



SOIL TREATMENT, LANDFILLING AND REUSE IN NL - POLICIES, TECHNOLOGIES AND COSTS

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OUTLINE

- ◆ GOLDEN TRIANGLE
- ◆ POLICY DEVELOPMENT
 - Site remediation
 - Soil treatment and disposal
 - Soil reuse
- ◆ OPERATIONAL TREATMENT TECHNOLOGIES
- ◆ MARKET DEVELOPMENT
- ◆ NEW DEVELOPMENTS
- ◆ EPILOGUE



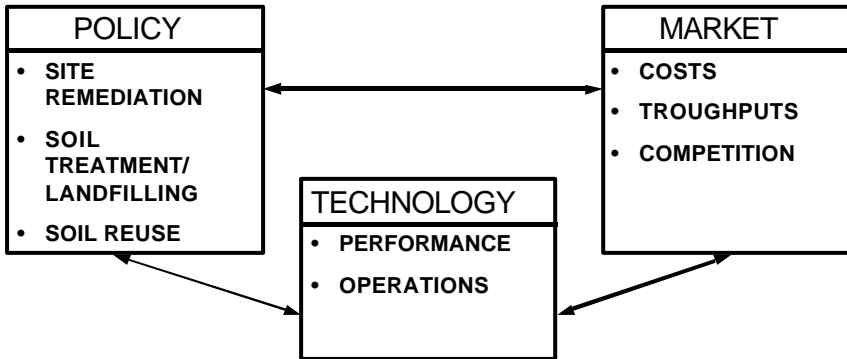
POLICY PRIORITIES (SINCE 1979)

- ◆ **PREVENTION**
- ◆ **DIRECT REUSE**
- ◆ **REUSE AFTER TREATMENT**
- ◆ **LANDFILLING**

NL SPECIFICS

- ◆ **REMEDIATION**
 - HIGH GROUNDWATER LEVEL
 - DENSELY POPULATED
 - HIGH LAND PRICES
- ◆ **REUSE**
 - HIGH SOIL TURNOVER (50 Mton/YR)
 - SCARCITY OF RAW MATERIALS

GOLDEN TRIANGLE



SITE REMEDIATION – POLICY DEVELOPMENT

ESTIMATES

- > 100.000 SITES
- ? 50 BILLION EURO TOTAL COSTS
- ? MARKET VALUE = 300-400 MILLION EURO/YEAR

PERIOD	LEGISLATION	FINANCE
80's	INTERIM ACT (multifunctional)	100 % P
90's	SOIL PROTECTION ACT	P + p
00's	SPECIFIC (DE)REGULATIONS (functional)	P + P

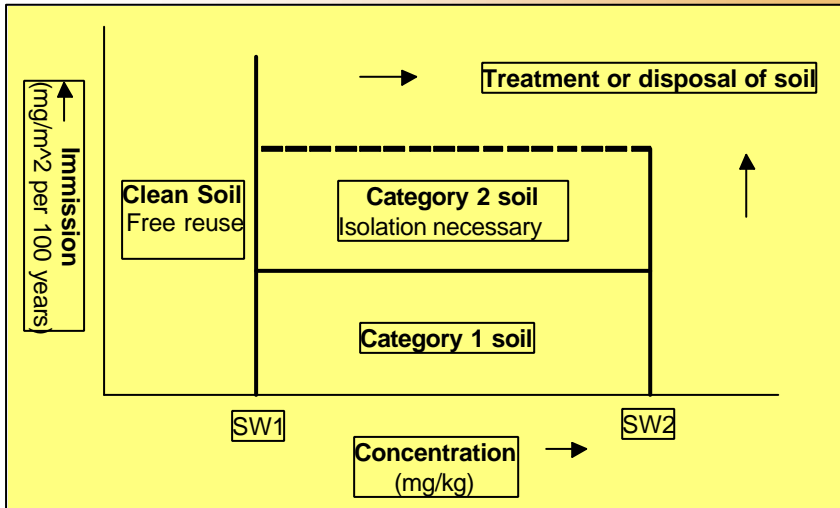
SOIL TREATMENT AND DISPOSAL – POLICY DEVELOPMENT

PERIOD	LEGISLATION
80's	"FREE FOR ALL"
90's	<ul style="list-style-type: none">• DISPOSAL OF TREATABLE SOIL PROHIBITED• LANDFILL TAX• SOIL TREATABILITY ASSESSMENT BY SCG
00's	SPECIFIC (DE)REGULATIONS

