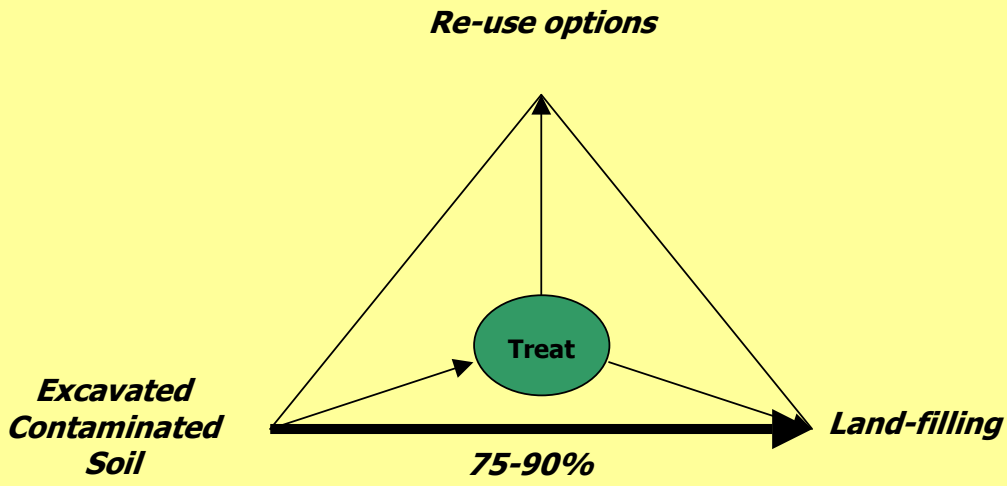
TerraNova

Summary Report
on
Technical and Legal Barriers
for the Introduction of Ex-Situ Biological Soil Treatment
in the EU Member States



EU Commission
Directorate General Research

John Vijgen Consult
Partner of TerraNova Consortium
Elmevej 14, 2840 Holte, Denmark
Email: john.vijgen@get2net.dk

August 2002

Table of contents

1. Summary and recommendations

How can (biological) remediation technologies penetrate, when the largest portion (75-90%) of the potential the market – represented by excavated contaminated soil – is disposed of at landfill sites?

Biological soil remediation is an environmental sustainable solution for remediation of contaminated soils in EU Member States. However it is not sufficiently breaking through, as in most Member States depositing of contaminated soil at landfill sites is stimulated and/or legally permitted. Landfilling of contaminated soil is the most important barrier to implementation of (biological) soil treatment. And major changes in the regulation and enforcement have to be implemented, *if* soil treatment should remain a priority in the European Union.

The following statements, discussed in this report, challenge the current position of contaminated land remediation in Europe:

- Successful Soil Management Policy requires "one level playing field" in the EU
- Landfilling of contaminated soils is the main barrier for development of (biological ex-situ) treatment technologies
- Role of the municipalities as stakeholders
- The road from multi-functional solutions to "least cost" solutions
- Influence of permitting procedures – a rather complex issue
- On-site treatment and disposal – a cheap and clever option of on-site landfilling?
- Validation of biological treatment compared with other technologies
- Challenges for biological treatment
- Definition of soil
- Harmonisation and comparability of decision-making tools
- Quality assurance and certification of treated soils
- Enforcement of laws by adequate governmental controls needed
- Liability for contaminated soils from the "cradle to the grave"

Soil remediation is largely determined by economic factors, which are translated into prices and the opportunities of achieving the lowest prices within the loopholes of the various laws. Lack of financial means often leads to inadequate and non-sustainable choices. On the other hand improvements of biological soil remediation technologies have to be made (main objective of the TerraNova project) in order to satisfy the needs in contaminated land remediation.

In order to contribute to the solution to the problems reflected in the above-listed issues, it is recommended that various steps are taken at national and at EU level. Proposed solutions (which are indicated in the various sections) could e.g. be implemented at EU level by means of the execution of small-scale demonstration and pilot projects in the various Member States. The experiences could then be used to disseminate to EU wide improvements.

2. Introduction

This report aims to summarise the main conclusions on emerging issues concerning the implementation of "new" biological soil treatment in general at EU level, as well at national and regional level in some of the EU Member States. The report does not claim to be complete and is not able to describe issues in full detail, but it does identify some of the main barriers. Many of the conclusions are not only applicable to biological remediation but to any treatment methods.

The information has been collected and researched between 2000 and 2001/2002. The main information has been abstracted from the various soils and waste and permit/license laws/acts, from literature and from many interviews both with the main stakeholders such as the various authorities at EU, national, regional level and with the various parties performing the actual remediation in the field such as contractors and consultants. Wherever possible the author has also indicated input to possible solutions. The report explains the general approach, and describes the fate of contaminated soils at present in EU Member States, and looks into the various options how to improve that situation. Thereafter the report consists of 2 main parts; part one a summary of EU and other general issues, and part two discussing EU Member State information. The EU Member State information is brief and not complete. However valuable information and inputs to the understanding of the mechanisms in relation to disposal of contaminated soil originates from individual Member States.

It must be noted that the report is written in the context of the larger project, which needed to identify and overcome the existing barriers in order to implement the TerraNova ex-situ bioremediation system. TerrraNova aimed to be an improved version of existing bioremediation systems in EU Member States. The report is therefore written from that perspective, and will therefore not be entirely neutral.

However, the Author explicitly wants to make available the information gathered from a large number of stakeholders in the EU Member States who have been willing to contribute to the TerraNova project. If the information in this report contributes to the understanding of the soil remediation situation within the EU, and - in particular – contributes to identifying a way forward on key issues, then this can only be referred to the input from all patient colleagues throughout Europe.

3. General approach

In order to address the technical and legal issues the soil remediation process has been analysed using 3 main sets of issues:

Issues related to the input of contaminated soils to the treatment plant
Issues related to the output of treated soils
Issues related to the treatment plant itself concerning the emissions and the necessary permits

This concept of 3 components is illustrated below:

Input materials[*)]	**Permits for treatment systems such as TerraNova**	**Output materials**[*)]
Definition of input:		Cleaned product
Input 1: Contaminated soils Input 2: Waste	Emissions related to: • air • noise • odour • water	• Re-use criteria (free application - restricted use) • Land-filling
Legislative regime:		
Combination of National and EU legislation a/o EU Waste List	EU legislation - in the future especially IPPC and EIA	National legislation and EU Landfill Directive

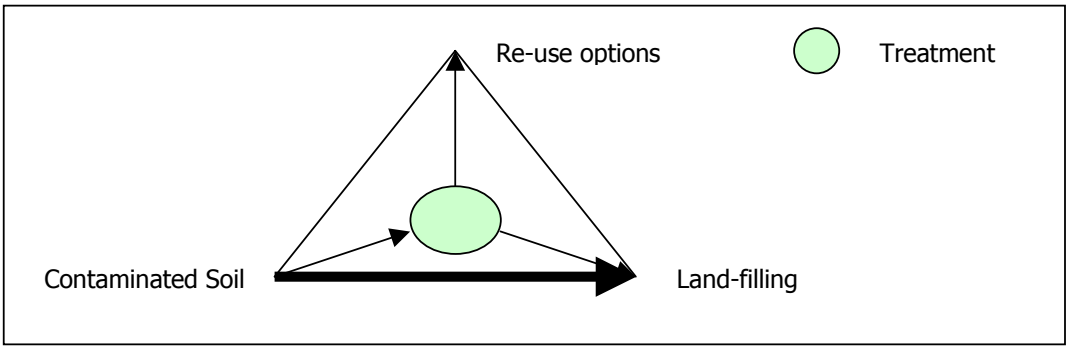
[*)] Soils can be polluted with a large number of contaminants. The report has limited itself to the core components mineral oil and petrol in order to concentrate on the main issues relevant to TerraNova. From the point of market introduction this choice makes most sense for biological treatment.

4. What is happening with contaminated soils at present in EU Member States?

4.1 General

Soil generated from a soil remediation project faces a certain number of options for its treatment before it reaches its final destination.

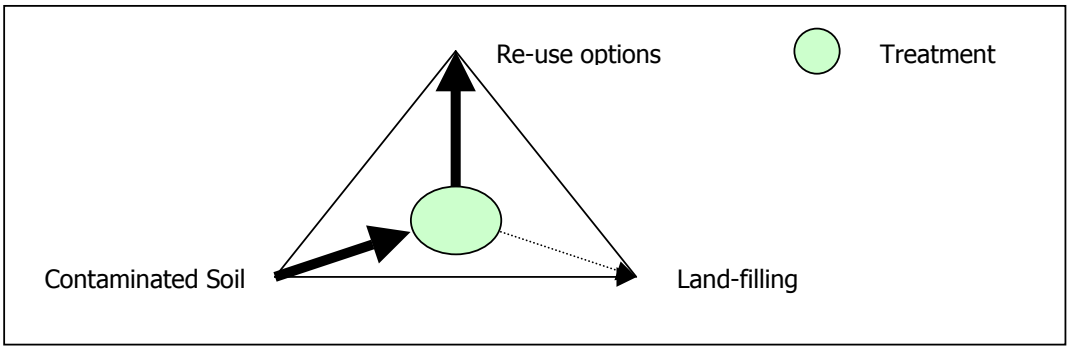
The following figure shows the possible routes of contaminated soil either to re-use or to landfill – with or without treatment. It indicates the large proportion of contaminated soils reaching landfill sites. The data is extracted from the large number of interviews with European stakeholders.



Scenario 1: 75-90% of all contaminated soil is landfilled.

Presuming that treatment of contaminated soil and re-use are an environmental as well as economic sustainable solution – then the amount of soil, which today is disposed of at landfills, is much too high. What could be done about this?

Simply looking at the routes in the diagram, it is obvious that one way of reducing the proportion of soil going to landfill is by stimulating more soil going to treatment and at the same time increasing re-utilisation after treatment. If direct disposal to landfill can be reduced, it may also be effective to restrict disposal on landfill sites of treated soil after treatment. These options are shown in the next diagram.



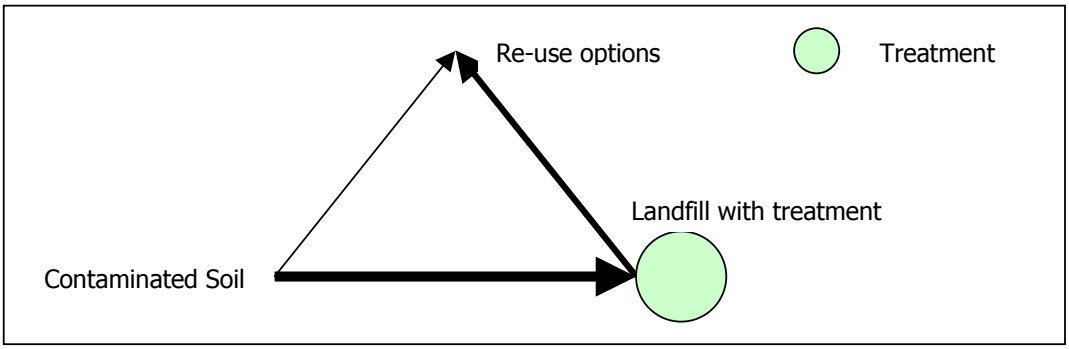
Scenario 2: Minimise disposal to landfills

4.2 Establish biological treatment plants a the landfill sites

Another option could be to install more biological treatment plants at landfills, where today most of the contaminated soil is ending. Incoming material could be assessed and allow more options for treatment to be created. An important issue is also then to assure that all treated soils, which are not

absolutely necessary for landfill operation and maintenance purposes, are brought onto the market again and therefore should leave the landfill again. This idea is more fitting into a category of 'end of pipe'-solutions, as it does not take away of the principal cause of the problem: too little soil treatment. It accepts the landfill and looks hereafter for improvements.

