

Exploration of Chinese Remediation Industry and Corporation between China&Europe



----- Striving to maintain our recognized leadership in Chinese remediation market by integrating innovative while environmentally-friendly approaches

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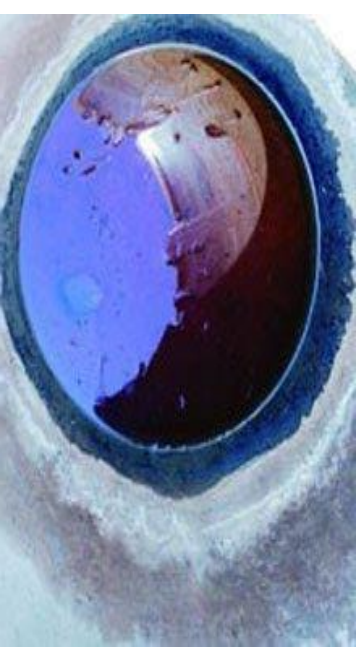
- 1、 **Current situation of Chinese remediation industry**
- 2、 **Challenge of remediation industry**
- 3、 **Company profile**
- 4、 **Corporation between China and Europe**



1. Current situation of Chinese remediation industry



Potential Soil Remediation Market in China



illegal dumping site in Yunnan Province

contaminated soil as hazard waste

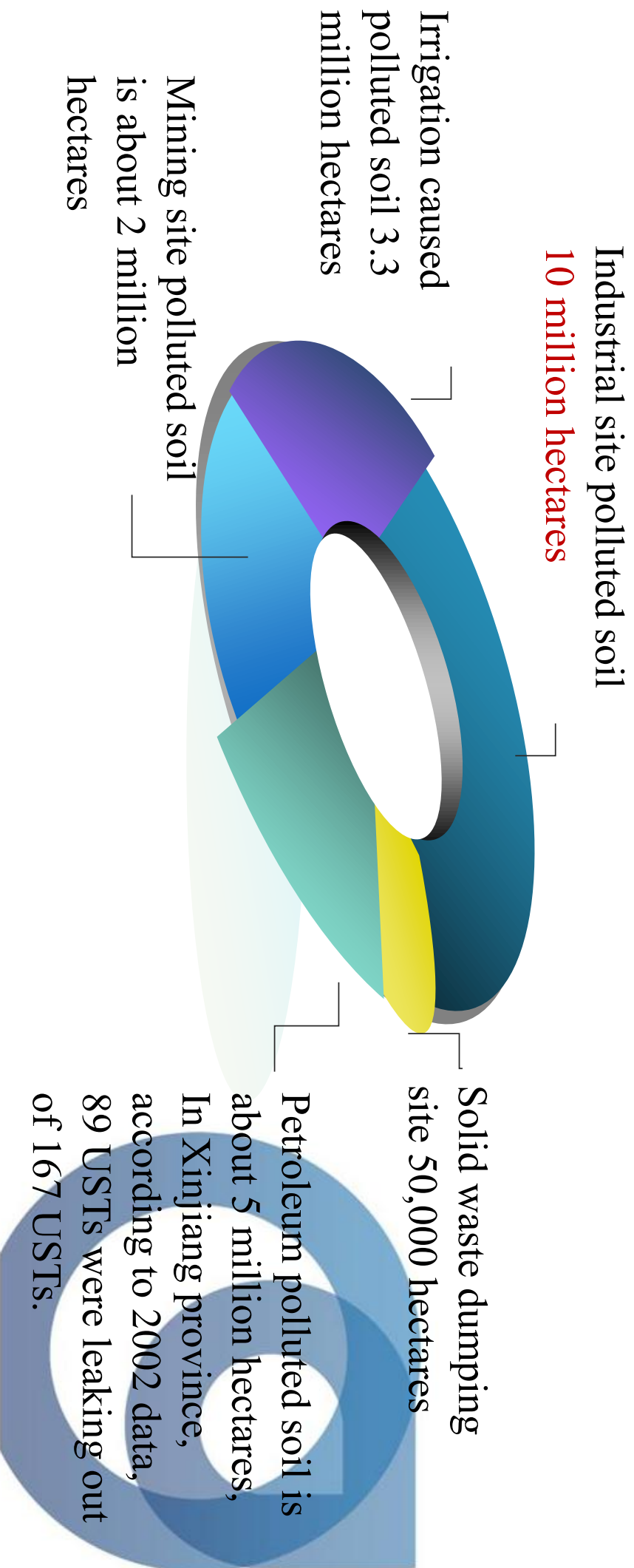
groundwater is turning red



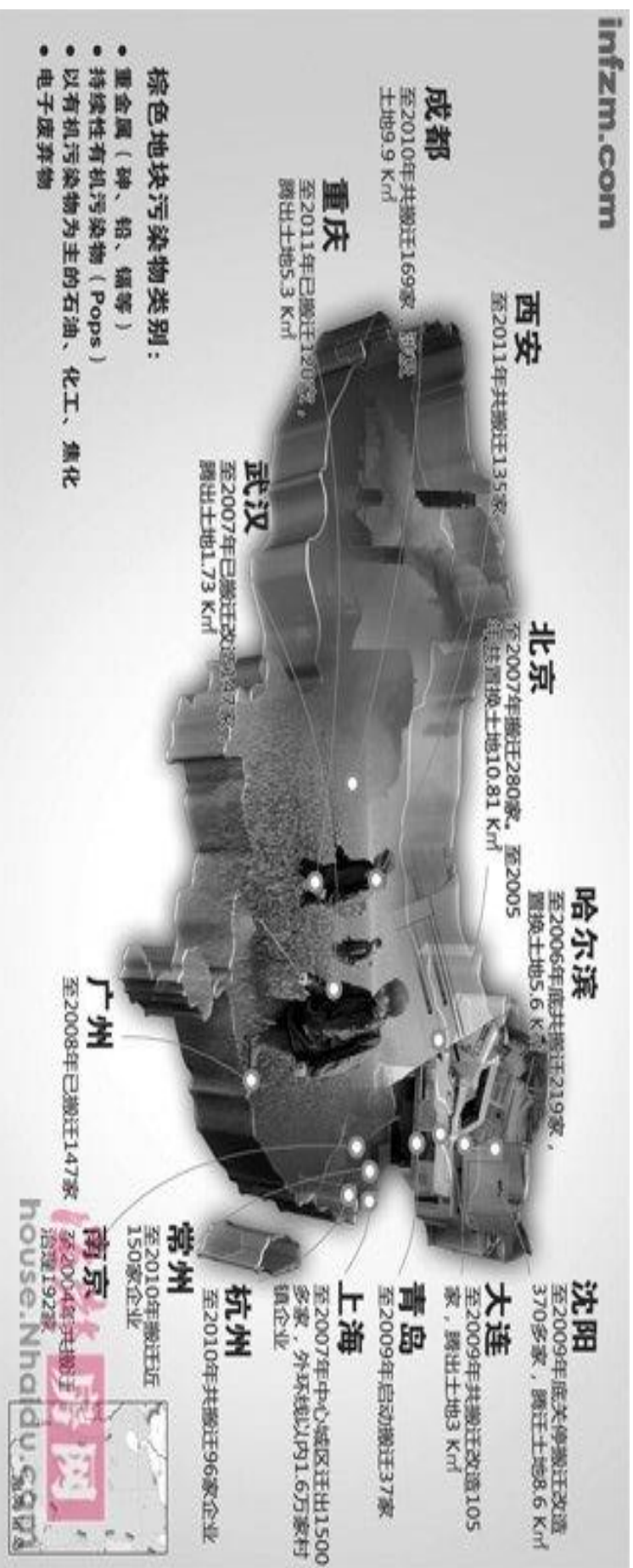
22,000 residential need to relocate due to the heavy metal pollution

Cadmium contaminated rice

Total contaminated soil is about 20 million hectares



Industrial Site



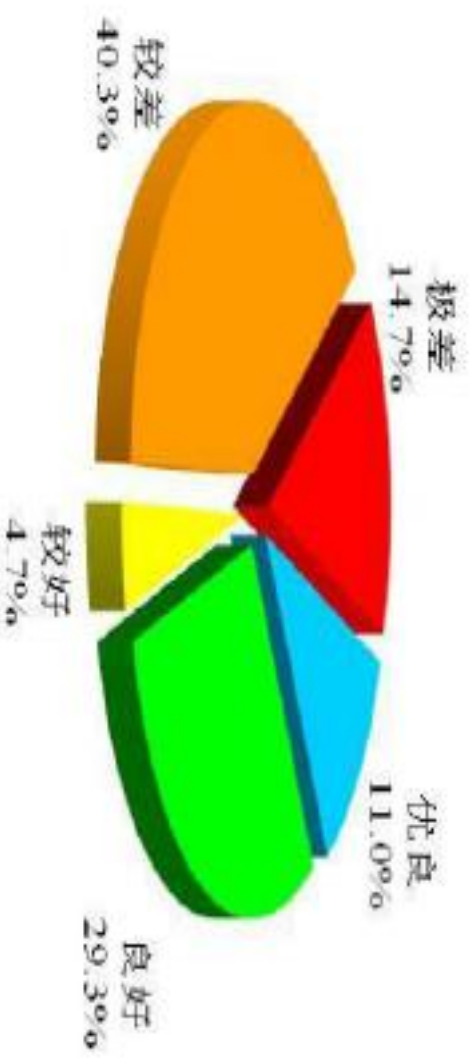
Lots of factories need to be moved out of the city center

