Integrated Policy for Soil Management– An Industrial Point of View

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Contents

1. Introduction

1.1 Regulatory Framework in Taiwan

(1) Soil and Groundwater Regulations

(A) Soil and Groundwater Pollution Remediation Act (The Act): Promulgated in February, 2000 and revised in January 2003, to govern soil and groundwater pollution problems in Taiwan. Application of health risk assessment is mentioned in Article 17.

(B) Soil Pollution Standards: Monitoring and Control Standards were established in Nov. 2001. The latter are enforceable standards.

(1) Soil and Groundwater Regulations-2

(C) Soil and Groundwater Pollution Control Site Preliminary Assessment Regulations (Preliminary Assessment”: Promulgated in May, 2003 and revised in March, 2006. When a control site is preliminarily assessed as seriously polluted, the central authority will officially announce the site as a “Remediation Site”. According to Article 6, health risk assessment can be used after the permission of local authorities.

(D) Soil and Groundwater Pollution Remediation Act Enforcement Rules: Promulgated in October, 2001. Established the enforcement rules for The Act and the responsibilities of central and local authorities.

1.1 Regulatory Framework in Taiwan-2

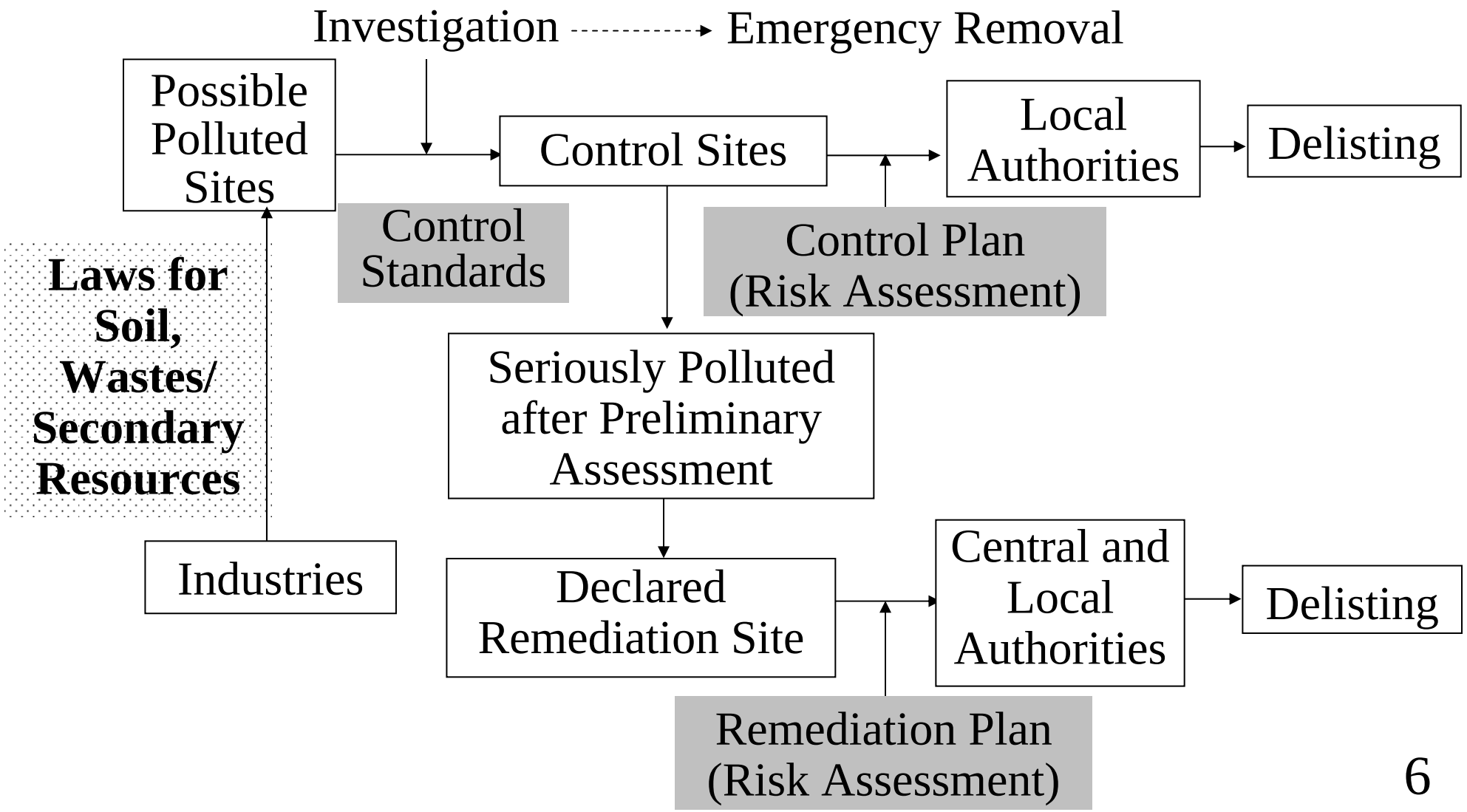
(2) Waste and Recycling Regulations

(A) Waste Disposal Act: Initially promulgated on July 26, 1974, latest revision in May, 2006. It is for the effective clearance and disposal of waste, improvement of environmental sanitation and maintenance of public health. The rules for hazardous waste identification (including TCLP) was enacted separately.

(B) Resource Recycling Act: Promulgated in July, 2002, to conserve natural resources, reduce waste, promote recycling and reuse of materials, and build a society in which resources are used in a sustainable manner

-A revision to combine these two acts is undergoing.

1.2 Overview of Pollution, Management and Delisting Process



1.3 Scope of This Study

(1) Discuss Current Issues to Industries: In regard to:

(A) Recycle in compliance with Soil Regulations, especially the secondary construction materials that the steel industry is most concerned about.

