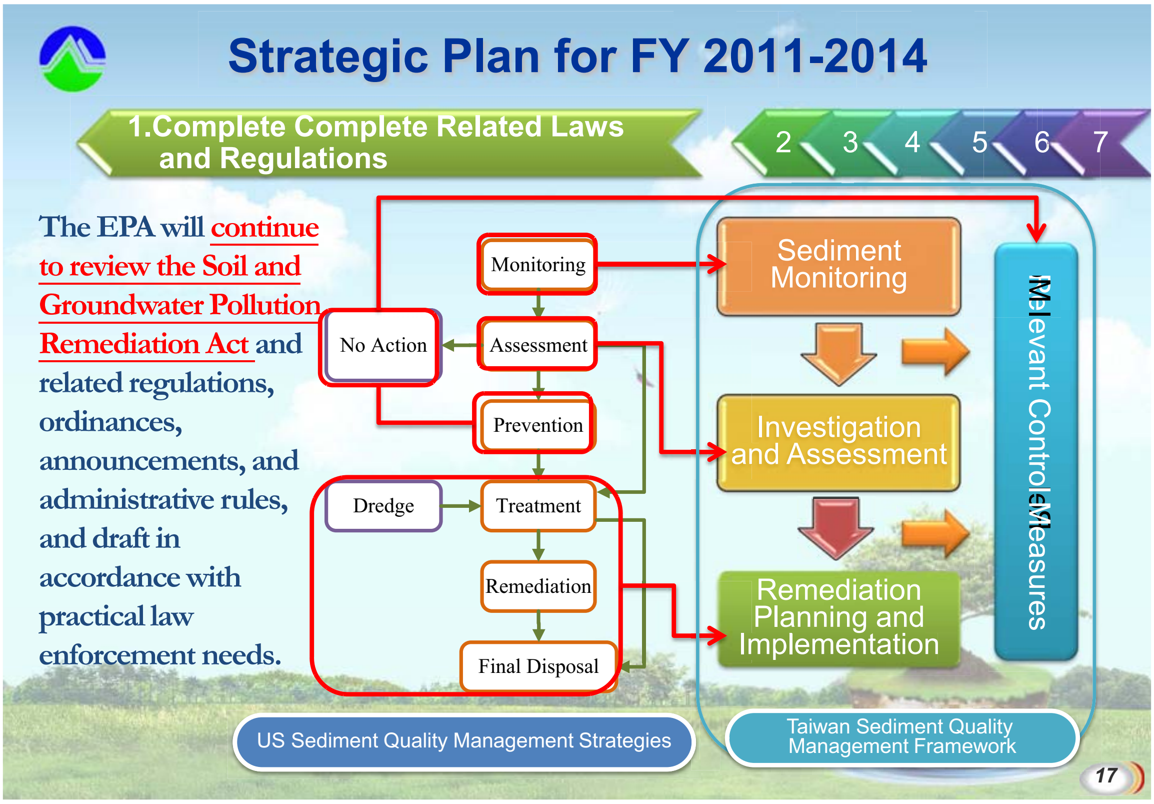


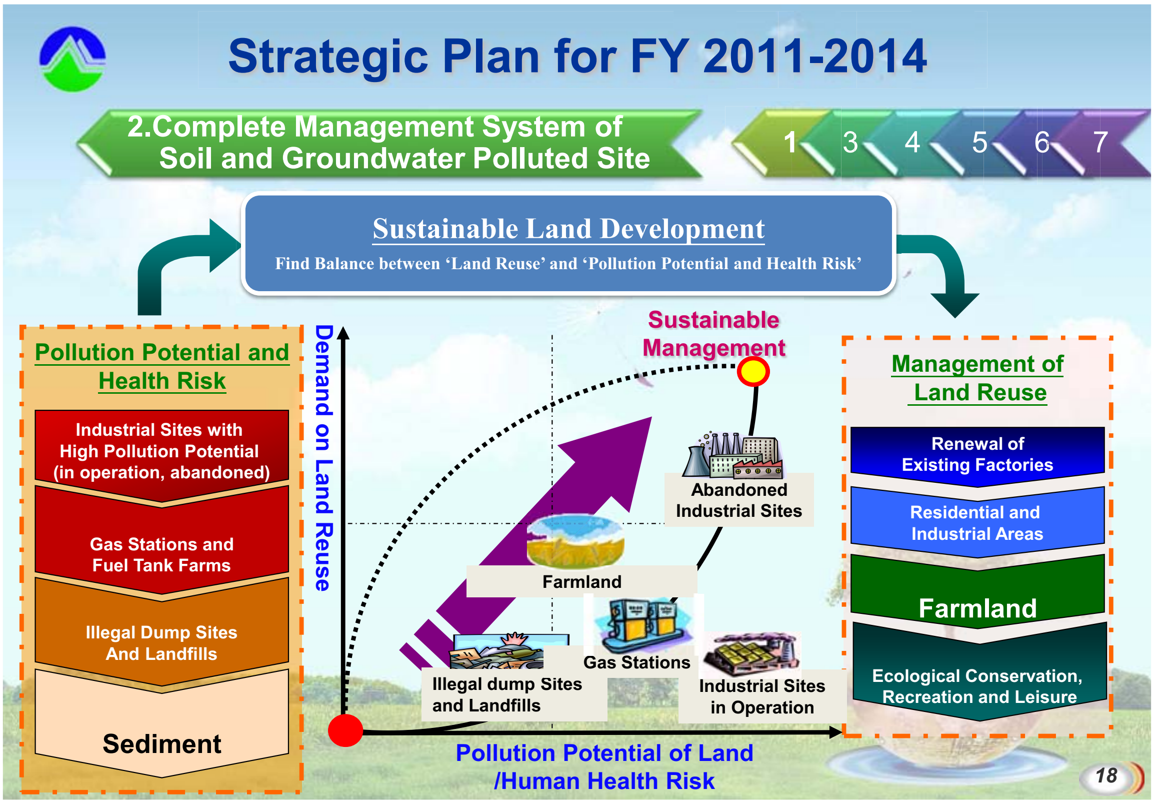

13


Accomplishments of FY 2000-2010
7. International Exchange and Collaboration
1. 2. 3. 4. 5. 6.
MOU Signed between Taiwan and UK
台灣土壤及地下水環境保護協會
Taiwan Association of Soil and Groundwater Environmental Protection
Taiwan Association of Soil and Groundwater Environmental Protection
CL:AIRE
CONTAMINATED LAND: APPLICATIONS IN REAL ENVIRONMENTS
Contaminated Land: Applications in Real Environments
A memorandum of understanding (MOU) was signed on June 24, 2010 between Contaminated Land Applications in Real Environments (CLAIRE) and the EPA. The MOU suggests ways for the collaborative development of soil and groundwater remediation and management techniques, including visits by both sides, academic exchanges, and joint holding of specialist conferences. It also calls for using the resources of the two organizations to promote and nurture collaboration with local enterprises in order to gain their assistance in rectifying the soil and groundwater pollution problems that both nations face.
14


Strategic Plan for FY 2011-2014
Legislation
Fund
Information
Research and Development
Educational and Public Outreach
International Collaboration
Site
Management
Pollution Prevention
Site Investigation
Risk Assessment
Remediation
Site Redevelopment
This strategic plan establishes 7 broad, closely interrelated goals to show the vision and fulfilling its statutory mission.
15


Strategic Plan for FY 2011-2014
1.Complete Complete Related Laws and Regulations
2 3 4 5 6 7
1.Complete Related Laws and Regulations
2.Complete Management System of Soil and Groundwater Polluted Site
3.Optimize the Utilization of the Fund
4.Establish Polluted Land Management and Decision Supporting System
5.Enhance Research and Development in Multi-disciplinary Fields
6.Promote Education and Public Outreach
7.Maintain Leading Position in Asian Regions
16


Strategic Plan for FY 2011-2014
1.Complete Complete Related Laws and Regulations
2 3 4 5 6 7
The EPA will continue to review the Soil and Groundwater Pollution Remediation Act and related regulations, ordinances, announcements, and administrative rules, and draft in accordance with practical law enforcement needs.
Monitoring
No Action
Assessment
Prevention
Dredge
Treatment
Remediation
Final Disposal
Sediment Monitoring
Investigation and Assessment
Remediation Planning and Implementation
Relevant Control Measures
US Sediment Quality Management Strategies
Taiwan Sediment Quality Management Framework
17


Strategic Plan for FY 2011-2014
2.Complete Management System of Soil and Groundwater Polluted Site
1 3 4 5 6 7
Sustainable Land Development
Find Balance between 'Land Reuse' and 'Pollution Potential and Health Risk'
Pollution Potential and Health Risk
Industrial Sites with High Pollution Potential (in operation, abandoned)
Gas Stations and Fuel Tank Farms
Illegal Dump Sites And Landfills
Sediment
Demand on Land Reuse
Sustainable Management
Abandoned Industrial Sites
Farmland
Gas Stations
Illegal dump Sites and Landfills
Industrial Sites in Operation
Pollution Potential of Land /Human Health Risk
Management of Land Reuse
Renewal of Existing Factories
Residential and Industrial Areas
Farmland
Ecological Conservation, Recreation and Leisure
18


Strategic Plan for FY 2011-2014
2.Complete Management System of Soil and Groundwater Polluted Site
1 3 4 5 6 7
– Other related loaning, incentive, or subsidizing supplementary programs will be established
– Attract private investors/developers to conduct contaminated site cleanup and remediation.
– 2 demonstration sites：
➢ Ruifang (瑞芳),Taipei
➢ Dapingding (大坪頂), Kaohsiung
Reuse polluted sites
Ruifang (瑞芳),Taipei
Dapingding (大坪頂), Kaohsiung
19

Strategic Plan for FY 2011-2014

3.Optimize the Utilization of the Fund

1 2 4 5 6 7

The EPA plans to build an estimation model for cost and benefit analysis by 2014, which can be used to optimize the utilization of the Fund.

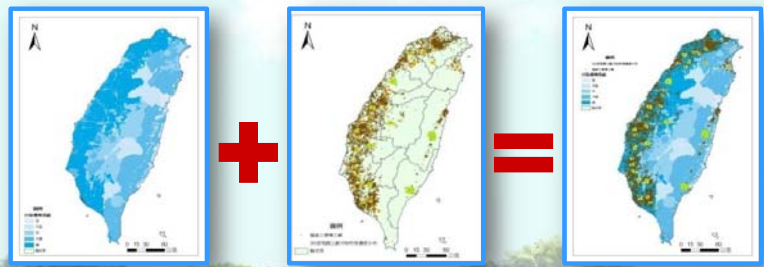
20

Strategic Plan for FY 2011-2014

4.Establish Polluted Land Management and Decision Supporting System

1 2 3 5 6 7

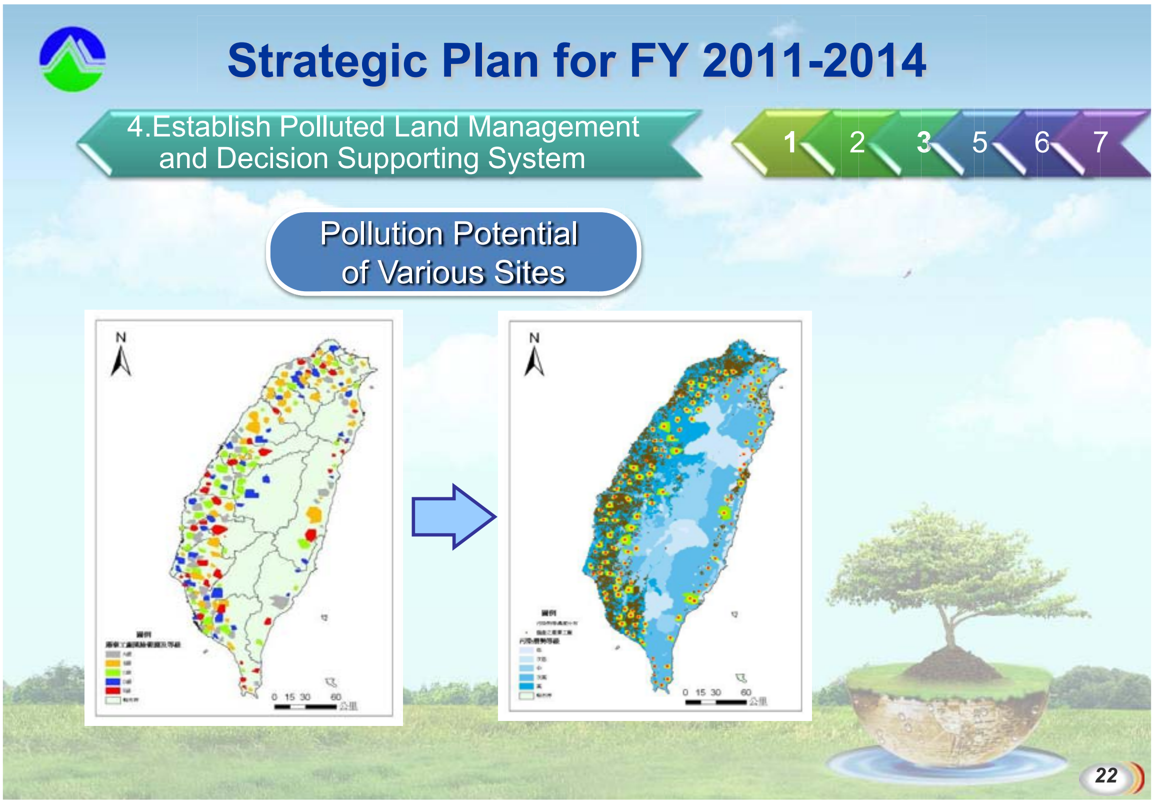
The EPA plans to use cloud computing services and mobile devices to build a soil and groundwater information exchange platform in the Asian area to share the information and resources. The EPA also plans to establish the Polluted Land Management and Decision Supporting System by 2014.



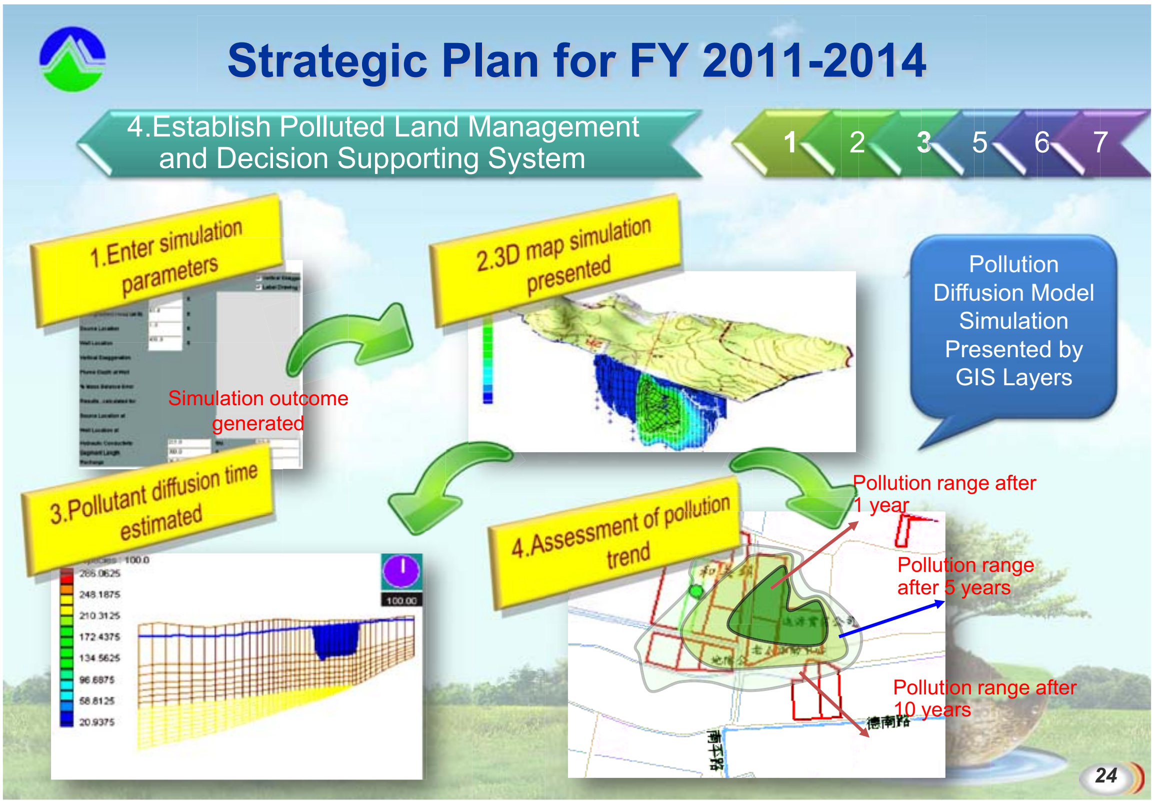
1.Water conservation area
2.Soil permeation
3.Land use
4.Areas of dense population
5.The range of exposure risk level

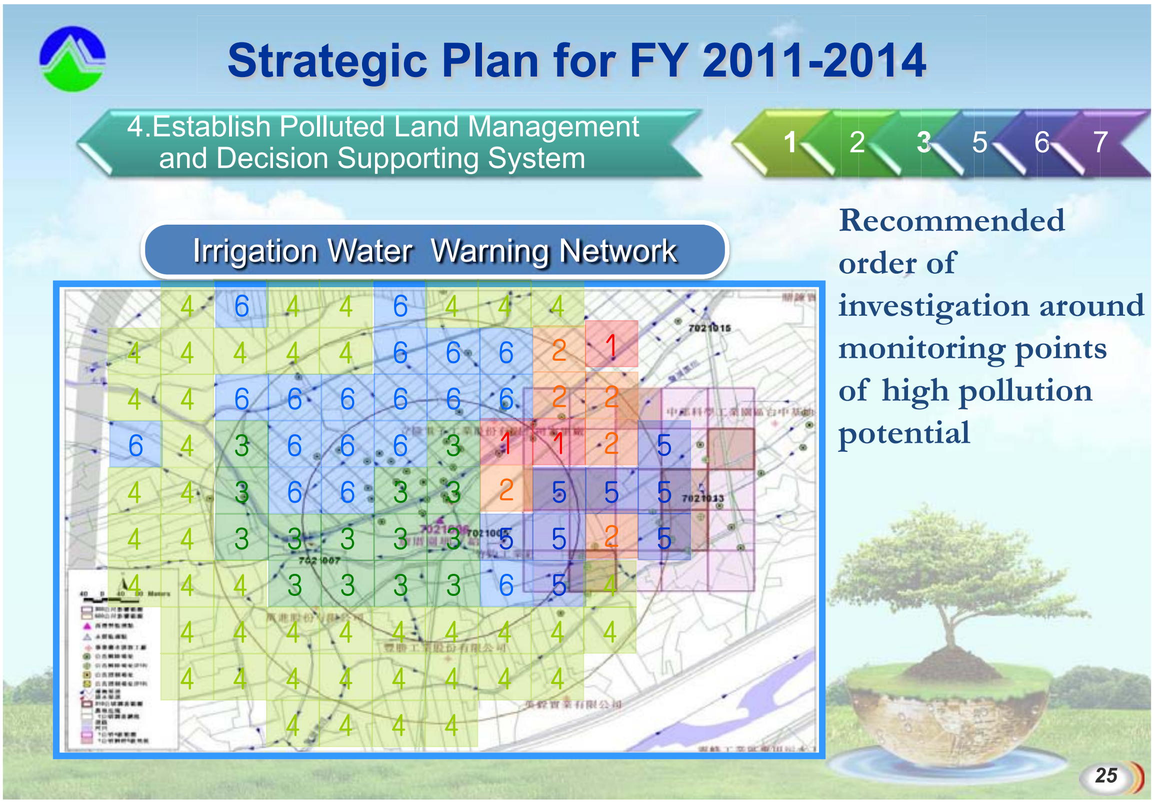
1.Pollution potential rating
2.concentration distribution of investigated factories

21


Strategic Plan for FY 2011-2014
4.Establish Polluted Land Management and Decision Supporting System
1 2 3 5 6 7
Pollution Potential of Various Sites
N
0 15 30 60
N
0 15 30 60
22


Strategic Plan for FY 2011-2014
4.Establish Polluted Land Management and Decision Supporting System
1 2 3 5 6 7
in the office
on-site operation
Internet
PC
●Mobile
●Laptop
●Mini Note
Database
Distribution map of sampling spots
Site area map
23


Strategic Plan for FY 2011-2014
4.Establish Polluted Land Management and Decision Supporting System
1 2 3 5 6 7
1.Enter simulation parameters
2.3D map simulation presented
Pollution Diffusion Model Simulation Presented by GIS Layers
Simulation outcome generated
3.Pollutant diffusion time estimated
4.Assessment of pollution trend
Pollution range after 1 year
Pollution range after 5 years
Pollution range after 10 years
24


Strategic Plan for FY 2011-2014
4.Establish Polluted Land Management and Decision Supporting System
1 2 3 5 6 7
Irrigation Water Warning Network
Recommended order of investigation around monitoring points of high pollution potential
25

Strategic Plan for FY 2011-2014

4.Establish Polluted Land Management and Decision Supporting System

1 2 3 5 6 7

Characteristics of operational pollution
- analysis of monitoring status and assessment of monitoring effect
- Overall emissions and consumption of air, water, waste, and toxic substances
- Industry and processing
- Scale and loading

Environmental risk assessment
- Receptor number and distance
- Receptors
  - •Densely populated areas
  - •Groundwater intake points
  - •Environmentally sensitive areas
- Study on the hazard of the pollutant and epidemiology
- Land use change

Hydrogeological index
- The difficulty of pollutant's travel to the receptor via groundwater
- DRASTIC Index
  - • 4 parameters of humanistic, social, and economic activities
  - • 7 hygrogeological parameters
- Distance and speed

Light Control
- Red（action） Reach pollution level or pollution exists
- Orange （warning） High pollution potential; monitoring network is needed for improved warning ability
- Yellow（caution） A complete monitoring network was established in areas with high pollution potential for warning and monitoring
- Green（concern） Industrial areas with low pollution potential

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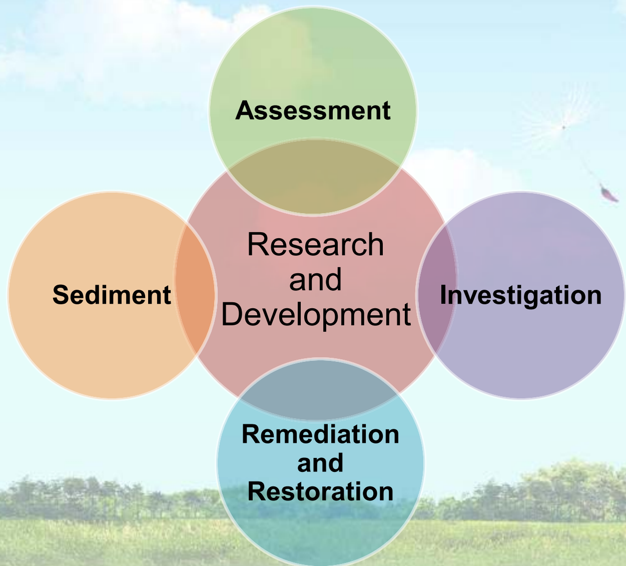
Strategic Plan for FY 2011-2014

5.Enhance research and development in multi-disciplinary fields

1 2 3 4 6 7



The EPA will continue to improve the capability to assess environmental conditions and to ensure the environmental data are of acceptable quality. The EPA will continue to integrate technological advances to enhance the site investigation capabilities, implement cost-effective remedies, and improve the operation and maintenance of existing remedies.

27

Strategic Plan for FY 2011-2014

6.Promote Education and Public Outreach

1 2 3 4 5 7

In order to increase public awareness of polluted land issues and the importance of knowing the land quality prior to purchasing, the EPA will continue to support the community education and outreach.

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Strategic Plan for FY 2011-2014

7.Maintain Leading Position in Asian Regions

1 2 3 4 5 6

1.Evaluate and introduce advanced technologies adopted in the United States or Europe
2.Convey our experience to our neighbors, the countries in East Asian and Southeast Asia
3.Promote the collaboration between Taiwan and Mainland China.

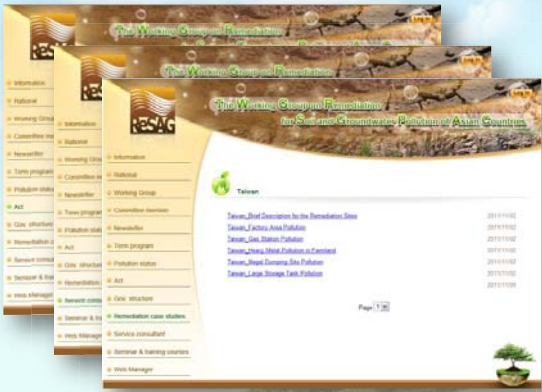
29

Strategic Plan for FY 2011-2014

7.Maintain Leading Position in Asian Regions

1 2 3 4 5 6

- To provide a technical-based network for Asian countries to exchange experience and promote advanced concepts, technologies, and products in the soil and groundwater field, a working group ReSAG was established.
- Useful information, such as laws & regulations, case studies, a list of service consultants, seminar & training opportunities provided by the Asian countries of the working group, are available on the ReSAG platform.



30

Looking Forward

- According to the data provided by the USEPA, revitalizing sites has created various benefits at the site and throughout the community.
  - ✓ $18.29 is leveraged for each EPA dollar expended.
  - ✓ 7.43 jobs are leveraged per $100,000 of EPA funding expended.
  - ✓ Residential property values increased between 2-3% once a nearby contaminated site was assessed or cleaned up.
  - ✓ Cleaning up a contaminated site can increase overall property values within a 1-mile radius by $0.5 to $1.5 million.

- In Taiwan, approximately $18 million (NTD 530 million) was spent on emergency responses, investigation, and remediation in 2010, with similar assumptions,
  - ✓ Over $ 300 million (NTD 9 billion) were expected to be leveraged.
  - ✓ more than 2,000 jobs were expected to be created.

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Looking Forward

- With the expenditures of the Fund, the EPA anticipates to create jobs, spur investment, and most importantly, return the polluted sites to productive use.
- On the enforcement side, recovering costs remains a key mission, the EPA will continue to hold polluters accountable through vigorous enforcement, thus ensuring that polluters pay for the cleanups.
- Green remediation is a growing area of focus. The EPA will increase its emphasis on implementing green remedies in environmentally sustainable ways.

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Looking Forward

The EPA is committed to preventing and remediating soil and groundwater pollution, to ensuring sustainable use of the land and groundwater resources, to improving the living environment, and to enhancing public health. Looking forward to FY 2012 and beyond, the EPA will continue to address the worst polluted sites, while maintaining protective remedies and balancing the need to complete response actions across the pollution control sites and pollution remediation sites.

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行政院環境保護署
Environmental Protection Administration Executive Yuan R.O.C
Thank you for your Attention!

The Contaminated Land Management Framework and Regulations in the UK

Phil Crowcroft
Partner ERM
Chairman – SiLC Register

CONTAMINATED LAND: APPLICATIONS IN REAL ENVIRONMENTS

7 GREAT CUMBERLAND PLACE | 7TH FLOOR | LONDON | W1H 7AL
T - 020 7258 5321 | F - 020 7258 5322 | www.claire.co.uk

Overview

- **Policy and objectives**
- **Legislation**
- **The voluntary framework initiatives**
- **Sustainability**
- **Approach to soil and groundwater standards**

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What drives us to deal with land contamination?

- Impedes social progress
- Inhibits use of land
- Presents an economic barrier to communities and individuals
- Threatens wider damage to environment

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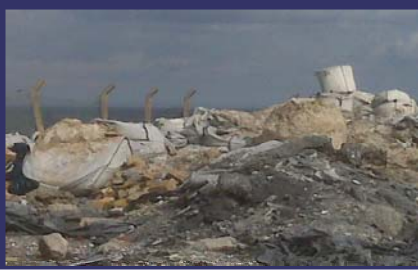
Policy issues for contaminated land

- Preventing new contamination
- Ensuring new development is protected
- Dealing with the legacy of past contamination
- Ensuring sustainable approach to remediation



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European approaches

- **Risk-based versus multifunctionality**
- **Risk-based**
  - land suitable for specified use
  - protective only of relevant receptors
- **Multifunctionality**
  - land suitable for all uses
  - protective of all possible receptors

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Multifunctionality

- **Assumes that we have little control over future use of land**
- **Does not consider cost-benefit of work**
- **Can be very costly for small area**
  - UK example of £2 M (TW$ 100 million) for 1 hectare
- **Creates a permanent long-term solution**
- **How sustainable is this approach?**

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Overview

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Risk - based approach

- Forms basis of UK approach
- Links with sustainable development
- Considers the balance of costs and benefits
- Three-pronged UK legislation
  - Pollution Prevention and Control
    - Environmental Permitting
    - Environmental Damage Regulations
  - Development - Planning Control
  - Dealing with existing contamination
    - Part 2A Contaminated Land Regime
    - Water Resources Act

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Environmental Permitting Regulations

- Environmental Permits control industrial sites, waste management operations and soil treatment operations
- Manage all emissions to air, land and water
- Set standards of operation, Best Available Technology (BAT)
- Have powers to prosecute for breach of permits

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Environmental Damage Regulations (2009)

- Implementation of Environmental Liability Directive, March 2009
- If a business carries out any activity that causes damage to **land, water** or **biodiversity**, the business will have to remedy the damage
- Not retrospective, only new pollution
- Applies specifically to damage to protected species, natural habitats, SSSIs, water and land
- Damage caused by **'economic'** activities
- Low impact to date in UK

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Town and Country Planning Act (1991)

- Under TCPA, land must be made suitable for use for new development
- This is controlled through conditions on planning permits
- Guidance PPS 23 states that if land can be made such that it can't meet the definition of "contaminated land" under Part2A, then it must be suitable for use
- Recent consultation is placing more emphasis on sustainability, and less on conservative "safe" approach

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Part 2A of the Environmental Protection Act (1990)

- The contaminated land regime
- About 1000 pieces of land determined as "contaminated land" since 2000, but in practice only 200 sites
- Recognised that this legislation is not working very well, and recent work to change the Statutory Guidance
- New emphasis on local decision making and better definition of risk

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Water Resources Act (1991)

- Prohibits causing or knowingly permitting the discharge or other entry of poisonous, noxious or polluting matter to controlled waters without a discharge consent
- Controlled waters – groundwater, surface water and coastal waters
- Anti-pollution Works Notices
- Rarely used – mainly a back-up if Part 2A can't be applied

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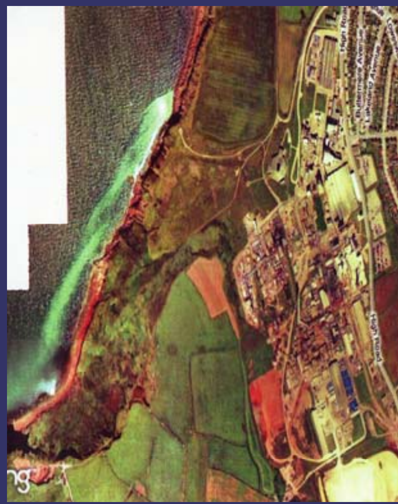
Government Agencies

- **Environment Agency (EA)**
  - Promotes sustainable practice and environmental protection
  - Is primary Regulator for the environment
- **Homes and Communities Agency (HCA)**
  - Promotes sustainable use of land
  - Has a regeneration role around coalfields and difficult sites
- **Land Trust**
  - Previously part of HCA, now a charity which takes on land with no value for community use



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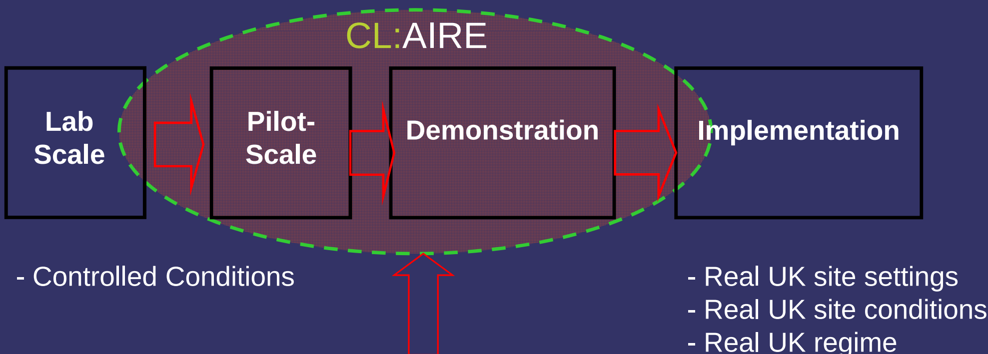
CL:AIRE - a central part of our approach

The vision - collaboration between stakeholders



Field Scale Sites for the Research, Development and Demonstration of Technologies for the Management of Contaminated Land – CL:AIRE

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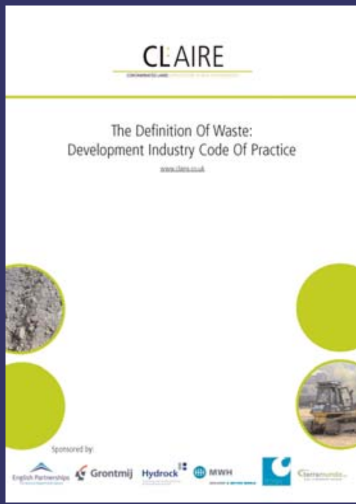
Definition of Waste – Code of Practice

- **Launched in 2008, and provides an alternative approach to strict regulation**
- **For handling and depositing materials (soils and fill) on site such that the EA does not consider them to be waste**
- **Requires Qualified Person to oversee works, and produce a Materials Management Plan and Declaration**
- **Soil is not waste if:**
  - It is suitable for use where it will be placed
  - There is certainty of use
  - Only the amount needed is used



The Specialist in Land Condition Register

- Professional Register
- Background or specialism (eg engineering, geology, chemistry, surveyor etc)
- Is a Chartered Member of a Professional Institution
- Has an understanding of the land assessment process
- 8 years relevant experience
- The ability to provide a high standard of interpretation and good communication skills
- Commitment to a professional Code of Practice

Industry and trade bodies

- **Soil and Groundwater Technology Association (SAGTA)**
  - Problem holders such as oil companies, gas providers etc
- **Environmental Industries Commission (EIC)**
  - Trade body promoting environmental services
- **Construction Industry Research and Information Association (CIRIA)**
  - Research body developing guidance

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Overview

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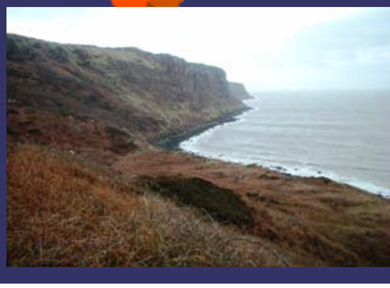
Sustainable Development

- Sustainable development is about making sure that people throughout the world can satisfy their basic needs now, while making sure that future generations can also look forward to the same quality of life.
- Sustainable development recognises that the three 'pillars' – the economy, society and the environment – are interconnected.



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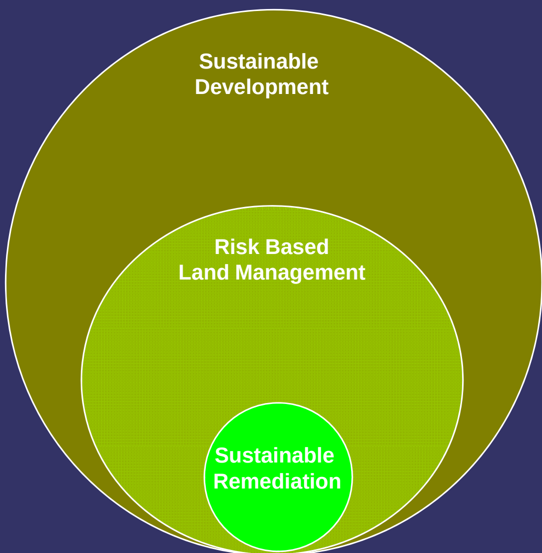
Sustainability versus risk



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Overview

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SOURCE → PATHWAY → RECEPTOR

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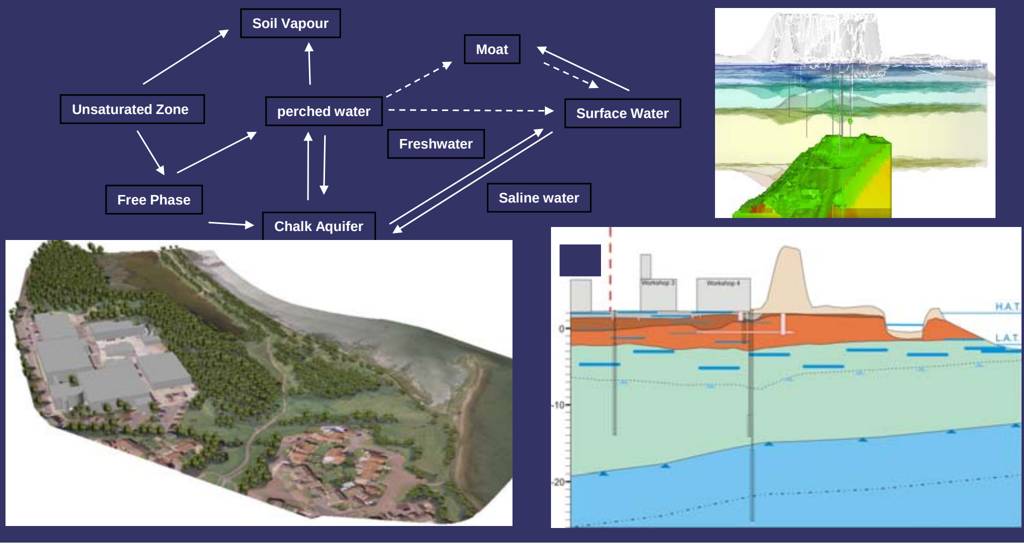
Defining the site conceptual Model



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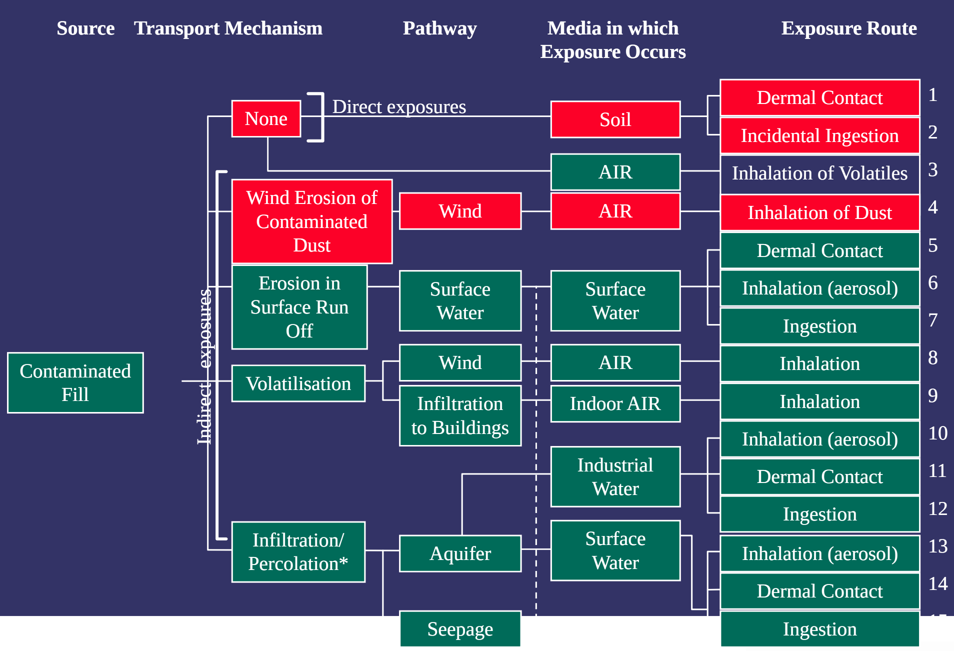
Formalised Conceptual Model



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UK Soil Guideline Values – Human Health

- **Generic Quantitative Risk Assessment (GQRA) Criteria**
  - Developed as criteria to assess potential impacts on human health
  - Currently based on exposure modelling using health criteria values which are set at minimum risk level
  - CLEA software model has been used to develop numbers
  - Proposed change to less conservative level to make more sustainable
- **Detailed Quantitative Risk Assessment (DQRA) uses site specific parameters**

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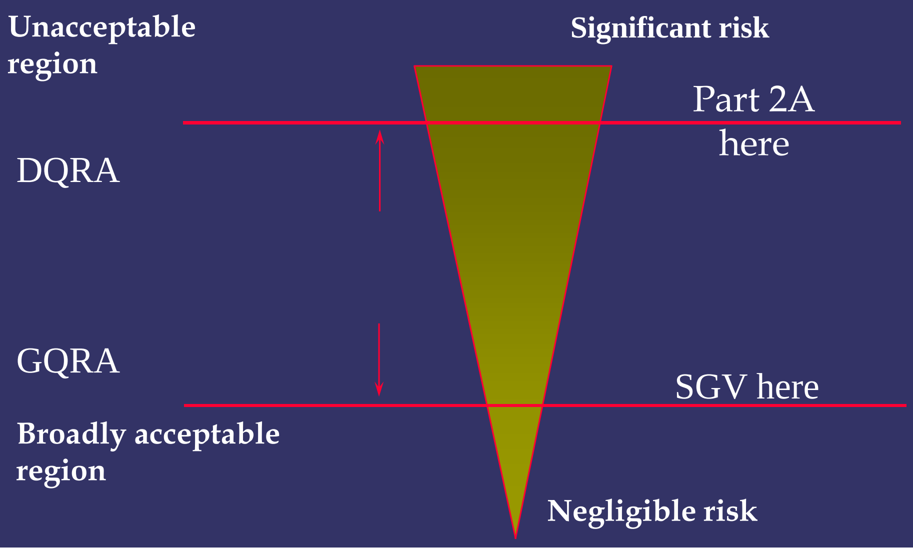
Risk Assessment



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Standards for Controlled Waters

- **Generic Assessment Crtiteria**
  - Environmental Quality Standards – for surface waters – dependent on ecology, and fresh/salt water status
  - Drinking Water Standards for groundwater
- **Detailed QRA**
  - Undertake detailed modelling with site specific parameters
  - Tiered approach, allowing for attenuation, biodegradation, dilution
  - Set compliance point to meet EQS/DWS
  - Take into account use of water body

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Legal and Legislative Approaches to Find Soil Contamination Sites in Korea

Yong-Ha Park
Korea Environment Institute

Abstract

Legal and legislative approaches have been attempted to find soil contamination sites in Korea. Definitions of soil contamination, soil contaminants, soil contamination levels, and legal systems to find the contamination sites are enumerated by the Soil Environment Conservation Act. Soil quality investigation systems, such as the Soil Quality Evaluation Network, Special Soil Contamination Management Facility System, Soil Environment Assessment, and Environment Impact Assessment are operated by the Ministry of Environment. The Soil Contamination Fact-Finding Investigation System is operated by the local governments. The inefficiency in detecting contaminated soil sites via Special Soil Contamination Management Facility System and Soil Contamination Fact-Finding Investigation System is a problem. In order to improve the low-efficiencies resulting from the inappropriateness, possible policy suggestions are discussed.

In Korea, discovering contamination sites remain one of its endless challenges. Appropriate policies for soil contamination management come from efficient soil contamination investigations. The rationales of policies include following questions: how many sites are contaminated?; how clean is clean?; and how should one approach to remedy contaminated sites? Soil contamination investigations were initiated during the early 1980's in Korea. However, the policy implementation at the national level was not fully realized until the Soil Environment Conservation Act (SECA) was enacted in 1995.

In SECA, soil contamination was defined as "harm to human beings and natural environment due to human activities." Twenty one compounds were designated as "Soil Contaminants," and "Soil Contamination Regulatory Levels (SCRLs)" and "Soil Contamination Potential Levels (SCPLs)" of 21 Soil Contaminants were specified (Table 1). SCRL was defined: "a regulatory level of the Soil Contaminant is the level which might cause harmful effects on health of human beings, and growth of animals and plants at a site. The contaminated site needs to remedy/clean." SCPL was defined as "a potential level of the Soil Contaminants which might cause harmful effects on health of human beings, and growth of animals and plants." The site may or may not need to be remedied depending on the land use purpose of the site (Fig. 1).

Table 1 and Figure 1

The legal system in Korea for investigating soil to find contamination sites comes from i) Soil Quality Evaluation Network (SQEN), ii) Soil Contamination Fact-Finding Investigation System (SCFFIS), iii) Special Soil Contamination Management Facility System (SSCMFS), iv) Soil Environment Assessment (SEA), and v) soil quality assessment of the Environment Impact Assessment (EIA).

Soil Quality Evaluation Network was initiated in 1987. Since 2002, the Network's function was separated. One function is to investigate the soil quality of the national land and its tendencies. The Network is operated by the Ministry of Environment (MoE). The Network has fixed ca. 1,520 sampling sites. The MoE has collected soil samples at the fixed sites, as well as investigate and report the soil quality data (Soil Contaminant concentrations) every year. The soil quality data from the Network are used to determine the background levels of soil contaminants in Korea. The other function, the Soil Contamination Fact-Finding Investigation System (SCFFIS), is to search out contamination sites operated by 16 local governments. The local governments select the soil sampling sites in the vicinity of possible soil contamination sources, including mines, underground storage tanks, oil pipelines, factory sites, heavy chemistry plants, and landfill sites. The local governments have investigated and reported the soil quality data (Soil Contaminant's concentrations) of SCFFIS every year. The total sampling sites of SCFFIS is ca. 4,200. The number of sampling sites varies slightly every year due to variations in the number of sampling sites chosen by the local governments.

Site investigations of Special Soil Contamination Management Facilities, including underground storage tanks and oil pipe lines, are conducted by the MoE. This system has investigated over ca. 21,000 facilities since 1996. The SEA was conducted to voluntarily investigate possible site contaminations by potential party(ies) such as buyers and/or sellers for the process of site transactions since 2001. Soil quality investigation for the EIA is conducted by site developers. The sites for the EIA are usually larger than 20,000m^2.