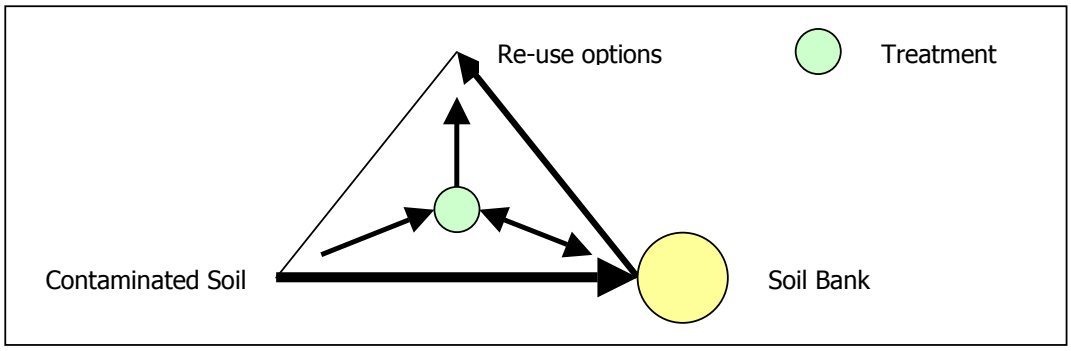
The combination of soil treatment at landfills, if not been thoroughly controlled and/or monitored can easily lead to the creation of new and uncontrollable soil streams. The concept is illustrated in the diagram below.



Scenario 3: Treatment at landfills – increase of re-use of treated soil

4.3 Eliminate transport of contaminated soils to landfills and establish system of Soil Banks

This concept eliminates the landfill with direct access to contaminated soil, as the main reason of the problem. The complete elimination of contaminated soil on landfill sites could be combined with establishing so-called Soil Banks, which store, treat incoming soils and distribute outgoing soils. In this way one could obtain the important separation between waste and soil, and with the help of the soil banks set up the necessary strategy for treatment, re-use etc. A similar idea is practiced in the Netherlands (Soil Banks in Dutch: Grondbanken), and has certainly given an increase in the re-use of soils, but is also criticised for non-sufficient control. Instead of treatment at landfill sites, treatment would take place at the Soil Banks. The landfill could then acquire (low-)treated soil for their internal activities (cover, etc.) from the Soil Banks, but the direct access to contaminated soils would be eliminated. This scenario is shown below.



Scenario 4: Establishing Soil Banks

4.4 Perspective of the proportion of contaminated soil that may be treated in EU Member States

Looking at the available numbers, the prospects for any kind of treatment technology look almost non-existent. Only 10-25% of all excavated contaminated soils are treated. Assuming a simple equal division according to the 3 main techniques (thermal, physical/chemical and biological) it would appear that only a small part of the soil (approx. 3-8%) excavated from remediation sites has any real chance of going to biological treatment (see figure below).

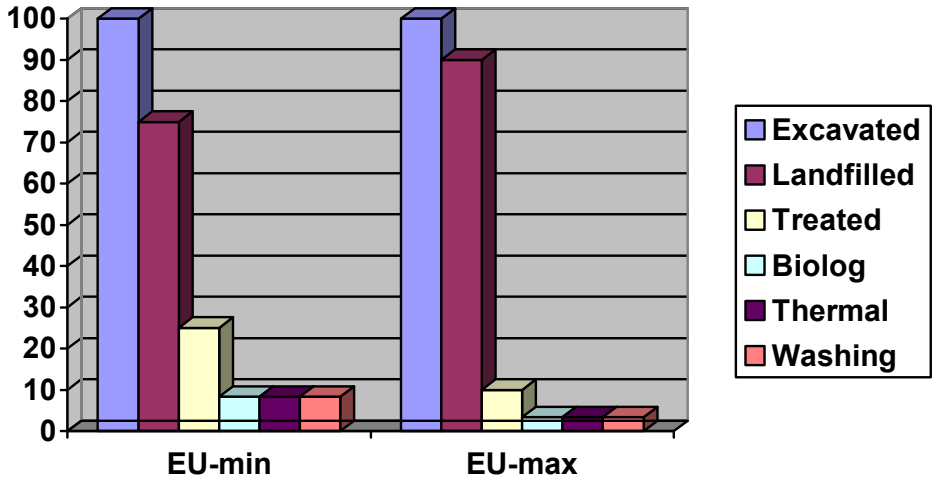


Figure 1: Visualisation of percentage of excavated soils possibly be treated EU wide. EU-min=75% landfilled, EU max= 90% landfilled.

Naturally, this rather simplified assumption can be significant different in each of the EU Member State. In Germany for example, a TerraTech publication (2/2002, page 12) concludes for a total of 3.35 mio. tons soil cleaned (in 1999) at the stationary treatment plants that the methods applied are 67% biology, 23% soil washing und 10% thermal treatment. Taken into consideration that the treated soil constitutes approx. 10-25% of the total excavated soil, the real treatment rate for the technologies would then be 1-3% for thermal, 2-6% for soil washing and 7-16% for biological treatment.

5. Summary of European situation and other general issues

5.1 General

Soil remediation is strongly determined by economic factors, which are translated into prices and the opportunities of achieving the lowest prices within the loopholes of the various laws.

Various statements can be presented which should challenge the current position

- Successful Soil Management Policy requires "one level playing field" in the EU
- Landfilling of contaminated soils is the main barrier for development of (biological ex-situ) treatment technologies
- Role of the municipalities as stakeholders
- The road from multi-functional solutions to "least cost" solutions
- Influence of permitting procedures – a rather complex issue
- On-site treatment and disposal – a cheap and clever option of on-site landfilling?
- Validation of biological treatment compared with other technologies
- Challenges for biological treatment
- Definition of soil
- Harmonisation and comparability of decision-making tools
- Quality assurance and certification of treated soils
- Enforcement of laws by adequate governmental controls needed
- Liability for contaminated soils from the "cradle to the grave"

5.2 Successful Soil Management Policy requires "one level playing field" in the EU

Disparities in the various EU Member States in a/o awareness and prioritisation are considerable. Some Member States have been active in 20 years and others are just starting. In that case soil can be considered as - just like water - always "running" towards the lowest point. This means that the soil stream will tend to go towards those Member States offering the cheapest solution and the weakest enforcement. Taking into account that such differences are already existing within the borders of several individual EU-Member States, one can image what consequences this will have on European enabling and stimulating the use of feasible solutions.

Presently decision-making within soil remediation takes place at National level, e.g. in Germany may the choice be Munich or Hamburg. In the European Union perspective soil may be transported from e.g. Germany to Naples in Italy. After the enlargement of the European Union new options are introduces and contaminated soil can be taken to the new Member States in the East. Legislation of one Member State may ruin good intentions of another Member State. Major differences in legislation, especially in neighbouring countries, may have fatal consequences for the balance between failure and success of soil treatment.

Different re-use criteria for contaminated soils can mean that certain soils are classified in one country as treatable and as such are not allowed to be disposed off at landfills. However, they can be transported "untreated" to the neighbouring country, where the same soil can be disposed of at landfills for very low prices or re-used at other locations (see also 5.3 below). Within the present EU laws at present, highly contaminated soils can be transported over the EU Member State borders until the soil, treated or untreated, finally can be re-utilised.

Under 5.11 below, Harmonisation and comparability of decision-making tools, similar issues are further addressed.

5.3 Landfilling of contaminated soils is the "main barrier" for development of (biological ex-situ) treatment technologies

a) General

It is generally believed that a large number of technical factors determine the feasibility of new and existing treatment soil treatment technologies. The numbers given above (based on a large number of interviews), however, show that there is sufficient reason to look in other directions to find the main barriers to soil treatment.

b) Economic advantages of landfilling against treatment

The most common answer for the preferred use of landfills by major stakeholders is the large difference in prices in comparison to treatment. The prices vary naturally from country to country but the price is always the main factor for decision-makers. However there are considerable differences between various Member States; some of them are briefly indicated below:

In the Netherlands and Flanders there are hardly any differences in price between landfill and biological treatment, and therefore also the amount of soil going to landfills is quite small. In Ireland, recent introduction of landfill tax has resulted in prices of around 110 €/ton for landfilling of soil, hence landfilling of contaminated soil is no economic alternative anymore. In the Netherlands, depositing of treatable soil is prohibited and leads to criminal prosecution because this is a violation of the laws. If one still disposes of soil to a landfill, an environmental fine must be paid.

On 10th December 2002, the Danish Parliament adopted an amendment of the rules of taxes regarding slightly contaminated soil. According to the amendment there will be no tax on slightly contaminated soil contaminated with heavy metals and PAH, if the soil is used to daily covering in the landfill or to roads inside the landfill.

In Germany, landfill prices match - in principal - the biological treatment prices, but there are many uncertainties, loopholes and exception rules, which ruin the originally planned intention. Just to mention some of them:

Closed Substance Cycle and Waste Management Act (1995) has created many discussions at the federal state level regarding a clear distinction between "disposal" (Beseitigung) and "recovery for re-use" (Verwertung) and thus led to many forms of "fictitious" recovery for re-use at landfill sites. Different interpretation of removal and utilisation per Federal State has thus led to transport over long distances of contaminated soils from one State to a disposal sites of another. Use of contaminated soils for so called construction engineering measures within landfill sites means that the disposal costs of these contaminated soils are set as being lower than the real cost of their disposal - the acceptance prices for the materials at landfills are therefore always well below the common biological treatment prices.

Exception rules of the various Federal States for former coal and salt mining areas, which need large amounts of soil for re-cultivation purposes, also add to the overall picture of uncertainty of rules.

Problem of proper registration of contaminated soils streams by means of "way-bills" (Begleitscheine), the set-up of Waste management balances (Abfallwirtschaftsbilanzen) which appear only several years after the year in which the waste disposal was done, and the problem of proper classification, which can lead to the fact that soils are not registered in the system. This is based on the fact that the individual state has different classifications for the so-called „landfill technical recovery for re-use". Contaminated soil, which cannot be "recovered" at the landfill, is then for "recovery for re-use" transported to another State and can hardly be retraced in the balances.

This overall picture has led to the fact that specialists in the soil remediation in Germany estimate that around 70% of the "treatable" contaminated soil excavated ends untreated at landfill sites. Furthermore, the examples contribute to an insight of the whole German soil remediation sector as for several years in a deep and not yet resolved crisis.

In Austria there is a landfill tax system, where taxes recently have been increased again and is said to reduce the large differences between the cost of landfill and the cost of treatment. But contaminated soils generated from locations listed in the so-called "Altlastenatlas" (the National Inventory sites) are exempted and tax-free.

In Finland, the Waste Tax Act (495/1996 changed by 1157/1998) lays a tax on all waste disposed on landfills. This however, does not affect contaminated soil, which is excluded from the scope of the tax.

In the UK, landfill disposal of soils from contaminated sites is currently exempt from the tax placed on most waste streams going to landfill. The main reasoning behind the exemption was that the tax would simply increase the total cost of site clean up, resulting in fewer sites being remediated, or a bigger need for public money in another form. This is seen as being counter to wider objectives to encourage the clean up and redevelopment of brownfield sites. (The exception is where sites are being remediated only in response to regulatory enforcement action – the intention behind this is to create a fiscal incentive on site owners and other responsible parties to clean up "voluntarily" without waiting for formal action by regulators.) The result of course is that landfill disposal is still very competitive with alternative technologies.

In Member States such as Italy and Spain, so few treatment plants are available that landfill is mostly the only viable alternative.

An important way forward would be a *EU-wide ban on disposal of treatable soils at landfill sites*. Such ban could be an important step forward towards more biological treatment but also towards all other soil treatment methods.

