REPORT OF THE NICOLE WORKSHOP

Sharing experiences in the management of megasites: towards a sustainable approach in land management of industrially contaminated areas

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Lille, France

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NICOLE (*Network for Contaminated Land in Europe*) was set up in 1995 as a result of the CEFIC "SUSTECH" programme which promotes co-operation between industry and academia on the development of sustainable technologies. NICOLE is the principal forum that European business uses to develop and influence the state of the art in contaminated land management in Europe. NICOLE was created to bring together problem holders and researchers throughout Europe who are interested in all aspects of contaminated land. It is open to public and private sector organisations. NICOLE was initiated as a Concerted Action within the European Commission's Environment and Climate RTD Programme in 1996. It has been self-funding since February 1999.

NICOLE's overall objectives are to:

- Provide a European forum for the dissemination and exchange of knowledge and ideas about contaminated land arising from industrial and commercial activities;
- Identify research needs and promote collaborative research that will enable European industry to identify, assess and manage contaminated sites more efficiently and cost-effectively; and
- Collaborate with other international networks inside and outside Europe and encompass the views of a wide a range of interest groups and stakeholders (for example, land developers, local/regional authorities and the insurance/financial investment community).

NICOLE currently has 156 members. Membership fees are used to support and further the aims of the network, including: technical exchanges, network conferences, special interest meetings, brokerage of research and research contacts and information dissemination via a web site, newsletter and journal publications. NICOLE includes an Industry Subgroup (ISG) – with 29 members; a Service Providers Subgroup (SPG) with 36 members; 77 individual members from the academic sector/research community; and 14 members from other organisations, including research planners, non-profit making organisations, other networks, funding organisations. Some members are involved in both the ISG and the SPG. For further general information, further meeting reports, network information and links to contaminated land related web sites, please visit NICOLE's web site: *www.nicole.org*.

Membership fees are currently 3,500 EURO per year for companies (1,750 EURO for smes), and 150 EURO per year for academic institutions. For membership requests please contact:

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Executive Summary

The NICOLE workshop at Lille focused on two main themes: the management of "megasites" and "sustainable land management". In broad terms the initial description for megasites has been that they are large conurbations of sites where contamination has arisen independently. However, often over time, as contamination has spread, these environmental problems caused by these sites have become inter-linked. The management of such conurbations may therefore be facilitated by taking an overarching approach, rather than trying to deal with each site on an individual basis. Even where contamination problems remain relatively discrete there may be economic, social or environmental advantages in an overall approach. Sustainable land management is a phrase that has been coined by NICOLE to describe a risk-based approach to land management that also takes into account the principles of sustainable development, a balanced environmental, economic and social approach.

These are only initial descriptions. Neither term, *megasite* nor *sustainable land management* has yet been explicitly defined, for example in a regulatory or spatial planning context. At this point in time, these are terms that describe a philosophical approach to land management. The purpose of the Lille workshop was twofold: to explore whether a consensus existed to define these terms more closely, and to see how these philosophies might be translated as more operational approaches.

The workshop included discussion groups and expert presentations. The presentations began with a review of the EC Welcome project, which opened the "megasites" debate in Europe. This was followed by a review of the legal, economic issues, policy, social and management issues surrounding megasites. The development of *sustainable land management* thinking in this workshop was linked to the megasites debate.

Discussion

The need for a vision for managing megasites, and the importance of stressing opportunities in such a vision was widely expressed. And the key to a vision that is appealing is that it must be for a better future.

A "can-do" attitude is very important, with goodwill, foresight and common sense, solutions can be found, even to apparently intractable problems. Problems often seem difficult to solve because as technical people we tend to approach them from a narrow perspective, but as the example of Rotterdam Harbour shows, some innovative thinking, in this case about the true sources of surface water contamination, can yield both environmental progress and be cost effective. To use a common modern cliché, looking for solutions to megasites may mean that individuals have to think "out of the box", especially because the solutions will be a puzzle made up of a large number of pieces

The importance of involving multiple stakeholders in the development of a vision for managing each megasite was stressed by many, and the potential contribution of professionals in planning, socio-economists, geography was one that was felt very necessary. Equally important is the need for "someone" to "own" management of the process and therefore draw together the different strands into a vision and a means of delivering it. Looking at brownfields projects that have been successful (or are at least moving in the right direction), this is the common thread.

The management of megasites poses major challenges to the current paradigm for contaminated land management in Europe, for example in supporting a multi-site owner response to contaminated land management. Furthermore the management of megasites may actually be being impeded by the apparent disconnection between soil and water policy at an EU level, and the lack of recognition of risk-based decision making in the draft Groundwater Directive. At a national level, it can be difficult to get planning and regulatory authorities at local, regional or national level to deal with the individual

units of land on a megasite as a cluster requiring a uniform regulatory and planning approach, with a shared risk management solution.

In taking forward solutions to megasites , it might be useful to remember – "think big, act small". It is wise to develop solutions for megasites at the megasite level. However, for implementation and to solicit the co-operation of some stakeholders, a translation has to be made to a local (site) level. As Einstein put it: "problems cannot be solved at the same level that they were created". Seeing the complete picture and keeping the balance between all the small pieces is a major challenge for solving megasite problems.

As well as megasites that are large in area, there can be smaller areas where several sites with different operators and owners are linked by overlapping and/or shared land and water contamination problems. These sites may be a microcosm of the issues faced by megasites, and the tools developed for supporting a holistic approach to megasites should also be scaleable so that they are useful for these smaller sites as well.

One possible way forward might be to consider a broader classification than "site" or "megasite", that recognises that there can be similar issues arising from transboundary pollution and multiple ownership on relatively small sites, as well as sites that cover a large geographical area.

While this workshop did not achieve a final prescriptive definition for megasites and sustainable land management, it certainly demonstrated a general enthusiasm for the development of sustainable land management, and a wide recognition of the particular problems posed by megasites. It was a useful step forward towards NICOLE's new theme of developing effective tools for sustainable land management. Future NICOLE workshops will focus on developing a little more detail and definition of these concepts, and, in conjunction with other who might be interested, will also working developing tools to make sustainable land management a practical proposition.

As well as continuing the development of sustainable land management as a concept and a discipline, these conclusions indicate that NICOLE may also need to consider some specific actions:

- NICOLE needs to argue the technical reasons for both a stronger risk management basis in the draft Groundwater Directive, and also for a stronger interaction between EC soil and water policy and regulatory development. Given that the draft "daughter" groundwater Directive now has an agreed text, some of these interventions will need to via national routes to the European Council of Ministers and the European Parliament. Similar views have been expressed by the Common Forum, with whom NICOLE should collaborate.

- It would be useful for NICOLE to stimulate a wider debate on how the risk management of source-pathway-receptor linkages can be integrated, for example on megasites, and develop an understanding of when this might be beneficial and when not.

- Over several workshops the need for risk communication has been discussed. Perhaps there is a need for a NICOLE project to develop a simple NICOLE guide on stakeholder involvement and communication?

The full report provides summaries of the papers given, along with a discussion based on points raised during the meeting, and comments from a number of delegates after the meeting.

Contents

1 Introduction

Management of contaminated land is an important issue throughout Europe, and one that involves many stakeholders: governments, regulatory bodies, the community, industry and the wide range of researchers and service providers who support the process. NICOLE supports two workshops a year and produces a meeting report for each. Past events and future workshops are listed in Table 1. Further information, for example reports or registration forms, is available on the NICOLE web site: www.nicole.org.

The NICOLE workshop at Lille focused on two main themes: the management of "megasites" and "sustainable land management". In broad terms the initial description for megasites has been that they are large conurbations of sites where contamination has arisen independently. However, often over time, as contamination has spread, these environmental problems caused by these sites have become inter-linked. The management of such conurbations may therefore be facilitated by taking an overarching approach, rather than trying to deal with each site on an individual basis. Even where contamination problems remain relatively discrete there may be economic, social or environmental advantages in an overall approach. Sustainable land management is a phrase that has been coined by NICOLE to describe a risk-based approach to land management that also takes into account the principles of sustainable development, a balanced environmental, economic and social approach.

These are only initial descriptions. Neither term, *megasite* nor *sustainable land management* has yet been explicitly defined, for example in a regulatory or spatial planning context. At this point in time, these are terms that describe a philosophical approach to land management. The purpose of the Lille workshop was twofold: to explore whether a consensus existed to define these terms more closely, and to see how these philosophies might be translated as more operational approaches. The Lille workshop was seen as the beginning of these activities; it did not aim to develop prescriptive definitions, but rather to open a debate across industry and other stakeholders, for example regulators and stakeholders.

The workshop included discussion groups and expert presentations. The presentations began with a review of the EC Welcome project, which opened the "megasites" debate in Europe. This was followed by a review of the legal, economic issues, policy, social and management issues surrounding megasites. The development of *sustainable land management* thinking in this workshop was linked to the megasites debate. Discussions were based on four megasite case studies:

- Région Nord Pas de Calais – France,
- Bitterfeld – Germany,
- Metaleurop – France,
- Port of Rotterdam – The Netherlands.

This report provides summaries of the papers given, along with a discussion based on points raised during the meeting, and comments from a number of delegates after the meeting.

Table 1: Recent and Forthcoming NICOLE Events and Publications

Date	Event / Report
13-14 May 2004	**Forthcoming NICOLE Workshop:** *Sediments, Sludges and Ecological Risk Assessment"*, at Dechema in Frankfurt, Germany - see www.nicole.org knowledge base
13 February 2004	**Forthcoming NICOLE Project Workshop:** devoted to disseminating the results of various (NICOLE) research projects currently underway, and to learn about recent activities of a number of other networks, Runcorn, UK - see www.nicole.org knowledge base
September 2003	*NICOLE News* 2003 issue, Web link: www.nicole.org knowledge base
12 – 14 March 2003	**Report of the NICOLE Workshop**: *Management of Contaminated Land towards a Sustainable Future: Opportunities, Challenges and Barriers for the Sustainable Management of Contaminated Land in Europe*, Barcelona, Spain see www.nicole.org knowledge base and *Land Contamination and Reclamation* **11** (3) 366-395
6 - 7 November 2002	**Report of the NICOLE Workshop**: *Financial Aspects of Site Restoration with an Emphasis on Central and Eastern Europe*, 6 - 7 November 2002, Budapest. Web link: www.nicole.org knowledge base, and *Land Contamination and Reclamation* **11** (3) 366-395
September 2002	*NICOLE News* 2002 issue, Web link: www.nicole.org knowledge base
18 – 19 April 2002	**Report of the NICOLE Workshop**: *Cost-effective Site Characterisation - Dealing with uncertainties, innovation, legislation constraints*, 18-19 April 2002, Pisa. Web link: www.nicole.org knowledge base, and *Land Contamination & Reclamation* **10** (3) 189-219
14-15 November 2001	**Report of the NICOLE workshop:** *ICT/Computing applied to contaminated land characterisation /remediation and MNA*, Rotterdam, the Netherlands (Port of Rotterdam) in conjunction with the Network on Natural Attenuation in Groundwater and Soil (NNAGS). Web link: www.nicole.org knowledge base 7, and *Land Contamination & Reclamation* **10** (1) 33-59
October 2001	*NICOLE News* 2001 issue, Web link: www.nicole.org Information Gateway: NICOLE News Service – Announcement 171
17-18 May 2001	**Report of the NICOLE workshop**: *Cost-effective clean-up technology; quality assurance and acceptance* , Paris, France. Web link: www.nicole.org knowledge base, and *Land Contamination and Reclamation* **9** (4) 377-395
January 2001	Special Issue of *Land Contamination and Reclamation*, outlining NICOLE and CLARINET work, www.nicole.org and www.btInternet.com/~epppublications/ and *Land Contamination and Reclamation* **9** (1)
9 and 10 November 2000	**Report of the NICOLE workshop:** ***Brownfields: How to Change a Potential Threat into an Asset,*** IJmuiden**,** The Netherlands. Web link: www.nicole.org knowledge base, and *Land Contamination and Reclamation* **9** (2) 252 – 256
October 2000	*NICOLE News* 2000 issue, Web link: www.nicole.org knowledge base
September 2000	Joint Statement of NICOLE, CLARINET, ETCA and SENSPOL: Sustainable Management of Contaminated Land for the Protection of Water Resources, Web link: www.nicole.org knowledge base
21-23 June 2000	EU Workshop on The Protection of European Water, Resources, Contaminated Sites, Landfills and Sediments, Venice. Web link: www.etcanet.org/
22-23 May 2000	**Report of the NICOLE Workshop:** ***Source Management,*** Helsinki, Web link: www.nicole.org knowledge base, *Land Contamination and Reclamation* 8 (4) 67 – 68.

2 Case Studies

Overview of the Management of Contaminated Sites in France: Extract from the CLARINET WG2 Report.

This section has been included to provide a background for the French case studies and the summary of the presentation by Asscher. It is extracted from a report[1] published in 2002 on behalf of the European Commission (EC) Project CLARINET: The Contaminated Land Rehabilitation Network For Environmental Technologies in Europe (www.clarinet.at). A comprehensive review of the regulation of contaminated land in France has been published in English by BRGM[2] and is available from www.fasp.fr.

The approach to dealing with polluted sites is derived from the legislation on environmental management of industrial installations, and to a lesser degree, to the legislation on waste management. There is no specific legislation regarding soil protection or polluted sites. Four key policy documents define the principles for contaminated land remediation - The Ministerial Directives of 3.12.93, 3.04.96, 31.03.98 and 10.12.99, which relate to the management and remediation of contaminated sites (they are linked to a law on environmental protection of 19.7.76). The approach involves three steps:

1. The Inventory phase involves a systematic search for polluted sites - either active or historical.
2. The Selection phase involves an initial characterisation of any site that the state or any responsible party wants to study based on a simplified evaluation of risk. This results in a threefold classification.
    - Class 1 sites requiring further investigation and detailed risk assessment and remedial approaches;
    - Class 2 sites requiring monitoring and possible restriction on use; and
    - Class 3 sites may be used for specific purposes with no further investigation or treatment.
3. The Treatment phase is guided by a flow diagram and is highly site-specific giving detailed evaluation of risks to humans and the environment, guidance on treatment options and remedial objectives.

Regulation is at the level of the Prefects (administrative representatives) of the French Government in the 99 Departments and their inspectors. The inspectors within these Departments are members of the Directions Régionales de l'Industrie, de la Recherche et de l'Environment (DRIRE). Owners of the site will also be involved. The remediation of orphan sites (sites where the responsible party is not able to pay) is funded by public financial support.

A key element in the French policy is the participation of the full range of stakeholders involved in dealing with contaminated land including the local population. There is specific guidance describes how to keep Municipalities and the population fully informed of the state of play at a contaminated site and actively involved in the decision making process. The Prefect can decide to inform representatives of the population (for example, the Mayor, environmental organisations and residents associations) through special meetings called CLIS (Commission of Local Information and Monitoring) during the whole of the investigation and/or remediation.

French policy is characterised by two successive steps of assessment, a simplified risk assessment (SRA) and a detailed risk assessment (DRA). Generic and/or limit values are used in SRA to score the level of expected impact as a function of future land use. National guideline values have been

[1] Bardos, R.P., Lewis, A. J., Nortcliff, S., Mariotti, C., Marot, F. and Sullivan, T. (2002) Review of Decision Support Tools for Contaminated Land Management, and their use in Europe. Final Report. Austrian Federal Environment Agency, 2002 on behalf of CLARINET, Spittelauer Lände 5, A-1090 Wien, Austria. Available from: www.clarinet.at

[2] The French approach to contaminated-land management. Study carried out as part of BRGM Public Service activities 2000-POL-315 and the MATE-BRGM 30/2000 (point 6) contract, August 2001. BRGM/RP-51098-FR

defined for two end uses (sensitive (residential) and non-sensitive (industrial) uses). Guidelines are calculated from the main exposure pathways (soil ingestion and soil contact and by vegetable ingestion for sensitive use).

The approach is a case by case approach based on the structure outlined above (Inventory; Selection; Treatment). In the first step of the risk assessment (SRA), only risk for humans and water resources are considered. If a site is found to be in Class 1, a second step is then needed. At this level a quantitative assessment is conducted, taking into account specific receptors, for example human health, water supplies, ecosystems and buildings can be considered according to the site.

In the first stage of SRA, water and soil are considered as receptors. Three types of water use are distinguished (drinking water supplies, other uses, and future resources) from two different origins (surface water and groundwater). The site is graded for each receptor based on these uses. Limit values are used to score the level of impact. These limit values are derived from national or European limit values for water. Limit values for soil for a range of substances and two types of end-use have been developed. They are already available for two types of land use (residential use with vegetable gardens and industrial use).

If the results of Detailed Risk Assessment conclude that the risk of the current or proposed use is unacceptable, then either the site use has to be changed or remedial action is required. Whatever the decision the objectives or tolerable risk must be both technically and economically realistic.

The persons responsible for the site (industrial operator, owner or ADEME in the case of orphan sites[3]) must present the risk study to the regulator. Where the regulator and responsible party cannot agree, BRGM and INERIS are able to act as independent evaluators. The Prefect of the Department makes the final decision about risk management decision. Where site use is restricted then this information must be recorded and archived. If a site is to be sold, the seller is obliged to inform the buyer of the potential risks. There is now a move to make all information about soil pollution easily accessible, especially when a development project is planned. The results of any risk assessment must be systematically presented to the mayor, and sometimes public meetings (CLIS) may be organised to inform the representatives of the public.

The responsible party (site owner, site operator, etc) must check the remediation during and after the operation. There are two options to check on the efficacy of a treatment for soil. Either an independent laboratory samples and analyses the treated soil, or the site operator samples and analyses and their results are cross-checked by an independent laboratory.

Case Study 1. Région Nord Pas de Calais – France

The Nord Pas de Calais region is faced with profound social, economic and environmental challenges, which have been brought sharply into focus by the recent and sudden closure of the Metaleurop plant at Noyelles Godault. Some several dozen square kilometres located around the site are reported to be polluted by lead and other heavy metals, which threaten the farming activities in the vicinity of the site. A wide swath of urban and agricultural land may have been degraded by atmospheric fallout from this plant, and by other human activities in the area which has both one of the highest urban densities in France and one of the largest numbers of former industrial sites and brownfield sites. Over 14,000 sites have been recorded, and are a result of the area's economic history and its industrial past, which was based on the production of energy, iron and steel production, chemical engineering and textiles.

