The strategies for the management and development of contaminated sites in Taiwan

Shian-chee Wu

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Outlines

- Sites with potential of development
- Constrains of site development
- The chances of the development of contaminated sites
- The management strategies in foreign countries
- The possible approaches for Taiwan
- The core technique: risk management

1. Contaminated sites with potential of development

1.1. Currently regulated sites in Taiwan

- Controlled sites：593
- Sites to be cleaned up (remediation sites)：13
- Controlled sites delisted：1218
- Remediation sites cleaned up:0

1.2. Brownfields

- Brownfields sites: abandoned, idled, or underused industrial and commercial facilities where expansion or redevelopment is complicated by real or perceived environmental contamination (USEPA, 1999).
- Sites of interest
  - Currently there is no agricultural, industrial, commercial or residential activities
  - Contaminants will not be cleaned up or delisted in the foreseeable future
  - Sites have significantly large area to support development projects

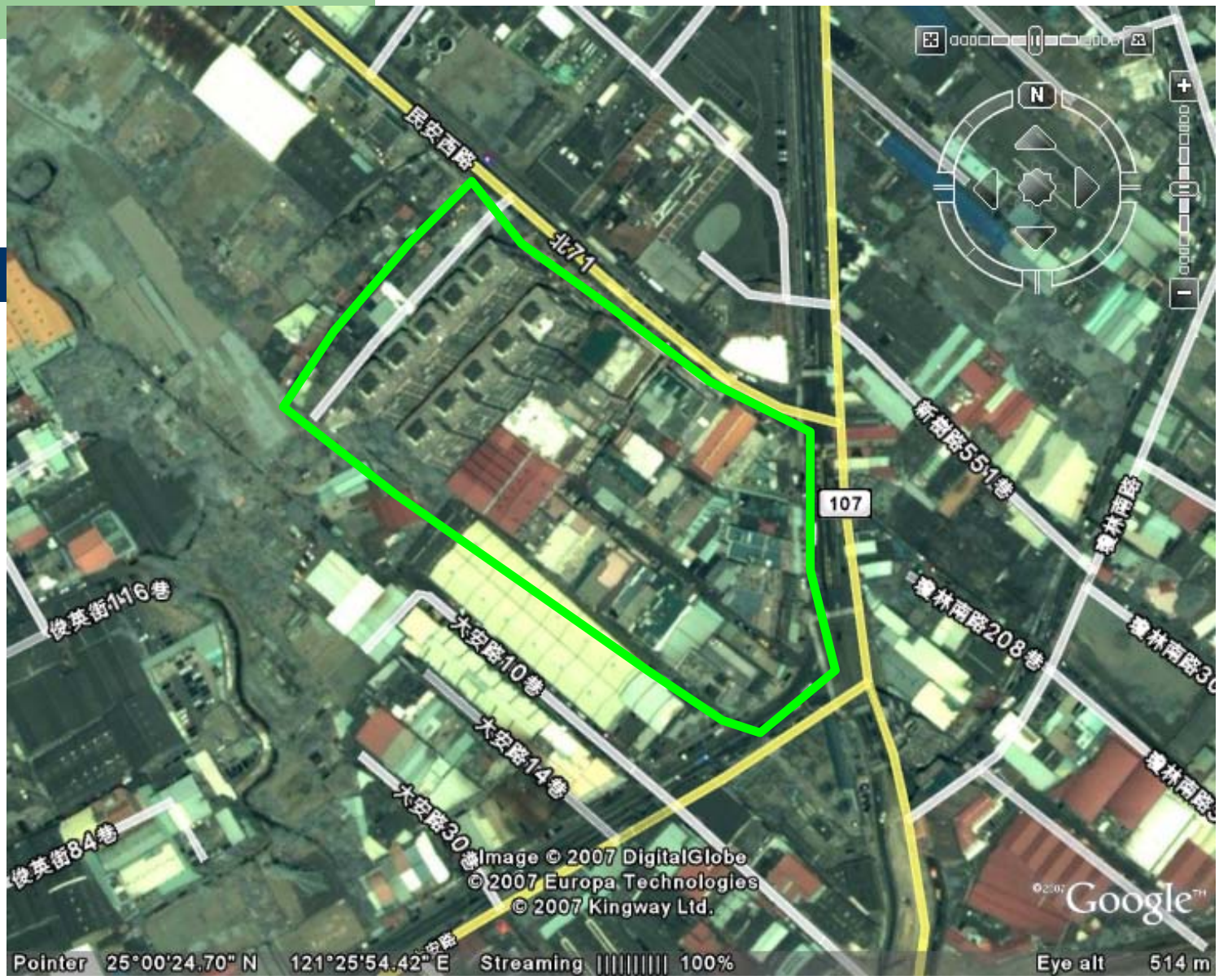
- Agricultural land：112 ha
- Abandoned waste sites：1.5 ha
- Industrial sites with large area：38.6 ha
  - RCA Taoyuan old plant; Site #1438、1439 in Sinan Dwan, Wandan Hsiang, Pingtung Hsian; Sinyang Dwan, Sinyuan Hsiang, Pingtung Hsian; Taiwan VCM Co. Tofen plant; CPC An-shung plant, Tainan.

