



REPORT OF THE NICOLE Network Meeting: Rotterdam revisited; a renewed look at soil and groundwater management



16-18 November 2011

Rotterdam, The Netherlands

www.nicole.org

Compiled by Marianne Blom, ENVIRON and
Lida Schelwald-van der Kley, NICOLE OC



Acknowledgements

NICOLE gratefully acknowledges:

- The Port of Rotterdam for hosting the event
- The sponsors and co-sponsors: Port of Rotterdam, MWH, ARCADIS, SBNS
- The speakers and chairpersons for their contributions to the meeting
- The members of the Organising Committee:
 - Lida Schelwald-van der Kley – NICOLE Industry Group/ Chair Organizing Committee
 - Willem van Hattem – Port of Rotterdam
 - Paul van Riet - DOW
 - Suzanne van der Meulen - Deltares
 - Jaap de Rijk - MWH
 - Sytze Keuning - Bioclear
 - Willem van der Zon - Vopak
 - Chris van de Meene and Jan Pals - SBNS
 - Marianne Blom - ENVIRON
 - Hans Slenders - ARCADIS

NICOLE is a network for the stimulation, dissemination and exchange of knowledge about all aspects of industrially contaminated land. Its 120 members of 20 European countries come from industrial companies and trade organizations (problem holders), service providers/ technology developers, universities and independent research organizations (problem solvers) and governmental organizations (policy makers).

The network started in February 1996 as a concerted action under the 4th Framework Programme of the European Community. Since February 1999 NICOLE has been self-supporting and is financed by the fees of its members.

More about NICOLE on www.nicole.org



Contents

Background	4
Setting the scene	5
Linking soil and operational management at infrastructural sites	6
Risk and liability management at infrastructural sites	8
Soil in a broader context	10
Sustainable management and remediation of areas with multiple contaminant zones	11
The soil; from cost factor to business opportunity	13
Overall conclusions and recommendations	15
Appendix 1. List of participants NICOLE Network Meeting on 16-18 November 2011, Rotterdam, the Netherlands	17
Appendix 2. Program NICOLE Network Meeting on 16-18 November 2011, Rotterdam, the Netherlands	20
Appendix 3. Results of interactive session I : "Soil in a broader context"	23



1. Background

In 2001, NICOLE held a workshop in Rotterdam. Ten years later, we returned to the Port of Rotterdam, with a renewed focus on ports and other infrastructural facilities, and the issues and challenges that these face with regard to contaminated land management.

Ports, railroads, and storage and distribution sites have through the centuries been key economic drivers for growth in Europe. Continued investment is needed for sustained economic health. Not only in ports, but also across the infrastructural works on which our EU societies rely to keep their economies alive. At the same time infrastructural facilities, such as airports, railroad lines, power transmission grids and other utilities companies operate within a complex landscape of environmental regulations, responsibilities and liabilities. More complex than that classically found at industrial sites occupied by a single company.

The objective of the NICOLE workshop in 2011 was to examine the complex and dynamic arena in which infrastructural works must operate and manage contaminated land challenges. Owners, users, operators, and stakeholders of the infrastructural works are multiple; classical 'site boundaries' are not always present, or may as a minimum be blurred. Also, potential sources of land contamination are multiple, and contaminant sources may moreover be mobile. This dynamism requires sound logistical operations and results in a clear focus on prevention and issues such as liability transfer risks.

The dynamic situation also invites a renewed look and consideration of responsibility for soil and groundwater quality, land management, and contamination liability. Can we continue to assign and allocate contaminant sources to a single polluter or pollution source? Are land plot boundaries not too static?

Nowadays there is more noticeable attention for sustainability and an integral soil remediation and management approach. The value of land can therein be restored or enhanced, and the status of soil itself returned from a status of (potential) 'problem or cost factor' to a positive asset providing a solid base and business opportunity for sustainable development. Therefore the second day of the workshop was used to step away from the aspects of boundaries and liability allocation, and provide a return to the "basics" of soil and groundwater as we addressed integrated soil management and discussed renewed alternatives for land and soil re-application.

For each session theme below you will find a list of conclusions drawn from the different presentations given at the Network Meeting. The power point presentations and the abstracts provided by the speakers can be downloaded from the NICOLE website www.nicole.org. For further information on the presentations please approach the speakers – their contact information is listed in the appendix to this report.

This report reflects the conclusions of the Network meeting and the outcome of discussions. This document does not necessarily reflect the opinion of NICOLE and/or individual NICOLE members or member organizations.

2. Setting the scene

Opening and welcome

- by Thessa Menssen, COO Port of Rotterdam

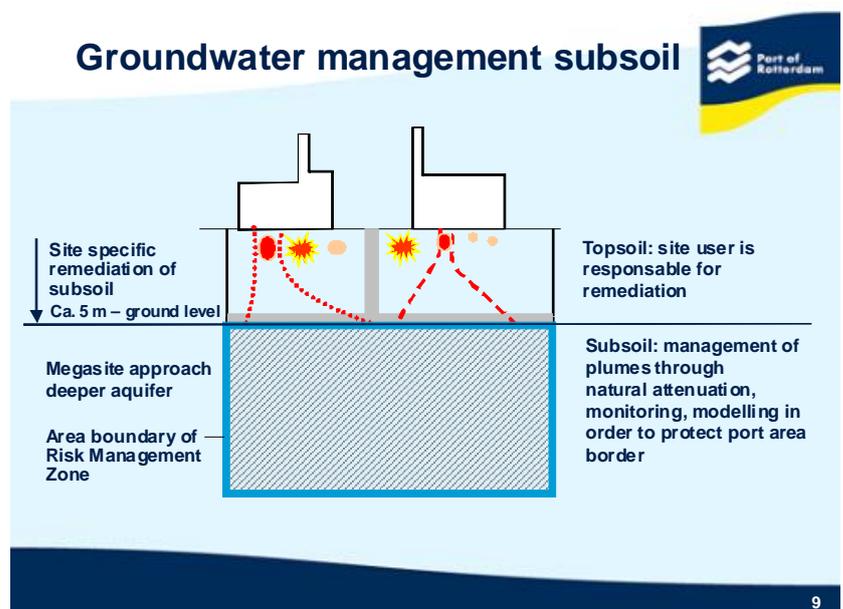
Thessa Menssen welcomed everyone on behalf of the Port of Rotterdam (PoR) and explained the importance of soil and groundwater management in the context of sustainable port development. Together with the responsible authorities and industrial companies, the Port of Rotterdam is working on a cost-effective regional groundwater management approach. The basic premise is a healthy balance between economy and environment. In Ms. Menssen's words: "This is our license to operate and will be our license to grow".

