

Preventive management strategy for soil contamination

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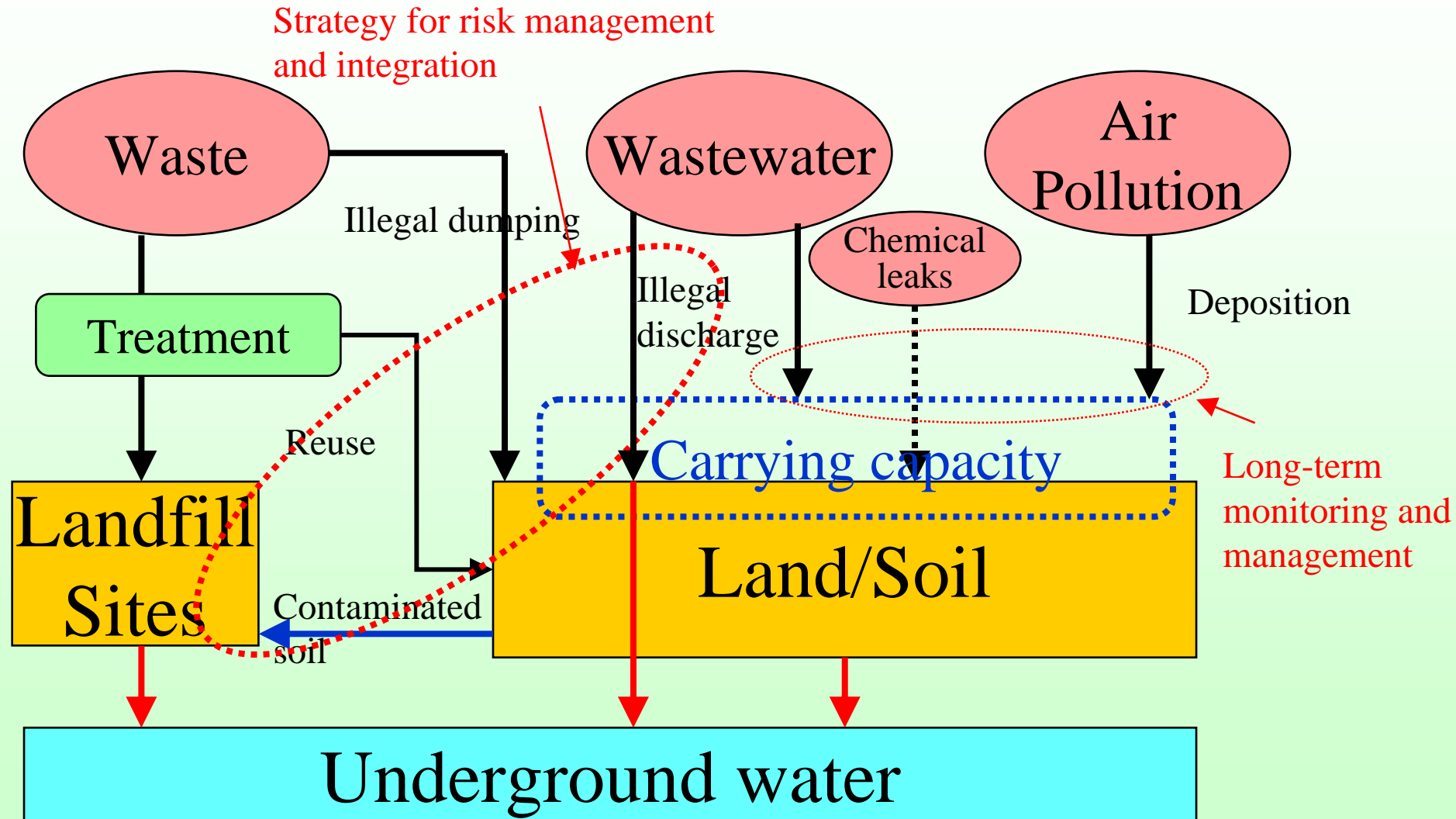
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Outlines

Topic	Description
Background of soil contamination	<ul style="list-style-type: none">•Relationship between soil/ground water and other media•Comparison of sources and potentials of soil contaminations•Frameworks of soil contamination management
Assessment of Preventive activities (with other countries)	<ul style="list-style-type: none">•Regulations in Taiwan and problems of regulatory baselines•Control of resource reclamation and underground storage tanks•Reference studies of other countries for comparison•Case study—key problems and considerations
Harmonization of management systems	<ul style="list-style-type: none">•Integration of regulations of all media and cross-cut harmonization•Synchronization for the control of soil contaminations and waste management
Conclusions & Suggestions	

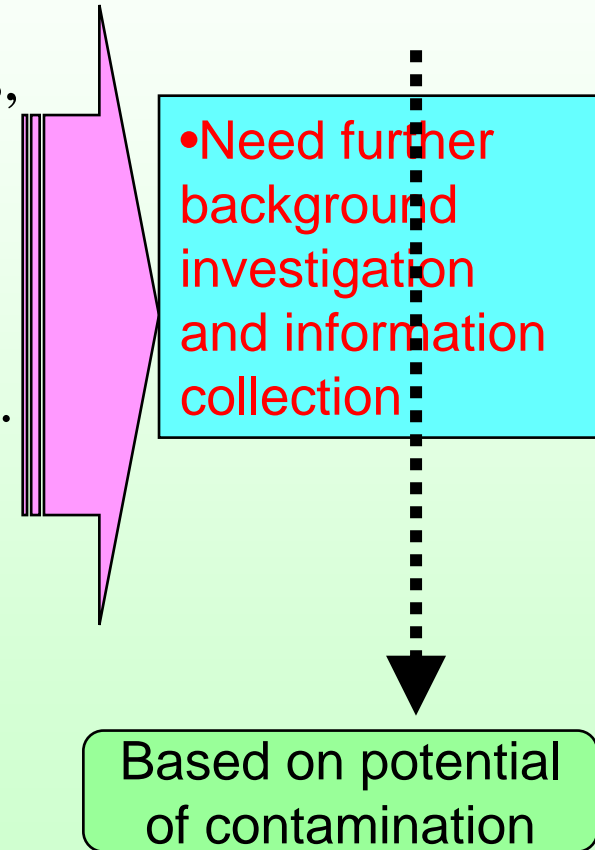
Background of soil contamination

Soil contamination vs. sources from other media



Comparison of sources and potentials of soil contaminations

- The number of soil contamination cases in Taiwan exceeds underground water contamination; In other developed countries, those two figures are comparable.
- For soil contamination cases in Taiwan, heavy metal pollutions covers 97.4%, -- the cases for VOC, SVOC and Oil products are relative rare comparing with other countries.
- Most of the sites in Taiwan has only one major contaminates.
- Most of the contamination sites in Taiwan are farmlands, it covers 97.2%.