(B) Proper Control and Remediation Standards, especially for Cr and Zn that are most related to the steel industry.

(2) Review International Developments: Based on the information collected.

(3) Proposals for Regulatory Considerations: Based on the understanding of this study.

2. Current Issues to Industries

2.1 Recycle in Compliance with Soil Regulations

(1) Increasing Demand of Secondary Sources: Secondary construction materials are becoming more important in Taiwan as the natural ones more are more and more scarce and costly.

(2) Proper Recycling is Crucial: Secondary construction materials are normally generated in large quantities. Finding a proper reuse/recycle means for them can significantly reduce their disposal cost and environmental burden.

2.1 Recycle in Compliance with Soil Regulations-2

(3) Hazardous Wastes not Allowed: Hazardous wastes, i.e. exceeding limits in TCLP, ignitability, corrosively, reactivity or dioxin can not be used as secondary construction materials.

(4) Permission for Recycling: Permissions can be obtained via one of the following review procedures:

- Deemed as products or commodities by the central authorities (very seldom).
- Approved to be usable in certain constructions either in a general rule or as a special case.

(5) Additional Environmental Criteria: Other criteria or requirements to be met are generally not very clear.

2.1 Recycle in Compliance with Soil Regulations-3

(6) Regulatory Concern: The soil and groundwater authorities are very much concerned when the toxic contents of secondary construction materials exceed that of Soil Control Standards, due to the following reasons:

(A) Interfacial Pollution: The interfacial soil may become polluted since some toxics may be released from secondary construction materials during their service life in the application.

(B) Blended Pollution: The pollution may become more serious if these secondary materials are mixed into soil , as might happen in some applications.

2.1 Recycle in Compliance with Soil Regulations-4

(7) Other Questions: include the following:

(A) How to balance between recycling and soil and groundwater protection?

(B) Is TCLP suitable to determine the leacheable amount of toxics from secondary construction materials or other leaching procedure should be used?

(C) How should the secondary construction materials be properly disposed of after their service life?

2.1 Recycle in Compliance with Soil Regulations-5

(8) Problems to the Industrial Sector: Due to the above-mentioned situation, the industries are faced with the following problems :

(A) Outside Suspicion and Objections: Land-related applications of secondary materials is not legally clear to the society, and strong suspicion or objections may occur in some local areas.

(B) Risks of Future Liabilities: Recycling projects of secondary construction materials are with high risks due to its potential liability to soil and groundwater pollution.

2.1 Recycle in Compliance with Soil Regulations-6

(9) Recent Progress

(A) Promote Recycling of Bottom Ash: Taiwan EPA is concerned about the proper recycling of incinerator bottom ash, and is trying to find a solution based on international development and local conditions.

(B) 3-Tiered Recycling System: Taiwan EPA stipulated a "Three-Tiered Quality Assurance System" and the related environmental criteria for the reuse of incinerator bottom ash in road and other constructions.

(C) Extended Use: These criteria for bottom ash, if fit our current needs, could be used as a common basis for other secondary materials in similar applications.

(D) Environmental Quality Criteria of Bottom Ash (should be analyzed for each batch ≦ 500 ton)

		Tier 1	Tier 2	Tier 3
TCLP (mg/l)	T. Pb	≦5.0		
	T. Cd	≦1.0		
	T. Cr	≦5.0		
	T. Se	≦1.0		
	T. Cu	≦15.0		
	T. Ba	≦100.0		
	Cr^{+6}	≦0.25	≦0.25	≦2.5
	T. As	≦0.50	≦0.50	≦5.0
	T. Hg	≦0.02	≦0.02	≦0.2
Soluble Cl^-(%)		≦0.024	----	----
Dioxin (ng I-TEQ/g)		≦0.1	≦0.1	≦0.1

(E) Reuse Applications for Three-Tiered Bottom Ash

Tier 1	Tier 2	Tier 3
- Aggregates for road base, sub-base and bank . - Low strength filling material. - Additive for concrete ,asphalt concrete, brick - Other uses.	- Aggregates for road base, sub-base and bank . - Low strength filling material. - Additive for concrete without re-bar. - Additive for asphalt concrete and brick.	- Aggregate for base and bank (The quantity of each reuse must be >10,000 ton, and shall submit the permitted plan for insulation, control and monitoring)

2. Current Issues to Industries-2

2.2 Control and Remediation Standards

- The Soil Pollution Control Standards of Taiwan are characterized with:

(1) Two-Category Standards: Residential, commercial and industrial lands are all regarded as “non-agricultural” since they are easily mixed with one another in Taiwan.

(2) Stringent Standards for Industrial Soil: The Control Standards for non-agricultural soil are not far different from the stringent ones for agricultural soil. Hence industrial sites or their nearby areas are under high risks of soil pollution.

2.2 Control and Remediation Standards-2

- e.g. for heavy metals in non-agricultural land:

	As	Cd	Cr	Cu	Hg	Ni	Pb	Zn
Control Standards	60	20	250	400	20	200	2,000	2,000
Monitoring Standards	30	10	175	220	10	130	1,000	1,000

(3) Strictly Enforceable: Soil Control Standards are the regulatory standards for pollution assessment. A site exceeding them is will be regarded as a “Control Site” or a “Remediation Site” that has the liability for remediation.

2.2 Control and Remediation Standards-3

(4) Ideal Remediation Standards: Under The Act, the "Remediation Standards" are to return the controlled soil back to the Soil Control Standards. Due to the ideal and stringent nature of these Standards, remediation is often costly and difficult to realize. Although The Act allows the use of risk-based approach to determine "Remediation Goals", it is very seldom used.