Potential groundwater remediation market

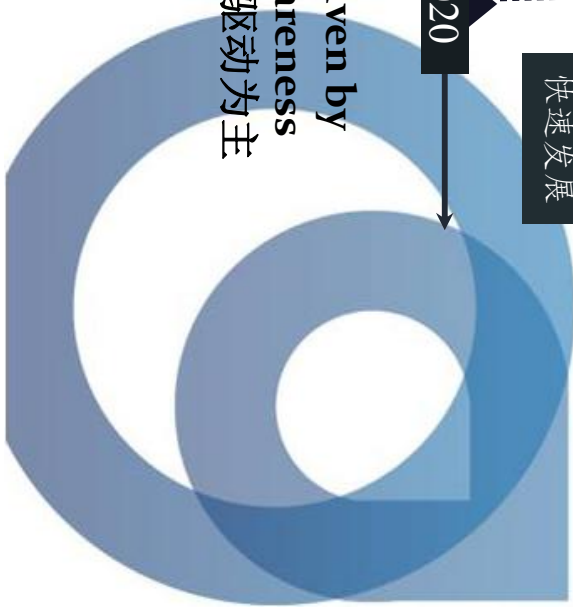
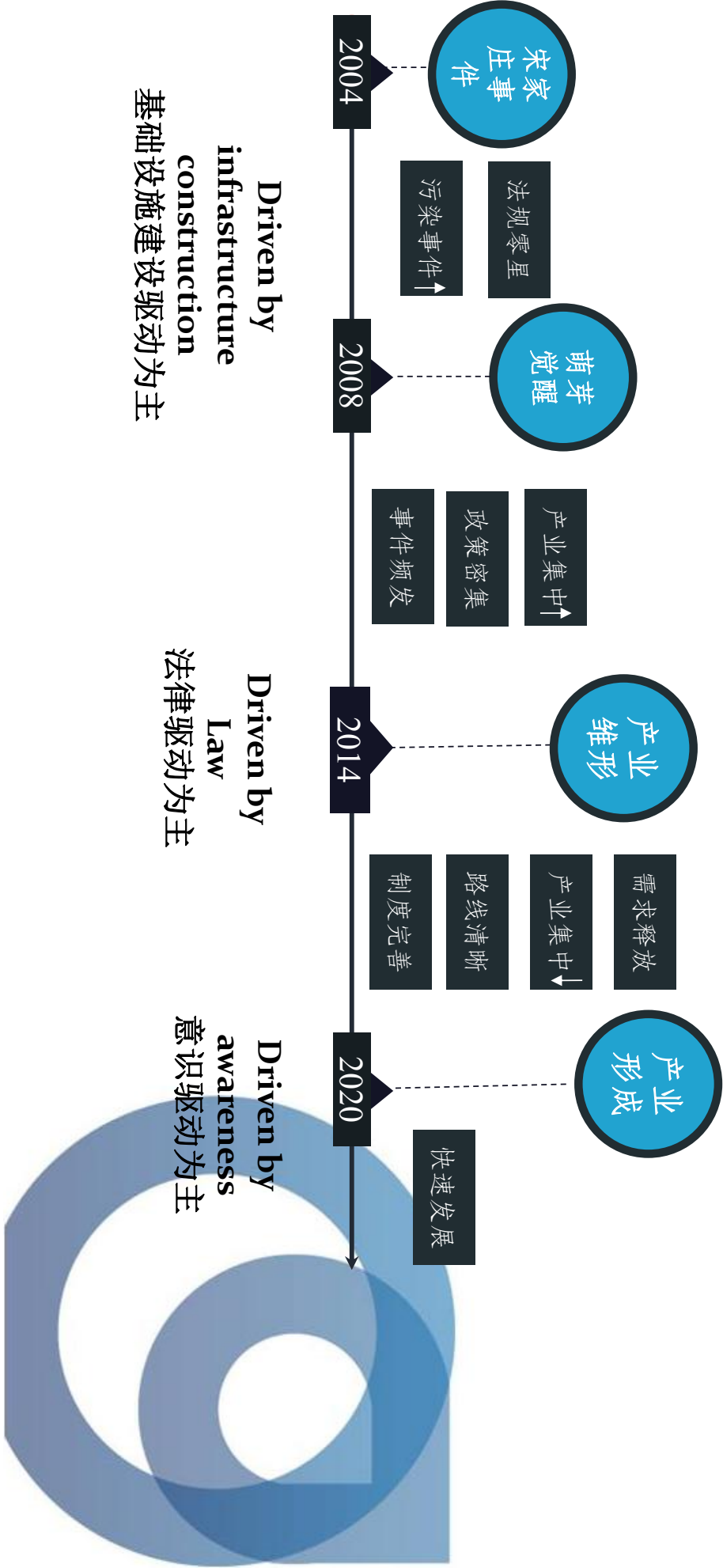
118 cites monitoring date:

- About 64% of cites' groundwater are severely polluted
- 33% of groundwater are lightly polluted
- Clean water is only about 3%
- About 400 out of 655 cites use groundwater as the drinking water