According to SECA, soil regulatory procedure is begun with application of the SCPLs and SCRLs to the sites in most cases. If the concentration of a certain Soil Contaminant(s) is higher than the SCPL by any means of the soil investigation systems, soil regulatory process begins. The SQEN, SCFFIS, SSCMFS, SEA, and EIA are usually good measures in checking the concentrations of the Soil Contaminants at certain sites. If the concentration of a Soil Contaminant is lower than the SCPL, no further action is required. The Precise Soil Quality Investigation (PSQI), including the site history, is applied to sites where the concentration(s) of (a) Soil Contaminant(s) is/are higher than the SCPL(s). PSQI is a measurement tool to investigate and verify the soil quality of sites in detail. The number of soil samples and methodology correspond to the Phase II of the US EPA. In case the concentration(s) of (a) certain Soil Contaminant(s) is/are higher than the SCRL(s), the site is designated as "the Contaminate Site" by SECA, and the site needs to be cleaned. If the concentration(s) of (a) certain Soil Contaminant(s) is/are between the

SCPL and SCRL, the site does not need to be remedied; however, the contaminant concentration of the site should be monitored (Figure 2).

Recently, Soil Risk Assessment was adopted by SECA. Risk Assessment of the Soil Contaminants for human-beings and natural environment is implemented. The result could be applied to decide the scope, time, and degree of the soil clean-up. A guideline for the Risk Assessment by the MoE is being prepared. Nonetheless, responsible party(ies) of the site contamination could still conduct a Risk Assessment to determine the risk of the site. If the risk is high, the site needs to be cleaned. If not, no further actions are required (Figure 2).

Figure 2

The inefficiency in detecting soil contaminated sites via SQEN, SCFFIS, and SSCMFS is a problem. Based on the data from soil contamination investigation systems in Korea, the overall probabilities of detecting contaminated sites are usually less than 5% of all soil investigation cases (Fig 3). In order to improve the low-efficiencies resulting from the inappropriateness of the systems, possible policy suggestions are discussed. First, functions of SECA on liability should be updated and reinforced to positively initiate soil contamination investigation processes for stakeholders, including an owner(s) and/or responsible party(ies) of potentially contamination soil sites. Second, appropriate soil contamination investigation systems should be developed to properly implement the SCFFIS and SSCMFS. Stakeholders of potentially contaminated sites should easily access and raise the soil contamination issues. Implementation of soil contamination investigations through liable and for-profit environment (consulting) companies should be encouraged.

Figure 3

Table 1. Soil Contaminants and their contamination levels (mg/kg) by the Soil Environment Conservation Act

	Soil Contamination Potential Levels (SCPL)			Soil Contamination Regulatory Levels (SCRL)		
	A area[1]	B area[2]	C area[3]	A area	B area	C area
Cd	4	10	60	12	30	180
Cu	150	500	2,000	450	1,500	6,000
As	25	50	200	75	150	600
Hg	4	10	20	12	30	60
Pb	200	400	700	600	1,200	2,100
Cr^{6+}	5	15	40	15	45	120
Zn	300	600	2,000	900	1,800	5,000
Ni	100	200	500	300	600	1,500
F	400	400	800	800	800	2,000
Organic Phosphate	10	10	30	-	-	-
PCBs	1	4	12	3	12	36
Cyanide	2	2	120	5	5	300
Phenol	4	4	20	10	10	50
Benzene	1	1	3	3	3	9
Toluene	20	20	60	60	60	180
Ethylbenzene	50	50	340	150	150	1,020
Xylene	15	15	45	45	45	135
TPH	500	800	2,000	2,000	2,400	6,000
TCE	8	8	40	24	24	120
PCE	4	4	25	12	12	75
benzo(a)pyrene*	0.7	2	7	2	6	21

[1]A (area): rice paddy field, farmland, orchard area, ranch area, school area, park area, playground, etc.

[2]B (area): forest, salt paddy field, river basin, sports area, amusement parks, etc.

[3]C (area): factory site, parking area, road, railway area, national defense sites, etc.

* only apply to sites for manufacturing and storing toxic chemicals or railroad ties such as railway areas, park areas, factory areas, and river basin etc.

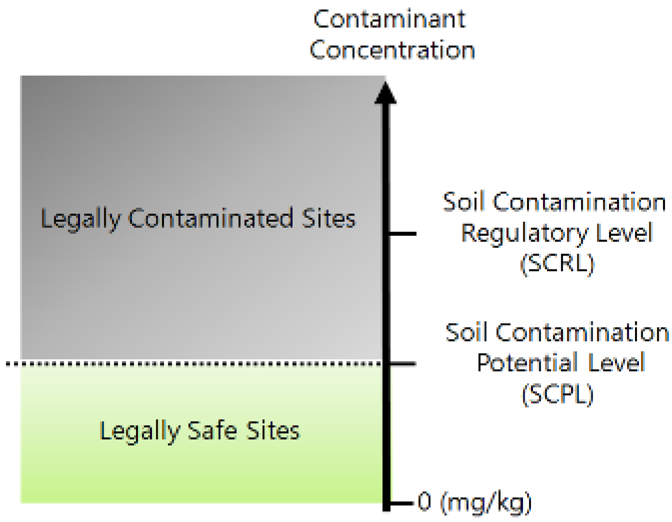

Figure 1. Concept of the Soil Contamination Regulatory Level (SCRL) and the Soil Contamination Potential Level (SCPL) of the Soil Environment Conservation Act

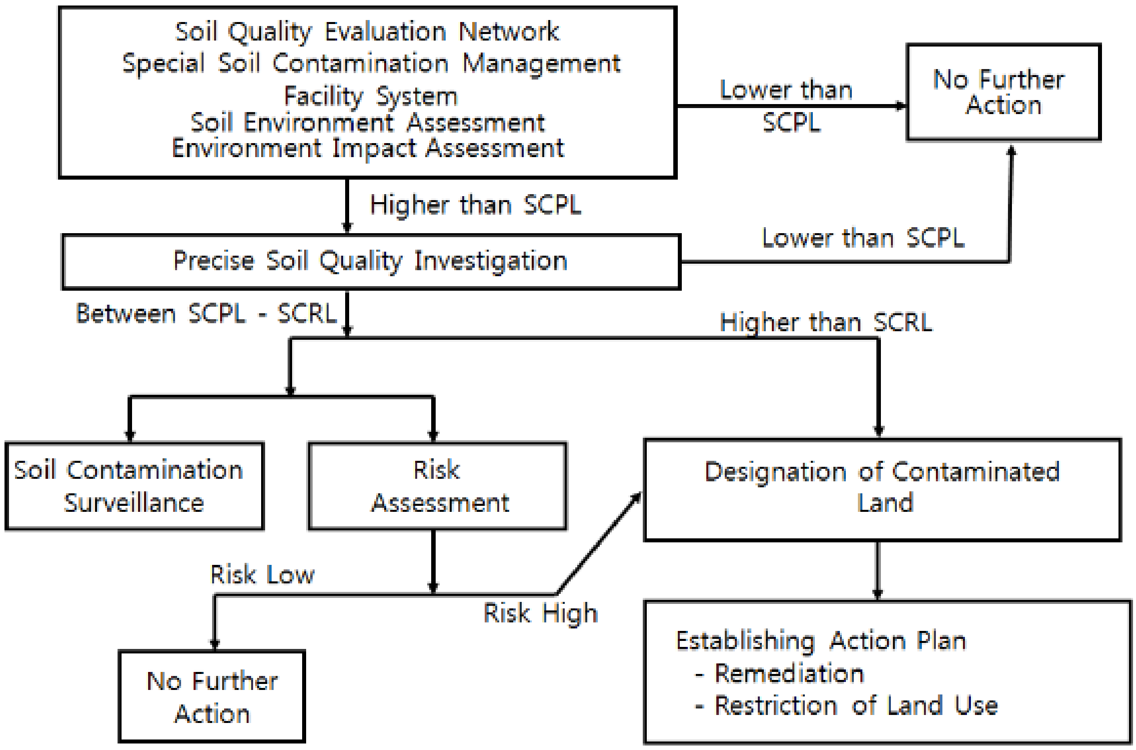

Fig. 2. Diagram of soil regulatory procedure by the Soil Environment Conservation Act

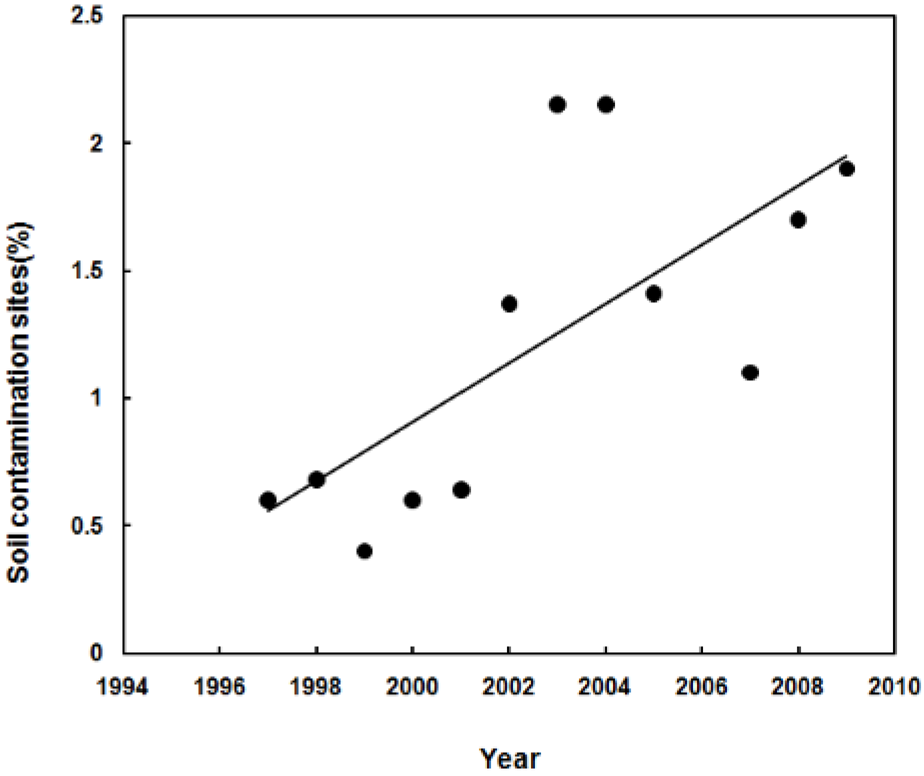

Figure 3. Percentage of contaminated Special Soil Contamination Management Facility Sites where the concentrations of Soil Contaminants are above the Soil Contamination Potential Levels

Development of Soil Control Standards for Organic Pollutants in Taiwan
台灣土壤有機污染物質管制值之研擬

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The development of Control Standards of organic pollutants in soil

The Soil and Groundwater Remediation Act was enacted in February 2 in 2000. The aim of this act is to protect the human health and preserve the living environment. Accordingly, the Control Standards of soil contaminants were first promulgated on November 21, 2001 including 8 heavy metals, 23 organic compounds and 8 pesticides.

The Standards were established towards the aim of the Act. At least three sources were considered while selecting the contaminants to be controlled, the already regulated toxic substances by law, the Drinking Water Quality Standard (ROC), and the contaminants found in some emerging contaminated sites in Taiwan (including Yi-Fung and Da-Yuang Cheimcal Plant, old Radio Company of America (RCA), Ron-Ming Chemical Plant, An-Shoin Plant, etc.)

For setting the values of the Control Standards, the following information sources were referred:

1. the values of the allowable concentration of organic contaminants, based on the threshold of 10^{-6} cancer risk and 0.1 hazard quotient due to the exposure to groundwater, listed in the groundwater protection guidance of state governments of US, of foreign countries, including Finland, France, Soviet Union, Netherlands, Australia, Canada, etc.;
2. RCRA (Resource Conservation and Recycle Act) Action Levels;
3. the research reports performed by local researchers (Yeh et al., 1999, EPA ROC Researches on Drafting Regulations in Response to the Concerned Environmental Issues, Part II: Regulations of Soil Pollution Control and Hazard Ranking System for Contaminated Soil).

The decision making process of drafting the Regulatory Standards is shown in Figure 1. The original version of the draft included 79 volatile and semi-volatile organic compounds and pesticides. The values of the standards of the organic contaminants were set according to the maximum value among the controlling values of the abovementioned foreign countries, suggestions by local researchers and the RCRA Clean-up Standards. If the value of a compound exceeded the RCRA value, the RCRA value was taken. Finally, only minor adjustment was made during the legislation process based on the other social and economic considerations.

Although the Soil and Groundwater Remediation Act is the first statute adopted the risk assessment as the tool to facilitate the decision-making, for instances, setting the clean-up goals, however, most of the values of the Control Standards were chosen based on the values of the existing standards of the RCRA values and state regulatory values in US, and other countries. The risk of human health due to the uptake of contaminants in the soils and groundwater, the damage to the proper uses of the land, for instance, the contaminants level is so high as that the cultivation of plants on the land is not possible; or the hazards posed to the ecosystem due to high levels of contaminants were all not explicitly considered.

Later, after debating in the Executive Yuan and in the Legislative Yuan, and considering the limit of the implementing capability of EPA(ROC) controlling limits of 31 contaminants were firstly promulgated.

Strategies of revising the current soil Control Standards

The revision of the Control Standards of organic contaminants were started in 2008 as part of the EPA(ROC) project "Soil Pollution Control Standard Revision Project". The project had reviewed the originally enacted standards and proposed some new standards. The final suggestions were: adding 6 new organic contaminants, total phenol, chlorobenzene, cyanide, phthalate esters, dichloromethane, chloromethane; adding a more stringent standard for sensitive land uses and a less stringent standard for industrial or other assigned land uses with less exposure and less risk comparing to the common land use for each compound (Table 1).

The approaches taken during drafting the proposal included:

1. Selecting new compounds from 82 compounds (including 79 compounds suggested by EPA,ROC (2000) before, TPH, cyanide and total phenol) by using a ranking system. The priority of a compound was based on the score of the compound. The total score of a compound is the summation of the scores of the items which applies to the compound. The scoring items include the promulgated toxic substances, carcinogens listed by IARC, chemicals found or likely to be found in local contaminated sites, the total amount manufactured and used, compounds at the highest rank in the evaluation results of the investigation of pollutant fate, compounds listed in Groundwater Control Standards, Effluent Standards and Soil Treatment Standards, compounds regulated by foreign countries. Finally, total phenol, dichloromethane, chlorobenzene, cyanides, chloromethane and di-(2-ethylhexyl) phthalate were the six new pollutants,
2. Comparing to the enacted standards in foreign countries either based on land use category or not,
3. Adopting the suggested values by local researchers (Yeh et al., 1999),
4. Establishing the ratio between the controlling values in category 2 (residential) and in category 3 (industrial) by performing risk calculation for the scenarios of residential land uses and industrial land use,
5. Establishing the ratio between the controlling values in category 1 (agricultural) and in category 2 (residential) by referring to the values of foreign countries,
6. Suggesting the values of the newly selected compounds in category 2 by comparing the enacted values of residential area in foreign countries.

The final draft of the revised Standards is shown in Table 1. Again, most of the values of the Control Standards were the same as the previously suggested ones which were chosen based on the values of the existing standards of the RCRA values and state regulatory values in US, and other countries. Even the values of the newly listed compounds were established by choosing the numbers within the ranges of the values of foreign countries. The risk assessment approach was only applied for rationalizing the ratios of the controlling values between categories, not for the absolute values of the Standards. Furthermore, the scenarios as well as the parameters used in the risk assessment process are mostly based on the default numbers of USEPA's. Local human model has not been established. Many values of parameters were not suitable to use in this country, for instance, the exposure durations, the soil uptake rate, event frequency, and surface area of the skin contacting.

Discussions

To maximize the benefits of a clean-up action, including human health risk reduction and addition of the value to the land, and to minimize the cost, one should obtain the following information before setting the values of the Control Standards:

1. The results of health risk assessment based on the scenarios as well as parameters of typical local situation and all types of receivers and their behaviors under all possible types of land uses,
2. The ecological and economical values of every type of land use, short-term and long-term,
3. The feasible measures to ensure the assigned use of the land in the future,
4. The estimates of the cost of the best available remediation technologies.

And all these estimates should all be presented as functions of the concentration of the contaminant in the soil.

So far, the values of the Control Standards of compounds were mostly established by choosing numbers within the ranges of the values of the regulatory standards of foreign countries. Risk assessment has not been applied in the decision-making process to set the Standards. In addition, one regulatory standard should have been followed and also defined implicitly by specific actions according to the law, which are quite different in different countries. For example, the actions triggered by a Soil Screen Level would be different from the actions required for a site with contaminant concentration exceeding the Clean-up Level.

The current Control Standard, ROC has not been optimized in terms of cost and benefit by using the abovementioned decision supporting tools.

Conclusions

More has to be done to introduce the decision-making tools, like risk assessment and land value evaluation, for setting the Soil and Groundwater Control Standards in order to obtain most cost-effective regulatory Standards/goals as well as the values in different land categories. Values of parameters of exposure models have to be localized to obtain better estimates of risk and better decision.

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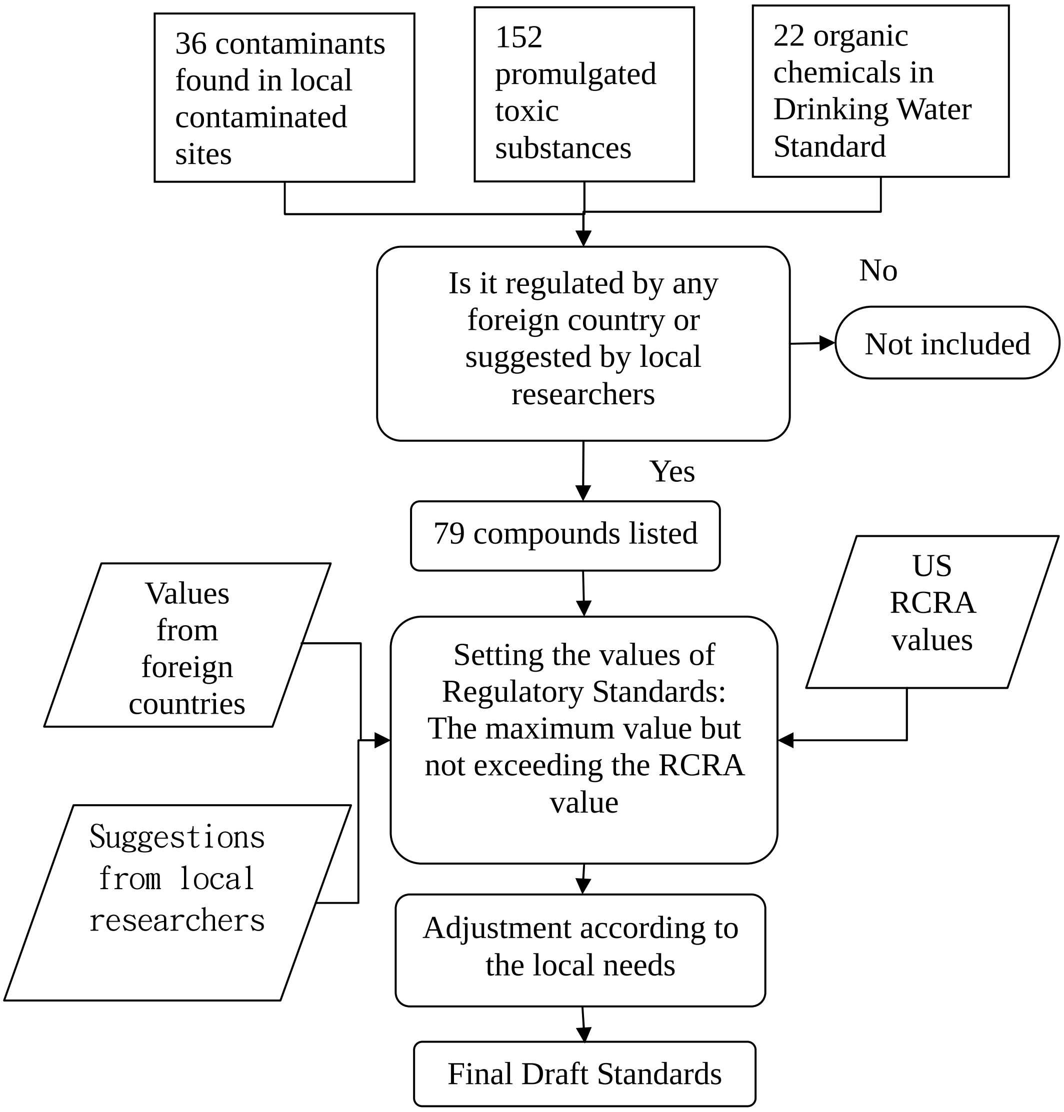

Figure 1 Flow chart of the procedure of setting the values in the current Regulatory Standards (modified from EPA, ROC, 2000)

Table 1 The current values and the proposed revision of Control Standards for some organic contaminants by EPA(ROC)

Contaminants	**Current standard (mg/Kg)**	**Referred sources for setting the current values**	**Proposed standard revision**	**(mg/Kg)**		**Standards of foreign countries (common/residential area)**
	Uniform value		**Category I (sensitive area)**	**Category II (common area)**	**Category III (industrial area)**	
1,2-dichloroethane	8	a	3	**8**	24	0.4~20
1,2-dichloropropane	0.5	b	0.2	**0.5**	1.5	0.5~15
1,2-dichlorobenzene	100	c, d	35	**100**	300	3~600
1,3-dichlorobenzene	100	c, d	35	**100**	300	3~750
2,4,5-trichlorophenol	350	c	**20**	**50**	**150**	0.5~100
2,4,6-trichlorophenol	40	d	14	**40**	120	0.5~200
3,3'-dichlorobenzidine	2	a	0.35	1	**3**	0.05~1
c1,2-dichloroethylene	7	b, c and Delaware	2.5	**7**	21	0.3~18
DDT	3	Delaware	1	**3**	9	1～5
t1,2-dichloroethylene	50	c	20	**50**	150	0.7~5
ethylbenzene	250	c, d	35	100	**300**	5~250
xylene	500	d	60	170	**500**	10~100
trichloroethylene	60	d, e(Holand)	7	20	**60**	1~10
Trichloromethane (chloroform)	100	d	10	**30**	100	3~100
pentachlorophenol	200	c	**20**	**50**	**100**	2~100
hexachlorobenzene	500	c	60	170	**500**	2~200
chlordane	0.5	a	**0.5**	1.5	4.5	2~5
tetrachloroethylene	10	d	3.5	**10**	30	1~30

Table 1 (continued)

Items	Current standard (mg/Kg)	Referred sources for setting the current values	Proposed standard revision	(mg/Kg)		Standards of foreign countries (common/residential area)
	uniform		Category I (sensitive area)	Category II (common area)	Category III (indistrial area)	
carbon tetrachloride	5	a	0.6	1.7	5	0.3~5
toluene	500	c	60	170	500	5~135
dieldrin	0.04	a	0.04	0.1	0.3	0.1~5
polychlororinated biphenyls	0.09	a	0.09	0.3	0.9	1~10
endrin	20	a	7	20	60	0.1~23
aldrin	0.04	a	0.04	0.15	0.5	0.1~5
toxaphene	0.6	a	0.6	1.7	5	0.6~5
benzene	5	e(Holand, Canada(business and industrial areas))	0.6	1.7	5	0.5~2.5
heptachlor	0.2	a	0.07	0.2	0.6	0.2~7.5
vinyl chloride	10	c	1	3	10	0.1~1
dioxin (ng-TE/kg)	1000	e(Canada(residential and park))	175	500	1500	1000~5000
total petroleum hydrocarbon (TPH)	1000	-	350	1000	3000	4~1000
dichloromethane	—		7	20	60	1~60
chlorobenzene	—		10	30	90	1~30
total phenols	—		25	70	210	3.8~70
total cyanides	—		20	50	150	1~300
chloromethane	—		7	20	60	1~50
phthalate esters	—		10	30	90	10~35

a: RCRA, USA;
b: State (US) standard value (industrial);
c: State (US) standard value (residential);
d: local researchers;
e: Standards of other foreign countries

2011 International Workshop on Regulatory Standards of Pollutants and Management Systems for Soil and Groundwater Pollution

Development of Soil Control Standards for Organic Pollutants in Taiwan
台灣土壤有機污染物質管制值之研擬

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1

1. The development of Control Standards of organic pollutants in soil

- The Act
  - The Soil and Groundwater Remediation Act was enacted in February 2 in 2000.
  - The aim of this act is to protect the human health and preserve integrity of the living environment.

2

1.1. Control Standards of Soil Contaminants

- First promulgated on November 21, 2001 including 8 heavy metals, 23 organic compounds and 8 pesticides.

3

- chloromethane
- vinyl chloride
- dichloromethane
- 1,2-dichloroethane
- 1,2-dichloropropane
- 1,2-dichlorobenzene
- 1,3-dichlorobenzene
- 3,3'-dichlorobenzidine
- c1,2-dichloroethylene
- t1,2-dichloroethylene
- trichloroethylene
- Trichloromethane (chloroform)
- carbon tetrachloride
- tetrachloroethylene
- toluene
- benzene
- ethylbenzene
- xylene
- total petroleum hydrocarbon (TPH)

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- chlorobenzene
- hexachlorobenzene
- 2,4,5-trichlorophenol
- 2,4,6-trichlorophenol
- total phenols
- total cyanides
- phthalate esters
- polychlororinated biphenyls
- dieldrin
- endrin
- aldrin
- toxaphene
- DDT
- heptachlor
- pentachlorophenol
- Chlordane
- dioxin (ng-TE/kg)

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References for selection

- Already regulated toxic substances
- Drinking Water Quality Standard (ROC)
- Contaminants found in some emerging contaminated sites in Taiwan
  – Yi-Fung and Da-Yuang Chemical Plant,
  – Old Radio Company of America (RCA),
  – Ron-Ming Chemical Plant,
  – An-Shoin Plant, etc.

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1.2. Setting the values of the Control Standards

- Information sources referred
  - the values of the allowable concentration of organic contaminants, based on the threshold of 10^{-6} cancer risk and 0.1 hazard quotient due to the exposure to groundwater, listed in the groundwater protection guidance of state governments of US and other foreign countries.

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- RCRA (Resource Conservation and Recovery Act) Action Levels;
- The research reports performed by local researchers (Yeh et al., 1999, EPA ROC Researches on Drafting Regulations in Response to the Concerned Environmental Issues, Part II: Regulations of Soil Pollution Control and Hazard Ranking System for Contaminated Soil)

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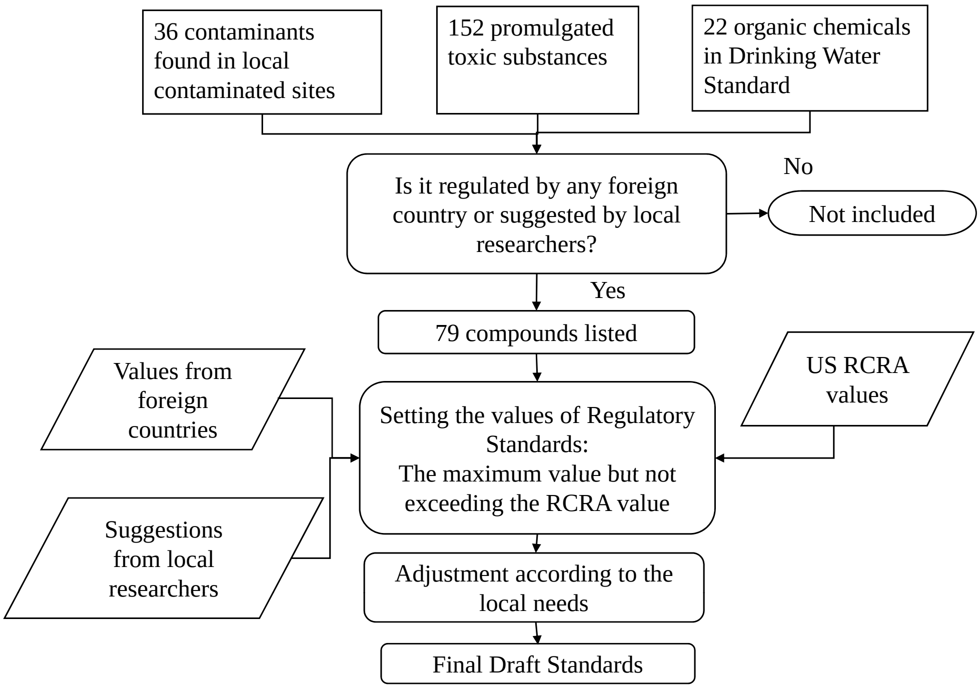
Decision making process



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The decision was based on

- Mostly the values of the existing standards of the RCRA values and state regulatory values in US, and other countries

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Without the consideration of

- the risk of human health due to the uptake of contaminants in the soils and groundwater;
- the damage to the proper uses of the land, for instance, the contaminants level is so high as that the cultivation of plants on the land is not possible;
- nor the hazards posed to the ecosystem due to high levels of contaminants.

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Final promulgated standards

- Later, after debating in the Executive Yuan and in the Legislative Yuan, and considering the limit of the implementing capability of EPA(ROC) controlling limits of 31 contaminants were promulgated.

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2. Revising the current soil Control Standards

- Started in 2008
- Originally enacted standards were reviewed
- Some new standards were proposed

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Proposed revision

- Adding 6 new organic contaminants
  - total phenol, chlorobenzene, cyanide, phthalate esters, dichloromethane, chloromethane
- Adding a more stringent standard for sensitive land uses
- and a less stringent standard for industrial or other assigned land uses
  - with less exposure and less risk comparing to the common land use for each compound

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2.1. The approaches taken during drafting the proposal

1. Selecting new compounds from 82 compounds (including 79 compounds suggested by EPA,ROC (2000) before, and TPH, cyanide and total phenol) by using a ranking system.
   - The total score of a compound is the summation of the scores of the items which applied to the compound.

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- The scoring items include:
  - the promulgated toxic substances,
  - carcinogens listed by IARC,
  - chemicals found or likely to be found in local contaminated sites,
  - the total amount manufactured and used,
  - compounds at the highest rank in the evaluation results of the investigation of pollutant fate,
  - compounds listed in Groundwater Control Standards,
  - Effluent Standards and Soil Treatment Standards,
  - compounds regulated by foreign countries.

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- Finally,
  - total phenol,
  - dichloromethane,
  - chlorobenzene,
  - cyanides,
  - chloromethane
  - di-(2-ethylhexyl) phthalate
- were the six new pollutants,

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2. Comparing to the enacted standards in foreign countries either based on land use category or not;
3. Adopting the suggested values by local researchers (Yeh et al., 1999);
4. Suggesting the values of the newly selected compounds in category 2 (residential) by comparing the enacted values of residential area in foreign countries;

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5. Establishing the ratio between the controlling values in category 2 (residential) and in category 3 (industrial) by performing risk calculation for the scenarios of residential land uses and industrial land use;
6. Establishing the ratio between the controlling values in category 1 (agricultural) and in category 2 (residential) by referring to the values of foreign countries.

2.2. The current values and the proposed revision of Control Standards for some organic contaminants by EPA(ROC)

Contaminants	Current standard (mg/Kg)	Referred sources for setting the current values	Proposed standard revision	(mg/Kg)		Standards of foreign countries (common/residential area)
	Uniform value		Category I (sensitive area)	Category II (common area)	Category III (industrial area)	
1,2-dichloroethane	8	a	3	8	24	0.4~20
1,2-dichloropropane	0.5	b	0.2	0.5	1.5	0.5~15
1,2-dichlorobenzene	100	c, d	35	100	300	3~600
1,3-dichlorobenzene	100	c, d	35	100	300	3~750
2,4,5-trichlorophenol	350	c	20	50	150	0.5~100
2,4,6-trichlorophenol	40	d	14	40	120	0.5~200
3,3'-dichlorobenzidine	2	a	0.35	1	3	0.05~1

a: RCRA, USA;
b: State (US) standard value (industrial);
c: State (US) standard value (residential);
d: local researchers;
e: Standards of other foreign countries

Contaminants	Current standard (mg/Kg)	Referred sources for setting the current values	Proposed standard revision	(mg/Kg)		Standards of foreign countries (common/residential area)
	Uniform value		Category I (sensitive area)	Category II (common area)	Category III (industrial area)	
c1,2-dichloroethylene	7	b, c and Delaware	2.5	7	21	0.3~18
DDT	3	Delaware	1	3	9	1～5
t1,2-dichloroethylene	50	c	20	50	150	0.7~5
ethylbenzene	250	c, d	35	100	300	5~250
xylene	500	d	60	170	500	10~100
trichloroethylene	60	d, e(Holand)	7	20	60	1~10
Trichloromethane (chloroform)	100	d	10	30	100	3~100
pentachlorophenol	200	c	20	50	100	2~100
hexachlorobenzene	500	c	60	170	500	2~200
chlordane	0.5	a	0.5	1.5	4.5	2~5
tetrachloroethylene	10	d	3.5	10	30	1~30

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Items	Current standard (mg/Kg)	Referred sources for setting the current values	Proposed standard revision	(mg/Kg)		Standards of foreign countries (common/residential area)
	uniform		Category I (sensitive area)	Category II (common area)	Category III (industrial area)	
carbon tetrachloride	5	a	0.6	1.7	5	0.3~5
toluene	500	c	60	170	500	5~135
dieldrin	0.04	a	0.04	0.1	0.3	0.1~5
polychlororinated biphenyls	0.09	a	0.09	0.3	0.9	1~10
endrin	20	a	7	20	60	0.1~23
aldrin	0.04	a	0.04	0.15	0.5	0.1~5
toxaphene	0.6	a	0.6	1.7	5	0.6~5
benzene	5	e(Holand, Canada(business and industrial areas))	0.6	1.7	5	0.5~2.5
heptachlor	0.2	a	0.07	0.2	0.6	0.2~7.5
vinyl chloride	10	c	1	3	10	0.1~1
dioxin (ng-TE/kg)	1000	e(Canada(residential and park))	175	500	1500	1000~5000

Contaminants	Current standard (mg/Kg)	Referred sources for setting the current values	Proposed standard revision	(mg/Kg)		Standards of foreign countries (common/residential area)
	Uniform value		Category I (sensitive area)	Category II (common area)	Category III (industrial area)	
total petroleum hydrocarbon (TPH)	1000	-	350	1000	3000	4~1000
dichloromethane	—		7	20	60	1~60
chlorobenzene	—		10	30	90	1~30
total phenols	—		25	70	210	3.8~70
total cyanides	—		20	50	150	1~300
chloromethane	—		7	20	60	1~50
phthalate esters	—		10	30	90	10~35

a: RCRA, USA;
b: State (US) standard value (industrial);
c: State (US) standard value (residential);
d: local researchers;
e: Standards of other foreign countries

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- Most of the values of the Control Standards were the same as the previously suggested ones which were chosen based on the values of the existing standards of the RCRA values and state regulatory values in US, and other countries.
- Even the values of the newly listed compounds were established by choosing the numbers within the ranges of the values of foreign countries.

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2.3. The application of risk assessment

- The risk assessment approach was only applied for rationalizing the ratios of the controlling values between categories, not for the absolute values of the Standards.
- the scenarios as well as the parameters used in the risk assessment process are mostly based on the default numbers of USEPA's.

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表 4.2-14 土壤有機污染物新增列管物質風險評估參數表（2/3）

parameters		Residential area		Industrial
		adults	children	adults
$IR_{oral\text{-}soil}$：攝食土壤速率（mg/day） soil uptake		100	200	100
EF：曝露頻率（day/year Exposure frequency		350	350	250
ED：曝露期間（year） Exposure duration		24	6	25
BW：體重（kg） body weight		61.67	17	61.67
AT：曝露發生之平均時間（day） average time	cancer	27375	27375	27375
	non-cancer	8400	2100	6250
EV：事件發生頻率(1/day)		1	1	1
SA：身體表面積(cm^2) body surface area		17300	11400	17300
fsa：上臂體表面積與身體表面積比(unitless)		0.2	0.2	0.2
AF：土壤對皮膚之吸附係數(mg/cm^2 adsorption		0.07	0.02	0.07
ABSd：皮膚吸收分率(unitless)*註二		0.1	0.1	0.1
ρs：土壤密度(bulk density)(g/cm^3)		1.6	1.6	1.6
I：入滲率 (infiltration rate)(cm/year)		20.32	20.32	20.32

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parameters	Residential area		Industrial
	adults	children	adults
T：孔隙度(cm^3/cm^3-soil)	0.43	0.43	0.43
θws：土壤中水分含量(cm^3-water/cm^3-soil)	0.15	0.15	0.15
θas：土壤中空氣含量(cm^3-air/cm^3-soil)	0.28	0.28	0.28
foc：土壤中有機碳含量(g-carbon/g-soil)	0.0025	0.0025	0.0025
W：污染源與地下水流平行之最大寬度(cm)	1500	1500	1500
Ugw：地下水流速(cm/year)	2500	2500	2500
δgw：地下水混合層高度(cm)	200	200	200
Ls：場址土壤污染源深頂端度(cm)	200	200	200
Lw：地下水高度(cm)	300	300	300
kd：土壤地下水分配係數(cm^3-water/g-soil)	0.05935	0.05935	0.05935
IRoral-water：飲水量(L/day) water uptake	3	1.3	3
B：呼吸速率(m^3/hour) breathing rate	1	0.58	1
t1：每次淋浴時間(hour)	0.5	0.5	0.5
t2：每次淋浴後仍待在浴室中的時間(hour)	0.2	0.2	0.2
EVshower：淋浴次數(1/day)	1	1	1

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表 4.2-14 土壤有機污染物新增列管物質風險評估參數表（3/3）

parameters	Residential area		Industrial
	adults	children	adults
f：蒸散分率(unitless)	0.75	0.75	0.75
Fw：水流速率(L/hour)	300	300	300
Va：浴室容積(L)	3000	3000	3000
IRinh：呼吸速率(m^3/day)	17.14	13.95	17.14
WHF：每天用水流量(L/day)	1000	1000	1000
HV：室內容積(L)	307937	307937	307937
ER：室內換氣率(air changes/day)	21.6	21.6	21.6
MC：為空氣混合係數(uniteless)	0.15	0.15	0.15
Lsc：皮膚角質層厚度 (cm)	0.001	0.001	0.001
t1：一次經皮膚接觸的時間(hour)	0.5	0.5	0.5
Pe：揚塵逸散速率 (g/cm^2-sec)	6.9E-14	6.9E-14	6.9E-14

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Uair：污染源上方風速(cm/sec)	200	200	200
δair：污染源上方空氣混合區高度(cm)	200	200	200
τ：平均蒸氣流時間 (sec)	7.9E+08	7.9E+08	7.9E+08
d：表土深度(cm)	100	100	100
hcap：毛細管邊緣高度(cm)	5	5	5
hv：通氣層厚度(cm)	295	295	295
θacap：毛細管邊緣空氣含量(cm^3-water/cm^3-soil)	0.28	0.28	0.28
θwcap：毛細管邊緣水分含量(cm^3-air/cm^3-soil)	0.15	0.15	0.15

註一：暴露情境判定爲住宅區者，則受體爲當地居民；包括成人(12 歲以上屬於成人)及 12 歲以下之孩童。暴露情境判定爲工業區者，則受體僅爲現場工作人員，即成人。
健康風險評估中對住宅區受體暴露期間通常要求估計 30 年的土地利用預測（6 年兒童、24 年成人）；工業區的暴露時間通常以 25 年估計。

- Recipients in residential area include adults and children (under 12 year old), whose exposure duration is the sum of 6 years as child and 24 years adult.
- Recipients in industrial area are all adults and their exposure duration is 25 years.

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- Local human model has not been established.
- Many values of parameters were not suitable to use in this country, for instance:
  – the exposure durations,
  – the soil uptake rate,
  – event frequency,
  – surface area of the skin contacting.

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3. How to maximize the benefits and to minimize the cost of a clean-up action

- One should obtain the following information before setting the values of the Control Standards:
  - 1. The results of health risk assessment based on the scenarios as well as parameters of typical local situation and all types of receivers and their behaviors under all possible types of land uses,
  - 2. The ecological and economical values of every type of land use, short-term and long-term,

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  - 3. The feasible measures to ensure the assigned use of the land in the future,
  - 4. The estimates of the cost of the best available remediation technologies.
- And all these estimates should all be presented as functions of the concentration of the contaminant in the soil.

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4. Improvement needed

- The values of the Control Standards of compounds were mostly established by choosing numbers within the ranges of the values of the regulatory standards of foreign countries.
- Risk assessment has not been applied in the decision-making process to set the Standards.
- regulatory standard should have been followed and also defined implicitly by specific actions according to the law, which are quite different in different countries.
- The current Control Standard, ROC has not been optimized in terms of cost and benefit by using the abovementioned decision supporting tools.

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5. Conclusions

- More has to be done to introduce the decision-making tools, like risk assessment and land value evaluation, for setting the Soil and Groundwater Control Standards in order to obtain most cost-effective regulatory Standards/goals as well as the values in different land categories.
- Values of parameters of exposure models have to be localized to obtain better estimates of risk and better decision.

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Thank you for your attention

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Recent Contamination Cases and Development of Countermeasure Regulations in Thailand

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Soil, groundwater, and sediment contamination in Thailand has not received much attention from the general public in the past (before year 2000) due to its unobvious impact. However, during the past decade, cases on soil, groundwater, and sediment contamination have been rising in number thus become increasingly more important. This might be due to both the rapid industrialization of the country during the past ten years and lack of contamination prevention mechanisms and countermeasure regulations from the government.

Perhaps some of the famous contamination cases that occur in Thailand during the past ten years include 1) contamination of groundwater by VOCs in northern industrial estate in Lampoon province 2) contamination of groundwater by solvent at Klang Dong area, Nakhonratchasima province and 3) contamination in soil, groundwater and sediment in Map Ta Phut industrial complex in Rayong province. Most of these contamination cases posted some health risks to local residences partly due to lack of complete understanding of the nature of soil, groundwater and sediment contamination and their remediation/management procedure at that time.

Figure shown location of contamination cases in this article

However, as new contamination cases are discovered, the government of Thailand has been devising countermeasure regulations that aim to protect the people from such soil groundwater and sediment contamination. Example of such cases and countermeasures are as followed,

First, in the year 2000, VOCs contamination groundwater contamination case was found in northern industrial estate at Lampoon province by a group of research team led by Japanese university professors. The problem was believed to be originated from mishandling of spent solvent from electronic industries situate just surrounding that area. The rumor on worker died from contacting with groundwater contaminated with solvents had spread. Investigation from many governmental departments has found inconclusive data especially when using the soil gas screening technique. Although, groundwater in the nearby area has found to be contaminated, the site was not remediated and has to keep monitoring the level of contamination until now.

Second, in the year 2004, an illegal open dumping site that received used lube oil, paint, solvents, and oily sludge from industries was discovered at Klang Dong district in Nakhonratchasima province. Although the waste which roughly composed of 8,736 barrels of liquid and more than 8,000 ton of contaminated soil was quickly removed from the site for burning and secured landfilled, investigation during the period of 3 years later has found that Trichloroethylene (TCE), Tetrachloroethylene (PCE), Benzene and cis-1,2-Dichloroethylene in ground water of the area are exceeding US.EPA. standard. Long term analysis of the ground water sample using 70 meters open well*, has found PCE, TCE, and DCE exceeding standard in 2009 and 2010. However; in 2011 all VOCs' level are found to be within standard which might be because the contamination plume has moved to the deeper level.

Figure shown unauthorized landfill site at Klang Dong district in Nakhonratchasima province.

Because of limited knowledge on volatile organic compound, its health effect, and lack of information about contaminant's background level. In response to these two contamination cases, the groundwater quality standard in Thailand was set in the year 2000. The level in the standard is equal to the US.EPA's standard for groundwater suitable for drinking. Thailand groundwater standard currently composed of 4 main contaminants namely; volatile organic compounds (VOCs) such as Benzene 1,2-

Dichloroethane and Tetrachoroethylene, heavy metals such as cadmium, copper, mercury and arsenic, pesticides and other toxics such as cyanide, PCB and vinyl chloride. Later, in the year 2003, the soil standard was set. This standard was separate to two categories, the soil standard for residence and agricultural usages, and the soil standard for other kind of usages. Parameters appear in the soil standard are the same as in ground water standard set just 3 years earlier. Since then, these standards have been used to indicate contamination areas in various sites in the country; although, there is no requirement for factories to monitor their soil and groundwater or to do any site assessment.

Third, in the year 2008, pollution control department has received complaint from people surrounding Map Ta Phut Industrial complex that used groundwater from shallow wells for consumption on the problem of quality of water. Since Map Ta Phut industrial complex is one of the largest petrochemical complexes in the world, local people suspect that the contamination found was man-made. It takes a year or so for related governmental departments to thoroughly investigate contamination in the area by sampling groundwater and soil gas. Since there was no requirement for industries to monitor their groundwater quality at the time, the sample has to be mostly taken by using existing wells which composed of common monitoring wells, production wells and shallow well that developed by local residences, thus very difficult to analyze gathered data.

Figure shown Map Ta Phut industrial complex

The result had shown that there are approximately 10 areas within the industrial complex that are contaminated by VOCs. Although, the contaminants found in shallow water wells that local residents used and that found in industrial sites are different thus there is no link between them and it is also found that the background level of some heavy metals in the soil and groundwater in Thailand are higher than the level set in the standard. Further investigation revealed that contamination found inside each factory is most likely caused by spill, leaking, and mishandling of oils, solvents, storage tanks, wastewater treatment plants, and drain pipes. However; because there is no groundwater monitoring requirement for industries as stated above, contaminations found have either moved to the deep level or spread out vastly which is very difficult to deal with. Pollution Control Department has noticed the significance of this problem and proposing a groundwater monitoring requirement for facilities to National Environment Board (NEB) meeting on December 2nd 2010. The requirement which became NEB resolution that encouraged related departments to legislate regulation which force facilities that

1. Use, transport or store volatile organic compound (VOCs), pesticides or toxics that are in groundwater standard.
2. Has a landfill, surface impoundment, waste and material piles, underground storage tanks, and land treatment that involve any control parameters in Thailand's groundwater standard.

to regularly monitor the groundwater and soil quality within the factory using monitoring well that suitably cover the operation area and identify the contamination before beginning of operation so that each of the factories has their own baseline data and regularly monitor their own area and send monitoring results to related government unit. In case of contamination area is found, it is also recommended that factories use health risk as decision making tool for remediation. It is also recommended that the policy will be first adopt where there are higher risk that groundwater contamination can causes adverse health effect to community. For example, area where people is still consuming groundwater (Map Ta Phut Industrial Estate area is included.). This nationalized monitoring program will hopefully lead to discovery of more contaminated area in its early stage and will allow promptly action before the contamination becomes more severe.