(5) Various Limitations for Polluted Land: A polluted land is subject to analysis and is not allowed to have any transfer or transaction before returning the soil to Soil Control Standards.

(6) Risk Assessment Just Emerging

(A) An Allowed Option: Health Risk Assessment for Remediation Goals is an allowed option in Article 16 of The Act, but it must be permitted by the competent local authorities.

(B) Very Seldom Accepted: Due to various reasons the local authorities are very reluctant to accept Health Risk Assessment approach for a remediation case. Doubts also arise from other sectors as to whether this complicated approach can be properly used in Taiwan without abuse.

3. Overview of Global Developments

3.1 Regulatory Values for Soil-The Netherlands

(1) Multi-Purpose Soil Values: Risk-based, suitable to all land uses including agricultural, very stringent.

(A) Target Values: Basically the background values of substances in the environment.

(B) Intervention Values: Regarded as a limit value for serious soil pollution (soil volume>25M^3).

(C) Indicative Levels for Serious Contamination: Levels are much more uncertain. For substances with insufficient eco-toxicological toxicity data (such as Be, Se, Sn, Ag …).

3.1.1 Regulatory Values for Soil-The Netherlands-2

(2) For 12 Heavy Metals: Intervention Values for 8 of the 12 metals are similar to Taiwan's Control Standards for agricultural soil, as shown in the following :

	As	Cd	Cr	Cu	Hg	Ni	Pb	Zn
Target*	29	0.8	100	36	0.3	35	85	140
Intervention*	55	12	380	190	10	210	530	720
(Taiwan-Agriculture)	(60)	(5)	(250)	(200)	(5)	(200)	(500)	(600)
(Taiwan-Non-Agriculture)	(60)	(20)	(250)	(400)	(20)	(200)	(2000)	(2000)

(* http://www.sharedspaces.nl/Docs/internationaal/annexS_I2000.pdf)

3.1.2 Regulatory Values for Soil-Germany

(1) Risk-based Values Depending on Pathways:

(A) Trigger Values: Uniform soil screening levels for each federal state. By means of trigger values the responsible authority must decide on the need for further detailed site investigation.

(B) Action Values: Uniform action values (not cleanup standards) are also prescribed when there is good scientific justification. Action levels indicate a hazard level that has to be addressed with actions without the need for further site investigation.

(http://www.clarinet.at/policy/ger_approach.htm)

3.1.2 Regulatory Values for Soil-Germany-2

(2) Values for Cr and Zn: E.g, for Direct Intake and Additional Annual Loads:

		Trigger Values				Action Values
		Playgroun	Reside.	Park/ Recre.	Ind./ Comm.	
Direct Intake (ppm)	Cr	200	400	1,000	1,000	-
	Zn	-	-	-	-	
Permissible Additional Annual Loads (g/hectare-year)	Cr	300				-
	Zn	1,200				

3.1.3 Regulatory Values for Soil-Canada

(1) Federal Soil Quality Guidelines (SQGs) :

(A) Risk-based: SQGs are determined based on risk assessment tools to ecology and human health.

(B) SQGs for Different Uses: Based on the chosen receptors and exposure pathways for agriculture, residential/parkland, commercial and industrial soils.

(C) Conservative and Stringent Values: The derived SQGs are also quite conservative since a variety of pathways and receptors are chosen. Nevertheless, since they are not uniform for each type of soils , the SQGs are not quite so stringent as the Netherlands' Intervention Values.

3.1.3 Federal Soil Quality Guidelines (SQGs)-2

(D) Pathways and Receptors Chosen for SQGs:

Route of Exposure	Agriculture	Residential/ Parkland	Commercial	Industrial
Soil Contact	Crops/Plants Invertebrates Nutrient Cycling Processes Livestock/ Wildlife	Plants Invertebrates Nutrient Cycling Processes Wildlife	Plants Invertebrates Nutrient Cycling Processes	Same as Left
Soil and Food Ingestion	Livestock/ Wildlife	-	-	-
Human Health	Child	Child	Child	Adult

3.1.3 Regulatory Values for Soil-Canada-2

(2) Provincial SQGs:

(A) Determined based on local ecological and soil conditions etc.

(B) Normally less stringent than federal SQGs.

(3) Not Remediation Goals: Federal or provincial SQGs are not remediation goals. They are normally considered as Trigger Values. Further investigations are required when SQGs are exceeded.

(http://www.ec.gc.ca/etad/csmwg///pdf/comp_rev_e.pdf)

3.1.3 Regulatory Values for Soil-Canada-3

-For Cr and Zn: Federal and provincial SQGs (ppm):

	Land	Total Cr	Cr^{+6}	Zn
Federal (2001 Version)	Residential	64	0.4	200
	Industrial	87	1.4	360
Ontario	Residential	750~2,500	8~600	600~2,500
	Industrial	750~5,000	8~1,100	600~5,000
Quebec	Residential	250	-	500
	Industrial	800	-	1,500
British Columbia	Residential	60~250	-	150~15,000
	Industrial	60~800	-	150~15,000

(http://www.ec.gc.ca/etad/csmwg///pdf/comp_rev_e.pdf)

3.1.4 Regulatory Values for Soil-Japan

(1) Leaching Standards for Soil Quality Levels

(A) Enacted in 1991.

(B) Land is Categorized as agricultural and non-agricultural (similar to Taiwan).

(C) Adopt Leaching Standards for metals in non-agricultural land, conducted with acid at pH of 5.8~6.3 (much lower than TCLP).

(2) Content Standards Added in 2002: In the Soil Prevention Countermeasure Law, some pollutants were also regulated by their contents, including several heavy metals with high risks (e.g. Hg, Pb etc).

