



Delivering Sustainable Solutions for Brownfield Regeneration

为棕地再开发提供可持续解决方案



Recent Developments in Chinese Brownfield Regeneration Market

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Outline of the Presentation



- **Status of Brownfield Site Contamination**
- **Problems and Challenges**
- **Risk Based Contaminated Land Framework**
- **HERA Software Introduction**
- **Recent Activities**
- **Platform for Collaboration**
- **Summaries**

Relocation of Contaminated Sites Intensified

中国行政区划图



Beijing: 200 sites within the 4th Ring Road were relocated and subjected redevelopment (8 km²) – Beijing Olympic Action Plan

Shengyang: 56 polluted sites were subject to relocate in 2008; Relocate all heavily polluted industries in 2009.

Jiangsu Province: 400 chemical works were relocation to suburbs, 1000 small scale were shut down between 2000 and 2005

Chongqing: 112 sites in urban areas in 2010

Guangzhou: 147 large scale industries shut down subject to relocation in 2007



Presence of High Risk Sites

- **1000 Pesticides Manufacturing Sites (44 containing POPs)**
- **80 Mining waste sites, no prevention measures**
- **Numerous Chemical Works**



Pressure on Realizing Land Values

- **Sites Dismantled and Demolished on Relocation**
- **Frequent Environmental Incidents**
- **Complicated Site Histories**
- **Groundwater Investigation being Largely Ignored**



Problems and Challenges



Relocation of Polluters Leading to Large Quantity of Sites

- 86,000 corporations shut down or relocated during 2001-2007
- 300,000 industrial corporations in China, 40% in urban areas, posing serious threat to human health and the environment



Problems and Challenges



Lack of Relevant Chinese Guidelines



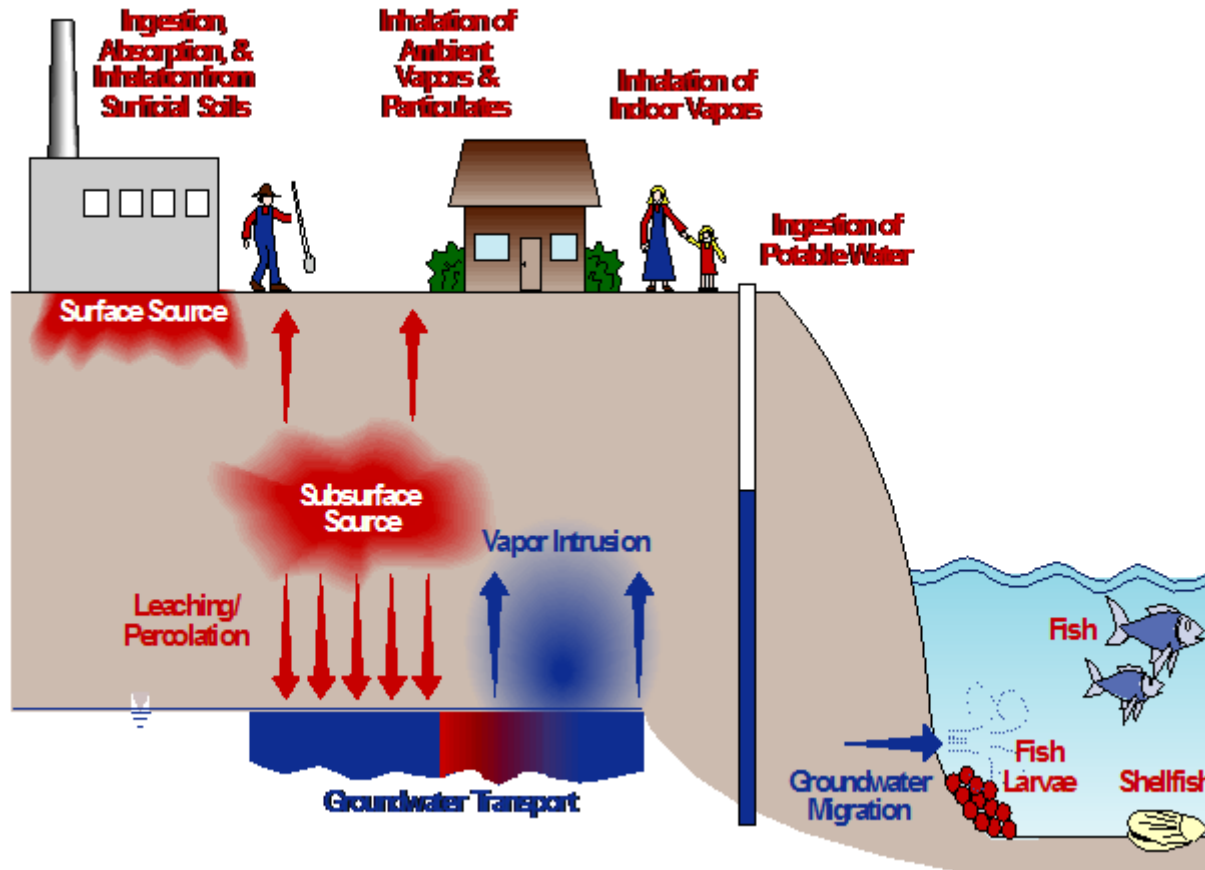
1. Technical Guidelines for Site Environmental Investigation (**Draft**)
2. Technical Guidelines for Site Environmental Monitoring (**Draft**)
3. Technical Guidelines for Risk Assessment for Contaminated Sites (**Draft**)
4. Technical Guidelines for Soil Remediation for Contaminated Sites (**Draft**)