[3] Orphan sites are managed by ADEME with funds derived from the 'pollution tax' (TGAP). For sites representing a risk to water resources, funds may be obtained from some water agencies. For Brownfield sites there may be regional support

10,000 hectares of industrial wasteland were recorded in 1983. Around a half of this area has been redeveloped over the past 20 years with support from regional and national government and the EC. Most of this regeneration has taken place in the towns of the area, and in their immediate vicinity. However, there remains a substantial amount of peri-urban contaminated land. Non-food based agriculture is seen as one possible way forward in restoring some (economic) function to this 5,000 ha of land.

The Regional Council has implemented a survey of 18 trace elements measured across agricultural land in the Nord-Pas de Calais region, from land located far from the industrial and urban activity zones. The "background" or "reference" levels found are linked to the characteristics of the regional parent material, diffuse deposits and agricultural practices. For example, mean values measured in the first 30 centimetres of loamy soils (which are well represented in the region) were reported as: 8.5 ppm for arsenic, 54.5 ppm for chromium, 0.41 ppm for cadmium and 30.3 ppm for lead. While these data indicate that the quality of the agricultural soils in the region is on the whole satisfactory, some of the levels recorded for some of these elements are close to the *Detailed Risk Assessment* guide values developed for the French regulatory system for contaminated land (see CLARINET WG2 extract - above). Of course, the quality of the soils located in the vicinity of industrial and urban sites may be greatly affected by atmospheric fallout and waste deposits.

Case Study 2. Bitterfeld – Germany

The Bitterfeld area of around 1,300 ha, contains the former industrial plants "Chemiekombinat Bitterfeld" and "Filmfabrik Wolfen" and is situated in the centre of eastern Germany. The availability of lignite as energy source was the main factor for the development of the chemical industry at the site. Industrial exploration of the site began more than 100 years ago and resulted in the development of three main industries: open-cast lignite mining, energy production and chemical industries. By 1990, these industries occupied an area of about 10 km^2, and more than 5,000 different products and compounds were produced.

Over time these activities have resulted in large-scale contamination of the subsurface, with an estimated 100 million m^3 of contaminated groundwater. This *megasite* also contains more than fifteen chemical waste disposal landfills in abandoned open-cast lignite mines. Major contamination problems include: aromatic Hydrocarbons (BTEX), chlorinated aliphatic compounds and chlorobenzenes. Almost all of the substances that were produced in the area can be found in the groundwater today.

The remediation of the megasite is managed as part a large-scale ecological rehabilitation project at a strategic level by the State Authority for Exemption from Pollution Liability (LAF). A contractor (MDSE Ltd) project manages site investigation and remediation measures.

There are two main aquifers in Bitterfeld, divided by a lignite layer: a quarternary aquifer and a tertiary aquifer. The base of the tertiary aquifer is a clay aquiclude. The flow direction of the groundwater is partly towards the River Mulder and partly towards the Goitsche lake. Discontinuation of pumping measures related to the past mining activities has caused a rising of the groundwater table and changing direction of groundwater flow.

There is a range of surface water systems in the area, including the: Strengbach/Leine, Lobber, Schlangengraben, Fuhne/Spittelwasser, Schachtgraben, Mulde river systems, as well as several abandoned and flooded open-cast lignite mines (Freiheit II, Goitsche, Johannes mine "Silver lake").

Risk management for the groundwater at Bitterfeld has followed a tiered approach consisting of the following steps:

1. Risk-based assessment of groundwater quality using EU-threshold values.
2. Risk-based site assessment.
3. Transfer based assessment of potential receptors.

4. Derivation of suitable and acceptable remediation measures.

Risk management problems have been sorted into clusters[4] for potential receptors of concern. These clusters have been used to devise an "optimised" set of remediation measures using the Integrated Management System being developed by the EC-funded WELCOME project (see following summary of Rijnaarts *et al*.).

Case Study 3. Metaleurop – France

The Métaleurop Nord smelting plant was established in 1894 to produce lead and was the only producer of primary lead in France until its recent closure. It is situated along the Dêule canal, 12 kms from Douai, and its site still extends over an area of 38 hectares by the small towns of Noyelles-Godault and Courcelles les Lens. The plant closed in 2003, following the withdrawal of financial support from its parent company Métaleurop SA, which led to its bankruptcy. As well as leaving a large legacy of contaminated land, the closure of this plant has had severe economic and social repercussions in the area with a "domino effect" impacting its subcontractors. The remaining assets are inadequate to deal with the plant's social and environmental consequences.

The Métaleurop Nord plant has had major impacts on air, water and soil, and consequently on agricultural production and the use of domestic gardens (see Figure 1).

Air. Over the past 30 years, under regulatory pressure, the plant has made considerable efforts to reduce and control air pollution. Nevertheless, in 2001 emissions to air were some 18.3 tonnes of lead, 26 tonnes of zinc, 0.8 tonnes of cadmium and 6,800 tonnes of sulphur dioxide. These emission levels are a considerable improvement on the 350 tonnes of airborne lead emitted in 1970. Lead in local children's blood and milk teeth shows elevated levels. Three screening campaigns for blood levels in children over 1994 to 2002 indicate that the decrease in airborne emissions has *not* been matched by a fall in lead concentrations in the blood. Between 1996 and 2001, out of the 3836 employees kept under special medical surveillance on account of the risk of lead poisoning, there were 36 notifications of occupational diseases due to lead poisoning. In 1997 of 100 workers presented blood lead levels exceeding 600 μg per litre of blood and were placed on medical treatment.

Water. The site has just one discharge point for liquid industrial effluent to the Haute-Deûle canal, which has a treatment works dating back to 1988. Before the final shutdown of the site, the effluent discharge was within the statutory levels. However, given the high volume of effluent, the amount of lead, zinc and cadmium discharged into the canal remained considerable. The Haute-Deûle canal is in *Class 3*, i.e. poor water quality, and has been so for a number of years. The regulator has set an objective of attaining *Class 2* quality by 2012 by reducing its chemical oxygen demand and reducing dissolved nitrogen and phosphate.

Soil. Over the past 20 years the DRIRE (see CLARINET WG2 extract – see above) has taken several hundred soil samples from around the Métaleurop plant. The metal contamination found is mostly within 40 cm of the surface, and is not found to be soluble or "very mobile", although zinc contamination has been found to migrate more deeply. A good correlation has been found between metal levels found in soils and crops, and levels have exceeded recommended limits for human and animal consumption. However, the data is highly variable. Samples of animal products indicate that levels in meat (muscle) are within recommended limits for human consumption, but levels of cadmium and/or lead in offal (kidney, liver, lungs) exceeded them, justifying its systematic seizure from abattoirs. Levels of metals in milk have been acceptable in the past, but samples have exceeded recent limits set by EC Directive, leading to a cessation of affected dairy production. Data from domestic production in gardens has been highly variable, however, typically at least one vegetable sample per garden is found to have cadmium levels in excess of acceptable values, and 10 of the 15 gardens surveyed also provided a vegetable sample with greater than acceptable lead content. Soil

[4] Defined in the Rotterdam case study

contamination in garden soils tends to be higher than contamination levels found in surrounding agricultural land. The levels of cadmium contamination in vegetable samples found for some gardens is such that permissible cadmium doses could be exceed from fairly normal use of garden vegetables (e.g. 2 kg of cut washed, peeled potatoes over one week)

Figure 1 Some views of the Métaleurop Nord before and after its closure

A series of actions have begun to deal with the social, economic and environmental aftermath of the Métaleurop Nord plant, including economic interventions to create jobs and social and environmental programmes. Following the bankruptcy of the company, the site is being managed as an orphan site by ADEME, which means that much of the remediation cost is being borne by the state. The measures planned include:

1. Purchase and the afforestation of the farms in the zone where the lead concentrations exceed 250 ppm. The total cultivated area covered by this measure may be estimated to be 350 ha. At the request of the administration Métaleurop Nord had over the past 15 years purchasing surrounding with the aim of replacing agriculture by trees, and had, by the end of 2002, bought 86 ha of farming land and afforested 49 ha of them. Nevertheless, 44 ha are still being farmed in a zone mapped as having between 500 and 1000 ppm lead.

2. Control of agricultural productions unfit for human or animal consumption in the polluted zone with soil leads level exceeding 250 ppm.. Métaleurop Nord had already made agreements with local farmers concerning milk production, where it compensated farmers for any loss suffered by an inability to market milk, and supplying farmers in contaminated areas with straw and maize produced outside the contaminated zone. Métaleurop Nord compensated abattoirs for offal seized from slaughtered animals (70 to 80 animals per annum).

3. Removal of topsoil and demolition materials for land redeveloped for housing. Métaleurop Nord had already taken responsibility for the removal, disposal of and the replacement of the stripped polluted soil and the demolition materials in the event of a new developments, in areas mapped as having soil lead concentrations of between the 500 and 1000 ppm.

4. Monitoring of the groundwater quality.

5. Completion of a detailed risk assessment.

6. "Cleaning up" school playgrounds.

Case Study 4. Port of Rotterdam – The Netherlands

The area around the Port of Rotterdam covers approximately 3,000 industrial sites. 10,000 to 15,000 contaminant sources are thought to be present. The entire harbour area, the municipality of Rotterdam and the polder areas is being considered as a megasite[5], an area which approximates the so called Rijnmond region, illustrated in Figure 2. Currently suspected sites in this area are investigated on an individual basis and risk assessment is primarily based on concentration measurements at single points of compliance related to surface water, deep groundwater and human exposure. When the contamination causes an unacceptable risk, remedial measures have to be taken to reduce the risks. Prioritising, design and implementation of these measures takes place site-specifically.

Figure 2 The Rotterdam megasite

The Port of Rotterdam is participating in the WELCOME project (described below) to develop a more holistic and overarching response to managing the risks across this megasite. There are indications that inventorying individual site's impacts on groundwater and surface water may be under-estimating the true potential pollutant emissions overall. On the other hand, biodegradation at the interfaces between groundwater and surface water may be removing pollutants, leading to a reduced contaminant

[5] by the WELCOME project

flux towards the surface water. Establishing the potential value of this biodegradation is not possible unless a more integrated and systematic approach is taken to the receptors in the Rotterdam megasite.

Within the WELCOME project a systematic approach to risk assessment divides the Rotterdam megasite into "risk-based clusters" for each receptor. A cluster is defined as *a part of the megasite, where the risks for receptors are comparable and for which a similar set of management options can be applied*. For example, a cluster could be an area where as a result of heavy industry and unfavourable geohydrological conditions, there is a high flux of chlorinated solvents towards the surface water. Another example of a cluster might be an area which is strongly contaminated with aromatic hydrocarbons, but as a result of the presence of confining layers, has a low risk for contaminants spreading to the deep groundwater.

Clustering is based on the categorisation of receptors and the evaluation of risks (emissions) to these receptors. In order to make this evaluation, databases, geographical information systems, models and new site and research data are used.

The receptors considered by WELCOME for the Rotterdam megasite for clustering: surface water, deep groundwater below the harbour, deep groundwater that discharges into the polder areas and receptors on the site surface. Information on emissions to each of these receptors has been aggregated (i.e. clustered), and the clusters linked in an overarching site conceptual model shown in Figure 3. This conceptual model is also used to define "planes of compliance" to be agreed with regulators, i.e. notional boundaries at which risks to water must be mitigated.

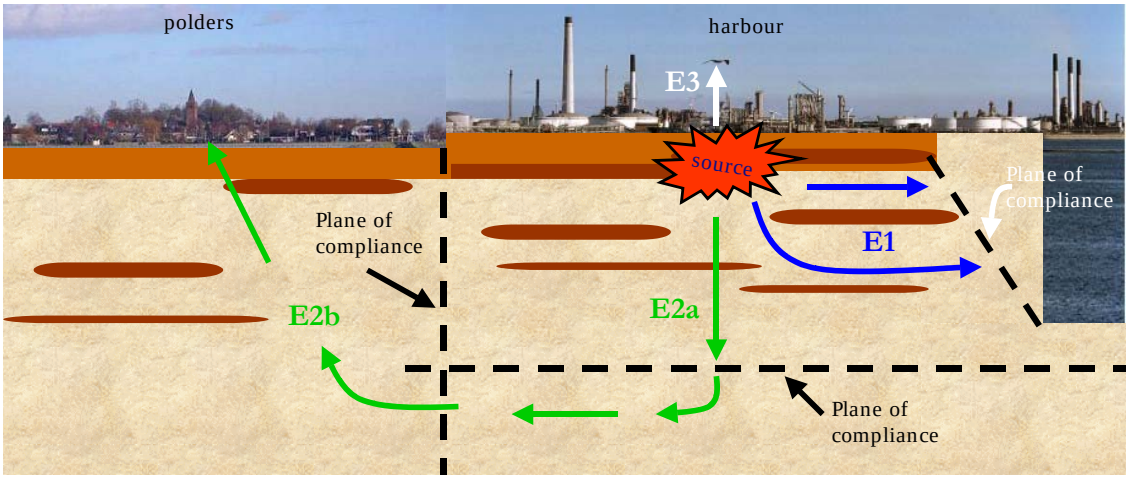


Figure 3 Cluster-based Site Conceptual Model for the Rotterdam Megasite ***(KEY: E1 – emissions to surface water, E2a - emissions to deep groundwater below the harbour, E2b – emissions to deep groundwater that discharges into the polder areas, E3 – emissions to the site surface.***

3 Presentations

What is a megasite? Risk-based Management approaches for contaminated megasites, Huub Rijnaarts, Natalie Hoogeveen, and Jeroen ter Meer, Jurand Bien – TNO

The EC-funded Framework 5 programme project, WELCOME[6], focuses on the management of complex, large scale groundwater damages, which cannot be remediated within a reasonable timeframe, either due to the lack of technical means or because it can only be achieved through disproportionately expensive measures. This groundwater contamination poses a risk to surrounding aquifer and surface water systems. A crucial element in establishing a risk-based approach is the constitution of a conceptual model, the identification of area of (potential) impact within a so called risk management zones or clusters, as described in the Rotterdam case study above.

WELCOME has defined *megasites* as large scale contaminated sites, that pose a large potential or actual risk to deterioration of groundwater, sediment, soil and surface water quality. Megasites exist all over the EU and its Accession States. It is estimated that these sites represent 30 - 50 % of all costs associated with the remediation of contaminated soils and groundwater in Europe; totalling some 100 – 1.000 billion € in the coming decades.

Megasites are complex contamination situations, not only from the technical point of view, but also with respect to stakeholders involved. There are many instances where two or more contaminated sites have overlapping contamination. In these situations two or more sets of site owners and perhaps regulators have to come to an agreement, with respect to liability (covering site characterisation, remediation and management costs), the type of mitigation measures to be implemented and the results to be achieved. This multi-site effect is at most megasites abundantly present. Risk-based land management at megasites therefore requires an integrated management approach, for the deduction and implementation of the technical measures as well as for establishing regulatory and stakeholder acceptance and participation.

Complete “clean-up” of megasites is enormously challenging, and WELCOME would contend generally not possible. A risk-based management approach is a sensible alternative. Riskbased management of multiple sites has been foreseen in the Water Framework Directive, which accommodates risk-based approaches via exception articles. At present, risk management approaches are far less clearly stated in the draft text for the “daughter” Groundwater Directive, which has just been presented to the Council of Ministers and the European Parliament. Nonetheless, WELCOME considers that future EU “integrated soil and water quality” policies are likely to take into account risk-based approaches.

Defining and establishing risk-based management approaches at megasites is difficult. The WELCOME project aims to develop and provide a helpful tool for establishing risk-based management approaches at megasites in Europe. Three megasite cases are included in the WELCOME project:

- the industrial harbour regions of Rotterdam (the Netherlands) and Antwerp (Belgium),
- the former chemical production area of Bitterfeld (Germany) – see Figure 4 - and
- the Tarnowski Gori mining area/chemical plant in Katowice (Poland).

In all of these areas there is a strong focus is on mitigating risks to groundwater and surface water. At many megasites the current and planned land-use is an important driver for taking risk management

[6] Supported under Key Action: *Sustainable Management of Water Resources in Europe*, WELCOME: Water, Environment, Landscape management at COntaminated MEgasites. http//www.EUwelcome.nl/. Coordinator WELCOME: Dr. Huub H. M. Rijnaarts, TNO the Netherlands, H.H.M.Rijnaarts@mep.tno.nl.

actions. Shallow groundwater and soil contamination and functional use are the most important risk determining parameters.

A comprehensive methodology for the evaluation and the derivation of remediation strategies for groundwater damage at megasites is being developed, which is an Integrated Management Systems or *IMS*. The *WELCOME-IMS* is intended to be a guideline, in the form of a manual, which will provide a procedure for designing risk management strategies, including risk-reducing remediation measures, for megasites. Figure 5 is a schematic of the WELCOME-IMS. IMS development is currently half way completed. A final version will become available through internet and on CD-ROM during the second half of 2004.

Figure 4 Aerial View of the Bitterfeld Site

Legal aspects Experiences with legal barriers and solutions in three cases, Jacques Asscher – Huglo Lepage Paris, France

Under French law obligations for site remediation are risk-based. Treated sites must present no future risk to the environment, or to public health or safety. There are three broad triggers for remediation in France: when activities on a site under its current use cease, in the event of an accident, and if required by the regulator. France applies the *polluter pays principle*. Case law in France has established that the responsible party is not necessarily the owner but is the operator. Where an operational site is being sold or has been sold the responsible party becomes the new operator/ owner. If operations have ceased then the vendor is usually regarded as the responsible party. A new regulation (of 30/7/03) provides that for new facilities operators will have to provide funds for the characterisation and remediation (if required) when they leave a site. An action plan has to be agreed before the facility begins operation for dealing with site closure, and this has to be drawn up in consultation with local authorities and regulators.

Example 1: St Denis Region of Paris. This area had a collection of chemical industries and petrol refineries, and these activities date back to the late nineteenth century. The area has a complex groundwater system, with flows in multiple directions, which has resulted in pollution being transferred back and forth between individual sites. The *Stade de France* stadium was built in this area. As part of this development the public body responsible for developing the stadium and its infrastructure made an offer for a site where the owners offered to make a voluntary sale for 7 million

Francs. However the public body decided to make a compulsory purchase for only 1 million Francs as the site was known to be polluted. The site owners, however, denied responsibility for all of the contamination found on their sites, given the complex groundwater regime. The site owners asked for a ruling from the regulators, and were found to be liable for remediation costs. However, given that the zoning for the area was industrial land use, remediation did not have to proceed to the requirements for, say, residential use. After remediation the land value was found to be 9 million Francs, which the administrators for the Stade de France had to meet. Van Asscher sees this example as illustrating the impact of different opinions from Public Sector bodies.