3.1.4 Regulatory Values for Soil-Japan-2

(3) Leaching and Content Standards: as shown in the following:

Heavy Metals	Leaching Limit Level	Content Limit Level
Cr^{+6} and Compounds	<0.05mg/l	<250mg/kg
Lead and Compounds	<0.01mg/l	<150mg/kg

（日本特定有害物質及び指定区域の指定基準, http://www.env.go.jp/press/file_view.php3?serial=4213&hou_id=3845 ）

3.2 Soil Remediation Goals

- Risk Assessment is More Common: It is becoming a trend in advanced countries, characterized as:

  (A) Switch from Ideal to Realistic: The stringent and ideal Intervention Values or SQGs are no longer used as Remediation Goals. Risk-based values according to land uses are far more cost-effective.

  (B) To Trigger Voluntary Remediation: Market forces are sufficient to trigger voluntary remediation.

  (C) Assessing with an Acceptable Health Risk : Normally at 10^{-4}~10^{-6} risk according to the local condition.

3.2 Soil Remediation Goals-The Netherlands

(1) New Policy: At end of 1999, the government statement on new soil remediation policy announced a drastic change.

(2) Goal: To bring the soil pollution problem under control within ~25 years by means of new remediation approach, additional resources by the state and by the private sector.

(3) Three Elements: Function-oriented and cost-effective remediation, market forces, effective government.

(http://www2.vrom.nl/Docs/internationaal/briefVTNZPronk.pdf)

3.2 Soil Remediation Goals-Germany

(1) Centralized Soil Conservation Act: Came into force in March 1999. An important object of this act is to permit contaminated land to be kept in beneficial use wherever practicable, and hence reduce the pressure to develop on green field sites.

(2) De-centralized Actions: Competent state authorities are responsible for the registration, investigation and risk assessment of all sites suspected of contamination.

(http://www.clarinet.at/library/Ferguson_Paper_Policies.PDF)

3.2 Soil Remediation Goals-Germany(2)

(3) Slow Down Land Consumption

- According to the Federal Statistical Office, the increase in land consumption dropped from 129 ha per day (2000) to 117 ha (2001). The Federal Environment Ministry considers this to be a step in the right direction.
- In its national sustainability strategy, the Federal Government set the aim to bring land consumption down to 30 ha per day by 2020.

(1. Joachim Sanden, The German Political and Legal Framework for an Effective Clean-up and Revitalizing of Contaminated Sites, The 5th International Workshop on Geo-Environmental Restoration, pp22-31 (2002).
2. Soil Conservation-Soil and habitats will benefit from reduction in land consumption, http://www.bmu.de/english/soil_conservation/doc/4982.php)

Germany: Exposure Pathways in Connection with Uses

Exposure from	Ingestion of Soil	Inhale Intake of Soil	Dermal Resorption from Soil
Children's Play Areas	✓	✓	✓
Residential Areas	✓	✓	✓
Parks and Recreational Facilities	✓	✓	✓
Industrial and Commercial Facilities	-	✓	-

(http://www.bmu.de/files/pdfs/allgemein/application/pdf/ableitbilanz.pdf)

3.2 Soil Remediation Goals-United States

(1) Screening Levels for Superfund Sites: Developed by EPA Headquarter and 3 of its Regional Agencies, for groundwater and soil protection etc respectively. All risk-based and dependent on land uses. Not remediation goals.

(2) De-centralized Regulations: Federal States may chose to develop their own Remediation Goals, normally risk-based.

(3) Some Differences: Due to the methods (risk-based or not) and the default parameters chosen for risk assessment etc, the central and local Remediation Goals may differ significantly.

Superfund: 4 Types of Non-Enforceable Regulations*

Type *	Compiler	Substances
1. Site Screening Levels, SSLs	US EPA	110
2. Risk Based Concentrations, RBCs	US EPA, Region 3	436
3. Medium-Specific Screening Levels, MSLs	US EPA, Region 6	465
4. Primary Remediation Goals, PRGs	US EPA, Region 9	597

* SSL is 1996 version, others are either 2004 or 2006 versions.

3.2 Soil Remediation Goals-United States-2

(4) Superfund: Screening Levels For Zn in Soil (ppm) :

Superfund	Migration to Groundwater		Residen.	Indust.
	DAF=20	DAF=1		
1.Soil Screening Levels, SSLs	12,000	620	-	-
2.Risk Based Concentrations, RBCs	-	-	23,000	310,000
3.Medium-Specific Screening Levels, MSLs	-	-	23,000	100,000
4.Preliminary Remediation Goals, PRGs	-	-	23,000	100,000
Federal State	**Residential**		**Non-Residential**	
5. Arizona	23,000		510,000	
6. California	23,000		100,000	
7. Florida	26,000		630,000	
8. Maryland	2,300		61,000	
9. Pennsylvania	66,000		190,000	

(3) Soil Remediation Goals-United States-3

(5) For Cr^{+6} and Cr^{+3} (ppm): Very different due to toxicity.