Understanding the Threat of Site Contamination

■ Soil and Groundwater Contamination Sources

■ Human Health

■ Water Environment





Problems and Challenges



Catching Up with the Rest of the World (Mainly Europe and USA)

1980 - 1990



1991 - 2004



2005 – Present



Complete Removal

1. **Difficult to achieve**
2. **No need to do so**

Risk based remediation framework that focuses on the selection of techniques and environmental effects

More attention on sustainability that balances on remediation and economy

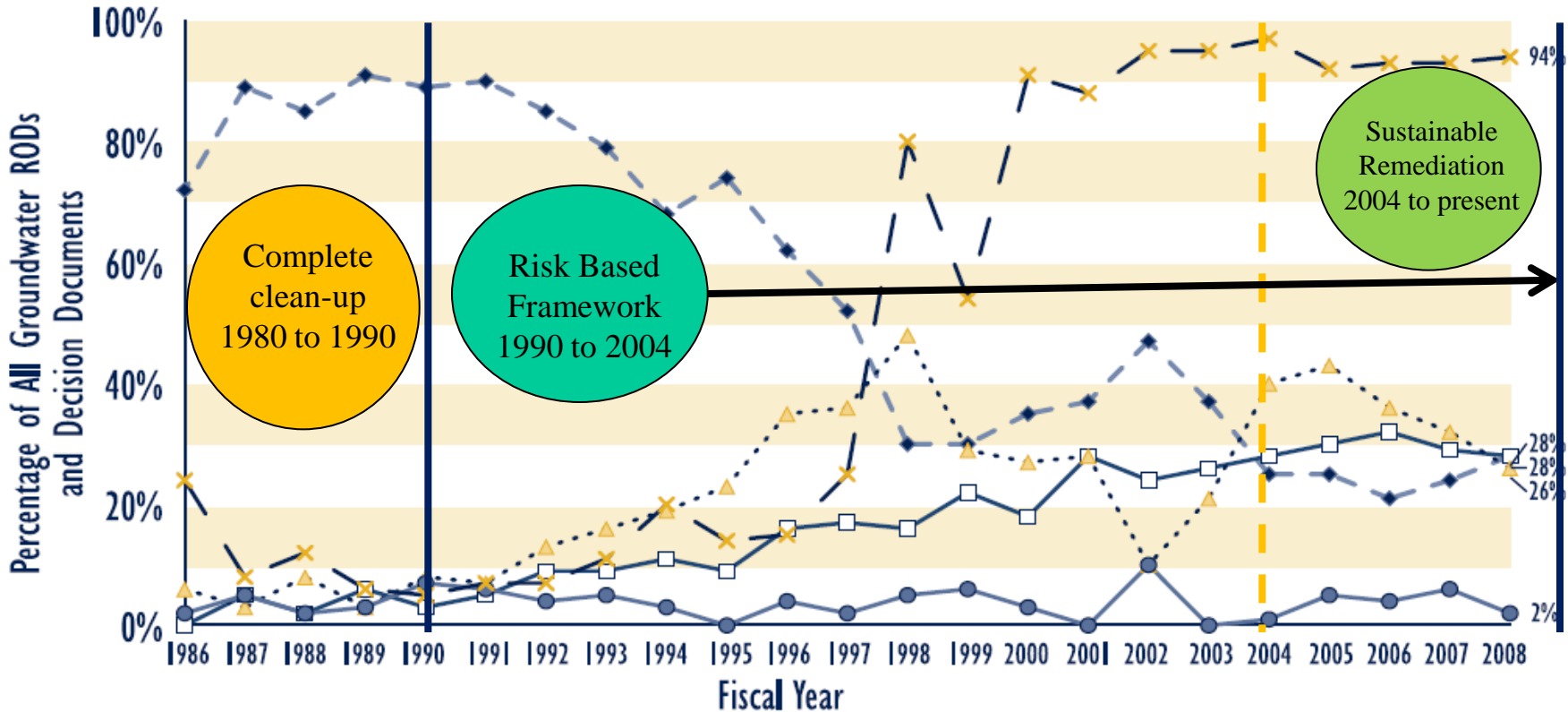
Based on CL:AIRE Presentation



Problems and Challenges



Trends in Selecting Groundwater Remediation (FY 1986-2008)



- ◆— GW P&T
- GW In Situ Treatment
- GW Containment (Vertical Engineered Barrier)
- ▲— GW MNA
- ×— GW ICs and Other

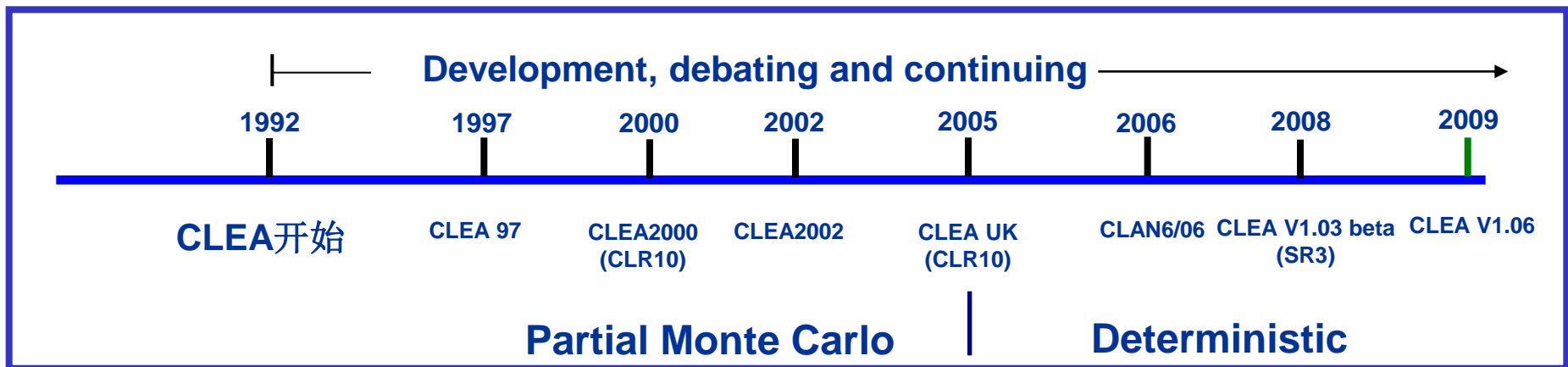
- Groundwater ICs and Other includes institutional controls and other components not classified as treatment, MNA, or containment, such as monitoring and alternative water supplies.
- Groundwater ICs and Other remedy components selected prior to FY 1998 may be under-represented in figure.
- RODs and decision documents may be counted in more than one category.
- RODs from FY 1986–2004 include RODs and ROD amendments.



History of ASTM RBCA Development

Guidance	1989	1995	1998	2000	2002	2004	2005	2006
USA	USEPA RAGS	ASTM E1739 Petroleum RBCA	ASTM P104 Chemical RBCA	ASTM E2081 Chemical RBCA	No New Guidance being published			

History of UK CLEA Development





Relevant Chinese Guidelines



- 1. Soil Quality Standards for Industrial Sites - 1999**
- 2. Technical Guidelines for Risk Assessment for Contaminated Sites (Draft) - 2009**
- 3. Risk Assessment Tool – HERA (August 2012)**