The general tendency by decision-makers is that many urban private and public partnership development projects are only feasible due to the low landfill costs. However considering the marginal percentage which is soil remediation and treatment in relation to the total costs of such projects, this seems more an unjustified argument, which has to be looked into and discussed further in the future of such projects.

c) New Landfill Directive: A solution towards sustainable soil treatment?

Implementation of the *Landfill Directive* will in principle improve EU-wide standards for controlled landfill sites and thus increase the construction and long-term monitoring costs of landfill sites during operation and after closure. Certainly it will lead to the closure of many old landfills, which cannot fulfil the higher technical requirements and lead to a reduction of the total number of landfills.

On the other hand in many of the EU Member States a large number of the requirements for the construction of new landfills in the Directive have already been implemented over a number of years. A major impact could thus occur if the Directive is implemented strictly and within a very rigid timescale, especially in the Southern European region. Here the soil remediation market has not begun - or has hardly begun - in some of the Member States, so the Directive could lead to considerable improvements.

Even in those Member States where the Directive is largely already applied, large differences in prices still occur, as described before. So in principal the Directive is a guidance tool for the right direction, but additional measures will be needed in order to create the necessary chances and incentives for more treatment.

A major problem can also be expected in the transfer phase in which a large number of landfills will be closed. The closure procedures take usually quite some years and require a huge amount of soil, which the soil remediation market can easily provide at a low price. For example in the Netherlands, at present there is a possibility of using around 15 mio m^3 of slightly contaminated soil in the closure of old landfills. This is, - even if spread over a period from 5 to 10 years, an enormous volume and creates large competition for any kind of soil treatment. Placing the Dutch example in the European context, it is obvious that closure procedures in each country have to be in balance with the incentives to create more soil treatment. This balance may only be found though common European regulation.

d) Instruments to register all contaminated soil streams needed

Most of the interviews confirm the high percentage of soil being landfilled, but documentation is only available from a small number of Member States. In the Netherlands the SCG (Service Centrum Grondreiniging=Service Centre Soil Cleaning) produces each year an overview of the amounts of soil being treated by treatment plants, soil being disposed at landfill sites and the amount of soil being re-used. Recently also the Dutch Institute for Public Health RIVM (Rijksinstituut voor Volksgezondheid en Milieu) together with the Ministry of Environment VROM (Volkshuisvesting, Ruimtelijke Ordening en Milieubeheer) have produced an annual overview on the soil remediation operation (the second of its kind), where they have started to verify how much was planned, how much has actually been remediated and how much has been re-used. The fact that this report is made on an annual basis is important in itself, but also the increasing participation of important stakeholders should be noticed together with a special chapter on EU benchmarking, which points to a need of more and comparable registration.

In Germany data are extracted from the "way-bills" and each of the Laender produces waste management balances (Abfallwirtschaftsbilanzen). But as discussed above, these only appear several years later, and soils may not be registered because of interpretation of classification. So the present system is not able to identify exact data.

In order to enable better decision-making for the future, including encouraging more soil treatment, it is recommended that *each Member State should set up uniform systems for monitoring contaminated soil treatment.*

However, a uniform system will need exact definitions. In Germany for example a clearer distinction between "disposal" (Beseitigung) and "recovery for re-use" (Verwertung) will be needed to analyse the exact route for soil. And beware, monitoring in itself will not ensure that contaminated soil is treated or prevent transportation to another cheaper landfill site.

e) Creation of synergy between landfill and biological treatment

Stimulation of concepts bringing synergy to the management of landfill sites and (biological) soil treatment plants could be created by stimulating the establishment of treatment plants at a large number of future landfill sites. However at present at most of landfills with biological treatment plants, the treated soil is never leaving the landfill again. Therefore these concepts should be set-up in such way that most of the treated soil is then re-used outside the landfill site and only the part absolutely necessary for the internal construction measures shall remain.

Thus biological treatment could then have a double function on the landfill sites - on the one hand it provides "cheap" treatment (assuring the permanent supply on site of necessary covering materials and at the same time guaranteeing a minimum quality for that purpose) and on the other hand stimulating production and re-use of treated soil as good quality top soil for e.g. gardens and parks.

For example for many years it has been very difficult to obtain good topsoil for gardens with sufficient organic substances and the necessary mineral content. Eventually a link to composting facilities could be made and the production of such valuable materials would also provide extra income. It may be clear that in such cases the minimum quality criteria have to be fulfilled.

In France biological treatment centres at landfill sites are generally implemented, but here the soil is not re-used due to lacking re-use criteria. Evaluation of the practical experiences in France could however contribute to the further development of such concepts.

An important factor that must be considered is that the combination of soil treatment at landfill sites, can easily lead to the creation of new and uncontrollable soil streams, if not been thoroughly controlled and/or monitored.

f) Establishment of "Soil Banks" for the management of contaminated and treated soils

Many stakeholders in the treatment sector argue that any kind of involvement of landfills is killing the development of treatment technologies. They require a different approach. Thus, in order to simply avoid discussions on landfills and to avoid all kinds of exception rules (see descriptions above), it

would be interesting to explore the establishment of a "new system" of soil banks, which would take responsibility on the management of contaminated and treated soils.

This concept would mean that no soil whatsoever would directly enter landfill sites. Landfill sites could then only obtain soil of various qualities on request and under specific conditions "contaminated soils" from the soil banks. This idea could also support the separation of the issue 'waste' from 'soil'. It could furthermore improve the promotion of market "products" from biological treatment such as valuable and top soil or for example link up compost products with treated soils which are lacking organic components and minerals (see also under 5.12). The examples of soil banks in the Netherlands could eventually be taken into account and be evaluated for further implementation at European level. However the concept will work only, if managed through an enforced restrict control system and by assuring the soil banks as fully independent organisations.

5.4 Role of the municipalities as stakeholders

The role of the municipalities as stakeholders should be addressed. Many municipalities and towns are the biggest owners of large contaminated areas, which they would like to redevelop for the lowest costs possible. At the same time most of them own landfill sites (either directly or through public owned management companies), which allow cheap deposition, and on the other hand generate an income for the municipalities. It cannot be expected of such municipalities that faced with this double role that they will not use the cheap disposal available at their own landfill sites in order to save money and to make their projects feasible. It is unrealistic to expect that such municipalities will fully support the implementation of a wider range of treatment options for contaminated soils unless the economic and other longer-term advantages are clear.

This tendency will further increase, as many of the municipal budgets for soil remediation have been cut in the last years. In Germany for example municipal financing of soil remediation has largely come to a standstill.

In France the double role of the municipalities is not applying as in other Member States as the municipalities may well be the owners, but all operators are private companies and the large polluted sites (such as most brownfields) are largely owned by the industry and not by the municipalities.

5.5 The road from "multi-functional" solutions to "least cost" solutions

After having made enthusiastic starts with remedial actions stimulated by political prioritisation, many national governments in the more pro-active Member States such as the Netherlands and Germany are recently confronted with much lower political attention combined with heavy cuts in remediation budgets. This has led to tendencies to create least cost strategies, where the "grey" areas of lightly contaminated soils are growing, including acceptance of transport and rearranging of such soils within defined areas.

The spectrum of total solutions within the framework of multi-functionality has moved towards a relatively new formal concept defined as "natural attenuation". Natural attenuation, sometimes described simply as "No Action", is certainly an interesting way of examining how nature is degrading contaminants, but cannot be considered as a remediation technology.

Natural attenuation should be used only as a way of guiding and complementing the use of technologies. It could be relevant to investigate whether there are practitioners who have previously represented and promoted more immediate solutions, who – because of the difficult market situation - have jumped on a bandwagon of solutions, which may simply represent survival, rather than a true longer-term objective.

5.6 Influence of permitting procedures – a rather complex issue

EU Directives

In each Member State the following European Directives have to be considered:

- Directive 75/442/EEC on waste as amended by Directive 91/156/EEC and Decision 96/350/EC (Waste Framework Directive)
- Directive 96/61/EC concerning integrated pollution prevention and control (IPPC)
- Directive 85/337/EEC on the assessment of the effects of certain public and private projects on the environment (EIA)

Definition of 'Soil' as 'Waste'

Waste is in the Waste Framework Directive defined as "any substance or object in the categories set out in Annex I, which the holder discards or intends or is required to discard" (Article 1 (a)). In Annex I, soil falls then under category of Waste Q15, *"Contaminated materials, substances or products resulting from remedial action with respect to land"*.

In the interpretation of the Commission's services, contaminated soil that is not moved does not come under the definition of waste. Thus, it is up to the national authorities to decide what to do on the basis of national legislation. On the other hand, when the contaminated soil is moved (transported off site for disposal, treatment etc) it fall under the waste definition. In this case, it is also subject to the provisions of Regulation (EEC) No 259/93 of 1 February 1993 on the supervision and control of shipments of waste within, into and out of the European Community.

As described under 5.10 below a new definition that recognises soil as something other than waste within the EU is recommended.

Definition of biological treatment

In order to implement the relevant undertakings for operations as specified in the Annexes II A and II B of the Waste Framework Directive, a permit must be obtained. Both annexes are meant to describe operations carried out in practice and may not be fully exhaustive. The annexes are not completely clear, so one can decide into which category the biological treatment could fit. Hence, it is up to the economic operator, the competent national authority, the national court and, eventually, the European Court of Justice to decide in a specific case if a waste management operation is a disposal or a recovery for re-use operation according to the Waste Framework Directive.

Two options are suggested here for considering a biological treatment plant:

Annex II A: Disposal Operations

D 8: "Biological treatment not specified elsewhere in this Annex which results in final compounds or mixtures which are discarded by means of any of the operations numbered D 1 to D 12"

Annex II B: Recovery for re-use Operations

R 3: "Recycling /reclamation of organic substances which are not used as solvents (including composting and other biological transformation processes)"

A general conclusion on the two Annexes is that disposal is not treatment and Annex II A can consequently not be applied. Only recovery for re-use can address the issue. However R 3 is not clear, but is the only available option for the biological soil remediation plant.

Clarification within EU Member States is recommended including a more specific definition of biological treatment.

Necessary permits

The Directive 85/337/EEC on the assessment of the effects of certain public and private projects on the environment (EIA), in conjunction with a number of laws, varying from Member State to Member State, is the main directive influencing permitting of biological soil treatment plants. In principal every new biological treatment installation needs an EIA as part of the permit. This means consultation of the public, which can lead to a long lasting and sometimes difficult permitting procedure.

All Member States had to take necessary measures to comply with the Directive on Environmental Impact Assessment (EIA) 3 years after this legislation has come into force in June 1985. The legislation has been by now been introduced in all Member States. However in many Member States with established treatment plants, the permits have not been given according to the EIA Directive, but as the duration of permits are limited, most installations will eventually receive additional requirements, where the EIA-regulation shall be implemented.

Permitting issues at EU level under the IPPC and EIA directives leave much interpretation at national levels and the same technology can be interpreted differently in various Member States. A uniform definition of technologies is necessary in order to avoid false competition etc.

Even at present (in 2002) certain investors are still able to obtain licenses at local and sometimes regional levels for biological treatment systems, which do not even deserve the name of "treatment". Some authorities still assess biological systems as "black boxes" where an operator can do what he chooses. In order to avoid conflicts, certain authorities have therefore classified biological treatment under the "other treatment" category, whereby an EIA is compulsory in all cases.

In some Member States like Germany and the Netherlands, the situation in the market is such that market saturation or closure of treatment plants is taking place. The issue of permitting for treatment plants is not so relevant anymore, and will be restricted to adaptation of older permits to the latest requirements.

In other emerging markets the situation will be completely different.