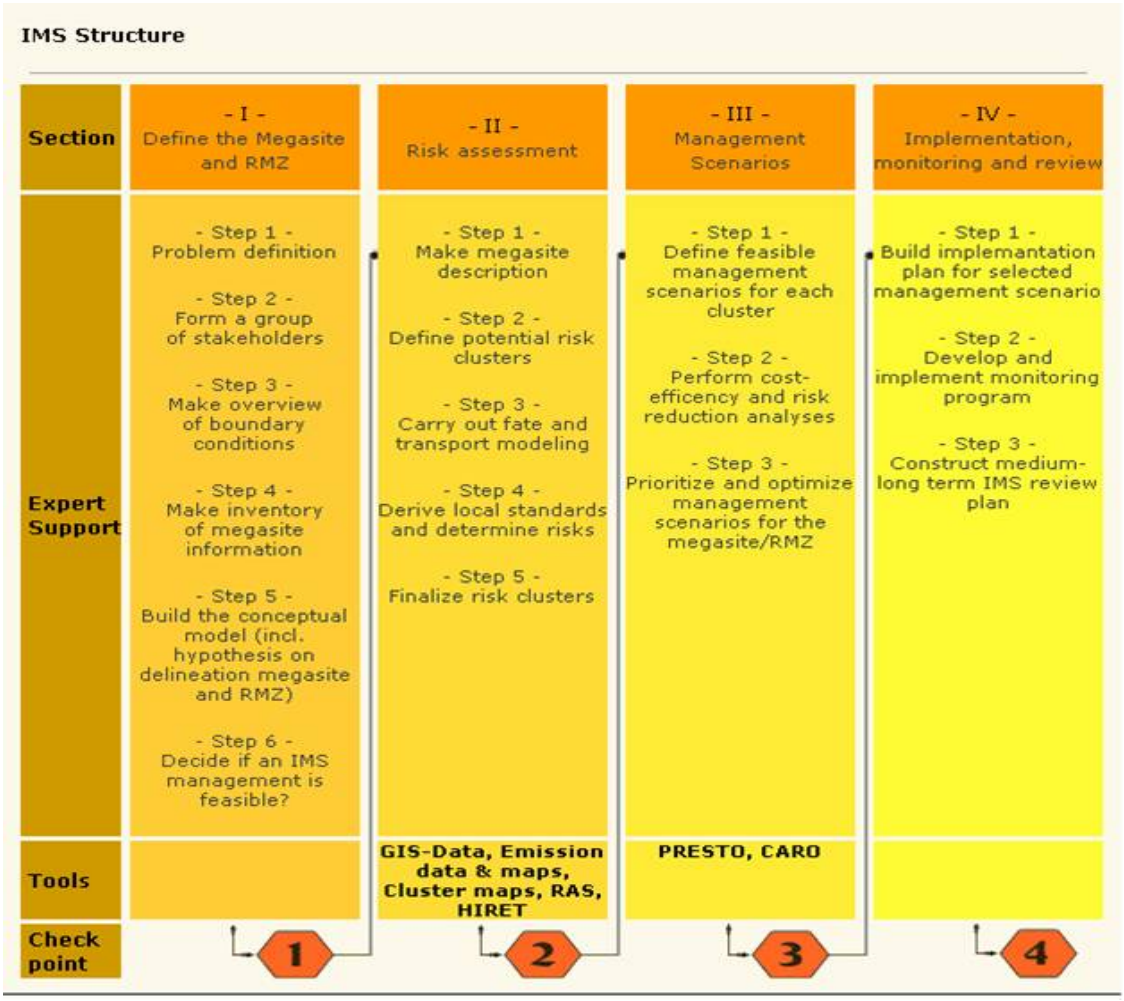


Figure 5 Schematic for the WELCOME-IMS

Example 2 pollution migrating from one site to another site or from one part of a site to another in the event of multiple activities. A "problem" for the management of megasites in France is that responsible parties are only responsible for dealing with the contamination that they caused. In this example the administration requested clean-up of a site upon termination of activities. The current operator held that some of the pollution present on site did not originate from the site itself but was in fact due to the activities carried out on an adjacent site. Regulators automatically turn to the operator of a site for meeting remediation costs. However, there are often situations where liabilities are difficult to assign. In this instance the site had been subjected to a historical activity which caused land contamination. Subsequently the site was divided into two parts, on each of which different

activities were carried out. It is up to the operator to prove that it is not responsible for the pollution, and the same approach was applied in this instance where more than one operator was present on the site. French Case Law has recently confirmed that where several different operators have successively carried out activities on a site, liabilities may be shared.

Example 3 legal effect of contractual warranties within the scope of a site acquisition or a share purchase. Private law contracts are not binding upon regulators. Liability for site characterisation and remediation (where necessary) remains with the operator. As part of a transfer the purchaser can undertake to bear all responsibility and liability. Alternatively, a vendor, operating other installations on surrounding sites, may wish to manage environmental work even after the sale of one of its sites.

Overview of legislation in several European countries focussing on barriers and solutions - Hans Kuijvenhoven URS, The Netherlands

This presentation overviewed the soil and groundwater legislation in a number of European countries[7]. Legislation is one of the most important drivers for investigation of potential contamination and as a result, also for remediation. Remediation is not always necessary, or can be postponed to a later date. Contaminated soils may also be "stored" in an engineering application, for example a bund acting as a barrier to sound along a highway. Risk analysis normally forms the basis for such a decision making.

The Netherlands. Triggers for risk management are serious contamination (levels of contaminants above the *Intervention Value* in more than 25 m^3 of soil, or more than 100 m^3 of soil saturated with groundwater). For such situations a site specific risk assessment must be carried out for human, ecological, and water receptors. Site investigation typically arises as a result of a request from a municipal or provincial authority, changes to activities on site, or major accidents or spills. For example a site in Dordrecht was found to be contaminated with DNAPL and LNAPL[8] since the 1950's. Contamination was found >10 m below the surface and covered an area of approximately 1,000 m^2. A number of investigations had been carried out, which proposed remedial solutions including *in situ* soil flushing of various kinds and electro-remediation. The regulators approved a remediation plan in 1996. The remedial system was partly installed, but not started. The goal of the remediation plan was to achieve a multi-functional level of clean-up. However, changes in Dutch policy left the permitting situation unclear. In the early 2000s new discussions were held with the regulatory authorities on the basis of a site specific risk-based approach to remediation. No large risk of off-site migration was identified and a revised remediation plan was agreed encompassing: the upgrading of storage facilities, limited excavation and removal and liquid phase removal, which greatly reduced the costs of the remediation compared with the original plan.

France. The general approach to contaminated land management in France is described in the CLARINET WG2 extract (see previous pages). An example French project handled by URS was a site in Paris contaminated by chlorinated solvents (TCE and cis-DCE). At the site concentrations of these DNAPLs of > 50,000 µg/l were found > 15 m depth below ground. However, no wells were permitted beyond the site perimeter. There is residential housing around 20 m from the site perimeter and drinking water wells 500 m away, possibly downstream in the aquifer. A risk assessment was carried aout, along with soil vapour extraction. The remediation route agreed was anaerobic *in situ* biological treatment using the injection of molasses to stimulate reductive dechlorination. The initial target concentrations proposed by the DRIRE (1998/9) were based on achieving WHO values for drinking water (TCE 70 µg/l & cis-DCE 50 µg/l), with no migration of contamination above the WHO values off-site. An immediate containment of contamination in the site was required. Attempts

[7] Note information on national approaches to contaminated land are provided on www.clarinet.at (current 2001) and will be made available on www.eugris.info from the end of 2004. www.nicole.org contains links to many national policy and regulatory information sources in its knowledge base area.
[8] Dense and light nonaqueous phase liquids

to achieve containment, via pump and treat, as ordered by the DRIRE, led to the further spread of contamination down gradient in the aquifer. In 2003 the DRIRE agreed a risk-based approach would be more appropriate for this site and negotiations have re-opened.

Germany. Triggers for remediation are contamination levels exceeding action values, which consider the following pollutant linkages: soil to human health, soil to plant and soil to groundwater. Regulations are determined at the Federal and Laende level, and are initiated by local authorities.

Belgium. Regulations vary somewhat across the Flanders, Walloon and Brussels regions. For Flanders OVAM is the regulator, and site investigation is triggered when there is a serious suspicion of contamination. Furthermore, property transfers cannot take place without a "Bodemattest" (soil declaration) where potential contamination problems must be disclosed. In the Walloon region draft soil and groundwater legislation has been published, but not yet enacted, which is similar, but not identical to the Flanders legislation. In the Brussels Region there is no specific legislation and no general obligation for remediation except for fuel supply stations, new industrial processes on site, and former landfill sites.

Sweden. Contaminated land and groundwater is enacted via the "Strickt" legislation and Swedish Environmental Code, and is based on risk assessment and site classification using a national inventory of contaminated sites. Known contamination and spillages must be reported. Regulations are enforced by the Swedish Environmental Protection Agency, environmental courts, regional authorities and municipalities.

Norway. All spills and incidents resulting in contamination must be reported. Appraisal of site management needs is risk-based and dependent on land use. Regulation is carried out by the State Pollution Control Authority (SFT) with the regional and local administrations. The SFT operates a national clean-up programme and a public register of contaminated sites available.

Denmark. Contaminated land and groundwater is enacted via the "Strickt" legislation and Danish Environmental Code. Site management decisions are made on a risk-based approach. Triggers for activities include enforcement actions and where site use changes. Regulation is set at a strategic level out by the Dabish Environmental Protection Agency, but implemented by the Counties and municipalities. A key regulatory objective is the protection. A public register of contaminated sites available.

Finland. Remediation may be triggered by an enforcement action where a site is suspected of having contamination problems and as a matter of course before any closure of operations on site. There is a duty of disclosure on property transfers where all relevant information must be provided to the new owner. Regulation is the responsibility of state and regional environmental authorities and municipalities. A public register of contaminated sites available. All known contamination must be reported.

UK. Risk assessment can be triggered by a regulatory request (or voluntarily) where a site is suspected of causing serious harm to receptors (including human health, water, ecological receptors) and/or a site has breached its operating permits and is also typically triggered also by commercial activities such as the sale of land and/or its redevelopment. Decision-making is on the basis of risk assessment, and land must be suitable for its current and intended use. National regulatory authorities exist for England and Wales; Scotland and Northern Ireland. For most sites regulations are implemented by local authorities.

Ireland. Ireland follows a similar approach to the UK, with the national regulatory agency being the Irish Environmental Protection Agency. In Ireland (and the UK) regulations for IPPC[9] are being

[9] Integrated Pollution Prevention and Control

developed and enacted, which places a more onerous duty of remediation to original conditions for new industrial operations.

Italy. Remediation may be triggered as a result of accidents / emergency response, authorities' suspicion of contamination and voluntary notification by owner to authorities. Initial assessment is on the basis of comparisons with generic guideline concentrations on soil or groundwater. Overall strategy is managed by the national environmental agency (ANPA) but is implemented at a regional level and is implemented by municipalities. Regional lists of contaminated sites are compiled, and prioritised for severity.

Spain. Remediation may be triggered as a result of a change in site ownership or land use, and/or damage to third parties and the redevelopment of former industrialised areas. There are 17 Environmental agencies across Spain. Each compiles inventories of potentially contaminated sites. Assessment and decision making is on the basis of guidance values, derived on a risk management basis.

Portugal. Remediation may be triggered as a result of a change in site ownership or land use, and/or damage to third parties and the redevelopment of former industrialised areas. Site appraisal is often on the basis of the guideline values derived by the Netherlands. Regulations are implemented by the State authorities and municipalities. Emerging legislation will relate to the redevelopment of former industrialised areas and damage to third parties, mainly (ground)water.

Economic Aspects: Région Nord Pas de Calais: the management of contaminated agricultural land: reflection on the development of an innovative and financially viable land farming/food processing industry Laurent Candelier – Région Nord Pas de Calais / University of Lille

In the Nord-Pas de Calais region the rural space is sometimes greatly subject to the influence of the town and the urban centres. The superimposition of a very high urban density and former polluting industrial activities has degraded the peri-urban rural space. Some agricultural soils in peri-urban areas may no longer be suitable for the growing of food crops or animal husbandry because the foodstuffs produced may exceed acceptable levels of metal contamination under EC Regulation 466/2001 and Directive 2002/32. For example, the limit for lead levels in leaf vegetables and cultivated mushrooms is 0.3 ppm and for cereal crops 0.2 ppm. The search for non-food crop alternatives appears to be a useful alternative development opportunity to maintain land in the economic cycle.

Non-food use also fits in with the recent changes away from intensification of the Common Agricultural Policy. There are many possible non-food crop opportunities:

- Energy - short rotation coppice, bio-diesel (rape seed oil) and *Miscanthus* (elephant grass)
- Lubricants – seed oils
- Fibres – hemp, flax
- Essential oils – e.g. lavender

However, while such production is technically possible, its development has not taken off in a major way, because the price of raw materials of fossil origin whose cost price remains very low. However, combining the benefits of alternative crops with the needs for land restoration and regeneration may lead to cheaper land management costs, even if the commercial return on products remains relatively low.

The University of Lille has set up an expert group (the "competency pole on Alternative Crop Productions" or " PVA") in partnership with the Région Nord Pas de Calais. This proposes a strategy of development of local outlets for non-food crops for farms located in the region will be developed over a period of 5 to 7 years. Such strategy can be transposed for farms located in peri-urban and industrial zones.

Experimental studies will evaluate the use of energy crops, biolubricants, eco-materials (fibres) and vegetable extracts with high added value. The strategy developed will encompass five stages:

1. Creation of working groups (administrations, researchers, manufacturers) to study the feasibility and the development of each outlet.
2. Development of experimental tools for crop processing which will be made available to farmers.
3. Putting in place of contracts between farmers and local authorities for the marketing of the products.
4. Study of compensatory/incentive measures with the regional Chamber of Agriculture and the DRAF (Agricultural and Forestry Regional Agency – from the Agricultural ministry).
5. Accompanying research into the development of certain alternative outlets on degraded spaces (study notably of the vectoring of the pollutant to the finished product).

Economic Aspects: Bitterfeld – experiences on financing soil cleanup in the Bitterfeld region, Eastern Germany, Martin Keil – LAF Landesanstalt fur Altlastenfreistellung des Landes Sachsen-Anhalt, Germany

After the political and economical breakdown of the former German Democratic Republic (GDR), industrial areas with considerable soil and groundwater contamination remained. The burden of these contaminated sites constituted a considerable hindrance for the economical restructuring. In order to get rid of this investment impediment, a law was passed giving the five new States formed on the territory of former GDR ("New States") the possibility of exempting the investors from the risks of contaminated sites.

The restructuring of the East German economy to a competitive market economy has been mainly based by privatising state owned industry, and was the task of the Treuhand Agency, for the Federal Government. The Treuhand Agency always included regulations on the contractual release from risks of contaminated sites in its privatisation contracts.

There are two possibilities for the investor to avoid the financial risk of contaminated sites in the former GDR administered by the Treuhand Agency. These are exemptions contained in the contaminated land legislation, and the assertion of contractual claims against the Treuhand Agency. These two routes turned out to be an obstacle to the financing of remediation projects because the New States referred claims to the Treuhand, while the Treuhand refused obligations arising from legislation that entitled the New States themselves to exempt an investor from the risk of contaminations. In order to break the mutual blockade the New States negotiated an administrative agreement with the Federal Government. Under this agreement, the costs needed for remediation works are divided between the Federal Government and the States.

A subsequent problem of this shared financial responsibility of the Federal Government and the States was difficulty in reaching agreements on what technical measures were needed on sites to achieve remediation. This problem led to further delays in the process of remediation. Bitterfeld is in the region of Saxony-Anhalt, and is one of several megasites in this New State: Bitterfeld, Magdeburg Rothensee, Mansfelder Land, Zeiz, Buna, Leuna. The overall risk management and remediation for these sites is likely to cost an estimated 1.5 billion Euros, of which the lion's share (1.2 billion Euros) is accounted for by Bittersfeld.

Saxony-Anhalt which has carried out a further negotiation with the Federal government resulting in the Federal Government being able to end its financial commitments in return for handing over a lump sum, which must be invested and used solely for financing remediation projects.

In order to use the new responsibility effectively and to steer the remediation procedures accurately, the State of Saxony-Anhalt founded a new institution, the Regional Authority for Exemption from Residual Pollution Responsibilities (LAF). The most important, financially as well as technically, project of the institution is the megasite Bitterfeld/ Wolfen.

Tools in financing and funding of megasite redevelopment, Dominique Ranson and Dr.ir.Laurent Beuselinck – ERM, Belgium

Brownfields are abandoned or unused industrial or non-industrial sites for which expansion or development is not evident due to the presence of effective or possible site contamination, although those sites present an active potential for re-use or (re)development. Brownfields may be small or large facilities (megasites) and are present worldwide. Ranson proposed a classification of brownfields and "roadmap" to understand how their redevelopment might be facilitated. His suggestion was that in most cases there a limited number of "bottlenecks" that constrain the development of a particular site. These bottlenecks, and potential solutions to them, could be most clearly seen from the perspective of the overall "life-cycle" of a site. Often constraints on a particular project are related to the different needs of different stakeholders (e.g. site owner, regulator, investor, etc), so all of the stakeholders need to be consulted in any decision making process. His methodology consists of the following steps:

- Determining bottlenecks, difficulties, critical success factors using questionnaires
- Applying a classification system to each step of the development process
- Considering social impacts (questionnaire)
- Comparing social impact against the degree of difficulty in redevelopment
- Using a classification to consider feasibility.

His classification system consists of three components: a risk index (from low to high); an index of "boundary conditions" (from low to high); and a financial index (from negative to positive). He uses scores for each index.

The risk index is scored from 0 to 3. Sites/projects with no risk or uncertainty score "Low", (0) or (1). Sites/projects with high risk or uncertainty score "High" or (3). Factors determining the risk index are as follows.

- *Enviro-technical aspects*: level of knowledge of soil/groundwater contamination, clarity on target remediation values and confidence in who carries liabilities
- *Development aspects*: the market for the "end-product", and the impact of urban planning
- *Budgets*: confidence and accuracy of projections
- *Risk transfer*: mechanisms of insurance, mechanisms for dealing with budget over-runs, management of potential claims and liabilities.

The boundary conditions index is scored on the following basis: no problems foreseen: low score (0 or 1); bottlenecks foreseen: high score (3). Factors determining the boundary conditions index are as follows.