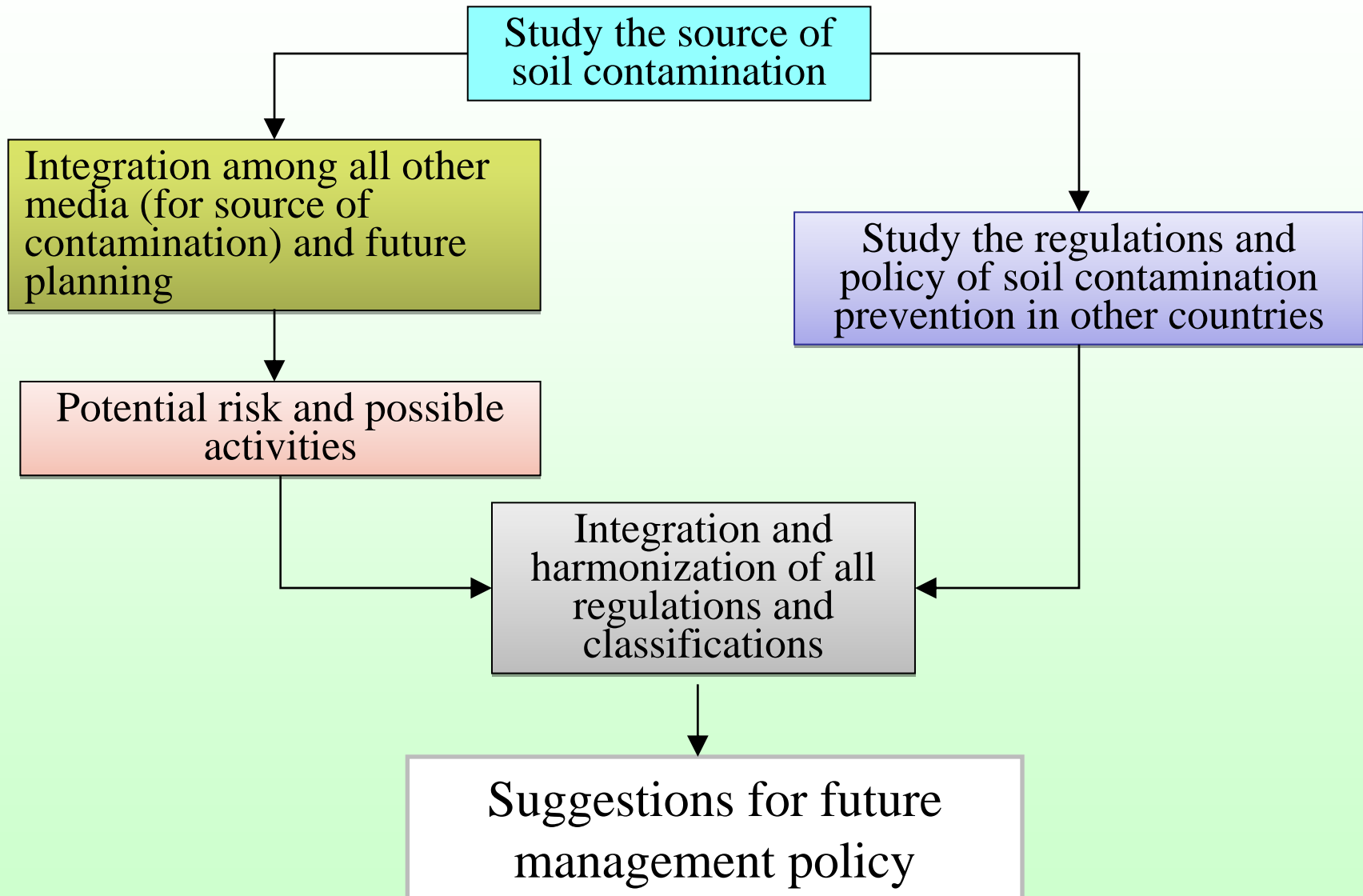


(Source: Project of soil and underground water contamination investigations and supporting works, 2005)

Analysis of the soil contamination potential



Frameworks of soil contamination management



Assessment of Preventive activities

Regulation in Taiwan

Solid Waste Clean Act

- Impact assessment for the utilization of recycled wastes
- The impact of landfill sites
- Impact of illegal dumping sites
- Resource Recovery and Reuse Act

Water Pollution Control Act

- Control of wastewater discharge and soil contamination
- Control and monitoring of gas stations
- SOP for the monitoring of underground storage tanks

Soil and Underground Water Clean Act

- Classification and control of soil contamination
- Guidelines for the utilization of contaminated soil
- Monitoring and management of other liquid storage tanks



Focus

- Insulating from the problems caused by waste disposal and re-utilization
- The management for wastewater discharge versus soil contamination
- The management of underground storage tanks
- **【 Contaminated soil be treated as waste for control and management 】**

The control of chemicals in different media – heavy metals

Types	Threshold for soil contamination (mg/kg)	Control value for underground water (mg/l)		Wastewater discharge (mg/l)	Leaching test (mg/l)	Landfill site (mg/l)*
		Class I	Class II			
Hg	20/5(Crops)	0.002	0.02	0.005	0.2	0.2/0.025
Cd	20/5(Crops)	0.005	0.05	0.03	1.0	0.11
Cr	250	0.05	0.5	2.0	5.0	0.6
Cr ⁺⁶	-	-	-	0.5	2.5	-
Pb	2000/500 (Crops)	0.05	0.5	1.0	5.0	0.75
As	60	0.05	0.5	0.5	5.0	5.0
Ag	-	-	-	0.5	5.0	0.14
Cu	400/200 (Crops)	1.0	10	3.0	15.0	-
Zn	2000/600 (Crops)	-	-	5.0	-	11

Compromising for risk management

Note: the standards for landfill sites in Taiwan are referred from UTS standards in USA

The control of chemicals in different media – organics (part of it)

Type	Standards for soil contamination (mg/kg)	Control value for underground water (mg/l)		Wastewater discharge (mg/l)	Leaching test (mg/l)	Landfill site (mg/l)*
		Class I	Class II			
Hexachlorobenzene	500	-	-	-	0.13	10
Vinyl Chloride	10	0.002	0.02	-	0.2	6.0
Benzene	5	0.005	0.05	-	0.5	10
1,2-dichloroethane	8	0.005	0.05	-	0.5	6.0
trichloroethylene	60	0.005	0.05	-	0.5	6.0
1,1-dichloroethylene	-	0.007	0.07	-	0.7	6.0
tetrachloroethylene	10	0.005	0.05	-	0.7	6.0
PCP	20	-	-	-	100	

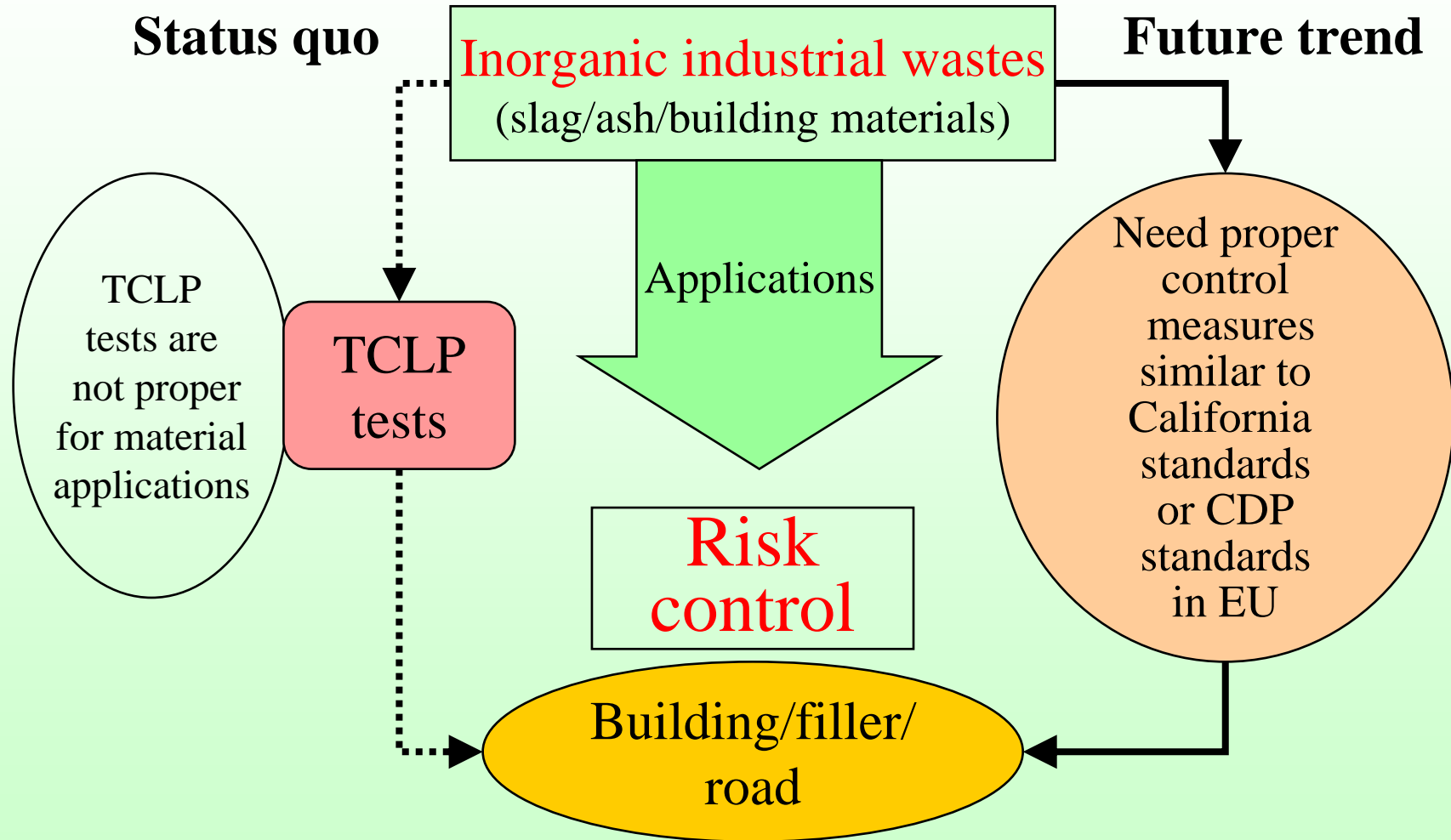
(~100 times)