- by Elayne Alwayn, Dutch Ministry of Infrastructure and the Environment

The key-word in Elayne Alwayn's presentation was decentralization, for infrastructure, spatial planning and environmental projects. Finding the right balance between soil policy making at the national level and the implementation at the regional and local levels is key to the success of decentralization. Ms. Alwayn's presentation was structured around defined national interests, the first being investment and optimization of the business climate in Netherlands' major urban regions, and the fourth national interest, notably, being the sustainable use of the sub-soil. The sub-soil is viewed to be the soil underlying an 'occupational layer', the occupational layer serving as host to our traffic, green and utility networks and the underlying sub-soils can be viewed as the layer to conserve. Another national interest stressed concerned the development of a robust rail, road and waterway network. As decentralization was a new concept to many in the audience, a number of questions were raised, mainly on communication with citizens and how to ensure that local authorities are equipped to perform their tasks. In her answer Ms. Alwayn emphasized that "it's all a matter of trust and good communication".

Setting the scene; Rotterdam revisited by Willem van Hattem, Port of Rotterdam

In his presentation, Willem van Hattem introduced another new strategy, the "Megasite approach", in which a distinction is made between the top soil (ie the cover soils) and the underlying 'sub-soil'. Industrial property users remain responsible for the soil remediation at their own sites, while the management of the contaminated groundwater plumes, falling in the sub-soil, becomes a joint or shared responsibility (see picture) particularly where there are instances of cross-boundary contamination. This sort of shared management approach requires the involvement of all primary stakeholders of the Rotterdam port area and shared objectives for industry, Port and authorities. Decision making is based on balancing economical versus environmental interests, and (future) developments in the region. The key goal is to ensure that migration of contaminated plumes beyond defined 'standstill' boundaries does not take place. Human and ecological risks must also be avoided and managed. There was a lot of interest in the megasite approach as it was new to many. The main question was how to value the individual liability or allocation of responsibility / contribution to remediation in the overall approach?



3. Linking soil and operational management at infrastructural sites

This session gave a closer look at the dynamic and complex arena in which infrastructure companies like ports, airports and railroad companies must operate and manage contaminated land challenges.

Remediation of the former military territories in Latvia by Indulis Emsis, Eiprojekts, Latvia

Indulis Emsis explained that Latvia has more than 3,500 contaminated sites to address, mainly as a heritage from the former Soviet system. These are former industrial and infrastructural sites, such as military naval bases and airfields. It is difficult to apply the polluter pays principle and the State is responsible for historical contaminated land. Mr Emsis summarized the most dangerous historically polluted sites of national relevance and of these two case studies were discussed in further detail. The first case study was about the remediation and redevelopment of the Liepaja Karosta channel in the Port of Liepaja. This 78 ha area is heavily polluted with oil products and heavy metals, with a layer of contaminated sludge measuring 1,4 meters in thickness. The remediation work, involving the removal and transport of the contaminated sediment to a depot, will cost approximately 20 million Euros. After treatment and stabilization the deposit site will be used as new port land. The second case study concerned the 10 million Euro remediation operation of the Milgravis and Sarkandaugava territories in Riga Port area, heavily contaminated with oil products. The remediation work will involve a combination of pumping and biological remediation and will take up to 35 years. The audience confronted Mr Emsis with the question if he was happy with the environmental rules and regulations that he made when he was in charge as prime Minister. He explained that at the time when Latvia became an EU member there was not a lot of time to change the Soviet legislation, which differed substantially from the European one, into new legislation in accordance with EU requirements. And yes, he admitted; now we experience the outcome! There were also questions concerning financing and on whether or not budgets and expenditure shown include the remediation of resultant plumes of contamination. The response was that the projects summarized address source areas only and do not address the residual groundwater contamination or after-care. Monitoring following source removal was explained to be a responsibility of the State.

Soil management at airports- how to deal with contaminants by Jaap de Rijk, MWH and Simon Bootsma, Comon invent, NL)

This dual presentation started with an overview of the main contaminants of concern found at airports, including airport fuels (hydrocarbons), de-icing components (glycol) and fire foams (PFOS). Remediation work is always difficult due to possible interference with airport flight operations. The characteristics of the contaminants differ. A problem with PFOS, which is now prohibited for use but still widely found, is that it is highly persistent and difficult to treat (editorial note from NICOLE: see also the NICOLE technical session of Autumn 2010 on PFOS). The second part of the presentation focussed on prevention by means of the e-nose technology developed for monitoring volatile compounds, such as Jet-A1 vapor. As such an on-line soil monitoring was installed around the Aircraft fuelling pipeline network at Schiphol Airport. The system provides an early warning of soil contamination.

Railways; the landfill program of Deutsche Bahn- an integrated approach for sustainable soil management, landscape modelling and renewable energy use by Rolf Gerhardt, Deutsche Bahn, Germany

In his presentation Rolf Gerhardt described the complexity of soil handling in railroad building and construction activities. Many regulations apply, both at EU and federal level. In addition there is a need to communicate with the regulating authorities well in advance for the securement of permits to proceed. Within Deutsche Bahn, there is an obligation to establish a soil recycling and landfill process as part of the project planning. In the past Deutsche Bahn has operated or contracted landfills and is

now involved in a major landfill closure and aftercare plan. The materials needed for filling, landscape modelling and surface sealing come from DB infrastructure or demolition projects. One must determine carefully what can be recycled and what can be landfilled. The closure operation also offers economic and environmental opportunities. A nice example is the use of landfills as preferred locations for photovoltaic or wind energy, thereby contributing to the goal of CO₂ reduction through an increased use of renewable energies in Germany. One question raised was whether one can use the landfill also as a bioreactor? Mr Gerhardt explained that because of government regulations that is not possible. They opt for safe closure.



Train length: 120m
2000 t/d delivery

4. Risk and liability management at infrastructural sites

This session focussed on boundaries – on the allocation of responsibility and liability when boundaries for ownership of contamination cannot be easily set, and on the boundaries beyond which actions extend when addressing contaminated land in infrastructural works.