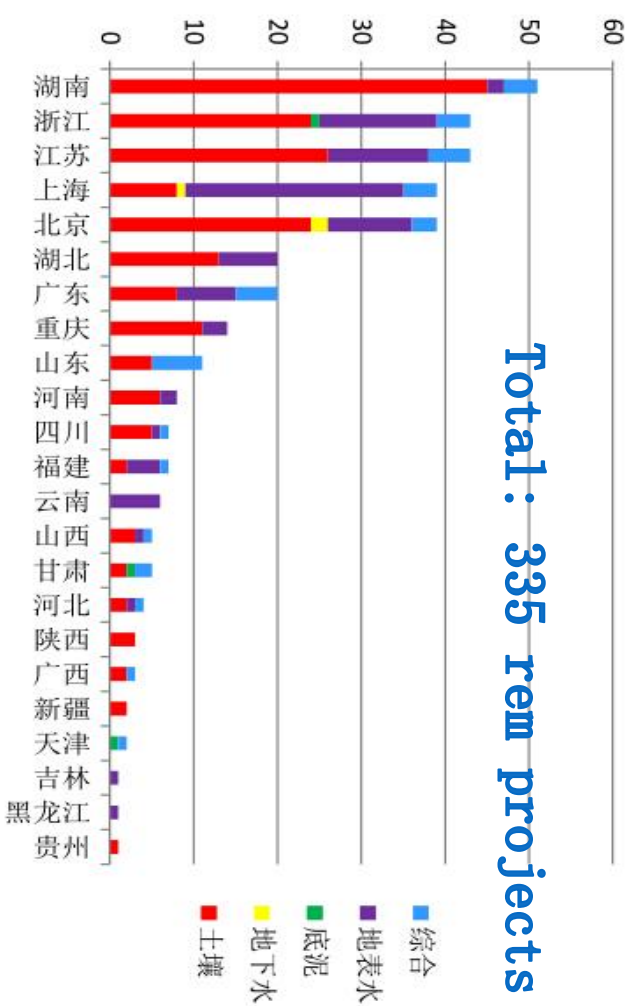
GW quality in 2011



2004—2014



Current Situation



2006-2014 Remediation projects distribution map

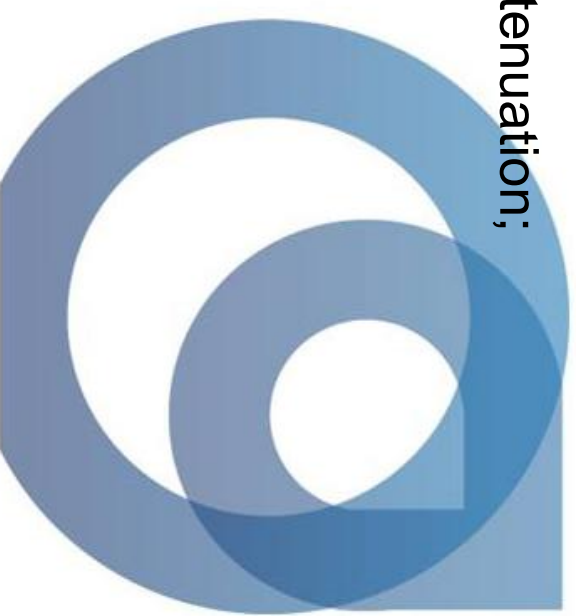
57% are soil rem projects, mainly distributed in developed areas.

Rem Industry VS Environmental Protection Industry (2013)

	Rem Industry	EP Industry	%
Industry scale (Billion USD)	1.1	580	0.19%
Annual output (Billion USD)	0.33	183	0.18%
# of companies	300	35000	0.86%
# of practitioners	3000	3,000,000	0.10%

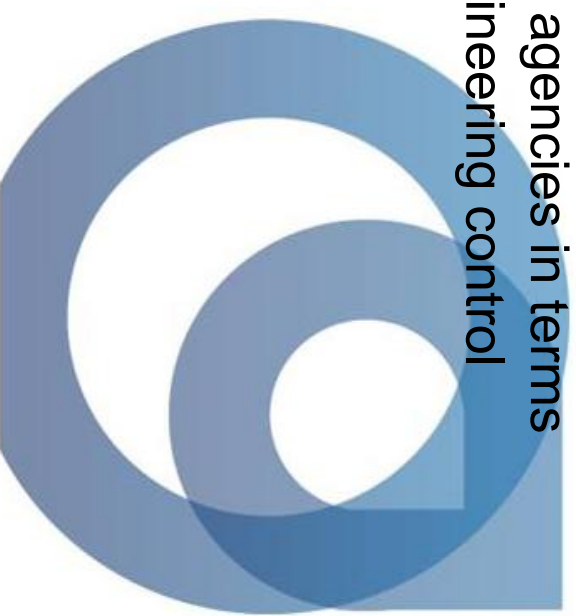
Development Trend in China:

- More thorough site investigation;
- An evolving remedial investigation approach with extensive use of fast site screening equipment/tools;
- Use of institutional control/engineering control measures;
- Preference of in-situ or onsite remediation where applicable;
- Combination of active remediation and monitored natural attenuation;
- Onsite reuse of remediated soil to the extent practical.



Current Limitations

- Oftentimes very limited time for site investigation/remediation because of redevelopment schedule, and off-site treatment is thus generally preferred over onsite treatment.
- Unwillingness of client to spend a fair share of money in thorough site investigation (much less focus on consulting when compared to construction part), leading to greater uncertainty in remedy selection and implementation.
- Limited information sharing between difference government agencies in terms of contaminated sites, which makes institutional control/engineering control measures hard to implement.



3、 The Development of BCEER



Full-Service Consulting, Engineering, and Construction Company

Remedial Investigation

- Site information collection
- Preliminary site investigation
- Detailed site investigation
- Risk assessment

Remedy Selection

- Remedy screening
- Feasibility study Bench-scale test and/or pilot test
- Remedial design

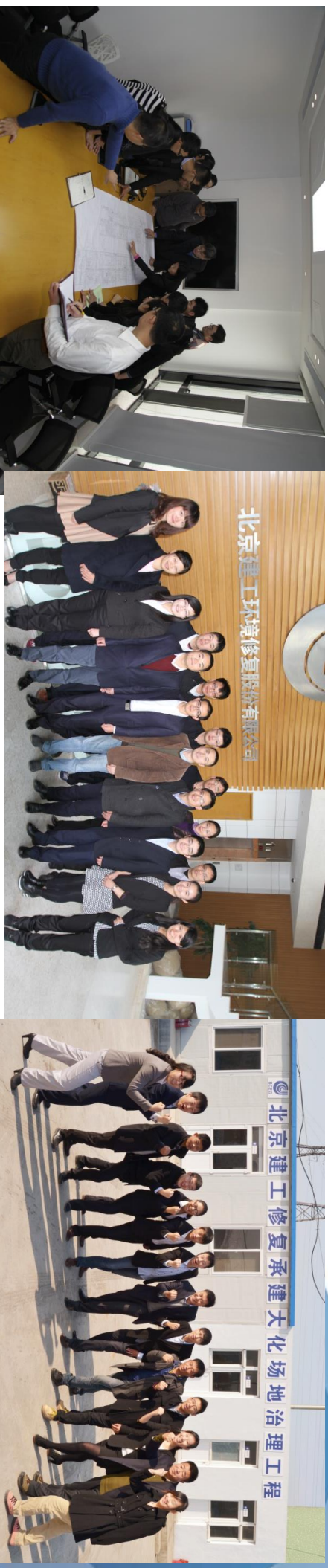
Remedy Implementation

- Preparation
- Implementation
- Post-remediation monitoring

ABOUT BCEER



BCEER has over 300 employees across the country. More than 40% holding Master/PhD degree ; 6% of employees have overseas studying or working experience. Employees from different academic background, including environmental engineering, environmental science, chemical engineering, biology, civil engineering, agriculture, water resources etc.