Note: the standards for landfill sites in Taiwan are referred from UTS standards in USA

Problems for control— integration and synchronization

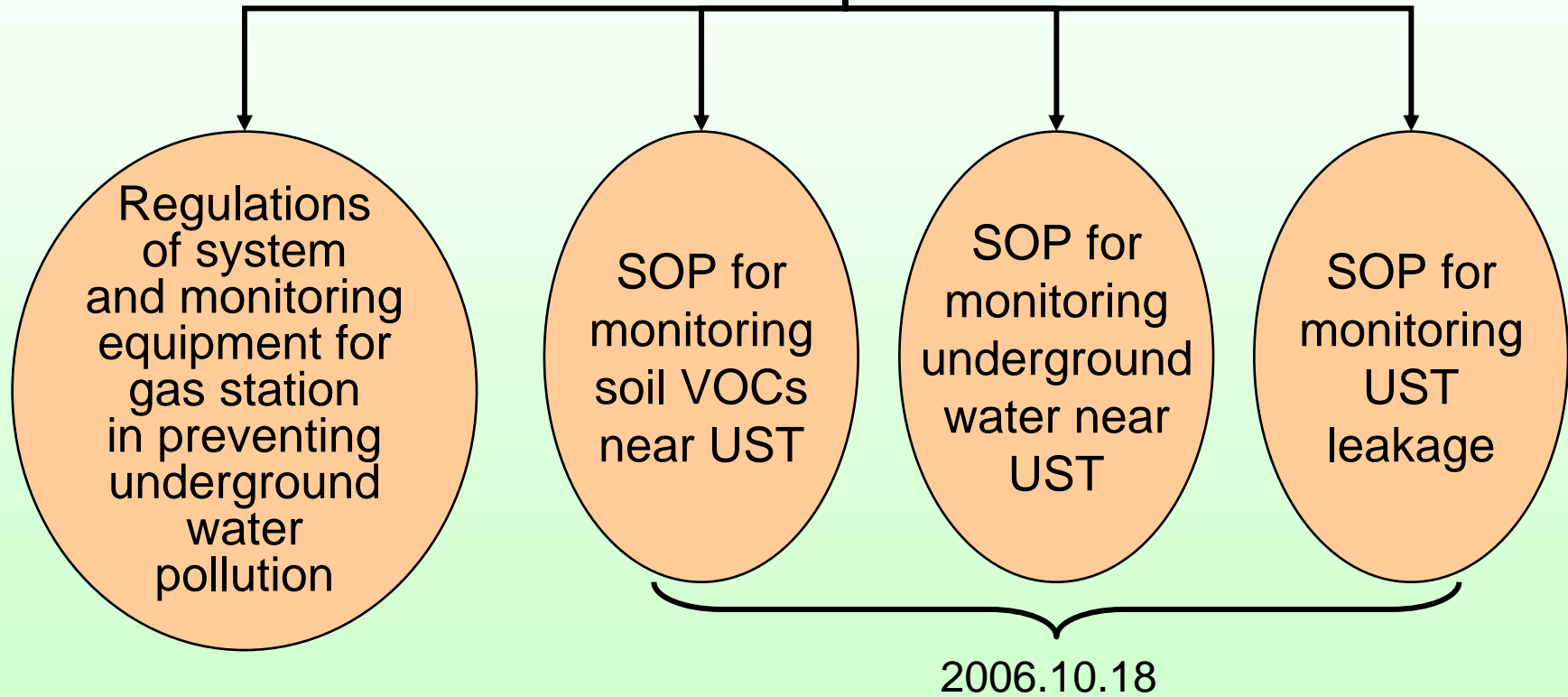
- **Control standards (for all media) are not unified** —wastewater effluent standard, permitted standard for landfill sites, control standard for soil contamination, the regulatory standard for underground water control
- **Possible unified and simplified control for certain chemicals** —Based on risk management and operational conditions, the control of certain (toxic) chemicals can be focused and unified (e.g. the control of total chromium or chromium 6)
- **Proper localization** —Need better understanding for the contamination cases in Taiwan to propose more comprehensive regulations based on cost effectiveness considerations. (especially, when we take the regulations and standards in other countries as reference)

The control of waste reuses and land applications



Management of UST

Water Pollution Control Act



2006.07.04

Note: UST- Underground Storage Tank

Future trend for managing UST

- Regulations are completed after 2006. However, all of those old USTs need to be investigated to ensure the conformity. The preventive strategies for soil and underground water also need to be integrated.
- Monitoring is the key issue, which can be focused on:
 - Sampling by authorities: to understand the risk of all UST and propose preventive activities.
 - Self S/A and monitoring: specified bodies have to do the S/A and monitoring on regular basis specified by the authority.
 - Proposed management guidelines and technical SOPs to unify and integrate the system.

Regulations in other countries

USA

- Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)
- Superfund Amendments and Reauthorization Act (SARA)
- Land Disposal Restrictions (LDR) Program

Japan

- Control Act for Soil Contamination
- Preventive Act for Water Contamination (Monitoring and control of underground water)
- Solid Waste Control and Treatment Act