HERA Software Introduction



Human and Environmental Risk Assessment Software

污染场地健康与环境风险评估软件 - 【编号: 999 场地名称: Example 层次: Tier2】

新建项目 打开项目 保存项目 关闭项目 删除项目 导入/导出 打印窗体 帮助

项目输入

- 项目信息
- 选择污染物
- 选择暴露途径**
- 选择模型
- 设置参数

项目输出

- 参数管理

暴露途径选择 暴露途径示意图

原场 离场

植物吸收

吸入室内蒸气

吸入室内颗粒物

吸入室外颗粒物

经口摄入

皮肤接触

吸入室外蒸气

饮用地下水

吸入室内蒸气

吸入室外颗粒物

吸入室外蒸气

饮用地下水



Key Features

- **Windows Based Software Using Visual Studio (C#)**
- **User Friendly Interface, High Stability and Fast Calculation**

Process

- **Multi-Tiered Risk Assessment System**
- **Toxicity and MCL Based Soil and Groundwater Assessment**
- **Derivation of Generic and Site Specific Assessment Criteria**
- **Multi-Tiered Database Management**
- **Implementing CL: AIRE & CIEH Statistical Guidance**



HERA Software Introduction



Exposure Pathways Included

Exposure pathways	USA RBCA	UK CLEA	China HERA
Plant Uptake	√	√	√
Soil Ingestion	√	√	√
Dermal Contact	√	√	√
Indoor Dust	X	√	√
Outdoor Dust	√	√	√
Indoor Vapour	√	√ (Only Soil)	√
Outdoor Vapour	√	√ (Only Soil)	√
Soil Leaching	√	X	√
Air dispersion	√	X	√
Groundwater Migration	√	X	√