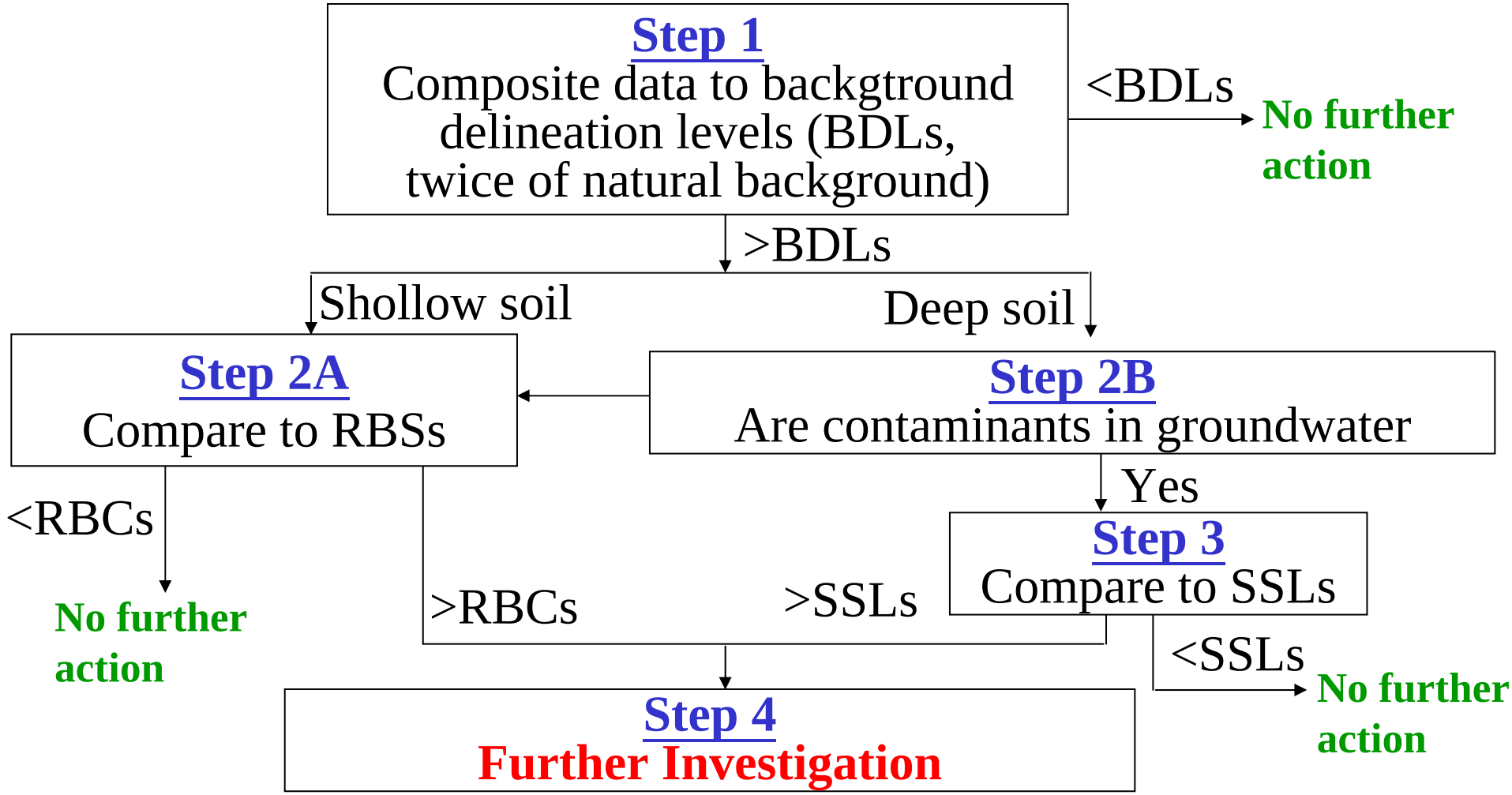
Federal/State	Residential Land			Industrial Land		
	T. Cr	Cr^{+6}	Cr^{+3}	T. Cr	Cr^{+6}	Cr^{+3}
1.Superfund-RBCs	-	230	120,000	-	3,100	1,500,000
2.Superfund-MSLs	210[a]	30	100,000	450[a]	64	100,000
3.Superfund-PRGs	210[a]	30	100,000	450[a]	64	100,000
4. Arizona	210[a]	30	77,000	450[a]	64	1,000,000
5. California	-	17	100,000	-	37	100,000
6. Florida	210[b]	210	110,000	470[b]	470	-
7. Maryland	-	23	12,000	-	610	310,000
8. Pennsylvania	-	94	190,000	-	420	190,000

[a] Assume 1/7 is Cr^{+6} , so values for total Cr is 7 times as for Cr^{+6}.

[b] Take T. Cr as Cr^{+6}.

(3) Soil Remediation Goals-United States-4

(6) Simplified Standard Procedure: Risk-based Decision Tree:



3.2 Soil Remediation Goals-Canada

(1) Three-Way Approach:

(A) Use SQGs as remediation goals directly.