- *Actors*: the number of stakeholders, distance to residential housing, community pressures, views of authorities.
- *Planning perspective*: environmental/ urban permitting, urban spatial planning, impacts on conservation (e.g. of monuments or landscapes).
- *Location issues*: the characteristics of the local area, its infrastructure and its property market.
- *Financial issues*: possible tax reductions or subsidies, available cash flow.
- *Time period for redevelopment*.

The financial index is made on a (semi) quantitative basis, or modelled on a probabilistic basis, considering the expected costs and revenue, including elements such as:

- Expected costs;

- Purchase of the site (comparable prices (/m²) in neighbourhood);
- Demolition – decontamination (soil – groundwater / asbestos, …);
- Land preparation; Infrastructure (road, sewers, …);
- Development;
- Transaction costs, fees, insurance;
- Expected revenue;
- Selling / letting the end-product, based on local prices;
- Potential subsidies (regional, national, EU).

These three indexes are then combined to provide a single index of the degree of difficulty of a brownfields development project. Indexes are normalised before they are combined on the following basis, as illustrated in Figure 6.

- Boundary conditions: value between 0 and 100
- Risk: value between 0 and 100
- Financial: expected return on investment

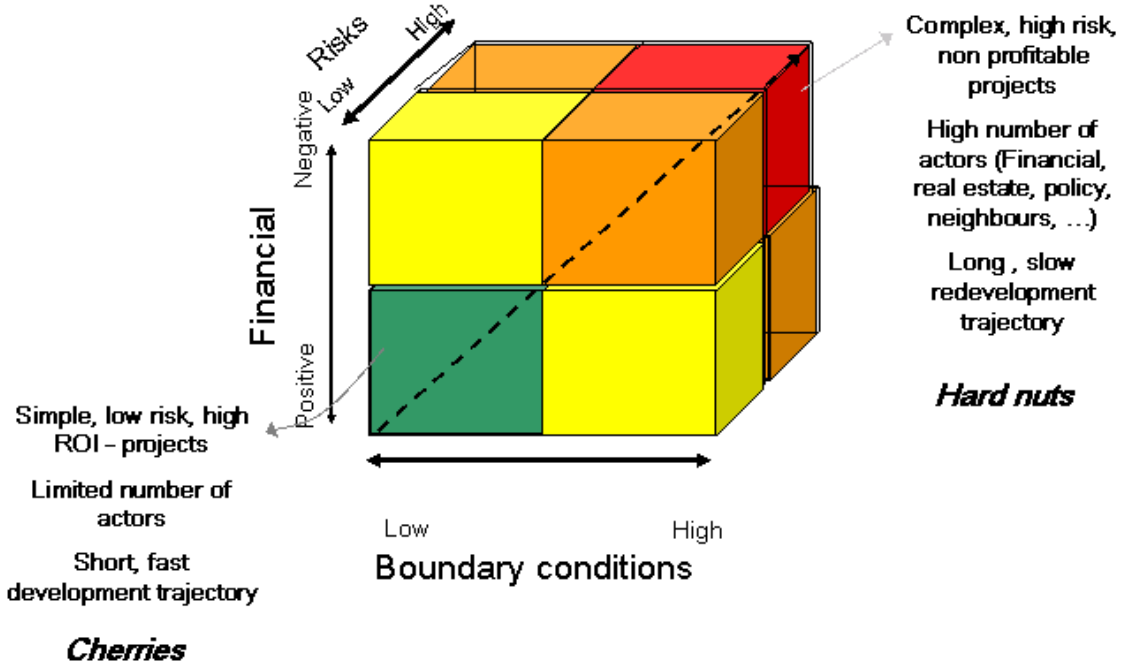


Figure 6 Classifying Brownfield sites on their degree of difficulty.

The classification can change during the brownfield development process based on updated information, such as: more detailed cost estimates, change in economical situation, risks or boundary conditions being eliminated or changed and unexpected costs or changes in risks or boundary conditions. Of particular interest is trying to reduce the degree of difficulty during conceptualisation and planning. For example, the added social value of some redevelopment or regeneration projects may justify a higher level of support by Public Sector funding agencies. Risk transfer mechanisms,

including insurance products, can encourage projects where stakeholders are inhibited because risks cannot be fully foreseen[10].

The INTERREG tool for redevelopment of regions, Philippe Doucet – Joint Technical Secretariat, Interreg IIIB NWE (EC)

The INTERREG IIIB North-West Europe Programme is an initiative of the European Union, as part of its programme of the structural fund, the European Regional Development Fund (ERDF). 5.35% of the EU Structural Funds are being used to support four "Community Initiatives" : URBAN, LEADER, INTERREG and EQUAL. The total ERDF contribution for INTERREG III is € 4,875m. over the 2000-2006 programming period (at 1999 prices).

The objective of INTERREG is: *to strengthen economic and social cohesion in the Community by promoting cross-border, transnational and interregional cooperation and balanced development of the Community territory*. INTERREG supports co-operation between regional and local governments. There are three strands of co-operation:

- Strand A: Cross-border co-operation (67% of INTERREG budget). Eligible areas are border regions, on both sides of EU, including internal borders (i.e. between Member States) and external borders.
- Strand B: Trans-national co-operation (27% of INTERREG budget).
- Strand C: Interregional co-operation (6% of INTERREG budget). The aim of Strand C is: "to improve the effectiveness of policies and instruments for regional development and cohesion through networking, particularly for regions whose development is lagging behind and those undergoing conversion". Funding is arranged across four programme areas: South Zone, North-West Zone, East Zone and North-East Zone.

INTERREG IIIB may be of particular interest to NICOLE members as a possible project funding route. Its aim is to support: "sustainable, harmonious and balanced development in the EU and better territorial integration with candidate and other neighbouring countries". There are thirteen INTERREG IIIB programmes over thirteen wide, overlapping transnational co-operation areas.

€330 million has been allocated to the North West Europe (NWE) programme (www.nweurope.org) for 2001 to 2008, with around €55 million committed per year. Projects may have a duration of up to six years. The North West Europe area includes Ireland, the United Kingdom, Belgium, Luxembourg, part of the Netherlands, France, Germany and Switzerland. The land area is 787,400 km^2 or around 24% of EU land surface. 180,000 km^2 of this is sparsely populated rural land. It is home to 171 million people - 45% of population of the EU. Its population density twice the EU average, with 123 million people in densely populated urbanised areas.

The key objective of INTERREG IIIB NWE is to: *contribute, through an innovative and integrated approach of transnational co-operation on territorial issues, to a more cohesive, balanced and sustainable development of the European territory, and of the NWE area in particular.* The programme is managed as a single unit with one secretariat, one bank account and one budget. The key administrative components are:

- Monitoring Committee: Representatives of the National and Regional Authorities of the participating Member States and Swiss Confederation Their task is overall strategic management and monitoring of CIP (Community Initiative Programme)
- A Steering Committee with similar country representation. Their task is project selection
- A Managing Authority: Conseil régional Nord-Pas de Calais

[10] See also Report of the NICOLE Workshop: Financial Aspects of Site Restoration with an Emphasis on Central and Eastern Europe, 6 - 7 November 2002, Budapest. Web link: www.nicole.org Knowledge base, and Land Contamination and Reclamation 11 (3) 366-395.

- A Paying Authority: Caisse des Dépôts et Consignations
- A Joint Technical Secretariat and Contact Points in the Member States.

Key issues for INTERREG IIIB NWE projects are a strong emphasis on transnationality, both in terms of the nature of the issues addressed and the partnership. Projects must address territorial development issues and support EU goals of social economic and territorial cohesion. Cross-fertilisation is expected to take place between projects and the "NWE Spatial Vision" .This strategic document, still a modest diagrammatic outline at this stage, strives to answer the question : "what needs to be done and where?", and provide a first tentative NWE-wide picture of geographically-differentiated policy options. It is meant to act as an interface between the European Spatial Development Perspective and the NWE co-operation. The CIP is the main reference document for project applicants. It includes an indicative financial plan with a breakdown by priority and measure.

There are five priority areas for projects:

- **Priority 1**: An attractive and coherent system of cities, towns and regions
  - 1.1 More attractive metropolitan areas in the global and European context
  - 1.2 Coherent and polycentric pattern of complementary cities, towns and rural areas, coastal and peripheral regions
- **Priority 2**: External and internal accessibility
  - 2.1 Sustainable mobility management
  - 2.2 Improved access to the Information Society
- **Priority 3**: Sustainable management of water resources and prevention of flood damage
  - 3.1 Land use and water systems
  - 3.2 The prevention of flood damage
- **Priority 4**: Sustainable development, prudent management and protection of other natural resources and of cultural heritage
  - 4.1 Stronger Ecological Infrastructure, Reduced Ecological Footprint
  - 4.2 Protection and Creative Enhancement of the Cultural Heritage
- **Priority 5**: Promoting the maritime potential of NWE and its territorial integration across seas
  - 5.1 Promote transnational co-operation in the enhancement of maritime functions and in the development of more sustainable links between seaports and their hinterlands
  - 5.2 Facilitating co-operation across and between maritime and inland regions.

Key recommendations for submitting good project applications are as follows:

1 Address preferably *transnational issues*
2 Alternatively, aim at a real *pooling of resources*
3 Set up a *strong and reliable* international project *partnership*
4 Deliver *tangible and innovative* results, to the common benefit of all partners, which can include locally validated protocols, etc.

Upcoming EU Liability Directive, Claire Smith – Allen & Overy, UK

The draft Environmental Liability Directive establishes a framework of environmental liability based on the "polluter pays" principle to prevent and remedy environmental damage. It is not all-encompassing and it is not retrospective. Neither is it a civil liability regime - giving compensation rights to individuals e.g. for personal injury, property damage or economic loss. It is intended to:
set minimum standards across EU for environmental liability regimes (e.g. those dealing with contaminated land), provide a common framework of liability (e.g. for the Wild Birds Directive, Habitats Directive and Water Framework Directive) and prevent risk of pollution and clean-up of significant environmental damage in the public interest. It requires the "polluter to pay". It is intended to encourage the clean-up of high risk contaminated sites, preserve or restore biodiversity, prevent water quality degradation and over-abstraction, and also to avoid future contamination.

The rationale for the draft Directive is a based on the view that there are many contaminated sites posing significant health risk in Europe and the loss of biodiversity has dramatically accelerated over last decades. The Directive prevents further contamination by legislating for

- "preventive" actions where there is an "imminent threat of damage"
- "remedial" actions to restore environment where "damage has already occurred".

The assessment of local conditions is a key aim in determining the appropriate remedial action.

The Directive will apply to:

- Operators of IPPC and other installations
- Waste management operators
- Chemicals industry
- Water abstractors
- Agri-businesses (e.g. GMOs, plant protection biocides)
- Transporters of dangerous goods & waste
- Negligent operators who cause damage to habitats

The definition of Operator may also be wide enough in certain instances to include lenders, financial institutions and insolvency practitioners.

It has taken ten years of debate before a "proposal" was published. This is now subject to the EU co-decision procedure. A first reading and European Parliament Resolution took place in May 2003. The Commission's common position was adopted by the European Council of Ministers in September 2003. The next stage is a second reading before the European Parliament, thought to be due in December 2003. The draft may then enter the conciliation process. Figure 7 shows the key elements of the draft Directive.

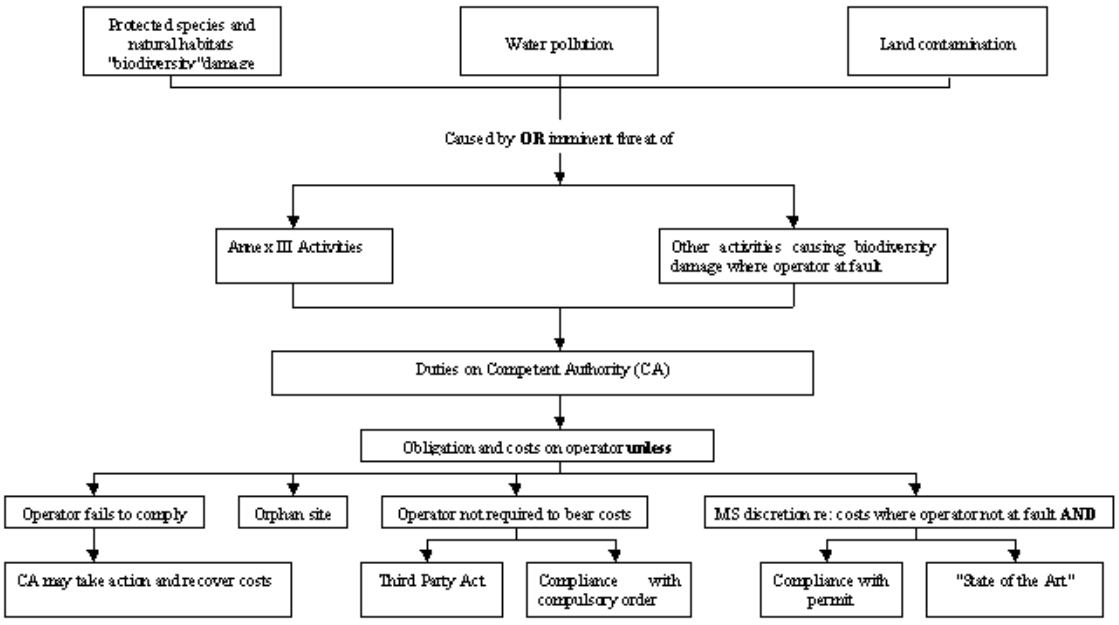


Figure 7 Linkage of the draft Environmental Liability Directive with issues of water and land contamination and biodiversity

The Directive addresses three types of environmental damage namely: bioadversity damage, water pollution and land contamination. Bioadversity damage is any damage that has significant adverse effects on reaching or maintaining favourable conservation status of protected species or natural habitats (designated under Special Protection Areas pursuant to the Wild Birds Directive and Special

Areas of Conservation pursuant to the Habitats Directive) or designated under national law "for equivalent purposes". The significance of any damage is assessed by reference to the baseline condition (criteria are set out in Annex I of the Directive).

Water damage covers the damage envisaged by the Water Framework Directive (WFD) which significantly adversely affects the ecological, chemical and/or quantitative status and/or ecological potential of the waters[11].

Land damage is damage that creates a significant risk of human health being adversely affected by direct or indirect introduction of substance, preparations, organisms or micro-organisms. The land contamination definition does not extend to serious harm to environment, but may be wide enough to include damage caused by Genetically Modified Organisms.

The activities subject to strict liability under the draft Directive are set out in Annex III and include:

- operation of IPPC installation (exclusion for research and development)
- waste management operations
- discharges of pollutants into surface waters, groundwater or air (84/360/EEC) requiring authorisations
- water abstraction/impoundment
- manufacture/use, release, etc. of chemicals, plant protection products, biocidal products
- transport of dangerous goods by road, rail, inland waterways, sea or air
- contained use or deliberate release of genetically modified organisms
- transboundary shipment of waste.

For other non-Annex III activities the draft Directive provides for fault-based liability for biodiversity damage.

The following are outside the scope of the draft Directive.

- personal injury
- damage to property and economic losses
- widespread diffuse pollution (where no causal link can be established within the polluter)
- oil pollution damage
- nuclear risks and damage caused by nuclear activities
- environment damage resulting from an act of war or a natural phenomenon
- activities whose main purpose is national defence/international security
- activities whose sole purpose is to protect from natural disasters.

Preventive or remedial actions can be required under the draft Directive. Where there is an imminent threat of significant damage, operators must take necessary preventive measures without delay. This includes a voluntary reporting requirement to the regulator where appropriate and in any case where there is an imminent threat of damage which is not remedied by the operator as soon as possible.

Remedial actions are required where environmental damage has occurred. All practicable steps must be taken to immediately control, contain, remove or otherwise manage relevant contaminants to prevent further environmental damage or impairment of services. Remediation may be complementary (provides a similar resource elsewhere) or compensatory (compensates for the resource loss, while it recovers), or primary (remediation to "baseline" conditions).

Regulating authorities have to be designated by Member States. They will have a duty to establish which operator caused damage/imminent threat, to assess the significance of damage and to determine what remedial measures are to be taken.

[11] The draft Directive also adopts the WFD derogation in Article 4(7)

There are a number of mitigating circumstances allowed for under the draft Directive. Defences include establishing that the act that caused the damage was carried out by a third party act (providing the operator had appropriate safety measures in place), or that the damage was occurred as a result of actions made under a compulsory order from a regulator. Qualified defences may be available where Member States are allowed discretion about non-negligent acts and where the damage occurred even though the operator was in compliance with its permit, or despite "State of the Art" pollution control. Operators are not liable for biodiversity damage - caused by non-Annex III activities where operator was not negligent. The draft directive currently does not apply to orphan sites.

The draft Directive allows a period of time for measures to encourage the development of financial security instruments and markets by the appropriate economic and financial operators. The possibility of introducing mandatory financial security, however, is a key element that is being hotly debated by the Commission and the Council as part of the conciliation process at the moment.

Other key issues include whether Member States should have any responsibility for clean-up of orphan sites; what activities are scheduled as Annex III or non-Annex III; guidance for determining damage; the qualified defence offered through permit compliance and state of the art; how requests for action are triggered and whether mechanisms need to be put in place to offer the financial security from operators that can pay to prevent immediate threats or remedy damage.

Notes on additional developments since the Lille workshop have been supplied by the author, and are listed in Annex 3.

EU Water Framework Directive and Groundwater Daughter Directive: state of affairs and developments, Victor Dries – OVAM, Belgium

The Groundwater Directive (GWD) supplements the Water Framework Directive, which is now in force. The GWD is linked to the WFD by Article 17 of the WFD, which sets out the scope of the GWD. The draft GWD is shortly to be give its first reading by the European Parliament and the European Council of Ministers. The GWD is likely to be in force in about 18 months time. The linkage of the new GWD with the existing Groundwater Directive and WFD is shown in Figure 8. Transitional arrangements under Article 11 of WFD allow for the continuation of the protection regime of Directive 80/68/EEC.

The GWD's scope encompasses:

- Defining good chemical status – linked to existing EU and Member State threshold values, and set out in Annex V of the WFD
- Pollution trend analysis – to strengthen the Strengthening the "no deterioration" clause of the WFD
- Prevention or limiting of pollution - integrates relevant legislation to consider both direct and indirect discharges (e.g. discharges from diffuse sources).