Liability and allocation of responsibility at a Port ; New York/ Newark Harbor (USA) by Rick Wenning, ENVIRON USA and Mark Travers, ENVIRON USA/ France

In port development and management of the environmental impacts cost allocation is a major issue. How do you assess costs and how do you determine everyone's fair share when it comes to remediation? Using the Port of New York/ New Jersey USA as an example, Rick Wenning and Mark Travers gave offered considerations for practical cost allocation approaches. As an example of how difficult it may be to deal with cost allocation, they noted the contaminated sediment resulting from combined sewer overflows of household and industrial waste that end up in the Port's surface water. This constitutes a situation of mixed source contamination wherein temporary and spatial boundaries are difficult to impossible to assess. A question was raised if it is possible to go back as far as the original manufacturer when looking at a particular chemical? Answer: There have been attempts to go back (eg PCB's), but normally the liability remains with the original user. As lawyers' fees are high, cost allocation is not always worth the time and effort. Yet for infrastructure projects, we face expenditure of millions to billions of Euros, which makes this worthwhile. Another question raised was; how to put value on ecological use of the water? In the past this was done by monetizing it, now we tend to look at ecosystem services in terms of the enjoyment that society has from clean water. And last but not least: prevention pays off!



Today



In 1962, the Port Authority opened the world's first container port, Elizabeth-Port Authority Marine Terminal (the 1958 photo before construction).

In 2010, the Port of New York and New Jersey handled 5.3 million loaded and unloaded 20-foot equivalent units (TEUs). The Port is the third largest in North America.



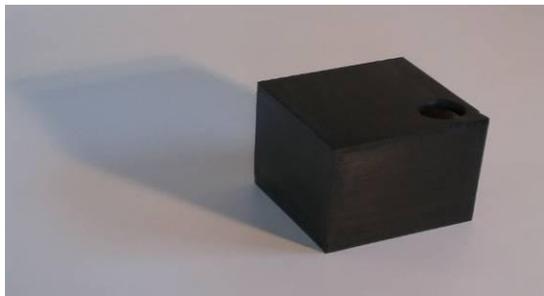
Integrated terminal management in an increasingly complex environment by Willem van der Zon, VOPAK Europe

Willem van der Zon agreed that the focus of VOPAK worldwide (83 sites in 31 countries) is nowadays on prevention and integrated environmental management. This forces the company to have a broad, all-encompassing view and knowledge of its impacts that fits the sustainability efforts. Environmental management also includes risk, relation and financial asset management. Making the right balance between investments may mean that sometimes priorities lie with, for example, vapour handling instead of a manageable risk such as soil contamination. Mr van der Zon also stated that this is the decade of biodiversity. A likely future issue is climate change and CO₂ bookkeeping may be close to becoming legally significant in court. This remark raised the question if a company could be held liable for neglecting environmental risk. This is indeed possible. One must ensure that necessary measures are taken (eg storm drainage to combat the impact of high water).

Provisioning and expenditure reduction in remediation liability by Frank Evans, National Grid, and Ian Goodacre, RSK Group Plc, UK

Frank Evans and Ian Goodacre talked about making financial provisions for National Grids network of electricity substations and associated sites. Sub-stations are risky places to work (with regard to occupational conditions), but do not have high risk in terms of soil and groundwater contamination. Remediation is driven by the presence of significant free product. Potential liability is more likely due to historical site usage. The sites were grouped based on their historical land use, potential sources and sensitive receptors. A detailed site investigation and risk assessment for selected representative sites was used to determine a reasonable remediation forecast and financial provisions for the entire portfolio. The data thus gathered allow National Grid to manage its contaminated land liabilities and costs in a planned and proactive manner.

Alternative solutions for risk, uncertainties and liabilities at infrastructural sites by Michel Hensens, AT Osborne, NL



Michel Henssen presented a broad perspective on risk management for infrastructure projects. Contaminated land issues and sites can be viewed as a 'black box' that must be addressed. However there are factors and processes that come into play beyond and outside of this black box. In this regard, the project manager must recognize the elements and surroundings, and identify the community around him (including engineers on the projects, the project team, physical factors, politics etc).

He emphasised that risks for infrastructural works can also be non-technical. We need therefore to also account for political, policies and public issues; identify these stakeholders and stakeholder factors and work with them. We can therefore also turn these risks into an opportunity by collecting input and data from them and working with this.. Examples of (good) combined soil and infrastructure examples are; soil remediation and energy (heat storage), energy-road projects (energy from asphalt), soil use and agricultural and/or nature (eco-system); and nature & energy- infrastructure (power lines). A question was raised about how to deal as a company with politicians who want to be re-elected after 4 years in a long-term soil & infrastructure project? One way to do this is to take into account this fact of life, be flexible and divide a project into stages with a time-span that allows subsequent politicians to set a landmark or score within their elected governing period.



5. Soil in a broader context

Introduction by session chair, Paul van Riet, DOW

Paul van Riet stated that in 2001 remediation, soil & groundwater issues were a “hot issue” in many Western European countries. In 2011 this is less so. He demonstrated this for the Netherlands and several other European countries by showing a number of graphs in which the costs spent on soil were compared with the budgets for other environmental aspects (air, waste, noise, landscape and water). The EU Soil Strategy website mentions: “Soil, the forgotten resource?”

The question at hand is: Where will soil remediation be in 2021? And: Is there a difference between the various member states? And if remediation has a different status, why?

Interactive session I

In the interactive session the questions raised above were discussed in subgroups from the perspective of both industrial problem holders and service providers.

The outcome

The results of the interactive session are presented as graphs per country in appendix 4. It should be noted that no statistically sound conclusions can be derived from the graphs presented, as the number of respondents per country was too limited in most cases. Some indicative conclusions are drawn below.

The results indicated that the attention for soil remediation has indeed declined in the period 2001-2011 and is likely to further diminish in the next 10 years compared to other environmental aspects. The only reason why soil will remain on the agenda is that not all countries will have completed the remedial operation of their contaminated land sites by 2021 and soil themes like sustainable land use and biodiversity will become important. Also, more soil is needed for food production. Waste management and in particular water management have always had a high priority and will continue to score high in the years to come. Water will rank first as the problems with floods and water supply will increase. Climate change was not so much an issue in 2001, but is a ‘hot’ topic now in 2021 and will receive a lot of attention in 2021. Air and noise will become less important. Other themes that will appear on the agenda are occupational safety, biodiversity, green energy and sustainability.

There was not much difference between the results from the problem holders and the problem solvers.

It was remarked that we need to realize that our professional perception may differ notably from the public or general scientific perception and that the problem perception in different EU countries may also vary. The results reflect the individual opinions of soil remediation specialists from different countries.