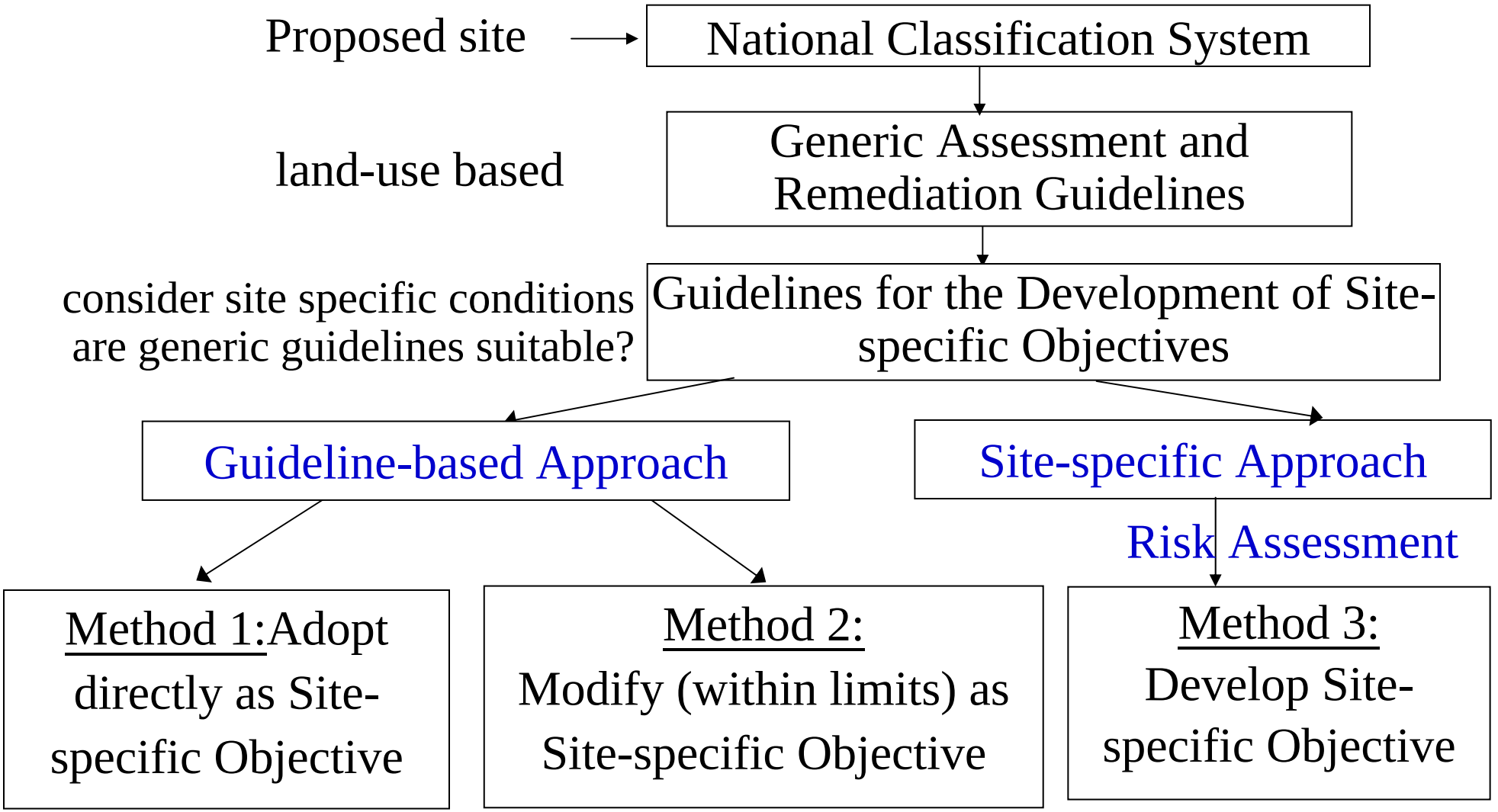
(B) Modify SQGs within limits.

(C) Site-specific, risk-base approach: Usually the preferred approach.

(Sources:

1. Overview-Soil Quality Guidelines, Development and Application of Soil Quality Guidelines within the CCME Framework for Contaminated Site Assessment and Remediation (1998).
2. Guidance Manual for Developing Site-Specific Soil Quality Remediation Objectives for Contaminated Sites in Canada (1996), http://www.ccme.ca/assets/pdf/sqg_site_sp_guidance.pdf)

Canada-Three Ways to Determine Remediation Goals



3.2 Remediation Goals for Soil-Canada-2

(2) A Remediation Case in Canada:

(A) Risk-based Clean-up Criteria: At one site impacted with chlorinated solvents, risk-based clean-up criteria were developed that were approximately 20 times the generic MOE guidelines. Remediation of this site to meet these risk-based levels was permitted.

(B) Fostering Voluntary Cleaning: If these attainable, less-stringent clean-up criteria were not developed, the owner would never have started the remediation, but would have chosen instead to abandon the site.

(http://www.aboutremediation.com/render/pageRender.asp?itemcode=AR-PRS-PRS&itemid=3149 (2003))

3.2 Remediation Goals for Soil-Japan and Taiwan

- Remediation Standards Bound to Soil Standards

(A) Remediation Standards Pre-determined: The Control Standards for agricultural or non-agricultural land are used as Remediation Standards directly without considering the actual risks (in Taiwan, the risk-based approach is very seldom used).

(B) Less Stringent in Japan: In Japan, although both Leaching and Content Standards are to be met. Though in Taiwan only Content Standards are controlled, Japan's control is less stringent due to the lower standards it chooses.

3.3 Risk Control of Secondary Construction Materials

(1) Policy Issues :

(A) Main Policies Covered:

-protect soil and groundwater

-promote secondary materials (reduce wastes)

-conserve natural resources and green fields

(B) Minimizing Total Risk:

-A reasonably small risk to soil is acceptable to minimize the risks in waste disposal and metrical resources depletion.

(The Netherlands, Building Materials Decree-Text and Explanatory Notes, (1999), http://www.sharedspaces.nl/docs/internationaal/BMDtexts.pdf)

(1) Policy Issues-2

(C) Netherlands: Policies driving recycling

- Sustainable development drives all other policy lines; e.g. economic policy, spatial planning policy, environmental policy, mineral planning policy.
- Develop policy lines together.
- Growth in population, growth in welfare and well-being can only take place if pollution and use of non-renewable sources declines at the same time.
- Acceptable soil risk <1% Target Values/100-year.

(1. http://www.rmrc.unh.edu/Partners/Presentations/vanderzwan/vanderzwanpresentationhouston_files/frame.htm
2. Jan Peter Brouwer, TNO-MEP, Recycling in the Netherlands, Presentation to Taiwanese Delegates, 2004)

3.3 Risk Control of Secondary Construction Materials-2

(2) Establish Suitable Criteria: Content and Leaching Criteria are both used to control the risks of secondary construction materials.

(A) Content Criteria: They are the Direct Exposure Criteria to protect the health of people who may come into contact with polluted soil, normally based on risk assessment.