SOIL REUSE – POLICY DEVELOPMENT

PERIOD	LEGISLATION
80's	CLEAN SOIL ONLY
90's	<ul style="list-style-type: none">• LOCAL REUSE POLICIES• DUTCH BUILDING MATERIALS DECREE
00's	SPECIFIC (DE)REGULATIONS

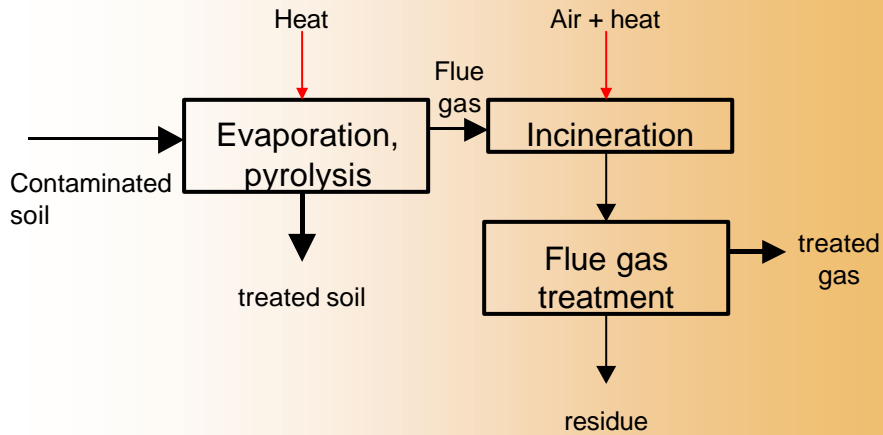
SOIL QUALITY STANDARDS



STATE OF THE ART SOIL TREATMENT TECHNOLOGIES

- ◆ THERMAL TREATMENT
- ◆ BIOLOGICAL TREATMENT
- ◆ SOIL WASHING

PROCESS FLOW SCHEME THERMAL TREATMENT



THERMAL TREATMENT (1)



THERMAL TREATMENT (2)



THERMAL TREATMENT (3)



THERMAL TREATMENT (4)



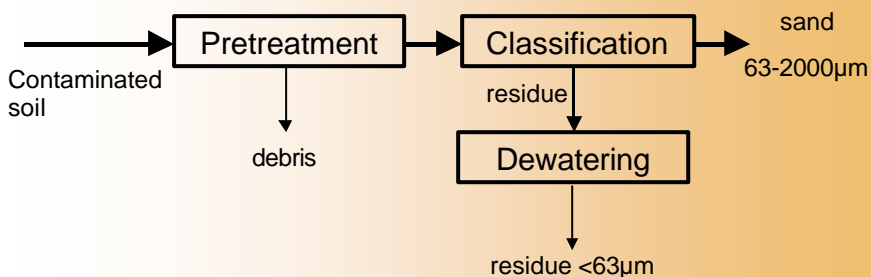
THERMAL TREATMENT (5)



BIOLOGICAL TREATMENT

- ◆ **MODES OF OPERATION**
 - INTENSIVE / HEAT + AIR / 0.5 YEAR / 5 FACILITIES
 - EXTENSIVE / 0.5 - 2.0 YEARS / 20 FACILITIES
- ◆ **SANDY SOILS WITH MINERAL OIL AND “LIGHT” PAH’s**

PROCESS FLOW SCHEME SOIL WASHING



SOIL WASHING (1)



SOIL WASHING (2)



SOIL WASHING (3)



APPLICABILITY OF TREATMENT TECHNOLOGIES

TECHNOLOGY	SOIL TYPE	ORGANICS	HEAVY METALS
THERMAL	ALL	ALL	< REUSE
BIOLOGICAL	SANDY	DEGRADABLE	< REUSE
WASHING	SANDY	50-95 % REMOVAL EFFICIENCY	80-90 % REMOVAL EFFICIENCY