6. Sustainable management and remediation of areas with multiple contaminant zones

Introduction by session chair, Hans Slenders ARCADIS

This session focussed on the sustainable and integral management of infrastructural megasites with multiple contaminant zones, mobile overlapping plumes and multiple neighbours. Hans Slenders illustrated such an approach by showing a conceptual model for the Port of Rotterdam.

Integral site management at a DOW site in Germany by Robert Upmann, Tauw, Germany

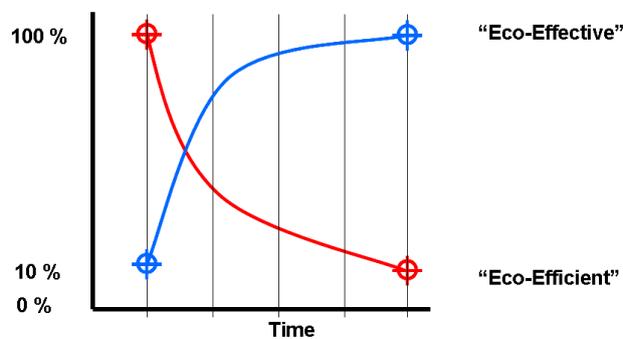
Robert Upmann described the integral management approach for the BUNA site in Eastern Germany that was bought by DOW and redeveloped from an old, potentially high risk site into a modern and safe production site. This meant that the ecological burdens of the past had to be remediated. To do so investigations were carried out to locate the presence of mercury contamination in the soil in order to excavate the contaminated soil. Also, a large-scale innovative groundwater investigation was performed by using FLUTe (Flexible Liner Underground Technologies) to determine the flow conditions of the groundwater and the contaminant transport processes. The results were used to optimize the groundwater remediation of the VOC source-zone. A question was asked about the benefits of all the detailed characterisation. Mr Upmann indicated that a major benefit was that a smaller amount of contaminated soil than originally estimated had to be removed.

Mission possible ! Plume owners cooperate for a sustainable end solution by Peter Ramakers, Province of Noord-Brabant, NL

In his presentation, Peter Ramakers gave the audience two examples of dealing successfully with the combined situation of overlapping contaminant plumes and multi-problem owners. He demonstrated this for two cases in the province of Noord-Brabant in the Netherlands. The first site was an industrial area with 5 site owners and a shared groundwater problem reaching to a depth of more than 130m below surface. The second case was a public site with contaminated groundwater that threatened nearby drinking water wells of the drinking water company. In this case the local and regional (water) authorities worked together on an integrated approach in which also the use of the subsurface for thermal energy storage was considered. The Province had to give the ok for the remediation plan. Lessons learned so far: for the success of the project it is essential that the views of the different stakeholders are known and taken into account. Communication and cooperation are also essential. As to the question of which party assumes legal responsibility Mr Ramakers answered that the public companies involved assumed the after-care and gave the companies involved an indemnification for future possible expenditure / responsibility.

Cradle to Cradle and Soil Remediation by Key-note speaker Prof. Michael Braungart, Erasmus University of Rotterdam, University of Twente, NL

Michael Braungart, also known as one of the two founding fathers of the cradle to cradle (C2C) concept, explained the C2C concept to the NICOLE audience and translated it to soil remediation. With cradle to cradle, as in nature, there is no such thing as waste. All things can be re-used for other processes and new products. This principle can be used in product design, wherein the end of life can be planned (for dismantling, next use etc). Mr Braungart encouraged us to come up with different mind-sets for dealing with contaminants. He also indicated that soil remediation as a whole or as a sector is further along than other areas– as in the C2C concept remediation can be viewed as a means of finding the next use for land. An example of a contamination situation in which no remedial program or next use is apparent concerns office buildings – the quality of indoor air (for long term exposure) is questionable, there is no plan of remediation /mitigation during use and there is no plan (not always) for end of use. He invited discussion on approaches to addressing (office) building remediation.



Braungart emphasized that C2C is not about doing less bad; if we only concentrate on emission reduction, etc we might as well be non-existent. For 'less bad' we are also with too many on this planet. Cradle to Cradle is rather about eco-effectiveness (doing the right thing) and less so about efficiency (optimising the wrong things). It is important not to be 'carbon neutral' but 'carbon positive'. As an example of eco-effectiveness he noted phosphate recovery from sewage sludge by putting it back into the cycle. It is important to give

people a positive perspective, formulate positive goals and take nature as an example (eg buildings like trees, cities like forests). He challenged the NICOLE members, with their environmental background and expertise, to become change agents



7. The soil; from cost factor to business opportunity

Introduction by session chair, Sytze Keuning, Bioclear

As an introduction to the session Sytze Keuning gave a presentation on the benefits that we can get from the soil, also termed here as ecosystem services. Soil hosts most of the biodiversity (>95%) on earth. Using as an example the Frisian cow he showed that the seemingly paradox of economy and ecology or use versus protection can go hand in hand. This special type of cow, which had nearly become extinct, was saved by the fact that its meat became a delicacy in restaurants. He also stated that the traditional and hierarchical world perspective in which man determines and regulates nature is transforming into a new perspective in which man is part of the ecosystem. This implies co-creation and working together.

Interactive session II, organized and lead by Sytze Keuning (Bioclear) and Suzanne van der Meulen (Deltares)

In this interactive session several opportunities for soil use were discussed in subgroups. The discussed options are provided below and classified as general opportunities for use of the subsoil and opportunities for contaminated land.

Opportunities for (intermediate) beneficial use of contaminated land
- Grow trees and industrial crops on contaminated land. Advantages: wood for the fireplace; biomass for energy and fibres; increase the happiness of workers; make a noise screen; make a visual screen; saving cost (no excavation); create jobs; a positive footprint; stimulating biodiversity; recreation; dust removal; legislation is no problem. Besides, better use of the contaminated land will save clean soil for food production. An opportunity for this idea is that several countries face a need for forestation.
- Grow food crops. Contaminants will accumulate in specific parts of the plant, other parts could be eaten. An option is to develop new crops in which contaminants will not affect the eatable parts of the plant. Possible to combine with phytoremediation? Fire retardant crops! Legislation and public acceptance are threats to this idea.
- Soil and sediment mining, for instance mining of phosphate that will become scarce in future or mining of metals.
- Use contaminated land for: solar panels; biofuels production; wind turbines; extreme tourism.
- Use residual heat from industries for enhancing Natural attenuation (NA) and store heat in the subsoil.
- Tapping energy as electric power from the border between salt water and sweet water (a new and already demonstrated technology using membranes to produce electricity where volumes of sweet and salt water come together).
- Redevelop new industrial areas on old industrial sites and areas (instead of developing them on new land).