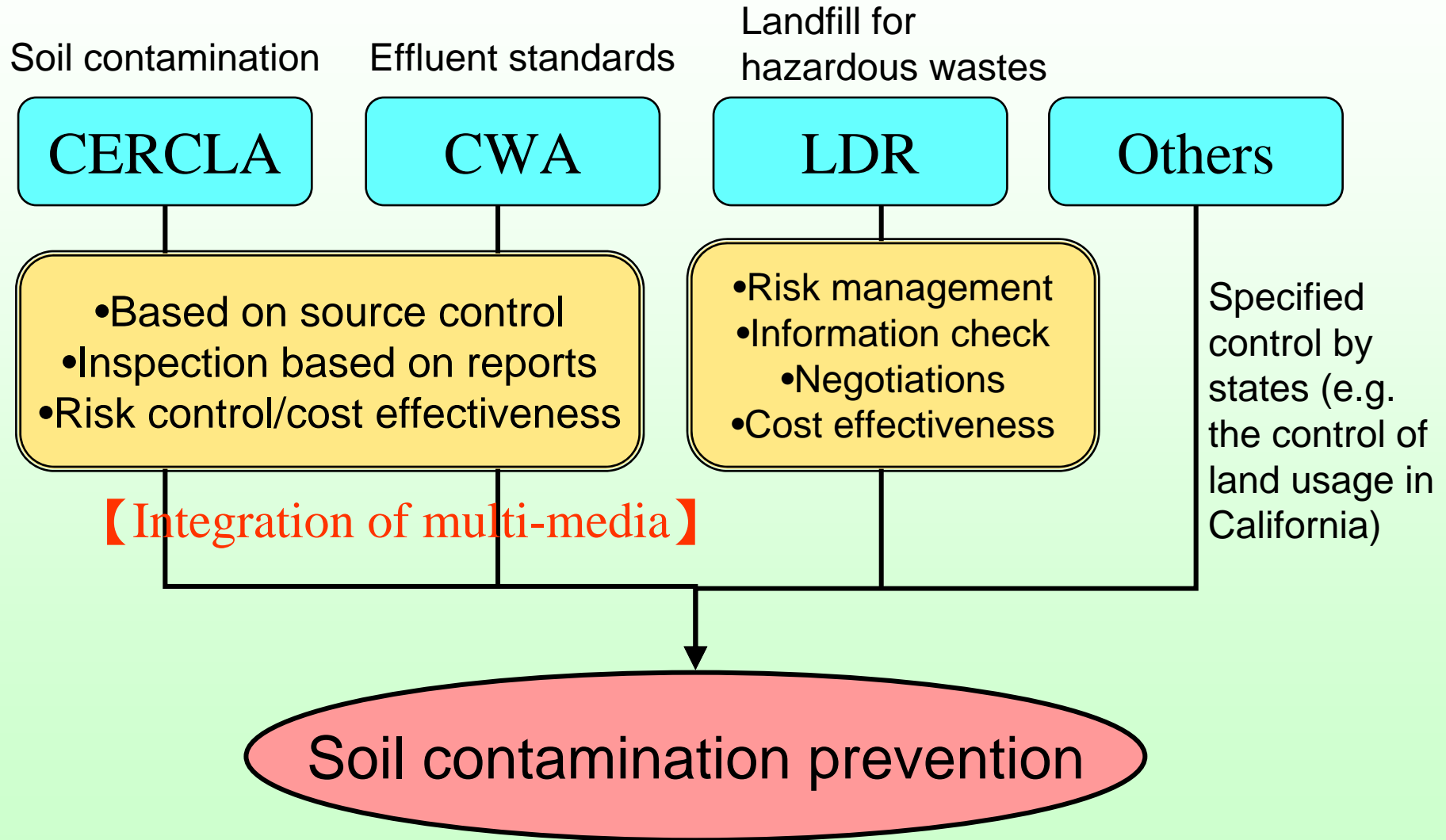
Europe

- EEA Report - Integration of environment into EU agriculture policy
- European soil monitoring and assessment framework
- Down to earth: Soil degradation and sustainable development in Europe

Core
ideas

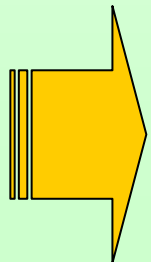
- Integrated management for multi-media and information (including cost effectiveness study)
- The risk control for land utilization and considering the carrying capacity of land

Soil contamination preventive regulations in USA



Guidelines for the control of reused materials in California, USA

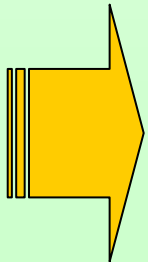
- California Code of Regulations focuses on the control of the usage of recycled and reused materials. All materials with toxic contents shall follow the regulations of California Health and Safety Code
- All reused materials from waste shall not only follow the basic requirements from 40CFR261 (classifications for hazardous wastes) or 40CFR268 (treatment standards) but also meet the thresholds for soluble concentration (STLC; Soluble Threshold Limit Concentration) and total threshold specifications (TTLC; Total Threshold Limit Concentration).



Based on environmental risk management and carrying capacity, the ratio for total amount versus leachate is 100 for heavy metals, 10 for organics.

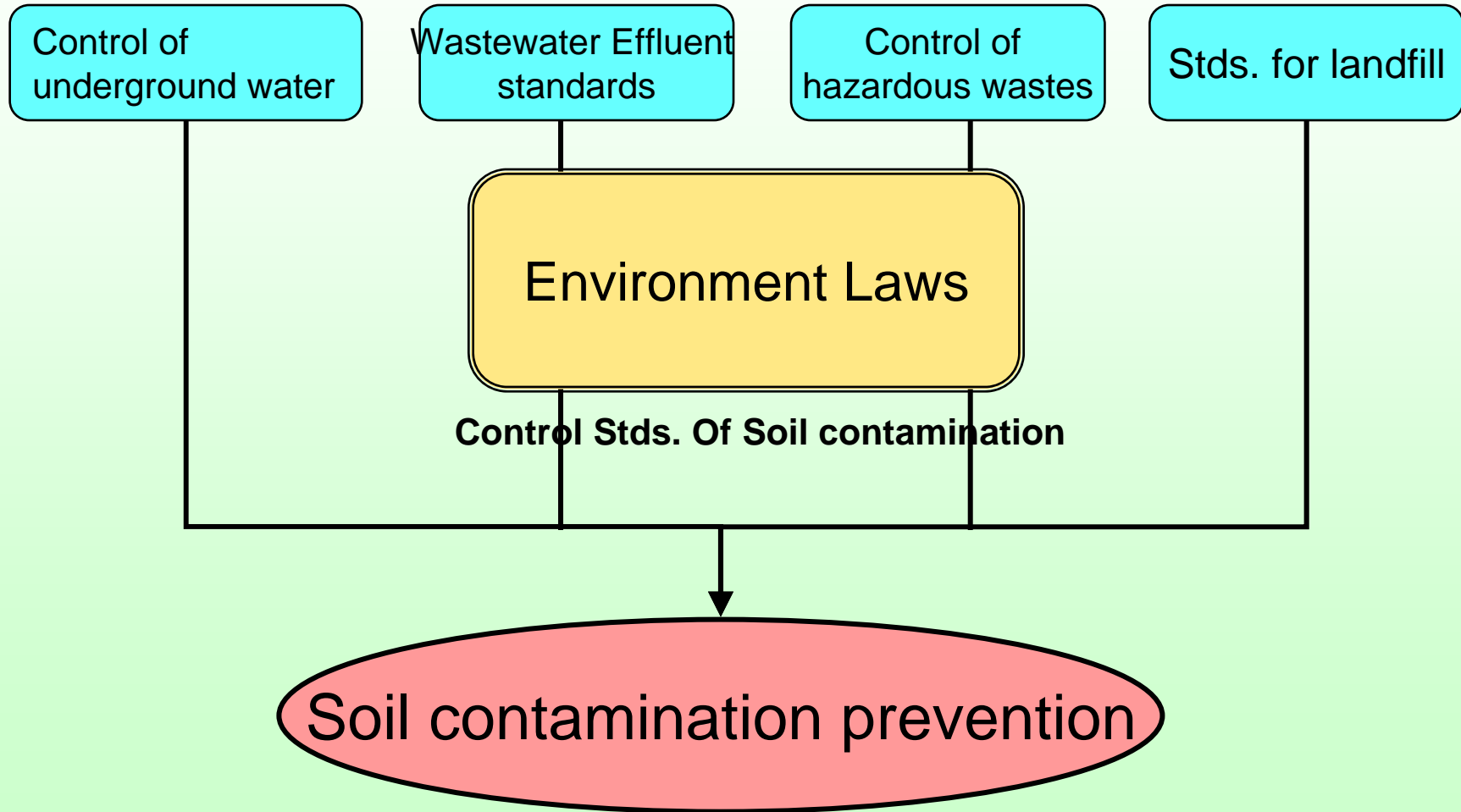
The permit conditions for land application of reused materials in California

- Shall not be regulated by RCRA (hazardous wastes); major constituents do not exceed certain limitations.
- Can not be used for industrial incinerators unless permit is granted.
- Shall follow the leaching standards (STLCs) for the usage of industrial raw materials. The final products shall also be recalculated to check the STLC requirements.
- The thresholds of toxic chemicals shall not exceed other regulations of specified products when it is used for the relevant manufacturing process.
- Need the certifications signed by professional engineers and follow the products standards such as ASTM.