In response to NEB resolution on December 2nd 2010, Department of Industrial Works, Ministry of Industry, proposed a draft version of ministerial regulation on soil and groundwater management within factory area. Synopsis of this regulation includes

- Using of the risk approach to calculated acceptable level of contamination within each factory.
- Each factory must have level of contamination within the calculated level.
- Secretary of industry is authorized to announce type of factories that has to act according to this regulation.
- New factories are required to sample soil and groundwater contamination level and assess health risk level before commissioning.
- Older factories are required to sample soil and groundwater contamination level and assess health risk level first time within 6 month after announcement of regulation on the government gazette. The second measurement is 6 months after the first one and a year after for the third measurement of ground water.

- In case of any contaminants found within any factories is exceeding calculated limit the factory must propose a risk reduction plan, failure to do so will result in serious fine and penalty such as hulting of factory operation.

DIW had organized several seminars and public consultations to promote this new regulation until the first half of the 2011. After that, the regulation was sent to secretary of industry. This regulation is now under review of the juridical council.

Groundwater act of Thailand is legislated in BE. 2520 (1977). The main focus of the current groundwater act has always been in the utilization of ground water resource. Since groundwater was considered as main water resource in many part of the country, an intention of this act was intended to stop freely development of groundwater wells which sometimes can cause damage to the ground water resource. In response to such contamination cases stated above; the department of ground water resource (DGR) is proposing to amend the current ground water act. This new addition utilize the polluter pays principle (PPP) concept in the way that anyone causes damage to ground water resource is entitled to be liable for the remediation cost occurred. The addition simply adds in a new article 36 (3) to the fifth section of the act (which is the section on amending and provoking license) which states that “Anyone conduct groundwater related business or possess of ground water well which cause or being the source of pollution leakage or dispersion or cause damage to ground water or national resource or causing harmful environment or causing damage to public or private properties or to health of people will be responsible for restitution or damage cost which resulting from any of the case mention above including cost that the government used for reduction of pollution or remediation of ground water resource or national resource or the environment” This new amendment is now under review by the juridical council. When the addition is finalized, department of ground water resource will be able to prosecute any pollution sources that pollute the ground water on their own instead.

Tainan Low Carbon City - Green Remediation: Case of An-Shun Site

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Abstract

Tainan City is selected by Taiwan EPA as a low-carbon demonstration city. Under this major effort, one of the 12 projects Tainan undertakes is green remediation, using CPDC (Chinese Petrochemical Development Corporation) An-Shun Site (hereafter An-Shun Site) as a case in point. An-Shun site is designated by EPA as a "remediation" site, requiring an effective remediation action to remove major contaminants including dioxins and mercury, to ensure a safe and clean soil and groundwater environment. Tainan City Environmental Protection Bureau in April 2009 approved the An-Shun Site remediation plan involving a two-phase remediation process. The first phase up to 2014 is to apply the thermal treatment method to treat the highly contaminated soils and reduce the total contaminant quantity by 82% and the total contamination area by 71%. The second phase up to 2024 is to apply suitable phyto-/bio-remediation and/or physical/chemical methods to treat the remaining low- to medium contaminated soils to satisfactory levels.

The challenges of this remediation work are many, including: low-carbon and safe treatment of contaminated soils, minimizing water usage and air emissions, eco-engineering method to ensure ecological compatibility, risk management to protect human health, vision building to facilitate the site redevelopment, and stakeholder consultation to encourage community participation and support. All of these require a carefully planned and executed process of green remediation, which is expected to set a good example of site remediation and redevelopment protocol and administrative system.

This paper summarizes Tainan City EPB's approach to an effective management of the An-Shun Site via green remediation and its best management practices as well as detailed programs, for experience sharing and expert consultation.

Introduction: Low Carbon/ Green Remediation Policy and An-Shun Site

Tainan City has been selected by Taiwan EPA as a low-carbon demonstration city, aiming to provide a humanistic low-carbon environment, implement a high quality public service, inspire an innovative green growth and enhance international competitiveness. 12 major projects are being embarked on, among which green remediation is an exemplary effort, using An-Shun Site as a case of focus.

Tainan Low Carbon City - Green Remediation

In line with the low carbon policy, for green remediation Tainan City has adopted a vision of approaching “low carbon, low risk and zero waste” and ensuring a sustainable remediation, Tainan City Environmental Protection Bureau (TCEPB) applies the best management practices (BMPs) by using an integrated approach throughout all stages of site investigation, cleanup, remediation and redevelopment. The objectives are: setting a green remediation project model contributing to the practice advancement and protocol development, and enhancing regional value and community redevelopment via partnership consultation and consensus building.

The integrated approach is to take a realistic approach to effect the green remediation, which is to be supervised collectively by Taiwan EPA, TCEPB and community. It is based on the sustainable remediation policy, considering and incorporating: best available remediation technologies, responsible application of sustainable practices, energy-saving source treatment or removal, sound risk management, land re-use planning and development, and community/stakeholder consultation.

An-Shun Site Characteristics

Site remediation of the An-Shun Site presents a great challenge because of the complexities of the pollutants and the potential risks they pose to the remediation workers and the surrounding environment. This site is contaminated with high concentrations of mercury and dioxins, and to certain extent, pentachlorophenol. Coincidently, An-Shun Site is located in the rural coastal An-Nan District, an area of rich history, valuable cultural heritage as well as unique aquaculture industry.

The operation of the now decommissioned chloroalkaline plant and pentachlorophenol plant were officially shut down in 1979. Contamination issues became public and intensive dioxin investigations started in 1994. Site cleanup began in 2004. Under a court ruling, CPDC is now held responsible for the site remediation. The estimated budget of the remediation work is 1.65 billion NTD.

The major contamination areas are generally categorized as: (a) seawater storage pond: used to be the receiving body for wastewater discharge, therefore high level of mercury and dioxins in the sediment; (b) chloroalkali plant: used to manufacture alkali-chlorine products via mercury-electrolytic method, therefore high level of mercury in the soil; (c) grass area: used to be a fish farm and a sludge storage area within close proximity of a public road, of which the soil has been replaced on a priority basis, (d) pentachlorophenol (PCP) plant: used to manufacture sodium-PCP; unused stockpile causing the contamination of the surrounding soil and groundwater to various degrees; by-products like dioxins in the wastewater and sludge storage remaining as persistent organic pollutants (POPs), and (e) vegetation area: in covered the 1980's by whitish waste lime; subject to a decade of wind-blowing and dusting, now protected by composed green remediation techniques using soil retaining plants.

BMPs concept is incorporated into the An-Shun Site remediation plan right from the start of the project. Based on the BMPs principle, energy-saving and carbon-reduction action are implemented throughout all stages of site investigation, assessment, cleanup, remediation and reuse, to reduce environmental impacts. Remediation work is designed to reduce fuel usage during pre-treatment and thermal treatment stages and also to conduct plantation, thus saving 20,444 m^3 of diesel consumption and reducing 54,300 tonnes of carbon emission per year. The 23 ha of vegetation (i.e. planting about 2,300 trees) is expected to result in carbon fixation by 132 tonnes/year.

Remediation Method Evaluation

The remediation method evaluation includes four tasks:

- soil washing pilot test evaluation: assessing effectiveness of concentrating Hg-contaminated soil for reducing the volume of required thermal treatment; inputting gaseous Hg emission data to risk assessment for planning of control and mitigation measures
- trial excavation in chloroalkaline plant: inputting Hg emission data to risk assessment, for planning of control and mitigation measures
- thermal treatment pilot test evaluation: assessing effectiveness of treating high-concentration dioxin and Hg contaminated soil; inputting dioxin and Hg emission data to risk assessment for planning of control and mitigation measures
- phyto-remediation pilot test evaluation: assessing effectiveness of treating low-to-medium concentration dioxin and Hg contaminated soil; inputting emission data to risk assessment for planning of control and mitigation measures when necessary.

Health Risk Assessment and Management

The focus of the health risk assessment is placed on potential exposure to gaseous mercury, particularly in the decommissioned chloroalkaline plant site. First, measurements of soil mercury fluxes are first taken, and the emission data are input into the Gaussian dispersion model to estimate the point-of-impingement mercury concentration at possible receptors. Inhalation exposure of receptors is then assessed with regards to their potential health risks, by comparing to set standards or criteria. If exceeding the criteria, appropriate mercury risk control and management plan is developed and implemented during the site excavation, cleanup and remediation stages.

The preliminary results show that the mercury flux values range between 411.0 and 5,374.9 $ngm^{-2}h^{-1}$ with an average of 1,225.6 $ngm^{-2}h^{-1}$ during diurnal hours. These values are three orders of magnitude higher than the world background value of 1–35 $ngm^{-2}h^{-1}$ but similar to other chloro-alkaline plants or poly-metallic ore mining districts (> 100,000 $ngm^{-2}h^{-1}$). The mercury concentration at downwind receptor is estimated to be > 200 ng/m^3 at distance of 200 m, exceeding Chronic REL of OEHHA for mercury (90 ng/m^3). This indicates that there is a possibility of health effects for on-site workers and nearby residents. To counter this likely risk, an extensive control plan is being developed, including an enclosed shelter to cover the working area, protection masks and clothes for the on-site workers, and a gaseous mercury collection and treatment system before emission to the atmosphere), to protect the workers and the population nearby.

A more comprehensive risk assessment is to be done to estimate effects of future remediation work and land reuse to workers, nearby residents and ecosystem, taking into account of changes in environmental conditions due to construction and operation of remediation facilities. In all, results of the aforementioned risk assessment work will be used for developing and implementing appropriate control measures, to reduce the potential health risks to workers and nearby population to a minimum.

Site Redevelopment Planning

A strategic planning method is used in planning of the An-Shun site redevelopment. This method is designed to guide the vision of future goals and action plans, and map out strategy choices under different scenarios. Steps taken include: conducting the situation analysis, setting the strategic direction, developing strategy, and implementing the preferred strategy.

In parallel with a situation analysis on land use regulations, current land use pattern, local characteristics, and potential risk in response to climate change, a review is also done on national policies, related policies of Tainan City Government, and other local development plans. Based on these interrelated analyses, a proposed vision of An-Shun Site is developed.

The proposed site redevelopment vision is then communicated with stakeholders through a series of regional forum, questionnaire survey analysis. The accuracy of the above results, i.e. planning direction, is again checked via expert questionnaire and expert discussions. Following this lengthy consultation process, a common denominator is now established among the stakeholders regarding the site redevelopment, that is, setting up an ECO-Museum as a basis for redevelopment planning. This ECO-Museum should incorporate various components of regional value, i.e. ecology, culture, decommissioned industry, heritage, etc .

Community and Stakeholder Consultation

Working with the community and stakeholders is an on-going process. The key is to translate the complicated site contamination issues and planned remediation, risk management and site redevelopment work into plain language, to effect a cordial and two-way dialogue towards building a consensus among all concerned parties. Intensive effort has been made to provide education on site contamination and remediation work to the communities, in the form of easy-to-comprehend brochures, puppet shows, tour guides, guided tours, and showrooms. Stakeholder consultation has been done via regional forum, questionnaire survey, expert consultation, AHP survey, and sometimes, community discussions.

The community and stakeholder consultation work proves to be a very successful and rewarding exercise, in that a trust is being built up among the stakeholders including the involved communities, governmental agencies and CPDC, with the assistance of participating research organizations. The trust and understanding among stakeholders and TCEPB certainly paves a sound foundation for green remediation, site redevelopment and risk management.

Conclusion

This project has set a good example and an effective model of green remediation, integrating multi-disciplinary expertise comprising low-carbon remediation, urban planning, risk assessment and stakeholder consultation, to help to facilitate the CPDC An-Shun site remediation and redevelopment process during its planning, cleanup, test runs, and remediation stages. The experience gained from this project can be drawn by other similar remediation projects particularly with respect to low-carbon remediation, risk management, land redevelopment planning and stakeholder consensus building.

To assist the vision building and community communication process, a strategic planning and communication framework method has been applied. It has demonstrated a cordial and effective platform to help the affected communities understand the issues involved and work together towards a common goal of re-discovering the redevelopment value via vision building.

For partnership and consensus establishment, a series of forum, roundtable discussion, seminars, expert consultation, and neighborhood activities have helped to build the trust among CPDC, communities, local and central governments, academia and environmental groups, to work together on an integrated green remediation and redevelopment approach.

Risk assessment and management is essential for Green Site Remediation and Redevelopment. Risk assessment on gaseous mercury emission has identified potential risks associated with the old chloro-alkaline plant site, which would help the project design and implement control measures to minimize health risk to workers and residents nearby. More comprehensive risk assessment is to be done to arrive at a well-thought risk control plan during the site excavation and remediation processes.

Tainan Low Carbon City - Green Remediation Project: Case of An-Shun Site

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Outline of Presentation

- Introduction
- Remediation Method Evaluation and Practices
- Health Risk Assessment and Management
- Site Redevelopment Planning
- Community and Stakeholder Consultation
- Conclusion

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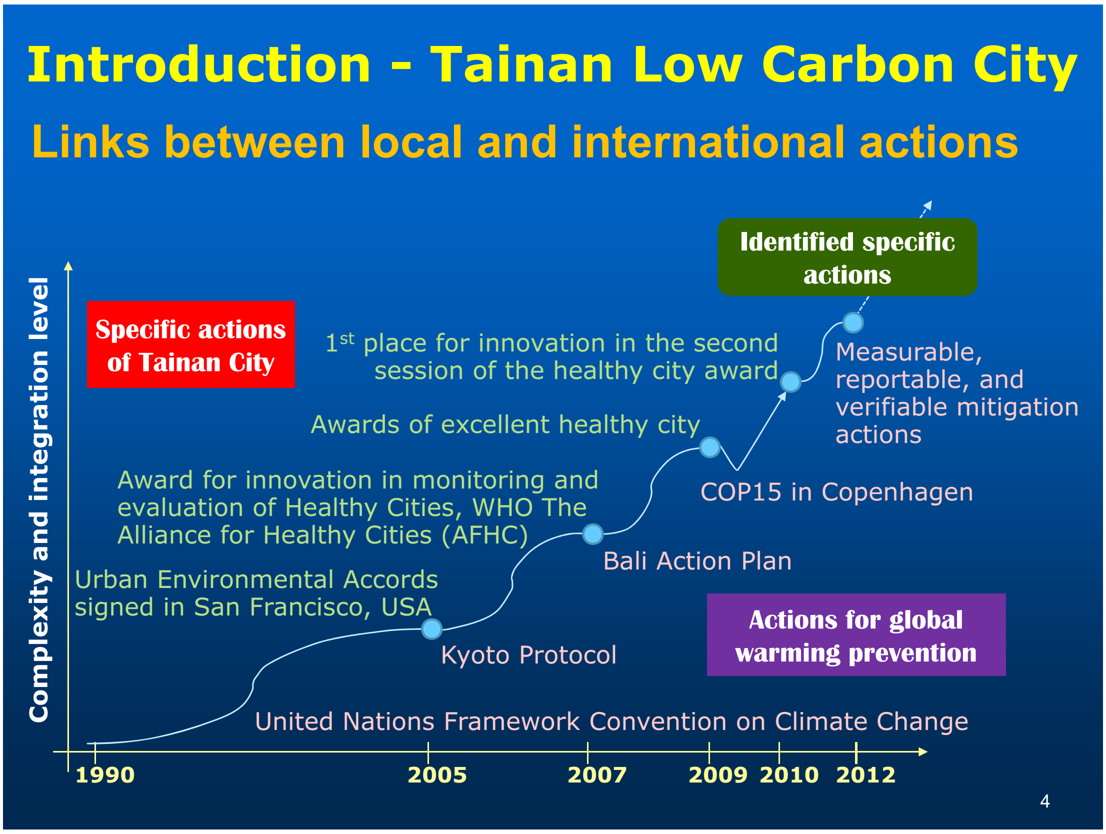
Introduction - Tainan Low Carbon City
Sustainable environment
Public service
Vision
Green innovation
International competitive -ness
3


Introduction - Tainan Low Carbon City
Links between local and international actions
Identified specific actions
Specific actions of Tainan City
1st place for innovation in the second session of the healthy city award
Measurable, reportable, and verifiable mitigation actions
Awards of excellent healthy city
Award for innovation in monitoring and evaluation of Healthy Cities, WHO The Alliance for Healthy Cities (AFHC)
COP15 in Copenhagen
Bali Action Plan
Urban Environmental Accords signed in San Francisco, USA
Actions for global warming prevention
Kyoto Protocol
United Nations Framework Convention on Climate Change
Complexity and integration level
1990
2005
2007
2009
2010
2012
4

Introduction - Tainan Low Carbon City

- Population：1.87million (41% Proportion live in primal Tainan city)
- Geographical size：2191 square kilomete
- 37 Districts

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Introduction - Tainan Low Carbon City

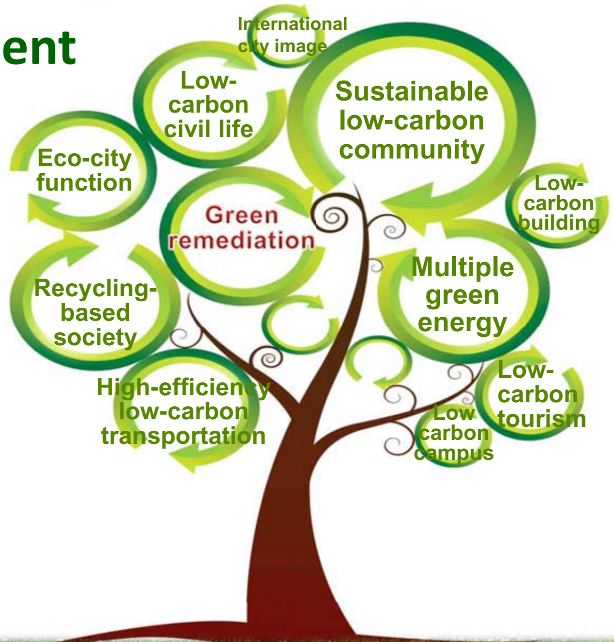
12 Low Carbon Projects

Protocol achievement

- Up to 2014- Carbon emission reduction by 34%

  Reduction Goal: 2.74 million tonnes
- Up to 2020- Carbon emission reduction by 40%

  Reduction Goal: 3.56 million tonnes



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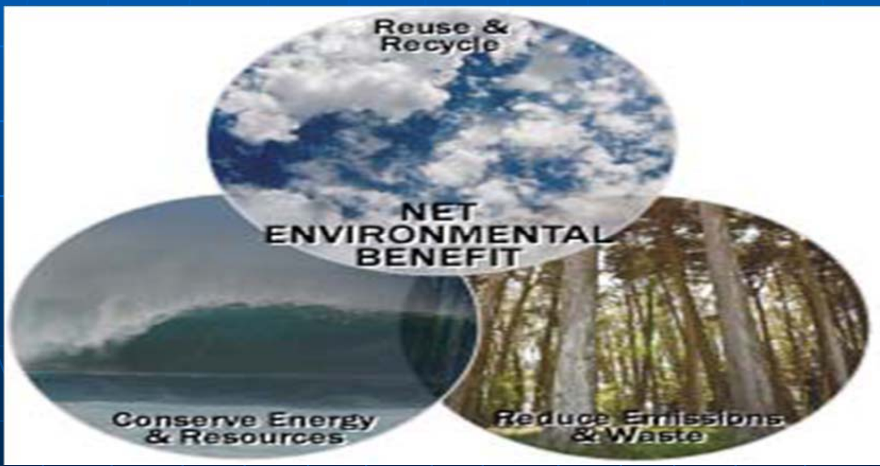
Definition - Green Remediation

USEPA :

- The practice of considering all environmental effects of remedy implementation and incorporating options to maximize net environmental benefit of cleanup actions



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Introduction - Green Remediation

SURF Sustainable Remediation Approach:

1. Minimize or eliminate energy consumption or the consumption of other natural resources;
2. Reduce or eliminate releases to the environment, especially to the air;
3. Harness or mimic a natural process;
4. Result in the reuse or recycling of land or otherwise undesirable materials; and/or
5. Encourage the use of remedial technologies that permanently destroy contaminants.

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Tainan of Green Remediation

Vision: **Approaching *"Low carbon, low risk and zero waste"* and ensuring a sustainable remediation**

Goal:

- Be a **model** green remediation project contributing to practice advancement and protocol development
- Applying **best management practices** using integrated approach throughout all stages of site investigation, cleanup, remediation and redevelopment
- Enhancing **regional value and community redevelopment** via partnership consultation and consensus building

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Introduction - Integrated Green Approach

Integrated approach :

- Taking a realistic approach to effect the green remediation
- Supervised collectively by EPA, TCEPB and community
- Based on sustainable remediation policy, considering and incorporating:
  - best available remediation technologies
  - responsible application of sustainable practices
  - energy-saving source treatment or removal
  - sound risk management
  - land re-use planning and development
  - community/stakeholder consultation

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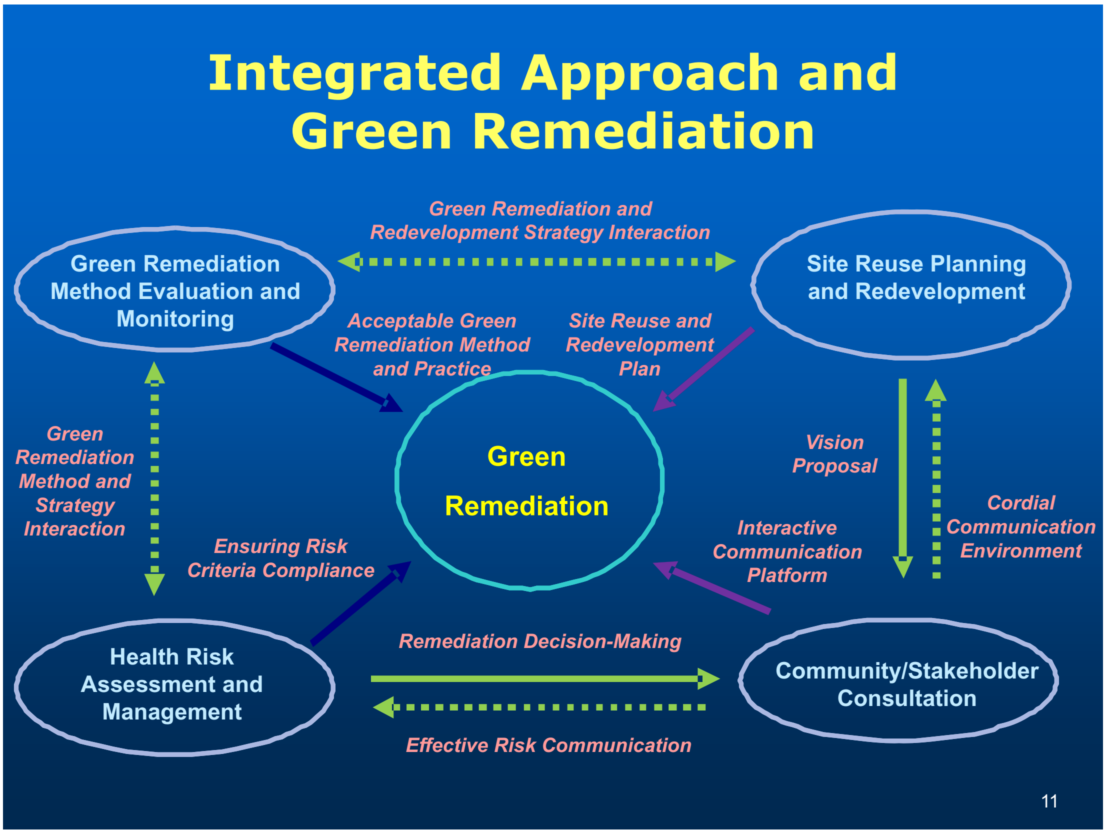
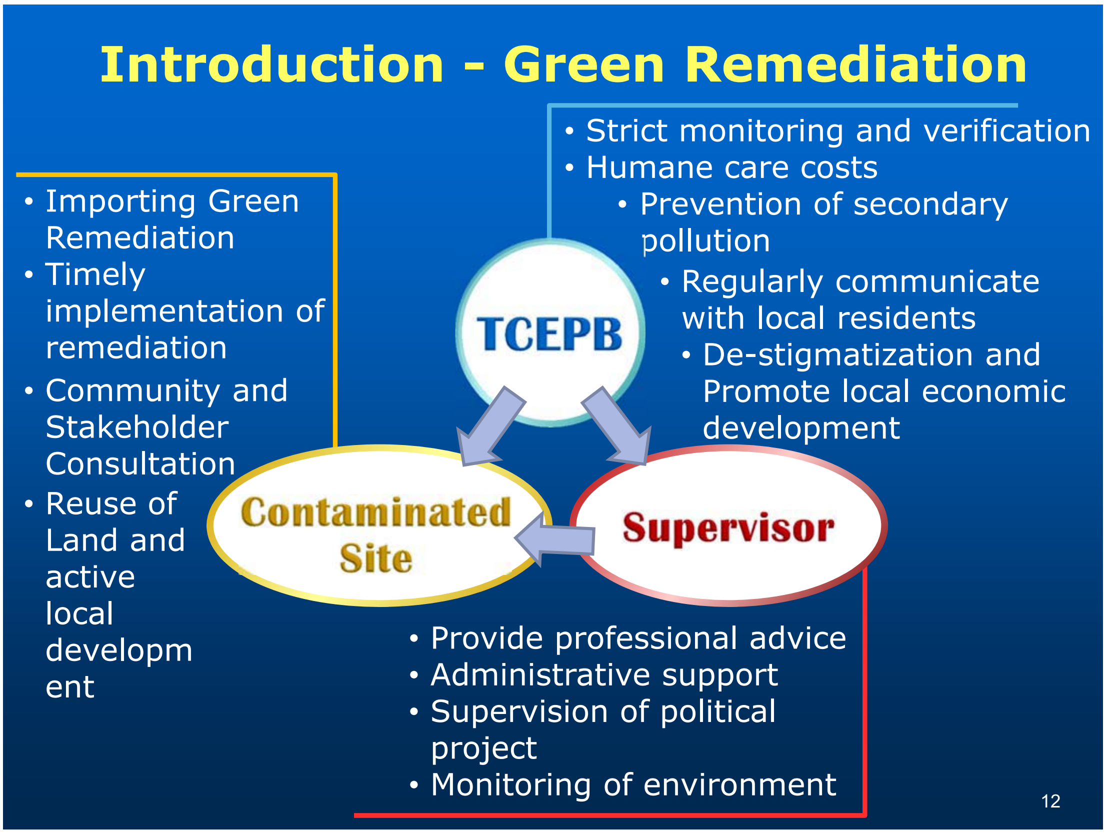

Integrated Approach and Green Remediation
Green Remediation and Redevelopment Strategy Interaction
Green Remediation Method Evaluation and Monitoring
Site Reuse Planning and Redevelopment
Acceptable Green Remediation Method and Practice
Site Reuse and Redevelopment Plan
Green Remediation Method and Strategy Interaction
Green Remediation
Vision Proposal
Cordial Communication Environment
Interactive Communication Platform
Ensuring Risk Criteria Compliance
Remediation Decision-Making
Health Risk Assessment and Management
Community/Stakeholder Consultation
Effective Risk Communication
11


Introduction - Green Remediation
• Strict monitoring and verification
• Humane care costs
• Prevention of secondary pollution
• Regularly communicate with local residents
• De-stigmatization and Promote local economic development
• Importing Green Remediation
• Timely implementation of remediation
• Community and Stakeholder Consultation
• Reuse of Land and active local development
TCEPB
Contaminated Site
Supervisor
• Provide professional advice
• Administrative support
• Supervision of political project
• Monitoring of environment
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Case-in-Point
CPDC An-Shun Site

- Site contaminated with Hg, PCP and dioxins
- Investigation in 1982 revealed that :
  - PCP had reached subsurface
  - Hg and dioxins were found in surface water, groundwater, soils and sediments
- In 1994 dioxin contamination problems surfaced
  - a series of investigative actions were taken to define the area of problems and to alleviate public health concerns
- In 2003 high levels of PCDD/PCDFs were found in blood of local residents
- On 19 March 2004 Taiwan EPA declared the CPDC An-Shun site (CPDC AS) a “contaminated soil remediation site”, demanding an immediate remedial action

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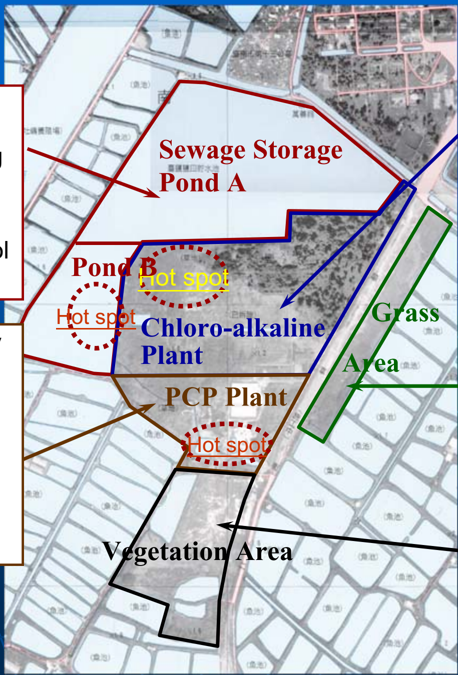
Current Contaminant Distribution

- Highest Hg contamination in Pond B: 1,400 mg/kg
- Depth of Hg contamination exceeding soil control standard: 90cm

- Soil (0-45cm) heavily contaminated with dioxin: >1,000 ng-I-TEQ/kg), as deep as 90 cm
- Also contaminated with Hg, as deep as 45 cm



- Max Hg concentration at old electrolytic unit site: 3,370 mg/kg
- Depth of Hg pollution in soil: 90 cm
- Dioxin concentration: <10,000 ng/I-TEQ/kg

- Contaminated soil removed and stored away
- De-listed on 99.9.21; undergoing re-landscaping

- Mostly waste lime
- Slightly contaminated in northern part

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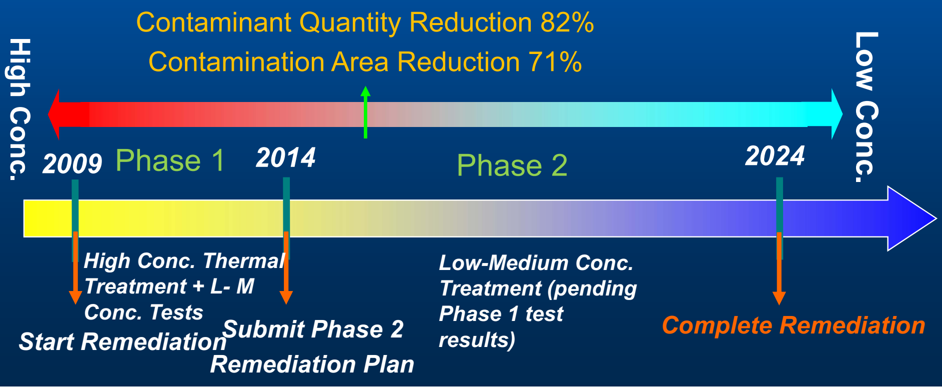
Remediation Plan

Phase 1:
- Focusing on thermal treatment of highly polluted soil, to effectively reduce the total quantity and area of contamination
- Continuing research on suitable technology/system to treat soils of low-to-medium contamination

Phase 2 :
- Implementing Phase 1 research results and applying suitable technology/system to treat the low-to-medium contamination to within the regulatory standard



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Remediation Method Evaluation

Soil Washing Pilot Test Evaluation

- Assessing effectiveness of concentrating Hg-contaminated soil to reduce volume of thermal treatment
- Inputting gaseous Hg emission data to risk assessment for planning of control and mitigation measures

Trial Excavation in Chloro-alkaline Plant Site

- Inputting Hg emission data to risk assessment for planning of control and mitigation measures

Thermal Treatment Pilot Test Evaluation

- Assessing effectiveness of treating high-concentration dioxin and Hg contaminated soil
- Inputting dioxin and Hg emission data to risk assessment for planning of control and mitigation measures

Phyto-Remediation Pilot Test Evaluation

- Assessing effectiveness of treating low-to-medium concentration dioxin and Hg contaminated soil
- Inputting emission data to risk assessment for planning of control and mitigation measures when necessary

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Green Remediation of CPDC An-Shun Site

After remediation and plantation

- Carbon reduction during remediation

54,300 tonnes/year based on 2014

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Green Remediation Practices

- **BMPs** (Best Management Practices) concept is incorporated into remediation plan right from the start.
- Based on the BMPs principle, **energy-saving and carbon-reduction** action is implemented throughout stages of site investigation, assessment, cleanup, remediation and reuse, to reduce environmental impacts.
- Remediation work is designed to reduce fuel usage during pre-treatment and thermal treatment stages and also to conduct plantation, thus **saving 20,444 m^3 diesel** usage and **reducing 54,300 tonnes of carbon** emission.
- Adding 23 ha of vegetation (i.e. planting about 2,300 trees) is expect to **carbon fixation by 132 tonnes/year**.

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Green Remediation Practices

- Reuse the wastewater for road washing, irrigation for.
- Use recycled material for landscape walls.
- Classify the protective clothing by the industrial safety level to reduce the waste.
- Joint plan for soil decontamination, site preparing and greening.
- Reuse of the bricks and tile from the deconstruction of the sites



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CPDC An-Shun Site Remediation Expected Carbon Reduction

Project	Practices	CO_2 Reduction (tonne) Based on 2014	Budget (NT$)	Energy Saving
Implementation of green remediation	Reducing fuel use during pre-treatment	21,200	75.04 million	Diesel saving 8,000 m^3
	Reducing fuel use during thermal treatment	32,978		Diesel saving 12,444 m^3
	Plantation	132		Carbon fixation

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Plantation after Cleanup


Cleanup operation


Plantation after cleanup


Plantation completed

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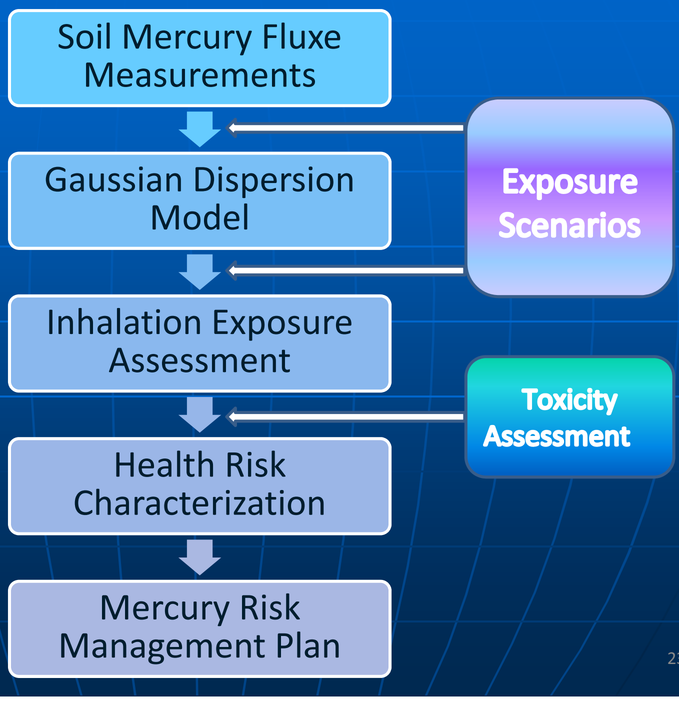
Health Assessment and Management Framework - Exposure to Gaseous Mercury



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Exposure Factors and Model Input Parameters for Exposure and Risk Assessment

Intake Parameters			
Lifetime (years)	70	Average Weight (kg)	65
Exposure Frequency [days/year]	350	Inhalation Rate [m^3/h]	0.833
Exposure Duration [years]	3	Time Outdoors [hours/day]	4
Bioavailability	1		

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Inhalation Reference Exposure Levels of Mercury

Agency	Risk Index	Reference Value	Health Effects
OEHHA[a] (2005)	Chronic REL	0.00009 mg/m^3 (90 ng/m^3)	Impairment of neurobehavioral functions in humans
ATSDR[b] (1999)	Chronic inhalation MRL	0.0002 mg/m^3 (200 ng/m^3)	nervous system; increased frequency of tremors
U.S. EPA (1997)	RfC	0.0003 mg/m^3 (300 ng/m^3)	nervous system
WHO (2003)	Chronic tolerable concentration	0.2 $\mu g/m^3$ (200 ng/m^3)	system effects

[a]OEHHA (Office of Environmental Health Hazard Assessment), REL (recommended exposure limit).
[b]ATSDR (Agency for Toxic Substance and Disease Registry), MRL (Minimal Risk Level).

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Mercury Fluxes from CPDC An-Shun Site

Location	Sampling Time	Soil Temp. (°C)	Air Temp. (°C)	Humidity (%)	Wind Speed (m/s)	TGM Flux (ng/m^2-h)
1	09:20	21.8	19.9	71	2.4	556.2
1	13:45	22.5	19	63	2.4	477.9
1	16:20	22.8	19.8	60	2.4	474.3
2	09:30	22.5	20.3	68	2.4	5,374.9
2	14:15	22.2	18.9	64	2.8	411.0
2	16:35	22.6	19.8	61	3.3	761.0
3	09:40	28.7	20.8	67	2.4	1,157.3
3	14:30	25.4	18.9	63	3.3	1,269.9
3	16:50	26.2	19.4	63	2.2	1,336.0
4	09:50	24.4	20.7	69	3.4	1,512.1
4	14:40	26.9	19.1	63	1.9	822.1
4	17:00	25.2	19.4	61	3	873.5
5	10:00	24.2	20.4	70	4	1,297.4
5	14:55	20.7	19.4	62	3.1	1,300.0
5	17:10	24.2	19.4	62	3.1	759.6
Mean		24.0	19.7	64	2.8	1,225.6

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Preliminary Results of Risk Assessment

Mercury flux values

- Values ranged between 411.0 and 5,374.9 $ngm^{-2}h^{-1}$ with an average of 1,225.6 $ngm^{-2}h^{-1}$ during diurnal hours
- Values three orders of magnitude higher than world background value of 1–35 $ngm^{-2}h^{-1}$ but similar to other chloro-alkaline plants or poly-metallic ore mining districts (> 100,000 $ngm^{-2}h^{-1}$)

Mercury concentration at downwind receptor

- Estimated to be more than 200 ng/m^3 at distance of 200 m, exceeding Chronic REL of OEHHA for mercury (90 ng/m^3)
- Possibility of health effects for on-site workers and nearby residents

Gaseous mercury control plan

- An extensive control plan to be developed and implemented to protect workers and population nearby
- Study results providing important information that helps to determine appropriate gaseous mercury control actions needed to reduce potential health and environmental impacts in future remediation efforts and land reuse

Follow-up work

- A more comprehensive risk assessment to be done to estimate effects of future remediation work and land reuse to workers, nearby residents and ecosystem, taking into account of changes in environmental conditions due to construction and operation of remediation facilities
- Results of above to be used for implementing appropriate control measures

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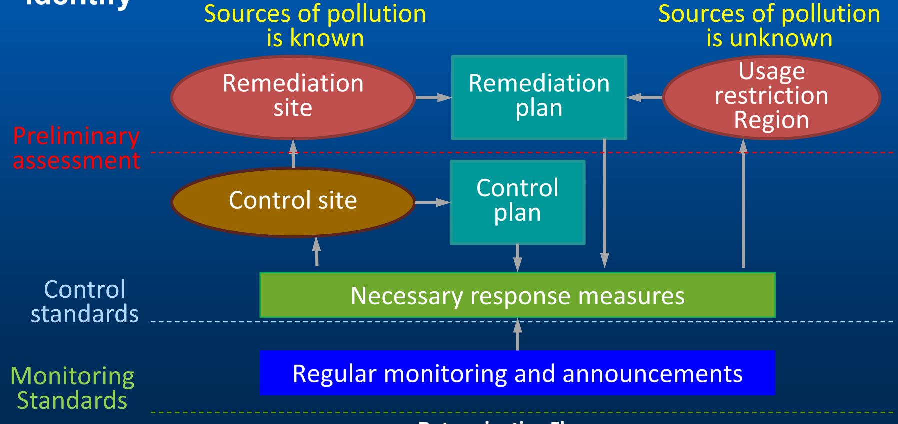
Contaminated Site Redevelopment Planning

Difficulties and issues in Taiwan:

- **Complexity of chemical pollution and clean-up techniques**
- **Current regulations too rigid or inappropriate**
- **Unique geographical condition**
- **Impact level of surrounding areas/local communities not easy to identify**



Determinative Flow
Source : http://sgw.epa.gov.tw/public/0202.asp

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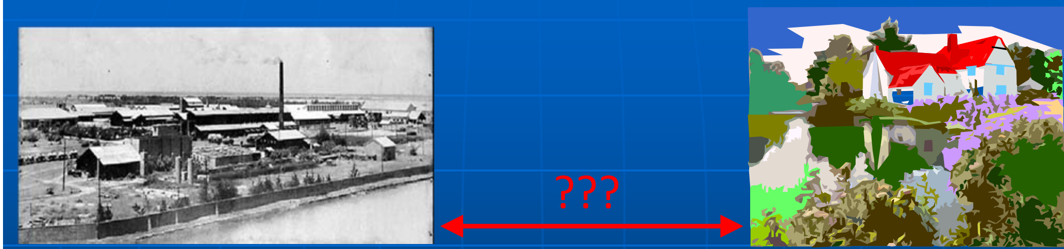
Site Redevelopment Planning - Approach

Relating site risk management with land use planning



- Selection of appropriate risk scenarios;
- Deciding on risk assessment methodology to be employed;
- Deciding on hazard end-points and risk tolerability criteria;
- Basis for delineation or restrictions around existing and new installations

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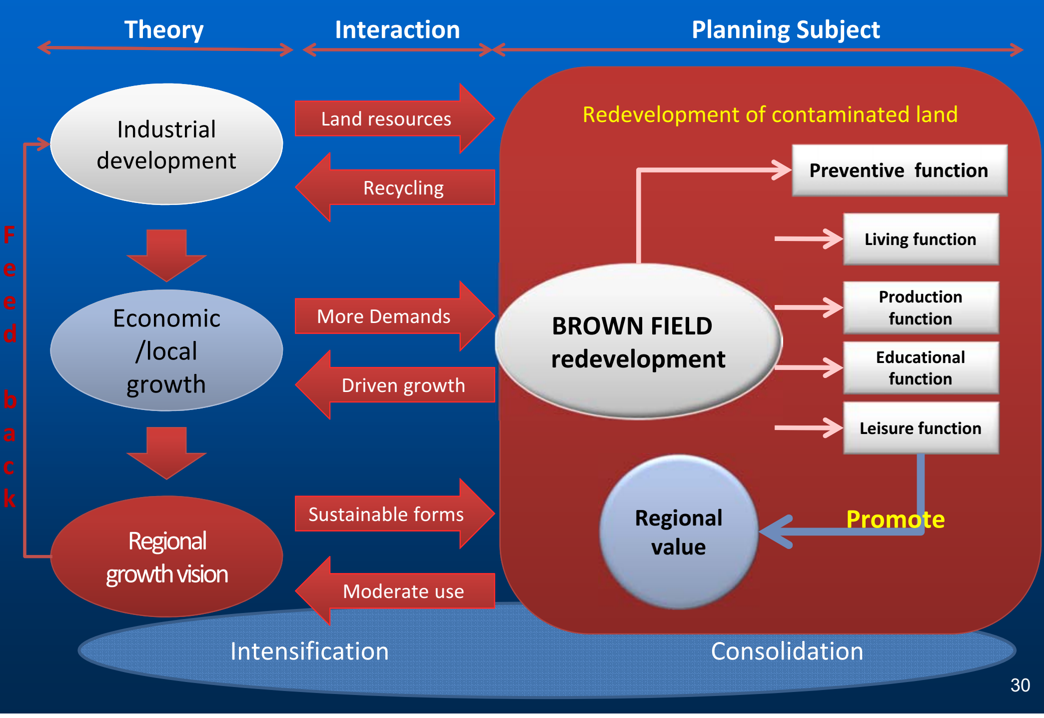
Site Redevelopment - Planning Structure



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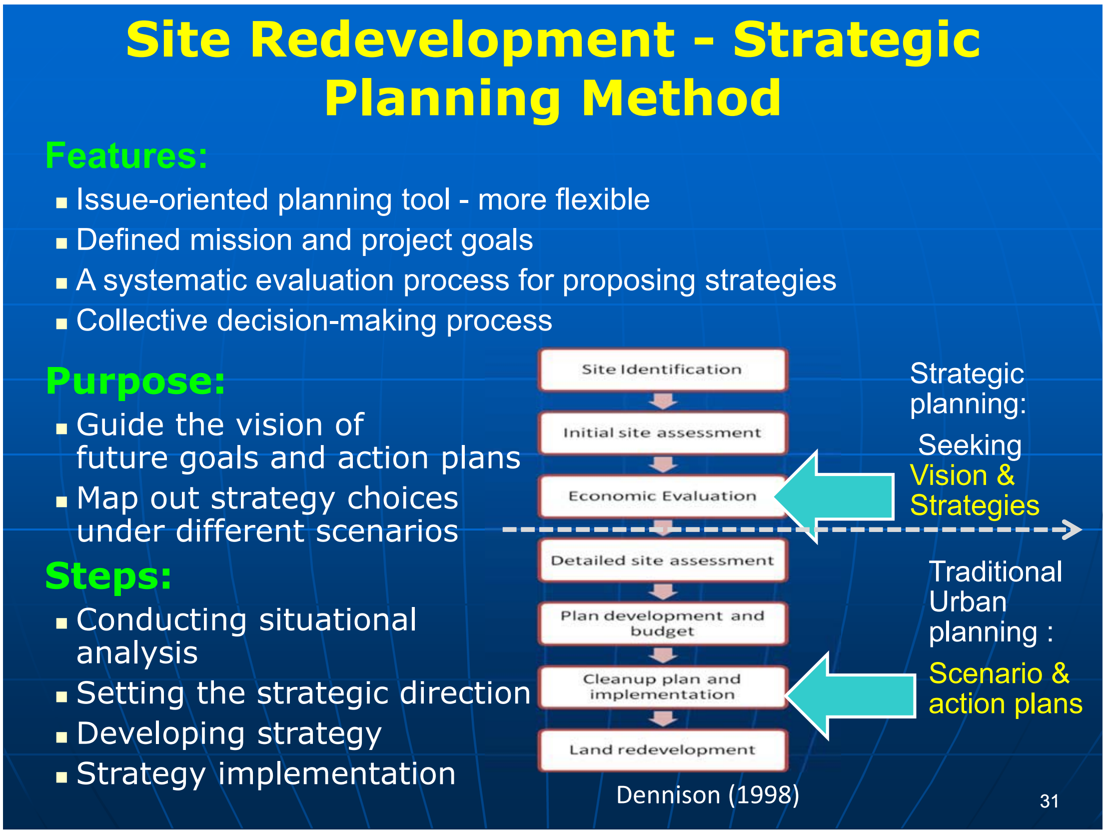
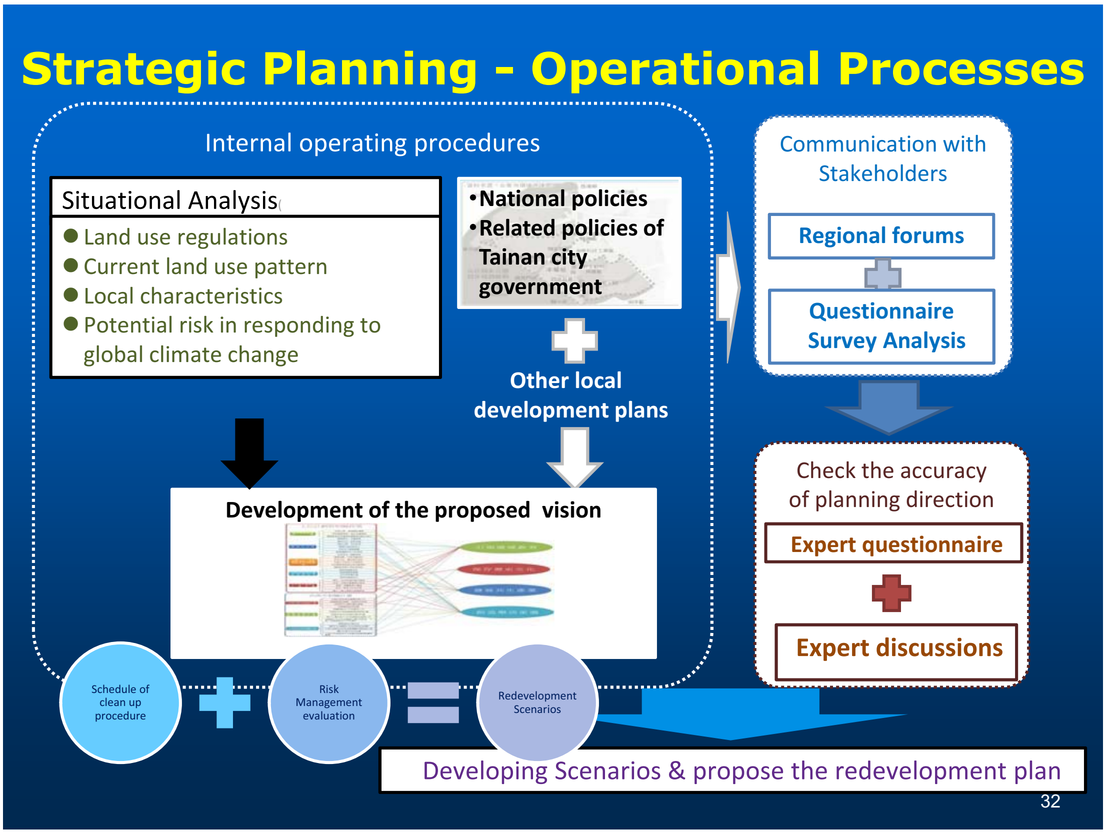

Site Redevelopment - Strategic Planning Method
Features:
Issue-oriented planning tool - more flexible
Defined mission and project goals
A systematic evaluation process for proposing strategies
Collective decision-making process
Purpose:
Guide the vision of future goals and action plans
Map out strategy choices under different scenarios
Steps:
Conducting situational analysis
Setting the strategic direction
Developing strategy
Strategy implementation
Site Identification
Initial site assessment
Economic Evaluation
Detailed site assessment
Plan development and budget
Cleanup plan and implementation
Land redevelopment
Strategic planning:
Seeking Vision & Strategies
Traditional Urban planning :
Scenario & action plans
Dennison (1998)
31


Strategic Planning - Operational Processes
Internal operating procedures
Situational Analysis
Land use regulations
Current land use pattern
Local characteristics
Potential risk in responding to global climate change
•National policies
•Related policies of Tainan city government
Other local development plans
Development of the proposed vision
Communication with Stakeholders
Regional forums
Questionnaire Survey Analysis
Check the accuracy of planning direction
Expert questionnaire
Expert discussions
Schedule of clean up procedure
Risk Management evaluation
Redevelopment Scenarios
Developing Scenarios & propose the redevelopment plan
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Vision Proposed & Communication with Stakeholders

Regional forum

Members :

Community Development Association Chair, CPDC rep., Tainan city government official, National Taijian Park rep., CHASS research team, academic rep.