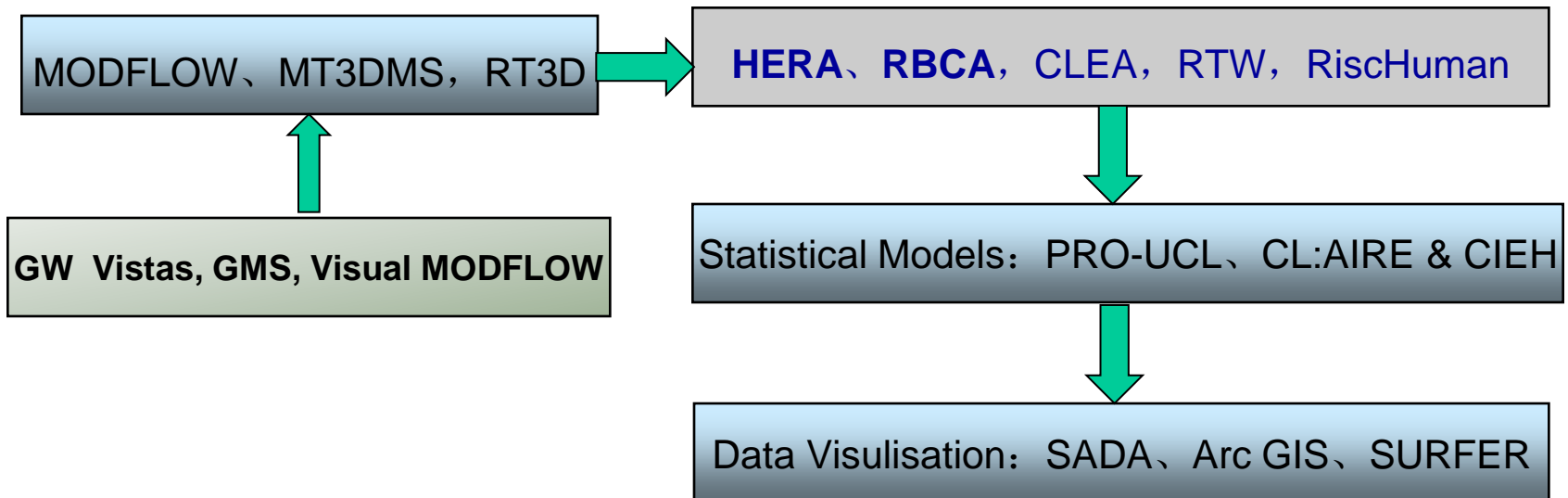
HERA Software Introduction



Exposure Pathways	Contaminant Transport Models
Plant Uptake	Ryan Model; Trap Model; PRISM Model
Inhalation of Indoor Particulates	USEPA Q/C Model; ASTM Model
Inhalation of Outdoor Particulates	USEPA Q/C Model; ASTM Model
Inhalation of Outdoor Vapour (Surface Soil)	ASTM Model; USEPA Q/C Model
Inhalation of Outdoor Vapour (Subsurface Soil)	Johnson-Ettinger Model Johnson-Ettinger & Mass Balance Model
Inhalation of Indoor Vapour (Subsurface Soil)	Johnson-Ettinger Model Mass Balance Model & Johnson-Ettinger Model
Soil Leaching	ASTM Model; SAM Model; SAM Model with Biodecay
Inhalation of Groundwater Vapour (Outdoor)	ASTM Model
Inhalation of Groundwater Vapour (Indoor)	Johnson-Ettinger Model
Air Dispersion (offsite)	3D Gaussian Dispersion Model
Groundwater Migration (offsite)	Domenico Model with First-Order Decay



Recommended Software Architecture for Undertaking Risk Assessment



The First International Workshop on Site Remediation November 22nd to 24th 2010

■ Policies ■ Technologies ■ Funding Mechanism



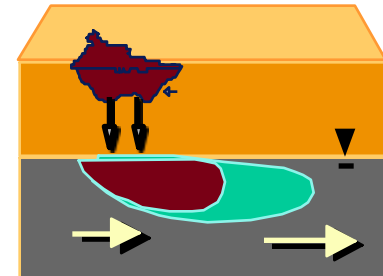


Recent Activities



The First Training Course for Soil and Groundwater Risk Assessment Using RBCA June 13th to 15th, 2011, Nanjing, China

Hands-On Training for RBCA Tool Kit V2.5



Organiser: Key Laboratory of Soil Environment and Pollution Remediation
Supporting Organiser: GSI Environmental Inc, Texas, USA



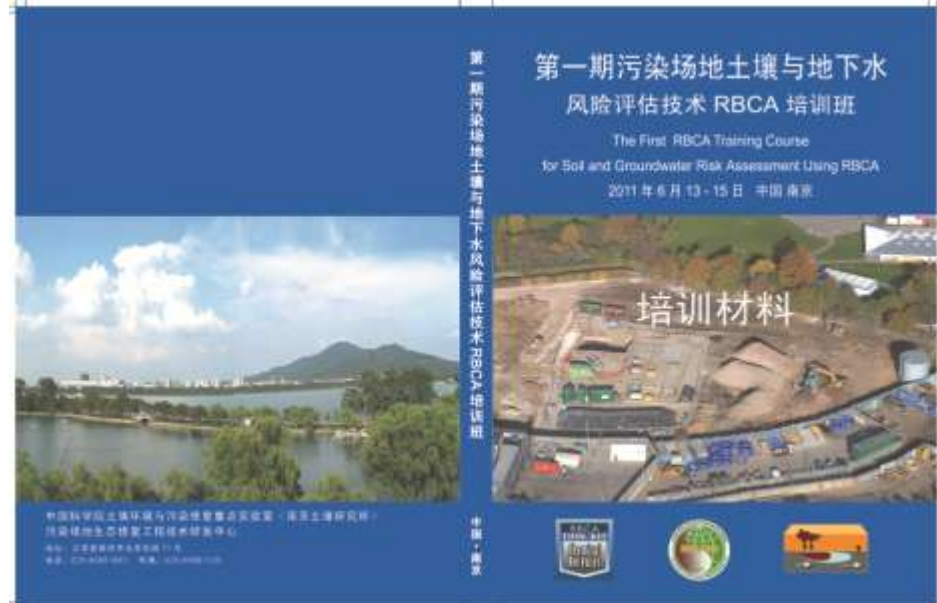
The First Soil and Groundwater Risk Assessment RBCA Training

June 13 to 15th 2011



- Risk Assessment Fundamentals
- Fate and Transport Modelling
- Collation of Physio-Chemical and Toxicity Parameters
- RBCA Interface Introduction
- Derivation of Generic and Site-Specific Assessment Criteria
- Comparison of International Risk Assessment Guidelines
- Developing Chinese Specific RBCA Model
- Application of Statistical Tools

No. of Attendees	120
Government	28
Universities	20
Research Institutes	22
Consulting	50





Recent Activities



The Second International Workshop on Site Remediation September 22nd to 24th 2012