- Others
  - Chemical Plant in Taipei Hsian: Hg
  - Kuan-du terrain, Taipei: As

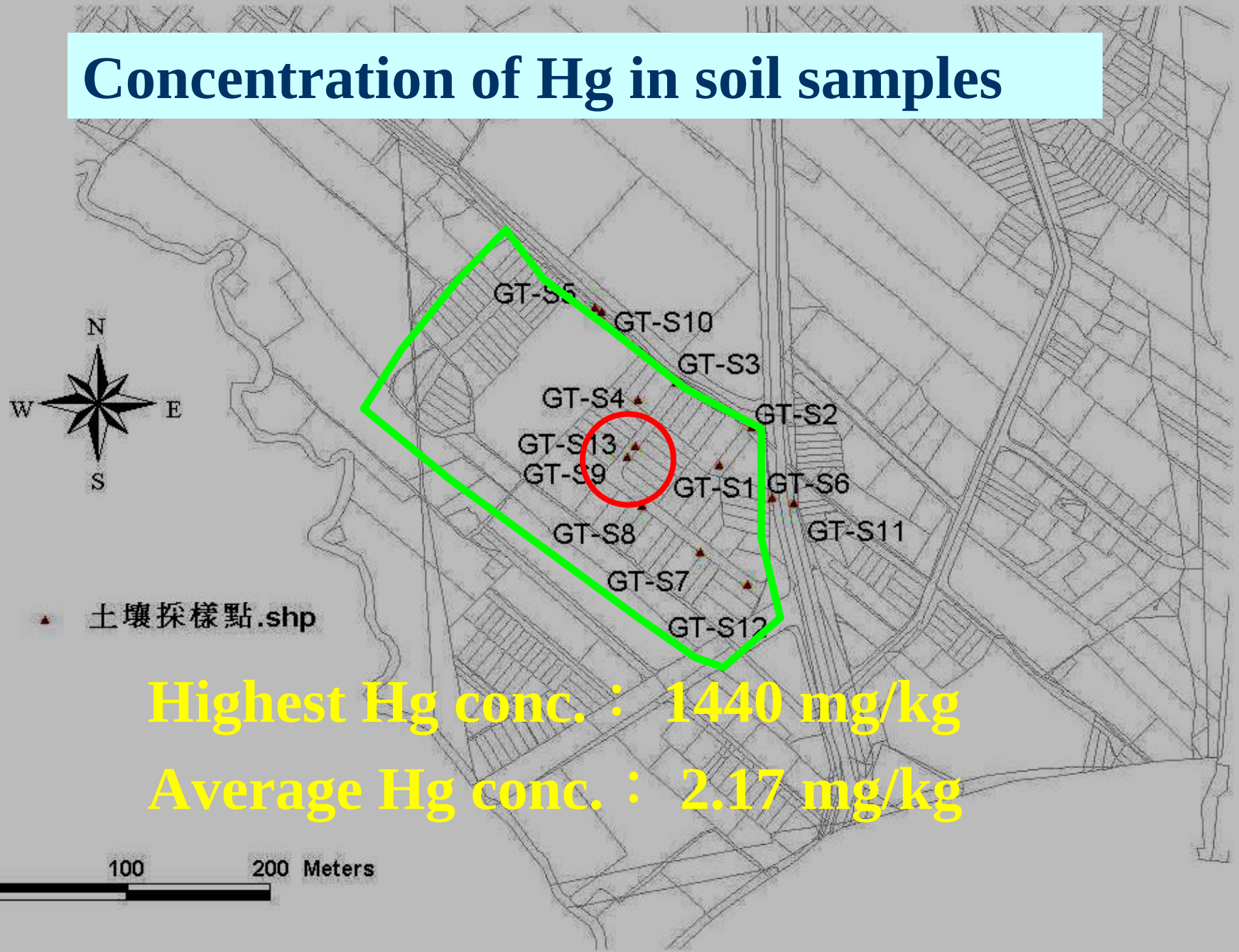
1.3. Some cases

- Case #1: Chemical plant in Taipei Hsian
  - Originally an alkali-chlorine plant
  - Presently an industrial and residential complex