Under the Directive Member States must identify all groundwater bodies at risk of pollution within 18 months of the GWD coming into force, and provide an inventory to the Commission during June 2006. Member States must also make proposals for environmental quality standards for their groundwater within 12 months of the GWD coming into force. Quality standards for nitrates, biocides and pesticides are already enacted under existing legislation. Where groundwater bodies have been identified as being at risk, sources of risk need to be distinguished between pollutants that may occur naturally and specific synthetic pollutants. Environmental quality standards for pollutants that may occur naturally may be set in the context of a study of the background chemical composition of the groundwater body. Environmental quality standards for specific synthetic pollutants must be based on an analysis of "pressures and impacts".

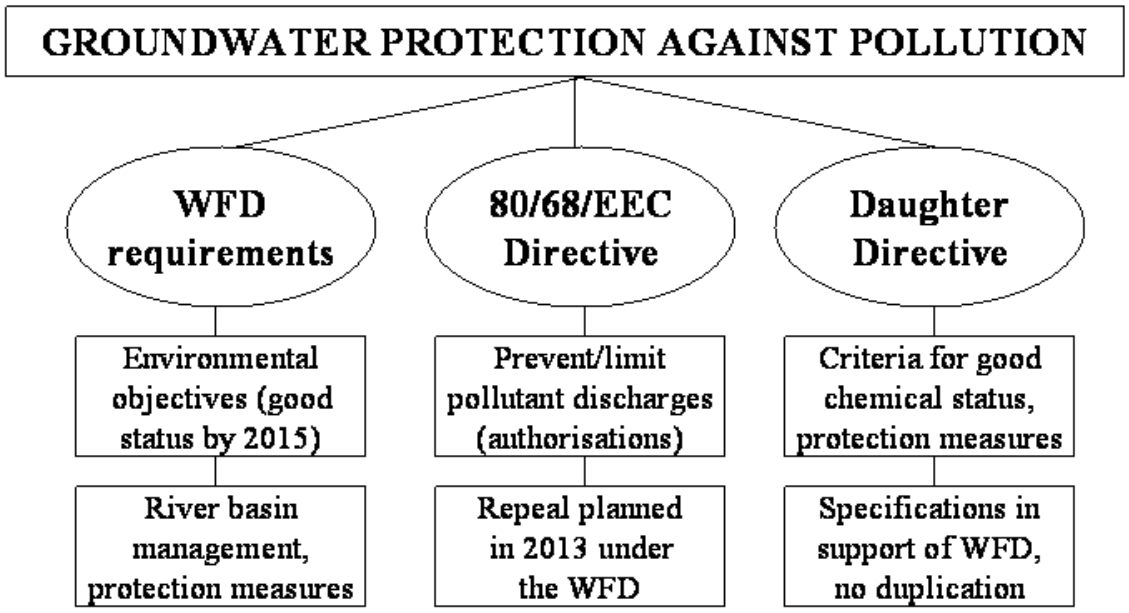


Figure 8 Directives relating to Groundwater Protection

The GWD sets out a minimum list of compounds for which environmental quality standards must be set by Member States: naturally occurring substances: ammonium, arsenic, cadmium, chloride, lead, mercury, and sulphate; synthetic substance: trichloroethylene and tetrachloroethylene.

The GWD also provides a framework to stop further pollution and reduce existing pollution. Direct discharges are controlled as previously under the existing Groundwater Directive (80/68/EEC) and the WFD. Indirect discharges (i.e. discharges occurring after percolation through soil) are to be regulated via a system of prior investigations and authorisations. Control measures are to be based on specific trend assessment for point sources of pollution. This scheme of trend identification and reversal is based on the concept that any significant and sustained upward pollution trend should be reversed, where the increasing trend is of anthropogenic origin. The trend analysis approach applies to all pollutants identified as important for a particular groundwater body. It is illustrated in Figures 9 & 10.

The goal of the trend analysis approach is that pollutants in groundwater bodies affected by (historical) point sources do not expand over a defined area and deteriorate chemical status of the groundwater. It is seen as particularly important in areas of GWB where an upward trend in contaminant loadings might result in adverse effects on associated aqueous or terrestrial ecosystems.

Dries identified a number of problems in the current draft GWD, which were agreed and amplified upon by many of those present at this NICOLE meeting. The timeframe for establishing prevention and remedying of groundwater bodies to achieve "good" chemical status is very short, by 2015, given the complex, and often slow, hydrogeological and biological processes that affect aquifers. The trend reversal concept has some substantial technical weaknesses. This is exacerbated by the EC suggestion that interventions for trend reversal should take place at 75% threshold environmental quality standards. There is also no explicit link between the GWD draft and the developing EC soil strategy. Finally, despite may comments from experts, the focus of the GWD remains with concentrations of selected pollutants, rather than a risk-based approach[12]. It is not clear how the GWD will impact on *in situ* remediation techniques involving the re-infiltration of groundwater, which remain the most likely

[12] Derogations are possible under the WFD, and these may be able to include a risk-based approach to contaminated aquifers.

treatment route for some contaminated aquifers. These problems are likely to be greatest for aquifers beneath urban conurbations or megasites.

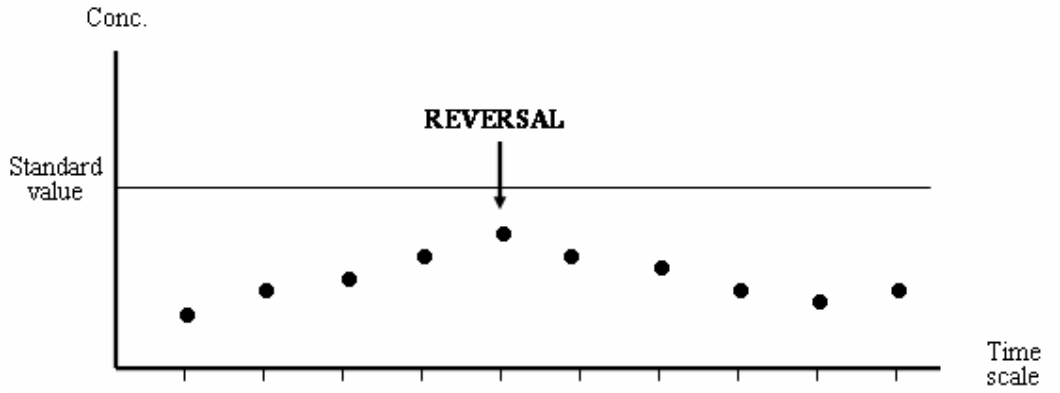


Figure 9 General Draft Groundwater Directive trend reversal concept

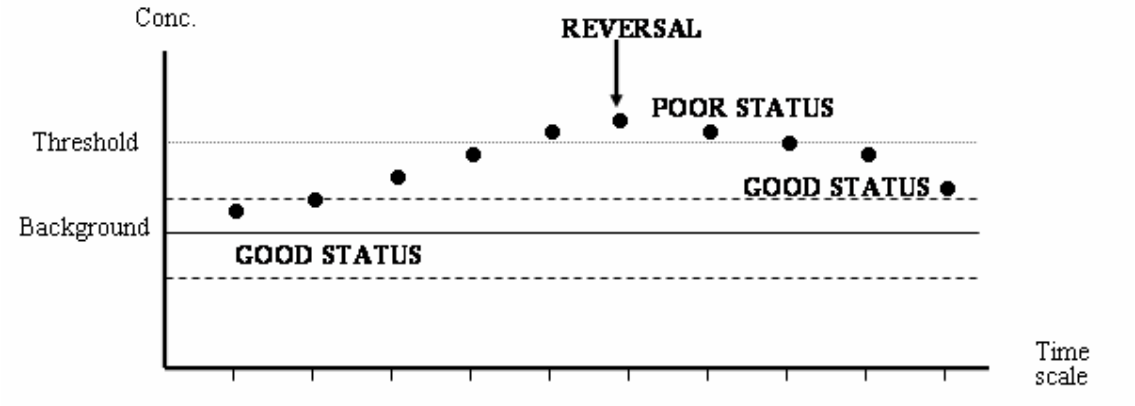


Figure 10 General Draft Groundwater Directive trend reversal concept applied to naturally occurring substances.

Technical problems with the trend reversal concept are that it may be very hard to detect any significant trends given the inherent variability of groundwater measurements, and the seasonal changes from water movements in to and out of the groundwater. It is also by no means clear how trends for anthropogenic origin are to be distinguished from natural phenomena.

Figure 11 sets out the expected schedule for the implantation of the Water Framework and new Groundwater Directives.

NICOLE and EC soil strategy: state of affairs and developments – Johan De Fraye, MWH, Belgium

NICOLE takes an active role in technical consultations related to EC policy and Directives on contaminated land and groundwater. One of NICOLE's key areas of interest is in the developing EC soil strategy. Although no overarching soils framework Directive is yet envisaged, a soils monitoring Directive is being considered. Figure 12 sets out the administrative structure of the consultations on

EC soil policy, and how NICOLE participates in them, both directly, and through its collaboration with the EU Members States Common Forum on Contaminated Land[13].

NICOLE is, of course, not the only consultee in the development of EC soil policy. The EC consults widely during policy development, with comments taken from public authorities, academics, industry, trades unions, nongovernmental organisations and private citizens. EC policy develops through a set of formal publications, and consultations are held on drafts of these documents:

- Communications:
  - new legislative strategies, areas not yet regulated by EU law
  - first steps of a new policy strategy
  - involves stakeholders in the very early stage of the legislative process
- Green Papers:
  - consultation process at European level
  - range of ideas in a specific policy area
  - addressed to interested parties, organisations and individuals
- White Papers:
  - often follows a Green Paper
  - official set of proposals for Community action in a specific area presented for further development.

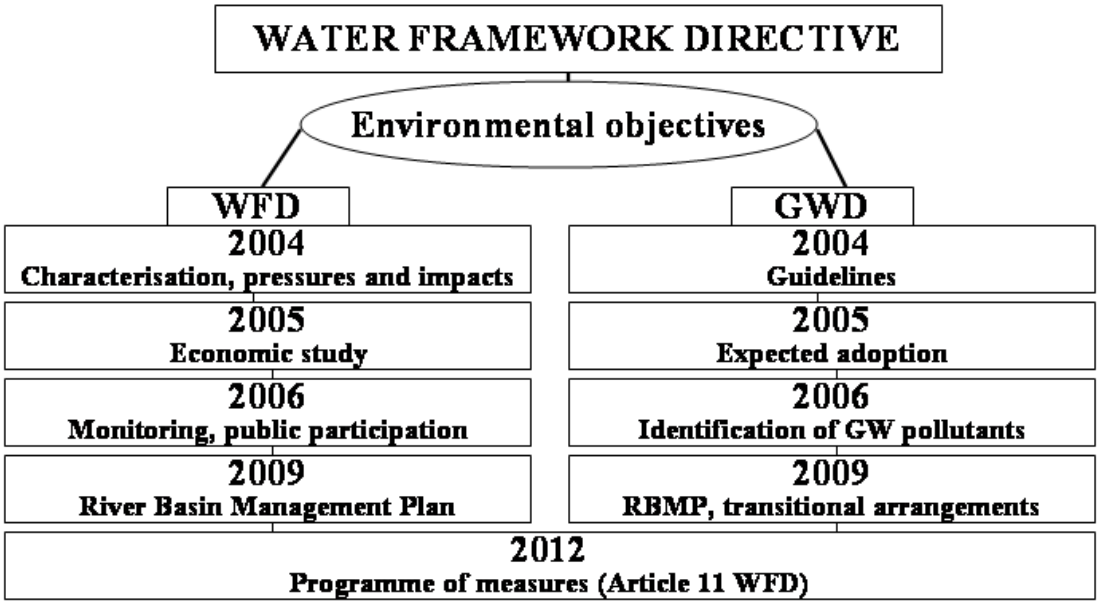


Figure 11 Expected schedule for the implantation of the Water Framework and new Groundwater Directives[14]

[13] See web links in the Knowledge Base in www.nicole.org

[14] Dries' presentation and diagrams were extracted from a previous presentation by Phillipe Quevauviller of EC DG Environment

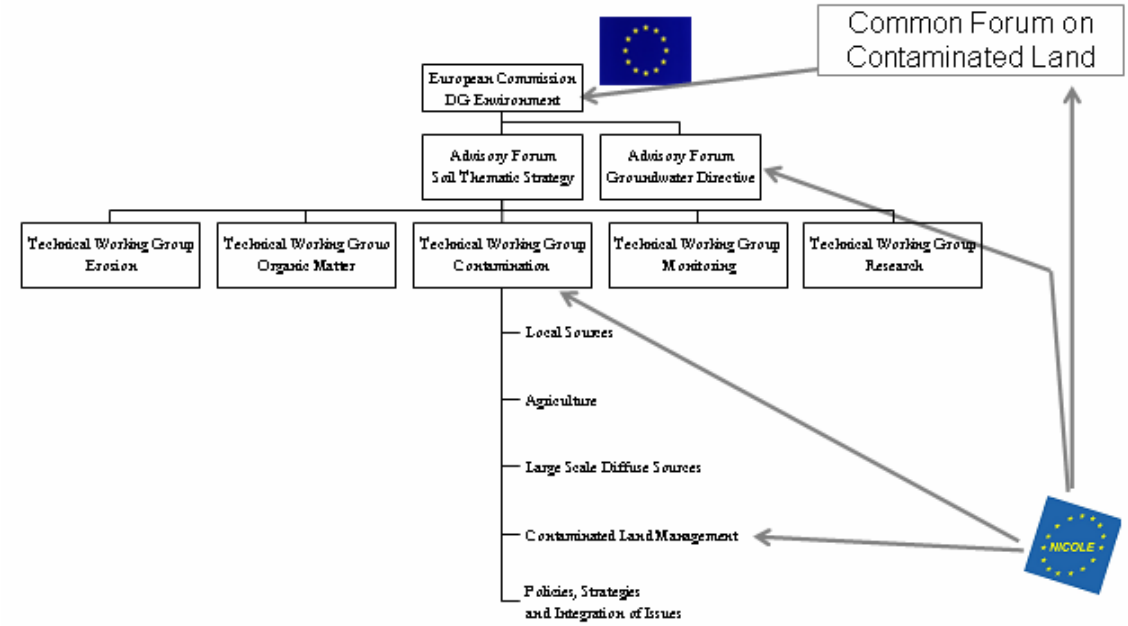


Figure 12 NICOLE's Participation in EC Soils Policy Development

EC Communication COM (2002) 179 Final, "Towards a Thematic Strategy for Soil Protection" sets out the case for EC policy on soil protection. COM (2002) 179 described the multiple functions of soil, identified its characteristics, and identified the main threats to soil. It reviewed EU policy related to soil (see Figure 13) and identified where there might be gaps in soil protection policy. From this it established a basis for future policy development, and set out a strategy for policy development into 2004. In essence, COM (2002) 179 defined soil as: the top layer of earth's crust including sediments and subsoil, as deep as human activities go. It did not encompass groundwater. COM (2002) 179 takes a holistic approach to soil, which is seen as having a number of key functions:

- It provides a physical and cultural environment for mankind.
- It stores, filters and transforms minerals, organic matter, and groundwater.
- It is a habitat and gene pool.
- It supports food and biomass production.

COM (2002) 179 identifies several distinctive features of soil. It is a very variable medium so that a strong local element has to be built into soil protection policies. It is a non-renewable resource, whose degradation leads to reduction in its potential to perform functions. The soil provides considerable storage and buffering capacity, which also applies to man-made chemicals. The agricultural value of soil must be preserved. Soil has abundant biodiversity. The threats to soil, and the importance of its function necessitate the monitoring of soil quality. The threats to soil reviewed by COM (2002) 179 include: erosion, decline in organic matter; soil contamination – local and diffuse; soil sealing; soil compaction; decline in soil biodiversity; salinisation; floods and landslides.

The actions outlined by COM (2002) 179 at a policy level included ensuring a stronger focus on soil in existing legislation (see Figure 13); new or revised legislation: mining waste, sewage sludge, compost, land use planning and pesticides; and a new Directive proposal for soil monitoring by mid-2004. A further Communication is to be drafted covering three priority areas: soil erosion, contamination and organic matter. Possible longer term ambitions might include a soil framework Directive, EU wide

reporting of the state of soils and an EU soil conservation service. Draft stages of these various activities are available from http://forum.europa.eu.int/Public/irc/env/Home/main.[15]

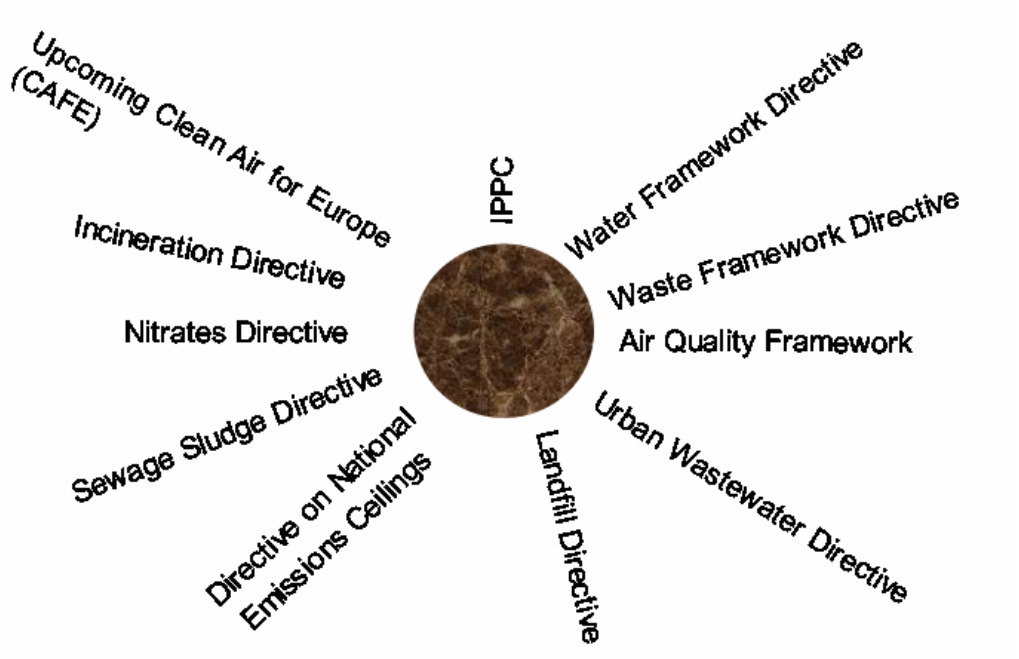


Figure 13 Existing EC Legislation containing elements of soil protection

De Fraye participates in a Technical Working Group (TWG) of the soil strategy development relating to "contamination" for NICOLE. This group has identified a number of key issues for soil protection:

- absence of common definition of contaminated land
- distinction between local and diffuse contamination
- lack of comparable information
- a very high number of contaminated sites (estimate 750.000)
- high costs of remediation
- regional differences, hence a need for subsidiarity
- common approach to remediation to avoid distortions in internal market
- liability schemes, hence a need for the polluter pays principle
- the need for different treatment of historical and future pollution.