Opportunities for beneficial use of the subsurface

- Open areas that are necessary for access to pipelines in combination with nature/vegetation on these areas. Limitations are the current legislation: in order to get immediate access vegetation in these areas is not allowed. Advantages of applying vegetation would be: increase of biodiversity; more green; less maintenance costs; more acceptance for industry to occupy space; improves air quality, less dust particles; regulation of groundwater levels.
- CO₂ consumption in the subsoil.
- Subsoil for containment of freshwater.
- Open soil with vegetation for flood control and flood balancing and as a result also a better urban climate (health, energy saving, recreation).
- Food production in the city. Advantages: less logistics; children learn where food comes from/ educational aspects; the number of people on the planet may increase to 15 billion in 2050 which requires much more food production.
- Combine composting of waste with top soil creation, but be careful with quality.
- Unsealed open soils for infiltration of sewage; for control of flooding; for vegetation to reduce urban heat.
- Smart soils: using and manipulating physical properties of soil to increase the carrying capacity of soil for buildings and infrastructure.
- Use caverns for growth of food crops.
- Improve soil quality for agriculture by using wood chips instead of fertilizer. Benefits are reduction of leaching of nutrients, enhanced structure of soil, reduce erosion. Opportunity for this idea is the need to reduce fertilizer use. Threat is the competition for wood chips as a result of burning of wood chips and export. A cost benefit analysis should be carried out.



8. Overall conclusions and recommendations

8.1. General conclusions

The network meeting has given us a renewed look to deal with the challenges of managing soil and groundwater management at infrastructural and industrial sites. Key conclusions from this meeting are:

- Rotterdam 'revisited', from 2001 to 2011: activity in contaminated land investigation and remediation has continued over the past decade and will likely continue into the next decade, however:
 - statistics available for environmental spending in the Netherlands indicate and the (subjective) opinions of individuals attending the NICOLE meeting conclude that focus on property remediation in the traditional sense has dropped, although it is thought that activity in soil remediation and land restoration shall continue into the next decade. Greater focus and spending appears to be placed on other environmental challenges such as climate change, affecting air emissions management, company liability assessment, and water management (rising tides, less predictable flooding patterns, effect on asset management and maintenance)
 - the manner in which contaminated land management is viewed and organized is shifting. There is more routine incorporation of contaminated land investigation in real property and asset management, and investigation approaches have started to become more uniform to provide consistency
 - approaches to addressing cross-boundary and/or shared responsibility in land contamination have started to evolve, see the points further below
 - the above pertains to systems and regions with active contaminated land investigation programmes. Examples were also given of situations in which contaminated land projects are prioritized and discretized (remediation of only one aspect such as the source).
- Contaminated land in an infrastructural setting has a higher degree of multiple party involvement and a higher degree of public involvement
 - Cross-boundary: if a means of calculating and allocating 'cash-outs' or contributions to shared contamination can be agreed, one party can be assigned to address a shared contamination issue.
 - Insurance and contract clauses (but also law suits) offer means of allocating contribution
 - Alternative means of assigning and allocating liability lie beyond the framework offered by contaminated land (public) regulations
 - A number of presentations emphasized the high degree and therefore importance of stakeholder influence. Stakeholders and stakeholder forces may include the community, the party commissioning works, political will, but also project staff and colleagues. It is best to acknowledge, embrace and plan for this
- The 'multiple' faceted aspect of large infrastructural sites also pertains to other environmental compartments. Some managers of contaminated land are increasingly faced with a need to monitor overall effect on the environment, contribution or distraction from 'bio-diversity'. This trend is a trend which has started to enter the stage in traditional industrial land management and remediation as well, and has started to even give rise to policies surrounding climate change (and the manner in which a company may / may not be neglecting to manage for climate change).
- Megasite / cross boundary remediation:
 - Contaminated land in infrastructural settings has 'matured' ie literally remained in place giving rise to cross-boundary situations which must be addressed. In a case example for an industrial zone, a system of cash contribution to a remediation programme for the subsoil, operated by the Municipality has been set up. This includes



the clear allocation of responsibility to the Municipality and therefore indemnification of contributing parties from the responsibility at hand. In the case example presented by the Port of Rotterdam it is noted that the shared contamination plumes are bounded: by the cover soils which remain the responsibility of property operators / users and the greater aquifer resource lying beyond the Port and underneath the impacted zone.

- Further technological developments in contaminated land investigation continue to offer improved efficiency in investigation and remediation / restoration and in monitoring of possible impact, to prevent the arising of more or additional complex situations in future
- Liability allocation: cash-out: as noted above, several alternative routes are sought and used in infrastructural settings
- Next use / land restoration: in keeping with several sustainability themes, of cradle to cradle planning for a next use, in eco-system consideration for land restoration, etc; creative thinking and a regulatory system that is flexible to allow for alternative solutions can lead to useful productive 'next' uses for land, ie can lead to land restoration as opposed to remediation to a brownfield, derelict or otherwise unused state.

8.2. Recommendations

- A notable development was the use of the term 'sub-soil' as a zone that is differentiated from the occupational layer on which we act and even an initial receptor layer (in which contamination can be ecologically tolerated). Given the state of flux of an EU soil directive, this notion may be worth carrying forward when the soil directive is next revived.
- Another notable feature was the incorporation of other environmental factors (effects of other environmental media) and the factor of social and eco-system remedial solutions. This invites a recommendation that in future, in considering views at the NICOLE level but also in the day to day management of industrial contaminated land projects, additional focus and consideration should possibly be placed on this. Particularly increasing urbanization pressure can serve as a driver for a growing need to address stakeholder management and to see increasingly more eco-system solutions.
- Infrastructural party participation in NICOLE: the emphasis for parties involved in infrastructural works such as building, railway may well handle the liability and cash settlement aspects rather than management of longer term remediation programs. The presentation on stakeholder factors, involvement of the community etc resonated particularly well with infrastructural attendants of the meeting. The technical aspects of land remediation for infra pertain to service providers and to infrastructural parties, however programme or project managers at infrastructural companies probably cope primarily with other factors.
- Although not explicitly discussed at the meeting, cash-out or contribution approaches may also offer options for other scenarios which industrial members may encounter.
- Anticipate for further development in planning for a 'next' use ie land exit and restoration. This would be in keeping with sustainability principles and it is noted that similar concepts in planning and restoration are in fact already exercised and practiced in some geographic regions and/or settings.