(B) Leaching Criteria: Pollutant Mobility Criteria. To protect the quality of groundwater from the toxic chemicals moving from secondary materials, based on their leaching characteristics.

3.3 Risk Control of Secondary Construction Materials-3

(3) Typical Examples:

(A) The Netherlands: “Immission Test” has been designed to evaluate the pollution potential of some inorganic contents in secondary construction materials, while content criteria was for organic contents.

(B) Connecticut State: Use Remediation Standard Regulations (RSRs) to determine whether a secondary material can be used as aggregates.

(C) California State: Hazardous wastes are not allowed. In addition to EPA RCRA, also use “Total Threshold Limit Concentrations (TTLCs)” and “Soluable Threshold Limit Concentrations (STLCs)” to classify hazardous wastes.

(A) Netherlands: Categorize Building Materials in "Building Materials Degree (BMD)".

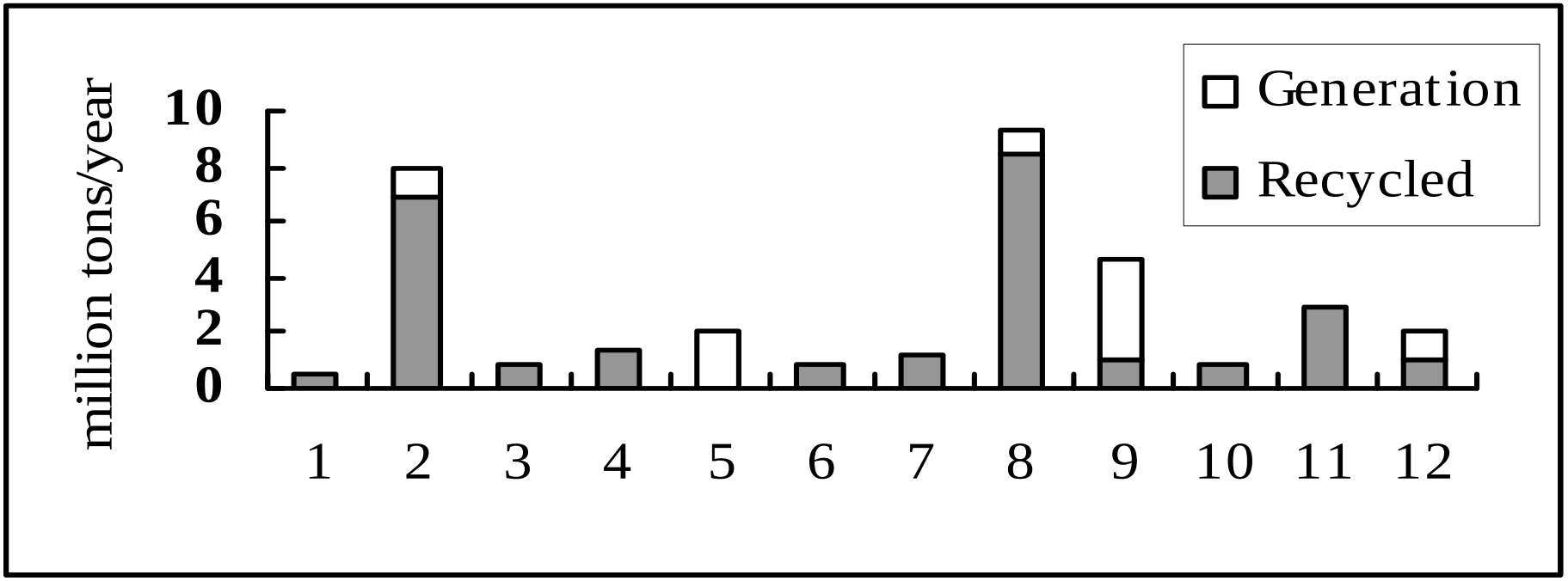
IMMISSION

Landfill (Soil Protection) Decree	Special Category: MSWI bottom ash -similar to category 2 except capped from above
Category 2: containing tarry asphalt aggregate -isolation measures:0.5 meter above the highest groundwater level, capped -control measures in connection with duty of removal -other control and monitoring measures	
Category 1: general control measures in connection with duty of removal	

COMPOSITION

(http://www.sharedspaces.nl/docs/internationaal/BMDtexts.pdf)

-Generation and Recycling of Secondary Resources in The Netherlands (1999)



1. demolition waste sand, 2. waste soil, 3. steel slag, 4. blast furnace slag, 5. phosphorous gypsum, 6. phosphorous slag, 7. fly ash, 8. concrete and brickwork, 9. dredge spoil,
10. waste incinerator fly ash, 11. asphalt rubble, 12. others

(B) Connecticut: Concrete Recycling/Disposal Criteria

Concrete Categories	Recycling or Disposal
1.Contaminated at or above characteristic hazardous waste levels.	Dispose as a hazardous waste at a permitted hazardous waste facility.
2.Contaminated below hazardous waste levels, but above Remediation Standard Regulations ("RSRs").	Recycle at a permitted recycling facility, or dispose in a solid waste landfill.
3.Clean (e.g., non-hazardous, not visibly stained; not painted; not mixed with asbestos, not from contaminated site or chemical storage areas).	Use as clean fill or recycle at an aggregate recycling facility.

(http://www.ct.gov/dep/cwp/view.asp?a=2718&q=325404&depNav_GID=1646)

- Connecticut RSRs for Cr and Zn (ppm)

	Residential (ppm)	Industrial/ Commercial (ppm)	Groundwater A/AA	Groundwater B
Cr^{+3}	3,900*	5,100*	Not Established	Not Established
Cr^{+6}	100*	100*	Not Established	Not Established
Zn	20,000*	610,000*	5 mg/l **	50 mg/l **

* Risk-based Values, ** Criteria deved by SPLP or TCLP test.