2010/03/31

Questionnaire Survey Analysis

Consultation objects:

Local community leaders: 15

Results of consultation:

- Vision: Consistency of local expectations and the vision outlined in this study.
- Local development issues:

1) The benefit from the future development of Taijian area and CPDC contaminated site.
2) Maintenance of the low density development.
3) Prevention of the secondary contamination.

- Development Strategy:
  Creating and setting up an ECO-Museum should earn the recognition and support of the residents

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Site Redevelopment - Preliminary Result

Check the accuracy of planning direction

Expert questionnaire

- Take into account of the results of the previous phase (Situational Analysis & Questionnaire Survey Analysis)
- Conduct three-phase AHP questionnaire on government officials, experts and scholars
  - First phase - Sustainable Environment, Industrial & Economy, Space use
  - Each item of first phase has 3 sub-items in second layer
  - Each item of second phase has 2 or 3 sub-items in third phase
- In total, 20 issues have been examined

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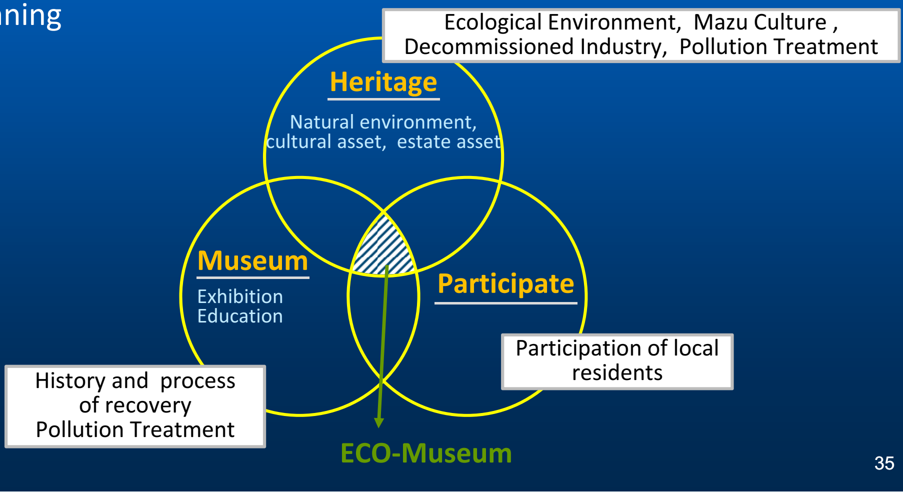
Site Redevelopment – On-Going Work

Developing and Implementing Strategy

- Developing Scenarios in line with the remediation work/schedule and environmental risk management principles
- Using the ECO-Museum model as a basis for redevelopment planning



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Community Consultation and Environmental Education

Environmental Education:

- Public education on contaminated site
- Tour guide – CPDC An-Shun Site
- Guided tour
  - Old Bromide site
  - Garden site preparation
  - Aqua species investigation
  - Showroom (3D virtual CPDC plant , history, and environment)

Stakeholder Consultation:

- Regional forum, questionnaire survey
- Expert consultation, AHP survey

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Conclusion

Green Approach for Site Remediation and Redevelopment

- This project has set a good example of green remediation, and the experience can be drawn by other similar remediation projects.

Vision Building and Community Communication

- This project has demonstrated a platform to help the communities understand the issues involved and work together towards a common vision.

Partnership and Consensus Establishment

- The trust of several stakeholders are built by a series of forum, roundtable discussion, seminars, expert consultation, and neighborhood activities.

Risk Assessment and Management for Green Site Remediation and Redevelopment

- Risk assessment can help the project design and implement control measures to minimize health risk to workers and residents nearby.

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Thanks for your attention

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Monitoring of Agent Orange Pollution and a Potential Management Strategy in the Military Base

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2. National Institute of Environmental Research, Ministry of Environment, Incheon 404-708, Korea (boystone@korea.kr)

Introduction

A retired U.S soldier once stationed in Korea alleged that more than 250 drums of Agent Orange were buried at Camp Carroll, located in Chilgok County, North Kyungsang Province. He specifically stated that the metal drums were buried around the helipad area of the U.S military base. Agent Orange is critically harmful to groundwater, soil and human. This deadly chemical is known to be used only at the Southern Limit Line of Demilitarized Zone in 1968 and 1969. The burial or storage of Agent Orange by the U.S Forces in Korea (USFK) has never been a problem before this incident. Against this backdrop, the ROK government and the USFK promptly set up a joint investigation team and embarked on a scientific investigation on the allegation of Agent Orange.

Agent Orange, containing dioxin, is one of the herbicides used during the Vietnam War to defoliate the leaves of trees. There are other kinds of defoliants besides Agent Orange: Agent White, Blue, Purple and Pink; however, Agent Orange was the most common form. Agent Orange is a 1:1 mixture of 2,4-D and 2,4,5-T, and a byproduct (contaminant) of manufacturing 2,4,5-T is the most toxic dioxin, 2,3,7,8-TCDD (1.77-40ppm). The U.S banned the usage of Agent Orange during the Vietnam War in 1970 because 2,3,7,8-TCDD was found to pose risk to human health, causing birth defects and cancer. This became a social issue in Korea in 1991, and led the ROK government to enact a law in 1993 to compensate and provide medical treatment for the Vietnam War Veterans suffer a long-term effect of exposure to Agent Orange.

As Camp Carroll has been a supply base to the U.S forces in Korea and Far East Asia, there are warehouses, auto repair shops, gas stations and various transport vehicles inside the installation. Furthermore, it has stored solvents, oil, lubricants, herbicides and many types of chemicals used during the war for more than 40 years. Area 41, in particular, stored numerous drums of hazardous substances in the past. It is known that some of them leaked and contaminated the soil. According to the records, the contaminated soil and debris were buried in Area D. The research found that most of the contaminants were pesticides, herbicides, and solvents. The records also show that 40 - 60 tons of soil in this area was excavated, taken outside and disposed in 1979 and 1980.

About 1 km west of Camp Carroll, there is Nakdong River flowing north to south where many downstream areas take a drinking water source. The ridge of Mountain Jago and a mountain peak Doosan run north and east of the base. The south and west ends of the base are faced with a small town Waegwan. The groundwater of this area flows from the mountain ridge of Jago located north of the base toward Nakdong River and Dongjeong stream. In particular, the groundwater of Area D flows toward southwest, and that of Area 41 flows toward south. The groundwater finally converges with Dongjeong Stream.

Method

The ROK-US Joint Investigation Team first conducted geophysical survey to find metal drums buried underground, and then soil sampling followed based on the geophysical survey result. The samples were analyzed to detect hazardous substances, particularly 2,4,5-T and 2,3,7,8-TCDD, which are components of Agent Orange. The geophysical survey consisted of Ground Penetrating Radar (GPR), Electronic Resistivity (ER) and Magnetic Survey. The result did not show any anomalies indicating the burial of metal drums in large scale. Soil samples were taken on and off post, based on the geophysical survey result. 150 different kinds of hazardous chemicals were analyzed: herbicides such as 2,4-D and 2,4,5-T; dioxin including 2,3,7,8-TCDD; organochlorine pesticides (OCPs) such as lindane, DDD and DDT; volatile organic compounds (VOCs) such as TCE and PCE; semi volatile organic compounds (SVOCs) such as chlorophenols and PAHs; heavy metal such as arsenic and mercury. As for the method of analysis, the ROK side abided by the Korea Official Method and the US followed the EPA method.

Results

The following is the summary of the officially released result of the ongoing investigation.

At the off-post, 2,4-D, 2,4,5-T, 2,3,7,8-TCDD or anything related to Agent Orange was not detected, but some VOCs and OCPs were found, and PCE in particular exceeded the domestic standard. Meanwhile, a very small amount of dioxin was detected in the stream water samples, but that was not related with Agent Orange. VOCs and OCPs were found in some samples of stream water. Neither soil nor sediments had 2,4-D or 2,4,5-T. The amount of dioxin detected was below the national average. Also, heavy metal and OCPs were found in some soil samples.

With regard to on-post, no Agent Orange related substance such as 2,4-D, 2,4,5-T or 2,3,7,8-TCDD was detected in groundwater, but a very small amount of dioxin was detected in some groundwater samples. Moreover, OCPs such as Lindane (2.72-3.65 ?/L) and Dieldrin (0.03-0.69 ?/L) went beyond the WHO guideline (Lindane 2 ?/L, Dieldrin 0.03 ?/L), and VOCs such as TCE (0.04-2.74 ?/L) and PCE (0.03-9.59 ?/L) exceeded the domestic guideline (TCE 0.03 ?/L, PCE 0.01 ?/L). The analysis of on-post soil is underway.

Conclusion

The investigation results so far do not reveal that many drums of Agent Orange are present on-post, and no substances related to Agent Orange was detected. Only some VOCs like TCE and PCE as well as Lindane, Dieldrin and other OCPs were detected but those concentrations were lower than WHO and domestic standards. More accurate and comprehensive understanding will be achieved once on-post soil analysis is finalized.

In addition to the investigation, the ROK government is currently assessing the health impact on the local residents. The local people could be exposed to Agent Orange or solvents if these substances contaminated the soil. Groundwater might be the major pollution source and residents expose to this sources through drinking well water. For the Health Impact Assessment, the government first decides whom and how to examine and predict the diseases likely to occur depending on the size and level of contamination of the surrounding environment. In accordance with the decision, the government is carrying out the Health Impact Assessment step by step from surveys to exposure assessment to detailed medical checkup under the supervision of experts.

Regulatory Standards of Heavy Metal Pollutants in Soil and Groundwater in Taiwan

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1. History of development and implication of regulatory standards

The Soil and Groundwater Pollution Remediation Act (SGWPR Act) was promulgated by the President of Taiwan on February 2, 2000. The aims are to prevent and remediate soil and groundwater pollution, to ensure sustainable use of the land and groundwater resources, to improve the living environment, and to enhance public health. The SGWPR Act comprises general provisions, prevention and remediation measures, investigation and assessment measures, regulatory measures, remediation and rehabilitation measures, finance and responsibility, penalties, and supplementary provisions.

According to the SGWPR Act, the related enforcement rules and monitoring and control standards had to be determined by the Environmental Protection Administration (EPA) of Taiwan. On November 21, 2001, "Soil Pollution Monitoring Standards", "Groundwater Pollution Monitoring Standards", "Soil Pollution Control Standards" and "Groundwater Pollution Control Standards" were promulgated.

The "monitoring standard" of soil and groundwater pollution means the minimum level of pollutants to which soil and groundwater monitoring is required to prevent soil and groundwater pollution. In addition, loading-inhibition measures should be taken in case that the concentrations of heavy metals in soil or groundwater are still increased. The "control standard" of soil and groundwater pollution implicates the threshold values of pollutants to which the pollution is identified. Consequently, the detailed survey, identification of polluted area, spatial isolation, feasible remediation procedure and other necessary measures should be carried out while the content of certain pollutant in soil or groundwater exceeds the control standard.

Special municipality, county and city competent authorities (herein referred to as "competent authorities with local jurisdiction") shall regularly monitor the quality of the soil and groundwater within their jurisdictions. When the concentrations of pollutants in soil and groundwater exceed the soil pollution or groundwater pollution control standards, the competent authorities with local jurisdiction shall take necessary measures, investigate the party responsible for the pollution and report it to the central competent authority. When pollutant concentrations are lower than the soil pollution control or groundwater pollution control limits but exceed the soil pollution or groundwater pollution monitoring standards, local authorities shall conduct regular monitoring, publicly announce the monitoring results and report such results to the central competent authority for reference.

When the concentration of any pollutant exceeds the value shown in soil pollution control standards, this site will be announced as a “pollution control site”. The polluters of the identified control sites need to take necessary actions to avoid further deterioration by the pollutants. Control sites assessed to have risk on human health by a tiered approach will be further designated as “remediation sites”. The remediation sites cannot be sold and the polluters must remedy the site in accordance with the SGWPR Act.

The pollution monitoring/control standards of soil and groundwater set forth in the foregoing paragraph shall only be determined by the central competent authority. The EPA of Taiwan promulgated the latest revisions of the SGWPR Act on Feb 3, 2010, of the Soil Pollution Monitoring/Control Standards on January 1, 2011, and of the Groundwater Pollution Monitoring/Control Standards on February 10, 2011, respectively.

2. Monitoring and control standards of heavy metal of soil and groundwater in Taiwan

The risks of pollutants injuring human health depend on the pathway of exposure. In other words, the risk of certain pollutant in soil or groundwater at low content with high exposure can be equal or even higher than that at high content with low exposure. Therefore, the soil and groundwater can be classified into various categories according to the different exposure pathways from pollutants to human. Hence, the standards for various categories are different.

In Taiwan’s SGWPR Act, groundwater is classified into two categories. Category I is for the groundwater in the protection area for drinking water source which implicates that high exposure of pollutants can happen to human. Category II is for the groundwater which is not of Category I and implicates the low exposure of pollutants to human. Similarly, soils in food crop farmland are categorized to result in high exposure of pollutants to human since the intake via the soil-plant-human pathway exists. Otherwise, the soils elsewhere are considered providing low exposure of pollutants to human.

Eight heavy metal elements were listed in the pollution monitoring/control standards of soil and groundwater as shown in Table 1. The limit values were established referring to the background concentration, the toxicity level to human and plants, the recommended values supported by related researches in Taiwan, and heavy metal regulation limits developed in Denmark, Italy, Australia, New Zealand, Belgium, Holland, Norway, South Africa, Switzerland, UK, several states of US, EU, Germany, Canada, and China.

Table 1. The metal(loid) monitoring/control standards of soil and groundwater pollution in the SGWPR Act in Taiwan.

	As	Cd	Cr	Cu	Hg	Ni	Pb	Zn
Soil pollution monitoring standards								
Food crop farmlands	30	2.5	175	120	2	130	300	260
Others	30	10	175	220	10	130	1000	1000
Soil pollution control standards								
Food crop farmlands	60	5	250	200	5	200	500	600
Others	60	20	250	400	20	200	2000	2000
Groundwater pollution monitoring standards								
Category I	0.025	0.0025	0.025	0.5	-	-	0.025	2.5
Category II	0.25	0.025	0.25	5.0	-	-	0.25	25
Groundwater pollution control standards								
Category I	0.05	0.005	0.05	1	0.002	0.1	0.05	5
Category II	0.5	0.05	0.5	10	0.02	1	0.5	50

The latest revision adapted here was revised on February 10, 2011.
Unit: mg/kg and mg/L for soil and groundwater, respectively.

Organic pollutants are also listed in the pollution control standards (not shown in Table 1) but not in the pollution monitoring standards. Generally, organic pollutants do not exist in a natural environment and can be toxic to environment and human at much lower levels than heavy metal pollutants in soil and groundwater. Moreover, the measurement of organic pollutants is costly and tedious and organic pollutants can be degraded in the environment thus resulting in the temporal variation of the concentrations of pollutants. Thus, there is not monitoring standard for specific organic pollutant and only the total organic carbon in groundwater is listed in the pollution monitoring standard for an early warning. Unlike organic pollutants, heavy metals exist in soils naturally and tend to be accumulated in the soils. In addition, the concentrations of heavy metals are easier to be measured compared to those of organic pollutants and can be increased gradually by human activity before reaching the control standards. Therefore, pollution monitoring standards of heavy metals in soil and groundwater were established for the purpose of an early warning. The values of pollution monitoring standards were set to be about at the middle point between background concentrations and the pollution control standards.

The exclusive clauses for the above mentioned monitoring/control standards of soil and groundwater were stipulated in the SGWPR Act. If concentrations for listed heavy metals in soil and groundwater are affected by regional hydrogeological conditions and environmental background and if solid scientific data confirms that external pollution sources are not the cause of concentrations exceeding standards for listed pollutants, the pollution standards will not be applicable to certain cases, upon approval by the EPA.

3. Remediation standard

Environmental risk assessment is a method to deal with the local effects of pollutants and have been increasingly used. Moreover, objective decisions can be made according to the results of risk assessments. In UK, one of the objectives underlying the government's approach to deal with land contamination is stressed on identifying and removing unacceptable risks to human health and the environment (DETR, 2000). Lai *et al.* (2010) assessed the health risks of heavy metals-contaminated sites before and after soil remediation processes in Taiwan and denoted that the reduction of the health risks of a contaminated site to an acceptable level is more important than to lower the concentration of pollutants below the control standards because the final objective of the SGWPR Act is to protect the health of the public.

According to the SGWPR Act in Taiwan and for a control site, a control project can be conducted to decrease the health risk of contaminants to an acceptable level. When decreasing the concentrations of contaminants in a remediation site below the soil and groundwater control standards is not possible because of the limitation of geologic conditions, characteristics of the contaminant, and remediation techniques or due to financial situation, risk assessment can be carried out with the provision of a flexible remediation target. In such circumstances, the value of remediation goal can be higher than the pollution control standard if the remediation proposal is approved by EPA.

4. Taiwan's standards vs. other countries' standards

Soil and groundwater control standards (SCSs) are often considered as trigger criteria to determine the need for a further soil/groundwater investigation or remediation. These SCSs often have a different application in each legislative framework. In addition, their scientific basis and derivation procedures differ in various countries. The variation in SCSs is the product of political consideration, risk perception, and differences in model parameters and algorithms with their boundary conditions (De Sousa, 2001; Weber et al., 2001). Provoost et al. (2006) described the variation in SCSs in the Flemish region of Belgium, France, Germany, Great Britain, the Netherlands, Norway, Sweden, Switzerland, Canada, and USA for arsenic, cadmium, chromium, copper, mercury, nickel, lead, and zinc, for which the differences were more than two orders of magnitude.

Differences in clean-up standards in government regulations such as in or exclusion of ecotoxicological criteria in the derivation of the final SCS, differences in model parameters and algorithms with their boundary conditions, or the use of different bioconcentration factors (BCFs) for plant uptake have been compared. Key elements involved in the legislative framework under one target regulation in a country therefore trigger remedial actions, which in turn trigger further soil investigation, differentiation between land use types, protection of human health, protection of the ecosystem, and protection of groundwater and surface water.

5. Further revision of monitoring and control standards of heavy metal

Despite that several revisions of pollution monitoring/control standards of soil and groundwater were promulgated, adjustment of the limit values is still under discussion to provide more reasonable and protectable standards according to more and more solid research results and field control experiences. For example, since the health risk of Cr(VI) is much higher than that of Cr(III) (Adriano, 1986; Smith, 2008), Cr(VI) tends to be listed in the pollution standards of soil and groundwater in addition to total Cr despite of the difficulty of oxidation of Cr(III) to Cr(VI) in natural soil and groundwater environments (Eary and Rai; 1987; Apte et al., 2005).

The concentration of Pb in rice grain was limited to be less than 0.2 mg/kg recently announced by the Department of Health (DOH), Executive Yuan in Taiwan and the concentrations of Cd in rice grain and vegetables are limited to be below 0.4 and 0.05-0.2 mg/kg, respectively. However, the concentrations of Pb or Cd in rice grain or vegetables on several farmlands were found to be higher than the DOH limits even if the crops were cultivated in the soils with metal concentrations lower than the Soil Pollution Control Standards. Accordingly, the pollution control standards of Pb and Cd tend to be lower down for food crop farmland soils. In addition, emerging heavy metal contaminants, such as Indium (In), Gallium (Ga), Molybdenum (Mo), which are widely used in high technology industry, such as semiconductor manufacture, are discussed to be included in the pollutant lists of monitoring/control standards of soil and groundwater. The adjustment or revision of monitoring and control standards of heavy metal is still under discussion in Taiwan.

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Regulatory Standards of Heavy Metal Pollutants in Soil and Groundwater in Taiwan

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History of development of regulatory standards

- The Soil and Groundwater Pollution Remediation Act (SGWPR Act) was promulgated on February 2, 2000.
- According to the SGWPR Act, the monitoring and control standards had to be determined by the Environmental Protection Administration (EPA) of Taiwan.
- On November 21, 2001, the monitoring and control standards of soil and groundwater were promulgated.

2

Implication of regulatory standards: Monitoring standards

- The “monitoring standard" of soil and groundwater pollution means the minimum level of pollutants to which soil and groundwater monitoring is required to prevent soil and groundwater pollution.
- When pollutant concentrations are lower than the control limits but exceed the monitoring standards, local authorities shall conduct regular monitoring, publicly announce the monitoring results and report such results to the central competent authority for reference.
- Loading-inhibition measures should be taken in case that the concentrations of heavy metals in soil or groundwater are still increased.

3

Implication of regulatory standards: Control standards

- The "control standard" of soil and groundwater pollution implicates the threshold values of pollutants to which the pollution is identified.
- When the concentrations of pollutants exceed the control standards, the competent authorities shall take necessary measures, investigate the party responsible for the pollution and report it to the central competent authority.
- Consequently, the detailed survey, identification of polluted area, spatial isolation, feasible remediation procedure and other necessary measures should be carried out.

4

Implication of regulatory standards: Control sites and remediation sites

- When the concentration of any pollutant exceeds the value of control standards, this site will be announced as a "**control site**". The polluters of the identified control sites need to take necessary actions to avoid further deterioration by the pollutants.
- Control sites assessed to have risk on human health by a tiered approach will be further designated as "**remediation sites**". The remediation sites cannot be sold and the polluters must remedy the site in accordance with the SGWPR Act.

5

Latest revisions of regulatory standards

- The EPA of Taiwan promulgated the latest revisions of the SGWPR Act on Feb 3, 2010.
- The Soil Pollution Monitoring/Control Standards on January 1, 2011
- The Groundwater Pollution Monitoring/Control Standards on February 10, 2011

6

Monitoring and control standards of heavy metal of soil and groundwater in Taiwan

- In Taiwan's SGWPR Act, groundwater is classified into two categories and different standards were set up for different categories.
  - **Category I** is for the groundwater in the protection area for drinking water source which implicates that high exposure of pollutants can happen to human if pollution occurs.
  - **Category II** is for the groundwater which is not of Category I and implicates the low exposure of pollutants to human if pollution occurs.

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Monitoring and control standards of heavy metal of soil and groundwater in Taiwan (continued)

- Similarly, soils in **food crop farmland** are categorized to result in high exposure of pollutants to human since the intake via the soil-plant-human pathway exists.
- Otherwise, the soils elsewhere are considered providing low exposure of pollutants to human.
- Different standards were set up for food crop farmland and other soils.
- Eight heavy metal elements (including As, Cd, Cr, Cu, Pb, Zn, Ni and Hg) were listed in the monitoring/control standards of soil and groundwater.

8

Rationale of set up the control standards of heavy metals in soils

- The control standards were established referring to:
  - the background concentration in Taiwan,
  - the toxicity level to human and plants,
  - the recommended values supported by related researches in Taiwan, and
  - the heavy metal regulation limits developed in other countries.

Rationale of set up the control standards of soils - As

- Arsenic in soils at the level of more than 40 mg/kg can be toxic to paddy rice based on research results carried out in Taiwan.
- The limit standards of As in Holland, Germany, and UK are between 50 to 55 mg/kg.
- The limit of soil As in agricultural land, residential area, and commercial-industrial area were 50, 80, and 150 mg/kg in Germany and 20, 30, and 50 mg/kg in Canada, respectively.
- In Taiwan, the soil pollution control standard of As was therefore set to be 60 mg/kg.

Rationale of set up the control standards of soils - Cd

- In Taiwan, when the rice was planted in the soil with 1-2 mg/kg Cd (0.1N HCl extractable), the Cd concentration in the grain can be over 2 mg/kg.
- The limit of soil Cd in agricultural land, residential area, and commercial-industrial area were 5, 15, and 20 mg/kg in Germany and 3, 5, and 20 mg/kg in Canada, respectively.
- In Taiwan, the soil pollution control standard of Cd was therefore set to be 5 mg/kg for food crop farmland soils and 20 mg/kg for other soils.

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Rationale of set up the control standards of soils - Cr

- In Taiwan, the background level of total soil Cr is about 100 mg/kg.
- The limit of soil Cr in agricultural land, residential area, and commercial-industrial area were 500, 600, and 800 mg/kg in Germany and 750, 250, and 800 mg/kg in Canada, respectively.
- In Taiwan, the soil pollution control standard of Cr was set to be 250 mg/kg.

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Rationale of set up the control standards of soils - Cu

- In Taiwan, the background level of total soil Cu is about 35 mg/kg.
- The limit of soil Cu in agricultural land, residential area, and commercial-industrial area were 200, 600, and 1000 mg/kg in Germany and 150, 100, and 500 mg/kg in Canada, respectively.
- In Taiwan, the soil pollution control standard of Cu was set to be 200 mg/kg for food crop farmland soils and 400 mg/kg for other soils.

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Rationale of set up the control standards of soils - Zn

- In Taiwan, the background level of total soil Zn is about 120 mg/kg.
- The limit of soil Zn in agricultural land, residential area, and commercial-industrial area were 600, 3000, and 3000 mg/kg in Germany and 600, 500, and 1500 mg/kg in Canada, respectively.
- In Taiwan, the soil pollution control standard of Zn was set to be 600 mg/kg for food crop farmland soils and 2000 mg/kg for other soils.

14

Rationale of set up the control standards of soils - Pb

- In Taiwan, the background level of total soil Pb is about 120 mg/kg.
- The limit of soil Pb in agricultural land, residential area, and commercial-industrial area were 1000, 2000, and 2000 mg/kg in Germany and 200, 2000, and 1000 mg/kg in Canada, respectively.
- In Taiwan, the soil pollution control standard of Pb was set to be 500 mg/kg for food crop farmland soils and 2000 mg/kg for other soils.

15

Rationale of set up the control standards of soils - Ni

- In Taiwan, the background level of total soil Ni is about 100 mg/kg.
- The limit of soil Ni in agricultural land, residential area, and commercial-industrial area were 200, 250, and 500 mg/kg in Germany and 150, 100, and 500 mg/kg in Canada, respectively.
- In Taiwan, the soil pollution control standard of Ni was set to be 200 mg/kg.

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Rationale of set up the control standards of soils - Hg

- In Taiwan, the background level of total soil Hg is less than 1 mg/kg.
- Hg is highly toxic to human and its limits are between 1-2 mg/kg in many countries.
- The limit of soil Hg in agricultural land, residential area, and commercial-industrial area were 50, 15, and 20 mg/kg in Germany and 0.8, 2, and 10 mg/kg in Canada, respectively.
- In Taiwan, the soil pollution control standard of Hg was set to be 2 mg/kg for food crop farmland soils and 10 mg/kg for other soils.

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Rationale of set up the control standards of heavy metals in groundwater

- The control standards of groundwater were established referring to:
  - the pollutants found in the groundwater in Taiwan.
  - the items listed in the soil pollution control standards in Taiwan.
  - the items and their standards listed in the drinking water quality standards in Taiwan.
  - the items and their standards listed in the related regulations in other countries.

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Rationale of set up monitoring standards of heavy metal in soil and groundwater

- Monitoring standards of heavy metals in soil and groundwater were established for the purpose of **an early warning.**
- The values of pollution monitoring standards were set to be about **at the middle point between background concentrations and the control standards.**

Monitoring and control standards of heavy metal of soils in Taiwan
(Total content determined by aqua regia digestion)

	As	Cd	Cr	Cu	Hg	Ni	Pb	Zn
Soil pollution monitoring standards (mg/kg)								
Food crop farmlands	30	2.5	175	120	2	130	300	260
Others	30	10	175	220	10	130	1000	1000
Soil pollution control standards (mg/kg)								
Food crop farmlands	60	5	250	200	5	200	500	600
Others	60	20	250	400	20	200	2000	2000

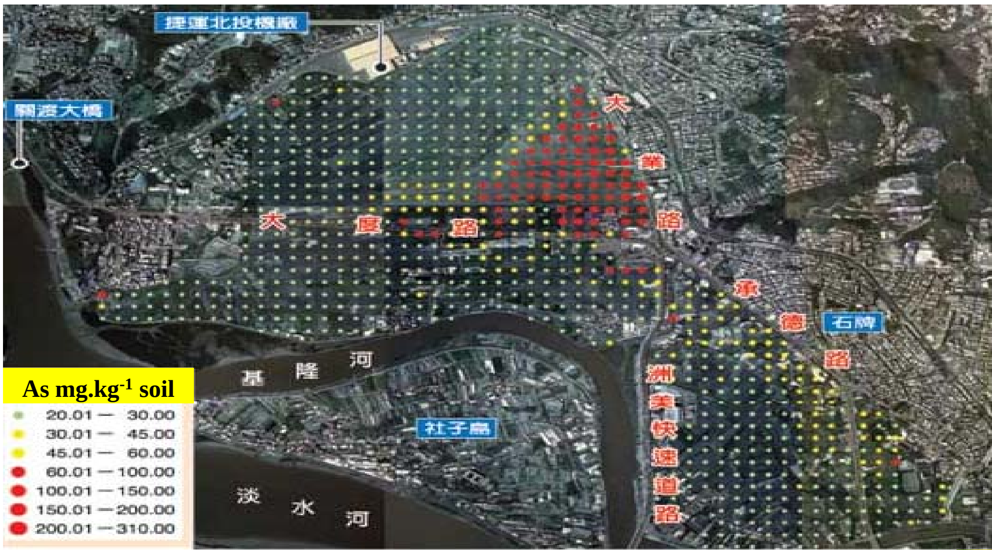
Monitoring and control standards of heavy metal of groundwater in Taiwan

	As	Cd	Cr	Cu	Hg	Ni	Pb	Zn
Groundwater pollution monitoring standards (mg/L)								
Category I	0.025	0.0025	0.025	0.5	-	-	0.025	2.5
Category II	0.25	0.025	0.25	5	-	-	0.25	25
Groundwater pollution control standards (mg/L)								
Category I	0.05	0.005	0.05	1	0.002	0.1	0.05	5
Category II	0.5	0.05	0.5	10	0.02	1	0.5	50

Exclusive clauses for the above mentioned monitoring/control standards

- If concentrations for listed heavy metals in soil and groundwater are affected by regional hydro-geological conditions and environmental background and
- If solid scientific data confirms that external pollution sources are not the cause of concentrations exceeding standards for listed pollutants, the pollution standards will not be applicable to certain cases, upon approval by the EPA.

Taiwan, Taipei – Guandu Plain



There were 128 ha of Guandu plain soils in which the As concentrations were > 60 mg kg^{-1}.

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Remediation standard

- When decreasing the concentrations of contaminants in a remediation site below the control standards is not possible because of the limitation of geologic conditions, characteristics of the contaminant, and remediation techniques or due to financial situation, risk assessment can be carried out with the provision of a **flexible remediation target**.
- In such circumstances, the value of remediation goal **can be higher than the control standard** if the remediation proposal is approved by EPA.

24

Taiwan standards vs. Other countries' standards

- The soil and groundwater control standards (SCSs) often have a different application in each legislative framework. In addition, their scientific basis and derivation procedures differ in various countries.
- The variation in SCSs is the product of political consideration, risk perception, and differences in model parameters and algorithms with their boundary conditions.

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Example: Cd standard in Taiwan vs. other countries

Countries		Cd standard for agricultural lands (mg/kg)
Slovakia	(sand/loamy sand)	0.4
Czech		0.4
Slovakia	(sandy loam/loam)	0.7
Austria	(intervention value)	1
Slovakia	(clay loam/clay)	1
Canada		1.4
Korea	(dangerous value)	1.5
Belgium		2
Poland		4, 5
Taiwan		5
Korea	(action value)	12
France		20

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Further revision of standards

- Adjustment of the limit values is still under discussion to provide more reasonable and protectable standards according to more and more solid research results and field control experiences.
- Since the health risk of Cr(VI) is much higher than that of Cr(III), Cr(VI) tends to be listed in the pollution standards of soil and groundwater in addition to total Cr.

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Further revision of standards (continued)

- The concentration of Pb in rice grain was limited to be less than 0.2 mg/kg and the concentrations of Cd in rice grain and vegetables are limited to be below 0.4 and 0.05-0.2 mg/kg, respectively in Taiwan.
- However, the concentrations of Pb or Cd in rice grain or vegetables on several farmlands were found to be higher than the limits even if the crops were cultivated in the soils with metal concentrations lower than the control standards.
- Accordingly, the pollution control standards of Pb and Cd tend to be lower down for food crop farmland soils.

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Further revision of standards (continued)

- Emerging heavy metal contaminants, such as Indium (In), Gallium (Ga), Molybdenum (Mo), which are widely used in high technology industry, such as semiconductor manufacture, are discussed to be included in the pollutant lists of monitoring/control standards of soil and groundwater.
- The adjustment or revision of monitoring and control standards of heavy metal is still under discussion in Taiwan.

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Ecological Risk Assessment of Heavy Metal Pollution in Watershed Impacted by Abandoned Metal Mine

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ABSTRACT

Heavy metal pollution has been awarded as a critical problem in ecosystem but few studies were available for assessing ecological risk of heavy metal pollution in the environment comprehensively. This study was conducted to evaluate ecological risk assessment in the watershed near at the abandoned metal mine in Korea using calculation of pollution index in order to construct a pollution map on which to base the management strategy. Total of seven clusters were defined to measure heavy metal concentration in soil and 18 sampling sites were selected for surface water, sediment, and plants samples along with watershed near at the abandoned mine. The highest heavy metal concentration in soil was observed at cluster A where is the closest cluster to portal with 1,199.46 mg kg^{-1} for As, and 2,373.08 mg kg^{-1} for Pb. In case of Cd, the highest concentration, 13.09 mg kg^{-1}, was measured in cluster D. Calculated pollution index of heavy metals in each environmental compartment was ordered as plant (6.08) > sediment (1.86) > soil (0.92) > surface water (0.57). This result might indicate that plant is highly affected by heavy metals and heavy metals in the environment have tendency to adsorb on solid phase rather than to dissolve in aqueous phase. In conclusion, the ecological risk assessment of heavy metals is necessary to minimize its adverse effect on ecology system and human health. Furthermore, calculating pollution index and constructing the pollution map can be adapted for comprehensive understanding of hazardous pollutants in the environment and thereby the setting management strategy.

Key words: Heavy metals, Abandoned metal mine, Pollution index, Watershed, Risk assessment

1. Introduction

Elevated heavy metal concentration released from mine wastes such as overburden, waste rock, and tailings nearby abandoned mine can have adverse effect not only on ecological system but also human health (Davis and Ballinger, 1990; Merrington and Alloway, 1994). For this reason, risk assessment of heavy metals is necessary and especially aquatic environment is more important because of toxicity, bioaccumulation into biota, and persistency in sediment of heavy metals (Akagi et al., 2000; Kimmel et al., 1999; Sekhar et al., 2003). Objectives of this research were i) to monitor heavy metal concentration in the environment including soil, surface water, sediment, and plants in the watershed ii) to calculate pollution index based on heavy metal concentration and iii) to construct a heavy metal pollution map using various environmental parameters for assessing comprehensive ecological risk assessment in the watershed.

2. Materials and Method

Sampling was conducted in the Han River watershed near at the abandoned metal mine in Kangwon Province. Major ores of abandoned metal mine were gold, silver, copper, and zinc. Three portals, tailings and other solid wastes were major sources of the potential pollution in the study area. Sample was collected from 3 different environmental compartments, soil, surface water, and sediment, including plant samples during 2009-2010 (Fig. 1). Total of 155 locations were selected for soil samples and 7 clusters (A through G) were defined depending on portal location and distance from portal. Hand auger was used to collect soil samples and three different soil samples were composited to make one soil sample in each location.

Fig. 1 Sampling locations for soil, surface water, sediment, and plant in study area (Cluster A-G)

In case of surface water and sediment samples, total of 18 samples were collected in the watershed and sediment sample was collected at the same location where the surface water sample was collected. Main stream and conversion between main stream and ditch were selected as sampling locations for surface water and sediment. Plant samples for assessing bioaccumulation of heavy metals in the watershed were also collected in the main streams. Major biospecies were *Impatiens textori, Zizania latifolia, and Persicaria vulgaris* in the watershed. Heavy metal concentration in soil and sediment was determined with ICP-AES (Inductively Coupled Plasma-Atomic Emission Spectrophotometer, Perkin Elmer Optima, 3200XL, USA) after extracting with 0.1N HCl for Cd and Pb and 1.0N HCl for As. Concentration of heavy metals in plants was determined by acid digestion followed by ICP-AES measurement. For surface water sample, collected sample was filtered through 0.45μm filter paper and the filtered sample was subjected to ICP-AES measurement.

3. Results

3.1 Heavy Metal Concentration in the Environmental Samples

Heavy metal concentrations in soil, surface water, sediment, and plant are summarized in Table 1.

Table 1. Summary of heavy metal concentration in soil, surface water, sediment, and plant

Matrix	Clusters	Concentration (mg/kg or mg/L)								
		Cd			Pb			As		
		Min	Avg.	Max	Min	Avg.	Max	Min	Avg.	Max
Soil	A	ND	0.48	5.68	1.01	192.27	2,373.08	ND	123.05	1,199.46
	B	ND	ND	ND	0.23	1.97	4.64	ND	0.05	0.20
	C	ND	0.01	0.10	ND	4.60	11.45	ND	0.57	1.40
	D	ND	0.70	13.09	1.01	15.08	275.06	ND	13.70	370.51
	E	ND	0.14	6.49	14.94	18.09	35.52	ND	0.67	9.80
	F	ND	0.49	6.47	14.65	17.57	43.89	0.11	1.50	4.17
	G	ND	0.37	1.32	4.22	14.12	20.61	0.15	1.95	7.77
Surface Water		ND	0.01	0.25	ND	0.10	1.81	ND	0.01	0.10
Sediment		ND	3.43	11.79	14.19	61.90	520.13	0.84	79.04	1,136.04
Plant		0.20	2.02	6.63	0.27	0.94	1.92	ND	1.39	11.19
ND: Not Detectable										

Among clusters for soil sample, cluster A and D where are the closest sampling sites to mine portal showed the highest concentration of heavy metals (Pb and As in cluster A and Cd in cluster D). In addition, lower heavy metal concentration was observed as distance from mine portal was increased. This result indicated that heavy metal concentration in soil is dependent to distance from mine portal. Similar trend was observed in surface water and sediment samples. The highest concentration of As (0.10 mg/L) in surface water was observed in cluster A and Cd (0.25 mg/L) and Pb (1.81 mg/L) in cluster D. In case of heavy metal concentration in plant samples, dependency of distance to mine portal was not observed.

3.2 Calculation of pollution index (PI)

Ecological risk assessment (ERA) evaluates the potential that adverse effect may occur as the result of exposure to one or more hazard pollutants. However, conducing ERA with individual heavy metal has a limitation to fully understand the detrimental effect of heavy metals on ecosystem. Therefore, calculating pollution index (PI) has been used for compensating its limitation. Depending on varied environmental matrix, different calculation of PI can be used. Representative calculation method for soil, surface water, sediment, and plant is summarized in Table 2.

Table 2. Representative calculation method for pollution index in different environmental matrixes

Matrixes	Equations	Description	Ref.
Soil	$SPI = \frac{\sum \frac{\text{Heavy metal concentration in soil}}{\text{Tolerable level}}}{\text{Number of heavy metal}}$		[5]
Surface water			[5]
Sediment	$SePI = \frac{\sum (I_{geo})\, n}{\text{Number of heavy metal}}$ $I_{geo} = \log_2 \frac{C_n}{1.5 \times B_n}$	I_{geo}= index of geoaccumulation C_n= sample concentration B_n = background concentration	[3]
Plant		C_i= sample concentration n= charge of heavy metals	[7]

In order to apply equations shown in Table 2, tolerable level of heavy metal concentration in soil and surface water (Table 3) was used. Results of PI calculation in soil, surface water, sediment, and plant (Table 4) were widely varied with environmental matrixes. Based on the average calculation, risk of heavy metal in this study area was ordered as plant>sediment> soil>surface water, even though a direct comparison among pollution indices of different matrix needs a further discussion. This result indicated that released heavy metals from abandoned metal mine might have the most adverse impact on aquatic and plant environments and thus management scheme where to put priority should be followed.

Table 3. Summary of tolerable level of heavy metals in soil and surface water

Matrixes	Tolerable level (mg/kg or mg/L) *		
	As	Cd	Pb
Soil	6	1.5	100
Surface water	0.05	0.005	0.05
*Set by Korea Ministry of Environment			

Table 4. Summary of pollution index calculation in different environmental matrixes

Matrix	Pollution index		
	Minimum	Average	Maximum
SPI (soil)	0.003	0.921	51.997
WPI (water)	0.026	0.572	3.007
SePI (sediment)	0.512	1.862	6.097
PPI (plant)	1.756	6.078	16.537

3.3 Heavy Metal Pollution Map

Pollution map of ecological risk assessment was construed to show the comprehensive impact of heavy metals in the watershed (Fig. 1). This map considered the calculation of pollution index in surface water, sediment, and plant and summed together to exhibit the potential hazard from a combination of individual heavy metal and environmental matrix. As shown in Fig. 1, the highest risk was observed in sampling points of 2 and 4 where sites are the closest downstream from mine portal. Combined assessments of ecological and human health risk assessment are desirable in setting management strategies in this area but this might be difficult due to financial and technical reasons. However, the pollution map from ERA might provide the management strategy in setting priority which environmental matrix should be remediated first.