Appendix 1. List of participants NICOLE Network Meeting on 16-18 November 2011, Rotterdam, the Netherlands

Ackermann, Markus	DuPont	Switzerland
Agterberg, Frank	SKB	NL
Alwayn, Elaine	Ministry of Infrastructure and Environment	NL
Ambrosini, Paolo	Saipem S.p.A.	Italy
Bangels, Stefan	RSK	Belgium
Bardos, Paul	R3 Environmental Technology Ltd.	UK
Beuthe, Birgitta	SPAQuE	Belgium
Blanka, Liga	Eiprojekts Ltd.	Latvia
Blom, Marianne	ENVIRON	NL
Blumats, Peteris	Eiprojekts Ltd.	Latvia
Bootsma, Simon	Comon-Invent	NL
Bracke, Arno	DuPont	NL
Braungart, Michael	Erasmus University / University Twente	Germany
Buvé, Lucia	UMICORE	Belgium
Camerani, Caterina	AkzoNobel	Sweden
Can, Handan	Ondokuz Mayıs University	Turkey
Cooper, Daniel	WSP Remediation	UK
Curca, Cristina	Petrom SA	Romania
De Buysscher, Geert	ENVIRON	Belgium
De Fraye, Johan	CH2M Hill	UK
de Groof, Arthur	Grontmij	NL
de Jong, Klaas	Hannover Milieu- en Veiligheidstechniek	NL
de Jong, Guido	Port of Rotterdam	NL
de Rijk, Jaap	MWH	NL
de Vrede, Harmen	MWH	NL
Dixon, Nik	Grontmij	UK
Dols, Pieter	Arcadis	NL
Elelman, Richard	Centre Tecnològic de Manresa	Spain
Emsis, Indulis	Eiprojekts Ltd.	Letland
Euser, Marjan	NICOLE Secretariat	NL
Evans, Frank	National Grid	UK
Firastraeru, Ionut	Petrom SA	Romania
Florea, Daniela	Petrom SA	Romania
Fokkens, Jan	SBNS	NL
Garcia de la Rasilla, Mascha	Eurofins Analytico	NL
Gehrels, Hans	Deltares	NL
Gerhardt, Rolf	Deutsche Bahn	Germany
Gevaerts, Wouter	Arcadis Belgium NV	Belgium
Goodacre, Ian	RSK	UK
Groot, Hans	Deltares	NL
Habashi, Nahal	Saipem S.p.A.	Italy
Haerens, Bruno	URS Belgium	Belgium
Hall, Iain	Grontmij UK	UK
Haselhoff, Annette	Tauw	NL
Heasman, Ian	Taylor Wimpey UK Ltd	UK
Helmink, Jeanine	ENVIRON	NL
Hensens, Michel	AT Osborne	NL
Hof, Dries	Railtrade	NL
lordache, Valentin	Petrom SA	Romania
Jacquet, Roger	Solvay S.A.	Belgium
Jager, Doite	Grontmij	NL
Jubany, Irene	Centre Tecnològic de Manresa	Spain
Keijzer, Thomas	Deltares	NL



Keuning , Sytze	Bioclear BV	NL
Kirkebjerg , Kristian	Grontmij	Denmark
Kolle , Marcel	Dura Vermeer Milieu	NL
Koomans , Ronald	Medusa Explorations	NL
Koschitzky , Hans-Peter	VEGAS	Germany
Lobs , Art	Verhoeve Milieu	NL
Lucassen , Pim	Philips Real Estate	NL
MacKay , Sarah	WSP Environmental	UK
Maerten , Kris	Regenesis Ltd.	Belgium
Menssen , Thessa	Port of Rotterdam	NL
Mezger , Thomas	Akzo Nobel	NL
Mueller , Jim	Adventus Europe	Austria
Nicolae , Paula Mirela	OMV Petrom S.A.	Romania
Nijland , André	Promeco	NL
Noël-Debaecker , Elise	Shell Petroleumcompany	France
Norin , Malin	Renaremark	Sweden
Ooteman , Kevin	MWH	NL
Özkaraova Güngör , Burcu	Ondokuz Mayıs University	Turkey
Pals , Jan	SBNS	NL
Palte , Jacco	Eurofins Analytico	NL
Papassiopi , Nymphodora	National Technical University of Athens	Greece
Parkman , Rick	URS Corporation Ltd.	UK
Pensaert , Stany	DEC Deme Environmental Contractors NV	Belgium
Phipps , Oliver	ERM	UK
Plaisier , Wim	Arcadis	NL
Ramakers , Peter	Province of North-Brabant	NL
Richter , Fred	Dow Olefinverbund GmbH	Germany
Rivers , Clive	Worley Parsons Ltd.	UK
Robbeson , Carel	Railtrade	NL
Robold , Erhard	Arcadis	Germany
Sborea , Giuseppe	Eurofins-Analytico	NL
Schelwald-van der Kleij , Lida	NICOLE ISG Secretariat	NL
Schreurs , Jack	Philips Environment & Safety	NL
Sévêque , Jean-Louis	UPDS	France
Shoesmith , Colin	National Grid Property Ltd.	UK
Slenders , Hans	Arcadis	NL
Smeder , Maria	Akzo Nobel AB	Sweden
Spence , Mike	Shell Global Solutions (UK)	UK
Stuut , Robert-Jan	MWH	NL
Svensson , Håkan	KemaktaKonsult AB	Sweden
Takens , René	Tauw	NL
ter Meer , Jeroen	ProRail B.V.	NL
Travers , Mark	ENVIRON	France
Upmann , Robert	Tauw GmbH	Germany
van de Meene , Chris	SBNS	NL
van de Pol , Erwin	Witteveen+Bos	NL
van der Meulen , Suzanne	Deltares	NL
van der Voort , Jack	Ingenieursbureau Oranjewoud BV	NL
van der Zon , Willem	Royal Vopak	NL
van Dunné , Bruno	SBNS	NL
van Hattem , Willem	Port of Rotterdam	NL
van Herpen , Bas	Groundwater Technology BV	NL
van Houten , Martijn	Witteveen+Bos	NL
Van Nieuwenhove , Karel	Anteagroup	Belgium
van Noord , Wilfred	AkzoNobel	NL
van Riet , Paul	Dow Benelux BV	NL
Van Straaten , Mark	MAVA	Belgium