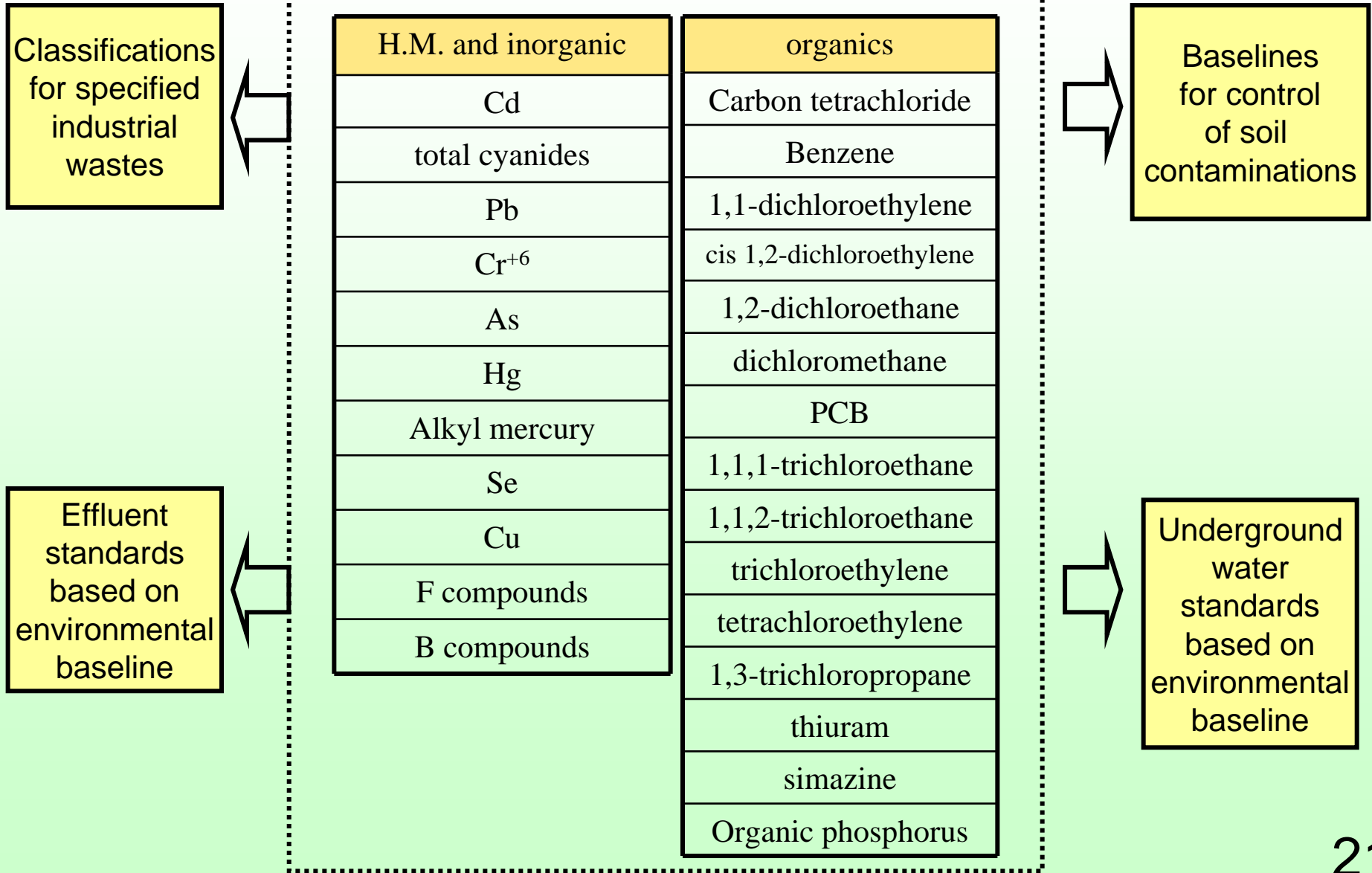
Source control to reduce risk (include following management)

Soil contamination preventive regulations in Japan



Hazardous chemicals controlled in Japan

Items controlled for environmental baseline



Classifications for specified industrial wastes

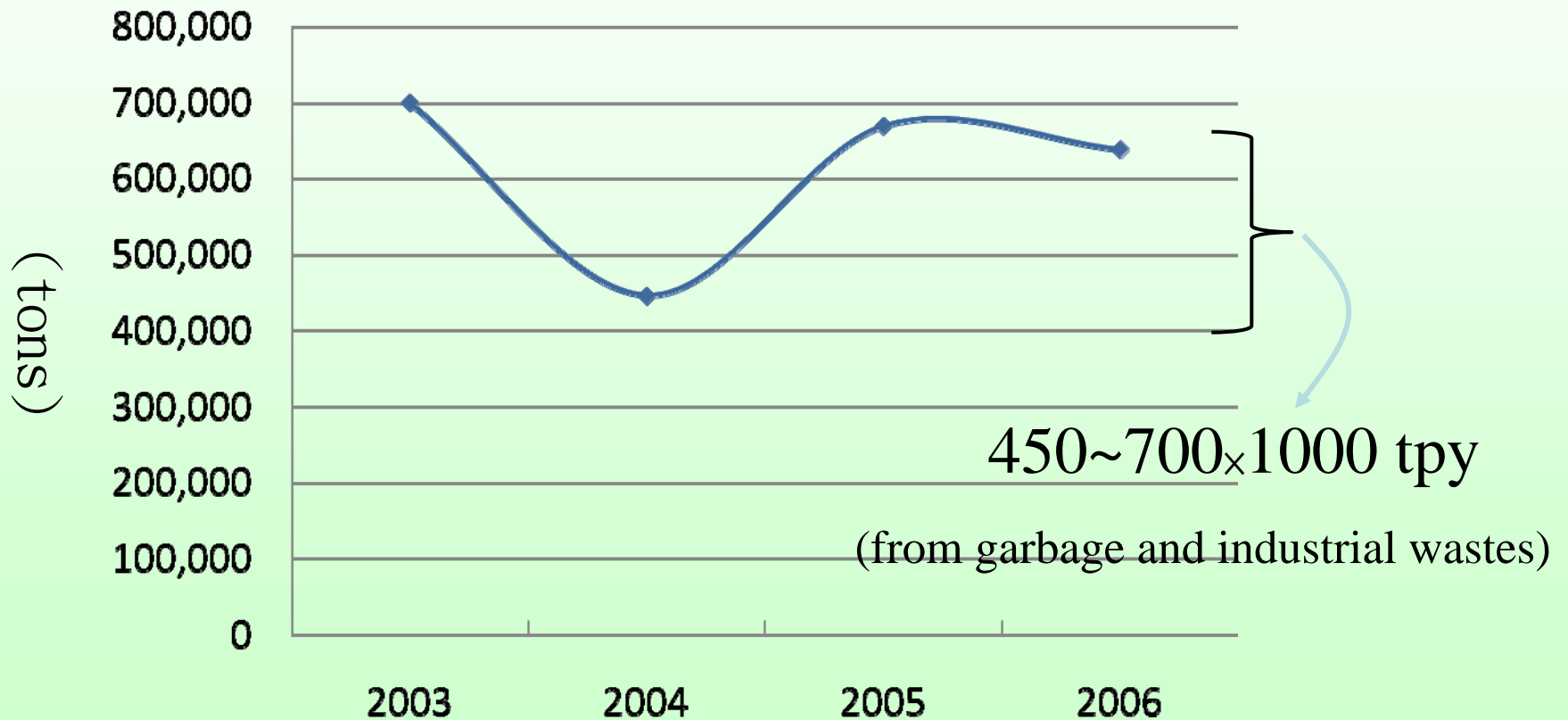
Effluent standards based on environmental baseline

Baselines for control of soil contaminations

Underground water standards based on environmental baseline

Case study: Reuse of bottom ashes from incinerators —(1) source and needs

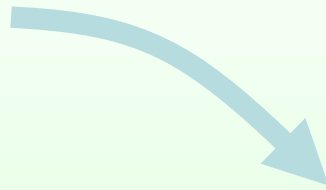
Annual generation in Taiwan



Case study: Reuse of bottom ashes from incinerators —(1) status



Filler for road



Substitutes for cement



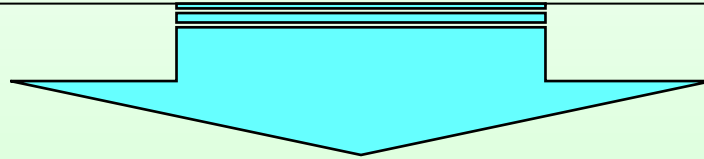
Case study: Reuse of bottom ashes from incinerators —(3) items to be regulated