The TWG suggests that where remediation – *for historic pollution* - of soil is needed, this should be based on pragmatic risk oriented remedial, using the concept of *Best Available Technology (BAT)*. Remediation goals should be linked to achieving *fitness for purpose*. The TWG defined historical pollution for contaminated land management as: *anthropogenic in origin and poses a risk in a specific land use scenario*. It suggests that the CLARINET approach of Risk-based Land Management is a good basis for considering historic pollution problems (see Figure 14).

The approach to future pollution should obviously focus on prevention. The overall aim of EC soil strategy is to ensure that there are no further "additional impacts" on soil. A difficulty with this approach is in how historic and contemporary impacts, such as contamination can be distinguished. The TWG has suggested that for new pollution from point sources there should be immediate risk-based remediation to satisfactory level. The TWG suggests that EC approaches to managing diffuse

[15] For soil policy development information 1- Click in the group "Soil Policy"; 2- Click in the Tab LIBRARY; 3- select a TWG, e.g. "Contamination"; 4- Click on "Working Group"; 5- Click on "Interim Reports"; etc.

sources should be driven by Member States governments. However, there are some important areas where the existing level of knowledge is too poor to support regulatory development, in particular:

- definition of risks on food quality, ecosystem, groundwater
- define pathways and processes
- quality control of emissions to water and air
- definition of acceptable deposition limits (critical loads) for soil.

The TWG also identified a number of deficiencies in the current soil strategy development, and other EC initiatives relating to soil protection, most critically:

- An integrated approach for soil strategy development and the draft groundwater Directive is both essential and possible.
- There is a need for harmonisation of risk assessment approaches, including: identical basic concepts (toxicology, chemistry, etc), consensus on tolerable daily intakes (TDIs). The TWG, however, feels that a consensus on excess cancer risks is unlikely as it depends on political decisions.

Metaleurop - France: Health aspects and the impact of restrictions for use, Jean-Marie Haguenoer and B Zuindeau – University of Lille, France

In 1987 the authorities carried out a screening of lead levels in umbilical cord blood of new born children. This revealed that 14% of the children tested had excessive blood lead levels (i.e. > 100 µg/l). Four subsequent sampling campaigns were carried out for children aged between 2 and 4 years of age between 1994 and 2003. These surveys showed a fairly uniform frequency of excessive blood lead levels over time (16.6%-16.7%-15.9%-18.2%) – see "sub total" row in Table 2.

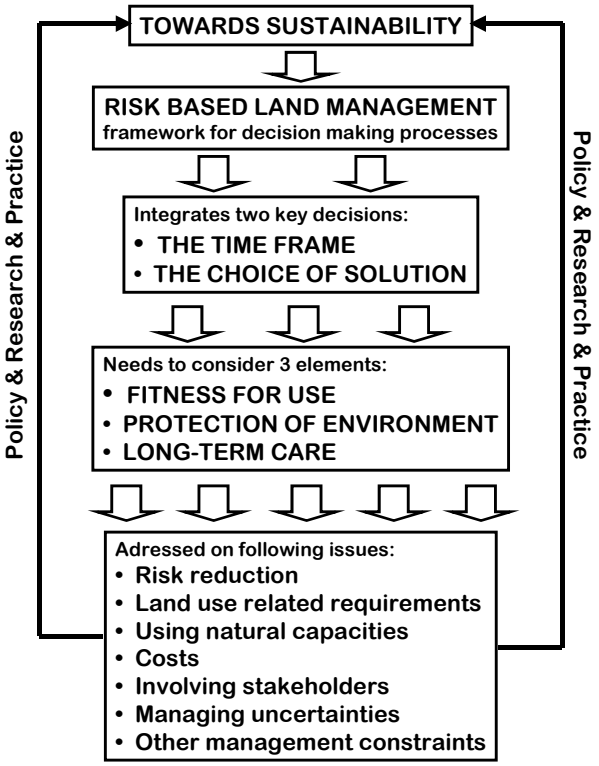


Figure 14 The Risk-based Land Management process (see also www.clarinet.at)

These consistently high frequencies are probably linked to a failure to act on the local environment. Consequently individual prevention measures are administered to the families of these children to limit their dust absorption.

An epidemiological survey of children aged between 8 and 10 years and adults confirmed the prevalence of high blood concentrations of lead in the area, and showed that there could also be health problems linked to cadmium. Surveys and research in this area and in the home surroundings of the children suffering from infantile lead poisoning have showed the critical role played by the hand-to-mouth relationship.

Local families have accepted the principle of screening their children very well, since the level of participation in the surveys is still over 80%. Similarly, the measures to be taken to reduce exposure are implemented well by both by the local authorities and the families. However, families remain concerned about the causes and the consequences of the high blood lead levels.

The health survey results partly triggered the portfolio of actions in the area around the plant mapped with soil concentrations of lead above 500 ppm of lead area (described above).

In addition to its relatively serious impacts on health, the Metaleurop plant has had a major impact on the local housing market. Hedonistic price modelling indicates that proximity to the plant has a significant negative effect on the selling prices of the local housing, in the region of around €3,800 per house within 500 ppm lead zones and €13,300 with the > 1.000 ppm lead zones. House values increase with increasing distance form the Metaleurop plant. The final closure of the firm and the setting up of a Scientific Committee for the Metaleurop site have further sensitised the local population, the authorities and the media.

Table 2 Blood lead levels found in children aged between 2 and 4 years of age – number of samples with excessive[16] blood lead (percentage of sample size)

Commune	**1994-1995**	**1999-2000**	**2001-2002**	**2002-2003**
Courcelles-les-Lens	8 (12,7 %)	5 (10,4 %)	12 (15,6 %)	10 (14,3 %)
Evin-Malmaison	18 (20,9 %)	15 (31,9 %)	17 (26,6 %)	13 (24,5 %)
Noyelles-Godault	10 (14,7 %)	6 (11,1 %)	0 (0,0 %)	9 (17,0 %)
Subtotals for the same towns sampled in the initial 1987 survey	**36 (16,6 %)**	**26 (16,7 %)**	**29 (15,9 %)**	**32 (18,2 %)**
Dourges (more distant)		1 (2,1 %)	3 (4,1 %)	1 (2,1 %)
Leforest (more distant)		2 (3,4 %)	2 (3,6 %)	1 (1,5 %)

[16] I.e. > 100 µg/l

Lessons learned in communication with citizens around a multi industrial site in the vicinity of Dunkerque, Myriam Duchène – ALTERIS France

The company Sollac Dunkerque (now called Arcelor) encounters problems with its neighbours because of atmospheric emissions, including sulphur dioxide, dust, and graphite particles; and also because of noise from the site since its establishment after the Second World War.

The level of dissatisfaction has increased over the years, in spite of a large decrease in dust emissions, which have been reduced by 50% over ten years between 1989 and 1999. All the same, residents have had the impression that Sollac has not made any efforts and that the pollution has stayed the same. The neighbourhood is Fort Mardyck, the community most close to the site, where some houses are only 10 meters away from the site.

Sollac had has planned large investments to further combat the emissions, and has been certified to ISO 14000. In 1999, the company decided in to start up a communications strategy for its nearest neighbours. Two other companies, also based at the Sollac site (GIS and Europipe) have joined this strategy as their operations contribute to the complaints.

Two voluntary working groups have been set up with residents. One group deals with noise, the other with dust. Each working group sets its own agenda, has two meetings a year, and a general meeting open to all the inhabitants of Fort Mardyck. Each year a written emissions inventory has been made and distributed in the whole village, the local government, the DRIRE (Directions Régionales de l'Industrie, de la Recherche et de l'Environment) and the vice-prefecture.

The atmosphere has been a bit tense since the working groups started. However, residents now have access to the emissions information, and have the possibility of making visits to investigate the origin of noise and dust. Any solutions they suggest are investigated or tested.

Investments planned at the plant include: sulphur dioxide abatement, and abatement of diffuse dust. At the request of the working group, this second investment will be replaced by an investment for abating the emission of graphite particles. At the same time various adaptations have been made to counter noise, based on suggestions from the residents.

Today Sollac continues to meet with the working groups. The "communication-operation" has been transformed into an educational operation and a deeper level of consultation. Around 30 people, take part in meetings and visits on a regular basis, and have been remarkably faithful to the initiative since it started. In 2001, an opinion study for Sollac showed a considerable improvement in its image among the population of Dunkerque and its environs.

Social and health aspects, Fred Woudenberg – Municipal Health Services GGD Rotterdam, The Netherlands

Two important aspects of the management of contaminated sites are health and risk perception. At first sight health seems to be the most important of the two. This is not true in practice. The health risks of living at or close to a redeveloped contaminated site are small. The perception of risks can be considerably larger. Many experts and responsible authorities react to situations where actual health risks are small or do not exist, yet the public retain substantial worries, by calling this risk perception "irrational". They then try to correct this irrational view by the dissemination of information containing the "true" facts about the health risks. This response nearly always fails.

There are good reasons why the public is only seldom convinced by information given by experts or authorities. People worry more if exposure to a contamination is not voluntary, if they cannot influence the exposure themselves, if there is a lot of (negative) attention in the media, if they think

that information is withheld, and if they do not trust responsible authorities (as illustrated in Figure 15). Trust in experts and authorities has eroded substantially over recent years. At the same time the population has grown more affluent and emancipated and hence more critical. Western society is a critical, well-educated public which is confronted with a great number of threats, including soil pollution and contaminated industrial sites. While for understanding and protecting them against these threats, people depend on experts and authorities, they do not always trust them.

The practical impacts of perceptions of risks are as real to society and economy as the risks themselves. Hence the management of risks must incorporate risk perception in order to cope with the increased importance of risk in modern society. It must ensure good communication about risks, and in this communication, risk perception must have its place.

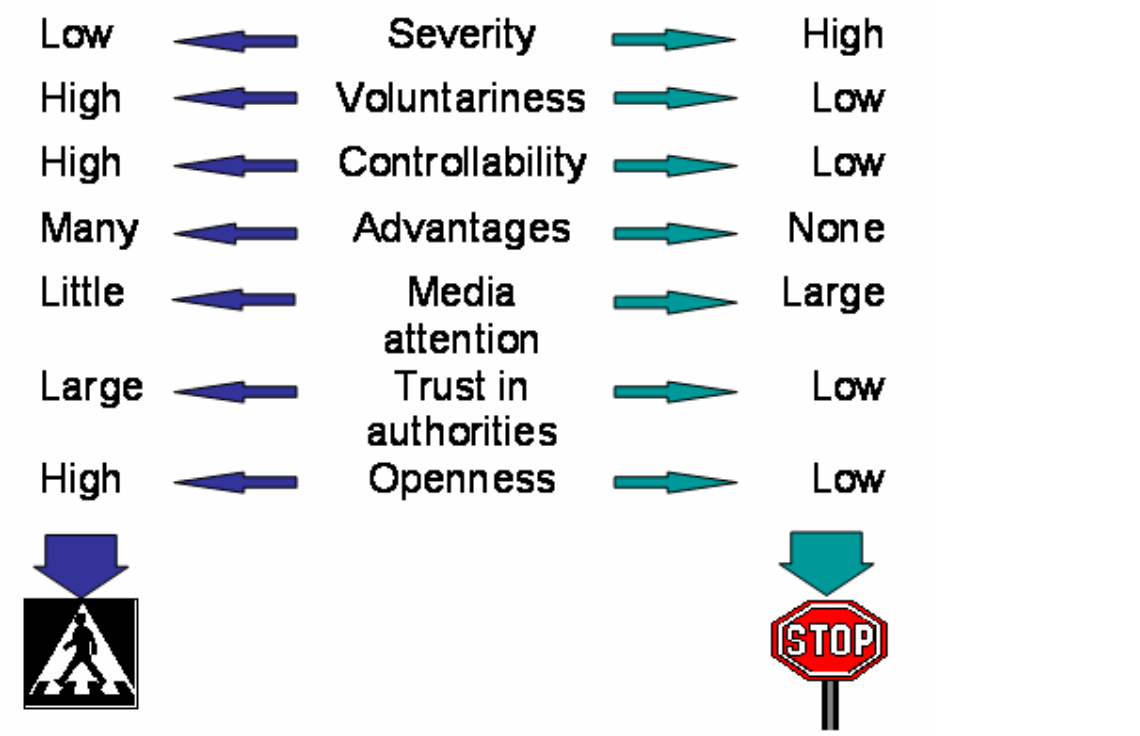


Figure 15 An illustration of the factors governing the perception of risks (from contaminated land).

Different parties need to be explicit, open and honest about their own perceptions.

- Risk communication is *not* the transmission of outcomes of risk assessments calculated by experts in order to *give* the public knowledge about objective and real risk levels, which should automatically lead to a level of fear in accordance with this risk level.
- Risk communication *is* taking the fears of people and the causes of these fears seriously, to engage in two-way interaction and to be willing to take measures that are not necessary from a more technical perspective. This always involves being open and giving information about the contamination to people who are planning to rent or buy a house at or close to a contaminated site.

People must have freedom of choice about whether they wish to buy / rent. For some sites it can also be useful to set up, in co-operation with the public, a monitoring programme to show the public that spread of contamination does not occur. Under these conditions it must be possible to have people live on a remediated site without them worrying about health risks.

Port of Rotterdam: Experiences with an integrated management system, Bert Satijn – SKB/NOK, The Netherlands

The Port of Rotterdam is an industrial megasite of 5,000 ha with about 1,000 active industrial sites and potentially 15,000 "hot-spots" of contamination. 95% of the sites are owned by the Port of Rotterdam and rented or leased to companies. On many sites, soil has been contaminated by industrial activities and contaminants have migrated into groundwater in the direction of receptors, which are the sediments and surface water in the harbours and the deep groundwater underneath the megasite.

Nowadays contaminated site remediation is standard work. However, if remediation were to proceed on a site by site basis it has estimated that the total bill for remediation would be in the region of €1.5 billion, even if it was technical feasible.

Hence the management of soil quality on a megasite requires an integrated approach to come to cost efficient solutions. An integrated approach is necessary to deal with the complexity of a megasite which has numerous hot spots, complex geohydrological conditions, many site owners and operators, and different receptors each with its own regulatory negotiation. Contamination spreads across sites through the aquifers. Plumes mix and remedial activities focussed on one location have their influence on the neighbouring locations. Thus, the remediation of groundwater in the area intrinsically requires an integrated approach is needed. As mentioned above the Port of Rotterdam is following the Integrated Management System (IMS) approach of the WELCOME project. The aim is to provide an integrated approach to risk management over the next 50 years. The driver for this initiative is the need to achieve good groundwater status 2015 to comply with WFD.

The following tasks are nearing completion:

- Inventory of the megasite, development of the conceptual model and formation of group of stakeholders;
- Risk assessment for all receptors; and
- Development and selection of management scenarios.

For the surface water as receptor, it seems to be the most cost efficient solution will be to reduce industrial discharges other than those originating from contaminated soil. The inventory work has identified that these discharges are substantial sources of contamination to surface water, compared with diffuse and groundwater sources, for example see Figure 16. The contribution from soil to surface water in mass balance for benzene is around 2%, for 1,2-DCA (dichloroethane) around 2 % and for perchloroethylene around 7%. The major sources of surface water contamination are permitted (industrial) waste water discharges.

The strategy in Rotterdam for the deep groundwater is a combined strategy of:

- a site-specific approach of partly removal of hot spots of contaminated soil and groundwater in the shallow aquifer based on an analysis of the groundwater system and inventory of contaminant sources, hot-spots can be prioritised on the basis of the flux of contaminants leaving them for the groundwater system,
- a megasite wide integrated approach using (enhanced) natural attenuation of the deep aquifer in combination, if necessary, with containment measures at the boundaries of some industrial sites.

The national legislative framework as well as the EU Groundwater Directive will be used as reference. The (shallow) groundwater system around the megasite is therefore seen as a *risk management zone*, i.e. a zone around a megasite with an actual or potential impact of contaminants from this megasite which can be used to provide the time and space to manage the risks to a downstream receptor in a cost efficient way. The costs of this approach are estimated as being €50 million/year, which is double current groundwater management expenditure, but less than the expected expenditure of complying with approaches that would typically be adopted under existing regulations for WFD compliance – estimated as €50 million/year.

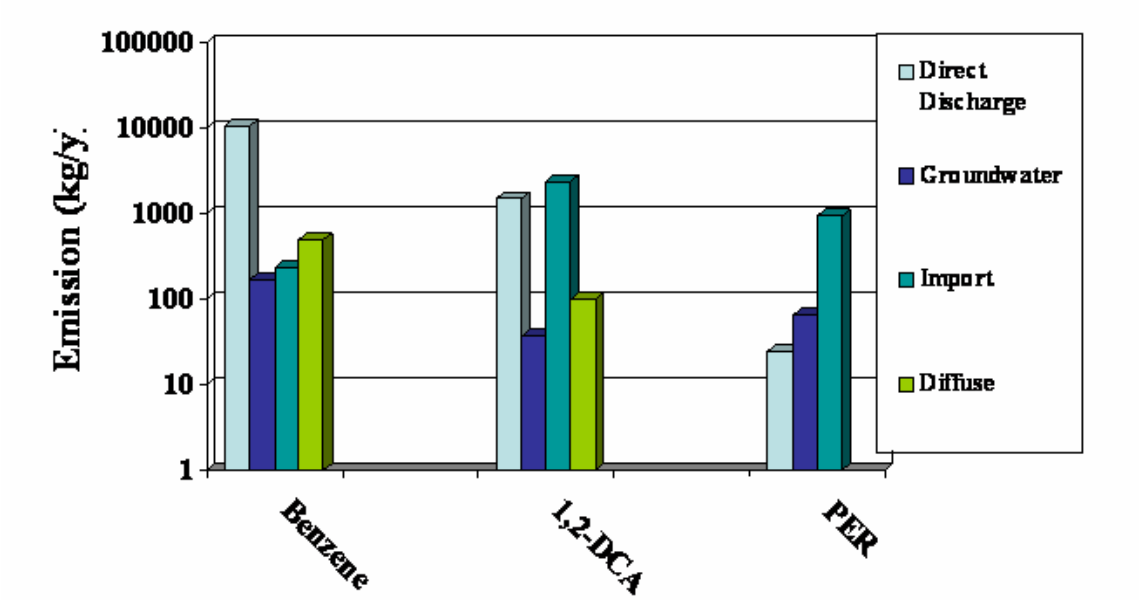


Figure 16 Inventory of surface water contamination sources for some example organic contaminants

There are some differences of opinion and difficulties yet to be resolved. The lack of an integrated regulatory system for soil and groundwater does not suit an integrated approach to megasite management. Some use of the deep aquifer will be required in the risk management zone, but what proportion of the deep aquifer this would be is not yet clear from a technical perspective, and also has to be resolved with the regulators. There is also a difficulty that Dutch legislation will take time to be in line with the European legislation. Stakeholder involvement has been somewhat patchy. The Port of Rotterdam, Ministry and Regional Authorities are promoting an integrated approach. Some site owners/operators and surface water authorities are hesitating. The public is not yet involved. Some key administrative tasks are yet to be completed: determining long term liabilities for site owners/operators, providing an overall management organisation for the megasite and its risk management zone, securing full stakeholder involvement including engagement with the public.