OTHER TECHNOLOGIES

◆ IN-SITU

- NATURAL ATTENUATION
- PLUME ABATEMENT
- REACTIVE WALLS
- GROUNDWATER REMEDIATION

◆ IMMOBILISATION

- CEMENT-BASED AND IN BITUMEN
- TREATMENT PREFERRED OVER IMMO

MARKET DEVELOPMENT - 80's

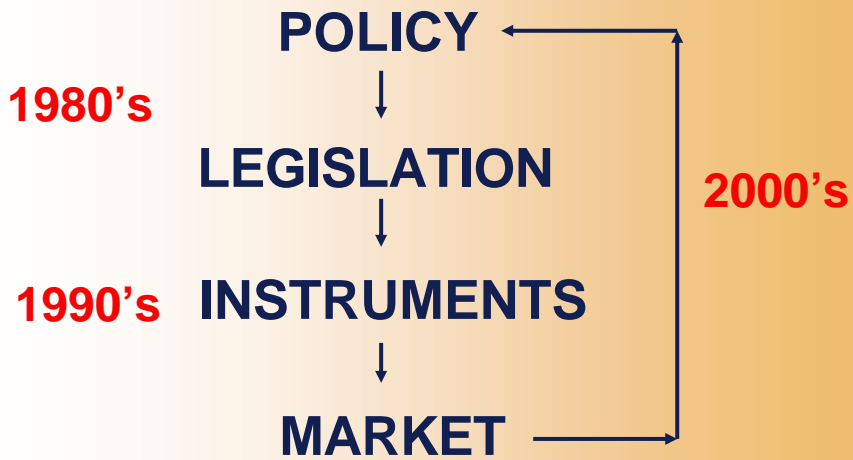
◆ CHARACTERISTICS

- TRIAL AND ERROR TREATMENT
- SMALL SCALE/LOW THROUGHPUT FACILITIES
- LITTLE SUPPLY & HIGH COSTS

◆ RESULTED IN STAGNATION

- LANDFILLING & TEMPORARY STORAGE
- LITTLE TREATMENT
- LITTLE REUSE

DEVELOPMENT TRIGGERS



MARKET DEVELOPMENT - 90's

- ◆ LEGISLATION ON DISPOSAL
- ◆ LEGISLATION ON REUSE
- ◆ INSTRUMENT = CENTRE FOR SOIL TREATMENT

CENTRE FOR SOIL TREATMENT (SCG)

- ◆ **ASSESSMENT OF SOIL TREATABILITY (LEGISLATION)**
 - TECHNICAL AND ECONOMIC CRITERIA
 - GATEKEEPER FOR LANDFILLING
 - 95 – 02: 20 Mton ASSESSED, 67 % NON-TREATABLE
- ◆ **COMPULSORY CENTRAL SUBCONTRACTING OF SOIL TREATMENT**
 - STREAMLINING OF PROCEDURES
 - STEADY SUPPLY OF SOIL
 - PRODUCT SOIL QUALITY ASSESSMENT