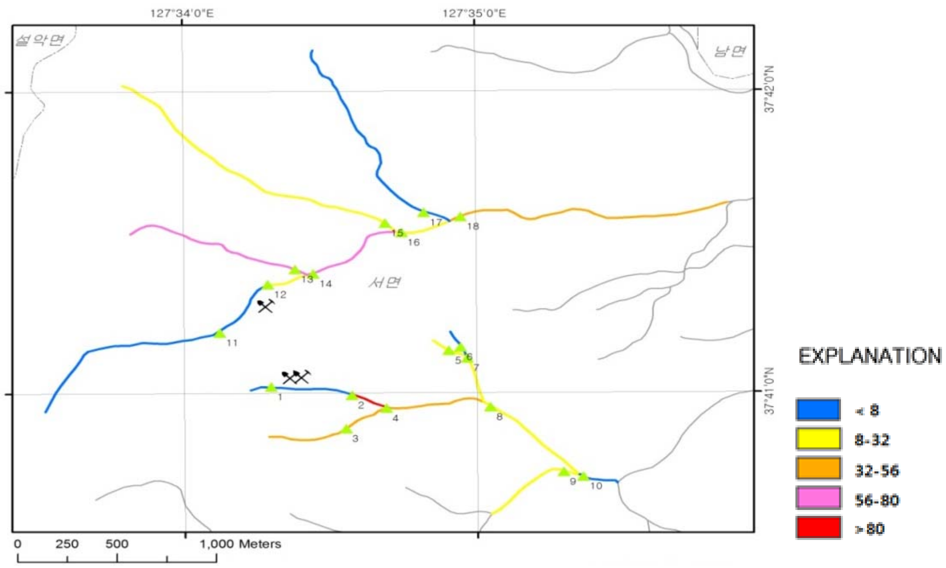

Fig 1. Map of ecological risk assessment in study area

4. Conclusion

Comprehensive ecological risk assessment in watershed was conducted based on heavy metal concentration and calculation of pollution index in soil, surface water, sediment, and plant. Heavy metal concentration in soil, surface water, and sediment was dependent on distance from mine portal meaning that much higher heavy metal concentration was observed in sampling sites where mine portal is closely located. Result of pollution index calculation showed that sediment needs to be remediated prior to other environmental compartments to result less impact of heavy metals on plant.

5. References

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The Practice of Contaminated Land Management in UK and Case Studies

Phil Crowcroft
Partner ERM

CONTAMINATED LAND: APPLICATIONS IN REAL ENVIRONMENTS

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ERM

CL:AIRE

Overview

- **How are sites discovered?**
- **Investigation methods**
- **Risk assessment**
- **Remediation options appraisal**
- **Implementation of remediation**
- **Case studies**

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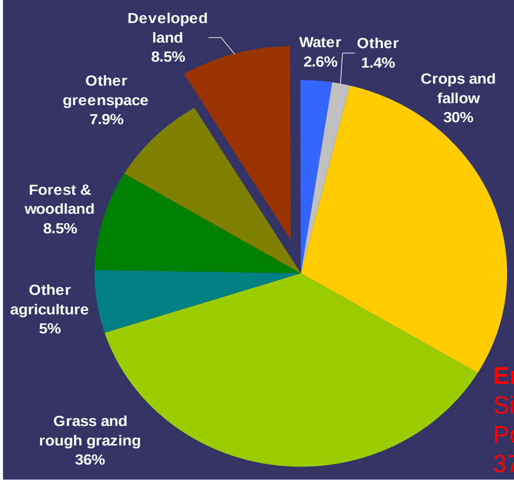
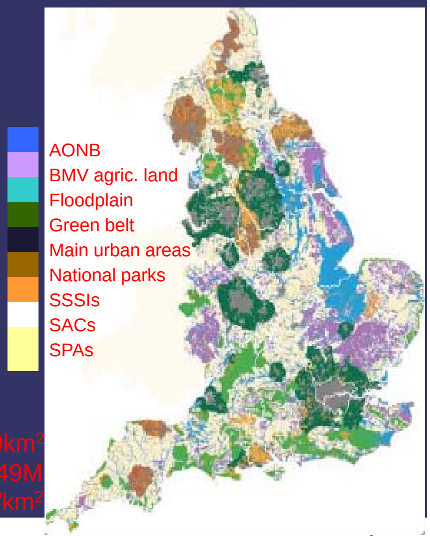
Where is our Contaminated Land?

The UK has a mature knowledge base of land condition





England
Size: 130,410km^2
Pop. (2001): 49M
376.8 people/km^2

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Three ways in which contamination found

- **Operational industrial sites – permit requirements, voluntary investigation**
- **Part 2A legislation requires Local Authorities to inspect their areas for potential contaminated land**
- **This is land posing an unacceptable risk to health or the environment under current use**
- **Planning applications for new use of land – investigation usually required**

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Overview

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Case study site, 1921

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Case study site - 1974

- **Former industrial site in northern England**
- **Historic use of chlorinated benzenes** (TCB, DCB, CB) including DNAPL
- **TCB concentrations remain >EQS in immediately adjacent river post remediation**

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Case study site - 2007

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Investigation methods

- Boreholes – on land and water
- Trial pits
- In-situ testing
- Laboratory testing

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Pre-Remediation Characterisation – Waterloo Profiler

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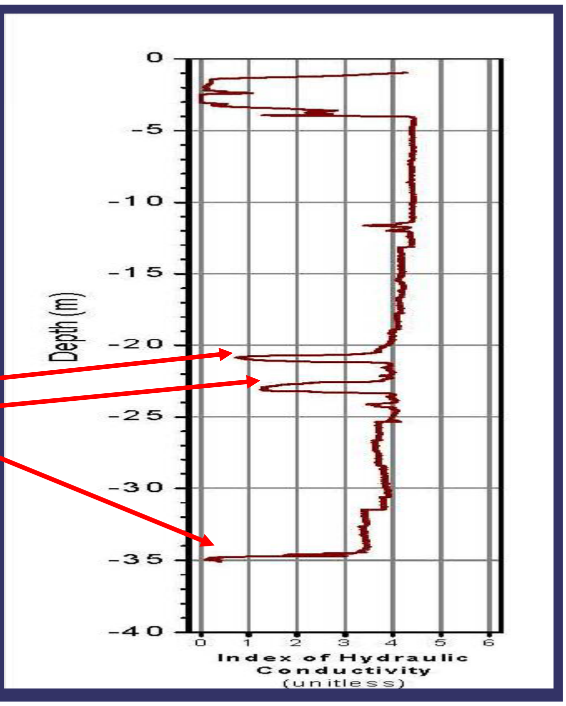
Modified Waterloo Profiler Real Time Sampling

- Targeted DNAPL sampling above low K horizon



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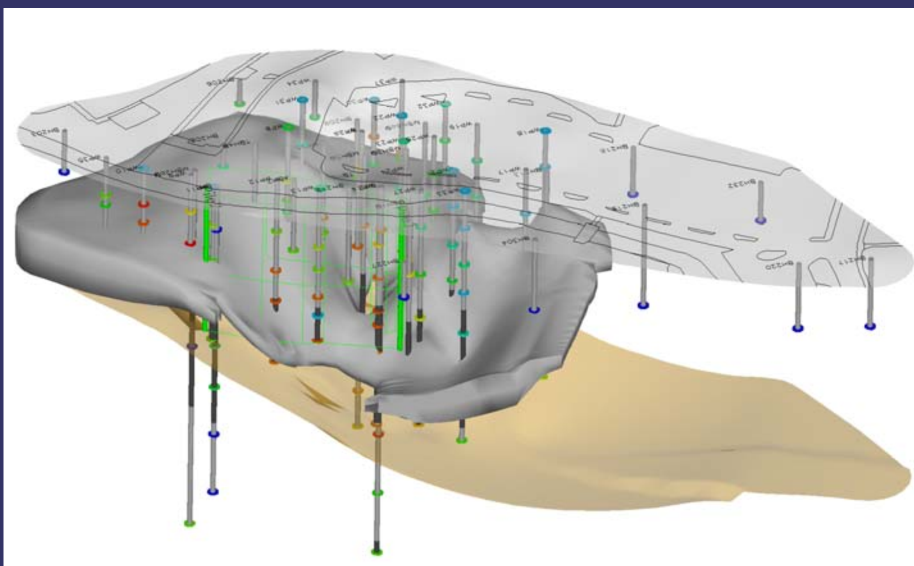
Geology



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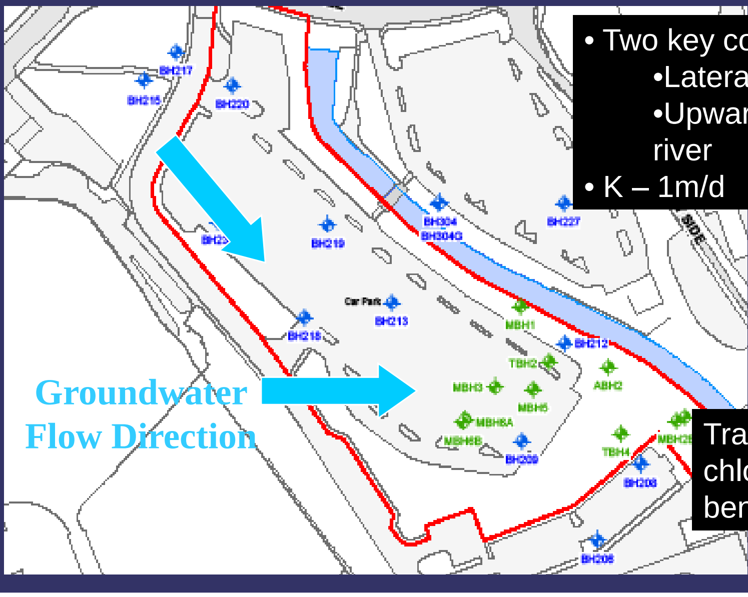
Hydrogeology



- Two key components:
  - Lateral flow to river
  - Upward Gradient near river
- K – 1m/d

Trace levels of chlorinated benzenes in river

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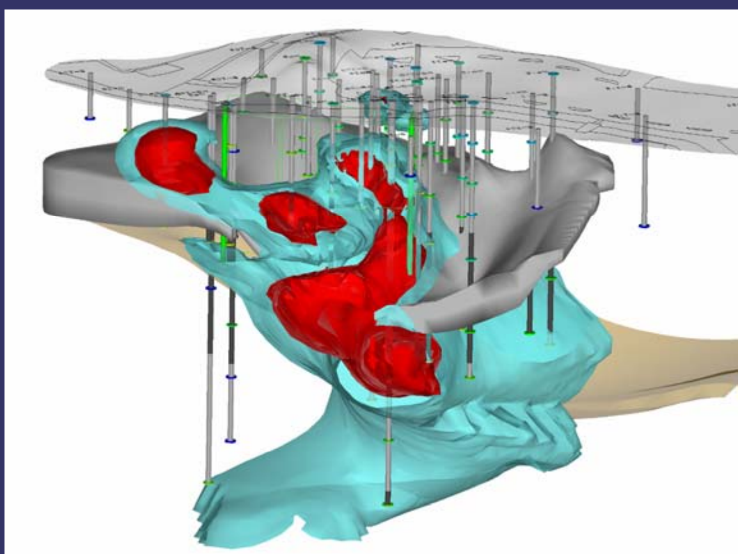
Contaminant Distribution



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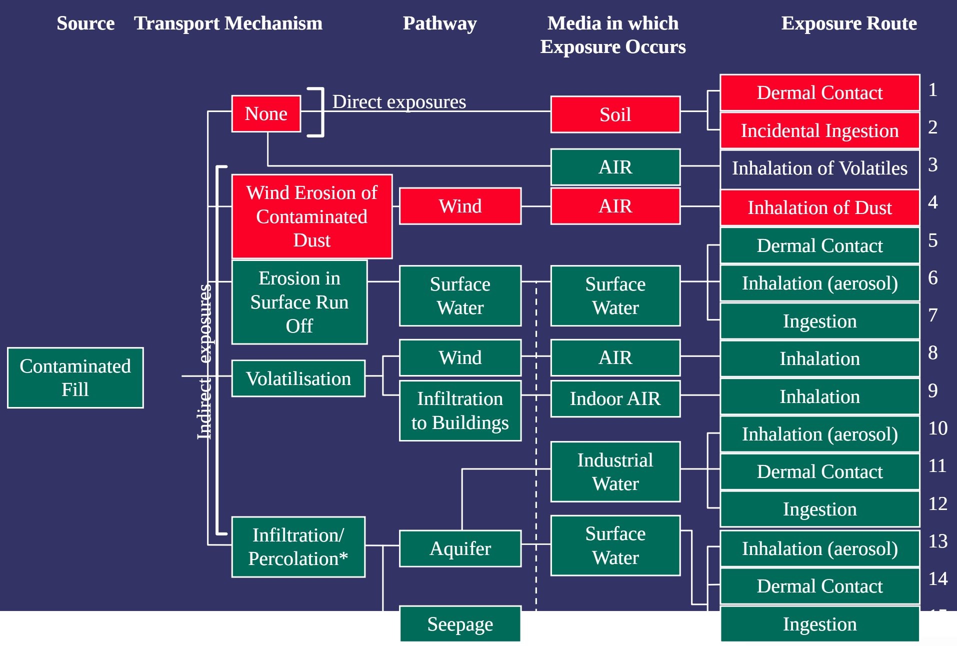
Formalised Conceptual Model



UK Soil Guideline Values – Human Health

- **Generic Quantitative Risk Assessment (GQRA) Criteria**
  - Developed as criteria to assess potential impacts on human health
  - Currently based on exposure modelling using health criteria values which are set at minimum risk level
  - CLEA software model has been used to develop numbers
  - Proposed change to less conservative level to make more sustainable
- **Detailed Quantitative Risk Assessment (DQRA) uses site specific parameters**

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Standards for Controlled Waters

- **Generic Assessment Crtiteria**
  - Environmental Quality Standards – for surface waters – dependent on ecology, and fresh/salt water status
  - Drinking Water Standards for groundwater
- **Detailed QRA**
  - Undertake detailed modelling with site specific parameters
  - Tiered approach, allowing for attenuation, biodegradation, dilution
  - Set compliance point to meet EQS/DWS
  - Take into account use of water body

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Sustainable Remediation defined

- **Sustainable Remediation**
  - SuRF-UK defines Sustainable remediation as “the practice of demonstrating, in terms of environmental, economic and social indicators, that the benefit of undertaking remediation is greater than its impact and that the optimum remediation solution is selected through the use of a balanced decision-making process
  - If poorly selected, designed and implemented, remediation activities may cause greater impact than the contamination that they seek to address

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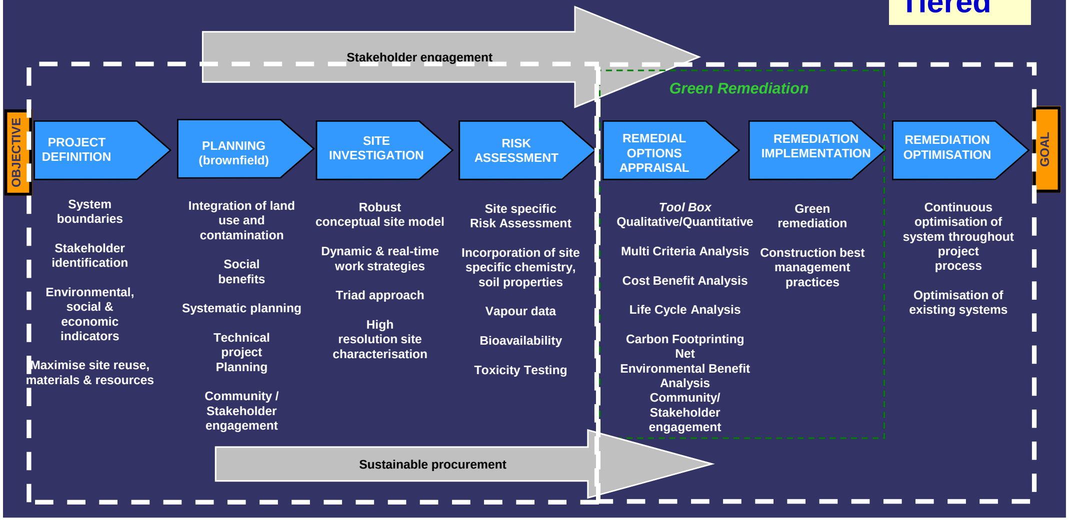
Integrating Sustainable Remediation with the Development process

Flexible
Iterative
Tiered



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Typical options appraisal

- **Consider:**
  - Objectives of remediation (end use, timings etc)
  - Methods – physical, chemical, thermal, biological, stabilisation
  - On site/off site solutions
  - Materials re-use

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Typical Sustainability Criteria Considered

- Carbon dioxide equivalents
- Energy use and alternative energy use
- Natural resource use
- Occupational risk (safety)
- Quality of life issues - local air quality, traffic, noise
- Land redevelopment
- Waste production
- Life-cycle cost

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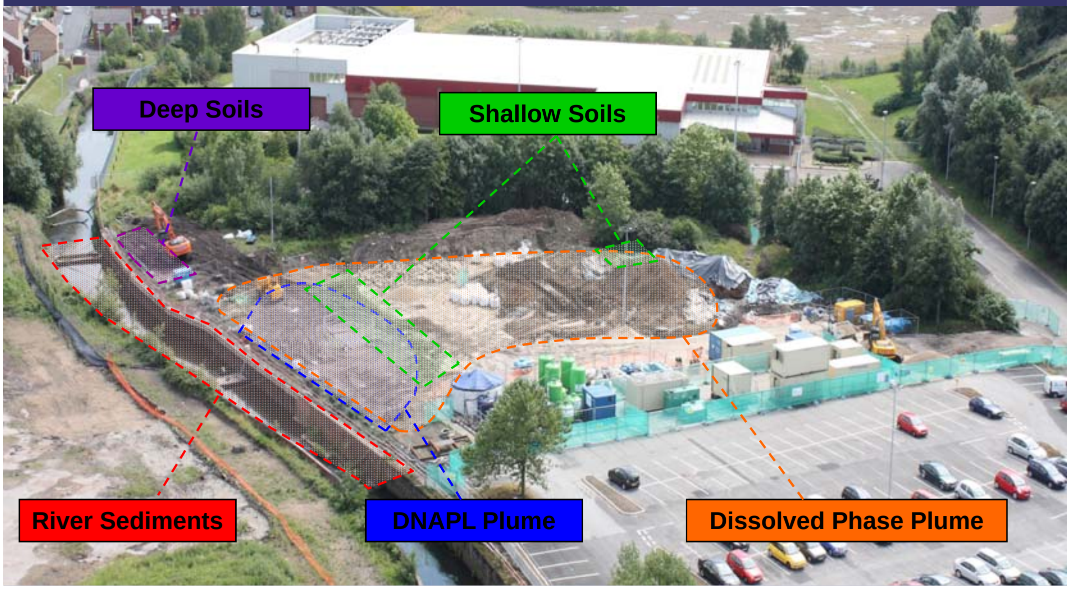
Site Overview



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Shallow Soils Removal

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River Sediment Removal

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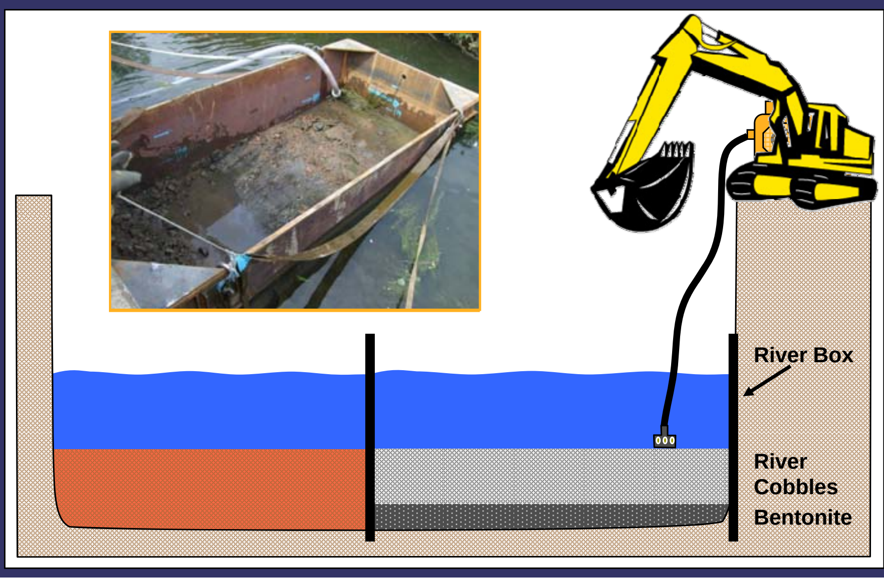
River Sediment Removal



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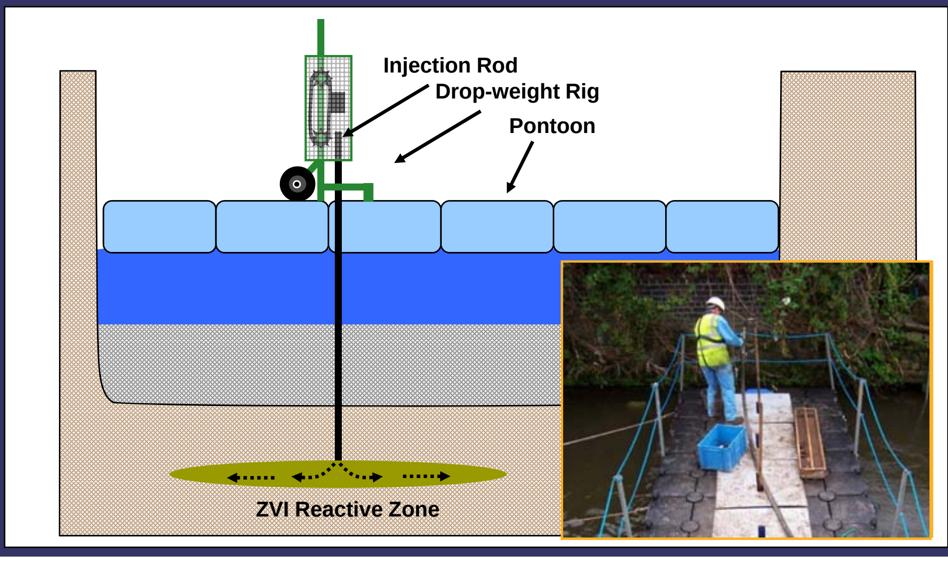
Reactive Zone Installation



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DNAPL Remediation – surfactant flushing

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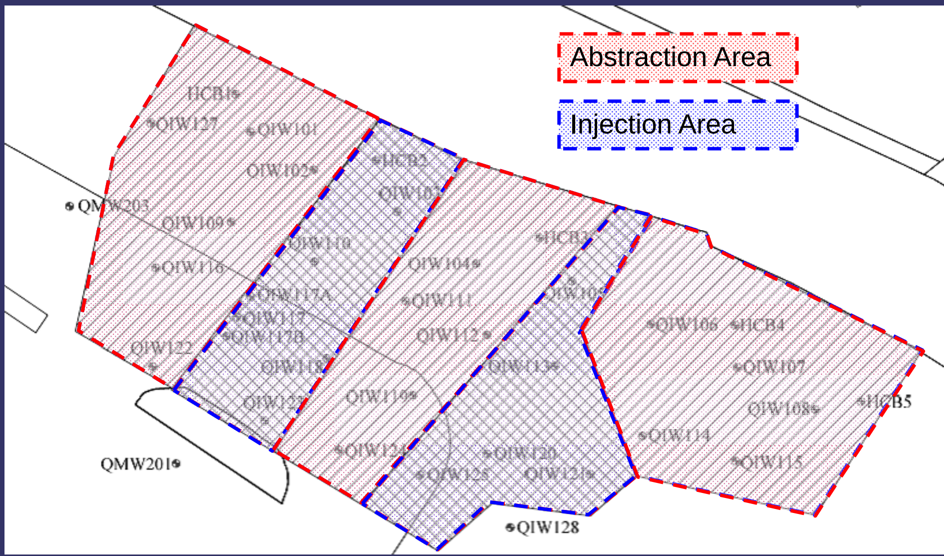
DNAPL Remediation



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Dissolved Phase Remediation – EVO injection

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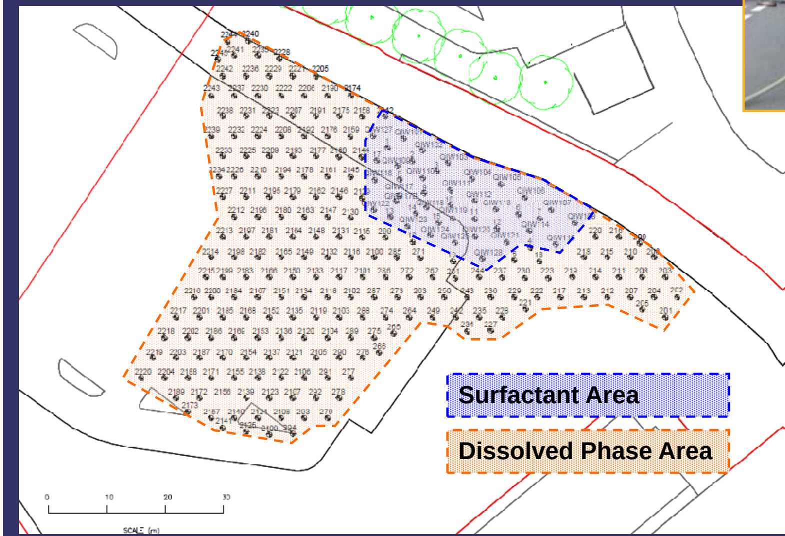
Dissolved Phase Remediation



250 injection points (including surfactant wells)

Approximately 3,000m^3 of EVO water injected

ROI 4m

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Summary

- Works completed in 9 months
- Combined remediation technologies: soil excavation, sediment removal, surfactant flushing, EVO injection and ZVI injection
- Recovered over 9,000kg of contaminant mass
- TCB concentrations in groundwater declined by 85%. DCB/CB increase due to dechlorination
- Average TCB concentrations in river showed decreased significantly from 16.58µg/L to 0.93µg/L
- Regulatory sign off achieved

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Overview

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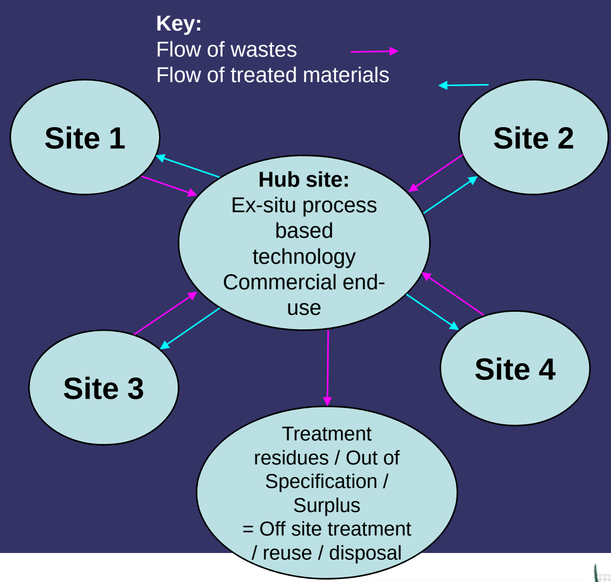
Creation of Soil Treatment Centre & Reuse Case Study

Former Landfill Remediation, Coventry, UK (CL:AIRE CSB9)

- Example of remediation with the reuse of soils after remediation was undertaken under the 'Definition of Waste: Code of Practice' in a Cluster arrangement.

- The Landfill became the treatment 'hub' and a 'receiver' site, with another 'donor' site supplying soils for treatment and re-use on the landfill site.



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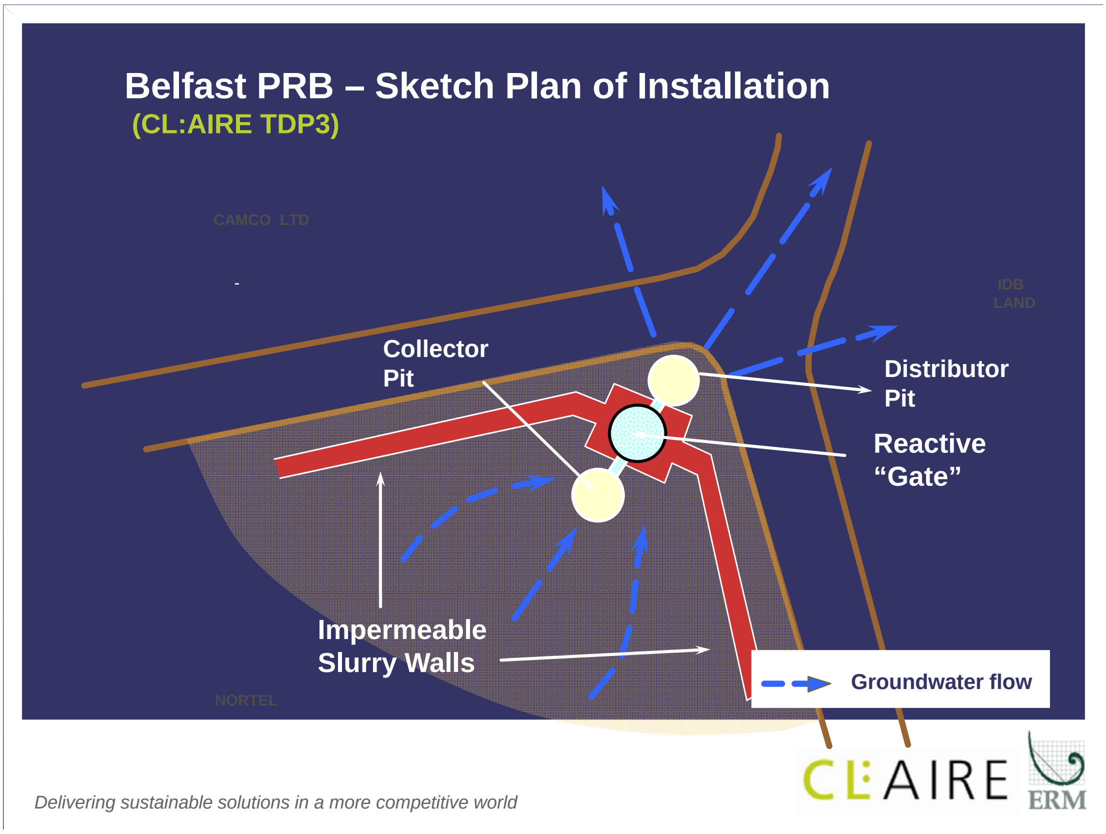
Belfast PRB – Sketch Plan of Installation
(CL:AIRE TDP3)
CAMCO LTD
IDB
LAND
Collector
Pit
Distributor
Pit
Reactive
“Gate”
Impermeable
Slurry Walls
NORTEL
Groundwater flow
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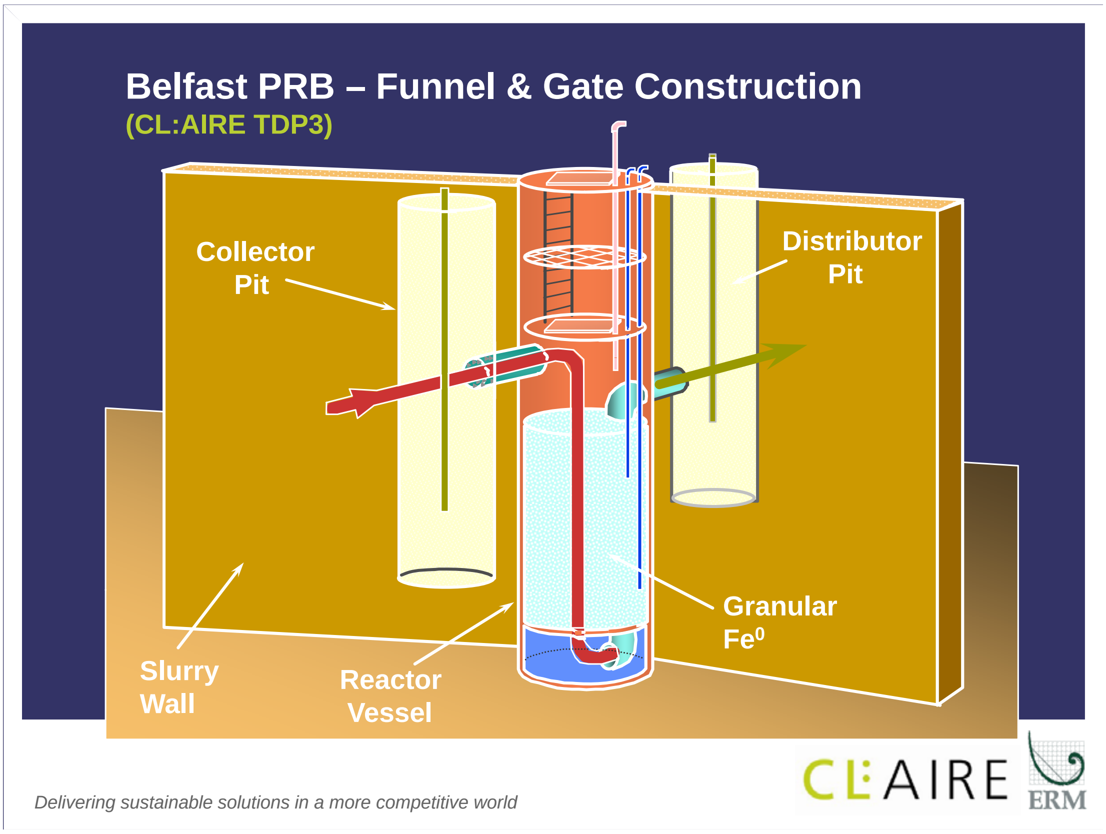
Belfast PRB – Funnel & Gate Construction
(CL:AIRE TDP3)
Collector
Pit
Distributor
Pit
Granular
Fe0
Slurry
Wall
Reactor
Vessel
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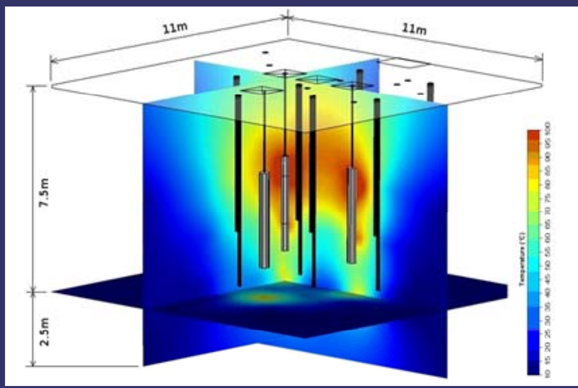
Case Study: *In Situ* Radio Frequency Heating of Hydrocarbon Contaminated Chalk (CL:AIRE TDP28)

- Trial of Soil Vapour Extraction (SVE) with *in situ* Radio Frequency Heating (ISRFH) technology to remove volatile and semi-volatile organic contaminants from soil.



Temperature profile in the treatment area following heating stages.

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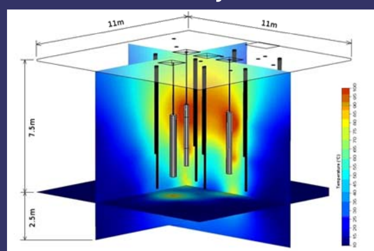
Case Study: *In Situ* Radio Frequency Heating of Hydrocarbon Contaminated Chalk (CL:AIRE TDP28)

- The technology uses Radio Frequency (RF) to excite polar molecules present in the soil (soil water), thus generating heat in a manner similar to that of a microwave oven.

- Frequency of 13.56 MHz with a wavelength of 22 m, and can penetrate the soil to a much greater extent than microwaves.

- The electromagnetic field generated by the electrodes was fully contained within specially designed Faraday cages.

- Regular data logger/manual sampling of:
  Groundwater and soil temperature;
  strength of electromagnetic field;
  rate of extraction of VOCs; soil and
  groundwater concentrations.



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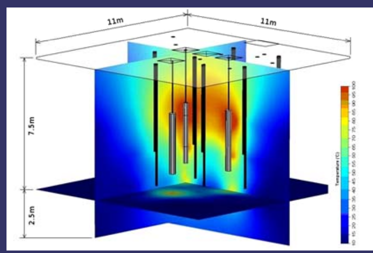
Case Study: *In Situ* Radio Frequency Heating of Hydrocarbon Contaminated Chalk (CL:AIRE TDP28)

- Heating spanning for 48 days, with SVE spanning 106 days
- Average soil temperature reached 45.4° C.
- Free phase hydrocarbon extraction 1291 kg, – approx 40% recovery
- Significantly reduce treatment times without entailing excessive energy costs.
- Key advantage of technology: can pinpoint heating in ground profile by installing electrodes at predefined depths. No need to heat entire soil profile.
- Competitive costs against excavation and landfilling alternative.



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The Conceptual Approach for Control Standard Setting Based on Human Health Risk

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ABSTRACT

The contaminated sites in Taiwan are managed mainly by two distinct standards-monitoring standard and control standard. To further solidify the scientific basis of the standards, the concept of setting regulatory standards based on human health risk has been examined. The case in practice shows that the realization of the concept needs elements beyond risk assessment. While a general framework could guide the process, there are elements having significant influences to the decision of standards. The elements include the consensus among stakeholders, the site management objective and target, the scientific protocol employed, and the economic and policy factors. This paper investigates the conceptual approach and recent practice of setting soil control standards based on human health risk in Taiwan. Despite the successful application of existing human health risk assessment guideline, the management target and the non-scientific considerations were found to be the major factors steering the decision making.

Introduction

With the promulgation of Soil and Groundwater Remediation Act (SAGRA), the soil and groundwater standards were released in 2001. After over 10 years of enforcement, the standards are under revision for better contaminated site management practices. The experience over last decade has offered Taiwan Environmental Protection Agency (TWEPA) various lessons learned for amending and updating the standards used for regulatory purposes. Both the contaminants concerned and values for declaring sites status need to be revisited.

In the SAGRA framework, the risk assessment protocol was integrated at the very beginning. This proactive thinking has made SAGRA the first environmental law which exclusively employs risk assessment as a tool for evaluation and management of contaminated sites. The human health risk assessment guideline was published in 2005 and the general practice and application of human health risk assessment have been getting penetration and diffusion effects to public sectors as well as consultants and industry. Although the practice of risk assessment is still misted to some extent to most of stakeholders, the risk-based management concept is gaining recognition. The condition for setting standards based on human health risk is more mature than ever. Thus, TWEPA has initiated a task to establish conceptual approach and methodology to set the standards based on human health risk in 2010. While the conceptual framework is in place, the practice shows that the process is not easier than traditional approaches. Nevertheless, the preliminary outcomes indicate the standards do have a robust scientific ground and localization characteristics. It is expected to facilitate a wider acceptance and discussion in the future. This paper intends to offer the general framework for risk-based standards setting and lesson learned in a practical case.

The Framework and Methods

Roles of Standards

The SAGRA defines two sets of standards for soil and groundwater contamination classification- Monitoring Standard and Control Standard. The functions and roles of the standards are illustrated in Figure 1. The Monitoring Standard represents the soil and groundwater are clean or exhibit potential of being contaminated which requires periodical monitoring. The Control Standard is the value indicating the soil and groundwater have been contaminated and regulatory actions shall be taken. When the regulated contaminant concentrations in soil and groundwater exceed the Control Standard, the site will be classified as a control site or remediation site based on the severity of contamination. The severity of contamination is evaluated with the Preliminary Assessment Protocol. The Monitoring Standard and the Control Standard resemble a background value and a trigger value, respectively. The trigger value warrants detail site investigation and necessary remedy actions.

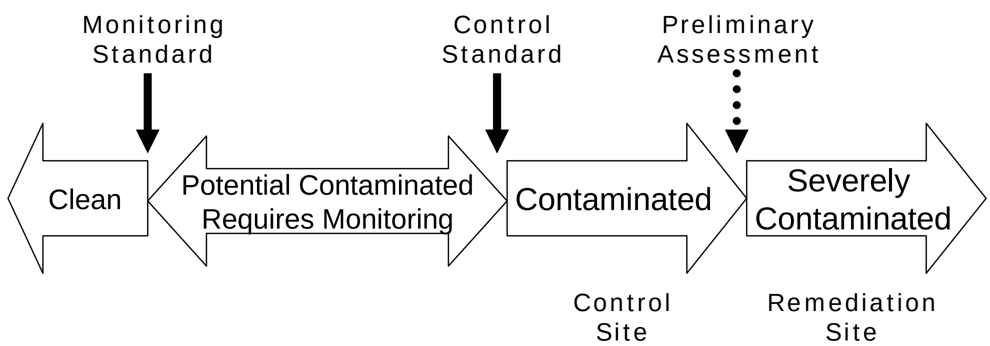

Figure 1. Contaminated Site Management Framework

Conceptual Approach

Developed countries have used risk-based standards for a long time. For example, the Soil Screening Level (SSL) by USEPA, the Target Value and Intervention Value by Netherlands, and Soil Guideline Value (SGI) by United Kingdom are all risk-based soil or groundwater standards used for contamination management per regulatory requirement. In general, setting risk-based standard involves define problem, choose target or scenario, risk assessment, and decision making with factors of economic and policy. Consequently, the conceptual structure for risk-based regulatory standards setting is established mimicking the general thought and is shown in Figure 2.

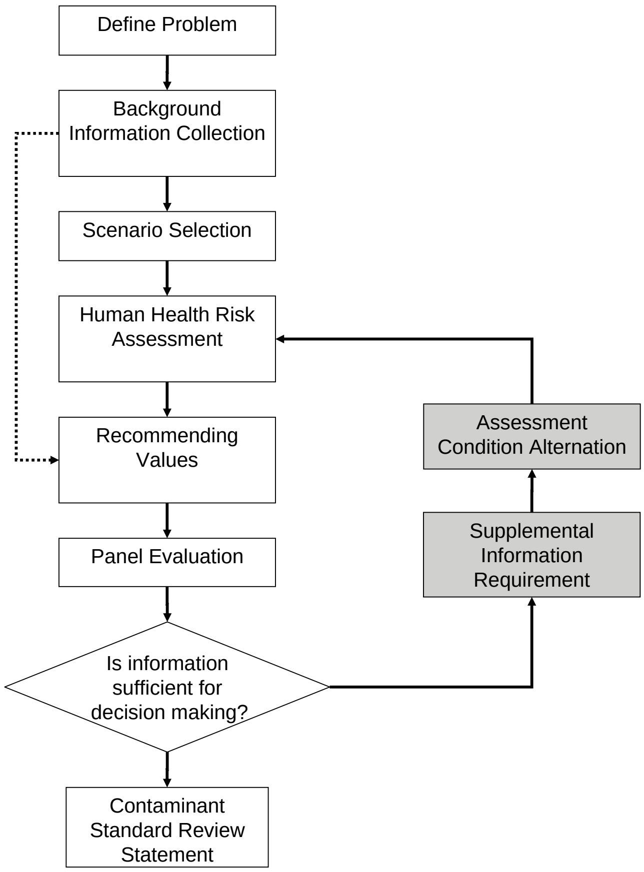

Figure 2. Conceptual Approach for Regulatory Standard Setting Based on Risk

Method Used

To realize the conceptual approach, methods employed for different phases in the structure were worked out through intensive discussions. When defining the problem, the management objective is first clarified by reviewing the existing environmental conditions and prioritizing the targets in concerned. This is followed by background information collection regarding the management target. Once the target is selected, the risk assessment is carried out based on the Human Health Risk Assessment Guideline for Soil and Groundwater Contaminated Sites published by TWEPA. The acceptable risks for carcinogenic and non-carcinogenic are defined as 1×10^{-6} and 1, respectively. This represents residential use assessment and is a more conservative consideration. The delivered recommendation values are then submitted to a panel consisting of experts from TWEPA, academia, and consultants/industry for further evaluation.

The conclusions made by the panel may call for further information and reassessment with altered conditions. Therefore, more decision choices could present themselves after reassessment. At this phases, the economic and policy resource are taken into account along with the multiple decision choices for a feasible standard setting. Finally, a standard review statement will be drafted and provided as the basis for public comment and discussions. The risk-based standard setting process is expected to offer a scientific sound information regarding the regulatory standards as well as a vehicle for better communications with public and stakeholders.

Case Study: Control Standards for MTBE

Defining Objective and Scenarios

The Soil Control Standard and Groundwater Control Standard do not include Methyl *tert*-butyl ether (MTBE) which is a common gasoline additive used as an oxygenate to raise the octane number. According to recent comprehensive gas station investigation, MTBE contamination has been found in soil and groundwater. The addition of MTBE in the regulatory standards is an issue which requires attention. There are several probable sources of contamination including refinery plants, storage farms, and gas stations. The historical investigation results suggested that the gas station is the main source of contamination. Therefore, the problem is defined as- to mitigate the MTBE contamination to the most probable receptors and reducing the risk by limiting the migration. Given the highly soluble and volatile characteristics of MTBE, the Control Standard for groundwater is more important than the Control Standard for soil. Also, the Soil Control Standard is considered as an early warning indicator to the groundwater contamination by MTBE. With the problem definition mentioned above, the scenario setting for the following risk assessment is setup for workers in gas station (Figure 3). Based on the site reconnaissance record, there are about 30% and 1% of the gas stations investigated using groundwater for car washing and for drinking purpose, respectively. To comply with the actual circumstance, the receptors are categorized as station work and car wash machine operator. For receptors beyond the boundary of the contaminated sites, the drinking is considered as the most stringent scenario.