5.7 On-site treatment and disposal – a cheap and clever option of on-site landfilling?

In many cases contaminated soil is managed within the remediation site ("on-site") and never leaves the site. In such cases soil can have been treated on site. In others it can have been classified as problem material but contained in 1 or 2 specific areas. This creates pseudo landfills on the site that may or may not be specifically permitted.

In Germany, strategies of non-treatment and partial treatment to "higher" levels, followed by containment at other locations within the site to be developed, have increasingly been applied and are accepted legal ways of reduction of available risks. These approaches are getting more and more common, especially after the expensive re-unification in 1989. Considering the difficult financial situation of many municipalities, it is one of the few remaining options that make redevelopment of brownfield sites in urban areas possible.

5.8 Validation of the biological treatment compared with other technologies

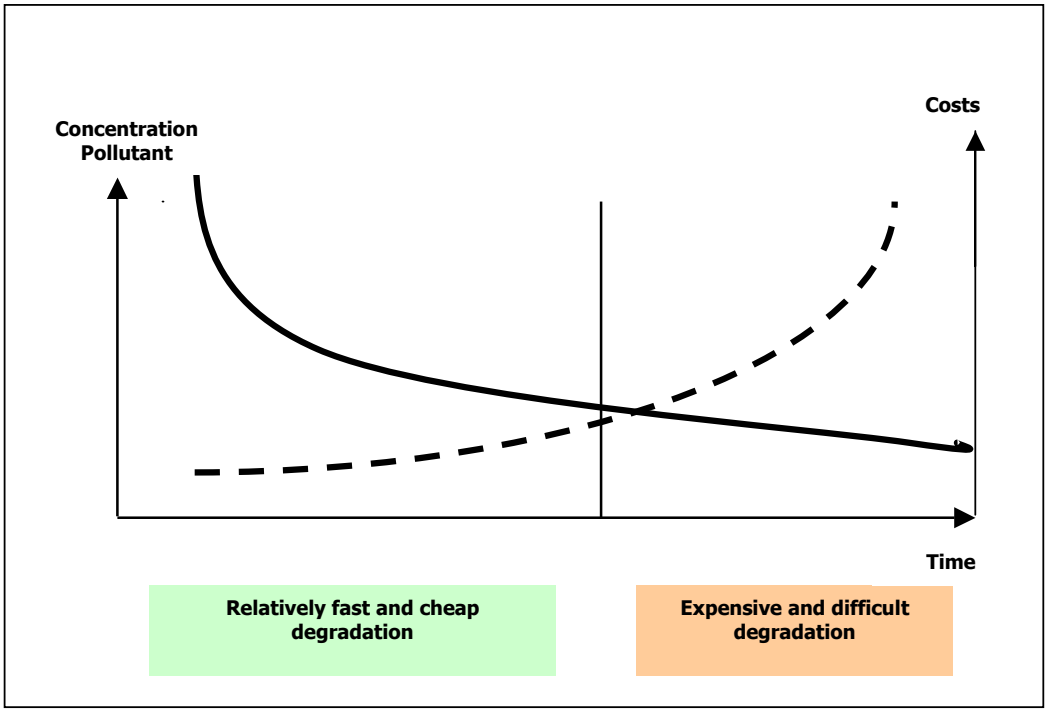
Within the field of treatment technologies, biological treatment needs a better and neutral validation in respect of the value of the product delivered after treatment. For example, many treatment technologies produce "biological dead soil". If such soil is to be used as topsoil, it has to be revived by the addition of organisms, minerals etc. Most treatment technologies require a relatively high consumption of energy, whereas biological treatment really contributes to biodiversity and a possibility of re-use as topsoil, a material lacking in many Member States.

5.9 Challenges for biological treatment

In order to make a more sustainable contribution towards the solution of soil contamination problems, biological treatment faces at present the following major challenges:

- Time consumption
- Considerable residuals in treated soils
- "Recovery for re-use"[1] is not possible without limitations
- Elimination of residuals requires considerable time, energy and costs

These core issues are illustrated in the figure below, and appropriate solution will certainly help to boost biological treatment in EU Member States and worldwide.



One issue, which is common to all Member States, is that the reputation of biological systems – including those that require knowledge, understanding and patience - is often bad. Here lies a task for the biological remediation branch to improve themselves and provide improved documentation for their processes.

5.10 Definition of soil

With the amending Decision 2000/532/EC (and its amendments from 16th January 2001, 21st of January 2001 and 23rd of July 2001) a principal categorisation of contaminated soil as waste or hazardous waste can be made from 1st of January 2002 and onwards. As a result former problems on the lack of clarity of the classification should be solved. However, the proper implementation of the list of waste should be monitored in each of the EU Member States.

Further distinguishing between problems of waste and of soil should be implemented in the future. *Soil is - just like air and water - a natural medium and can be brought back to a natural state after pollution, whereas waste is an artificially produced and/or created.*

[1] In Member States both expressions recovery and re-use are more or less used. The author uses frequently "recovery for re-use" in this report.

The development of a special soil monitoring legislation is under preparation and discussion in the commission now.

5.11 Harmonisation and comparability of decision-making tools

Key factors in decision-making are:

Risk assessment to enable standards for soil re-use to be harmonised: Risk assessment to establish soil quality criteria for re-use of treated soil for different land-uses needs to be harmonised. For example, in some locations, the apparent background concentrations of inorganic compounds (typically arsenic, lead and cadmium) are higher than existing soil quality criteria for most sensitive land uses.

EU wide valid re-use criteria, based on abovementioned risk assessment. Since there in many Member States are no risk assessment guidelines available for setting criteria for re-used materials, this often presents limitations on re-use, thus bringing treated soils back to the landfills again. Re-use criteria in some countries are applied, such as in The Netherlands and Germany. But for example the Dutch Construction materials Decree (Bouwstoffenbesluit) is at present been discussed. A main issue is the exclusion of soil from this decree.

Side effects of treatment - harmonising decision support needs to include comparable assessment of side effects of soil treatment, such as total energy requirement (transport and treatment), all types of emissions (to air, soil, water), including noise, CO_2 discharges to air, VOC discharges etc).

Criteria for operation of treatment processes - at present there is a lack of "equal" maintenance and operational criteria including requirement for sampling, analysis, documentation of good operation and education of treatment plant operators. The present situation provides the opportunity for bad operations. Suppliers of any disposal operations who can minimise the quality of materials and operational costs are winning bids and competitions.

Wider logistics – deciding the combination of intensive treatment, intermediate storage and long term treatment needs to be more focussed with clearer goals

Availability of resources – including expertise, which can cover general human resources, entrepreneurial skills in wastewater, waste, and skills in treatment of contaminated soil and sediments are generally low.

5.12 Quality assurance and certification of treated soils

When soils are introduced again onto or into the soil, the relevant quality standards in each Member State have to be assured. In Germany for example, this is executed according to the Federal Soil Protection and Contaminated Sites Ordinance (BbodSchV) and related DIN standards.

The psychological resistance against treated (former) contaminated soils, although completely clean is still very high and here the issue of quality certificates could support overcoming this barrier. Of course in parallel, the liability question should be solved. Such an approach could help to create a breakthrough for the re-use of treated materials in the future. Also here examples in the Netherlands could be taken into consideration.

5.13 Enforcement of laws by adequate governmental controls needed

In virtually every EU Member State there is a considerable lack of control. In the Member States that have started the process (e.g. Germany) many jobs have been cancelled due to budget problems and in the younger Member States often the administration is not yet sufficiently developed and is therefore not able to make intensive controls. And control in some Member States is carried out as desk exercises more than on location inspections of actual remedial actions and spoil transport. An

important factor is that such controls have low priority in many of the Administrations compared to other also important issues.

In order to steer the soil remediation process in each country a sufficient strong control apparatus should be established. By means of thorough controls, proper data can be made available in order to steer and adapt the soil remediation process in each Member state. The Dutch Environmental Ministry (VROM) published a report in April 2002 ('Soil in View'), where the VROM inspection has investigated the supervision by the Provinces and larger Cities within soil remediation. The report has concluded that 6 out of each 10 remedial actions taking place in the Netherlands can be classified as being unsatisfactory or of low quality. Consequently VROM has proposed a number of actions (See below under the Netherlands). However it should be avoided that controls will create an additional bureaucratic burden.

5.14 Liability for contaminated soils from the "cradle to the grave"

At present monitoring of the process of contaminated soil being excavated, transported and final treated and/or deposited is in many soil remediation projects very difficult. Instead of setting up a comprehensive monitoring apparatus, authorities should focus on the overall responsibility of the main contractor.

The concept of *liability of the overall contractor*, from the moment of excavation at the site to its final destination - *"cradle to the grave"* - will then make it possible to address one stakeholder (the main contractor) as the juridical person with direct responsibility and liability for safe conduct. This requires that the entrepreneur has to fulfil certain (high) requirement for environmental management of his own organisation and for eventual partners, suppliers and sub-contractors. The liability aspect in combination with guarantees supports the introduction of the required quality and transparency.

6. EU Member State information

The following chapter provides specific Member State information, which does not intent to be either exhaustive or authoritative. The information shall be seen as a 'flavour' of the individual country. Luxemburg and Sweden are not included. For Belgium, Flanders is missing.

The specific situation is quite complex in both theory and in practice, and it is also rapidly changing. Therefore the descriptions shall be seen as a snapshot of 2002, only.

6.1 Austria

The present situation for implementation of biological treatment is bad in Austria. There are too many legal options, which allow the contaminated soil to enter the various categories of landfill sites. Prices are very low, so there is no interest in any controlled biological treatment.

In the new Federal Act on the Clean-up of Contaminated Sites (Altlastensanierungsgesetz ALSAG), which was implemented by 1.1.2001, an extra tax was introduced for the deposition at landfill sites and limit values for a tax-free re-cultivation of landfill sites.

However the now ongoing discussions on the implementation of new guidelines for re-use could change this considerably over the next 3 years. Some quality criteria to distinguish between "recovery for re-use" and "disposal" for the use of soil for re-cultivation were introduced in the supplement to the National Waste Management Plan 2001. If the discussed changes, in combination with non-acceptance of potential treatable contaminated soils or with a pricing system, which makes both options compatible, are implemented, more opportunities for biological treatment systems would be created. It is expected that the new regulation will be passed sometime after Summer 2003.

The most important changes however can be expected from the new Landfill Act, which is expected to be implemented on 1.1.2004. A total prohibition of deposition of soil and dangerous wastes with a TOC higher than 5 % on landfills will be introduced. However there is still a long way to go in order to close the economic gap of a factor of two between the prices of biological treatment and deposition on landfills.

The new Waste Management Act of 2002 introduces the legal basis for ordinances defining the "state of the art" for treatment plants. The national Institute of Standards (ONI) is preparing a technical standard for the biological ex-situ decontamination of soil. For the year 2003 an additional Standard regarding in-situ treatment is part of the business plan.

6.2 Belgium

<u>Brussels Capital Region</u>
The Brussels Capital Region does not have general soil legislation, except for petrol stations. For those a decision of the government prescribes the procedures for soil investigations and the norms to be applied and reached after clean-up. For sites other than petrol stations, the administration can mainly ask for a soil investigation at the end of the activity. However the procedures and norms that have to be applied vary with the type of contamination. No specific regulation for the re-use of soil exists.

Since most clean-ups are done at the same time as the renovation of the petrol station, excavation is proposed in most of the cases. In case the excavation is difficult e.g. because of stability of nearby buildings, in-situ (bio) remediation is proposed and it is accepted by the administration, at least when the consultants can offer sufficient guarantees that the norms will be reached within a given period of time. Recently, thermal in-situ treatment has been proposed for clean-ups of some important sites.

As Brussels does not have any treatment facilities (neither (bio)remediation sites, nor landfills), Brussels is dependent on treatment facilities in other regions or countries. Most of the excavated, contaminated soil is transported to Flanders and treated there in (bio)remediation sites.