SOIL TREATMENT CRITERIA

1. REUSABLE PRODUCT

CONTAMINATION	REUSABLE PRODUCT	MAX.COSTS [EURO/ton]
-	< 80 %	40
LIGHT	> 80 %	45
HEAVY	> 80 %	75

2. EXPERT SYSTEM (DUTCH ONLY) BASED ON

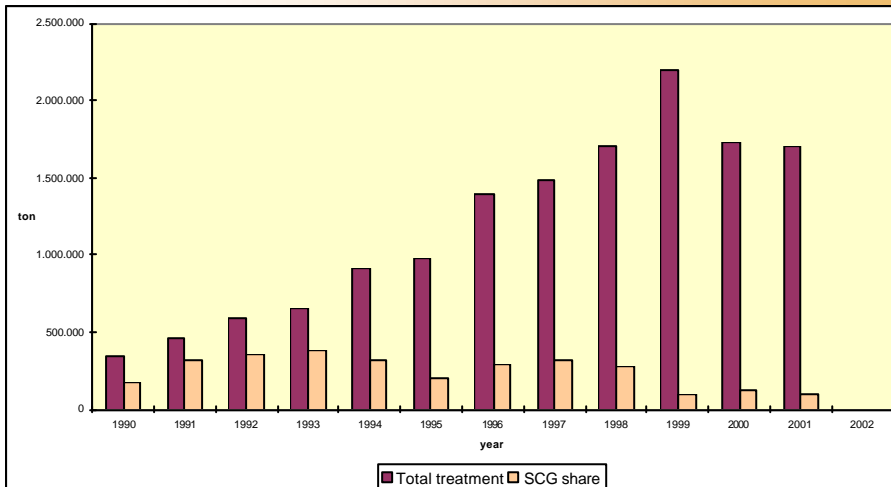
- VALIDATED TREATMENT EFFICIENCIES
- REUSE STANDARDS
- CONTAMINATION STANDARDS

TYPICAL EXAMPLES

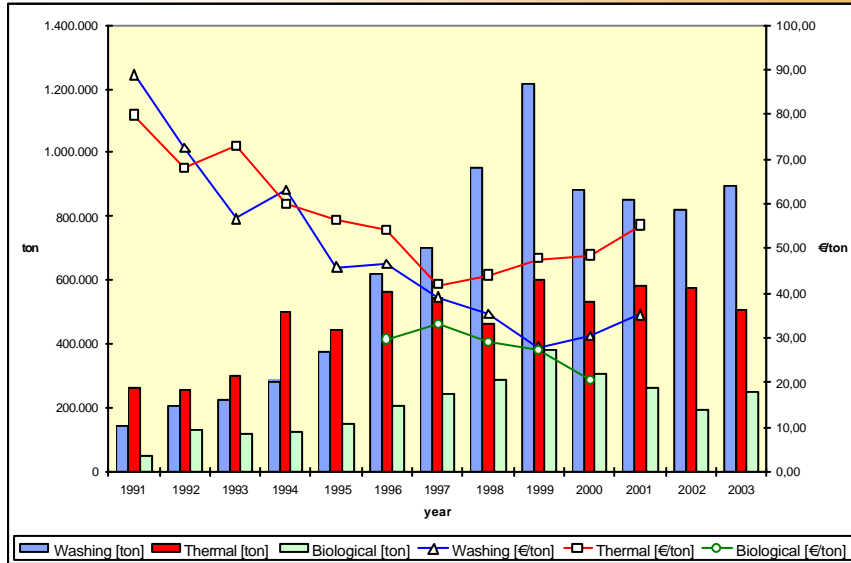
MIN.OIL	PAH's	HEAVY METALS	SOIL	OPTIONS
5000	20	< REUSE	SAND	THERMAL / BIO/ WASH
5000	300	< REUSE	SAND	THERMAL / WASH
5000	300	< REUSE	CLAY	THERMAL
5000	300	> REUSE	SAND	WASH
5000	20	> REUSE	CLAY	LANDFILL



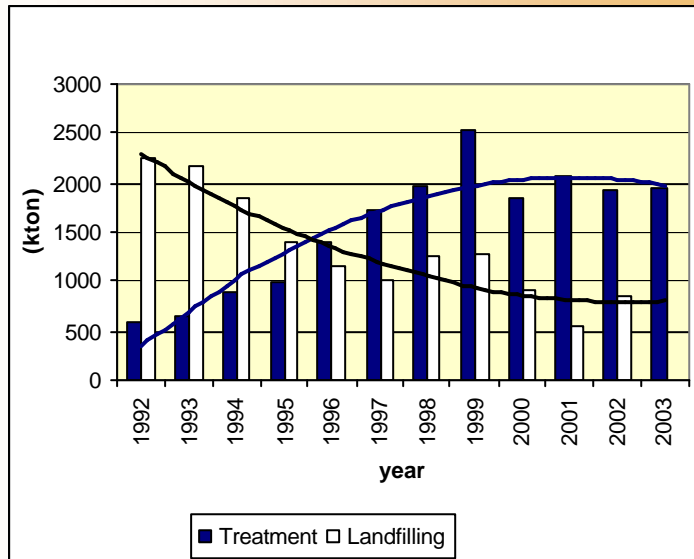
CENTRAL SUBCONTRACTING OF SOIL TREATMENT



YEARLY THROUGHPUTS AND COSTS



TRENDS IN TREATMENT AND LANDFILLING



MARKET OVERVIEW 2002

TECHNOLOGY	THROUGHPUT [kton/year]	COSTS [Euro/ton]
In-situ treatment	?	?
Thermal treatment	507	35-60
Biological treatment	326	20-40
Soil washing	1119	20-45
Immobilisation	150-250	40-45
Landfilling	854	40-70
Reuse untreated soil	9000	2-7
Reuse treated soil	1500	0-3

NEW DEVELOPMENTS

- ◆ **QUALITY CONTROL AND ASSURANCE**
 - Customer confidence and compliance with legislation
 - Audited certification schemes for relevant unit operations
- ◆ **P & P PARTNERSHIPS**
 - SHARING COSTS
 - SHARING RISKS

EPILOGUE (CRITICAL SUCCESS FACTORS)

- ◆ **CLEAR POLICY OBJECTIVES**
- ◆ **ADEQUATE LEGISLATION
(TREATMENT / LANDFILLING / REUSE)**
- ◆ **PRACTICAL INSTRUMENTS**
- ◆ **COMPETING MARKET**
- ◆ **SUFFICIENT BUDGET**