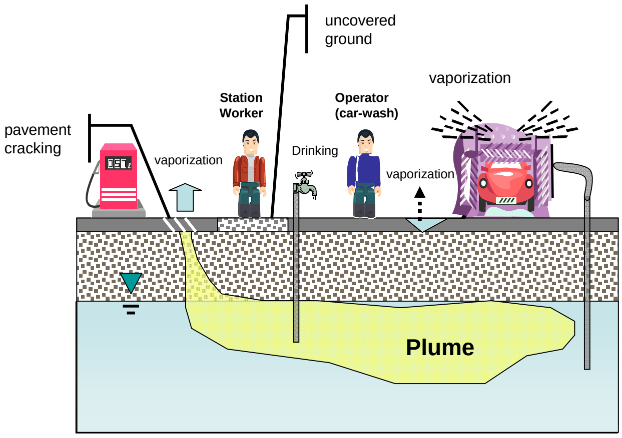

Figure 3. Scenario Setting for the Gas Station Workers

Basis for Decision Making

The risk assessment results suggested that the operator of car washing machine exhibits the higher exposure risk than the general station worker. The major sources of risk are inhalation of vapor from car washing machine and ingestion of contaminated groundwater for the operator of car washing machine (Table 1). The results also indicate the significance of groundwater ingestion in terms of human health risk and the decision making about the Groundwater Control Standard should have the priority with respect to the Soil Control Standard.

Table 1. Soil Control Standard Recommended Based on Acceptable Risk

Exposure Pathways	Recommending Soil Concentration (mg/kg)	
	cacinogenic based	non-carcinogenic based
Inhalation (Dust)	2.29E+07	4.08E+09
Inhalation (vaporization from soil)	9.51E+03	1.69E+06
inhalation (car washing machine)	3.22E+01	1.74E+02
Ingestion of soil	1.50E+03	6.17E+03
ingestion of groundwater*	6.00E-01	N/A

*: based on the groundwater MCL of 0.03 mg/L recommended by USEPA.

Obviously, the groundwater MTBE concentration dominates the decision for soil regulatory standard and the groundwater concentration becomes a more critical factor. While using a groundwater Maximum Contamination Level (MCL) of 0.03 mg/L provides a reasonably protection for the target receptor. However, the MCL might create a demanding resource input for site management based on the actual investigation results (Table 2). It might face a challenge of listing over 50% of gas stations as contaminated sites. Therefore, the policy and economic factors come into play at panel evaluation. While the setting of Groundwater Control Standard of MTBE is still in discussion, there is a general consensus of making groundwater MTBE standard stricter than the soil MTBE standard.

Table 2. Percentile of MTBE Concentration from Actual Investigation Results

Percentile (%)	MTBE Concentration (mg/L)
20	<0.01
30	0.01
40	0.01
50	0.03
60	0.05
70	0.12
80	0.28
90	0.98

Lesson Learned

The risk-based Control Standard setting can provide a scientific sound basis and a defensible regulatory statement. However, it exhibits several challenges for the regulator. For instance, the process of defining assessment target could already create diverse opinions. While the protocol for risk assessment is in place, the parameters used for the assessment could also raise questions regarding the representative of local situation and probable uncertainty. Thus, a fine comprehensive investigation and background information should be reasonably well established prior to the action.

The panel evaluation plays an important role in final decision making. During the conduction of risk-based standard setting work, the members of the panel should be carefully selected. Due to the characteristics of economic and policy making, the qualitative indicators should be defined and evaluated along with the quantitative risk assessment results.

Conclusions

TWEPA recognizes risk-based approach is the best practice for setting regulatory standards. With the support of past experience in applying risk assessment in soil and groundwater contamination valuation, the tools required are fairly handy. However, practicing the concept involves economical and political considerations. The rational decision is being made through the panel to compensate the probable doubt on the qualitative factors. Nevertheless, TWEPA is moving toward the risk-based environmental solution with a determining manner.

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2011 International Workshop on Regulatory Standards of Pollutants and Management Systems for Soil and Groundwater Pollution

The Conceptual Approach for Control Standard Setting Based on Human Health Risk

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Outlines

Outlines

- Introduction
- Conceptual Framework
- Method Employed
- Case Study
- Leason Learned
- Conclusions

Introduction

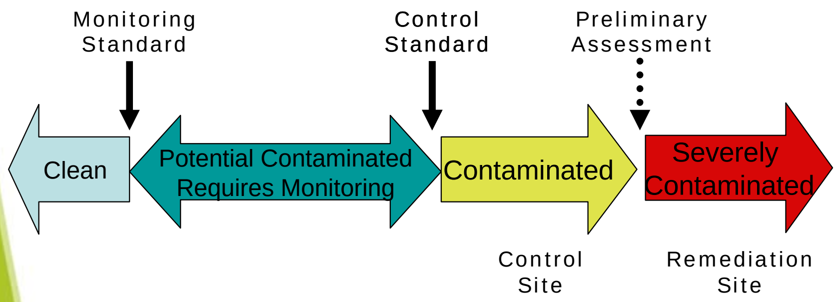
Initiation

- Regulatory standards need to be revisited after 10 years since the promulgation of Soil and Groundwater Remediation Act (SAGRA)
- Standards requires attention and revision for better contaminated site management practices

3

Introduction

Site Management Framework



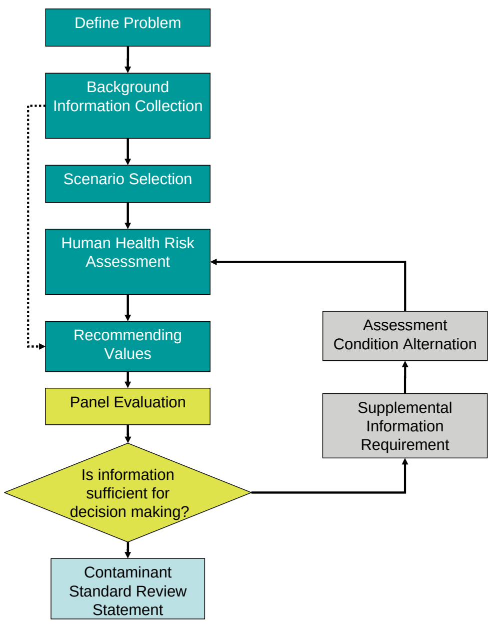
Introduction

Risk-Based Regulatory Standards

- Has been in practice for decades
  - Soil Screen Level (USEPA)
  - Soil Guideline Value (UKEA)
  - Target and Intervention Values (Netherlands)
- Localization for actual needs
- Availability of risk assessment protocol

The Framework

Conceptual Approach



The Framework

Methodology

- Defining problem
  - management objective clarified
  - prioritizing the targets of concerned
- Background information collection
  - regarding the management target
- Risk assessment
  - the Human Health Risk Assessment Guideline for Soil and Groundwater Contaminated Sites published by TWEPA

The Framework

Methodology

- Risk assessment
  - Acceptable risks for carcinogenic and non-carcinogenic are defined as 1×10^{-6} and 1, respectively
  - Represents residential use assessment
- Panel Evaluation
  - recommendation values are then submitted to a panel for evaluation

The Framework

Methodology

- Panel Evaluation
  - the economic and policy resource are taken into account along with the multiple decision choices for a feasible standard setting
- Standard Review Statement
  - provided as the basis for public comment and discussions
  - offer a scientific sound information
  - a vehicle for better communications

Case Study

Control Standards for MTBE

- Current Status
  - the Soil Control Standard and Groundwater Control Standard do not include Methyl tert-butyl ether (MTBE) which is a common gasoline additive used as an oxygenate
  - recent comprehensive gas station investigation, MTBE contamination has been found in soil and groundwater

Case Study

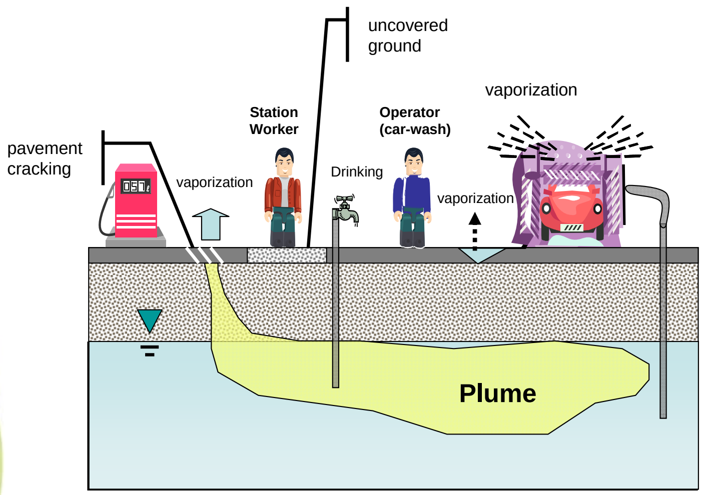
Control Standards for MTBE

- Defining Objective and Scenarios
  - historical investigation results suggested that the gas station is the main source of contamination
  - mitigate the MTBE contamination to the most probable receptors and reducing the risk by limiting the migration
  - based on the characteristics of MTBE, the Control Standard for groundwater is more important than the Control Standard for soil

Case Study

Control Standards for MTBE

- Defining Objective and Scenarios



Case Study

Control Standards for MTBE

- Basis for Decision Making
  - operator of car washing machine exhibits the higher exposure risk than the general station worker

Exposure Pathways	Recommending Soil Concentration (mg/kg)	
	cacinogenic based	non-carcinogenic based
Inhalation (Dust)	2.29E+07	4.08E+09
Inhalation (vaporization from soil)	9.51E+03	1.69E+06
inhalation (car washing machine)	3.22E+01	1.74E+02
Ingestion of soil	1.50E+03	6.17E+03
ingestion of groundwater*	6.00E-01	N/A

*: based on the groundwater MCL of 0.03 mg/L recommended by USEPA.

Case Study

Control Standards for MTBE

- Lesson Learned
  - groundwater MTBE concentration dominates the decision for soil regulatory standard
  - recent investigation data

Percentile (%)	MTBE Concentration (mg/L)
20	<0.01
30	0.01
40	0.01
50	0.03
60	0.05
70	0.12
80	0.28
90	0.98

Case Study

Control Standards for MTBE

- Focus of panel evaluation
  - the MCL might create a demanding resource input for site management
  - might face a challenge of listing over 50% of gas stations as contaminated sites
  - the policy and economic factors come into play at panel evaluation

Lesson Learned

Where are we now

- The risk-based Control Standard setting can provide a scientific sound basis and a defensible regulatory statement
- Challenges
  - process of defining assessment target
  - parameters used for the risk assessment
  - comprehensive investigation and background information

Lesson Learned

Where are we now

- The panel evaluation
  - plays an important role in final decision making
  - due to the characteristics of economic and policy making, the qualitative indicators should be defined and evaluated along with the quantitative risk assessment results

Conclusions

Conclusions

- TWEPA recognizes risk-based approach is the best practice for setting regulatory standards
- While the supporting tool and past experience are vital, practicing the concept involves economical and political considerations
- The rational decision could be made through a panel evaluation to compensate the probable doubt

Conclusions

Conclusions

- TWEPA is moving toward the risk-based environmental solution with a determining manner

Thank you for your attention

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INDONESIAN REGULATIONS RELATED TO THE PREVENTION OF SOIL AND GROUNDWATER POLLUTIONS

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INTRODUCTION

The first Indonesian environmental law had been appointed legally in 1982, i.e. **Act** (or **UU** in Indonesian abbreviation) **no. 4 th.1982**. This law was named as **"Environmental Management Law"**. Renewal or replacement of this law had been done twice, namely in 1997 **(Act or UU no. 23/1997)** and in 2009 **(Act or UU no.85/2009)**. Under these environmental laws, various **Government Regulations** (or **PP** in Indonesian abbreviation) and **Ministry of Environment Decrees** (or **KepmenLH** in Indonesian abbreviation), as the derivation or implementation products of those Acts (or UU), had been launched to regulate various environmental management issues and aspects. Some PP and KepmenLH are dealing with standardization of surface water, industrial effluent, and air qualities as the parts of environmental pollution prevention efforts. Some are dealing with the hazardous wastes handling and management, some with the procedures and technical requirements on remediation of contaminated soils, etc.
In 2008 a new Act (or UU) called as **"Solid-wastes Management Law"** had been issued, namely **UU no.18/2008**. The derivative law products in the form of PP and/or KepmenLH as the implementation or technical regulations of this law at present are still in preparation. These regulations will be very important and useful, especially relate to the prevention of soil and groundwater pollutions.
In the other side, there is a **Government Regulation** (**PP)** issued by Ministry of Public Works in 2006, i.e. **PP no. 16/2006.** This PP concerns with the water and sanitation. But, only a small part of pollution prevention issues is contained in this PP, and mentioned only in a few words i.e. **" prohibited to pollute ….".**

Anyway, up to this moment there is no regulation which is directly related to the groundwater pollution prevention issues in the form of PP as well as KepmenLH but, there are 5 (five) regulations which are **indirectly related to**. This paper will discuss those Indonesian regulations, i.e.:

1. PP (Government Regulation) no. 18/1999
2. PP (Government Regulation) no. 85/1999
3. PP (Government Regulation) no. 74/2001
4. KepmenLH (Ministry of Environment Decree) no. 128/2003
5. KepmenLH (Ministry of Environment Decree) no. 33/2009

GOVERNMENT REGULATIONS (or PP)

1. **PP no. 18/1999 about Hazardous wastes management**

   Refer to the Environmental Act (UU) no. 23/1997 as the basic consideration, this government regulation (PP) was issued in 1999. It consists of 8 (eight) chapters and 66 (sixty six) articles.

   Chapter 1: General provisions, consists of 5 (five) articles. This chapter contains **the definitions** (of wastes, hazardous wastes, hazardous wastes management and treatment, hazardous wastes producers, collectors and transporter, regulator, inspector, and others), **the objective of hazardous wastes management (**ato prevent and to solve the hazardous wastes pollution and/or environmental deterioration caused by these wastes, and performing remediation efforts of the contaminated environment), **the efforts on hazardous management** (prohibition of direct disposal of hazardous wastes into the environment without any treatment, prohibition to perform hazardous waste dilution for decreasing the concentration, radio actives wastes management that must be done by the competence institution according to the law).

   Chapter 2: Identification of hazardous wastes, consisting 3 (three) articles (no. 6, 7, and 8). In general, this chapter explains the identification of hazardous wastes according to the sources (non specific and specific sources, expired chemicals, unused packaging, etc.), the Toxicity Characteristic Leaching Procedure (TCLP) test, the characteristic test (explosive, reactive, corrosive, etc), and the Toxicological test (LD50). The detailed hazardous material is enclosed in the list.

   Chapter 3: Hazardous wastes management executors, consists of 6 (six) parts and 18 (eighteen) articles.
   This chapter contains the responsibility and obligation of the hazardous wastes producers, collectors, transporters, users who can take the advantage of hazardous wastes, treatment executors, heapers/depositors..

   Chapter 4: Hazardous wastes management activities, consists of 8 (eight) parts and 13 (thirteen) articles. In general, this chapter explains the procedures of reducing, packaging, keeping, collecting, transporting, taking the advantage, treating, and heaping the hazardous wastes, including the quality requirements and the executor obligations.

   Chapter 5: Administrative procedures. This chapter mentions about permit obligations, requirements and procedure for having permit, monitoring Institutions, cross countries border movement procedure, information and reporting, mitigation and recovery, accident mitigation monitoring, and financial.

   Chapter 6: Sanctions. This chapter explains the sanctions to executors who neglect this regulation, including the crime sanctions.

   Chapter 7: Transition provision. This chapter explains that the existing activities on hazardous wastes management should follow this PP (Government Regulation) at least 1 (one) year after validation of this PP.

Chapter 8: Closing provision. This chapter states that the former PPs (Govern-ment Regulations) related to hazardous wastes management are no longer valid after validation of this PP.

2. **PP no. 85/1999 as an Amendment of PP no. 18/1999 (hazardous wastes management)**

The amendment is done mainly on **chapter 2** of PP no. 18/1999 which is related to identification of hazardous wastes. The later PP article 6 mentions **"the hazardous wastes can be identified according to the sources and/or characteristic test and/or toxicological test"**) instead of **"the hazardous wastes can be indentified according to the source and its characteristic"** as mentioned in the former PP. The point is emphasized on characteristic and toxicological tests to identify the hazardous wastes category.

There is an additional point, i.e. to define the acute and/or chronic properties through toxicological test (article 7 point 4).

Article 7 point 2 of the former PP explains that "the wastes list having code D220, D221, D222, and D223 can be stated as hazardous wastes after **having Toxicity Characteristic Leaching Procedure (TCLP) and/or characteristic test". I**n the amended PP it was moved to article 7 point 5 and changed to **"………………………….. having characteristic test and/or toxicological test".**

Article 8 was totally changed as follows:

- Point 1: "The wastes produced by the activities which are not mentioned in annex 1 (table no. 2 of this PP) is belong to hazardous waste category" if it had been proven that it is in accordance with the article no. 7 point 3 and/or point 4,
- Point 2: "The hazardous wastes produced by the activities mentioned in annex 1 (table no. 2) can be taken out from the list (by the responsible institution) if it can be scientifically proven that it's not belong to hazardous waste category based on the procedure determined by the responsible institution in coordination with the technical institution, research institute, and wastes producers".
- Point 3: Scientifically proven mentioned in point 2 should be based on:
  - hazardous wastes characteristic test
  - toxicology test, or
  - study results which state that no pollution and health hazard to human as well as to other living organisms effected by the waste.
- Point 4: "Further provisions as mentioned in the point 1 and 3 will be determined by the responsible institution after coordination with the technical institution and related research institute".

3. **PP no. 74/2001: Hazardous materials management**

This Government Regulation (or PP) was established in 2001, consists of 15 (fifteen) chapters and 43 (forty three) articles.

Chapter I is about general provisions, containing definitions (article 1), and the objective of the regulation (article 2).

Chapter VI contains about accident mitigation and emergency situation. Article 24 explains that in case of accident or emergency situation caused by the hazardous materials, each person who involves in hazardous materials management activities have an obligations to do mitigation. Article 25 discusses the efforts that should be done related to the article 24, i.e.:

a. Isolating the location of accident
b. Doing mitigation according to the relevant Standard Procedure
c. Doing report to the local government officials,
d. Giving information and aids, and evacuating the peoples around the location of accident

Article 26 contains the obligations of the local government officials after receiving the report due to article 25 mentioned above, i.e. making the required mitigation steps. Article 27 mentions the obligations of each person who involve in hazardous substances management activities (in case of accident), to:

a. give financial compensation and/or
b. recover the spoiled or contaminated sites

The other chapters and articles explain about classification of the hazardous materials, administration and management, commission, work safety and health, accident mitigation and emergency condition, monitoring and reports, monitoring and reporting, other administrative steps, etc.

Consider to PP no. 18/1999, the article no. 2 of chapter 1 explains the objective of the hazardous wastes management, namely **to prevent and to solve the hazardous wastes pollution and/or environmental deterioration** caused by these kind of wastes, and to perform remediation efforts of the contaminated sites. Moreover, chapter 3 indicates the responsibility and obligations of each party of the management, and in the mean while chapter 4 mentions the activities procedures of each party, including the treatment procedure, and their obligations.

The article no. 2 of PP no. 74/2001 mentions the objective of the hazardous materials management, namely **"To prevent and/or to minimize the hazardous materials impact risks to the environment, human health, and to other living organisms".**

All discussed items have the objective to avoid accident which may cause negative impact to the environment, human health, and other living organisms. In case of a serious accident related to the hazardous wastes handling is happened and may cause pollution and deterioration to the environment (such as open stream, soil, and groundwater), it can be traced which party has the responsible, and then performing remediation efforts.

Those three regulations are not explicitly mentioned but, **implicitly included** the soil and groundwater pollution prevention issues because soil and groundwater is part of the possible contaminated site.

MINISTRY OF ENVIRONMENT DECREE (KEPMEN LH)

The Ministry of Environment Decree (or KepmenLH in Indonesian abbreviation) is derivative product of Government Regulation (PP) or technical implementation regulation. Actually there are many KepmenLHs related to the environmental issues and aspects such as on water quality and effluent standard, air pollution prevention and air quality standard, etc. But, there are only two Decrees (KepmenLHs), that directly related to the prevention of soils pollution, and indirectly related to the groundwater pollution prevention, namely:

a. KepmenLH no.128/2003
b. KepmenLH no. 33/2009

1. Kepmen LH no. 128/2003. "The procedures and technical requirements of the biological treatment for petroleum oil and petroleum oil contaminated soils"

This KepmenLH was issued in 2003 consists of 6 (six) articles and 2 (two) Annexes, and containing the procedures and technical requirements of:

a. petroleum oil wastes biological treatment
b. bioremediation of petroleum oil contaminated soils

The basic considerations of the establishment of this Decree were:

a. The petroleum oil wastes produced by oil, gas, and geothermal production activities or by other industrial activities, are belong to the hazardous waste category. This kind of waste is potential to create pollutions and/or environmental decays. So, this kind of pollutant has to be managed firmly.
b. One of the method that can be applied in petroleum oil wastes and petroleum oil wastes contaminated soil treatment is biological process
c. The hazardous wastes management had technically been regulated in 1995 concerning the technical requirements on hazardous wastes treatment, so that the treatment of petroleum oil wastes and petroleum oil contaminated soils need to be regulated separately.

Article 1 contains the definition of petroleum oil waste, petroleum oil, petroleum oil wastes treatment, and petroleum oil contaminated soils/locations.

Article 2 explains the obligation of each petroleum oil wastes producers to perform waste treatment which can be done biologically such as land farming, bio-pile, and composting. This article contains also the procedures and technical requirements of petroleum oil wastes and petroleum oil wastes contaminated soils biological treatment as figured out in annex 2.

Article 3, 4, 5, and 6 contains the administrative provisions of those mentioned activities.

Annex 1 contains permit requesting form of petroleum oil and petroleum oil contaminated soils biological treatment, consisting some information on the requestor (company) and proposed biological treatment, and list of documents which are provided by the requestor.

Annex 2 contains the detail procedure and technical requirements on petroleum oil wastes treatment and petroleum oil wastes contaminated soils bio-remediation. The technical requirements of treatment are related to the oil waste sources, wastes analysis, concentration of pollution components such as Total Petroleum Hydrocarbon (TPH), method of analysis, treatment location, treatment facilities, treatment process, etc. The maximum TPH concentration to be treated is decided at 15 mg/l. This annex contains also the treatment procedures consisted of treatment process and treatment performance evaluation. The parameters to be analyzed during the treatment process, the kinds of analysis, criteria of final treatment product, usage of the final product, and process monitoring & supervising are included in this Annex.

2. KepmenLH no. 33/2009. "The procedures on hazardous materials contaminated sites recovery efforts"

This KepmenLH was issued in 2009 containing the procedure on remediation of hazardous wastes contaminated soils, and based on following consideration:

a. The poured out, leakages, or direct disposal of hazardous wastes into soils or land space is potentially create environmental pollution and/or decays. So that, the remediation efforts on the hazardous wastes contaminated soil or locations should be done
b. Based on the first consideration mentioned above, and to execute the articles no. 3 and 58 of the PP no. 18/1999 concerning the hazardous wastes management, a regulation on procedure of hazardous materials contaminated soils or land sites has to be established.

This KepmenLH consists of 13 (thirteen) articles and 5 (five) Annexes. Article 1 mentions the definitions. Article 2 contains the objective of this regulation, namely "Guidance to the responsible of the hazardous wastes contaminated sites recovery efforts or activities".

Article 3 contains the obligation of the polluters to do recovery efforts on the contaminated sites. Article 4 mentions the contaminated site recovery activities (planning, execution, evaluation, and monitoring). Article 5 defines that the execution plan is included site recovery and contaminated soils remediation plans. Article 6 discusses about the scope of the recovery execution activities, i.e. survey, sampling point determination, and recovery activities according to the procedures mentioned in Annex 1, 2, and 3 respectively. The other articles explains evaluation procedure, reporting obligation, supervising and monitoring, and administrative issues. Annex 4 contains standard references of remediation goals (based on reference points, land-use standard approach, or *risk based screening level – RBSL)*, and annex 5 about letter of contaminated sites remediation status.

These two regulations (KepmenLHs) seem similar because the petroleum oil wastes are belong to hazardous wastes, but in fact the first one (KepmenLH no. 128/2003) is more specific for petroleum oil pollution, and the second (KepmenLH no. 33/2009) is more general for hazardous wastes. Differ to those 3 (three) PP mentioned formerly, these 2 (two) KepmenLHs explicitly mentions the contaminated soils/site remediation.

In the field practices, the maximum 15 % TPH content requirement to perform bio-remediation for petroleum oil wastes as well as for petroleum oil contaminated soils has induced to enlarge the volume of contaminated soils. The executors tend to decrease the higher TPH concentration by blending with uncontaminated (clean) soils. Bench scale study on oil recovery of oil sludge and its bioremediation had successfully decreased the TPH content from 32% to less than 3% within 30 days using a slurry reactor and the addition of bio-emulsifier.

The requirement level of TPH concentration in the final treatment goal mentioned in the regulations, i.e. less than 1 mg/l make the efforts on bioremediation very costly, because at low TPH concentration the biodegradation rate of petroleum oil is very low. In case of the contaminated sites land use are not for residential, agricultural, or farming areas, the most economic treatment goal is based on *Risk Based Screening Level* (RBSL). But, at moment we are not able to do so due to our limited facilities.

CLOSING REMARK

By the way, there are no regulations in Indonesia concerning the pollution prevention of groundwater. As the groundwater is one of the important water source for human needs, especially at present and coming situations where the water sources is becoming limited and in other side the demand increases rapidly however, an effort to protect this water source against pollution is definitely required. So, it needs regulations in various aspects to ensure the groundwater source protection. Frankly speaking, we don’t have experience in establishing such regulations on pollution prevention of groundwater. We hope that by joining this Working Group we can learn a lot to do so.

INDONESIAN REGULATIONS RELATED TO THE PREVENTION OF SOIL AND GROUNDWATER POLLUTIONS

ReSAGPAC Working Group Meeting

November 28 – December 1, 2011

HIRARCHIE OF REGULATIONS IN INDONESIA

STATE LAW or ACT (UU)

GOVERNMENT REGULATION (PP)

MINISTRY DECREE (KEPMEN) or MINISTRY REGULATION (PERMEN)

LOCAL GOVERNMENTS REGULATION
PROVINCE LEVEL
REGENCY LEVEL

GOVERNMENT REGULATIONS (PPs)

- Government Regulations (PP) are derivative or implementation products of Act on particular domain of Ministry
- To be proposed and drafted by the particular Ministry, and signed by the President of the Republic
- Sanctions are mentioned in PP (included criminal sanctions)

MINISTRY DECREE (KEPMEN) or MINISTRY REGULATION (PERMEN)

- Ministry Decree (KEPMEN) or Ministry Regulation (PERMEN) are derivative or implementation products of PP on particular issues
- Contains procedures and guidance on implementations of PP
- Proposed and drafted by related sections or fields of the particular Ministry
- Signed by the particular Minister

ENVIRONMENTAL BUREAUCRACY LEVEL

CENTRAL GOVERNMENT

PRESIDENT

↓

MINISTRY OF ENVIRONMENT

↓

LOCAL GOVERNMENTS

PROVINCE S – BPLHD*

↓

REGENCIES – BLH**

*BPLHD = Province Environmental Management Agency
**BLH = Regency Environmental Bureau

INDONESIAN ENVIRONMENTAL LAWS (ACTs)

- The first Indonesian environmental law was launched in 1982 (UU no. 4/1982) **"Environmental Management Act"**
- Renewed in 1997 (UU no. 23/1997) with the same name
- Second renewal was issued in 2009 (UU no.85/2009) also with the same name

INDONESIAN ENVIRONMENTAL REGULATIONS

Which are indirectly related to the prevention of soils and groundwater pollution:

1. PP (Government Regulation) no. 18/1999
2. PP (Government Regulation) no. 85/1999
3. PP (Government Regulation) no. 74/2001
4. Kepmen LH (Minister of Environment Decree) no. 128/2003
5. Permen LH (Minister of Environment Regulation) no. 33/2009

PP (Govt. Regulation) no. 18/1999

- Issued in 1999, concerns on **Hazardous wastes Management (HWM)**
- Consists of 8 (eight) chapters and 66 (sixty six) articles

  Chapter 1: definitions, objective, and efforts
- Chapter 2: consists of 3 (three) articles contains about identifications of hazardous wastes, Toxicity Characteristic Leaching Procedure (TCLP), characteristic (explosive, reactive, corrosive, etc), and the Toxicological (LD50) tests. The detailed hazardous material is enclosed in the list.
- Chapter 3: about HWM executors, consists of 6 (six) parts and 18 (eighteen articles)

This chapter contains the responsibility and obligation of the producers, collectors, transporters, users who can take the advantage, treatment executors, and heapers/depositors of the hazardous wastes

- **Chapter 4:** about HWM activities, consists of 8 (eight) parts and 13 (thirteen) articles.

This chapter explains the procedures of reducing, packaging, keeping, collecting, transporting, taking the advantage, treating, and heaping the hazardous wastes, including the quality requirements and the executor obligations

- **Chapter 5:** about Administrative procedure, including permit requirement

Chapter 6: Sanctions

Chapter 7: Transition provision (1 year after validation)

- **Chapter 8:** Closing provision

PP no. 85/1999 (Amendment of PP no. 18/199)

The amendment done mainly on chapter 2 (articles no. 6, 7, and 8):

- Article no. 6: *"The hazardous wastes can be identified according to the sources and/or characteristic and/or toxicological tests"*, **instead of** "*The hazardous wastes can be identified according to the source and its characteristic* " (former PP)

The point is emphasized on characteristic and toxicological tests to identify the hazardous wastes category

Article 7:
An additional point of article 7, i.e. to define the acute and/or chronic properties through toxicological test (point 4).

Point 5 explains that "the wastes list having code D220, D221, D222, and D223 can be stated as hazardous wastes after **having characteristic test and/or toxicological test".**
The amendment is emphasized on replacing the **TCLP test** by **toxicological test**.

- Article 8 is totally changed.
Point 1: "The wastes product which are not mentioned in annex 1 (table no. 2) is belong to hazardous waste category" if it had been proven that it is in accordance with the article 7 point 3 and/or point 4,

Point 2: "The wastes product mentioned in annex 1 (table no. 2) can be taken out from the list (by the responsible institution) if it can be scientifically proven that it's not belong to hazardous waste category based on the procedure determined by the responsible institution in coordination with the technical institution, research institute, and wastes producers".

Point 3: Scientifically proven mentioned in point 2 should be based on hazardous wastes characteristic test, toxicology test, or study results which state that no pollution and health hazard to human as well as to other living organisms effected by the waste.

Point 4: "Further provisions as mentioned in the point 1 and 3 will be determined by the responsible institution after coordination with the technical institution and related research institute".

PP no. 74/2001
Hazardous Materials Management

Established in 2001, consists of 15 chapters and 43 articles

Chapter 1: general provisions, containing definitions (article 1), objective of the regulation (article 2), and the Hazardous Substances which are not included in this PP such as radioactive, explosive, and mining product materials (article 3).

Chapter 2: Hazardous Materials (HM) classification (explosive, oxidizing, flammable, toxic, harmful, corrosive, irritant, dangerous to the environment, carcinogenic, teratogenic, and mutagenic.

Able to be used, prohibited to be used, and limited used HM as mentioned in the annex.

Chapter 3: HM Administrative and Management (15 articles)

Chapter 4: HM Commission (1 article)

Chapter 5: Safety and Health (2 articles)

Chapter 6: Accident mitigation and emergency situation (4 articles).

Article 24: In case of accident or emergency situation caused by the HM, each person who involves in HM management activities have obligations to do mitigation.

Article 25: The efforts that should be done related to the article 24, i.e isolation of accident location, to do mitigation according to the relevant Standard Procedure, doing report to the local government officials, giving information and aids, and evacuating the peoples around the location of accident

Chapter 7: Monitoring and report (4 articles)

Chapter 8: Public Awareness Development (3 articles)

Chapter 9: Open information and public role (2 articles)

Chapter 10: Finance (1 article) → central and local government budgets

Chapter 11: Administrative sanctions (1 article)

Chapter 12: Compensations (1article)

Chapter 13: Criminal provisions (1article)

Chapter 14: Transition provision (2 articles)

Chapter 15: Closing provision → validity of this PP is 6 months after announcement

Kepmen LH (Minister of Environment Decree) no. 128/2003

- Issued in 2003, concern on "the procedures and technical requirements of the biological treatment for petroleum oil and petroleum oil contaminated soils"
- Consists of (six) articles and 2 (two) Annexes
- **Article 1** contains the definition of petroleum oil waste, petroleum oil, petroleum oil wastes treatment and petroleum oil contaminated soils/locations.
- **Article 2** explains that:
  a. each effort or activity in the domains of oil, geothermal, and others which produces petroleum oil waste **should** perform waste treatment

b. the petroleum oil waste treatment can be done by biological method as an alternative of treatment technology, i.e. land farming, bio-pile and composting

c. the procedures and technical requirements of petroleum oil wastes and petroleum oil wastes contaminated soils biological treatment as depicted in annex 2 consists of:

- management technical requirement
- treatment process analysis
- end treatment product criteria
- treatment product handling
- treatment product monitoring and controlling

- **Article 3, 4, 5**, and **6** contains the administrative provisions of those mentioned activities.
- **Annex 1** contains a permit requesting form of petroleum oil wastes and petroleum oil contaminated soils biological treatment, consisting some information on the requestor (company) and proposed biological treatment, and list of documents that should be provided by the requestor.
- **Annex 2** contains the detail procedure and technical requirements on petroleum oil wastes treatment and petroleum oil wastes contaminated soils bioremedi-ation. The technical requirements of treatment are related to the oil waste sources, wastes analysis, concentration of pollution components such as Total Petroleum Hydrocarbon (TPH), method of analysis, treatment location, treatment facilities, treatment process, etc.

The maximum TPH concentration to be treated is 15 mg/l.

This annex contains also the treatment procedures consisted of treatment process and treatment performance evaluation.

The parameters to be analyzed during the treatment process, the kinds of analysis, concentration of final treatment product, usage of the final product, and process monitoring & supervising are included in this annex.

End treatment concentration requirements

Parameter	Unit	Values
pH	-	6 – 9
TPH	mg/g	10,000
Benzene	mg/g	1
Toluene	mg/g	10
Ethyl-benzene	mg/g	10
Xylene	mg/g	10
Total PAH	mg/g	10
Pb	mg/l	5
As	mg/l	5
Ba	mg/l	150
Cd	mg/l	1
Cr	mg/l	5
Cu	mg/l	10
Hg	mg/l	0.2
Se	mg/l	1
Zn	mg/l	50

In-situ bioremediation of petroleum oil contaminated soils at Babelan – West Java

A petroleum oil exploration well was blown out in 2003 at this site

- The contaminated soil TPH concentration was > 15 mg/l
- To reduce the TPH concentration, the contaminated soils were blended with clean soils taken from the ounding

 increasing the volume of contaminated soils and enlarging the spoiled site

- Bioremediation process was ended when TPH concentration decreased up to < 1%. It was achieved after 150

RESEARCH ON BIOREMEDIATION OF PETROLEUM OIL SLUDGE USING BIO-EMULSIFIER

- Laboratory scale research,
- Using bio-emulsifier produced by *Azotobacter sp GNC 01*.
- The oil sludge was taken from Balongan Oil Refinery
- TPH original concentration of oil sludge > 32 mg/l
- 24 hours washing phase, and 29 days bioremediation using petroleum oil degrading bacteria consortia

Done in a slurry reactor. The reactor is provided with a helical screw impeller to mix the oil sludge and emulsifier for performing a slurry system

RESULTS

TIME (days)	TPH CONCENTRATION (%)		
	USING BIO-EMULSIFIER	USING TWEEN 80	CONTROL
Soil washing:			
0	**32**	**32**	**32**
1	**20.20**	**24.00**	**29.40**
Removal efficiency (%)	36.90	29.00	9.10 %
Bioremediation			
1	**20.20**	**24.00**	**29.40**
3	**15.84**	**19.70**	**27.04**
6	**12.10**	**16.45**	**26.40**
14	**9.60**	**12.58**	**24.20**
20	**4.05**	**9.84**	**21.77**
29	**2.96**	**6.66**	**17.31**
Removal efficiency %	**85.30**	**72.30**	**41.10**
Total efficiency (%)	**90.80**	**79.20**	**45.90**

Permen LH (Minister of Environment Regulation) no. 33/2009

- Issued in 2009, concerned about "the procedures of hazardous wastes contaminated site"
- Consists of 13 articles, and 5 annexes
- **Article 1** contains the definition of hazardous wastes (HW), HW contaminated site, recovery, level of success on recovery program, etc.
- **Article 2** contains the objective of this regulation, i.e. as a guidance for relevant responsible people on the execution of HW contaminated site recovery
- **Article 3** mentions the obligations of polluter (responsible) to recover the contaminated site

Article 4 explains the recovery activities, i.e. design, execution, evaluation, and monitoring

‰ **Article 5** contains about design activities:
1. Design activities consist of HW contaminated site recovery execution and soil treatment designs
2. The designs should be submitted to the Minister of Environment (comply with annex 3) for getting permit

‰ **Article 6** mentions the recovery execution activities, i.e. contaminated site survey (according to annex 1), defining the sampling points (comply with annex 2), and site recovery practices (comply with annex 3).

‰ **Article 7** consists of 2 points:
1. The contaminated site will be declared that it is clean after evaluation on recovery success level
2. The recovery success level is defined according to

‰ **Article 8** explains that the responsible should make report to the Minister of environment and make cc to Governor and Regent/Mayor

‰ **Article 9** mentions the evaluation activities done by the Minister of environment. If the evaluation result have been in accord with this regulation, the Minister will issue a letter of status on contaminated site recovery completion (SSPLT) which will not release the polluter from law responsibility

‰ **Article 10** contains the obligation of the responsible who have received the SSPLT to do monitoring at least once in 6 months within one year. The monitoring results should be reported to the Minister, and cc to the Governor and Regent/Mayor

‰ **Article 11** mentions that contaminated soil treatment should be done in accordance with the HW management

Article 12 mentions that control on execution of HW contaminated site recovery is done by:

a. The Minister of environment if the site is located at two provinces area, or at the cross border of countries
b. The Governor if it is situated at two or more regencies/cities area
c. The Regent/Mayor if it is located in the regency/city area

- **Article 13** states the date of validity of this regulation, namely at the date of defined
- **Annex 1** contains about survey phases, i.e. preliminary, complete, and validity field surveys
- **Annex 2 :** about defining the sampling point locations (monitoring and reference points)
- **Annex 3** ……

- **Annex 3:** HM contaminated sites recovery activities, i.e.:
  - Contaminated sites mapping
  - Contaminated area isolation
  - Announcement board installment
  - Tests sampling
  - Contaminated soils excavation and transport, or other alternatives
  - Contaminated site recovery phase
  - Monitoring
  - Backfilling
- **Annex 4** contains about reference standards for level of success evaluation :
  - Reference points
  - Land used standard approach
  - Risk Based Screening Level

CLOSING POINT

- There are no regulations concerning the pollution prevention of groundwater in Indonesia
- As the water sources is becoming limited and in other side the demand increases rapidly, groundwater is becoming an important water source for human needs. Prevention regulations on groundwater sources against pollution is extremely required.

THANK YOU
FOR
YOUR ATTENTION

ReSAGPAC Working Group Meeting
November 28 – December 1, 2011

In-situ bioremediation of petroleum oil contaminated soils at Babelan – West Java

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- The contaminated soil TPH concentration was > 15 mg/l
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  increasing the volume of contaminated soils and enlarging the spoiled site
- bioremediation process was ended when TPH concentration decreased up to < 1%. It was achieved after 150 days of process

VIETNAM'S REGULATION ON MANAGEMENT OF THE SOIL AND UNDERGROUND WATER POLLUTION

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Vietnam Environment Administration
Ministry of Natural Resources and Environment

Foreword

Soil and underground water plays an important role in social and economic development, life of the human and ecosystems. The soil as filters; it provides necessary nutriments and water for growth and development of flora, habitats for different organisms and decomposition of the materials. Soil store and adsorb likely the energy sources; and provides platform for human and other animals. Underground water is unreplacement resources for human consumption.

Along with water and air environment, soil pollution and underground water also became interesting issues not only for each country but also for the entire world, including Vietnam. In recent decades, soil and underground water pollution not only directly affected to human health, activities of agriculture production, quality of agriculture products… but also indirectly affected to the health of human and animals through the kinds of vegetables, bulbs, fruits and other foods.

Causes of soil pollution mostly due to:

- Fertilizers, pesticides and chemicals, which be used, storaged for production activities, their 's waste;
- Kinds of waste generated by production activities;
- Along with water and air, soil also be polluted by condensation of toxic substances in atmosphere as dust, SO, NO…

From understanding of important role of soil as well as negative effects of soil environment pollution on social and economic development, life of the human and ecosystems, in the early 1980s, great number of legal documents related to environment protection, including soil promulgated by the State and Government of Vietnam. Wastes, chemicals and other substances also managed and controlled through promulgating legal documents, they are orientations, laws and sub-law documents. The following are status of those documents.

1. Status of current legal documents on soil environment and underground water management

In general, along with water and air environment, soil environment also is protected by different aspects, from the prohibition of waste discharge; management and treatment of wastes, wastewater, discharge sources; safety management and effective use of chemicals, pre-chemicals, fertilizers and pesticides, etc… up to development and promulgation of guidelines on environment impact assessment, national technical regulations on allowable limit of heavy metals, and residue of pesticides in soil. Based on review of the content of current legal documents, laws and sub law documents, management and protection of soil environment, it can briefly describe in each managed aspect as follow:

1.1. Management and treatmnent of solid and hazardous wastes

Strategic orientation on sustainable development of Viet Nam provided many priority activities, which need to be implemented;
National strategy of environment protection to 2010 and Orientation up to 2020 required on enhancement of capacity and efficiency of environment management activities through the variety solutions;
National plan on Environment Pollution Control to 2020, provided 04 main tasks: mechanism of wastes management; infrastructure to serve collection and treatment of wastes; database of discharge sources, types and amount of waste;
Direction No. 23/2005/CT-TTg of Prime Minister of the Government, provided requests for management of solid wastes at the urban areas and industrial zones,
National plan of Stockholm Conventions performance, setup 08 mandates which should have implemented for safe management of chemicals; reduction, replacement and removement of persistent organic pollutants
Law of environment protection (Item No. 2 – Chapter 8) includes the regulations on hazardous wastes management; non-hazardous solid waste management.
Law of Land stipulates for economical and efficient use of land, reasonable exploitation of natural resources (include land resource), and environmental protection
In this field, beside regulations in orientation documents and laws, there are still main sub-law documents.

1.2. Management and treatment of wastewater

In wastewater, Law on Environment Protection stipulates many articles related to the management of the waste water directly or indirectly.

- For collection and treatment of wastewaters (Article No. 81)
- For the system of wastewater treatment (Article No. 81):

1.3. Safety management of chemicals and pre-chemicals

In the management of chemicals and pre-chemicals, besides the regulations, which mentioned in Resolution No. 41-NQ/TW dated 15/11/2004 of Ministry of Politics; and at Article 88 of Law of environment protection, Law of chemical and relevant documents also developed and promulgated to support for management of chemicals and pre-chemical. Specifically:

Law of chemical, in environment protection, including soil environment, law of chemical stipulates:

- For prohibited actions:
- For planning of chemical industry:
- For the requests on chemical production and business:
- Requests on infrastructure and technique in chemical production and business:
- Transportation of hazardous chemicals:
- Storage and preservation of hazardous chemicals in chemical production and business.

There are still other sub-law documents related to management of chemicals.

1.4. Management and effective use of fertilizers and pesticides

Similarly as types of chemical and wastes, the fertilizers and pesticides also closely managed. The following is those legal documents.

Directives No. 29/1998/CT-TTg date 25/08/1998 of Prime Minister of the Government, regulate the actions are prohibited; and many actions need to be complianced strictly.

Law of environment protection (Article 46) stipulates on environment protection in agricultural production

Decree-law on flora quarantine, regulates the safety for the human health and ecological environment when using pesticides

There are still other sub-law documents.

1.5. Environment protection in urban areas, industrial zones and trade villages

In urban areas, industrial zones and trade villages, soil environment protected under regulations in legal documents as follow:

Directives No. 36-CT/TW of Politbureau

National strategy of environment protection to 2010 and Orientation up to 2020

Resolution No. 41-NQ/TW date 15/11/2004 of Politbureau

Directives No. 23/2005/CT-TTg of the Prime Minister of the Government

Law of environment protection stipulates as follows:

- For environment protection in economic zones, industrial zones, processing and export zones, high technology areas, industrial production groups, tourism and entertainment areas;
- Environment protection in the trade villages;
- Environment protection in urban and resident areas;

1.6. Management and treatment of discharge sources and serious polluted enterprises

Directives No. 17/2008/CT-TTg date 06/05/2008 of the Prime Minister of the Government provided some exigent measures to promote the thorough treatment for the enterprises, which caused serious environment pollution according to Decision No. 64/2003/QĐ-TTg of the Prime Minister of the Government.

To support and guide implementing the orientation documents above, sub-law documents developed and promulgated.

1.7. Land use planning

To support for soil environment protection, prevention of soil degradation and effective and saving use of soil resource, suitable land use plan is very necessary. The following are main relevant documents.

Directive No. 36-CT/TW by the Politburo asked: apply the economic measures and laws needed to quickly increase the rate of forest cover, strictly implement the order of closing of natural forests, forest protection with the resettlement and cultivation; provide employment and adequate food supply for people in the forest and quickly stop the uncontrolled mining of waste sources, destroying forests, soil degradation and environment pollution.

National Environment Protection Strategy until 2010 and orientation to the 2020 sets out the tasks include the rational exploitation, effective and sustainable use of land resources

Strategic Orientation for Sustainable Development in Vietnam provided 05 objectives and 03 fields, which should have prioritized in prevention of soil degradation, effective and sustainable use of soil resource;

The Law of land stipulates many articles related to land use planning and plans and preserve the soil quality. The firstly content of land use planning is surveys, researches of land use situation, assessment of land potentials; and the fifth content of land use planning is determination of method for using, protecting, rehabilitating land and protecting the environment.

1.8. Environment impact assessment and national technical regulations

For standards of soil environment: there were two national technical regulations issued, namely:

- QCVN 03:2008/BTNMT: National technical regulation on the allowable limits of heavy metals in the soils; and
- QCVN 15:2008/BTNMT: National technical regulation on the pesticide residues in the soils.

For environment impact assessment: along with general guideline on structure and contents of reports on environment impact assessment and engagements on environment protection, at Chapter 3 from Article 14 to 27 of Law on environment protection also provided the clear and specific stipulates for each subject.