Integrated management, Jan Vogelij – future chair of the European Council of Town Planners

Two key characteristics of spatial planning, relevant to megasites are that the planning is likely to need to be long term and very large scale. Policy and regulations pertinent to megasites falls under several sectors, e.g. economic policy (regeneration), environmental regulations (remediation), water management (groundwater and surface water) and land use planning (housing, zoning). Spatial planning generally has to take an integrated view across these sectors, and the principals for spatial planning are typically authorities that manage territory. Spatial planning usually has a long term view, seeking improvements into the future. Viewing problems from a spatial planning perspective, with its long term and integrated nature, can be a benefit for the management of megasites. For example, what might seem feasible in 50 years could encompass a far greater range of possibilities than what might seem feasible within five years.

A fundamental step towards achieving a sustainable long term management of a megasite is therefore to establish a shared *vision* for the future amongst the stakeholders involved. This conceptual thinking can then be used to prepare policy decisions about future developments in a balanced and sustainable way. The future oriented approach has the advantage to take the focus away from current

efforts to solve actual problems and difficulties and reorient the attention towards a commonly desired future. The aim is to generate discussions that are more about opportunities and challenges, rather than problems and protecting interests. The significance of megasites means that they should be approached not just from a local planning perspective, but also from a regional planning perspective.

A common vision creates a framework for identifying solutions for actual problems that support the development towards the desired future situation. This also helps to select those technical solutions that fit into the desired situation.

4 Discussion Sessions

Discussions focussed on identifying possible "tools" for implementing sustainable land management for megasites from the perspective of:

1. liability barriers and challenges for management of megasites
2. barriers and challenges to (co-) finance the management of megasites
3. barriers and challenges for communication around the management of megasites
4. barriers and challenges in sustainable management of contaminated megasites

However the first discussion was necessarily over what constituted a *megasite* and what constituted *sustainable land management.*

Megasites

Definitions for *megasite* proposed over the course of the workshop have included.

1. WELCOME has defined *megasites* as large scale contaminated sites, that pose a large potential or actual risk to deterioration of groundwater, sediment, soil and surface water quality (suggested by the WELCOME project)
2. Megasites are large conurbations of sites where contamination has arisen independently. However, often over time, as contamination has spread, these environmental problems caused by these sites have become inter-linked. The management of such conurbations may therefore be facilitated by taking an overarching approach, rather than trying to deal with each site on an individual basis (suggested by the report author)
3. a megasite is an area where contamination sources and pathways spread across multiple owners, and which requires the involvement of more than one land owner to understand the risk and to deliver a cost effective solution. A critical factor in megasite management is therefore the management of information between site owners and this may not all be related to risk management (see the summary of Steve Wallace's viewpoint below).

For many at the Lille meeting Steve Wallace's suggestion seemed the most useful basis for defining megasites. However, a significant number felt that the issue of scale brought in special issues, for example the need for a regional planning perspective, that were not encompassed in the definition suggested by Wallace. One possible way forward might be to consider a broader classification than "site" or "megasite", that recognises that there can be similar issues arising from transboundary pollution and multiple ownership on relatively small sites, as well as sites that cover a large geographical area.

Viewpoint: what is a megasite (A Secondsite Property Perspective), Steve Wallace, Secondsite Property Holdings Ltd

Presentations about Rotterdam, Bitterfeld and the Nord pas de Calais region have shown megasites as being enormous areas of land. Wallace's contention was that smaller sites could also be "megasites".

He suggested a simple definition for a megasite is an area where contamination sources and pathways spread across multiple owners, and which requires the involvement of more than one land owner to understand the risk and to deliver a cost effective solution. A critical factor in megasite management is therefore the management of information between site owners and this may not all be related to risk management. He illustrated this point of view with three examples.

1. **Shared history**. Wallace described a gasworks where Secondsite Property Holdings has partial ownership. The site had been split at some point in the past for operational reasons, as some facilities had still been needed. Secondsite now sought to sell its site, as its operational use had since finished. Site investigation revealed groundwater pollution but no source on Secondsite site. A review of historic information suggested a possible source on an adjoining site but no site investigation analytical data was available. The regulator required "proof" that the source was not on Secondsite site, but would not use its enforcement powers to investigate the adjacent site. This situation jeopardised the sale of the Secondsite site.

2. **Groundwater**. In a second example Wallace described a Secondsite site which was source of groundwater contamination. However other sources of the same contaminant were likely on adjoining sites. Secondsite was seeking to voluntarily remediate site so that it could be sold. However, Secondsite could not agree remedial objectives in isolation. The adjacent land owners were not willing to co-operate, and so the Secondsite land is potentially subject to formal Contaminated Land designation despite Secondsite's willingness to remediate.

3. **Cross-boundary source**. In the third example Wallace described an area where a source of contamination crosses multiple site boundaries. Clearly it is not desirable to excavate half a source zone, since recontamination of the Secondsite site would be likely. Unfortunately, the adjacent owner is not financially viable. Two possibilities are to excavate and remove on the Secondsite site and then install containment to protect the boundary, or to take private legal action against the other site owner. However legal action is not an approach to be taken lightly.

4. **Proving a "negative"**. Secondsite have on occasion been asked to prove that we are not the source of contamination. Wallace suggests that with any reasonable scope for a site investigation it is impossible to categorically prove that there is no possible source in a site. Absence of a positive result can also be taken to mean that the site investigation has not looked hard enough. However, with adequate sampling on neighbouring sites it would be relatively easy to determine where significant sources were most likely to be. Hence a site owner with investigation data wishing to move forward with a sale or development can be faced with situations where, because they wish to proceed with a site change they have a high density of data on their "side of the fence"; with little information on the other side, and little incentive for the other site owner to carry out an investigation. Hence the source remains unfound and the development or sale is stalled.

Wallace summarised a number of common issues that affect smaller megasites. The information available is very variable both in quantity and quality. Liabilities are often uncertain or unknown and different land owners have different views of timing and priorities as well as different levels of resources that they can bring to bear on problems. It seems that proactive land owners are often the easiest target for regulators who also often find it easier to talk science rather than to approach a difficult neighbour.

Sustainable land management

A number of papers described themes that might be a feature of sustainable land management, including the combination of an overarching view of land management problems, a risk-based approach to decision making and an integrated evaluation of the environmental, social and economic impacts and benefits of any particular approach to land management. It was felt that the lack of

connectivity between the development of EC policy on soil and water was not helpful to achieving a more sustainable approach to the management of the problems of contaminated land and groundwater, and that this message should be made very clear to European institutions.

Overall sustainable land management was thought to be related to the CLARINET concept of *Risk-based Land Management*, but NICOLE members desired a more all-encompassing approach that took a more explicit account of economic and social factors in decision making. However, the workshop did not agree a working definition for *sustainable land management* and work towards finding such a definition will be taken forward to the next NICOLE meeting in Runcorn in February 2004. The Service Providers subgroup of NICOLE is working on a paper that overviews work related to achieving sustainable land management (draft attached as Annex 2).

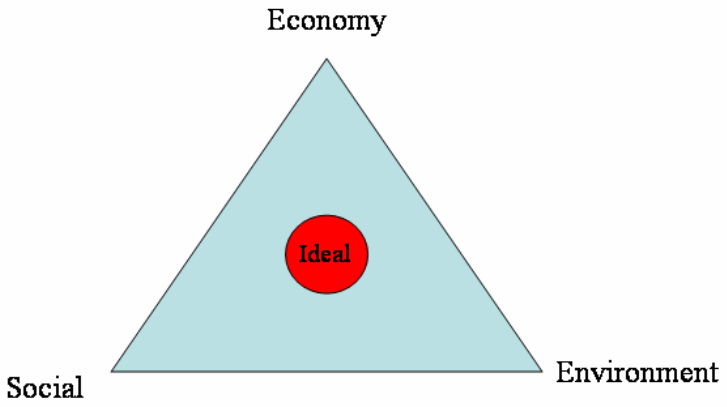
From the perspective of this report, *sustainable land management* is a phrase that has been coined by NICOLE to describe a risk-based approach to land management that also takes into account the principles of sustainable development, a balanced environmental, economic and social approach. The key features of such a balanced approach, and indeed its value, were summarised in a series of charts by Steve Wallace, shown in Figure 17.

Implementing sustainable land management

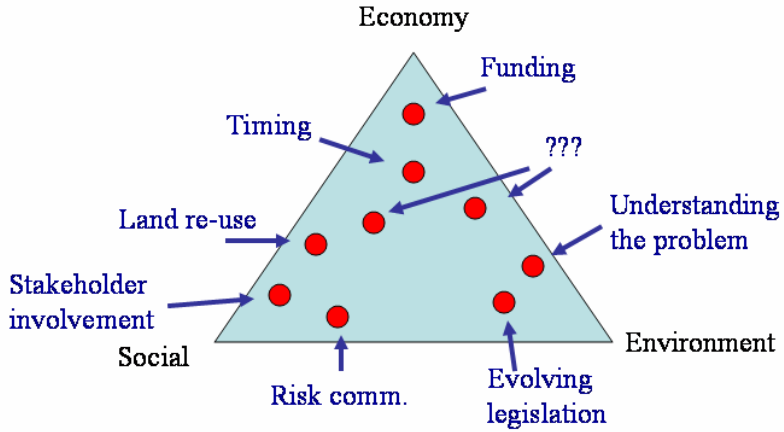
It is local, regional, national and/or EU economies that have to support what ever management interventions are made to deal with the legacy of contaminated land. Economic activity, in its widest sense, is the generator of the wealth that we need to manage the legacy of contaminated land. It is clear that solutions for megasites require more than technology alone, and *have to* involve wide ranging discussions with a broad range of interested parties. It is also important to shift the paradigm for managing these sites away from one of dealing with problems to one of creating opportunities. It is also important not to forget that current causes of contamination become the legacy future unless they are prevented now. It is justifiable to take a firmer view on current or new contamination problems than historic problems for two reasons. Firstly, the historic problem has already occurred and the passage of time has made problems very difficult to resolve without the use of economic resources that might be better applied to other social and policy goals. Secondly, prevention is easier than the cure, and that is a good incentive for better management of facilities in the future.

The vision thing! It is of course hugely challenging to be faced with a situation where wide ranging discussions are being held on wide ranging issues! Indeed it is perhaps a recipe for inaction and mutual recrimination. It is therefore very important to begin with a *vision* for the future of a megasite, and some ideas about how that vision is to be achieved. A vision cannot be generated by committee. It will almost invariably be the product of the imagination of just a few people. The challenge is then to bring this vision, perhaps gradually, to other stakeholders, adapting it to include their ideas, needs and ambitions; and all the while making the vision and its rationale more concrete both as more people agree with it, and as its technical, social, economic and environmental basis is developed. It is perhaps also better to be pro-active in developing an overarching concept and vision, rather than wait for a change in policy, regulation or economic instruments which may not really provide an ideal solution. Working from the bottom up may even allow those involved with a megasite to influence future developments in policy, regulations and economic instruments in a way that might benefit and support the achieving of a shared vision.

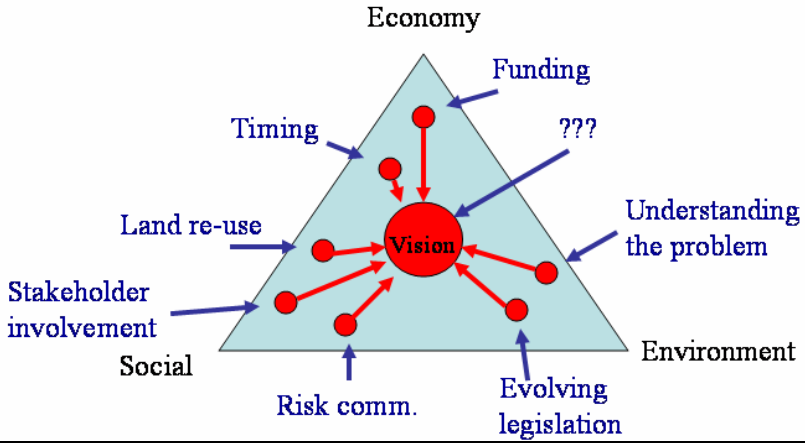
Of course solutions for megasite problems need more than a shared vision. Detailed planning, technical innovation and money are all necessary, but without a vision there is no hope for an integrated, holistic and sustainable solution.



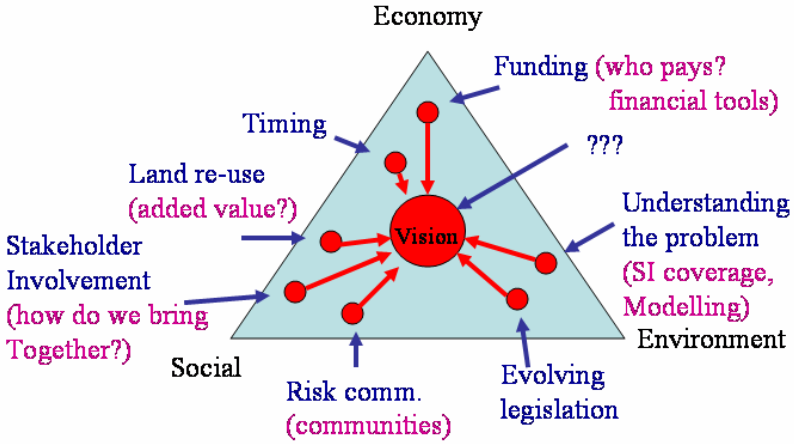
sustainable contaminated land management is a balance between social, environmental and economic factors.



For a variety of reasons sustainable management may not be achieved on contaminated sites, e.g. the different factors illustrated pull each of these nine sites away from an ideal.



What factors can we manipulate to achieve the vision of balanced sustainable management for any particular site ?



What interventions or tools can help achieve this vision?

Figure 17: Overview of the NICOLE Sustainable Land Management Debate.

5 Conclusions

These conclusions have been drawn from comments invited from NICOLE Steering Group members, the meeting organisers and speakers in the fortnight following the workshop.

The WELCOME project felt that this NICOLE contribution to the debate on megasites was very positive, not least because NICOLE can influence a range of stakeholders: industries, service providers, regulators, academia.

The need for a vision for managing megasites, and the importance of stressing opportunities in such a vision was widely expressed. And the key to a vision that is appealing is that it must be for a better future.

A "can-do" attitude is very important, with goodwill, foresight and common sense, solutions can be found, even to apparently intractable problems. Problems often seem difficult to solve because as technical people we tend to approach them from a narrow perspective, but as the example of Rotterdam Harbour shows, some innovative thinking, in this case about the true sources of surface water contamination, can yield both environmental progress and be cost effective. To use a common modern cliché, looking for solutions to megasites may mean that individuals have to think "out of the box", especially because the solutions will be a puzzle made up of a large number of pieces.

The importance of involving multiple stakeholders in the development of a vision for managing each megasite was stressed by many, and the potential contribution of professionals in planning, socio-economists, geography was one that was felt very necessary. Equally important is the need for "someone" to "own" management of the process and therefore draw together the different strands into a vision and a means of delivering it. Looking at brownfields projects that have been successful (or are at least moving in the right direction), this is the common thread.

The management of megasites poses major challenges to the current paradigm for contaminated land management in Europe, for example in supporting a multi-site owner response to contaminated land management. Furthermore the management of megasites may actually be being impeded by the apparent disconnect between soil and water policy at an EU level, and the lack of recognition of risk-based decision making in the draft Groundwater Directive. At a national level, it can be difficult to get planning and regulatory authorities at local, regional or national level to deal with the individual units of land on a megasite as a cluster requiring a uniform regulatory and planning approach, with a shared risk management solution.

In taking forward solutions to megasites , it might be useful to remember – "think big, act small". It is wise to develop solutions for megasites at the megasite level. However, for implementation and to solicit the co-operation of some stakeholders a translation has to be made to a local (site) level. As Einstein put it: "problems cannot be solved at the same level that they were created". Seeing the complete picture and keeping the balance between all the small pieces is a major challenge for solving megasite problems.

As well as megasites that are large in area, there can be smaller areas where several sites with different operators and owners are linked by overlapping and/or shared land and water contamination problems. These sites may be a microcosm of the issues faced by megasites, and the tools developed for supporting a holistic approach to megasites should also be scaleable so that they are useful for these smaller sites as well.

One possible way forward might be to consider a broader classification than “site” or “megasite”, that recognises that there can be similar issues arising from transboundary pollution and multiple ownership on relatively small sites, as well as sites that cover a large geographical area.

While this workshop did not achieve a final prescriptive definition for megasites and sustainable land management, it certainly demonstrated a general enthusiasm for the development of sustainable land management, and a wide recognition of the particular problems posed by megasites. It was a useful step forward towards NICOLE’s new theme of developing effective tools for sustainable land management. Future NICOLE workshops will focus on developing a little more detail and definition of these concepts, and, in conjunction with other who might be interested, will also work towards developing tools to make sustainable land management a practical proposition.

As well as continuing the development of sustainable land management as a concept and a discipline, these conclusions indicate that NICOLE may also need to consider some specific actions:

- NICOLE needs to argue the technical reasons for both a stronger risk management basis in the draft Groundwater Directive, and also for a stronger interaction between EC soil and water policy and regulatory development. Given that the draft “daughter” groundwater Directive now has an agreed text, some of these interventions will need to via national routes to the European Council of Ministers and the European Parliament. Similar views have been expressed by the Common Forum, with whom NICOLE should collaborate.