Wallonia

Biological treatment of contaminated soils is rarely applied in the Walloon Region. On the one hand, the loamy texture of most soils of the region constitutes a constraint for most of the *in-situ* biological techniques. On the other hand, the solution of off-site biological treatments still remains insufficiently attractive in comparison with landfilling.

This is due to the following reasons:

1. From an economical point of view, landfilling remains a (somewhat) cheaper alternative. This is partly due to the fact that the regional tax for landfilling is generally not applied in the framework of remediation plans approved by the authorities. Costs for transport are also lower as the landfill sites are generally located in closer vicinity than biological treatment plants, as the latter haven't been developed yet in Wallonia.
2. From a technical-legal point of view, conditions for the acceptance of contaminated soils for biological treatment are also more stringent: while clear legal rules exist in the Walloon legislation for the re-use of materials after decontamination, the conditions for the acceptance of contaminated soils in landfills are, up to now, only sustained by administrative circulars and is always subject to different interpretation margins. This being said, for soils contaminated by mineral oils over the limit of 5000 ppm (condition to fulfil to be landfilled), the ex-situ biological treatment alternative should theoretically remain the most attractive solution – at least for soils not cross-contaminated by heavy metals.

Nevertheless the picture described above could change in a near future as soil legislation is under preparation. The coming soil legislation should give an impulse for the development of various sustainable remediation solutions among which the one of biological treatment plants. In this respect, the solution of combining landfilling with biological treatments should be thought over. In addition, conditions required to landfill contaminated soils will be soon regulated more strictly with the imminent transposition of the European Council Directive 1999/31/EC.

6.3 Denmark

Also in Denmark a considerable amount of soil is ending up in landfills, but often after bioremediation has been taken place. However the so-called double role of the municipalities as owner of landfills and owner of contaminated sites is not always so easy in relation to landfills, as at present landfill space is scarce and costly and the permitting procedures for new landfills are considered as being very difficult (the NIMBY effect).

In the region of the Capital Copenhagen only 2-5 % of the soil, which is treated by biological treatment, is for free and unlimited re-use. On Sjælland the various landfill sites are allowed to accept soils contaminated with oil up to 100.000 mg/kg dm (Fakse Losseplads – here pre-treatment is taking place) and 50.000 mg/kg dm (Hasselø Nor and Fladså). When such high values are acceptable, there is little room for proper biological treatment left. It is a sad but valid reflection of today's reality. Also on Sjælland (the island where the capital of Copenhagen is situated) around 500.000 tons is brought to biological treatments plants. However also here the largest part, after a partial treatment is brought to special depots, which are owned by the biological treatment contractors.

Here a tendency is noticed that high goals on remediation levels have been slowly abandoned. Although that many counties and municipalities stick quite persistent on excavating hot spots, one is getting more and more confronted with cheap solutions, which are tending towards a minimum of soil excavation combined with remaining contaminations and use of cheaper encapsulation measures and so on where possible has excavation and removal been favoured instead of on-site remediation. Unfavourable for ex-situ bioremediation is the still considerable amount of oil and petrol contaminations, which are mixed with heavy metals and therefore not suitable for biological treatment.

As financial means are more and more restricted, authorities have been tending towards "less stringent" remediation levels, which has been used in government subsidised projects, private enterprises have been following this example too. A typical example is the OM-pulje (Oliebranchens Miljøpulje), a major actor in the remediation scene, for the clean-up of petrol stations, which has increasingly practised lower remediation goals. However, it must be said that the author could not obtain any official statements that can verify this.

Interesting are the statements that most of the soil remediations have been and are executed within town renewal and investment projects. Such costs are marginal or minor in comparison to the huge investments being made. This is an important factor, which has been often neglected and not taken into consideration.

As a weak factor from the side of the Danish authorities is regularly mentioned the small budget from the central Ministry of Environment considered. It is estimated that the public authorities generate only around 25% of the yearly budget for soil remediation. However, it has always been the basis for the Danish policy on contaminated soil that there is an expectation that private investors finance a large part of the contaminated land remediation.

Landfilling of contaminated soil is under taxation. On 10th December 2002, the Danish Parliament adopted an amendment of the rules of taxes regarding slightly contaminated soil. According to the amendment there will be no tax on slightly contaminated soil contaminated with heavy metals and PAH, if the soil is used to daily covering in the landfill or to roads inside the landfill.

6.4 Finland

Landfills

There is - like in many other Member States - a discrepancy between treatment and landfill costs. The Waste Tax Act (495/1996 changed by 1157/1998) lays a tax on all waste disposed on landfills. This however, does not affect polluted soil, which is excluded from the scope of the tax.

Disposal of soils is cheaper than treatment especially in sparsely populated areas for example in eastern part of Finland at the border to Russia. That is why contaminated soils are being transported from Helsinki several hundred kilometres for disposal. In spite of realtively high transportation costs, it is often the cheapest choice.

Reason for transporting is also the different disposal criteria for soils contaminated with oil. The oil concentration can vary from 500 mg/kg to 5000 mg/kg being and the criteria are usually stricter near the capital area. For landfills disposed soils are normally used in cover material (there are plenty of small landfills in Finland which will be closed in the near future).

Permits

The definitions of waste and hazardous waste in the Finnish Waste Act are similar to the definitions in the Waste Framework Directive 875/442/EEC and Council Directive (91/689/EEC) on hazardous waste. Therefore polluted soil material is always classified as waste. Whether polluted soil is hazardous waste is decided on case-by-case basis.

An "off-site" treatment of soil material is considered as recovery for re-use or disposal of waste and therefore subject to environmental permit procedure.

There are some derogations concerning the permit requirement in section 28 of the Environmental Protection Act, which could stimulate implementation of ex-situ soil treatment in Finland:

- Small-scale recovery for re-use or disposal activities (not institutional nor commercial) can be excused from the permit requirement.
- No permit is required for "short-term activities" undertaken on a trial basis when the purpose is to test manufacturing or treatment methods or equipment, or to investigate the impact, usefulness or other corresponding feature of such activities.

In these cases a notification according to section 61 of Environmental Protection Act shall be made to the competent permit authority, at least 30 days before starting the activity.

"Institutional or commercial recovery for re-use or disposal of waste" (section 28.3) may become subject to EIA on the basis of criteria set out in the EIA-decree section 6. An "off-site" disposal or recovery for re-use of polluted soil material can become subject to EIA. In considering whether or not EIA applies, relevance is given to the *amount of waste*, the *classification of the waste* and the *technology* at issue.

In case of *physical or chemical* purification or *incineration* of the soil material, the minimum capacity of 5.000 tons per year is the limit for EIA if the soil material is classified as *hazardous waste.* If the soil material is classified as *(normal) waste*, the minimum capacity of activities/establishments subject to EIA is 100 tons per day.

Biological treatment of waste is subject to EIA if the capacity of the plant/establishment is 20.000 tons per year at the minimum, thus making it quite interesting to get a fast start with a somewhat smaller capacity without an EIA. In case of *disposal*, more than 50.000 tons of waste per year is always subject to EIA.

Summary of applying EIA in soil restoration

A soil restoration project is, according to the ruling interpretation of the law among authorities, not subject to EIA. However, soil cleaning plants in cases where the soil is removed from the soil, can be subject to EIA if the conditions in the EIA-decree section 6 are met. If the *soil is classified as hazardous waste, EIA is required* for relatively small capacity plants/establishments.

Biopiling is considered as a biological treatment of waste and therefore subject to EIA if the capacity of the establishment is 20.000 tons per year or more.

For mobile soil treatment plants/technologies, a similar problem in relation to EIA exist as in relation to environmental permit: EIA is by definition a location based instrument and therefore the EIA requirement should be assessed case-by-case on all different "off-site" treatment/restoration locations.

Composting in Helsinki

In Helsinki there are 2 composting fields, one for oil and PAH contaminated soils and one only for oil contaminated soils. The composted soils can be disposed on landfills (or used there as a cover material) when the concentrations of oil are below the limit values. Composted soil can be used in road ramps, landscaping or in noise walls when the oil concentrations are below the target values. Re-use of composted soils is however forbidden in classified groundwater areas and in sites where the soil would be in continuous contact with groundwater. PAH containing soils can be used only in landfills.

Strategy of Helsinki

In Helsinki one would like to re-use more slightly contaminated or treated soils, mainly because of enormous lack of treatment, storing and disposal sites. In order to reduce disposal and transporting of soils one would like to use more in-situ-technologies as a remediation technology (in practice problem is tight time schedules and costs) to re-use soils in construction especially near the remediation sites and on the base of risk assessment to leave higher residuals concentrations on site. It is just very difficult to get permits for re-use of treated soil (that is the reason the re-use guidelines are needed) and also for storing sites, which are important also for flexible re-use.

In year 2001, around 134.000 tons contaminated soils have been excavated in the city of Helsinki. From that amount about 70.000 tons is treated somehow. Fact is, that almost all treated soils are used in landfill sites after treatment.

It is obvious that the Helsinki situation explains the need for re-use concepts in Finland in order to avoid large streams landing on landfill sites in the Eastern region of Finland and due the lack of suitable soils in the city of Helsinki.

Use of treated soil materials
There is no special legislation or other criteria concerning the use of contaminated soil in earthworks. Guidelines (non legal) on re-use are under preparation in the Finnish Environment Institute and are urgently needed.

EU waste list
Until now the soils exceeding limit values (non legal Finnish SAMASE values) are classified as a hazardous waste. Within the new EU waste list the limits for hazardous waste will be much higher. There is not yet much experience in applying of new waste list in practice.

It might be, that the new EU waste list will allow disposal for strongly contaminated (between limit values and hazardous waste values) soils, also in landfills.

Some examples of SAMASE-values and hazardous waste values is shown in the following table:

SAMASE-values		
	target value	**limit value**
mineral oil (light)	300 mg/kg	1.000 mg/kg
mineral oil (heavy)	600 mg/kg	2.000 mg/kg
Hazardous waste values		Hazardous waste value
Oils, C4-35		10.000 mg/kg
if containing benzene or benzo(a)pyrene		1.000 mg/kg

if concentration benzo(a)Pyrene is higher then 50 mg/kg, this concentration and also the concentrations of the individual PAH compounds have to be considered

Until now treated soil has been used for construction of landfills and earthworks of industrial and storage areas.

6.5 France

In France the main obstacle for treatment is created by the landfills, but there are some significant differences to other Member States. The main reasons for landfilling are:

- Lower costs
- No liability anymore for owner, whereas with treatment the owner remains liable
- In comparison to on site treatment, the duration is of course a important factor

It should be mentioned that conventional landfilling is not used very much anymore.

In France, the concept of having biological treatment at the landfill sites, as proposed in Chapter 3, has been widely applied. At landfill sites a considerable number of treatment centres have been established for contaminated soil, but also for waste. Any treatment decreasing the mobilization of pollutants on the long term is recommended.

Since 1999, this tax is included in the TGAP (Taxe Générale sue les Activités Polluantes or General Tax on Polluting Activities). Part of this tax is used for the remediation of orphan sites (since 1995 when the tax has been introduced). The moneys retrieved from this Industrial Waste tax are allocated to investigations and clean-up work. The remediation is limited to stopping actual or potential risks to the environment and human safety. Initially set at € 3.8 (FF 25) per ton of industrial waste, the tax was increased to € 6.1 (FF 40) from 1998 onwards. In the first year, the income of this new tax amounted to about € 10.5 M (FF 69 M), but it increased to up to € 15.3 M (FF 100 M) in 1998. A National

Committee manages the Industrial Waste tax and has agreed to 37 interventions at orphan sites, to a total cost of approximately € 30.5 M (FF 200 M).