1.9. Under ground water regulation

Law on water resources management (1998) regulates the protection measures of underground water and responsibility of the stakeholders for implementation.

Under this Law, many regulation has been promulgated and implemented such as:

- Decree 179/1999/ND-CP by the Government on implementation of Water Resources Management Law
- Decree 34/2005/ND-CP by the Government on sanctioning administrative violations in environment protection;
- Decree 149/2004/ND-CP by the Government on permitting of the investigation, exploitation and use of the water resources and discharge;
- Decision 05/2003/QD-BTNMT by MONRE regulates on permitting of investigation, exploitation of the underground water;

2. The issues in soil environment and underground water management

Based on the results of review of orientation documents, laws and sub-law documents related to management and protection of soil environment and underground water, there are still some issues in the field of soil management. The following are the achievements and shortcomings in soil environment management and soil pollution control.

2.1. Achievements in soil environment and protection

In legislation system of Vietnam, many legal documents, which related to protecting and managing soil environment promulgated. Soil environment protected by different tools and aspects, specific as:

2.1.1. Main regulatory tools

Many regulatory tools have been developed and promulgated, include Directions, Circulars, Laws, Strategies, Plans, Decisions, Guideline, etc, with regulations focused on soil environment and underground water management

2.1.2. Economic tools

Along with the regulatory tool, soil environment and underground water also protected based on the economic tools. Presently, in the system of legal documents of Vietnam, there were many sub-law documents on taxation and types of fee which promulgated by the Government, relevant ministries, ministry-level agencies and PPCs

2.2. The shortcomings in management and protection of soil environment and underground water management

2.2.1. Lack of specific terms on soil environment management in current legal documents and laws of Vietnam
2.2.2. There are no specific terms on management of soil types degraded and underground water polluted by natural impacts in legal documents
2.2.3. There is no "the Orientation of soil environment and underground water management" in Vietnam
2.2.4. The concern on these 2 issues by the stakeholders are not adequate, so the resources allocation is very limited; Up to now, there is no map or database for soil pollution and underground water reduction and degradation in Vietnam;
2.2.5. The implementation of the regulation is really weakness in Vietnam

3. Conclusion

For improvement of the soil environment and underground water management, futher trend and actions need to be considered:

3.1. Completion of the regulation system by revision, amendment and adding the specific documents on soil pollution prevention; blocking and remediation of the polluted sites; specific documents on underground water pollution by both natural and artificial causes.
Completion of national regulations and standards on soils and underground water quality, sampling, stograge and analysis.

3.2. Capacity building for the soil envinronment and underground water management, includes,but not limited to:

- Labs and equipments.
- Human resources
- Financial supports
- Technical supports: inventory and clasification methodology; mapping; database building and operation…

3.3. The National Action Plan for Soil and Underground Water should be developed for focusing and centralizing of the resources, with time line, budget distribution and organizations in charged.

3.4. Awareness raising at all levels on the causes, effects (long-term and short term) and the cost of the damages by soil pollution and underground degradation. Then, it would head to the change of behavious.

Annex 1: Under Law regulation on hazardous waste, solid waste and waste water management

- Circular letter No. 12/2006/TT-BTNMT, dated Dec. 12nd, 2006 of MONRE on guiding the condition of professional practice and procedure of record, registration, authorization of professional practice, code of hazardous waste management;
- Inter-ministerial Circular No. 02/2007/TTLT-BTC-BTNMT, dated Aug. 30, 2007 of Ministry of Industry and Trade and Ministry of Natural Resource and Environment that guides to execute Article 43 of Law on Environment Protection about business standard and terms of waste import.
- Decree 174/2007/NDD-CP, dated Nov. 29th, 2007 of Government that provides stipulations on environment protection fee of solid waste.
- Decision No. 12/2006/QĐ-BTNMT, dated Sep. 08th, 2006 of Minister of Ministry of Natural Resource and Environment approved the importing list of allowable waste as producing materials.
- Circular No. 04/2008/TT-BCT, dated Apr. 01st, 2008 that provides guideline on registration of production, processing, materials import, and gasoline products consumption.
- Decision No. 23/2006/QD-BTNMT, dated Dec. 26th, 2006 of Minister of Ministry of Natural Resource and Environment that provides the list of hazardous wastes.
- Decision No. 130/2006/QD-BTNMT, dated Dec. 31st, 2008 of Minister of Ministry of Natural Resource and Environment that provides statutes of hazardous substances residue control in animal and animal-marine products
- Decree No. 81/2006/ND-CP dated August 9th 2006 of the Government on sanctioning the administrative violations in environment protection.
- Decree No. 67/2003/ND-CP dated June 13th 2003 of the Government on environment protection fees for wastewater.
- Decree No. 04/2007/ND-CP dated January 8th 2007 of the Government on amending and supplementing some articles of Decree No. 7/2003/ND-CP dated June 13th 2003 of Government on environment protection fees for waste water.
- Circular No. 125/2003/TTLT-BTC-BTNMT dated December 18th 2003 of the Ministry of Finance and Ministry of Natural Resources and Environment guiding the implementation of Decree 67/2003/ND-CP dated June 6th 2003 of the Government on environment protection fees for waste water.

Annex 2: Under Law regulation on chemicals management

Circular No. 01/2006/TT-BCN on / 04/2006 of the Ministry of Industry guiding the management of export and import of chemicals and chemical products are toxic, drug precursor chemicals under technical standards of professional management as the Ministry of Industry.

- Circular No. 12/2006/TT-BCN, dated 22/12/2006 by the Ministry of Industry guiding the implementation of Decree No. 68/2005/ND-CP dated 20/5/2005 of the Government on chemical safety.
- Circular No. 10/2006/TT-BCN, dated 01/12/2006 by the Ministry of Industry on the amendment, Clause 3, Section II of the circular No. 01/2006/TT-BCN, dated 04/11/2006 on the management of chemical import and export subject to specialized management by the Ministry of Industry.
- Decision No. 34/2008/QD-BCT dated 01/10/2008 by the Ministry of Industry and Commerce approved the project on strengthening the management and control of precursors to 2010.
- Decision No. 40/2006/QD-BCN dated 01/12/2006 by the Ministry of Industry on the additional list of chemicals banned from export and import, issued together with Decision No. 05/2006/QD-BCN dated April 07th, 2006 by the Ministry of Industry announced the list of chemicals banned from export and import;
- Decision No. 41/2006/QD-BCN dated Dec. 1st, 2006 by the Ministry of Industry about amending Article 6, paragraph D of Article 8 on the management of precursors used in the industrial sector;
- Decision No. 10/2006/QD-BCN dated 14/04/2006 by the Ministry of Industry issuing the Regulation on the management of high concentrations of nitrate Amon;
- Decision No. 25/2005/QD-BNN dated May 18, 2005 by the Ministry of Agriculture and Rural Development on the releasing list of veterinary drugs for circulation, usage prohibition and restriction in Vietnam.
- Decision No. 26/2005/QD-BNNPTNT dated 18/05/2005 by the Ministry of Agriculture and Rural Development on the list of vaccines, biological products, microorganisms and chemicals used in veterinary allowed to circulate in Vietnam.
- Others

Annex 3: Under Law regulation on pesticides management

- Circular No. 09/2009/TT-BNN date 03/03/2009 of MOARD on promulgating the catalogue of unused pesticides in Vietnam
- Circular No. 17/2009/TT-BNN date 17/3/2009 of MOARD on promulgating the catalogue of fertilizes allowed in production, business and use in Vietnam
- Circular No. 20/2009/TT-BNN date 17/4/2009 on repairing and adding some the contents of Circular No. 09/2009/TT-BNN date 03/3/2009 of Ministry of Agriculture and Rural Development.
- Circular No. 32/2009/TT-BNNPTNT date 08/06/2009 on repairing and adding some the contents of Circular No. 09/2009/TT-BNN date 03/3/2009 of Ministry of Agriculture and Rural Development on promulgating the catalogue of used, limited and unused pesticides in Vietnam
- Circular No. 43/2009/TT-BNNPTNT date 14/07/2009 of MOARD on promulgating the catalogue of fertilizes which allowed in production, business and use in Vietnam
- Circular No. 62/2009/TT-BNNPTNT date 25/09/2009 of MOARD on promulgating the adding catalogue of fertilizes which allowed in production, business and use in Vietnam
- Circular No. 64/2009/TT-BNNPTNT date 07/10/2009 of MOARD on repairing and adding some the contents of Circular No. 09/2009/TT-BNN date 03/3/2009 of Ministry of Agriculture and Rural Development on promulgating the catalogue of used, limited and unused pesticides in Vietnam; and Circular No. 20/2009/TT-BNN date 17/4/2009 of MOARD.
- Decision No. 22/2005/QĐ-BNN date 22/04/2005 of MOARD on promulgating the catalogue of used, limited and unused pesticides in Vietnam
- Decision No. 21/2005/QĐ-BNN date 18/04/2005 of MOARD on adding some pesticides into the catalogue of used pesticides in Vietnam
- Decision No. 10/2007/QĐ-BNN date 06/02/2007 of MOARD promulgating the adding catalogue of fertilizes which allowed in production, business and use in Vietnam

- Decision No. 36/2007/QĐ-BNN date 24/04/2007 of MOARD promulgating the regulations on production, business and use of fertilizers
- Decision No. 100/2008/QĐ-BNN date 15/10/2008 of MOARD on promulgating the production process, business and use of fertilizers in Vietnam
- Decision No. 105/2008/QĐ-BNN date 22/10/2008 of MOARD on promulgating "List of fertilizer types which are allowed production, business and use in Vietnam
- Decision No. 130/2008/QĐ-BNN date 31/12/2008 of MOARD on promulgating the regulations on control for residue of toxic substances in the animals and aquaculture products
- Decision No. 05/2009/TT-BNN date 03/02/2009 of MOARD on adding some pesticides into catalogue of used pesticides in Vietnam
- Others

Annex 4: Under Law regulation on hotspots management

- Directive No. 08/CT-BCN dated July 10, 2007 on the application of cleaner production in industrial production facilities;
- Decree No. 61/1998/ND-CP dated August 15, 1998 by the Government on the audition, inspection of businesses;
- Decree 81/2006/ND-CP dated August 9, 2006 by the Government on sanctioning administrative violations in environment protection;
- Circular No. 07/2007/TT-BTNMT dated July 3, 2007 by the Ministry of Natural Resources and Environment guiding the classification and the lists of establishments causing environment pollution to be treated;
- Decision No. 64/QD-TTg dated April 22, 2003 by the Prime Minister approving the "Plan to thoroughly handle establishments causing serious environment pollution”
- Decision No. 10/2006/QD-BTNMT dated August 21, 2006 by the Minister of Natural Resources and Environment Ministry issued the regulation on the certification of establishments causing serious environment pollution which has been thoroughly treated in accordance with the Decision No. 64 / QD-TTg dated 22/04/2003.
- Others

NATIONAL TECHNICAL REGULATION ON THE ALLOWABLE LIMITS OF HEAVY METALS IN THE SOILS

1. General stipulations

1.1. Regulatory sphere

This technical regulation stipulates the limit of total content for some heavy metals, include as, Cd, Cu, Pb and Zn in the surface layer of soil according to use purpose. This regulation not applied to the types of soil in mining areas, landfill sites of industrial wastes, specific forestland, national parks, natural conservation areas, landscape areas, research forest areas.

1.2. Applied subjects

This regulation applied to management bodies of the state on environment, any organizations, individuals who related to land use overall country of Vietnam.

2. Technical regulations

The limits of total content for some heavy metals in the surface layer of soil stipulated in Table 1.

Table 1: The limits of total content for some heavy metals in the surface layer of soil

Unit: mg/kg of dry soil

No.	Parameter	Agriculture soil	Forest soil	Domestic soil	Commerce soil	Industry soil
1	As	12	12	12	12	12
2	Cd	2	2	5	5	10
3	Cu	50	70	70	100	100
4	Pb	70	100	120	200	300
5	Zn	200	200	200	300	300

3. Assessment method

3.1. Sampling

The soil samples collected to analysis and assess the content of heavy metals; they stipulated in Item 2 of this regulation according to TCVN 4046: 1985 – cultivation soil and TCVN 5297: 1995 – quality of soil.

3.2. Identification method

The heavy metals that stipulated in Item 2 of this regulation identified according to the method in TCVN 6649:2000 (ISO 11466:1995) and TCVN 6496:1999 (ISO 1 1047:1995).

4. Implementation organization

State agencies on environment management and organizations, individuals who related to land use with different purposes should have comply with this regulation.

NATIONAL TECHNICAL REGULATION ON THE PESTICIDE RESIDUES IN THE SOILS

1. General stipulations

1) Regulatory sphere: this regulation stipulates the allowable maximum limit of pesticide residues in surface layer of the soil. This regulation to use for controlling and assessing the rate of pollution, which cause by pesticides in the surface layer of soil
2) Applied subjects: this regulation applies for all the organizations and individuals who related to land use in the whole country

2. Technical regulation

Allowable maximum limit of pesticide residues in surface layer of the soil stipulated in table 1 as follow:

Table 1: Allowable maximum limit of pesticide residues in the soil

Unit: mg/kg dry soil

No.	Name of substance (chemical formula)	Name of commodity	Allowable maximum limit	Main use purpose
	Atrazine ($C_8H_{14}ClN_5$)	Atra 500 SC, Atranex 80 WP, Co-co 50 50 WP, Fezprim 500 FW, Gesaprim 80 WP/BHN, 500 FW/DD, Maizine 80 WP, Mizin 50 WP, 80 WP, Sanazine 500 SC	0.10	Clear of weeds
	Benthiocarb ($C_{16}H_{16}ClNOS$)	Saturn 50 EC, Saturn 6 H	0.10	Clear of weeds
	Cypermethrin	Antiborer 10 EC, Celcide 10 EC	0.10	Conservation of forest

No.	Name of substance (chemical formula)	Name of commodity	Allowable maximum limit	Main use purpose
	($C_{22}H_{19}Cl_2NO_3$)			procduts
	Cartap ($C_7H_{15}N_3O_2S_2$)	Alfatap 95 SP, Cardan 95 SP, Mapan 95 SP, 10 G, Padan 50 SP, 95 SP, 4G, 10 G, Vicarp 95 BHN, 4 H....	0.05	Clear of harmful insects
	Dalapon ($C_3H_4Cl_2O_2$)	Dipoxim 80 BHN, Vilapon 80 BTN	0.10	Clear of weeds
	Diazinon ($C_{12}H_{21}N_2O_3PS$)	Agrozinon 60 EC, Azinon 50 EC, Cazinon 10 H; 40ND; 50ND, Diazan 10 H; 40EC: 50 ND; 60 EC....	0.05	Clear of harmful insects
	Dimethoate ($C_5H_{12}NO_3SP_2$)	Dimethoate	0.05	Clear of harmful insects
	Fenobucarb ($C_{12}H_{17}NO_2$)	Anba 50 EC, Bassan 50 EC, Dibacide 50 EC, Forcin 50 EC, Pasha 50 EC...	0.05	Clear of harmful insects
	Fenoxaprop – ethyl ($C_{16}H_{12}ClNO_5$)	Whip'S 7.5 EW, 6.9 EC; Web 7.5 SC	0.10	Clear of weeds
	Fenvalerate	Cantocidin 20 EC, Encofenva 20 EC,	0.05	Clear of harmful

No.	Name of substance (chemical formula)	Name of commodity	Allowable maximum limit	Main use purpose
	($C_{25}H_{22}ClNO_3$)	Fantasy 20 EC, Pyvalerate 20 EC, Sumicidin 10 EC, 20 EC...		insects
	Isoprothiolane ($C_{12}H_{18}O_4S_2$)	Đạo ôn linh 40 EC, Caso one 40 EC, Fuan 40 EC, Fuji - One 40 EC, 40 WP, Fuzin 40 EC...	0.05	Clear of fungus
	Metolachlor ($C_{15}H_{22}ClNO_2$)	Dual 720 EC/ND, Dual Gold ®960 ND	0.10	Clear of weeds
	MPCA ($C_9H_9ClO_3$)	Agroxone 80 WP	0.10	Clear of weeds
	Pretilachlor ($C_{17}H_{26}ClNO_2$)	Acofit 300 EC, Sofit 300 EC/ND, Bigson-fit 300EC....	0.10	Clear of weeds
	Simazine ($C_7H_{12}ClN_5$)	Gesatop 80 WP/BHM, 500 FW/DD, Sipazine 80 WP, Visimaz 80 BTN...	0.10	Clear of weeds
	Trichlorfon ($C_4H_8Cl_3O_4P$)	Địch Bách Trùng 90 SP, Sunchlorfon 90 SP	0.05	Clear of harmful insects

No.	Name of substance (chemical formula)	Name of commodity	Allowable maximum limit	Main use purpose
	2,4-D($C_8H_6Cl_2O_3$)	A.K 720 DD, Amine 720 DD, Anco 720 DD, Cantosin 80 WP, Desormone 60 EC, 70 EC, Co Broad 80 WP, Sanaphen 600 SL, 720 SL.... 18 Aldrin (C12H8Cl6) Aldrex, Aldrite	0.10	Clear of weeds
	Aldrin ($C_{12}H_8Cl_6$)	Aldrex, Aldrite	0.01	Use prohibition
	Captan ($C_9H_8Cl_3NO_2S$)	Captane 75 WP, Merpan 75 WP...	0.01	Use prohibition
	Captafol ($C_{10}H_9Cl_4NO_2S$)	Difolatal 80 WP, Folcid 80 WP...	0.01	Use prohibition
	Chlordimeform ($C_{10}H_{13}CIN_2$)	Chlordimeform	0.01	Use prohibition
	Chlordane ($C_{10}H_6Cl_8$)	Chlorotox, Octachlor, Pentichlor	0.01	Use prohibition
	DDT ($C_{14}H_9Cl_5$)	Neocid, Pentachlorin , Chlorophenothane...	0.01	Use prohibition
	Dieldrin ($C_{12}H_8Cl_6O$)	Dieldrex, Dieldrite, Octalox,	0.01	Use prohibition
	Endosulfan ($C_9H_6Cl_6O_3S$)	Cyclodan 35EC, Endosol 35EC, Tigiodan 35ND,	0.01	Use prohibition

No.	Name of substance (chemical formula)	Name of commodity	Allowable maximum limit	Main use purpose
		Thasodant 35EC, Thiodol 35ND...		
	Endrin ($C_{12}H_8Cl_6O$)	Hexadrin...	0.01	Use prohibition
	Heptachlor ($C_{10}H_5Cl_7$)	Drimex, Heptamul, Heptox...	0.01	Use prohibition
	Hexachlorobenzene (C_6Cl_6)	Anticaric, HCB...	0.01	Use prohibition
	Isobenzen ($C_9H_4OC_8$)	Isobenzen	0.01	Use prohibition
	Isodrin ($C_{12}H_8Cl_6$)	Isodrin	0.01	Use prohibition
	Lindane ($C_6H_6Cl_6$)	Lindane	0.01	Use prohibition
	Methamidophos ($C_2H_8NO_2PS$)	Monitor (Methamidophos)	0.01	Use prohibition
	Monocrotophos ($C_7H_{14}NO_5P$)	Monocrotophos	0.01	Use prohibition
	Methyl Parathion ($C_8H_{10}NO_5PS$)	Methyl Parathion	0.01	Use prohibition
	Sodium Pentachlorophenate	Copas NAP 90 G, PMD4 90 bột, PBB	0.01	Use prohibition

No.	Name of substance (chemical formula)	Name of commodity	Allowable maximum limit	Main use purpose
	monohydrate $C_5Cl_5ONa.H_2O$	100 bột		
	Parathion Ethyl ($C_7H_{14}NO_5P$)	Alkexon, Orthophos, Thiopphos...	0.01	Use prohibition
	Pentachlorophenol (C_6HCl_5O)	CMM7 dầu lỏng	0.01	Use prohibition
	Phosphamidon ($C_{12}H_{19}ClNO_5P$)	Dimecron 50 SCW/ DD...	0.01	Use prohibition
	Polychlorocamphene $C_{10}H_{10}Cl_8$	Toxaphene, Camphechlor, Strobane...	0.01	Use prohibition

3. Identification method

1) To identify the pesticide residues in the soil, soil sampling should have implemented in the layer of surface soil according to TCVN 5297: 1995 and TCVN 7538-2: 2005.

2) The methods of analysis and identification for pesticide residues in the soil should have based on the guideline of current national technical regulation.

4. Implementation organization

This regulation is used to replace TCVN 594 1:1995 – soil quality – allowable maximum limit of pesticide residues in the soil.

The Vietnam 's regulation on management of soil and under ground water pollution

NGUYEN HOANG ANH
Pollution Control Department – Vietnam Environment Administration
Ministry of Natural, Resources and Environment

CONTENTS

- General information
- Pollution causes
- Regulation
- Weakness and sollutions

GENERAL INFORMATION

- Total land area: 33,121,159 ha
- Forestry and agricultural land: 24,822,559 ha (74.94%)
- Non-agricultural land: 3,232,715 ha (9.76%)
- Unused land: 5,065,884 ha (15.30%)

POLLUTION CAUSES

Rural and agricultural factor:

- More than 9 millions ha in total, around 4 millions ha for rice and paddy fields
- 3.355 craft villages (especially metal scrap recycle) cause heavy pollution to soil (heavy metal contamination)
- A numbers of storages for pesticides

POLLUTION CAUSES

Industrial and urban factor:

- These areas may be exposed to the integrated impacts from various sources (industrial wastes, domestic waste)
- Heavy metal level in soil is relatively low (lower than the threshold in Vietnam Technical Regulation QCVN 03:2008/BTNMT). The only problem is Arsenic pollution (in various sites).

POLLUTION CAUSES

Landfill and waste disposal factor:

Monitoring data at Nam Son landfill show that only the level of copper (Cu) is higher than the threshold in QCVN 03:2008, the other (Pb, As, Zn, Cd, Hg) are still lower

POLLUTION STATUS

Mining factor:

- Millions of tons of unmanaged excavated soil
- Heavy metal levels (Cu, Pb, Zn, As, Cd…) are high or very high (arsenic level at Lam Dong gold mine reaches 162,000 mg/kg)
- A very emergent issue is Hg pollution in gold mining and extraction sites

POLLUTION SOURCES

- Agriculture
- Industry
- Mining
- Chemical stockpile
- Waste treatment and disposal

REGULATION

Land Law:

- Regulation economical and efficient use of land
- Regulation reasonable exploitation of natural resources (include land resource) and environmental protection
- Land use planning and preserve the soil quality

REGULATION

Environment Protection Law:

- Intergrated Law
- Regulation the environmental measures for all sectors: industries, agriculture, aquaculture, underground water…
- Waste management
- Responsibility of the stakeholders

REGULATION

Water Resources Law:

- All water resources (surface, underground, pound, lake, river, sea…)
- Regulation the measures for management of water quantity and quality
- Responsibility of the stakeholders
- Inspection and Enforcement

REGULATION

Chemical Law:

- Cover all the activities related to the chemicals
- Regulation the measures for management of chemical production, business, and uses.
- Emergency response measures
- Responsibility of the stakeholders
- Inspection and Enforcement

REGULATION

Regulation on management and use of pesticides:

- MARD has promulgated a number of regulation related to the management and use of pesticides in Vietnam
- Some regulation on the management of the waste (containers, bags, bottles..)

REGULATION

National Regulation_Standard:

- 32 national regulations
- Underground water quality (QCVN09:2008/BTNMT)
- Pesticides Residue in Soil (QCVN 15:2008/BTNMT)
- Limited levels of heavy metals in soil (QCVN 03:2008/BTNMT)
- 23 QCVn for discharges (textile waste water, domestic waste water, hazardous waste, industrial waste, solid waste sanitary landfill, hospital waste water, waste water for petroleum stockpile…)

IMPACTS

Lowering crop yield and quality

- Toxic substance (heavy metals) may be accumulated in vegetables and affect people's health through the food chain. Data show that vegetables in many cultivation areas have high level of lead (exceeded the permissible threshold)

MANAGEMENT

- For for pesticides and fertilizer: MARD
- For mining: MONRE and MOIT
- For landfill: PPC
- For polluted areas: MOD (Ministry of Defence for the sites effected by chemicals); and MONRE (for the sites effected by waste); and PPC (for the sites within the provincial area)
- Waste open dumping sites: PPC

SOLUTIONS

Legislation and management:

- Improvement of legislation and policy system for soil and underground water pollution control
- Development and implementation of national strategy for soil and underground water pollution control (integrated measures)
- Development of supportive tools for soil management: technical regulations, monitoring system, database..
- Remediation of the hotspots

SOLUTIONS

Pollution reduction and control:

- Strengthening of legislation enforcement (through EIA, environmental fee etc.)
- Application of advanced and environmentally friendly technologies
- Reduction of chemical and fertilizer utilization in agriculture by using environmentally products.
- Control the chemicals use and discharge by industry and mining
- Control the pollutants from the landfills and open dumping sites

SOLUTIONS

Awareness raising and training:

- Pulication of materials on environmental and soil and underground water pollution issues
- Development and dissemination of models and measure for more efficient use of fertilizers, chemicals; contaminated water treatment technology
- Raising the awareness of the people on the strict use of pesticides

THANK YOU VERY MUCH

Prevention and Control of Soil Pollution: An Indian Perspective

Dr. Rashid Hasan, Director, India

Background:

Environment is an inseparable part of mankind that includes land, water, air, space, flora and fauna, and which are interconnected, interrelated and interdependent. Like any other country whose economy is in transition, India's environment has recently been several affected due to population explosion, changing lifestyles, urbanization and developmental activities which have exploited natural resources without due respect to nature, its preservation and conservation. The soil and groundwater require urgent steps to contain the damage and prevent the further deterioration in the Soil and ground water .

Out of the total geographical area of 329 million ha., 175 million hectare are considered degraded on account of water and soil erosion, salinity, alkalinity, river pollution and other factors. The land degradation continues to worsen and is hindering economic development in rural India Non-point pollution such as fertilizer and pesticide run-offs in rural areas is also emerging as a major cause of concern. Only 60% of chemical fertilizers are utilized in soils and the balance is leached into soil polluting the ground water. Industrial effluent from thermal power and industries like pulp and paper, fertilizers, iron and steel, chemicals etc. In addition, chemical and their waste, sewage mud, garbage, hospital wastes, plastic etc. are also major cause of soil pollution. Soil erosion is causing severe damage to environment and also have adverse impact on natural vegetation.

The soil in many States in India is affected by the incidence of fluoride above permissible levels of 1.5ppm occur in 14 Indian States, namely, Andhra Pradesh, Bihar, Gujarat, Haryana, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Orissa, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh and West Bengal affecting a total of 69 districts, according to some estimates. Some other estimates find that 65 per cent of India's villages are exposed to fluoride risk. High level of arsenic above the permissible level of 50 parts per billion (ppb) are found in the alluvial plains of Ganges covering six districts of West Bengal. Presence of heavy metals in groundwater is found in 40 districts from 13 states, viz., Andhra Pradesh, Assam, Bihar, Haryana, Himachal Pradesh, Karnataka, Madhya Pradesh, Orissa, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh, West Bengal, and five blocks to Delhi.

Contaminated Sites

There are more than 125 contaminated sites across the country. For example, eight such sites have been identified in the State (province) of West Bengal for investigation of old hazardous waste deposits and their remediation. The locations of the sites are as follows:

I. Ashalata Brickfield, Dt.-Hooghly

2. Minu Computer Weighbridge Access Road, Dt.-Hooghly

3. Shivang Trexim & Sree Balaji veneers Access Road, Dt.-Hooghly

4. Pashupati Seong and East India Flour Mills Access Road, Dt.-Hooghly

5. Access Road south of Sarkar Bridge, Dt.-Hooghly

6. Zenith Timbers Access Road, Dt.-Hooghly

7. Near Shivam Gases Limited (Chakundi Industrial Area), Dt.-Hooghly

8. Village Nibra, P.O.- Makardah, P.S.-Domjur, Dt.- Howrah.

The detailed analysis of these sites found that the dumped waste is the sludge generated from the basic chrome sulphate manufacturing units. The sites are located in Hooghly and Howrah districts of West Bengal. The adverse impacts and remediation options available with regard to containment of contamination are being employed taking into consideration the regional sensitive receptors and also the socio economic pattern of the region. The WBPCB has included in the world Bank CBIPM Project upgradation work of the existing TSDF site located at Chakundi in Hooghly. The capacity building of WBPCB for effective environmental regulation, improved enforcement for pollution prevention and improved environmental compliance is being done with the establishment of Environment Compliance Assistance Centre.

Prevention of Soil Pollution

There are several strategies and measures for prevention and control of soil pollution in India. The prevention and control of soil pollution involves integrated approval inter alia through legislation that involves preventing dumping or ensuring proper dumping of harmful substance soil pollution is prevented. Other methods of prevention include banning some use of chemicals on agricultural fields. Thermal or heat applies to the soil to kill the harmful substance may also. The prevention and control of pollution in India is still evolving. Apart from chemical and physical treatment, bioremediation has gained importance due to inherent advantages over the other treatment technologies.

Improved agricultural methods might help to reduce the use of fertilizers crop rotation or mixed cropping can improve the fertility of the land. Applying bio-fertilizers and manures can reduce chemical fertilizer and pesticide use. Biological methods of pest control can also reduce the use of pesticides and thereby minimize soil pollution. It is an very important method for the prevention of soil pollution. An efficient system of disposal should be developed to deal with domestic solid waste. Industrial wastes can be treated physically, chemically and biologically until they are less hazardous. Acidic and alkaline wastes are first neutralized; the insoluble material if biodegradable are be allowed to degrade under controlled conditions before being disposed. Solid wastes are be pre treated and recycles and only minimum quantity of such wastes should be discharged. In India no specific legislation has so far been enacted for soil Pollution prevention and control. Proper legislation should be passed and strictly enforced for the prevention of soil pollution. Stringent laws should be imposed on defaulters. Reforestation and plantation of grasses helps a lot in the prevention of soil pollution. In afforestation, native species should be proffered over exotic species. Control of land loss and soil erosion can be attempted through restoring forest and grass cover to check wastelands, soil erosion and floods. Recycling is another method for the prevention of soil pollution. Recycling paper, plastics and other materials reduces the volume of refuse in landfills, another common cause of soil pollution.

In India advances in science and technology have enabled us to apply the potential of biological processes and biodiversity for environmental clean up and pollution abatement which is termed as bioremediation. It is emerging as an effective, innovative technology for treatment of a wide variety of contaminants. This technology includes phytoremediation (plants) and rhizoremediation (plant and microbe interactions). Rhizoremediation, involves the I removal of specific contaminants from contaminated sites by mutual interaction of plant roots and suitable microbial flora.

Policy framework:

The present national policies for environmental management are contained in the National Conservation Strategy and Policy Statement on Environment and Development, 1992, the Policy Statement on Abatement of Pollution, 1992 and an overarching National Environment Policy, 2006. All of these policies have recognized the need for sustainable development in their specific contexts and formulated necessary strategies to give effect to such recognition. Further, to give effect to various measures for environment protection and conservation, a number of steps have been initiated which include stringent regulations, development of environmental standards, conservation strategies and control of pollution etc.

Institutional framework:

The MoEF is the Nodal Agency for implementation of Policies and Programmes relating to environment protection and conservation of the country’s natural resources. While implementing these policies and programmes, the Ministry is guided by the principles of sustainable development and protection of human health. Ministry formulates policies and enacts legislation at the national level. Apart from headquarter at New Delhi there are six regional offices at Bangalore, Bhubaneshwar, Shillong, Bhopal, Chandigarh and Lucknow.

Central Pollution Control Board (CPCB)

CPCB has been established under the Water (Prevention and Control of Pollution) Act, in November 1974 to implement the nation-wide programme on abatement of pollution. After the enactment of the Air (Prevention and Control of Pollution) Act, 1981, CPCB is also mandated with the responsibility of prevention and control of air pollution in the country. The discharge standards are notified under the Environment Protection Act, 1981 for their implementation through SPCBs.

State department of Environment and SPCB/PCCs

SPCBs/PCCs are constituted under the Water Act with the main mandated functions of prevention and control of water pollution in their respective States/UTs as per the provisions of the Act. The State/UT Governments are required to review the functioning of the SPCBs/PCCs and also to strengthen them to achieve the objectives envisaged under Water Act. The monitoring of stipulated norms is carried out by SPCBs/PCCs and their zonal offices through inspections. The SPCBs/PCCs issue directions under Section 33A of the Water Act, to the defaulting unit.

Regulatory and Legislative framework for Pollution Control/Abatement:

The introduction of legislative measures for pollution control including soil pollution in the country commenced with the enactment of the Water (Prevention and Control of Pollution) Act, 1974, the Environment (Protection) Act, 1986 and recently the National Green Tribunal Act, 2010. To implement these legislations, the Ministry formulated various regulatory instruments (e.g., environment standards, consent administration, authorization, environment clearances, etc.) and created institutional infrastructures at the national, regional and state levels in the form of Central Pollution Control Board (CPCB), regional offices of MoEF and CPCB, State Pollution Control Boards/Pollution Control Committees (SPCBs/PCCs), State Department of Environment, and Environmental Research Institutes/Organizations, etc.

Adequacy of existing legislation

Despite having plethora of legislation and regulations, enforcement remains a key concern. The EP Act has been in force since 1986. The Act was inactive after the Bhopal gas Tragedy in 1984. It is an umbrella legislation to control various kinds of pollution and to prevent damage to environment.

Under the Environment (Protection) Act, 1986 some major rules pertaining to chemicals and waste have been notified. These rules regulate the chemicals and waste in a maaner that prevent soil contamination. The Municipal Solid Waste (Management and Handling) Rules, 2000 are applicable to every municipal authority responsible for collection, segregation, storage, transportation, processing and disposal of municipal solid wastes in the country. The Rules stipulate specifications, source segregation, collection, transportation, waste processing, disposal and others.

For proper management of Bio-Medical Wastes (BMW) generated in the country, the Ministry of Environment & Forests notified the Bio-Medical Wastes (Management and Handling) Rules in 1998, under the E (P) Act, 1986. Three amendments have been issued so far. The Bio-Medical Wastes (Management & Handling) Rules, 1998 provides for segregation, packaging, storage, transportation, treatment and disposal of the bio-medical wastes. As per these Rules, it shall be the duty of every occupier of an institution generating BMW, to take all steps to ensure that such waste is handled without any adverse effect to human health and environment. Hospitals servicing 1000 patients and more per month are required to obtain authorisation from the respective SPCB/ PCC of Union Territory.

The Hazardous Wastes (Management and Handling) Rules, 1989 and as amended thereafter were re-visited in 2007 and the Hazardous Waste (Management, Handling and Transboundary Movement) Rules, 2008 were published on 24th September, 2008. At present, these rules are the main instrument to ensure proper management of hazardous waste in the country.

To ensure proper management of chemical accidents, the Ministry has notified two sets of rules namely - the Manufacture, Storage and Import of Hazardous Chemical (MSIHC) Rules, 1989 and the Chemical Accident (Emergency Planning, Preparedness and Response) Rules, 1996. The MSIHC Rules provide indicative criteria for hazardous chemicals and listed 684 hazardous chemicals. The rules stipulate notification and approval of sites, preparation of material safety data sheet, preparation and updation of safety report/ safety audit report notification of major chemical accidents, preparation of On-site Emergency Plans by the occupier and the Off-site Emergency Plans by the Districts Authorities.

Enforcement & Compliance:

The mechanism adopted by SPCBs/PCCs include; issuance of consents and authorizations to the industries and local bodies, undertaking regular inspections for verification of compliance, evolving appropriate action plan including legal actions against the non-compliance sectors. To check the compliance of industries, CPCB is also undertaking random inspections and takes action against the industries. In last 18 months, CPCB has issued 68 directions to the SPCBs and has issued directions under Section 5 of EPA to 118 units.

The enforcement and compliance has still been a weaker area and there is need to strengthen SPCBs/PCCs along with CPCB. These organizations will have to be strengthened in terms of adequate staff and to be provided with good service conditions. Further, laboratories have to be set up at the regional and district level so that compliance becomes stricter.

Impacts of Environmental Degradation:

Soil and Groundwater degradation can lead to a scarcity of resources, such as water and farmable land. Extreme weather events, such as severe flooding, increase the spread of waterborne diseases, such as malaria and diarrhoea. Air pollution particularly from particulate matters causes respiratory, skin, allergic diseases. The heavy metals present in soil, water and air can cause even cancer. One of the greatest challenges facing humanity is environmental degradation, particularly the soil and groundwater contamination an issue of increasing concern for the international community. Soil and groundwater contamination increases the vulnerability of the societies.

Role of People in Environment Protection:

The environment protection including soil conservation regime set up by the Government provides ample opportunity to the people and stakeholders to contribute their mite in the efforts of the Government. Under the environment statutes any person can give 60 days notice to take the polluter to the court/ National Green Tribunal. There is also a statutory provision of public hearing before granting environmental clearance to the developmental projects. All important rules and notifications are made available for public views/comments before finalization. There are various awareness and education programmes being implemented by the Ministry for the benefit of various stakeholders for making them sensitized about the need for environment protection**.** The other two important options like Public Interest Litigation as well as the Right to Information Act, 2005 are effectively being used by the people in redressal of environmental problems.

Republic of the Philippines
Department of Environment and Natural Resources

Regidor M. De Leon
Assistant Secretary for Field Operations

EMB MANDATE

EMB was created under EO 192 and became a line Bureau by virtue of Sec. 34 of Philippine Clean Air Act of 1992. It is mandated to implement on a nationwide scale the said Act and other environmental laws to wit:

1. RA 8749 (Clean Air Act of 1999)
2. RA 9003 (Ecological Solid Waste Management Act - 2000)
3. RA 9275 (Philippine Clean Water Act - 2004)
4. RA 6969 (Toxic Substances and Hazardous Waste Control Act -1990)
5. PD 1586 (Environmental Impact Statement System - 1978)
6. RA 9512 (Environmental Awareness act of 2008)

EMB is also mandated to provide research and laboratory services; and serve as secretariat in the adjudication of pollution cases.

PHILIPPINE CLEAN AIR ACT
REPUBLIC ACT 8749

Philippine Clean Air of 1999

An Act Providing for a Comprehensive Air Pollution Control Policy and for Other Purposes

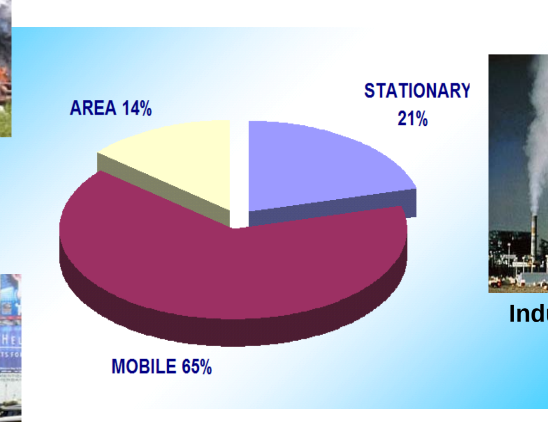
- To Guarantee the PEOPLE'S right to breathe CLEAN AIR

Principles of Philippine Clean Air Act

- Formulate and implement a holistic NATIONAL PROGRAM ON AIR POLLUTION MANAGEMENT
- Focus primarily on POLLUTION PREVENTION rather than control
- Formulate and enforce a system of ACCOUNTABILITY (Polluter's Must Pay)
- Promote PUBLIC INFORMATION AND EDUCATION

Sources of Air Pollution

Burning of Garbage



Industrial Emissions

Motor Vehicle Emission

Salient Features and Prohibited Acts of RA 8749

- Violation of standards for stationary sources *(Section 45 of RA 8749)*
  - 9 for actual exceedance of air quality standards or limitation
    (ex. TSP – 90μg/Ncm (*Standard*))

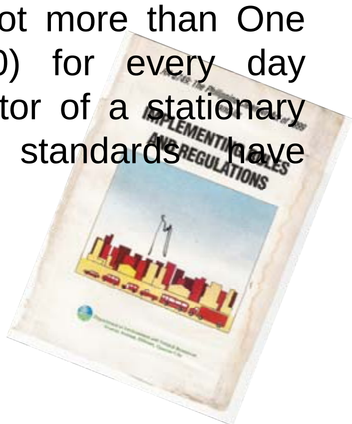
- Violation of any order, rule or regulation issued by the DENR with respect to such standard or limitation

- Violation of standards for motor vehicles *(Section 46 of RA 8749)*

Fines and Penalties (RA 8749)

SEC. 45. ***Violation of Standards for Stationary Sources.-***

For actual exceedance of any pollution or air quality standards under this Act or its rules and regulations, the Department, through the **Pollution Adjudication Board (PAB),** shall impose a fine of not more than One hundred thousand pesos (P100,000.00) for every day of violation against the owner or operator of a stationary source until such time that the standards have been complied with.



Fines and Penalties (RA 8749)

SEC. 46. ***Violation of Standards for Motor Vehicles***.

No motor vehicle shall be registered with the DOTC unless it meets the emission standards set by the Department...

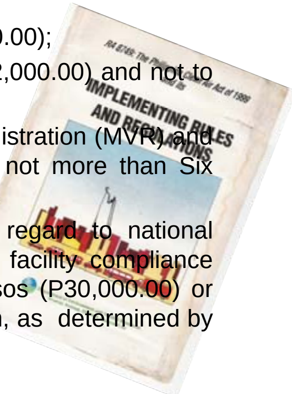
In addition, the driver and operator of the apprehended vehicle shall undergo a seminar on pollution control management conducted by the DOTC and shall also suffer the following penalties:

a) First Offense - a fine not to exceed Two Thousand Pesos (P2,000.00);

b) Second Offense - a fine not less than Two Thousand Pesos (P2,000.00) and not to exceed Four Thousand Pesos (P4,000.00); and

c) Third offense - one (1) year suspension of the Motor Vehicle Registration (MVR) and a fine of not less than Four Thousand Pesos (P4,000.00) and not more than Six thousand pesos (P6,000.00).

Any violation of the provisions of Sec. 21 paragraph (d) with regard to national inspection and maintenance program, including technicians and facility compliance shall penalized with a fine of not less than Thirty Thousand Pesos (P30,000.00) or cancellation of license of both the technician and the center, or both, as determined by the DTI.

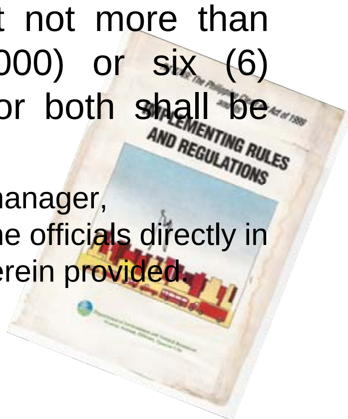


Fines and Penalties (RA 8749)

SEC. 47. ***Fines and Penalties for Violations of Other Provisions in the Act.***

For violations of all other provisions provided in this Act and of the rules and regulations thereof, a fine of not less than Ten thousand pesos (P10,000) but not more than One Hundred thousand Pesos (P100,000) or six (6) months to six (6) years imprisonment or both shall be imposed.

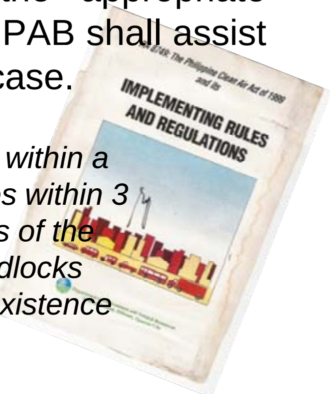
If the offender is a juridical person, the president, manager, directors, trustees, the pollution control officer or the officials directly in charge of the operations shall suffer the penalty herein provided.



Fines and Penalties (RA 8749)

SEC. 48. ***Gross Violations***.-

In case of gross violation of this Act or its implementing rules and regulations, the **PAB shall recommend to the proper government agencies** to file the appropriate criminal charges against the violators. The PAB shall assist the public prosecutor in the litigation of the case.



Gross violation = a) three or more specific offenses within a period of one year b)Three or more specific offenses within 3 consecutive years, c) blatant disregard of the orders of the PAB, such as but not limited to breaking of seal, padlocks and other similar devices or operating despite the existence of the order…

Violations	Fines and Penalties / Charges
Violation of the Standards (Stationary Sources)	P100K / day of violation until such time that the standards have been complied with. *(PAB Fine Rating System)*
Violation of other provisions in the Act	P10K – P100 or 6 mos to 6 years imprisonment or both
Gross Violation	Filing of Criminal charges Offenders shall be punished with imprisonment of not less than 6 years but not more than 10 years
Violation of the standards (motor vehicles)	1st offense – not to exceed P2K 2nd offense – not less than P2K and not to exceed P4K 3rd offense – 1 year suspension of Motor Vehicle Registration and fine not less than P4K and not more than P6K

Which entity has Jurisdiction over air pollution cases?