Presently a mix of apartment buildings, factories, and offices



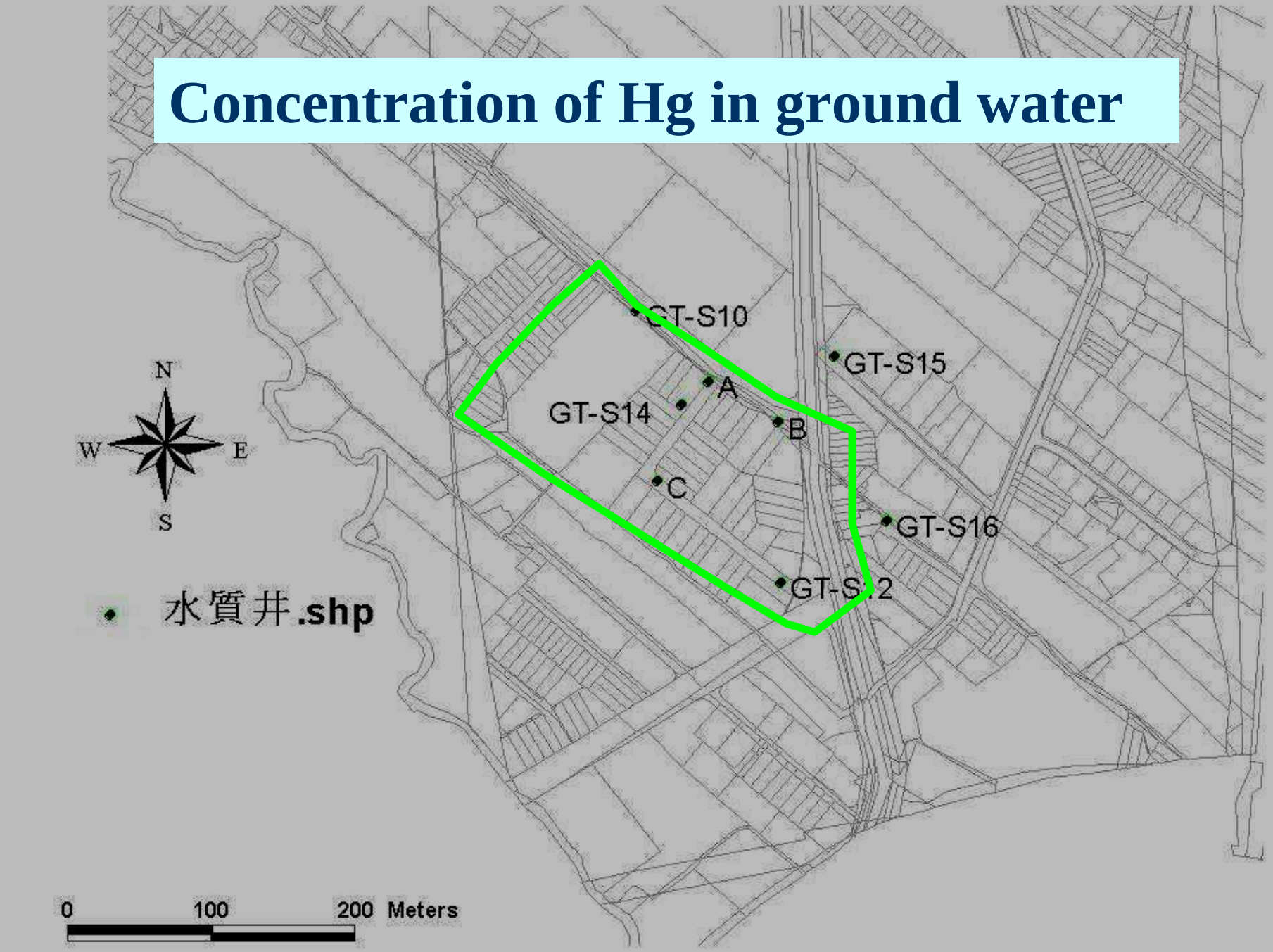
Concentration of Hg in soil samples



Highest Hg conc.： 1440 mg/kg

Average Hg conc.： 2.17 mg/kg

Concentration of Hg in ground water



Concentrations in groundwater

First monitoring result		
	B well	C well
水溫 Temp (℃)	28.2	25.0
導電度 Cond (ms/cm)	0.81	0.77
pH	6.70	6.54
總汞 Hg (μg/l)	21.4	1.17
氯鹽 Cl^- (mg/l)	25.5	45.1