In France, the TGAP is applied to all kinds of landfilled waste. Polluted soils or materials are classified as waste when they are moved away from the site (on-site treatment is not taxed) and if they are for example incinerated the tax is 9.15 € and if they are landfilled, the tax is 18.29 €. In some cases, if the soil is classified as non hazardous waste, the soil can be landfilled in a class 2 landfill (for municipal waste).

Other prices are:

- For landfill class 1 (hazardous waste landfills): 18.29 € per ton
- For landfill class 2 (municipal waste landfills): 9.15 € per ton

Biological treatments plants are generally unproblematic for the obtainment of a permit if one compares to thermal treatment plants. However as biological treatment plants are integrated in the concept of treatment centres at the landfill sites, the issue can be can be problematic as the NIMBY effect takes place for landfill sites.

Re-use criteria are not applied and therefore re-use of treated soil is hardly possible. Especially if the treated soil is removed to another location re-use is virtually impossible. Not technically but especially on the psychological side. There is at present a discussion going on concerning the re-use criteria. A working group has in 2002 elaborated criteria for re-use of treated soil at landfills (a/o as cover and construction material), but so far no definitive conclusions have been published by the Ministry of Environment. It would be interesting if the discussion on re-use of treated soil at landfills could be extended to other re-use solutions. The future re-use criteria can have major consequences for the re-use of soil biologically treated.

There is no Register of soil streams in France. At present the available registers are only related to:
- sites requiring administrative actions, so called in the past known contaminated sites (available on the website of the French Ministry of Environment),
- ancient industrial sites potentially at risk (available on hptt://basias.brgm.fr).

See also report on the French approach on contaminated sites management (available on http://fasp.brgm.fr).

Biological ex-situ treatment could be stimulated more in future in France by:
- More applications at specific niches
- Development of re-use criteria in combination with certification and liability regulation

6.6 Germany

General financial situation

In Germany, the treatment of contaminated soils has been largely influenced by budgetary circumstances. After the unification, the decontamination of many large-scale industrial areas in former Eastern Germany seemed simply economically not feasible. This has in the Soil Protection Legislation a/o led to the fact that soil "containment" has been equalised to soil treatment.

During the period of privatisation of large industrial estates in the former GDR, the Treuhandanstalt (the State Privatisation agency) criticised many of the ongoing – in their opinion - "luxury" remedial actions and introduced instead a very pragmatic systems of risk assessment and concepts of soil remediation. This strategy has led to considerable cost savings and thus to a large number of containment solutions or often simple "covering" of the contamination. At present the financial situation of most of the German towns and municipalities is so bad that hardly any funds for remedial actions are available and even the staff in these municipalities has been reduced to an absolute minimum.

Recent information on the situation on treatment in Germany, is given by a TerraTech publication (2/2002, page 12), which concludes for 1999, that of the total of 3,3437 mio tons soil cleaned at the stationary treatment plants, a relation of 67% biology, 23% soil washing und 10% thermal treatment is estimated.

In Germany, landfill prices are by principle matching the biological treatment prices, but there are many uncertainties, loopholes and exception rules, which ruin the originally intentions. A major issue is the unclear distinction between "disposal" (Beseitigung) and "recovery for re-use" (Verwertung), which has led to many forms of "fictitious" recovery for re-use of contaminated treatable soils at landfill sites. Just to mention some of them:

Closed Substance Cycle and Waste Management Act has since 1995 created many discussions at federal state level on the clear distinction between "disposal" (Beseitigung) and "recovery for re-use" (Verwertung), and thus led to many forms of "fictitious" recovery for re-use at landfill sites.

Different interpretation of removal and utilisation per federal state has led to transport over long distances of contaminated soils from one federal state to disposal sites of another federal state.
The use of contaminated soils for so-called construction engineering measures within landfill sites does not comply with the common fees valid for contaminated soils at landfill sites and therefore have the acceptance prices for these materials always been set sufficiently below the common biological treatment prices.

Exception rules of the various federal states for former coal and kali mining, which need large amounts of soil for purpose of re-cultivation are in place.

Problem of proper registration of contaminated soils streams by means of "way-bills" (Begleitscheine), the set-up of Waste management balances (Abfallwirtschaftsbilanzen) which appear only several years later, and the problem of proper classification, which can lead to the fact that soils are not registered in the before-mentioned system.

Permits
In general the permitting system is used over quite some years and most of the installations have been licensed years ago. Hence permits will be adapted according to new laws and environmental requirements. However, it can be expected that only a few new installations will be built in Germany, (except for one or other thermal treatment plant). On the contrary it can be expected that more installations with be closed in the near future.

In Germany, in opposition to other EU Member States, permitting is carried out according to the *Federal Immission Control Act ((Bundes-Immissionsschutzgesetz (BImSchG) und Bundes-Immissionsschutzverordnungen (BImSchV) im untergesetzlichen Regelwerk),* which then decides when the full or simplified EIA-Procedure is necessary or not. Of course the BImSchG is linked to a considerable number of other Laws such as the Building and Construction Law, which have to be considered for the permit.

The last change of the 4.BImSchG has been made on 03.08.2001 and the permitting especially for on-site treatment, which had quite some favourable options before, has been strengthened.

Off-site installations, independent of the duration of activities planned, are subject to an official permitting procedure according to BImSchV and EIA obligatory including public hearing.

On-site installations, which are expected to be active for more than 12 months, are always subject to an official permitting procedure according to BImSchV and EIA obligatory including public hearing. All procedures with public hearing are considered quite time-consuming.

There are only a limited number of options, which could be interesting for a faster start-up of biological ex-situ treatment:

On-site installations, treating waste at the location of their creation, a *simplified procedure, without EIA and without public hearing,* (but of course to be established and operated according to the State of the Art) is applicable when the timeframe is expected to *be shorter than 12 months.*
However biological installations with a minimum capacity of 10 tons/day (3.650 tons/year) a *simplified procedure, without EIA and without public hearing* is applicable. However it may be clear that a capacity of less than 10 tons/day is often far below the economical feasibility of such plants.

Pilot plants for the use of research and development of or the trial of new methods require no permits. However for off-site installations, a simplified procedure is executed, when the permit shall be issued of a maximum of 3 years, after the start of the operation. This period can be extended for another year.

Acquiring existing biological treatment plants and their license from operators, who are thinking of moving out of the soil treatment market could be an interesting option for those that see still a perspective in this market.

Recovery for re-use of treated soil
An additional problem, which can hinder soil treatment, is the lowering of re-utilisation values for treated soils within the framework of the latest Federal Soil Protection and Contaminated Sites Ordinance (BBodSchV), as well as the built-in guidelines of the federal states (Technische Regeln für die Verwertung mineralischer Reststoffe - M20 der Länderarbeitsgemeinschaft Abfall - LAGA). In order to avoid new contamination of soil and groundwater, the criteria for built-in soils are being set so low (conform the values stemming from the BBodSchV), that soils being treated partly will never be able to fulfil such criteria.

6.7 Greece

Greece has not yet addressed the problems of soil contamination and soil remediation. Main issues are now related to waste problems.

6.8 Ireland

General
Ireland lacks specific legislation for dealing with and remediation of contaminated sites. However, some existing legislation does provide a considerable range of powers to the EPA and Local Authorities. Existing legislation of particular importance includes the Waste Management Act, 1996 and the Environmental Protection Agency Act, 1992 with associated regulations. Remediation of historical waste disposal or recovery for re-use sites may require a waste licence from the EPA or a permit from local authority. Under the EPA Act 1992, the integrated pollution control licensing system may require remediation of contaminated soil on sites subject to a licence. The current approach used in the licensing system for waste and industrial activities encompasses pollution prevention, polluter pays principle, the precautionary principle and the use of risk assessment in relation to contaminated land.

Site-by-site approach for licences
Where soil contamination has been identified, the type of licence and remediation required is determined on a site-by-site basis taking into account fitness for use. There are no statutory or non-statutory guideline values for contaminants set in Ireland at present, although the EPA is currently developing non-statutory guideline values for groundwater and soils. Decisions on clean-up requirements to date are determined on a site-by-site basis using risk assessment as the main decision tool supported by existing international guidance from various countries such as the Netherlands and the USA.

The EPA has to date issued four waste licences for on-site remediation of old gasworks sites, which are under redevelopment. Integrated pollution control licensing of industrial activities commenced in Ireland in 1994. As part of the licensing process, possible soil and groundwater contamination must be identified and may require remediation. Risk assessment is the main tool that is used to determine

if remediation is required taking into account fitness for use. In 2000, the EPA granted an Integrated Pollution Control Licence (IPC) to a company to operate a soil bioremediation facility to treat soils contaminated with petroleum products. It is expected that this facility will be able to remediate up to 20.000 m^3 of contaminated soil on an annual basis. Additional regulations have been implemented (i.e. Waste Management (Licensing) Regulations, SI No. 185 of 2000) which provide for the licensing of mobile plant used for the recovery for re-use and disposal of waste at more than one site. It is envisaged that this regulation will apply to mobile units used for the remediation of contaminated soils.

Ex-situ remediation
The most common form of soil remediation to date in Ireland has been to excavate and transport off-site for disposal to landfill or exported from the country. Since the introduction of the waste licensing system in 1997 under the Waste Management Act, 1996, more stringent controls over waste acceptance into landfill have been imposed. Further has Ireland a lack of landfill space and according to official estimated Ireland will run out of landfill capacity within approximately 4.5 years. Recent introduction of landfill tax has resulted for the landfilling of soil in prices of around 110 €/ton. It is obvious that now landfilling of contaminated soil is no economic alternative anymore. All landfills, which have been licensed by the EPA to date, do not accept hazardous waste thereby requiring most of contaminated soil, which is considered hazardous to be exported from Ireland. The export of waste from Ireland is controlled under Council Regulation on the supervision and control of shipments within, into and out of the European Community (93/259/EEC) and Waste Management (Transfrontier Shipment of Waste) Regulations, 1998 (SI No. 149 of 1998). The EPA report "1998 Waste Data Base Report " indicates that a total of 45.486 tons of contaminated soil, categorized as hazardous waste has been excavated, from which 23.691 tons has been exported.

6.9 Italy

Off-site installations and re-use of contaminated and treated soils
According to the present legislation once the soil has exited the site of origin, it is classified as waste, and may be re-used at a different site only if it has or reaches quality standards of 'clean' soil, i.e. fit for any kind of use (multifunctional). In other words, even for re-use at an industrial site, excavated soil coming from a different site or from a treatment facility, must meet the standard of soils for most sensible use. There are exemptions for re-use of soils excavated during drilling and construction works, e.g. galleries or boreholes.

This approach restricts the re-use of soils off-site, as well as the use of off-site treatment plants, making it difficult to follow the principle of beneficial re-use of soil and fitness for use of remediated sites. Generally speaking landfill disposal is the most common solution applied. A favourable role for landfilling is also created through tax reduction.

Limitations to treatment off-site would apply to any treatment technology, biological included, unless it proves that 'residential' soil quality standards are reached. Off-site treatment plants must satisfy requirements of any waste treatment plant and EIA (approved by national or regional bodies) is generally required. On-site mobile treatment plants, and re-use of treated soils on site, may have better opportunities than off-site facilities.

The national legislation, concerning clean-up objectives, envisages the use of site-specific risk assessment and risk-based criteria only when BATNEC technologies are not available to reduce concentrations within standard values. Only in this case residual concentrations, higher than standard limits for the specific land use, may be left on the site.

On-site installations
On-site plants are authorized according to art. 10 in D.M. 471/99. The permit procedure encompasses three project phases that require each a separate authorization: characterization plan, preliminary project and final project.
The authority responsible for the permit is:

- The Municipality

- The Region for sites spanning over more municipal territories
- The Ministry for the Environment for "sites of national interest'"

Approval of the final clean-up project represents a variation to land planning procedures and replaces all other licences required by the current legislation: in other words one single permit includes all the authorizations (for emissions in air, water and noise) except for the EIA that has to be presented and authorized separately. This procedure is thus applicable to on-site biopile plants. The Province certifies the end of the clean-up.