- It would be useful for NICOLE to stimulate a wider debate on how the risk management of source-pathway-receptor linkages can be integrated, for example on megasites, and develop an understanding of when this might be beneficial and when not.

- Over several workshops the need for risk communication has been discussed. Perhaps there a need for a NICOLE project to develop a simple NICOLE guide on stakeholder involvement and communication?

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Annex 2 Draft NICOLE SPG Discussion Paper Sustainable Risk Management: Deciding how to Deal with Contaminated Sites

Aim

NICOLE has been a major influence in the widespread acceptance in Europe of the need for a risk-based approach to the management of contaminated land and groundwater. NICOLE now wishes to refine this approach by asking decision makers to consider the sustainability of any risk management work they are considering.

The overall goal of NICOLE is to assist decision-makers in determining what is *most appropriate* for contaminated land and groundwater management.

NICOLE does not have to start this development from "scratch". Choosing what is appropriate is the subject of widespread guidance across Europe (as summarised recently by CLARINET – WG2 Report). However, the advice available is often fragmented, considering one or several factors that help select a risk management response, but not an overall – and simple – conceptual approach.

Consequently, the NICOLE SPG suggests that a more holistic guidance is appropriate, and should be a theme for the new phase of NICOLE work, which should build on existing ideas, including the CLARINET suggestions of "*Risk-based Land Management"* – see Appendix 1. This SPG initiative is at least a useful debate for NICOLE, and also potentially a collaborative project for SPG and other interested members of NICOLE. One possibility is to develop a working protocol that is tested and verified (demonstrated) on a number of case study sites. A funding route for this may be Interreg IIIB, which would require strong local authority collaboration. This is a useful synergy given the interest NICOLE has in attracting local authority input.

Introduction to "Appropriateness"

A number of common themes are considered in determining what is an *appropriate* solution to a contaminated land[17] problem. These are illustrated in Figure 1, and are:

1. the reasons (or drivers) for the risk management work and any constraints on this work for the area in question
2. risk management
3. the suitability of the risk management response in strictly technical terms
4. the feasibility of the risk management response – is it *practical, workable, acceptable, technical uncertainties (how likely is it to work)*
5. the contribution to sustainable development mad both by the risk management *and* the *means* employed of achieving the risk management, i.e. wider environmental, social and economic impacts
6. the views of stakeholders
7. based on these considerations, the overall balance of costs and benefit ratio and (i.e. sustainable development)

It is also important to consider the manner in which a decision is reached. This should be a balanced and systematic process founded on the principles of transparency and inclusive decision-making.

[17] Contaminated land includes the solid and fluid parts of the subsurface, e.g. soil and groundwater.

Drivers and Boundaries for Remediation

Most remediation work has been initiated for one or more of the following reasons:

- Remediation may be necessary for land posing significant risks to human health or other receptors in the environment such as groundwater or surface water. The remediation may be enforced or voluntary.
- Remediation may be required to facilitate redevelopment of formerly used land, which may take place for strictly commercial reasons, or because economic instruments have been put in place to support the regeneration of a particular area or region.
- Repairs to previous remediation work may be necessary where a past remediation project has failed, or a redevelopment has been carried out with out adequate risk assessment and management. These situations are often due to inadequate site investigation in the first instance.
- Remediation may also take place on a voluntary basis without any regulatory requirement to control liabilities as an investment to realise a gain in land value. Two specific commercial activities are important drivers for such remediation projects:
  - Divestment of industrial sites where a potential purchaser requires environmental liabilities to be defined or removed prior to purchase, and
  - Acquisition / take-over, where a site has to satisfy the environmental policy of a new controlling company.

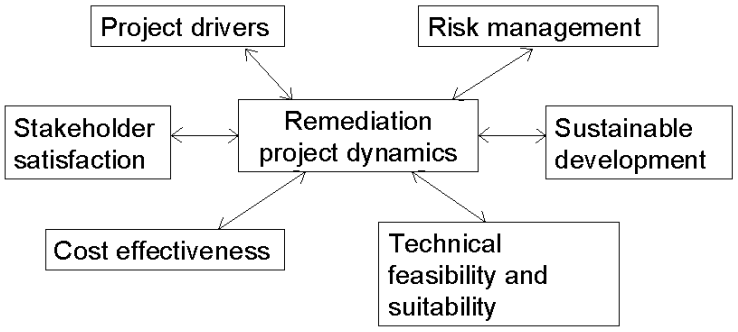


Figure 1. General Principles for Remedy Selection

What can be done for any particular contaminated land problem will also be constrained by a set of boundaries that are specific for the particular location in question. These can be grouped into two broad categories:

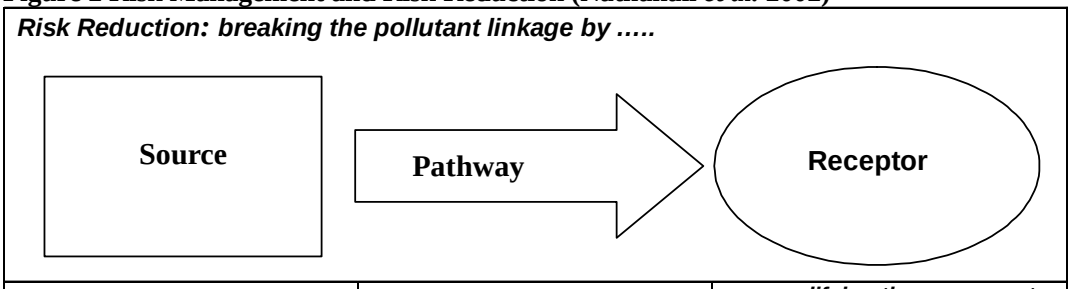
- boundaries that are intrinsic properties of the site, for example: geological conditions, the nature of the contamination, the accessibility of the site, the services available on a site (electricity, water ,etc), its proximity to sensitive stakeholders and many others,

- boundaries that are a related to the management of the site, for example: its ownership, the interests of other stakeholders, the time and budget available for remediation work, the linkage of the remediation work to activities on site before, during or after remediation.

Risk Management

The goal of risk management is to support decisions on risk acceptability for specified land uses and to determine the actions to be taken, following a site investigation and risk assessment. It is the process of making informed decisions on the acceptability of risks posed by contaminants at a site, either before or after treatment, and how any needed risk reduction can be achieved efficiently and cost effectively. In this way, the overriding needs for the protection of human health and the environment can be clearly identified and work prioritised accordingly[18]. Remediation activities are therefore employed to reduce risks, by breaking "pollutant linkages" identified as significant by the risk assessment, as illustrated in Figure 2.

Figure 2 Risk Management and Risk Reduction (Nathanail *et al.* 2002)



…. source reduction	….. pathway management	…. modifying the exposure to the receptor
Reducing, removing, modifying, or destroying the contaminant sources, (e.g. *in situ* bioremediation of petrol contaminated soil)	Preventing the further movement of hazardous substances *en route* to receptors, either by removing or destroying the contaminants or by preventing the transport pathway operating (e.g. by pump and treat or use of a physical barrier)	Protecting the receptor (e.g. installing an alternative water source, preventing site access, or restricting land-use).

Risk management choices need to take place on the basis of a thorough understanding of the conditions of each particular site. Good practice is to try and summarise this understanding as a conceptual model of the site. This usually takes a diagrammatic form, so that it is easier to use.

The use of site conceptual models (SCMs) – see Box 1 - is very important in supporting effective risk management. Using the SCM, a range of remediation goals can be set based on breaking pollutant linkages. Hence, the SCM crystallises understanding of what needs to be done to achieve risk management, and from this a shortlist of remediation techniques can be identified. This shortlist can then be refined, based on the other criteria summarised below.

Technical Suitability and Feasibility

A *suitable* technique is one that meets the technical and environmental criteria for dealing with (i.e. managing the risks of) a particular problem. The issues that affect the suitability of a remediation technology for a particular such as:

- Risk management application
- Treatable contaminants and materials

[18] In many European countries risk-based decision making is primarily used for historic contamination. Where contamination takes place after agreement of Pollution Prevention and Control (PPC) remediation to pre-contamination levels may be required.

- Remedial approach
- Location
- Available time and space
- Implementation of the approach (availability of services, accessibility of the site)
- Legacy (fate of contamination).

Many of these issues are controlled by the drivers of the remediation project and the constraints or boundaries that the remediation works will have to operate under.

Box 1: Site Conceptual Models

It is increasingly common now to see a holistic approach to contaminated land management with site investigation, risk assessment and risk management activities and decisions taking place in an iterative way. At the heart of any site management work must be the derivation of a *site conceptual model* (SCM). The SCM integrates what is already known about a site, identifies what still needs to be discovered, and how site information should be used. The SCM sets out the critical pollutant linkages of concern for a particular land contamination problem. It crystallises understanding of what needs to be done to achieve risk management, and from this point appropriate remediation techniques for those risk management goals can be chosen. The SCM should be established at the earliest possible stage of information gathering for a site, and then gradually extended and adapted as more information becomes available and as subsequent remediation activities take place. while site appraisal is still continuing. As remedies are considered site investigation can be adapted to provide better information to optimise remediation planning. Decision making can use pollutant linkages as an underpinning discipline.

It is possible that a proposed solution may appear suitable, but is still not considered *feasible or practical*, because of concerns about:

- Previous performance of the technology in dealing with a particular risk management problem;
- Availability of services (e.g. water, electricity) and facilities on a site;
- Ability to offer validated performance information from previous projects;
- Expertise of the purveyor;
- Ability to verify the effectiveness of the solution when it is applied;
- Confidence of stakeholders in the solution; and
- Its acceptability of the solution to stakeholders who may have expressed preferences for a favoured solution or have different perceptions and expertise.

Stakeholder Satisfaction

The stakeholders at the core of the decision making process for site remediation are typically the site owner and/or polluter, whoever is being affected by pollution, the service provider and the regulator and planner. However, other stakeholders can also be influential such as:

- Site users, workers (possibly unions), visitors,
- Financial community (banks, founders, lenders, insurers),
- Site neighbours (tenants, dwellers, visitors, local councils),
- Campaigning organisations and local pressure groups,
- Other technical specialists and researchers.

Stakeholders will have their own perspective, priorities, concerns and ambitions regarding any particular site. The most appropriate remedial actions will offer a balance between meeting as many

of their needs as possible, in particular risk management and achieving sustainable development, without unfairly disadvantaging any individual stakeholder. It is worth noting at this point that for some stakeholders, the end conditions of the site are likely to be significantly more important than the actual process used to arrive at that condition. Such actions are more likely to be selected where the decision-making process is open, balanced, and systematic. Given the range of stakeholder interests consultation can be a time consuming and expensive process, particularly if approaches are only made at a late stage in decision making.

Sustainable Development

The concept of sustainable development gained international governmental recognition at the United Nation's Earth Summit conference in Rio de Janeiro in 1992. Sustainable development has been defined as: "…. *Development that meets the needs of the present without compromising the ability of future generations to meet their own needs*" (Brundtland 1987). Underpinning this approach are three basic elements of sustainable development: economic growth, environmental protection and social progress.

At a strategic level, the remediation of contaminated sites supports the goal of sustainable development by helping to conserve land as a resource, preventing the spread of pollution to air, soil and water, and reducing the pressure for development on greenfield sites. However, remediation activities themselves have their own environmental, social and economic impacts. Clearly, the negative impacts of remediation should not exceed the benefits of the project. Tables 1 and 2 list some examples of the wider impacts of remediation projects.

Table 1 Some Examples of the Wider Environmental Effects of Remediation Activities

Negative	Positive
Traffic Emissions (e.g. volatile organic compounds) Noise Dust Loss of soil function Use of material resources (e.g. aggregates) and energy Use of landfill resources	Restoration of landscape "value" Restoration of ecological functions Improvement of soil fertility (e.g. for some biological remediation techniques) Recycling of materials

Table 2 Examples of Wider Economic and Social Issues

Economic Consequences	Social Consequences
Impacts on local business and inward investment Impacts on local employment Occupancy of the site Loss of revenue, for example to a site owner, through ongoing contamination / remediation operations Compensation for or mitigation of effects of contaminants before and during remediation, and of any residual contamination left behind.	Removal of blight Community concerns about remedial approach Amenity value of the site Provision of infrastructure[19]

[19] For example in the UK a developer may offer the provision of infrastructure as a consideration in its planning and development negotiations with a local authority.

Costs and Benefits

The aim of the assessment of costs and benefits is to consider the diverse range of impacts that may differ from one proposed solution to another such as the effect on human health, the environment, the land use, and issues of stakeholder concern and acceptability by assigning values to each impact in common units. Deciding which impacts to include or exclude from the assessment is likely to vary on a site-by-site basis. In many instances, it is difficult to assign a strictly monetary or quantitative value to many of the impacts. Hence, assessments can involve a combination of qualitative and quantitative methods. It is also useful to include a sensitivity analysis step, particularly where this encourages decision-makers to question their judgements and assumptions through the eyes of other stakeholders.

Discussion

There is often no one "best" solution for a contaminated land problem. Risk management has a dominant role in decision making for managing contaminated land as it provides a rational framework for evaluating problems and determining the availability of solutions. It is not, however, the only decision criterion. The drivers for a remediation project, the boundaries limiting what can be done on a site; the suitability / feasibility of available remediation options; the views of different stakeholders; and the wider effects of the remediation work should all influence the choice of approach. An appraisal of costs versus benefits can be a useful approach to integrating this wide range of considerations. Cost benefit analysis is not the same as a purely financial assessment, not least because many the wider costs and benefits cannot easily, or accurately, be assigned a pecuniary cost.

Good information is a pre-requisite for decision making. Environmental risks are the reason that remediation work is being considered, hence the importance of risk assessment as a decision making discipline and a site conceptual model for integrating the information available.

References

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Annex 3 Environmental Liability Directive - Recent Developments, Claire Smith – Allen & Overy, UK

On 17th December, 2003, the European Parliament (EP) adopted four amendments to Common Position (EC) No 58/2003 adopted by the Council on 18th September, 2003. The Commission published its opinion on the amendments on 26th January, 2004 (COM(2004) 55 final).

The Commission refused to accept the following amendments:

- Amendment 22 requires the Commission to submit proposals for a harmonised compulsory financial guarantee, if no appropriate instruments or markets for insurance or other forms of financial security have been established. Introduction of the compulsory financial guarantee would be gradual. A ceiling could be established by case and by location. Member States could decide not to apply the provision to low risk activities. The Commission refused to accept the amendment because it affected its rights of initiative. However, it commented that Member States were free to adopt financial security rules, such as the provisions on ceilings and low risk activities, through their general power to legislate on their territory.

- Amendment 46 deletes Article 4(3), which allows operators to limit their liability in accordance with national legislation implementing the Convention on Limitation of Liability for Maritime Claims (LLMC), 1976 or the Strasbourg Convention on Limitation of Liability in Inland Navigation (CLNI), 1988. The Commission refused to accept the amendment and commented that the proposed limitation of liability would not apply to environmental damage occurring in Member States that have not ratified and implemented the two Conventions.

The Commission accepted the following amendments and is revising its proposal accordingly:

- Amendment 12 specifies that competent authorities should only take remedial actions "as a means of last resort". The Commission accepted this amendment, subject to placing the wording "as a means of last resort" at the end of Art 6(3), not Art 6(2)(e).

- Amendment 27 specifies a further item to be addressed by the Commission in its report under Art 18 on the functioning of the Directive, namely the relationship between ship-owners' liability and oil receivers' contributions. The Commission accepted this amendment.

The Commission's opinion was transmitted to the Council and EP on 26th January, 2004. The Conciliation Committee was convened on 27th January, 2004.

- Link to EP's amendments of 17th December, 2003:
- http://register.consilium.eu.int/pdf/en/03/st16/st16145.en03.pdf

- Link to Commission's opinion of 26th January, 2004:
- http://register.consilium.eu.int/pdf/en/04/st05/st05759.en04.pdf

- Link to Prelex tracking of the Environmental Liability Directive:
- http://www.europa.eu.int/prelex/detail_dossier_real.cfm?CL=en&DosId=171860

AMENDED DRAFT DIRECTIVE ON ENVIRONMENTAL LIABILITY

Commission of the European Communities Documents - 26 January 2004

ENVIRONMENT

ENVIRONMENTAL LIABILITY : POLLUTION PREVENTION : ENVIRONMENTAL DAMAGE : ENVIRONMENTAL RESTORATION : LAND CONTAMINATION : WATER POLLUTION : BIODIVERSITY : NATIONAL LAW : TRANSBOUNDARY DAMAGE : ENVIRONMENTAL PROTECTION

Opinion of the Commission pursuant to Article 251 (2), third subparagraph, point (c) of the EC Treaty, on the European Parliament's amendments to the Council's common position regarding the proposal for a Directive of the European Parliament and of the Council on environmental liability with regard to the prevention and remedying of environmental damage amending the proposal of the Commission pursuant to Article 250 (2) of the EC Treaty.

The proposed Directive on environmental liability aims to establish a framework whereby environmental damage (damage to protected species and natural habitats, water damage and land damage) would be prevented or remedied through a system of environmental liability. Subject to certain exceptions, the operator that has caused the environmental damage or an imminent threat of such damage occurring would be required (in accordance with the "polluter-pays" principle) to bear the cost associated with the implementation of the necessary preventive or remedial measures.

In this document, the Commission sets out its opinion on the amendments adopted by the European Parliament at second reading. The Commission accepted an amendment which specified further one of the items to be addressed by the Commission in its report on the functioning of the Directive, and an amendment which specified that competent authorities should only take remedial actions 'as a means of last resort'. It did not, however, accept the amendment deleting the provision allowing operators to limit their liability in accordance with national legislation implementing the Convention on Limitation of Liability for Maritime Claims (LLMC), 1976, or the Strasbourg Convention on Limitation of Liability in Inland Navigation (CLNI), 1988, as it felt that this would disrupt the overall balance of the common position. The amendment which required the Commission to present proposals for a harmonised compulsory financial guarantee if no appropriate instruments or markets for insurance or other forms of financial security had been established, was rejected on the grounds that it affected its right of initiative. The Commission pointed out that the Member States may adopt such rules anyway, on the basis of their general power to legislate on their territory, since no provision of the Directive prevents them of doing so.

Reference: COM(2004) 55 final : 2002/0021 (COD)

Notes: 4 pages. For the initial proposal and legislative history, see COM(2002) 17 final.

Location: Austria; Belgium; Denmark; Finland; France; Germany; Greece; Ireland; Italy; Luxembourg; Netherlands; Portugal; Spain; Sweden; United Kingdom.