Site Investigation Projects

部分场地调查及风险评估项目

Project Site	COCs	Project Scale
Former Pesticides Manufacturing Facility	DDT, HCHs	160,000 m ²
Former Coking Plant	BTEX, PAHs	1,340,000 m ²
Former Chlor-alkali Plant	Chlorinated VOCs	649,000 m ²
Soil & Groundwater Investigation	TPHs	80,000 m ²
Former Fertilizer Manufacturing Facility	Arsenic, PAHs	540,000 m ²
Automobile Parts Manufacturing Facility	Hexavalent Chromium	10,000 m ²
Automobile Parts Manufacturing Facility	Chlorinated VOCs, TPH	MNA Evaluation
Former Chemical Plant	Arsenic, PAHs, TPH	3,000,000 m ²
Former Industrial Park	Heavy Metals, Pesticides, PAHs	1,000,000 m ²
Former Dye Manufacturing Facility	VOCs, Heavy Metals, Pesticides, PAHs	175,000 m ²

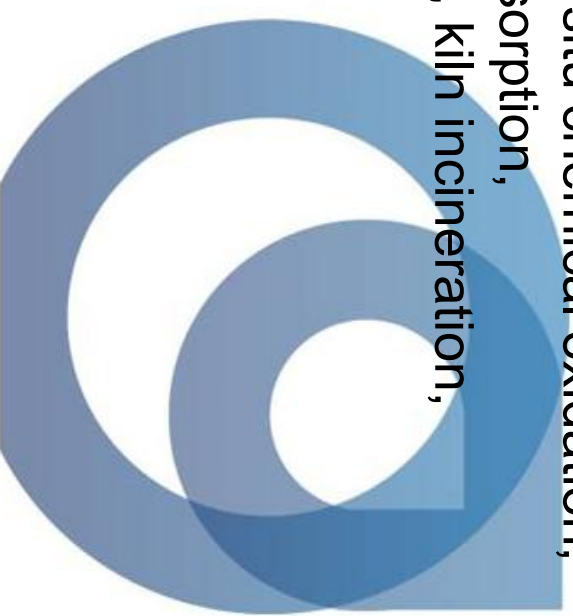
Site Remediation Projects

部分场地修复工程项目

Project Site	COCs	Project Scale
Former Chemical Plant	DDT, Heavy Metals	65,000 m³
Pigment Manufacturing Plant	DDT, HCHS	140,000 m³
Former Coking Plant	Phenols, PAHs	2,000 m³
Petrochemical Plant	Benzene, Nitrobenzene	8000 m³
Former Dye Manufacturing Plant	Heavy Metals, TCBS	80,000 m³
PCB Management & Disposal Demonstration Project	PCBs	3T/D 69,000 m³ 28,000 m³ 1,360,000 m³ 289,000 m³ 1,500 m³
Transportation Center	DDT, HCHS	
Subway Project	DDT, HCHS	
Former Chlor-alkali Plant	1,2-DCA、VC、Chloroform	
Former Pesticides Manufacturing Facility	DDT, HCHS	
Automobile Parts Manufacturing Facility	Hexavalent Chromium	

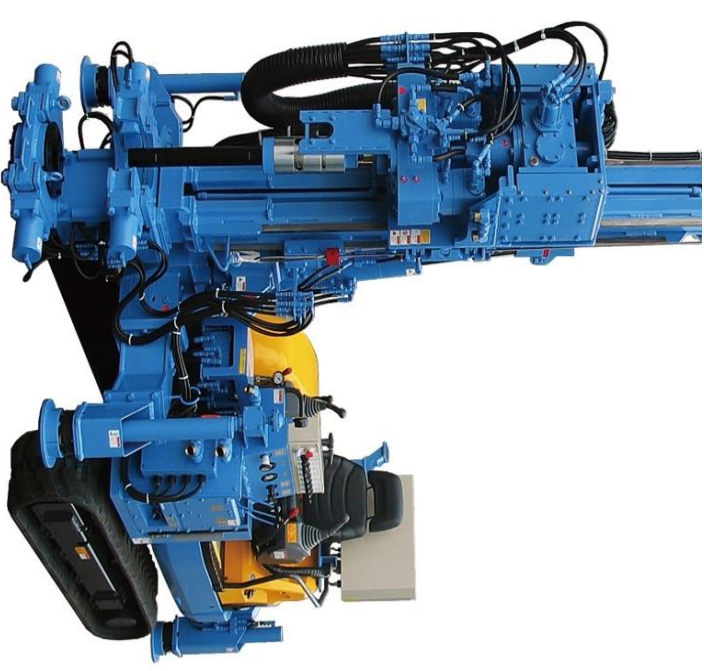
Completed Projects :

- More than 40 contaminated site investigation projects and 30 remediation projects, including 7 projects with respective contract value exceeding \$20 million USD.
- Volume of soil that has been remediated: ~4 million cubic meters
- Site type: existing and former chemical, petrochemical, refining, coking, mining, smelting, pesticide-manufacturing, landfill, agricultural, and medical facilities.
- Remediation technology used: thermal desorption, ex-situ/in-situ chemical oxidation, ex-situ/in-situ chemical reduction, mechanically-enhanced desorption, solidification/stabilization, bioventing, SVE, soil washing, P&T, kiln incineration, landfilling.