6.10 Portugal

Portugal has hardly touched upon the issues of soil contamination and remediation. The first bigger soil remediation actions have been performed for the Expo 98. For the remediation the "Interim Canadian Environmental Quality Criteria for Contaminated Sites" have been applied. Soil is not a high political issue, but major attention is at present given to the issue of waste.

At the moment Portugal has no specific legislation for the management of contaminated sites and till present the problems are handled within the Framework Law on the Environment.

At the moment the country is in the process of developing of a specific legislation of soil contamination and is gathering and evaluating experiences from the other EU Member States.

Very interesting information comes from a study executed in 2000. Here IPE/Regia obtained a first insight on the situation in Portugal. This state-owned company has made a preliminary inventory on contaminated sites and made suggestions of economic activities corresponding to priority sites for further evaluation and subsequent remediation and/or decontamination action:

First priority sites:
- 1765 petrol stations sites;
- 1491 industrial sites of oil refineries, chemical production, steel industry and metal coating sectors

Second priority sites:
- 6315 industrial sites for the production of electronic equipment, explosives and accumulator production

Additional sites:
- 450 sites defined as problematic and potential intervention areas due to waste storage, scrap yards and other industrial activities

A preliminary characterisation of 50 selected sites led to a first cost estimate for remediation and contamination of around 500 mio. €.

All in all the situation for contaminated land is new and under development, and it is very difficult at the present stage to make conclusions on the basis of the limited information available. In order to assess the further technical and legal barriers, first the necessary practical experience has to be obtained in the coming years.

6.11 Spain

Spain is one of the Member States, which has only recent activities ongoing and a lot of important issues are presently in discussion or not yet implemented into practice.

Spain is currently preparing a Royal Decree of soil contamination in which the Central Government will establish soil quality criteria and methods for analyses and sampling. Also in parallel another Royal Decree will be issued which addresses the identification of activities, which may be potentially contaminating. The text for the latter Royal Decree is completed, but will not come into force until the soil quality criteria are issued.

Major experiences have been made in the Autonomous regions of Catalonia, the Basque Country and Galicia. Thus Catalonia, the Basque Country and Galicia have soil quality values but they are stated as provisional until the Central Government issues the National soil quality criteria. However, the Government of Galicia for a specific decontamination project issued soil quality values for the compound Lindane, which was then subjected to a court case by the affected parties. The verdict of the judge was issued on March 13, 2002 and stated that the Government of Galicia was in its right to have set a soil quality criterion and it was based on the fact that for environmental issues the Autonomous Regions have the power to modify the legislation set by the Central Government in order to increase the protection to the environment. With this sentence, the Regional Governments have power to issue soil quality criteria.

Concerning ex-situ biological treatment, the problems for the remediation of a site are on one hand those that are project related and on the other hand the requirements of the orders issued by the environmental regional authority. An EIA may be required but not necessarily, as it will be project specific. *It is still possible for a company with sufficient land to execute a soil remediation without specific approval, but with an only provision to be able in a future moment to demonstrate that the site is indeed satisfactorily decontaminated*. As far as social pressure is concerned, there has not to date been any significant opposition rather in reverse, if it is to improve the local environment then the better.

Formally, landfarming projects in Spain would need permits from the regional authority and the necessary permits at municipal level such as construction permits. An EIA may not be necessary.

For permanent ex-situ installations there would be an EIA and other requirements to fulfil both at regional level and at local level. The biggest problem that a permanent installation may face will be social factors such as that there may be a suspicion or perception of it being a clandestine landfill and/or that it may cause adverse emissions and/or leachate, which may contaminate the surrounding area.

6.12 The Netherlands

Positive and negative drivers
The specific perspectives for biological soil cleaning can be summarised in two ways:

Positive drivers:

- The options for re-utilisation of biological treated soil are manifold in the Netherlands, even though the procedures to arrange re-use can be time consuming
- The most successful contractors have an established complete inner circle of re-use channels in order to work economically.
- The dead-end street of deposition on a landfill site after treatment, as occurring in many Member States as being the only legal alternative, is not a viable option. Presently the amount of soil to landfills sites is relatively low (estimated 19% of total excavated soils), although this could still be reduced further

Negative drivers:

- The relaxation and lowering of criteria for highly contaminated soil in urban areas can lead to a strong decrease of volumes of potentially treatable soil for the biological treatment plants.
- The increasing complexity for options of re-use of diffuse contaminated soils. The question: "Has the jungle of re-use become now an inscrutable labyrinth in The Netherlands?" has to be posed and to be tackled. The practical work with the different and overlapping regulations needs to be simplified to one unified regulation.
- The question of whether a new report "Evaluation of the Construction materials Decree (Bouwstoffenbesluit)" treating in part C: "Practical experiences of producers and utilisers",

which is now under preparation, will actually bring new proposals for improvement of the present situation
- Present soil remediation practice which does not use multifunctional criteria has a strong influence on the volumes of potential contaminated soil not coming available or being cleaned by in-situ methods
- The permitting procedures, which are more stringent than in the former years, will require longer procedures and certainly an EIA procedure will be required for new installations with the necessary public participation
- Permits cannot be obtained by dealing with one authority only to deal with the co-ordination of all procedures. EIA and/or Wm permit, Building permit and Housing Act permit run via each competent authority
- With the present market situation not many companies can be expected to apply for the construction of new treatment plants.
- Rules related to odour. There are no legal acts, but only the NeR is often taken as advice and the ALARA principle is more and more applied. Being well prepared is essential in order to avoid a long-running learning curve leading to costs and delay in installation of additional measures.
- Contaminated soil ending at a landfill is not connected to delivering a result and also no liability question is occurring. On the contrary, all treatment installations have to produce a treatment result. So it is much more simple to let the soil end at landfill sites.
- Due to the lack of expensive landfill space, it is reported that landfill exploiters are now digging out areas with soil, treating the soil, disposing the waste residues at the landfill and bringing the soil on the market again. It may be clear that this aspect could play a role in countries that are densely populated.

Collapse of biological soil remediation market?

In 2002 a drastic reduction of biological soil treatment has occurred, which affects the biological soil treatment sector very hard. It is not yet clear if this reduction will affect the biological treatment branch only or will also affect the other treatment methods in the future. Experiences show that values of 500 mg/kg/dm for mineral oil are still difficult to achieve and in the field of dredging sludge the Dutch authorities are considering to abandon the cleaning standard of 2000-3000 mg/kg. These factors could eventually lead to a total collapse of the biological soil remediation market in the Netherlands, now after nearly 20 years of soil remediation; investigations have to be made to assess this issue better. But it is clear that this issue is a real EU-wide issue, which needs tackling also now and should be harmonised in order to avoid worse in the other Member States. It should be investigated if the recent stronger enforcement conform to the Bsb, (Bouwstoffenbesluit bodem-en oppervlaktewaterbescherming, Construction materials Decree for the protection of soil and surface water), also is related to the reduction of biological treatment.

The issue if soil can be really defined as building material, according to the present Construction materials Decree for the protection of soil and surface water (Bsb), is also to be carefully investigated and re-considered.

In the Netherlands, in 2002 a discussion between the Ministry of VROM and the association of treatment companies NVPG is going on which could have quite some implications towards the need for EU wide harmonisation:

There is a significant difference in the implementation of the control of contaminated soils. The soils coming to the treatment plants is checked largely for the well known components, but the soil which is treated is controlled on a much larger group of elements such as Selenium, Vanadium, Sulphates, and fluorides and others. It has turned out that many of the treated soils contain these elements, and due to this the treated soils cannot be used to the extent as before. Of course here we have not to deal with a treatment issue but an issue about the prevailing background values in the Netherlands or in certain regions. These elements have never previously been monitored in The Netherlands.

Enforcement of laws by adequate governmental controls needed

The Ministry of VROM has published a report in April 2002, "Soil in View" (Bodem in Zicht), where the VROM inspection has investigated the supervision by the provinces and town of soil remediation. This report evaluated 12% being good, 31% being satisfactory and 38% as bad and concluded thus that 6 of each 10 remedial actions taking place in the Netherlands can be classified as being unsatisfactory or bad. The report has the following conclusions and recommendations:

Vision and strategy:

- Develop a qualitative and quantitative assessment framework for the definition of adequate supervision of soil remediation projects
- Determine deviations and chose a mix of enforcement measures, containing main elements such as stimulation of spontaneous observations of rules, calling attention, testing and action taking

Execution:

- Arrangement of the status of the "Soil in View" report
- Supply of information in order to steer the execution of soil remediation in the field by defining tasks for supervision
- Intensify supervision during and after termination of soil remediation
- Strengthen enforcement attitude

An important factor is also the publication of a recent report "Year report soil remediation for 2001, - the monitoring report-" (Jaarverslag bodemsanering over 2001, - de monitoringsrapportage -) by the Ministry of Public Housing and Spatial Planning and Environment (VROM) together with RIVM, the second of its kind in the Netherlands. Not so much the conclusions, but the fact that a national level monitoring takes place is an important factor.

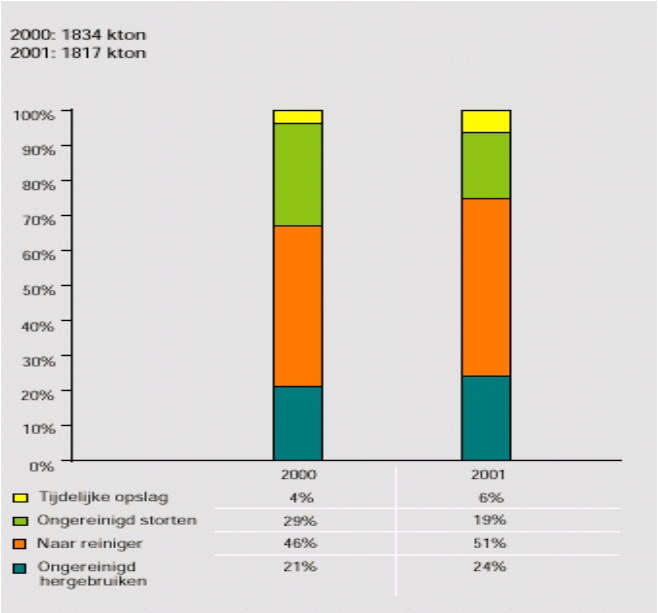
Legend:

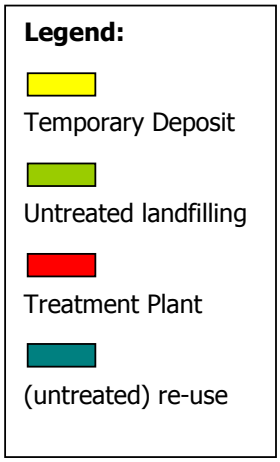
Direct ISV cities, which are Competent authorities

12 provinces

4 major cities Amsterdam, The Hague, Rotterdam, Utrecht

The following figure indicates a relative constant amount of excavated soils from soil remediations (2000 - 1.834.000 t and 2001 - 1.817.000 t), from which a small increase from 46 % respectively 51% is treated and a significant decrease of untreated soils from 29% to 19% landfills has taken place. A small increase of lightly contaminated (untreated) soil for re-use at locations with a less sensitive use.





One important chapter in this report discusses the Netherlands in the European context and looks into the monitoring on EU-level on local soil contamination by so-called DPIR (Driving Forces, Pressure, State, Impact and Response) method by the EEA (European Environment Agency).