Vanhove, Bart	CH2M Hill Belgium	Belgium
Veenis, Yvo	Groundwater Technology BV	NL
Vermeer, Mats	RSK EMN Netherlands	NL
Visser-Westerweele, Elze-Lia	NICOLE SPG Secretariat	NL
Volosko-Demkiv, Oksana	Kyiv-Mohyla Academy	Ukraine
Voogd, Leon	MWH	NL
Vroege, Rini	BP Europa SE - BP Nederland	NL
Waters, John	ERM	UK
Weller, Bas	MWH	NL
Wenning, Richard	ENVIRON	USA
Wiltshire, Lucy	Honeywell	UK
Wilyman, Mike	WSP Environmental	UK



Appendix 2 Program NICOLE Network Meeting on 16-18 November 2011, Rotterdam, the Netherlands

	Wednesday 16 November, 2011 NICOLE Working Group and Subgroup Meetings
	Venue: World Port Center, Wilhelminakade 909, Port number 1247, 3072 AP Rotterdam, http://www.portofrotterdam.com
11.00-12.30	Parallel meetings NICOLE Working Groups: <ul style="list-style-type: none"> - Mercury - Sustainable Remediation
12.30-13.30	Lunch
13.30-17.00	Parallel subgroup meetings: <ul style="list-style-type: none"> - Industry group (13.30-17.00 hrs) - Service providers group (14.30-17.00 hrs)
17.00-17.30	Activities CEN-ISO TC Soil Quality Frank Lamé, Deltares, NL
17.30-18.30	NICOLE General Assembly
18.30-19.00	Welcome drink
	Thursday 17 November 2011 – Conference Day 1
	Venue: RDM Campus, Heijplaatstraat 23, 3089 JB Rotterdam, the Netherlands, http://www.rdmcampus.nl/english
08.30-09.00	Registration
	OPENING SESSION Chair: Lida Schelwald, Organising Committee
09.00-09.20	Opening and welcome <ul style="list-style-type: none"> - by session chair - by Hans Smits, CEO Port of Rotterdam - by Elaine Alwyn, Dutch Ministry of Infrastructure and the Environment <p>Video: 'Rotterdam, your world class port'</p>
09.20-09.40	Update on NICOLE <ul style="list-style-type: none"> - Steering Group by Lucia Buvé, NICOLE chairperson - NICOLE Working Groups by working group leaders
09.40-10.00	Setting the scene Speaker Willem van Hattem, Port of Rotterdam, NL
10.00-10.30	Coffee break



	<p>LINKING SOIL AND OPERATIONAL MANAGEMENT AT INFRASTRUCTURAL SITES Chair: Bruno van Dunné, SBNS</p>
10.30-11.00	<p>Remediation of the former military territories in Latvia – putting polluted sites in port areas back in the economic circulation Speaker Indulis Emsis, Eiropprojekts Ltd, Latvia</p>
11.00-11.30	<p>Soil management at airports / e-Nose @ Amsterdam Airport Schiphol Jaap de Rijk, MWH, and Simon Bootsma, Comon Invent, NL</p>
11.30-12.00	<p>Railways; the Landfill Program of Deutsche Bahn – an integrated approach for sustainable soil management, landscape modeling and renewable energy use Speaker Rolf Gerhardt, Deutsche Bahn, Germany</p>
12.00-13.30	Lunch
	<p>RISK AND LIABILITY MANAGEMENT AT INFRASTRUCTURAL SITES Chair: Marianne Blom, ENVIRON</p>
13.30-14.00	<p>Liability and allocation of responsibility at a Port: New York / Newark Harbor (USA) Speakers Rick Wenning, ENVIRON USA, and Mark Travers, ENVIRON USA/France</p>
14.00-14.30	<p>Integrated terminal management in an increasingly complex environment Speaker Willem van der Zon, VOPAK Europe</p>
14.30-15.00	<p>Provisioning and expenditure reduction in remediation liability Speakers Frank Evans, National Grid, and Ian Goodacre, RSK Group Plc, UK</p>
15.00-15.30	<p>Alternative solutions for risk, uncertainties and liabilities at infrastructural sites Speaker Michel Hensens, AT Osborne, NL</p>
15.30-16.00	Coffee break
	<p>SOIL IN A BROADER CONTEXT Chair: Paul van Riet, DOW</p>
16.00-16.10	Introduction of interactive session by chair
16.10-17.20	<p>Interactive session in subgroups: <i>Ranking the importance of soil versus other themes in different countries; state of the art and future outlook from the perspective of:</i></p> <ul style="list-style-type: none"> - Policy makers - Problem holders - Service providers
17.20-17.45	Plenary wrap-up
18.00-22.00	Dinner cruise through the Port of Rotterdam (contribution of 50 Euro requested from participants)



	Friday 18 November 2011 – Conference Day 2
	Venue: RDM Campus, Heijplaatstraat 23, 3089 JB Rotterdam, the Netherlands, http://www.rdmcampus.nl/english
	SUSTAINABLE MANAGEMENT AND REMEDIATION OF AREAS WITH MULTIPLE CONTAMINANT ZONES Chair: Hans Slenders, ARCADIS
09.00-09.15	Introduction by session chair
09.15-09.45	Integral site management at a DOW site in East Germany Speaker Robert Upmann, Tauw, Germany
09.45-10.15	Mission possible! Plume owners cooperate for a sustainable end solution Speaker Peter Ramakers, Province of Noord-Brabant, NL
10.15-11.15	Cradle to cradle and Soil Remediation Key-note speaker Michael Braungart, Erasmus University of Rotterdam / University of Twente, NL
11.15-11.45	Coffee break
	THE SOIL; FROM COST FACTOR TO BUSINESS OPPORTUNITY Chair: Sytze Keuning, Bioclear
11.45-12.05	Introduction by session chair
12.05-13.00	Interactive session in subgroups: <i>Defining new future business opportunities from the subsurface</i>
13.00-13.20	Plenary wrap-up
13.20-15.00	Lunch and Networking Party
15.00	End of workshop; adjourn



Appendix 3. Results of interactive session I; Soil in a broader context



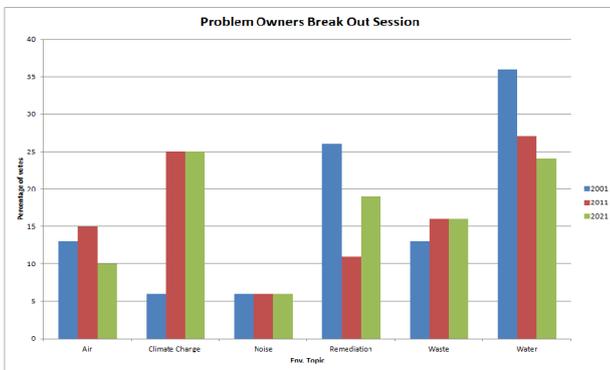
Break Out Session Output

- In the Breakout Session, attending people gave their vote on how they perceived where the focus of their country was, is or will be regard the different environmental topics.
- The breakout Sessions consisted of 4 groups
 - 2 Problem Solver Groups
 - 2 Problem Owner Groups (of which 1 also contained "Solvers")
- In each group were people from various countries
 - Some countries were represented by multiple persons while some countries were represented by only 1 or 2 persons.
- Limitations:
 - Due to the different way of voting in each group a conversion factor was needed to enable to get a "common" score. This makes the final score less accurate.
 - As the votes for some countries were done by only 1 or 2 persons the perception of these countries is hence based on limited votes.