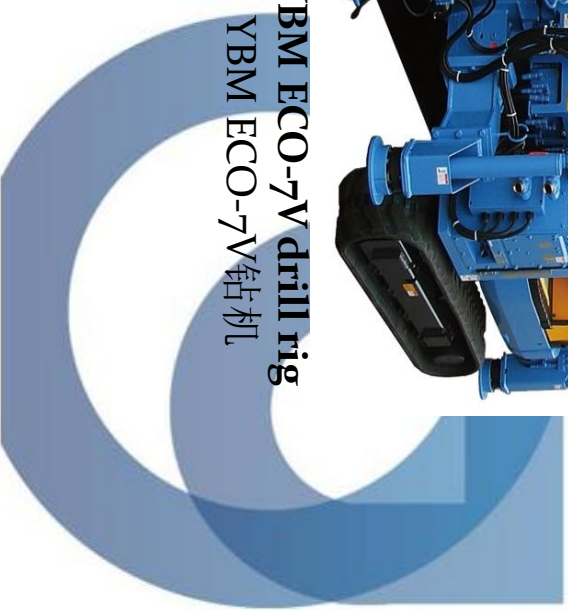




Geoprobe 6620 & 7822 drill rigs
 Geoprobe 6620 & 7822 钻机



YBM ECO-7V drill rig
 YBM ECO-7V钻机





Oil/Water Interface Probe



PID



Low-flow Sampling



XRF



HORIBA



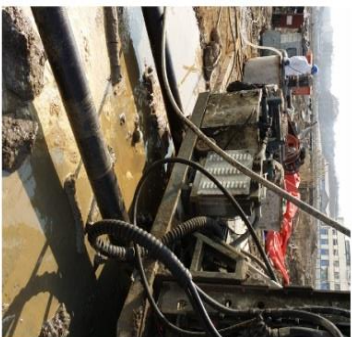
FROG-4000™

Low Temperature Thermal Desorption (LTTD)



In-situ Chemical Reduction (ISCR)





In-situ Chemical Oxidation (ISCO)

Ex-situ Chemical Oxidation



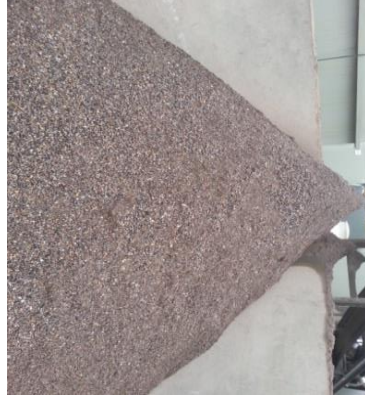
Mechanically-enhanced desorption



Solidification/Stabilization



Soil Washing



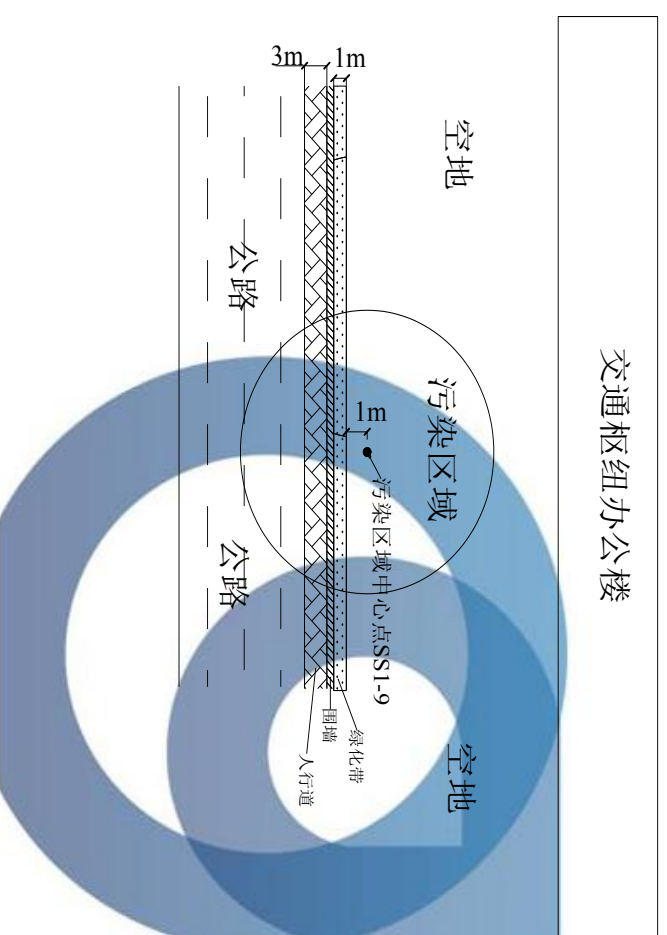
Monitored Natural Attenuation (MNA)



Case Study

Site Background

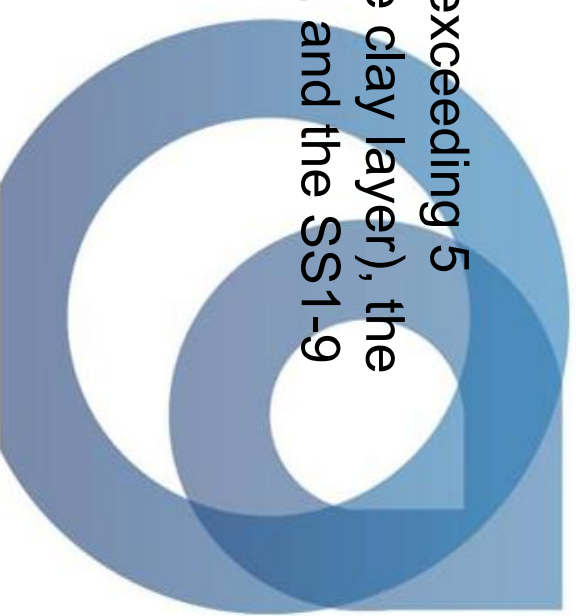
- Former pesticide manufacturing facility
- Four former 1,000 m³ ASTs were present within the southern portion of the site between 1981 and 2005, and used to store a variety of raw materials including toluene, xylenes, #200 solvent oil.
- Regional groundwater table @ below 20 m bgs.
- Based on previous site investigation results:
 - Xylenes exceeded the cleanup criterion, 5 mg/kg
 - Treatment area ~250 m²
 - Treatment depth - 15 m bgs
 - Total treatment volume - 3,750 m³



Case Study #1

Preliminary CSM

- Soil within 5 meter bgs does not exceed the proposed cleanup criterion for xylenes (5 mg/kg), and thus would not require remediation.
- The highly contaminated soils are generally located within the saturated sand layer immediately above the clay (top surface @ ~ 7m bgs), where perched groundwater was also encountered during previous site investigations.
- With the exception of SS1-9 where xylenes concentration exceeding 5 mg/kg was detected as deep as 11 m bgs (i.e., 4 m into the clay layer), the xylenes exceedances generally occur above the clay layer, and the SS1-9 exception might be attributed to the fractured clay thereof.