Second monitoring result				
	A well	B well	C well	Surface water
水溫 Temp (℃)	26.3	29.1	25.4	
導電度 Cond (ms/cm)	0.48	0.55	0.79	
pH	5.85	6.63	6.68	
總汞 Hg (μg/l)	~0.03<N.D	5.32	1.27	1.30
氯鹽 Cl^- (mg/l)	21.2	21.2	38.7	54.3
硫化物 S (μg/l)	9.82	47.2	21.5	96.3
硫酸鹽 SO4 (mg/l)	127	77.4	110	16.3

註 1：地下水中總汞檢測方法之方法偵測極限：0.227 μg/l。

Human risk on the site

- Background risk with drinking boiled tab water and exposing to soil with 2 mg/kg of Hg：

  HI = 0.233

- Risk by exposing to contaminated soil：

  HI = 8

- Risk of drinking groundwater：

  HI = 21200

  (HI = Hazard Index (dose/Ref. dose)

- Case #2: “Contaminated agricultural fields in Taoyaun
  - Soil contaminated by irrigation water with high concentrations of Pb and Cd
  - Human risk has been lowered by mixing the surface soil vertically with clean subsurface soil in some sites.
  - 52 ha of contaminated land, which has limited thickness of soil layer and high concentrations of contaminants, have not been cleaned up due to lack of available technology.

- Case 3:RCA Tauyuan site
  - the site with area of 8.08 ha were contaminated with vinyl chloride, 1,1-dichloroethylene, trichloroethylene, tetrochloroethylene
  - Soil had been cleaned-up while groundwater was remained contaminated after remediation starting in Dec. 1996 till Apr. 1998
  - The environmental impact assessment report for the modification of zoning of the site was conditional approved by EPA, ROC in May 1999 with conditions that no construction was allowed before the site had been completely cleaned up

- The difficulty of development
  - Existence of DNAPL in aquifers as deep as 21 meters below ground surface
  - Complex geological settings
  - High cost and high uncertainty of available remediation techniques at this site

2. Limitation on the development of contaminated sites

2.1. Limitation by regulatory statutes

- § 13　Local government may take necessary actions to eliminate the hazard and avoid the dispersion of the pollution, including
  - To order the responsible person to stop total or part of any operation, business or activity
  - （Prohibition of other activities)

- § 14　Local government should proclaim a “Soil and Groundwater Pollution Controled Area” according to the scope of the contamination
- The use of the land or any human activities should be restrained in need of the protection of the residents and living environment. The activities to be restrained include the utilization of the land.

- § 15 The local government should ask the land registry not to make any registry change under the request from the polluter or the related persons.

2.2. Technological limitation

- No polluted land can not be cleaned up as long as money is not a limitation
- It is commonly agreed that the remediation of DNAPL is not feasible in terms of cost and risk reduction due to geological factors.

2.3. Limitation by cost

- Cost is the limitation
- There is no subsidies for the sites where there is a responsible person.
- The money equal to 30% of the land value has to be donated to the Remediation Fund by the land owner if the land has been re-zoned.

3. The opportunity of development

3.1. The development of controlled sites

- § 11 Controlled sites is allowed to be utilized under the Control Plan approved by the local government.

3.2. Risk-based cleanup target or criteria

- § 17 A risk-based cleanup target can be proposed by the remediator with the consideration of the geological conditions, the characteristics of the contaminant and the remediation technologies.

- § 17 The local government is allowed to proposed a risk-based cleanup target with the consideration of the financial and environmental conditions.

- § 17　The central government is authorized to set a special cleanup target or criterion in consulting with the other related governmental institutes for a site which is to be developed for certain purposes by the government.

4. The regulations and management strategies in other countries

The incentives of the revitalization of brownfields and the neighbors **(USEPA, 1999)**

- To revitalize the abundant site and neighboring communities
- To reduce the pressure of the development of virgin lands
- To use innovative approaches to reduce the threat of pollutants to the environment and heatth
- To raise the land value, change the use of the land, sell or develop part of the land by the land owner, land user, local government and USEPA

4.1. Subsidies

- Cases in the US
  - Brownfields grants funding
    - Environmental assessment
      - Brownfields Assessment Grants provide funding for brownfield inventories, planning, environmental assessments, and community outreach