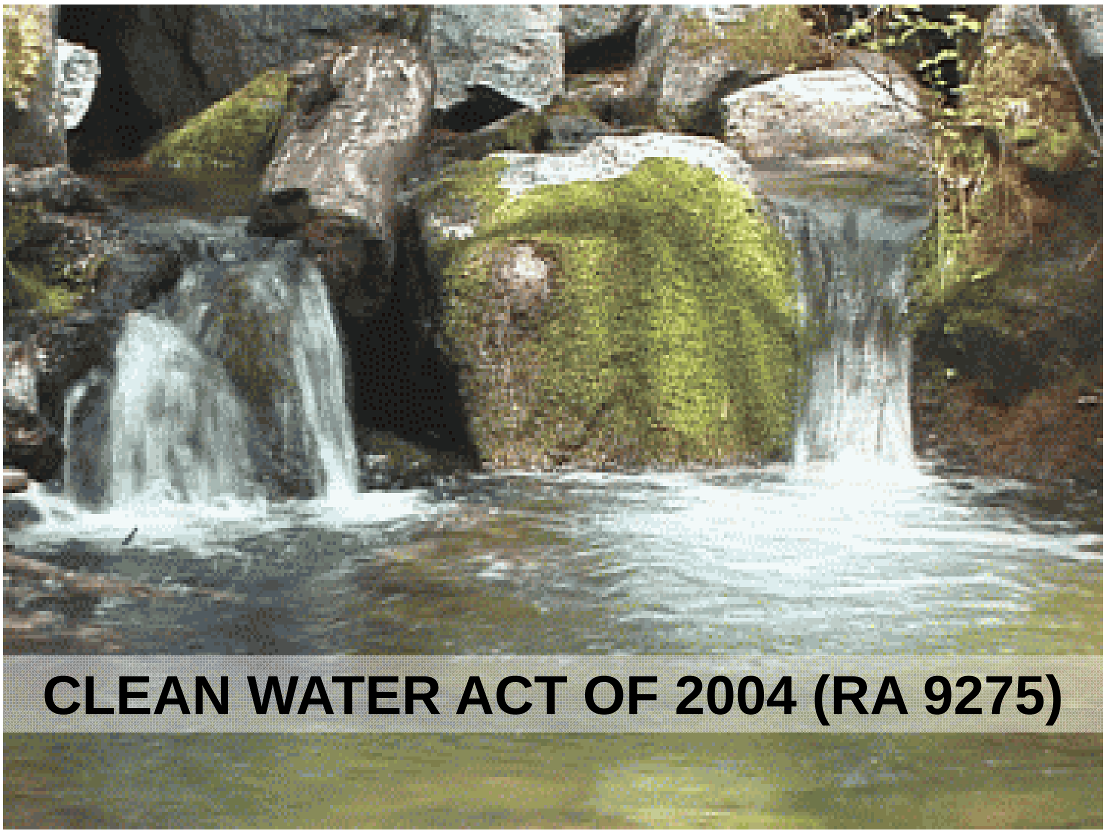
The Pollution Adjudication Board

- The Pollution Adjudication Board (the PAB) is a quasi-judicial body created under Section 19 of Executive Order 192 for the adjudication of pollution cases.
- The Board assumes the powers and functions of the Commission/Commissioners of the National Pollution Control Commission with respect to the adjudication of pollution cases under Republic Act 3931 and Presidential Decree 984...

Pollution Adjudication Board

- The PAB is organizationally under the supervision of the Office of the Secretary of the Department of Environment and Natural Resources (the DENR),

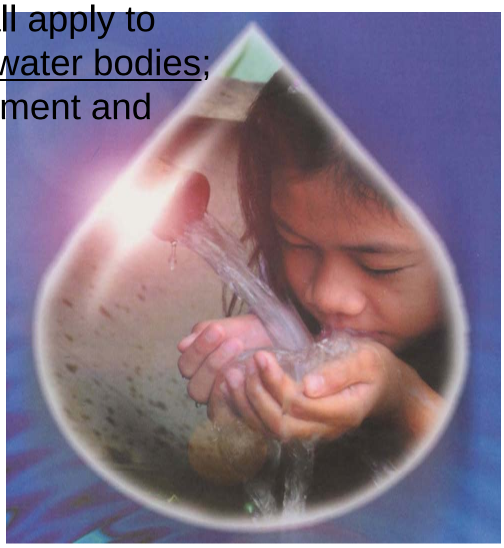
- The Environmental Management Bureau (EMB) provides the Secretariat support.



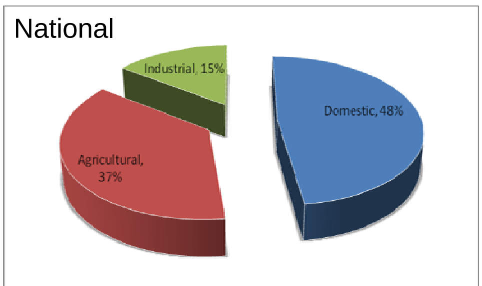
Philippine Clean Water Act of 2004

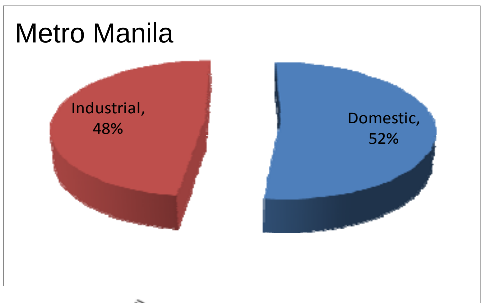
(Republic Act 9275) This Act shall apply to water quality management in all water bodies; Shall primarily apply to the abatement and control of pollution

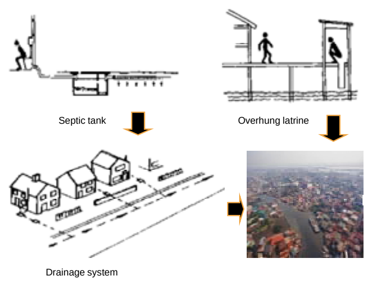
Aims to protect the country's water bodies from pollution from land-based sources (industries and commercial establishments, agriculture and community/household activities).



Sources of Water Pollution







Conceptual Framework

Integrated Water Quality Management Framework

Water Quality Mgt. Action Plan (WQMAP)

Households | Industries | Other Non-Point Sources

- Establishment of Water Quality Management Area (WQMA)
  - Non-Attainment Areas (NAAs)
  - Natl. Septage/Sewerage Management Program
  - Classification/ Reclassification
  - Groundwater Vulnerability Mapping
  - WQ Guidelines
  - Effluent Standards
  - Categorization of Industry
  - Wastewater Charge System
  - Discharge Permits
  - Financial Liability
  - Programmatic EIA
  - Incentives and Rewards
  - Prohibitions/Sanctions/ Actions

Water Quality Management System

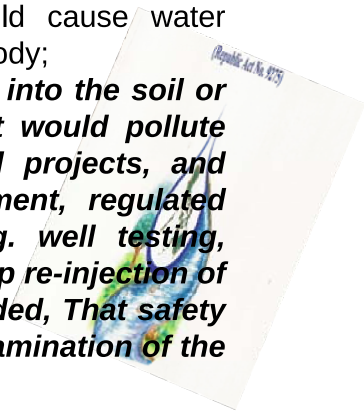
- Water Quality Management Area (WQMA)
- National Water Quality Management Fund (NWQMF)
- Area Water Quality Management Fund (AWQMF)

Salient Features and Prohibited Acts of RA 9275

SECTION 27. ***Prohibited Acts***. - The following acts are hereby prohibited:

a) Discharging, depositing or causing to be deposited material of any kind directly or indirectly into the water bodies or along the margins of any surface water, where, the same shall be liable to be washed into such surface water, either by tide action or by storm, floods or otherwise, which could cause water pollution or impede natural flow in the water body;

b) Discharging, injecting or allowing to seep into the soil or sub-soil any substance in any form that would pollute groundwater. In the case of geothermal projects, and subject to the approval of the Department, regulated discharge for short- term activities (e.g. well testing, flushing, commissioning, venting) and deep re-injection of geothermal liquids may be allowed: Provided, That safety measures are adopted to prevent the contamination of the groundwater;



Salient Features and Prohibited Acts of RA 9275

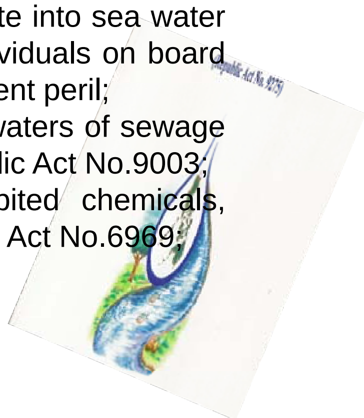
SECTION 27. ***Prohibited Acts***. - The following acts are hereby prohibited:

c) Operating facilities that discharge regulated water pollutants without the valid required permits or after the permit was revoked for any violation of any condition therein;

d) Disposal of potentially infectious medical waste into sea water by vessels unless the health or safety of individuals on board the vessel is threatened by a great and imminent peril;

e) Unauthorized transport or dumping into sea waters of sewage sludge or solid waste as defined under Republic Act No.9003;

f) Transport, dumping or discharge of prohibited chemicals, substances or pollutants listed under Republic Act No.6969;

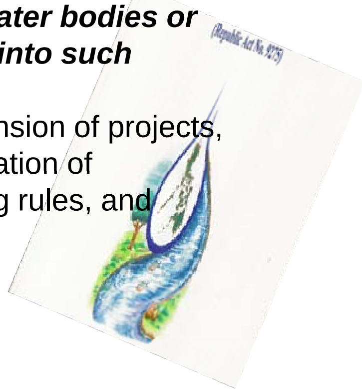


Salient Features and Prohibited Acts of RA 9275

SECTION 27. ***Prohibited Acts***. - The following acts are hereby prohibited:

g)Operate facilities that discharge or allow to seep, willfully or through gross negligence, prohibited chemicals, substances or pollutants listed under R. A. No. 6969 into water bodies or wherein the same shall be liable to be washed into such surface, ground, coastal, and marine water;

h)Undertaking activities or development and expansion of projects, or operating wastewater/sewerage facilities in violation of Presidential Decree. No.1586 and its implementing rules, and regulations;



Salient Features and Prohibited Acts of RA 9275

SECTION 27. ***Prohibited Acts***. - The following acts are hereby prohibited:

i) Discharging regulated water pollutants without the valid required discharge permit pursuant to this Act or after the permit was revoked for any violation of condition therein;

j) Non-compliance of the LGU with the Water Quality Framework and Management Area Action Plan. In such a case, sanctions shall be imposed on the local government officials concerned;

Salient Features and Prohibited Acts of RA 9275

SECTION 27. *Prohibited Acts*. - The following acts are hereby prohibited:

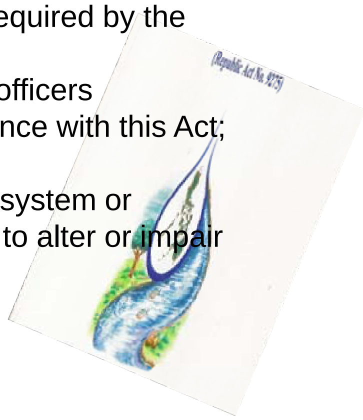
k)Refusal to allow entry, inspection and monitoring by the Department in accordance with this Act;

l)Refusal to allow access by the Department to relevant reports and records in accordance with this Act;

m)Refusal or failure to submit reports whenever required by the Department in accordance with this Act;

n)Refusal or failure to designate pollution control officers whenever required by, the Department in accordance with this Act; and

o)Directly using booster pumps in the distribution system or tampering with the water supply in such a way as to alter or impair the water quality.



Prohibited Acts of RA 9275 (Sec 27)

- Discharging or depositing materials that could pollute any water body
- Discharging regulated pollutants without valid discharge permit Undertaking activities in violation of P.D. 1586
- Transport or discharge of prohibited chemicals under R.A. 6969
- Transport or dumping of solid wastes under R.A. 9003

Jurisdiction/Adjudication:

DENR Secretary upon recommendation of Pollution Adjudication Board (PAB)

Water Pollution Permits and Charges

Wastewater Charge System

- Established on the basis of payment to government
- Based on net waste load
- Industries complying to be charged minimal reasonable amount

ECOLOGICAL SOLID WASTE MANAGEMENT ACT (RA 9003)

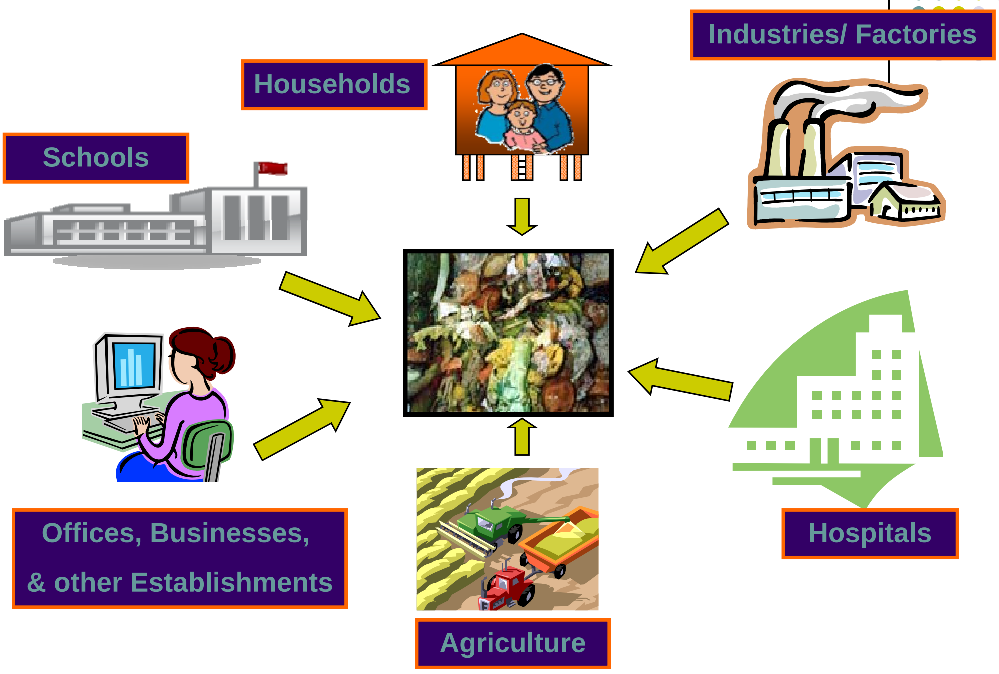
Waste is anything that arises from human and animal activities that are normally discarded

Ecological Solid Waste Management Act of 2001 (RA 9003)

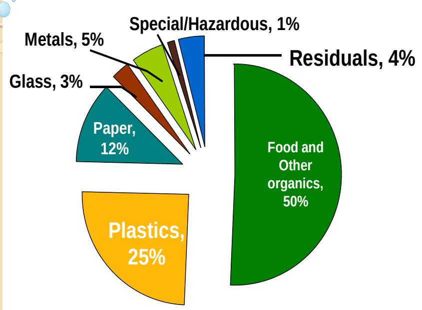
RA 9003 institutes measures to promote a more acceptable system which corresponds to the vision of sustainable development. Generally, it aims to merge environmental protection with economic pursuits, recognizing the re-orientation of the community's view on solid waste, thereby providing schemes for waste minimization, volume reduction, resource recovery utilization and disposal




Sources of Wastes



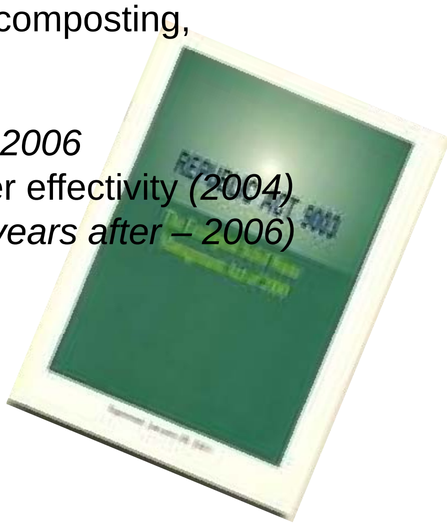
Solid Waste Composition



Waste Analysis and Characterization Survey (WACS)-Metro Manila Solid Waste Management Project, ADB 2003

Salient Features and Requirements of RA 9003

- mandatory segregation at source
- establishment of MRFs to facilitate composting, recycling & reuse (*by 2006)*
- segregated collection
- closure of all existing dumpsites *by 2006*
- shift to controlled dump 3 years after effectivity *(2004)*
- environmentally sound disposal *(5 years after – 2006)*



Status of Solid Waste Management

1. **Establishment of Materials Recovery Facilities:**

No. of Barangays serviced by MRF's (Before 2001 = 454 MRF's)	**-**	**7,014**
% coverage	**-**	**16 %**
Total no. of Barangays	**-**	**42,142**

MATERIALS RECOVERY FACILITIES

MRF – facility to process solid wastes:

- Segregation of solid wastes and materials for recycling
- Processing of biodegradable wastes into composts
- Processing of solid wastes into other products

Status of Solid Waste Management

2. Establishment of sanitary landfills:

Sanitary Landfills (Before 2001 = 2)	-	30
Open Dumpsites/Controlled	-	1,234
% compliance	-	2.3%

Note: 42 Sanitary Landfill under construction

Sanitary Landfill

Strategies

9 Provision of incentives/disincentive

¾ Implementation of the National Government-Local Government Cost Sharing Scheme for Solid Waste Management Services

¾ Implementation of the Zero Basura Olympics

¾ Filing of administrative charges to non-complying local government units (3 strike policy : issuance of reminders/notification)

Strategies

9 Access to Available Technology and Capacity Building

9 Strengthen the Operationalization of Materials Recovery Facility/System

¾ Backyard composting .

¾ Provision of biogas digester in all wet markets

¾ Provide market for compost and recyclable materials

¾ Promote organic farming using fortified compost

¾ Promote green charcoal technology

Strategies

9 Organize members of the informal sector engaged in recovery of recyclable materials to form a cooperative or association;

9 Enforce extended producers responsibility through:

¾ Buy-back scheme (waste markets, Recyclable collection event)

¾ Deposit-refund scheme

Strategies

- Promotion of Residual waste management
  - Adoption of alternative technologies;
  - Provision of market for products from residual wastes;
  - Adoption of the co-processing of residual wastes to cement kilns
- Continuous Massive IEC
- Continuous Mainstreaming of the ESWM in the Educational system through:
  - Replication of the eco-savers passbook
  - Mandatory establishment of the S-I-G-A (school in a garden using compost produced in the school)

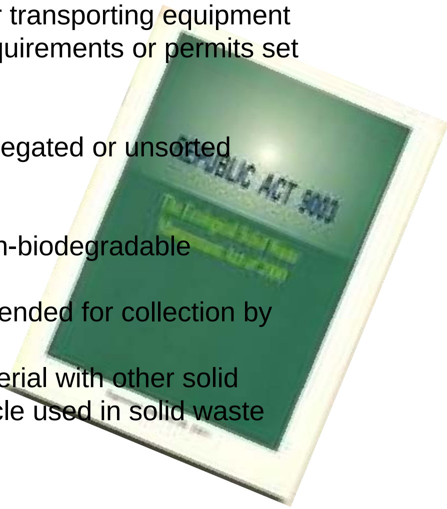
EO 774 **provides for 50% reduction of waste generation within 6 months.**

	FROM tons/day	TO tons/day
Nationwide	30,000	15, 000

Prohibited Acts of RA 9003

Section 48. *Prohibited Acts* - The following acts are prohibited:

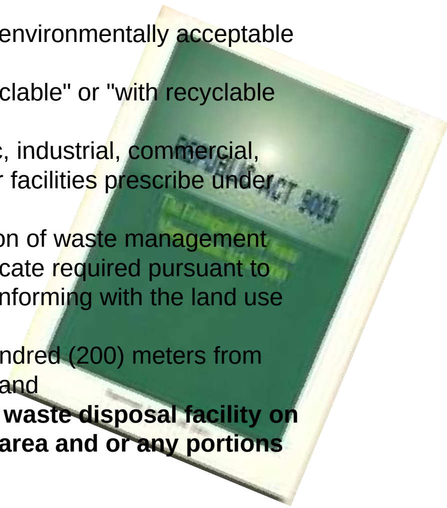
1) Littering, throwing, dumping of waste matters in public places, such as roads, sidewalks, canals, esteros or parks, and establishment, or causing or permitting the same;
2) Undertaking activities or operating, collecting or transporting equipment in violation of sanitation operation and other requirements or permits set forth in established pursuant;
3) The open burning of solid waste;
4) Causing or permitting the collection of non-segregated or unsorted wastes;
5) Squatting in open dumps and landfills;
6) Open dumping, burying of biodegradable or non-biodegradable materials in flood prone areas;
7) Unauthorized removal of recyclable material intended for collection by authorized persons;
8) The mixing of source-separated recyclable material with other solid waste in any vehicle, box, container or receptacle used in solid waste collection or disposal;



Salient Features and Prohibited Acts of RA 9003

Section 48. *Prohibited Acts* - The following acts are prohibited:

9) Establishment or operation of open dumps as enjoined in this Act, or closure of said dumps in violation of Sec. 37;
10) The manufacture, distribution or use of non-environmentally acceptable packaging materials;
11) Importation of consumer products packaged in non-environmentally acceptable materials;
12) Importation of toxic wastes misrepresented as "recyclable" or "with recyclable content";
13) Transport and dumping in bulk of collected domestic, industrial, commercial, and institutional wastes in areas other than centers or facilities prescribe under this Act;
14) Site preparation, construction, expansion or operation of waste management facilities without an Environmental Compliance Certificate required pursuant to Presidential Decree No. 1586 and this Act and not conforming with the land use plan of the LGU;
15) The construction of any establishment within two hundred (200) meters from open dumps or controlled dumps, or sanitary landfill; and
16) **The construction or operation of landfills or any waste disposal facility on any aquifer, groundwater reservoir, or watershed area and or any portions thereof.**



TOXIC SUBSTANCES AND HAZARDOUS WASTE CONTROL ACT (RA 6969)

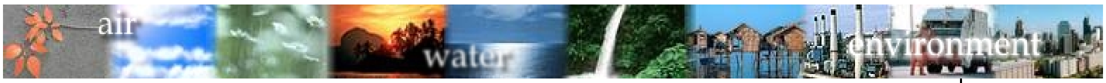
Collection of Infectious Waste by the Private Sector

Collection Vehicle with Refrigeration Unit

Hazardous Substances and Wastes Management

RA 6969: The Philippine Toxic Substances, Hazardous and Nuclear Waste Control Act

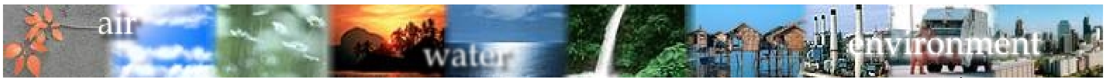
This Act mandates the regulation, restriction, or prohibition of the importation, manufacture, processing, sale, distribution, use, and disposal of chemical substances and mixtures that present unreasonable risk and/or injury to health and the environment.



What are Hazardous Wastes?

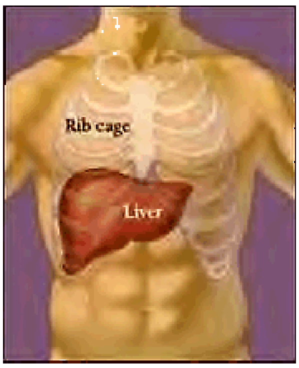
- substances that are without any safe commercial, industrial, agricultural or economic usage and are shipped, transported or brought from the country of origin for dumping or disposal into or in transit through any part of the territory of the Philippines

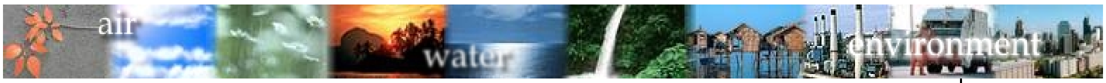
- by-products, side-products, process residues, spent reaction media, contaminated plant or equipment or other substances from manufacturing operations and as consumer discards of manufactured products which present unreasonable risk and/or injury to health and safety and to the environment



Why do we need to manage hazardous wastes?

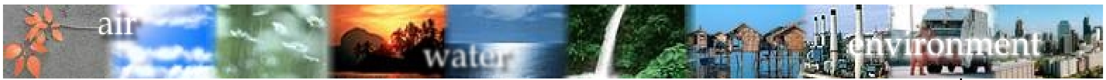
Health Effects





Health effects of Common Inorganic Contaminants

CONTAMINANT	SOURCE	PATHWAYS	HEALTH EFFECTS
Arsenic	Pesticides Ore smelting/refining	Air, water	Gastrointestinal disorder, lower-limb disorder
Asbestos	Heat/flame resistant applications	Air	Asbestosis (scarring of lungs)
	Elctroplating, battery manufacturing	Air, biota, water	Joint pain, lung, kidney disease
Lead	Gasoline, batteries, solder, radiation shielding	Air, biota, water	Impairs nervous system, red blood cell synthesis
Mercury	Electrical goods, chlor-alkali plants (inorganic); fungicides, slimicides (Organic)	Water, biota	Inorganic: disorder of central nervous system, psychoses Organic: numbness, impaired speech, deformity, death



Health effects of Common Organic Contaminants

CONTAMINANT	SOURCE	PATHWAYS	HEALTH EFFECTS
DDT(*d*ichloro*d*iphenyl*t*richloroethane	Application of pesticide worldwide	Water, food chain	Bioaccumulates in fatty tissues, nervous disorders, persistent
Dioxin 2,3,7,8-TCDD (Tetrachlorodibenzo para-dioxin)	Impurity of manufacture of trichlrophenols used in various biocides	Water, food chain	Damage to kidney, liver & nervous system; Powerful teratogen; possibly carcinogenic
PCB (polychlorinated biphenyls)	Dielectric, heat transfer & hydraulic fluid	Food chain	Persistent, probably carcinogenic; exposure results in chloracne, headaches; visual disturbance

Title II: Management of Chemicals and Toxic Substances

Main Features

- Philippine Inventory of Chemicals and Chemical Substances (PICCS)
- Pre-Manufacture and Pre-Importation Notification (PMPIN)
- Priority Chemical List (PCL)
- Chemical Control Order (CCO)

CHEMICAL CONTROL ORDERS (CCOs)

DA0 97-38: CCO for Mercury and its compounds
- ban, regulated and/or limited use

DAO 97-39: CCO for Cyanide and its compounds
- ban, regulated and/or limited use

DAO 2000-02: CCO for Asbestos
- ban, regulated and/or limited use

DAO 2000-18: CCO for Ozone Depleting Substances (ODSs)
- Ban and phase-out

DAO 2004-01: CCO for Polychlorinated Biphenyls (PCBs)
- ban and phase-out

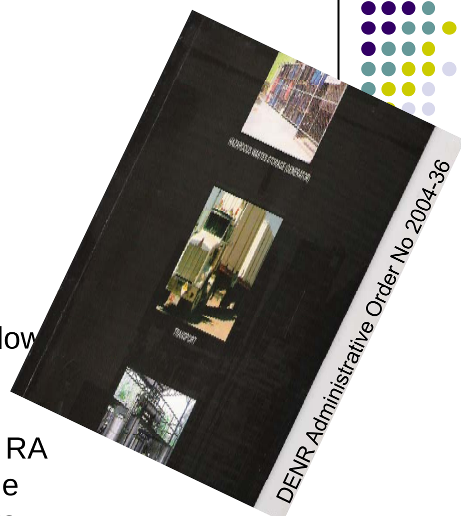
Prohibited Acts of RA 6969
Section 13

a) Knowingly use a chemical substances or mixture which is imported, manufactured, processed or distributed in violation of this Act or IRR or orders;
b) Failure or refusal to submit reports, notices or other information, access to records as required by the act;
c) Failure or refusal to comply with the PMPIN;
d) Cause, aid or facilitate, directly or indirectly, in the storage, importation or bringing into Philippine territory…any amount of hazardous and nuclear wastes in any part of the Philippines.

Jurisdiction/Adjudication:
EMB / DENR

<u>**Other laws that may apply**</u>**:**

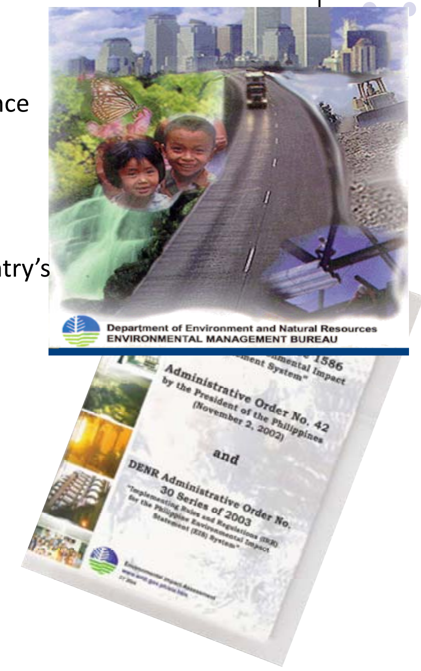
if the violation is under
Sec. 27 of RA 9275 related to RA 6969



f) Transport, dumping or discharge of prohibited chemicals, substances or pollutants listed under RA 6969;
g) Operate facilities that discharge or allow to seep, willfully or through gross negligence, prohibited chemicals, substances or pollutants listed under RA 6969, into water bodies or wherein the same shall be liable to be washed into such surface, ground, coastal and marine water.

Jurisdiction/Adjudication:
Thru PAB – DENR Secretary

The Philippine Environmental Impact Statement System (PD 1586)



" to attain and maintain a rational and orderly balance between economic growth and environmental protection "

This policy is achieved through the sustainable use, management, renewal and conservation of the country's natural resources including the protection and enhancement for the use of the present and future generations.

PURPOSE OF EIA

- The real value of the EIA Process is in the <u>reduction of adverse environmental impact</u> as a result of <u>incremental decision making</u> before a proposed action reaches final decision-making on whether it should be allowed to proceed or not

PURPOSE OF EIA

- To aid the proponent/applicant on environmental considerations prior to starting construction works on the project[1]
- To aid agencies in considering EIA results in their decision making for their respective permitting systems

[1]DAO 2003-30 of June 30,2003: Sec 1 (b) states - The EIS system aid proponents in incorporating environmental considerations in planning their projects as well as determining the environmental impacts of their projects

What is an ECC ?

The document issued by the **DENR Secretary or the EMB** certifying that based on the EIS by the proponent and the preparers, as **reviewed by the EIARC**, the proposed undertaking **will not cause significant negative impacts**; that the proponent has **complied with all the requirements of the EIS system**, and is **committed to implement its approved EMP** in the EIS or mitigating measures in the IEE”

Prohibition (Sec. 9 of PD 1586)

…No person partnership or corporation shall undertake or operate any such declared environmentally critical project or project located in an environmentally critical area without first securing an ECC…

Other laws that may apply:

If the violation is under Section 27. h of RA 9275

h. Undertaking activities or development and expansion of projects or operating wastewater/ sewerage facilities in violation of PD 1586 and its IRR.

Adjudication will be under PAB recommendatory to the DENR Secretary.

Jurisdiction: PAB–DENR Secretary

Environmental Awareness and Education Act (RA 9512)

…State shall promote national awareness on the role of natural resources in economic growth and the importance of environmental conservation and ecological balance towards sustained national development.

Environmental Awareness and Education Act (RA 9512)

Scope of Environmental Education:

Responsible Agencies shall integrate environmental education in its school curricula at all levels, whether public or private, including brgay daycare, preschool, non-formal, technical vocational, professional level, indigenous learning and out of school youth courses or programs…

Responsible Agencies:

DepEd, CHED, TESDA, DENR, DOST and other relevant agencies.

Proposed Bills

House Bill 07:
"Philippine Hazardous and Radioactive Waste Management Act"

Section 17: Formulation of Soil Quality Standards for Identification of Contaminated Sites

Websites:

www.denr.gov.ph
www.emb.gov.ph

Email: embcentral@yahoo.com

Thank you.

Latest Revision to the Japan's Soil Contamination Countermeasures Act and Policy Impacts of 2011 Disasters

Masanori Kobayashi, Yokohama National University[1]

1. Introduction

With respect to the implementation of the Japan's Soil Contamination Countermeasures Act, priority has shifted drastically after the 2011 East Japan Great Disaster. The Japan's Soil Contamination Countermeasure Act of 2003 was amended in 2009 and entered into force in 2010. Monitoring on the compliance with the 2009 Amended Act was supposed to provide further perspective on the environmentally sound countermeasures against soil contamination. However, the Japanese Ministry of the Environment is required to cope with a wide range of emergency measures for mitigating the 2011 Great Disaster including soil contamination caused by Tsunami and Fukushima Daiichi Nuclear Power Plant explosion and radiation fallout. This paper is intended to highlight the policy challenges brought by the 2011 East Japan Great Disaster and updates on the implementation of the 2009 Amended Act on Soil Contamination Countermeasures Act of Japan.

2. Earthquake, Tsunami and Nuclear Power Plant Explosion

The unprecedented level of an earthquake hit East Japan and caused multiple and enormous disasters and long-lasting damages across the areas. The earthquake occurred at 14:46 pm on 11 March 2011 at the epicentre located off the coast of Miyagi Prefecture in the distance of 130km from Oga Peninsula and 24 km deep (Disaster Emergency Response Headquarters). It was 9.0 Magnitude. The earthquake disaster was further devastated by the Tsunami that hit the coastal areas of East Japan at 15:21pm onwards. It was recorded that the height of 16.52 m, but higher tsunami wave was observed in a number of other places. As of 15 November 2011, the death toll rose to 15,838. The missing accounts for 3,647. In terms of infrastructure damages, 120,233 housing and buildings were completely destroyed. 189,583 were half destroyed and 598,131 were partially destroyed. As of 24 June 2011, the Cabinet Office estimated the damage to be 16.9 trillion JPY or approximately 200 billion USD. The level of damages far supersedes the past earthquake disaster in multiple folds. The death toll and damage cost is almost double compared with the 1995 Hanshin-Awaji Earthquake (Kobe Earthquake). The damage of the 2011 East Japan Earthquake is estimated to reach 85

[1] Masanori Kobayashi, Associate Professor, Yokohama National University Graduate School of Environment and Information Sciences m-kobayashi@ynu.ac.jp

trillion JPY according to other sources (Center for Human, Disaster and Future).

Due to the earthquake damages, electric power supply for the Fukushima Daiichi Nuclear Power Plant of the Tokyo Electric Power Company was disconnected soon after the earthquake and the emergency diesel generators failed to perform due to the damages caused by the subsequent Tsunami (Science Council of Japan).[2] The cooling systems malfunctioned and fuel rods were exposed. A large volume of hydrogen was generated and raised the pressure within the containment vessel. At 10:17 am on 12 March, the building housing the nuclear reactor in Unit 1 explored. The buildings in Unit 3 and Unit 4 explored on 14 March and 15 March 2011. As fuel rod temperature increases and the reactor vessel was cracked, there started a leakage of radioactive materials in Unit 1, and possibly Unit 2 and Unit 3 (Yamaguchi *et al.*). The Nuclear and Industrial Safety Agency (NISA) of the Ministry of Economy, Trade and Industry estimated that the total amount of radioactive materials leaked into the atmosphere was about 10 per cent of the quantity leaked at the Chernobyl accident in 1986. On April 10, the Nuclear Safety Commission indicated that the integrated dose rate could be over 20 millisievert per year in Northwest of the Power Plant, and the Government designated the areas within 20 km from the Power Plan a “Caution Zone” and the residents within the Caution Zone were ordered to evacuate outside of the Zone. It was estimated that 78,000 people resided in the Caution Zone and had to evacuate outside of the Zone.[3] In addition, it was also reported that about 66,000 had to evacuate outside of their home prefectures presumably due to the prolonged radioactive fallout.[4] The damages caused by the radioactive fallout from the Fukushima Daiichi Nuclear Power Plant remains contentious. It was said that 5.5 trillion JPY referred to by the Sub-Committee on Nuclear Power and Nuclear Fuel Recycle Technology was far lower than the actual damages.[5] Another estimate indicates a figure of 3.66 trillion JPY.[6]

3. Toxic substance and radioactive contamination

(i) Approach to monitoring of toxic substance and radiation contamination

As a number of facilities that use toxic substances have been destroyed by Tsunami in the disaster affected area, leakage of toxic substances over air, water and soil has

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[2] It was reported that the cause of the power supply disruption was not caused by Tsunami, but the fall down of the tower of electric power supply.
http://www.jcp.or.jp/akahata/aik11/2011-04-30/2011043004_04_0.html accessed on 15 November 2011

[3] Asahi Newspapers. 22 April 2011. http://www.asahi.com/politics/jiji/JJT201104210149.html accessed on 15 November 2011.

[4] Kahoku Newspapers. 14 September 2011. http://www.kahoku.co.jp/spe/spe_sys1071/20110914_01.htm

[5] http://www.foejapan.org/energy/eshift/pdf/111026.pdf accessed on 15 November 2011

[6] http://www.sailnyc.info/blog/ohi-report/209 accessed on 15 November 2011

become a social concern. The damaged facilities include gas stations and other food processing and production facilities that uses toxic substances.

Radioactive contamination has raised a concern not just in the area of the Fukushima Daiichi Nuclear Power Plant, but at the nation-wide scale. Radioactive substances have been detected at the higher level than usual, and in increasing number of cases higher level than the standard. Radioactive contamination has been detected in water at the water filtration plant, vegetable, livestock fodder, rice, tea, seafood as well as organic fertilizer. The standard on radioactive substance was set by the Ministry of Health, Labour and Welfare based on the recommendations from the Japan's Food Safety Commission. The standard was set as a provisional standard after the 2011 disaster. The standard was set for Iodine, Cesium and Uranium.[7] The Government has issued orders to prohibit the retailing of food items from the areas where the radioactive substance is detected above the provisional standard.[8] In some cases, prefectural governments and farmers association have agreed on voluntary restrictions in retailing agricultural products before the governments' order to prohibit retailing when the radioactive substance is found at the considerable level as a precautionary measure.

(ii) Monitoring of soil contamination

In terms of soil contamination, radioactive substance has been detected in the school playgrounds, roads and street gutters. The Japan's Nuclear Disaster Response Headquarters has issued the Basic Guideline on Emergency Countermeasures for Removing Radiation Contamination on 26 August 2011. The Guideline is developed based on the basic recommendations by the International Commission on Radiological Protection (ICRP) and the Nuclear Safety Commission of Japan and aims to gradually reduce radioactive substances from 20 millisievert or above. It is also provided that it is incumbent upon the government to undertake the removal of radioactive substances. At the same time, it is also provided that in the light of the need to take time for securing disposal sites, it is realistic to set up at the local and community levels, temporal storage of soils contaminated with radioactive substances and the government will provide financial and technical support.

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[7] Japan Business Press. 6 May 2011. http://jbpress.ismedia.jp/articles/-/6487 accessed on 1 November 2011

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The Ministry of the Environment (MOEJ), Japan has undertaken monitoring of soil contamination in 78 sites in the areas affected by Earthquake and Tunami, namely Iwate, Miyagi and Fukushima prefectures from 16 June – 6 July 2011 and released its monitoring result on 19 August 2011.

Table 1: Soil contamination in the disaster affected areas

Prefectures	Substance	Site number	Detected level (mg/L)	Standards (mg/L)
Iwate	Mercury	1	0.0006	0.0005
	Zinc	3	0.018 - 0.034	0.01
	Arsenic	2	0.019 - 0.027	0.01
	Fluorine	1	0.87	0.8
Miyagi	Zinc	4	0.012 - 0.036	0.01
	Florine	6	0.012 - 0.021	0.01
Fukushima	Mercury	2	0.0011 - 0.0013	0.0005
	Zinc	5	0.013 - 0.028	0.01
	Arsenic	3	0.011 - 0.013	0.01
	Florine	1	0.83	0.8

MOEJ (2011)

At the sites where the toxic substances are found above the standards, it was subsequently verified that the underground water is not used for drinking purposes. It is planned to undertake a follow-up monitoring in such sites.

(iii) Monitoring of underground water contamination

MOEJ conducted monitoring of underground water quality and contamination in June and thereafter covering 28 toxic substances such as Cadmium, Arsenic, Mercury, and PCB. The data was also released on dioxin contamination. None of the sites revealed contamination above the standards and it is planned that continuous monitoring will be undertaken.

(iv) Basin water quality and contamination monitoring

MOEJ has undertaken monitoring of basin water quality and contamination monitoring. It was undertaken at 551 sites of 37 prefectures over the period of late May – early October 2011. Only one site revealed the detection of radioactive substance, but it was below the standard. The detected site was Nakoso beach, Iwaki city of Fukushima

Prefecture.

(v) Radioactive contamination

MOEJ has issued a basic approach to the storage of soils contaminated with radioactive substances on 29 October 2011. In the MOEJ's approach, it is proposed that the intermediary facilities for storing soils contaminated with radioactive substances would be 1,500 – 2,800 m^3, and it would require 3 – 5 km^2 for each facility. It is provided that appropriate technologies will be employed for different level of contamination and categories of wastes. It is also stipulated that the set-up of intermediary facilities would be developed by the step-by-step approach in order to reduce the time duration for transporting contaminated wastes.

MOEJ estimated the volume of soils contaminated with radioactive substances and require storage based on the two scenarios. In the first scenario where the level of soil contamination with radioactive substances is relatively low, the removal of substances will be undertaken by removing the contaminated surface soil in the areas of frequently visited places such as road, road gutters, and woodland areas. In such a case, the volume of removed contaminated soil is estimated to be in a range of 15 million m^3 in Fukushima Prefecture and 1.4 million m^3 in other prefectures. In the second scenario where the removal of contaminated soil will be undertaken at all areas with the contamination at or higher than 20 millisievert per year, the volume of removed contaminated soil can be 28 million m3 in Fukushima Prefecture and 13 million m3 in other prefectures.

It is highly contentious and very sensitive to decide the location of facilities for intermediary and final storage of radioactive contaminated soils and wastes. Residents in Fukushima Prefecture voice their opposition to the idea of having their home prefecture as storages of radioactive substances. At the same time, MOEJ proposes and nudges that such storages need to be set up not just in Fukushima but other prefectures as well in the light that contaminated soils and wastes are in the great volumes and it is indispensable for a multiple number of prefectures to accommodate such requirements.

There have been already activities undertaken by local residents and volunteers to remove soils, mad, tree brunches, and fallen leaves that are contaminated with soils

4. Impending challenges

Radioactive contamination has been detected in a number of sites and the public concerns over the long-term impacts of radiation contamination are substantive and likely to mount over time. It is said that the level is not yet at what causes the immediate health hazard. However, the susceptibility to radioactive substance vary and infants, children and young mothers and women are more susceptible to radioactive substance. The level of sensitivity also varies from a person to person. The government needs to rely on the proper risk assessment. However, the interpretation of risk information varies as well.

The fiscal and physical constraint also poses difficulties in swiftly removing and storing contaminated soils and substances. It is an arduous task to have agreements with local communities to set up storage facilities of radioactive contamination substances.

A number of innovative ideas have been suggested to create space for storing wastes and facilitating reconstruction. However, the possibility of hazardous and radioactive substance content in waste and its future leakage poses difficulties in materializing such proposals.

The Amendment to the Guideline on the Implementation of the 2009 Amended Soil Contamination Countermeasures was introduced in July 2011 in order to enhance the effectiveness of countermeasures and their expediency. However, the priority has now been shifted towards dealing with the radioactive substance contamination in the affected areas and the surrounding prefectures. The Central Government devote its manpower and funding to such issues as priority. It is expected that policy makers, practitioners and scientists will explore further measures for dealing with toxic and radioactive substance contamination.

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Workshop and Accommodation Location

1. Meeting Location：

GIS Convention Center of National Taiwan University
No.85, Sec. 4, Roosevelt Rd., Da’an Dist., Taipei City 106, Taiwan .

2. Accommodation：

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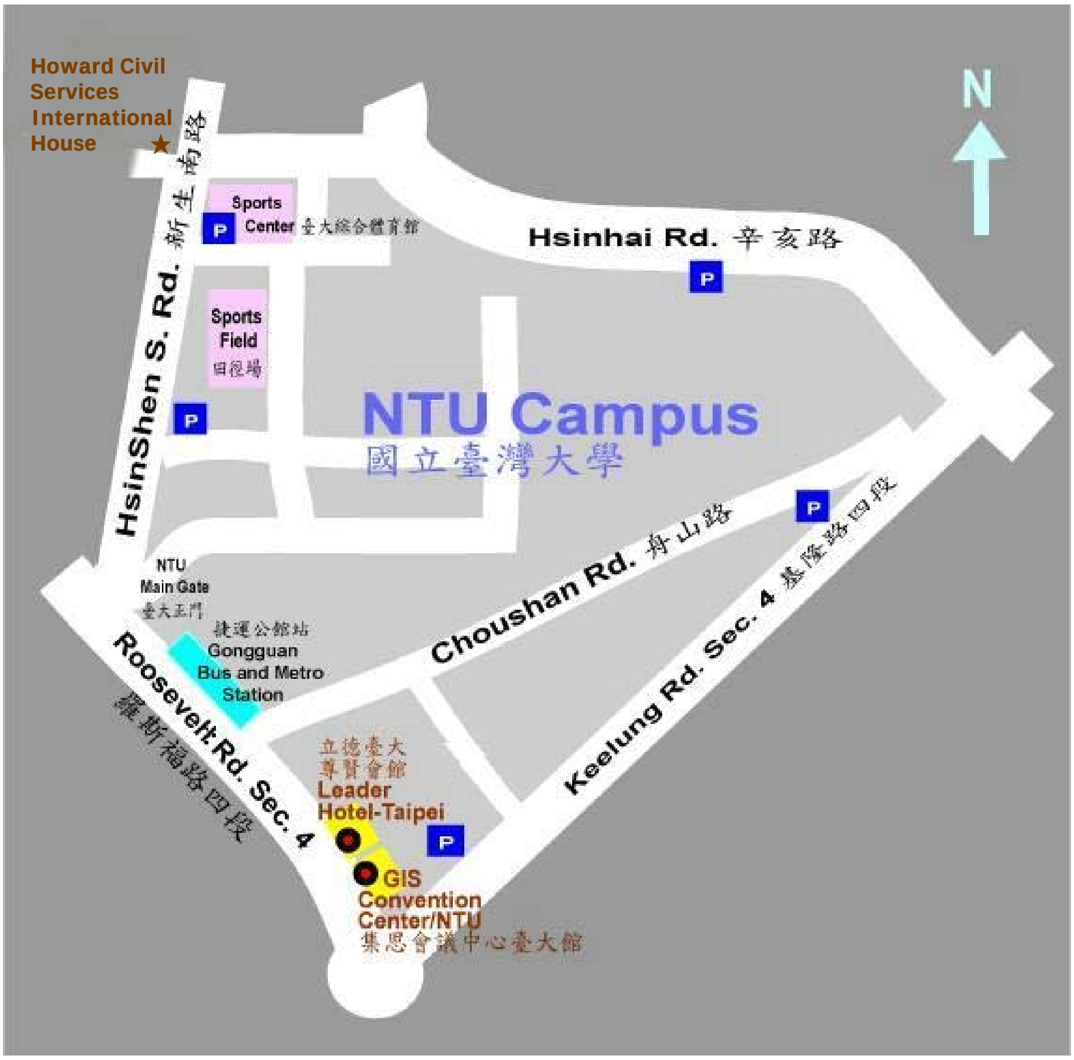

International Workshop on Regulatory Standards of Pollutants and Management Systems of Soil and Groundwater Pollution

Nov 29-30 2011

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(Listed on Nov 23, 2011)

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