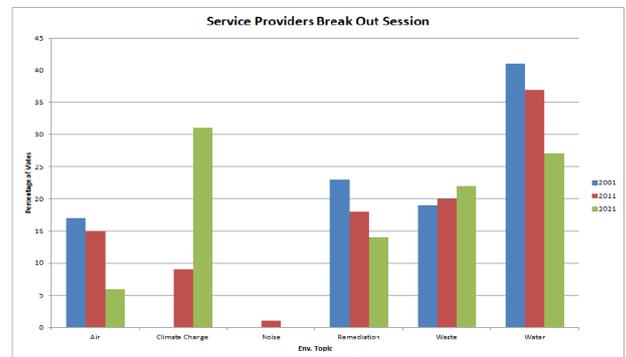
Problem Owners Perception

Overall perception of the Problem Owners for which environmental topic has the most attention / cost.



Problem Solvers Perception

Overall perception of the Problem Solvers for which environmental topic has the most attention / cost.



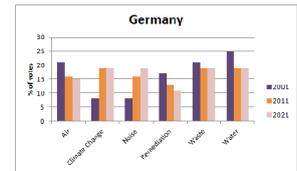
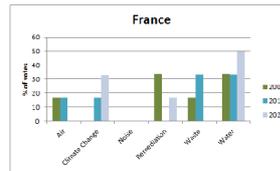
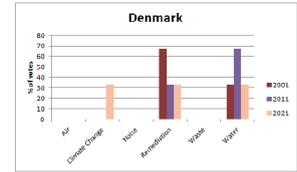
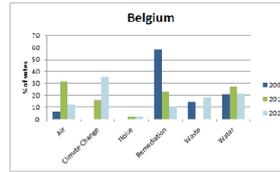


Comments

- Under Climate Change is also captured:
 - Energy use
 - Greenhouse Gasses
- Under Remediation is also captured:
 - Land Management



Country based Output PO/PS



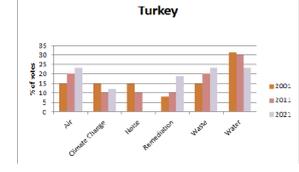
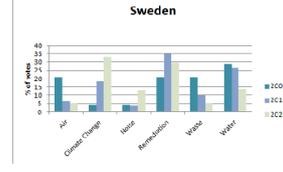
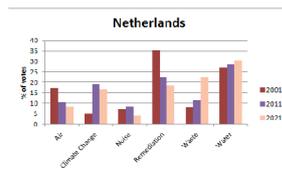
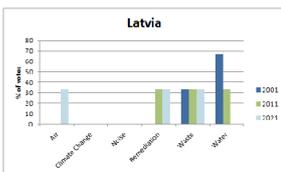
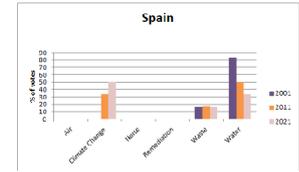
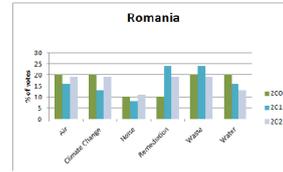
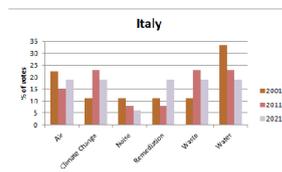
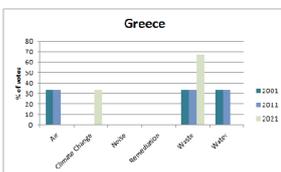
Note: many countries were represented by limited amount of persons



Country based output PO/PS



Country based output PO/PS

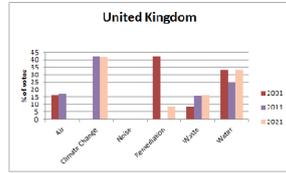
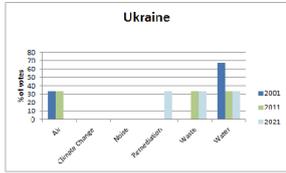


Note: many countries were represented by limited amount of persons

Note: many countries were represented by limited amount of persons



Country based output PO/PS



Note: many countries were represented by limited amount of persons



Previous NICOLE Network Meetings

State of the art of (Ecological) Risk Assessment, Stockholm, Sweden	16-17 June 2005
The impact of EU Directives on the Management of Contaminated Land, Cagliari, Sardinia, Italy	1-2 December 2005
Data Acquisition for a Good Conceptual Site Model, Carcassonne, France	10-11 May 2006
Making Management of Contaminated Land an Obsolete Business – Challenges for the future (NICOLE 1996-2006 Ten Year Anniversary Workshop), Leuven, Belgium	5-6 October 2006
Redevelopment of sites – the industrial perspective. Akersloot, the Netherlands	14-15 June 2007
Using baselines in liability management: what do upcoming Directives require from us? Brussels, Belgium	15-16 November 2007
Sustainable Remediation, London, UK	3 March 2008
Environmental Decision Support Systems, Madrid, Spain	9-10 October 2008
Basics and Principles of Environmental Law, Brussels, Belgium	31 March 2009
Sustainable Remediation - A Solution to an Unsustainable Past? Leuven, Belgium	3-5 June 2009
From Site Closure to Disengagement, Douai, France	18-20 November 2009
Contaminated land management: opportunities, challenges and financial consequences of evolving legislation in Europe, Trieste, Italy	5-7 July 2010
Emerging contaminants and solutions for large quantities of oil contaminated soil (Technical meeting), Brussels, Belgium	4 November 2010
Operating Windows for site characterisation, Copenhagen, Denmark	25-27 May 2011

For a complete overview of all networks meetings that have been held from the start of NICOLE up to now see www.nicole.org.