- Cleanup
  - Brownfields Revolving Loan Fund Grants provide funding to capitalize loans that are used to clean up brownfields.
    - 補助州政府做爲循環貸款資本額、購買保險、成立具風險分攤功能之基金以提供應變計畫之金融風險分攤
  - Brownfields Cleanup Grants provide direct funding for cleanup activities at certain properties with planned greenspace, recreational, or other nonprofit uses.
    - 特殊保護區、休憩區及非營利使用區污染復育之補助

- Job training activities
  - Brownfields Job Training Grants provide environmental training for residents of brownfields communities.
- Providing technical information on brownfields financing matters

- Other countries
  - Great British: financial support, loan
  - Japan: subsidies from Soil Pollution Relief Fund, loan

4.2. Regulatory adjustment

- Cases in the US
  - **The Brownfields Law** (the Small Business Liability Relief and Brownfields Revitalization Act) amended the CERCLA
    - providing funds to assess and clean up brownfields
    - clarified CERCLA liability protections
    - provided funds to enhance state and tribal response programs

- **Related laws and regulations**
  - Related laws: (Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), Resource Conservation Recovery Act (RCRA), Community Reinvestment Act (CRA), Superfund Amendments and Reauthorization Act (SARA))
  - Variety of financial incentives and regulatory requirements: All impact brownfields cleanup and reuse through financial incentives and regulatory requirements.

- Draft Soil Screening Guidance
  - Rapid identification of the needs of further investigation or actions
- Risk-Based Corrective Action
  - Management approaches based on risk assessment which considers the pollution and site characteristics

- Other countries
  - Great British: regulations on the development of contaminated land, 60% of new development should be in the brown field, land zoning.
  - European countries: utilization of brown fields, limitation on the development of green field, renewal of urban brown field, statutes in the environmental protection regulations and in the urban planning and laws of zoning

4.3. Tax deduction

- Cases in the US
  - Brownfields Tax Incentive
    - Environmental cleanup costs are fully deductible
- Cases in other countries
  - Great British: deduction of tax for remediation expense
  - Japan: deduction of tax

4.4. Liability relief

- Cases in the US
  - Small Business Liability Relief
  - All Appropriate Inquiries

4.5. Technical support

- Cases in the US
  - Assessment and Cleanup Tools
  - “Get Technical Help on Your Brownfields” Project
  - Land Use and Institutional Controls

- Protecting Public Health
- Index of Publications
- Sustainable Management Approaches and Revitalization Tools electronic
- Facilitation Support
- Anatomy of a Brownfields Redevelopment

4.6. Environmental insurance

- Cases in the US
  - pollution Legal Liability (PLL), Environmental Impairment Liability (EIL)
  - Third party liability
  - Insurance for real estate trading
  - Ceiling of remediation insurance, liability insurance for contractors
  - Liability insurance for environmental expertise

- Other countries
  - British: direct or corporate development and sharing of risk and benefit

4.7. Support from other institutes

- Cases in the US
  - USEPA: funding and technology support
  - Department of Housing and Urban Development: providing renovation program, low rate subsidies and loan, technical support
  - Department of Agriculture: providing technical support and funding to local governments
  - Agency for Toxic Substances and Disease Registry (ATSDR)
  - Department of Energy

- State and local governments: encouragement with money for purchasing of contaminated land; cooperation with land owners and potential buyers to conduct remediation; providing technological assessment, tax deduction, loan, financial support, and environmental insurance
- Non-profit organization：providing expertise of remediation technology by colleges and educational institutes
- Civil organizations and community：communication and sharing information

5. Strategies for the development of contaminated sites

5.1. Amendment and increase of flexibility

- Relief of some constraining measures in §13 and §14 by the utilization of risk-based decision making processes

- Removing the limitation on land transferring regulated by § 15 if appropriate measures, like sufficiently noticing the buyers, have taken by the land owner
- Removing the limitation on re-zoning regulated by §46, and returning the responsibility of making decision back to the responsible authorities
- Allowing and encouraging private developers to submit remediation proposals and remediation targets by expanding the scope of §46, "synchronization of remediation and development "

5.2. Financial support and encouragement

- Loans
- Exemption of the requirement of donating (money equal to 30% of the land value) by certain developers, like farmers and small business

5.3. Tax deduction

5.4. Providing insurance

5.5. Providing technical supports

5.6. Assistance from all levels of government

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6. Risk assessment is the core technology

- We need to upgrade the theoretical basis for the risk management and the risk and cost analyses to be the tool for setting the controlled area, remediation criteria and remediation targets,
- To enhance the skill of risk management of the regulatory agencies and the employees,
- To enhance the ability of risk communication,
- To establish the system and consensus of risk valuation

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Thank you for your attention