(http://www.ct.gov/dep/lib/dep/site_clean_up/remediation_regulations/regulated_criteria_summary_table.xls)

(C) California: TTLCs and STLCs for Hazardous Wastes

(i) TTLCs : To protect human health and the environment from the adverse effects resulting from all exposure pathways other than exposure via groundwater.

(ii) STLCs: To protect human health and the environment from the adverse effects resulting from groundwater.

(iii) Recent Developments:

- TTLCs: Has been modified using a multi-step, risk-based approach.
- STLCs: Use Waste Extraction Test (WET) in the past. Switched to TCLP in a recent revision.

(http://www.nap.edu/catalog.php?record_id=9466)

3.3 Risk of Secondary Construction Materials-4

(4) Global Trend:

(A) Leaching Criteria: To protect groundwater from the pollution of secondary construction materials. In the Netherlands, special leaching tests were developed to evaluate pollution from construction materials. In United States, TCLP is often used and is becoming more popular (others may use SPLP).

(B) Content Criteria: To protect human health and environment. In the Netherlands, they are mainly for organic substances. In United States, they are for toxic substances, mainly risk-based values.

4. Proposed Measures

4.1 Forward-looking and Practical:

(1) Incorporate new trend and practical policies.

(2) Minimize changes in current regulatory structure.

(3) Balance among soil and groundwater protection, waste recycling, and soil remediation for reuse.

(4) Consider indigenous factors such as

- Insufficient specialized manpower in health risk-based assessment.
- Good possibility to misuse health risk-based assessment if not well monitored and reviewed.
- Residential, commercial and industrial land can be easily mixed.

4. Proposed Measures-2

4.2 Preventive Soil Protection: Close control of clean soil with:

(1) Properly Stringent Alert Values: The current soil Control Standards of Taiwan can be transformed as the alert or trigger values, just like the cases in The Netherlands, Canada and Germany.

(2) Proper Environmental Criteria for Secondary Materials: Categorize and lead secondary materials to proper uses. Meeting the criteria/quality means the pollution risk of secondary materials is under good control.

4. Proposed Measures-3

4.3 Land Remediation for Reuse

(1) Allow Gradual Use of Risk-Based Remediation Goals: To improve cost-effectiveness and promote voluntary actions according to allowed risks (10^{-4}~10^{-6}).

(2) Categorize Land with a Different Approach: E.g. divide non-agricultural land into 2~3 categories, such as residential/commercial/industrial land 1, 2, or 3, as has been done in some states in United States.

(3) Reliable and Friendly Risk Assessment Tool: Import and standardize the tool as much as possible to minimize misuses. Provide good examples to make it more friendly.

(4) Friendly and Effective Checking System: Improve results of Risk Assessment and minimize misuse.

4. Proposed Measures-4

4.4 Recycling with Proper Environmental Criteria

(1) Consistency: The newly developed Three-Tiered Criteria by Taiwan EPA for incinerator bottom ash can be extended to other secondary materials. E. g. TCLP criteria for metals and content criteria for chlorides and dioxin and allowed applications etc.

(2) Risk-Based Content Criteria: Can be used to control other substances, if needed. Criteria can be similar to the the risk-based Remediation Goals developed for polluted soil, similar to the RSRs of Connecticut or the TTLCs of California.

5. Summary

1. After collecting and reviewing information to understand the global trend, and considering the indigenous conditions, the author made several proposals in regard to the integrated soil management policy.
2. The proposals include: (1)switching the current Soil Control Standards to Alert Values, (2) categorize residential/ commercial/industrial land by 2~3 classes and allow gradual use of risk-based approach for Remediation Goals, (3)determine proper leaching and content criteria to assess secondary materials for categorized reuse.
3. Due to insufficient specialized manpower in health risk-based assessment, risk-based tool should be made more friendly, easy to use, and easy for checking so that misuses can be minimized.

Appendix 1: Immission Tests of Dutch Regulations

(1) Release of contaminants is due to contact with water: therefore use leaching limits for all building materials.

(2) Principle of marginal soil load: maximum 1% of "target concentration" in upper meter in 100 years for metals, in 1 year for anions.

(3) Leaching limits: "Immission Values"

- Immission depends on the construction (dimensions, isolation)
-Only inorganic compounds (organics subject to composition limits)

Appendix 1: Immission Tests of Dutch Regulations-2

Component	Immission limit (mg/m^2 per 100 years)	Component	Immission limit (mg/m^2 per 100 years)
As	435	Sb	39
Ba	6 300	Se	15
Cd	12	Sn	300
Co	300	V	2 400
Cr	1 500	Zn	2 100
Cu	540	Br	300
Hg	4.5	Cl	30 000
Mo	150	F	14 000
Ni	522	SO_4	45 000
Pb	1 275		

Appendix 1: Immission Tests of Dutch Regulations-3

(3) Concentration Limits for Organic Components (mg/kg)：

• BTEX	1.25	(for each compound)
• Phenol	1.25	
• PAH	75	
•PCB	0.5	
• EOCl	3	
• Pesticides	0.5	
• Mineral oil	500	

Appendix 2: Steel Making Slag Recycle in Netherlands

1. LD slag

(1) Production : 500 kton/year
(2) Applications :

- Dumping stone (only a small fraction).
- Mixed with blast furnace slag in road foundation.

2. ELO slag

(1) Production: 200 kton/year
(2) Applications: 380 kton/year (including import from Germany):

- Hydraulic mixed granulates (with BFD-slag)
- Road construction (fraction 0-45mm)
- Hydraulic engineering works (fraction 45-200mm)