Heavy metals	Total (mg/kg)	TCLP study
Ag	8.5 ~ 10.7	
As	209 ~ 227	
Ba	1,104 ~ 1,166	
Cd	6.8 ~ 7.8	* Some exceed TCLP std.
Cr	323 ~ 439	
Cu	4,139 ~ 4,474	
Pb	2,471 ~ 2,807	* Some exceed TCLP std.
Se	230 ~ 265	
Zn	4,261 ~ 4,535	
Dioxin	0.7 ~ 1,903 (ng/kg)	* Some exceed TCLP std. for small incinerators

Source : The study of bottom ash materials in waste incinerators(EPA-93-U1H1-02-101)., The analysis of heavy metals and dioxins in garbage incinerators(EPA-93-H101-02-242)

Case study: Reuse of bottom ashes from incinerators —(4) future action

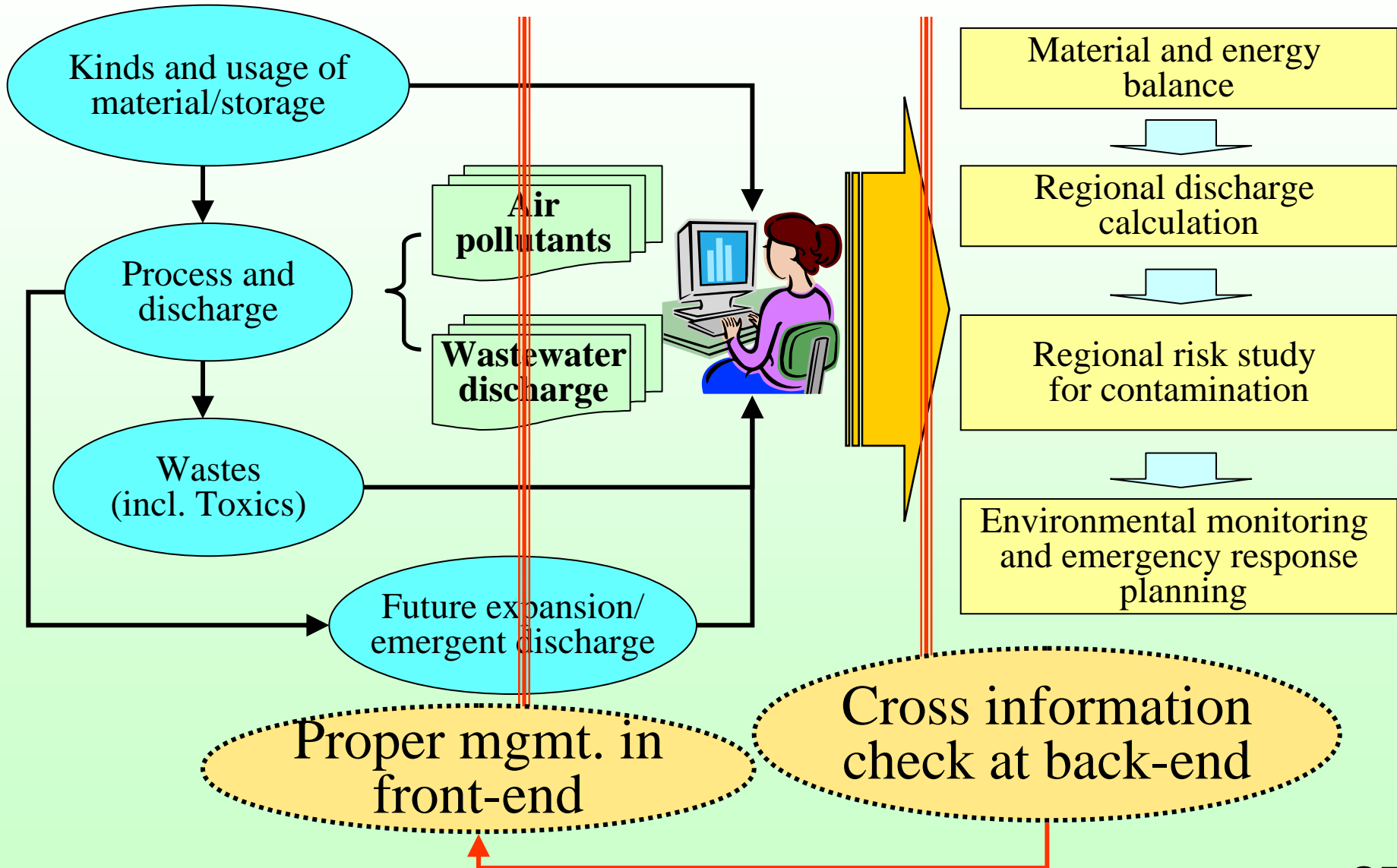
- Problems and environmental risks
 - High degree of variation for the contents and properties of solids wastes
 - The environmental risk is very high if rely on TCLP tests only
 - The lead contents in bottom ashes are relative high (2,471 ~ 2,807 mg/kg) –exceed the controlled baseline (1,000 mg/kg).



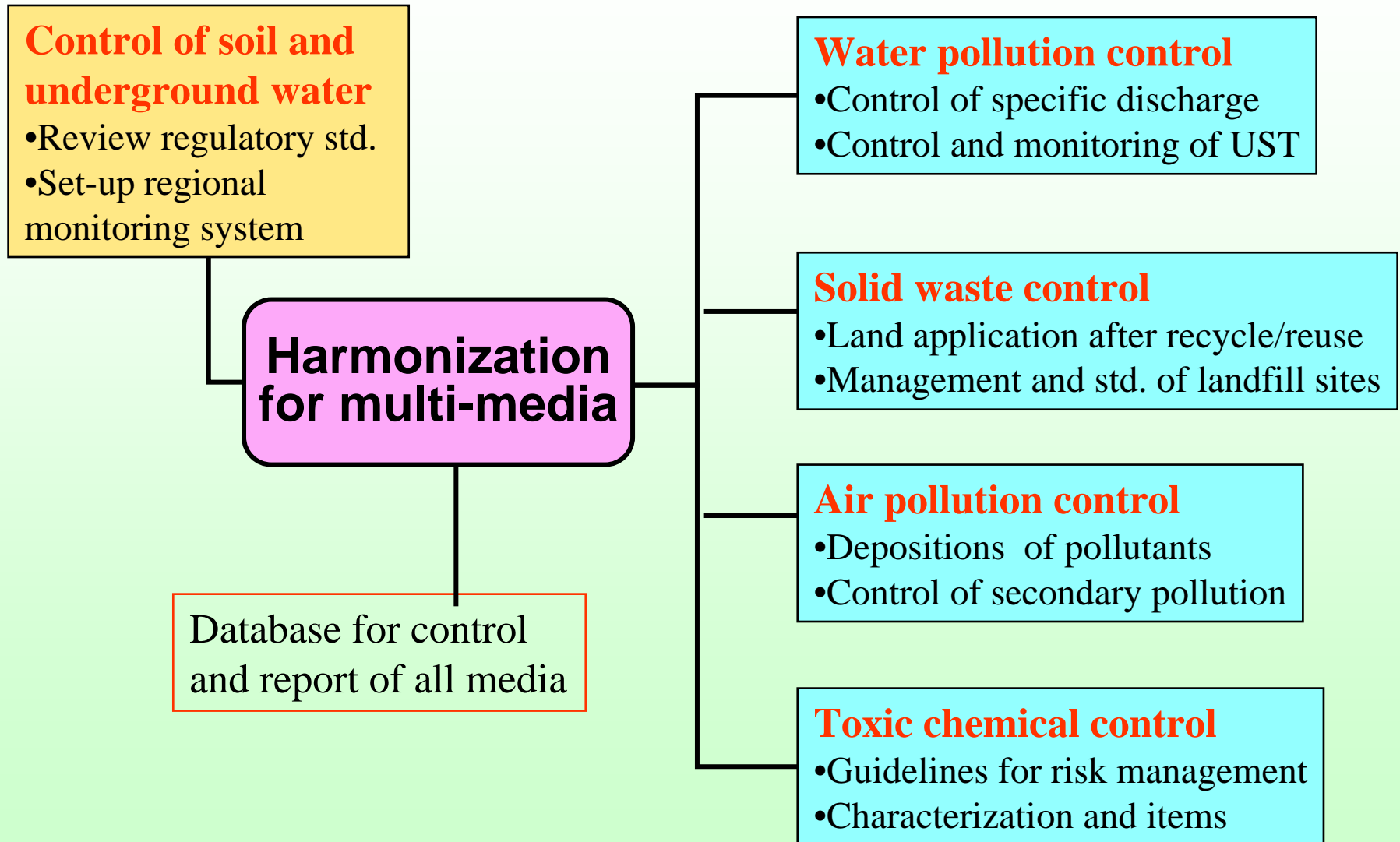
- Refer the planning in EU (esp. Netherlands), control and classified the feed of incinerators
 - Control measures and technical SOP for bottom ashes' stabilization
 - Study the reuse technologies and risk assessments
 - SOPs for cost effectiveness study, inspections and technical operations
 - All other management and economical measures (e.g. landfill tax)