Recent Activities



The Workshop on Site Investigation, Assessment and Remediation December 3rd 2012





Recent Activities



**The Second Training Course
for Soil and Groundwater Risk Assessment Using HERA
December 4th to 5th, 2012, Nanjing, China**



**Organiser: Centre for Site Remediation, Institute of Soil Science, CAS
Nanjing Kaiye Environmental Technology Ltd**



The Second Soil and Groundwater Risk Assessment HERA Training

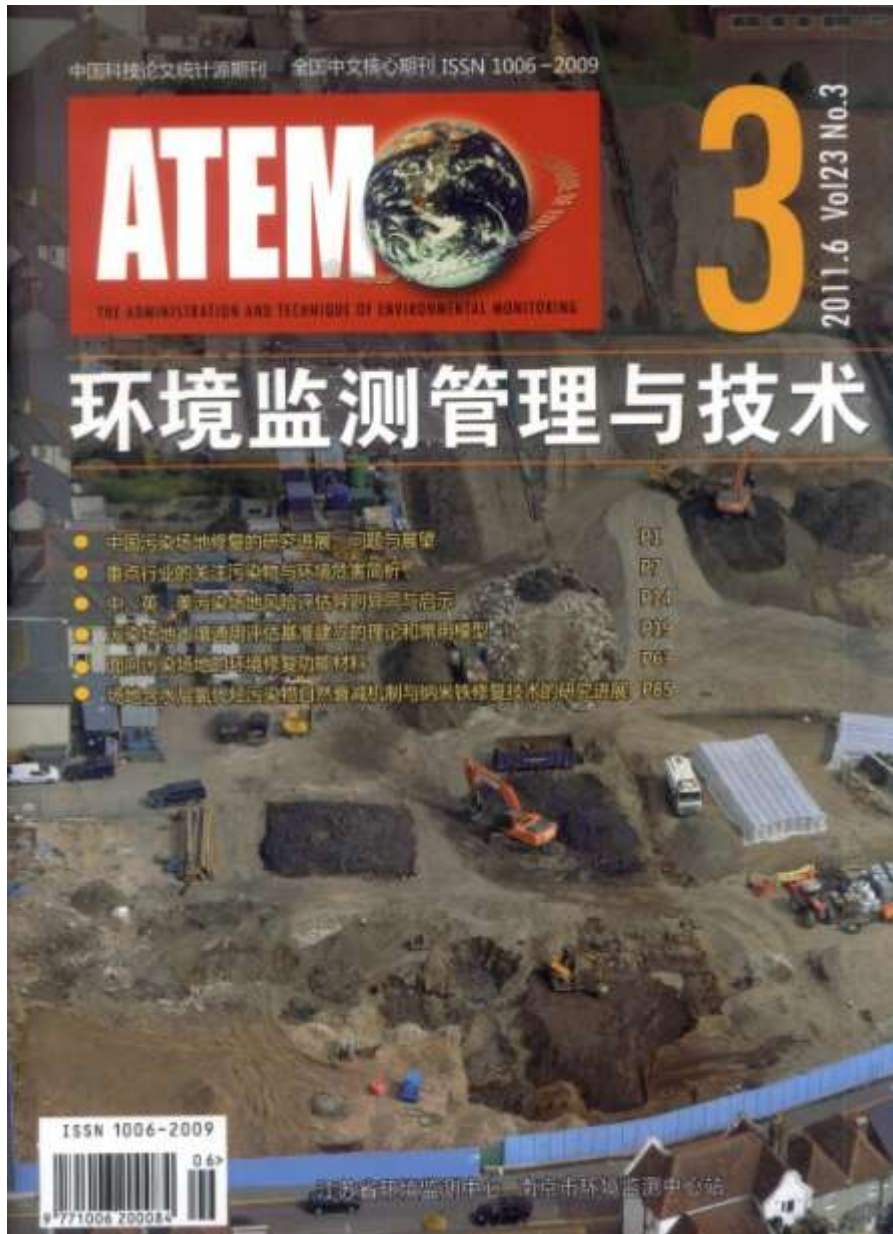
December 4th to 5th 2012



- Risk Assessment Principles
- Fate and Transport Modelling
- Collation of Physio-Chemical and Toxicity Parameters
- **HERA** Interface
- Derivation of Generic and Site-Specific Assessment Criteria
- Example Application