Important conclusions are that the main problem is the lack of uniform data in each Member State. However the EEA has made a first step of comparison by the introduction of a benchmarking strategy. On the data collection strong differences were noticed for the inventories per Member State, with very different progress and age and thoroughness of the inventories. One of the final conclusions states the need for further and better definition of indicators at EU level.

6.13 United Kingdom

The United Kingdom has a large, and growing, remediation market. The size of the market is responding to two major drivers:

- The political and commercial pressures to reclaim previously-developed land for new uses, particularly housing; and
- A new liability-based regulatory regime (Part IIA of the Environmental Protection Act 1990, which came into force in 2000).

Companies selling process-based remediation approaches – including biological technologies – have experienced growing sales in recent years. This has been almost entirely for "on-site" treatment, rather than being based on off-site treatment centres or plants.

Direct costs have, in the past, been a major factor in choice of remediation approach, with low landfill costs competing with more expensive process-based approaches. However, direct cost comparisons do not always favour landfill but if it is at all practical it is still chosen by those remediating sites for other reasons. Some of these other key factors in choice of remediation approach include:

- Greater confidence in the "success" of approaches, which remove contaminated material from the site, reducing fears of residual liabilities
- Much faster turn-around times for excavation rather than treatment; on development sites this alone can be the determining factor in choice of remediation approach;
- Regulatory difficulties and uncertainties associated with process-based approaches.

The last point regarding regulatory difficulties has become a major topic for discussion in the UK. The Environment Agency and, in Scotland, SEPA have increasingly been considering contaminated soils as a "waste", and therefore any remediation process has been regulated as a waste disposal or recovery for re-use process. This has been interpreted as applying to in-situ processes where the contaminated soils are not moved from their original locations on site, to the relocation of materials on the original site and to sometimes to the re-use of materials on site after treatment.

From the perspective of a developer looking to remediate a site for a new use the association with the waste regime provides big disincentive, as the existence of a "waste" licence attached to the site creates a major stigma and loss in value for the finished development. Although there has been an attempt to introduce a more flexible system for temporary plant a number of operators have complained about the specific rules. Many organisations involved in both brownfield regeneration and the environmental industry sector have been very active in lobbying for change to the current system.

A recent report, *The Remediation Permit - Towards a Single Regeneration Licence*, prepared for the Department for the Environment, Food and Rural Affairs (DEFRA) by a mix of stakeholders, has outlined proposals for a new specific "remediation permit" to control on-site land remediation. The Landfill Directive, in particular the requirement for the pre-treatment of wastes before landfilling, and the separation of "hazardous" and "non-hazardous" waste streams, is expected to have a strong influence on current practice. There are also proposals to develop new integrated controls on off site waste disposal and recovery for re-use operations. All these future changes will obviously affect the shape of the UK remediation market.

7. Acknowledgement

The author would like to express his gratitude to all the persons who volunteered to help during the last 3 years. I received many written comments, had numerous telephone discussions and personal meetings. Without their help I would not have been able to compile the information describes in this report.

In alphabetical order I would like to mention:

Ms. Ammon, Bundesministerium für Land-und Forstwirtschaft, Umwelt und Wasserwirtschaft, Austria
Jürgen Amor, EMGRISA, Spain
José Antonio Armolea Solabarrieta, Sociedad Pública de Gestión Ambiental, Basque Country, Spain
Ms. Ingegerd Andersson, Swedish Environmental Protection Agency, Sweden
Ms. Eilen Arctander Vik, Aquateam, Norway
Anton Azkona, IHOBE, Sociedad Pública de Gestión Ambiental, Basque Country, Spain
Ms. Anni Bäckmann, Helsinki Municipality, Finland
Ms. Inge Bantz, Umweltamt Stadt Düsseldorf, Germany
Christian Beau, Ministère de l'Ecologie et du Développement Durable, DPPR-SEI, France
Ms. Antje-Britta Behm, Ministerium für Umwelt und Verkehr, Baden-Württemberg, Germany
Adreas Bieber, Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit, Germany
Leon Bijlsma, NVPG, the Netherlands
Volker Boehmer, Hessische Industriemüll ASG,
Ad Bonneur, Tauw Milieu, the Netherlands
Ms. Fotini Boura, Ministry of Environment, Physical Planning and Public Works, Greece
Michael Braedt, Umweltministerium Niedersachsen, Germany
Ms. Jane Brogan, Environmental Protection Agency, Ireland
Franz Bruckbauer, Fachverband der Mineralölindustrie, Austria
Ole Bryskeland, Noteby, Norway
Fréderic de Bueger, Direction Générale Des Ressources et de l'Environnement, Belgium
Martien Bult, Province Gelderland, the Netherlands
Ms. Veerle De Coster, AMINAL, Belgium
Ms. Natalia Crespo González, Xunta de Galicia, Spain
Ms. Mathilde Danzer, Bundesministerium für Land-und Forstwirtschaft, Umwelt und Wasserwirtschaft, Austria
Ms. Dominique Darmendrail, BRGM, France
Ms. Muriel Delvaux, Direction Générale Des Ressources et de l'Environnement, Belgium
Jonathan Derham, Environmental Protection Agency, Ireland
Mr. Dernbach, Hansestadt Hamburg, Umweltbehörde, Germany
Siegfried D'haene, Grondreinigingscentrum GRC Kallo, Belgium
Malcolm Doak, Environmental Protection Agency, Ireland
Ms. Karin Dunér, Swedish Environmental Protection Agency, Sweden
Ms. Irene Edelgaard, Miljøstyrelsen, Denmark
Bertil Engdahl, Miljøforvaltning Stockholm, Sweden
Ms. Claudia Fangl, Bundesministerium für Land-und Forstwirtschaft, Umwelt und Wasserwirtschaft, Austria
Ernesto Ferrón de la Fuente, Gobierno del Principade de Asturias, Consejeria de Medio Ambiente, Spain
Wolfgang Feuerstein, Ministerium für Umwelt und Verkehr, Baden-Württemberg, Germany
Manfred Flittner, Landesanstalt für Umweltschutz, Baden-Württemberg, Germany
Ms. Lieve Gielis, ANIMAL. Belgium
Magnus Gislev, European Commission DG Environment, Belgium
Christian Glasel, Bundesministerium für Land-und Forstwirtschaft, Umwelt und Wasserwirtschaft, Austria
Detlef Grimski, Umweltbundesamt, Germany
Ms. Marjan De Groote, AMINAL, Belgium
Henri Halen, Spaque, Belgium

Ms. E. Hericks, Institut Bruxellois pour la Gestion de l'Environnement, IBGE, Belgium
Ludwig Hipp, Ministerium für Umwelt und Verkehr, Baden-Württemberg, Germany
Ms. Mag. Hochholdinger, Bundesministerium für Land-und Forstwirtschaft, Umwelt und Wasserwirtschaft, Austria
K. Hoffmann, Ministerium für Landwirtschaft, Naturschutz und Umwelt des Landes Thüringen, Germany
Alain Houtain, Direction Générale Des Ressources et de l'Environnement, Belgium
Pekka Huttula, Finnish Oil and Petrol Association
Ms. Nekane Ibargüen, IHOBE, Sociedad Pública de Gestión Ambiental, Basque Country, Spain
Fred Jansen, Grondbank Amsterdam, The Netherlands
Jean-Pierre Janssens, Institut Bruxellois pour la Gestion de l'Environnement, IBGE, Belgium
Thomas Johannesen, Miljøkontrollen, Agency of Environmental Protection City of Copenhagen, Denmark
Bernd Johnke, Umweltbundesamt, Germany
Gabe de Jong, Provincie Overijssel , The Netherlands
Frank Karg, HPC, France
Harald Kasamas, Bundesministerium für Land-und Forstwirtschaft, Umwelt und Wasserwirtschaft, Austria
Jussi Kauppila, Finnish Environment Institute
Pertti Koskelainen, Federation of Finnish Industry Service Providors
Ms. Marja van de Kraats, Provincie Gelderland, The Netherlands
Mr. Lehnguth, Thüringer Landesverwaltungsamt, Germany
Wim Levolger, Provincie Zeeland, The Netherlands
Andrea Lodolo, ICS, Italy
Ms. Barbara Lopes Dias, Instituto dos Residuos, Portugal
José Lopez de Velasco, Ministerio de Medio Ambiente, Spain
André Lox, Spaque, Belgium
Ms. Judith Lowe, Independent Consultant, United Kingdom
Herbert Ludwig, Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit, Germany
Ulrich Malorny, Landesumweltamt Nordrhein-Westfalen, Germany
Luca Marmo, European Commission DG Environment, Belgium
Frank Marot, Ademe, France
Ms. Nora Meixner, Bundesministerium für Land-und Forstwirtschaft, Umwelt und Wasserwirtschaft, Austria
Ms. Astrid Merl, Bundesministerium für Land-und Forstwirtschaft, Umwelt und Wasserwirtschaft, Austria
Jochen Michels, DECHEMA, Germany
Herman Miedema, SCG, The Netherlands
Carlos de Miguel Perales, ICADE, Spain
Christian Militon, ADEME, France
Franz Mochty, Bundesministerium für Land-und Forstwirtschaft, Umwelt und Wasserwirtschaft, Austria
Ms. Marjan Modderman, Provincie Groningen, The Netherlands
Stefan Morel, Commissie MER, The Netherlands
Andreas Moser, Bundesministerium für Land-und Forstwirtschaft, Umwelt und Wasserwirtschaft, Austria
Dietmar Müller, Umweltbundesamt, Austria
Emmanuel Normant, Ministère de l'Ecologie et du Développement Durable, DPPR-SEI, France
Michael Odensass, Landesumweltamt Nordrhein-Westfalen, Germany
Ms. Claudia Olazabal, European Commission DG Environment, Belgium
Thijs Olijve, Bioterra, Belgium
Paz Orviz, Gobierno del Principade de Asturias, Consejeria de Medio Ambiente, Spain
Ms. Louisa Piñeiro, Instituto dos Residuos, Portugal
Pouel Pedersen, Miljøkontrollen, Agency of Environmental Protection City of Copenhagen, Denmark
Patrick Poiret, DRIRE, Ile de France, France
Georges Pottecher, IRH Environnement, France
Ms. Angela Psaila, Special Environmental Service, Greece

Ms. Francesca Quercia, APAT (formerly at ANPA), Italy
Ms. Elisenda Real, Generalitat de Catalunya, Medi Ambient, Spain
Willem Rijtsma, De Vries en van de Wiel, The Netherlands
Arne Rokkjær, Amternes Videncenter for Jordforurening, Denmark
Alberto Otamendi Saldise, Ordenación del Territorio y Vivienda de Navarra, Spain
Ms. Jutta Shani-Kraus, Bundesministerium für Land-und Forstwirtschaft, Umwelt und Wasserwirtschaft, Austria
Gaetano Sgalambro, Ministry for the Environment, Italy
Martin Schamann, Umweltbundesamt, Austria
Mr. Scheuringer, Niederösterreichischer Landesregierung
Hans Joachim Schmitz, WLB/TerraTech,Vereinigte Fachverlage, Germany
Robert Schneider, Bavarian State Ministry for State Development and Environmental Affairs, Germany
Gezinus Schrage, Provincie Zeeland, The Netherlands
Jan Schreurs, Schreurs Milieuconsult, The Netherlands
Stefan Schroers, Landesumweltamt Nordrhein-Westfalen, Germany
Ms. Beate Schuller, Ministerium für Umwelt und Verkehr, Baden-Württemberg, Germany
Pascal Simonet, DRIRE, Rhône-Alpes, France
André Smits, Provincie Drenthe, The Netherlands
Mr. Sobich, Ministerium für Umwelt , Saarland, Germany
Ms. Neel Strøbæk, RAMBOLL, Denmark
Marco Valente, ASTALDI, Italy