Harmonization of management system

Integration of the interface among all media



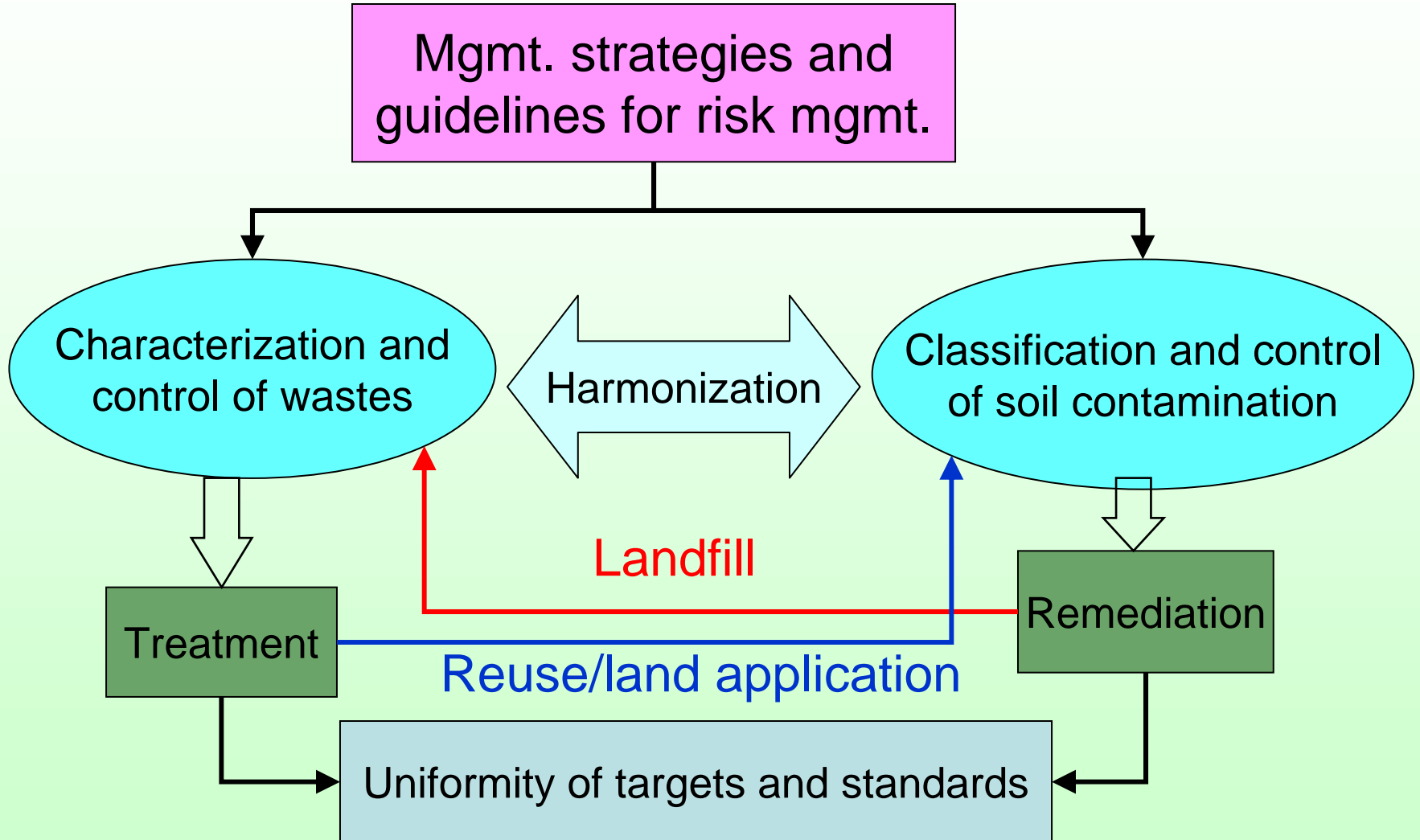
Harmonization and frameworks



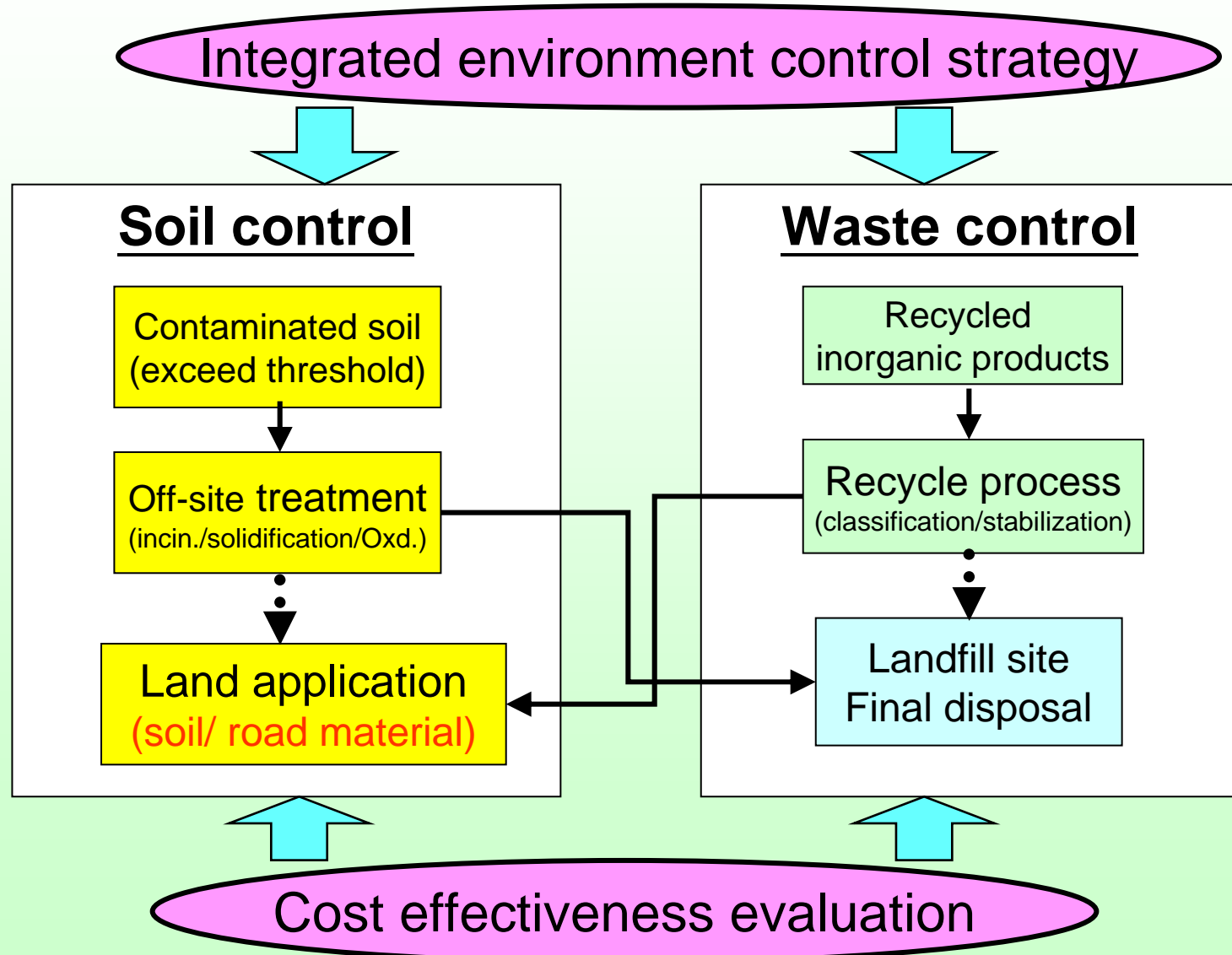
Focus of cross-sector negotiations

- **Integration and harmonization for all control measures**
 - propose integrated and harmonized control standards on the basis of risk management, carrying capacity and cost effectiveness,.
- **Conformation of control target (chemicals)**
 - Inventory the raw material, manufacturing process and emission sources of specific industries on the basis of multi-media integration
 - Evaluate and confirm the quantity and influence of target pollutants via long term data collection and evaluation.
- **Review of effectiveness and planning**
 - Based on the monitoring of all other media, evaluate the status of final receptor –"soil".
 - To get the ultimate goal of pollution prevention by regional specific soil and groundwater monitoring/control as well as the adjustment of the management for other media.