No. of Attendees	100
Government	15
Universities	25
Research Institutes	20
Consulting	40





Special Publication on Contaminated Land Management

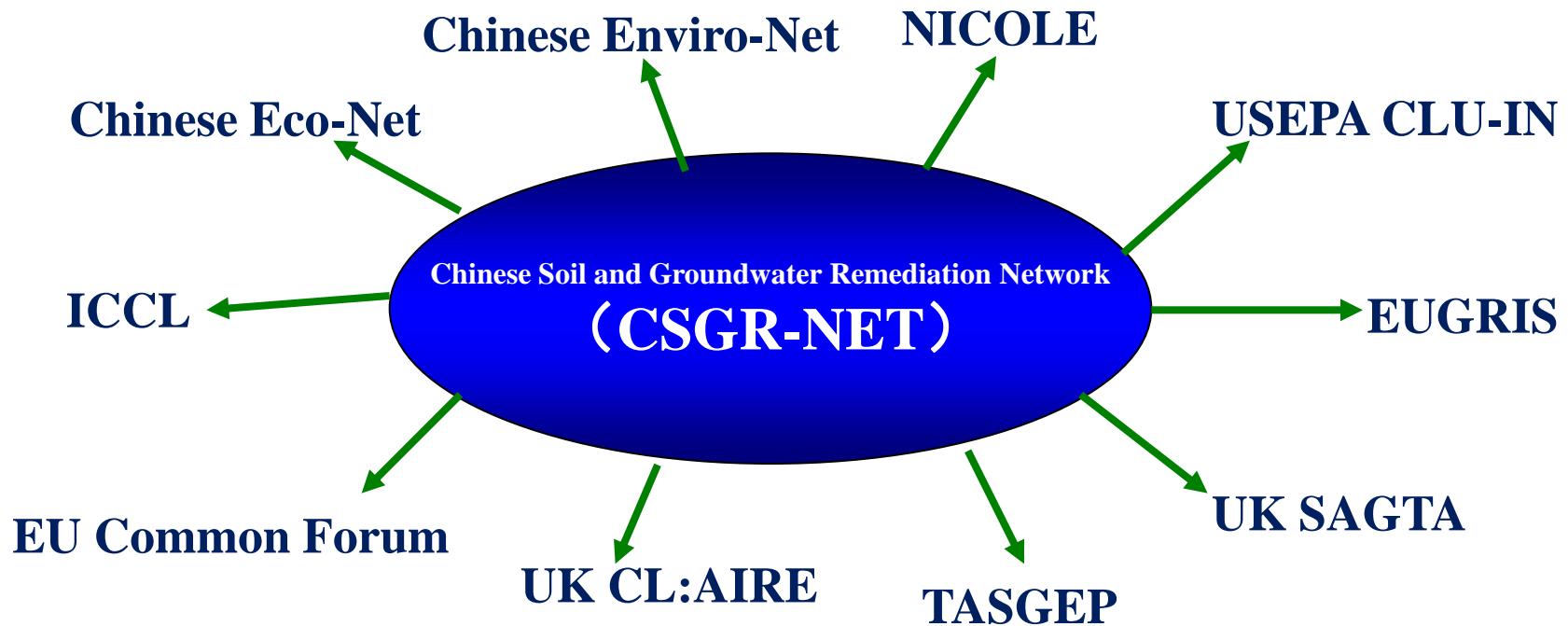
- Contaminants of Concern and Adverse Environmental Impact for Key Industries
- Comparison of USA, UK and Chinese Risk Assessment Guidelines and the Implications for China
- Theory and Common Used Models for the Derivation of Soil Generic Assessment Criteria for Contaminated Sites
- Natural Attenuation Mechanisms and the Status of Nano-iron Technology for the Remediation of Chlorinated Solvents in Groundwater



Platform for Collaboration



- SuRF China in 2013, SITEREM 2014, ICCL 2015
- Developing Chinese Soil and Groundwater Remediation Network



<http://www.CSGR.net>



Summaries



- **Slowdown of Redevelopment Needs**
- **Establishing Risk-Based/Sustainable Contaminated Land Management Framework**
- **Learning from USA and European Experience**
- **Providing Opportunities for Business and Research (Remediation Technologies and Equipments)**
- **Leading to Safe and Sustainable Brownfield Redevelopment**



谢谢! Thank You!

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