Case Study #1

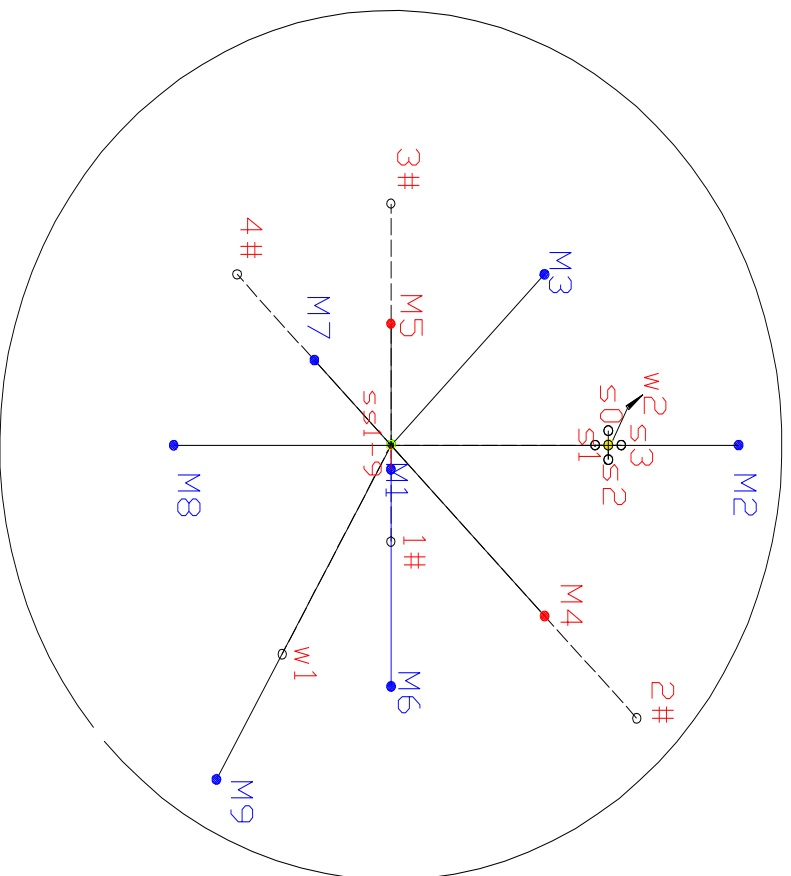
- Restrictions caused by access issue (i.e., ongoing construction nearby, subsurface utilities etc.) make originally proposed remedy, soil excavation, impracticable due to sloping requirements.
- In-situ heating being considered instead, whereas there were some data gaps that need to be addressed prior to remedial design.
- A membrane interface probe (MIP) survey to be conducted to refine the extent of treatment area/depth, which will be used to guide subsequent ISCO treatment.



Case Study #1

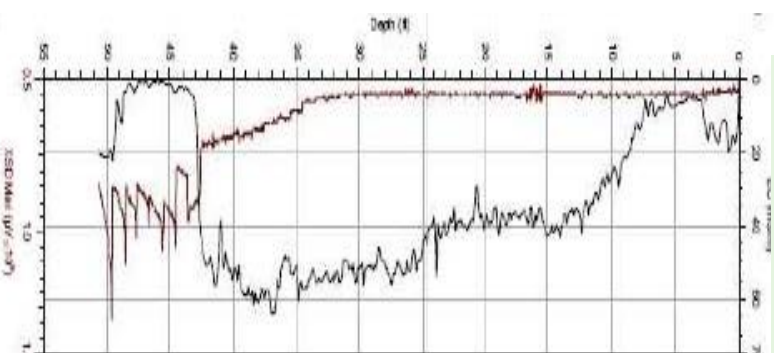
■ Site investigation :

- 9 conventional soil borings (red)
- 9 MIP survey locations (blue)



MIP作用:

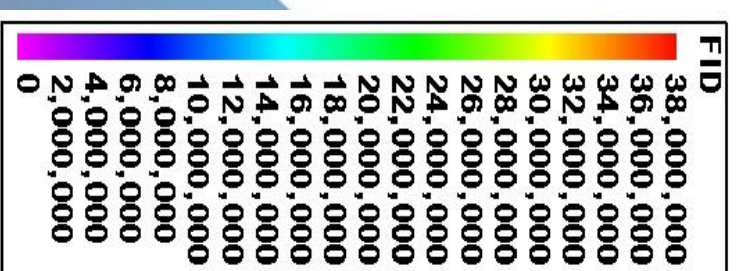
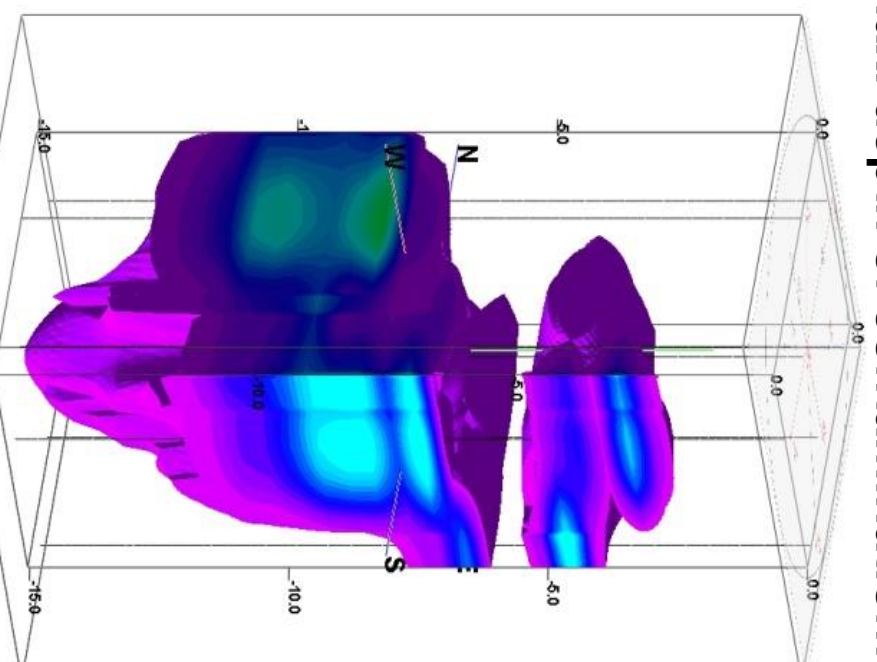
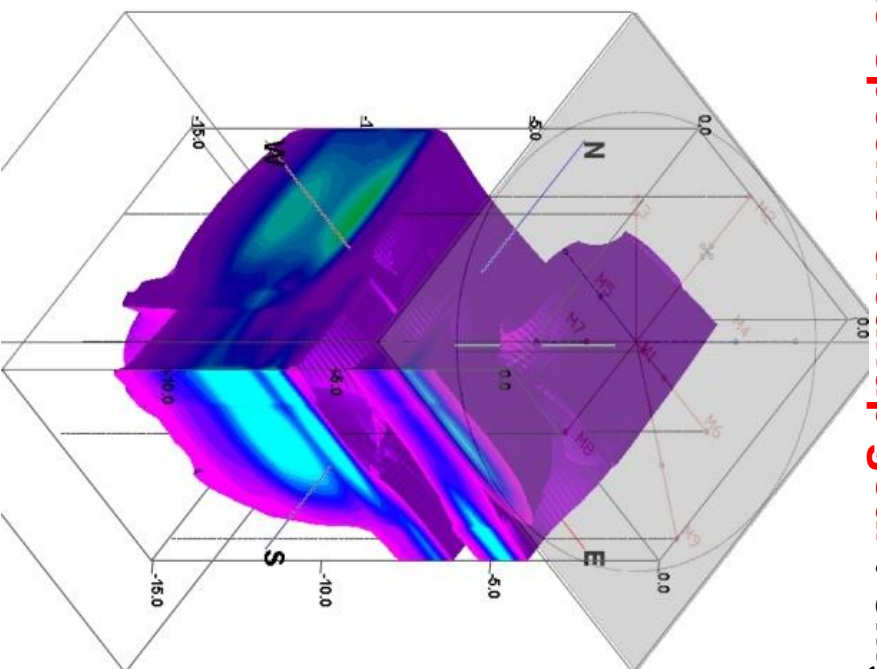
- 1、即时探测污染剖面分布情况（色谱分析）
- 2、通过电导度判断土质



Case Study #1

COCs : Xylenes

Site-specific cleanup goal : 5mg/kg; max. depth of contamination: 12m.



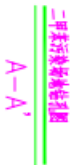
Spatial Distribution of Xylene Contamination in Soil

Case Study #1



Cross-section A-A

Clay Layer @ 7m bgs

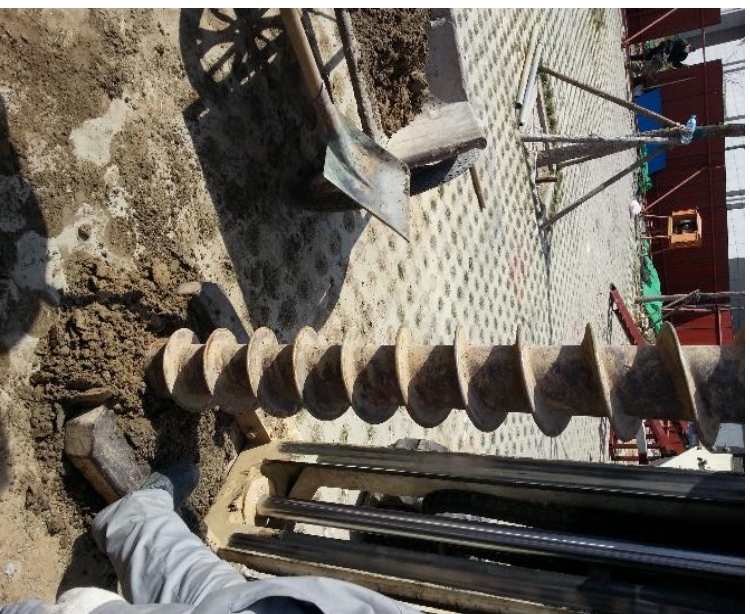


藥

1.SS1-9: 原始采样点, 位于图中心, 投影在立面图上的点为SS1-9;

Case Study #1

Geoprobe 建井



井口处理



Case Study #1



Case Study #1



4、 China-Europe Collaboration

Collaboration:

- 1. R&D**
- 2. Engineering Equipment**
- 3. Know-how and technologies**
- 4. Products**

Mode:

- 1. Single project (Sub contract)**
- 2. Joint venture**



Josie Zhang

zhangqiuzi@bceer.com



让环境回归自然

Make environment return natural.



BCEER