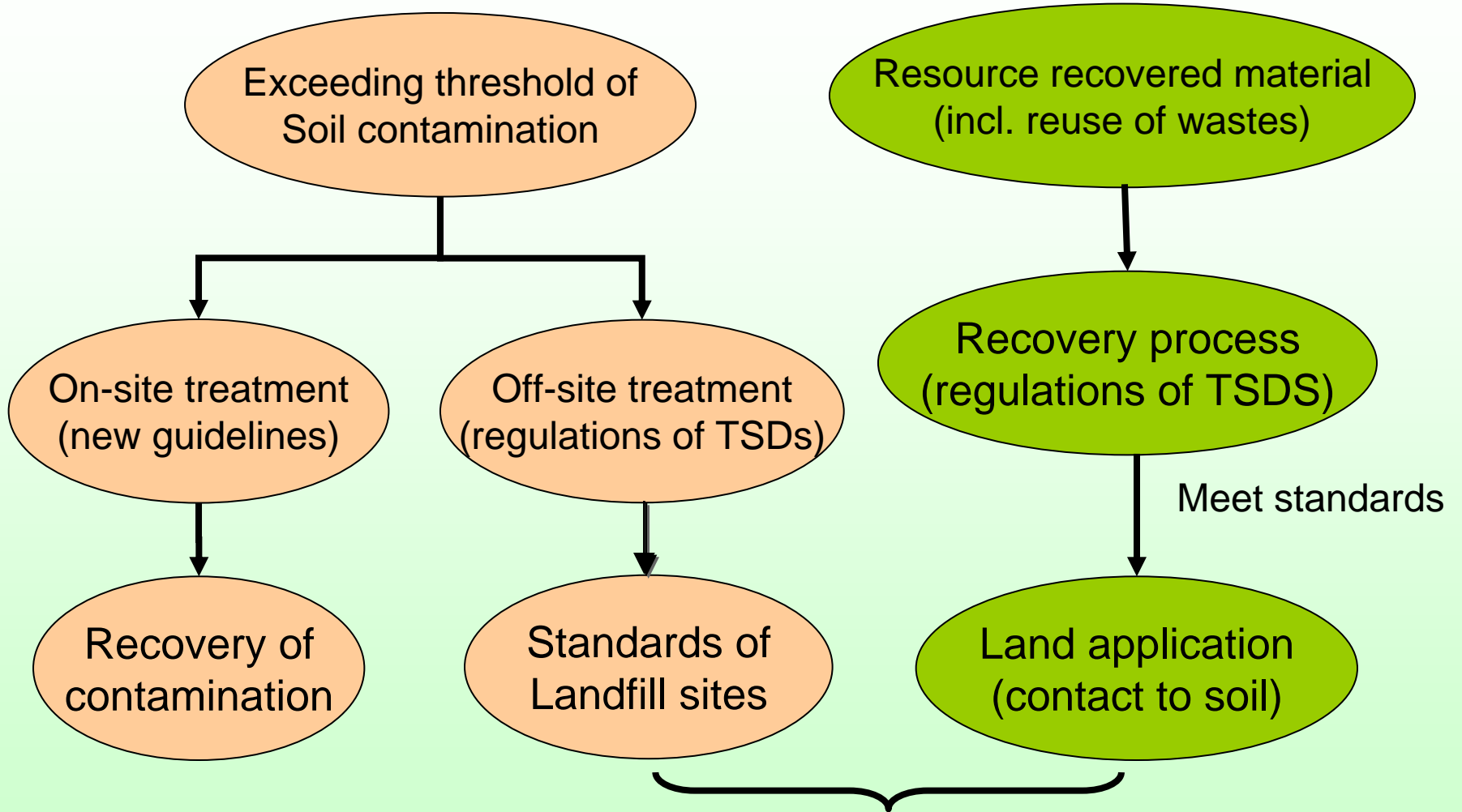
Coordination of soil and waste management activities



Integration of contaminated soil treatment and waste control



Suggestions for the harmonization of standards (1)



On the basis of risk consideration, “Acceptance standards of landfill” has to be connected to “Control thresholds of soil contamination”

Suggestions for the harmonization of standards (2)

- The authorities shall set the mechanism to investigate the status of those recycled inorganic materials from wastes been used as road construction foundations.
- Need guidelines and standards for industries to handle and process contaminated soil on-site.
- For the off-site treatment of contaminated soil, the guiding principles shall be synchronized and integrated with the existing system and standards for the TSDs of solid wastes.
- Based on risk evaluation studies, differences between the allowance of landfill sites and the classification of soil contaminations shall be integrated and harmonized by stage wise control policy and standards.

Suggested harmonized standards: heavy metals

Items	Thresholds for soil contamination (mg/kg)	Leaching tests (mg/l)	Landfill site (mg/l)*	Notes:
Hg	20/5(crops)	0.2	0.2/0.025	- require standards for reuse (including land reclamination)
Cd	20/5(crops)	1.0	0.11	
Cr(t)	250	5.0	0.6	
Pb	2000/500 (crops)	5.0	0.75	
As	60	5.0	5.0	
Ag	-	5.0	0.14	- Needs standards for soil-
Se	-	1.0	5.7	
Zn	2000/600 (crops)	-	11	
Cu	400/200 (crops)	15.0	-	- Needs landfill standards
Cr+6	-	2.5	-	Integrated with total Chromium

Suggested harmonized standards: organics

Items	Thresholds for soil contamination (mg/kg)	Leaching tests (mg/l)	Landfill site (mg/l)*	Notes:
hexachlorobenzene	500	0.13	10	-Requires uniformed system to control the soil and landfill sites -Risk evaluation shall be the proper backbone for new standards
Vinyl chloride	10	0.2	6.0	
Benzene	5	0.5	10	
Tetrachloride carbon	5	0.5	6.0	
1,2-dichloroethane	8	0.5	6.0	
trichloroethylene	60	0.5	6.0	
1,1-dichloroethylene	-	0.7	6.0	
tetrachloroethylene	10	0.7	6.0	
chloroform	100	6.0	6.0	
2,4,6-trichlorophenol	40	2.0	7.4	
1,4-dichlorobenzene	-	7.5	6.0	
PCP	200	100	7.4	
2,3,5-trichlorophenol	350	400	7.4	

Conclusions and Suggestions

Conclusions

- To prevent soil contaminations, we shall integrate information and cross examine the data for discharge and reports from all other media (air, water, solid waste pollutions).
- The existing regulations in Taiwan shall be integrated to consider the pollution preventions for soil contaminations– the ultimate receptors for all pollutants.
- Although the existing data shows that most contaminated sites in Taiwan are polluted by heavy metals, we still need further study to check the problems caused by organic chemicals.
- We shall collect the information, experiences, technical guidelines and manuals from other countries to reinforce the regulations and control measures in Taiwan.
- The urgent study shall be emphasized on the interactions between the control of soil contaminations and the management of solid wastes.

Suggestions

- Form a cross-sectional “Task force for the harmonization of standards of all media” in order to set the goal of pollution prevention and block all sources of soil contaminations.
- Utilized all information and experience from other countries, to foster the reasonable strategy of soil contamination prevention in Taiwan
- Set the ultimate mechanism for control of soil contaminations based on risk management, carrying capacities and evaluations procedures.