

SESSION 1 - INTERNATIONAL ACTIVITIES IN THE FIELD OF CONTAMINATED LAND

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INTRODUCTORY REMARKS OF THE CHAIRMAN: Mr. Urs Ziegler, Swiss Agency for the Environment

Welcome to Session 1 which will be about International Activities in the Field of Contaminated Land.

We have informative presentations about contaminated land issues throughout the world. I hope you will have a good picture after that about what is going on. This can also be a basis for discussion at the end of the meeting tomorrow afternoon when we will discuss future activities. Maybe we will find gaps or things that would be useful to discuss which are not discussed by other organisations or maybe you have some recommendations to make to other organisations. I think this will be a very helpful session for our future discussions.

I would like to ask Andrea Lodolo from ICS in Trieste, as the first speaker to tell us something about the activities of the United Nations and UNIDO in the field of contaminated land or something that goes beyond Europe or Western Europe and the United States but which also includes other places which have some problems with contaminated sites.

Open your presentations and welcome.

Note: This text was prepared by the compilers from Mr. Ziegler's recorded presentation.

ICS-UNIDO PROGRAMMES WITH THE FOCUS ON THE SUBPROGRAMME OF REMEDIATION - OVERVIEW AND STRATEGY

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The International Centre for Science and High Technology (ICS-UNIDO) is an institution operating within the legal framework of the United Nations Industrial Development Organization, with headquarters located in Trieste, Italy.

UNIDO is a specialized agency of the United Nations dedicated to promoting sustainable industrial development in developing countries and countries with economies in transition.

The mandate of ICS-UNIDO relates to the transfer of know-how and technology in favour of developing countries, and is justified by the perception that a competitive industrial technological capability cannot be built-up without appropriate scientific knowledge and commitment to a sustainable development approach utilizing new and environment friendly technologies. Activities of ICS are demand driven and aim to advance the industrial competitiveness and investment in target countries.

The last century was characterized by the positive economic and social results of industrial growth, which have been accompanied by the reversal effect of a global environmental crisis. The growing technology-based industry has had an important environmental impact, being the industry's major consumer of natural resources and the major contributor to the overall pollution load. In particular, four sets of factors are causing environmental problems at a global level:

- ♦ spoiling of the natural environment with the resulting loss of biodiversity;
- ♦ emission of gases which contribute to "green house effect" of global warming;
- ♦ emission of gases which are causing destruction of the ozone layer;
- ♦ pollution of water and soil caused by domestic and industrial activities.

Sustainable development can be the solution of the apparent paradox between economic development and environmental global crisis. This implies the agreement on necessary changes in people's lives and business philosophies, based on economic and technological development, prosperity and conservation and improvement of the environmental quality.

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The concept of sustainability lies on integrating economic, ecological and social dimensions into a broad overall system. Sustainable development requires harmonization of economic growth with environment conservation and protection. In this way, these three main dimensions – economy, environment and society – can be sustained into the future.

On the basis of the above, the activities of ICS follow an integrated pragmatic approach which includes awareness and capacity building in developing countries, dissemination of scientific and technological information and transfer of know-how and technologies, consulting and advisory services, training activities, scientific workshops, high level seminars, fellowships, publication of frontier issues.

In the present work programme the ICS's activities focus on specific sectors within the technical areas of **Pure and Applied Chemistry, Environment, High Technology & New Materials**. In selecting the specific subprogrammes and their related activities, special consideration was given to their relevance in relation to the scientific and technological development of developing countries.

Considering that sustainable development depends upon the harmonization of economic growth and environment conservation and protection, the ICS **Area of Pure and Applied Chemistry** has identified as priority fields in its work programme the following fields (**subprogrammes**), which are of key relevance to economic and industrial development as well as to environmental protection and recovery:

Environmentally Degradable Plastics

The expanding global production and consumption of polymeric materials coupled with increasing public awareness of environmental issues have created serious concern about problems related to the disposal of plastic waste generated by various sectors of human activity. Besides recycling, reuse, incineration and composting, new technological developments of environmental degradable plastics contribute dramatically to the tackling of the environmental issue in specific sectors of plastics use.

Combinatorial Chemistry and Technologies

These technologies have a strong impact on the development of new chemicals (pharmaceutical industries, agrochemicals and new materials). Developing countries need to get acquainted with and gain expertise in combinatorial technologies to help local enterprises remain competitive and economically viable in the coming decades. Combinatorial chemistry and technologies have a potential influence not only on industrial growth, but also on environment protection. In fact, by optimizing industrial processes and production, with the lowering of relevant costs, less waste and fewer by-products are created.

Catalysis and Sustainable Chemistry

This is an important scientific and technological area for the development of environmentally friendly chemical processes, which are the basis for cleaner industrial production and also the key elements for an industrial pollution prevention approach. New, less polluting processes together with the optimization of existing processes depend to a great extent upon the improvement of catalyst performance in heavy and fine chemical production lines, with direct impact on the generated by-products or waste.

Remediation Technologies

These are becoming an important tool to solve the problem of polluted sites, especially in developing countries and economies in transition, where the environmental issue has been until recently neglected and where large polluted areas, in addition to having lost their eco-functionality, often represent a serious risk for human health.

Among the different kinds of contamination, Persistent Toxic Substances (PTSs) and especially POPs (such as some pesticides and related chemicals, PCBs, etc.) represent one of the most serious and urgent problems to be faced because of their large diffusion in the environment on one hand, and because of their particular characteristics and properties which determine their persistence in the environment on the other hand. To face these problems, several remediation technologies have been developed in the last years and novel promising technologies and methodologies are emerging for various applications and are becoming more and more economically viable and effective to clean up contaminated waters and soils.

Bioremediation, in all its variations, is a very effective and widely-applied cleanup technology, which is able to degrade hazardous, toxic or merely offensive pollutants. Both *in situ* and *ex situ* applications have proved to be able to clean up sites which have been contaminated by a wide range of compounds that were once believed to be recalcitrant, such as chlorinated organics, PCBs, pesticides and other stable chemicals.

Other technologies, based on thermal and/or physicochemical processes, have already been developed on an industrial basis and many emerging techniques seem to be very promising to handle different kinds of contamination as they have reached significant results both in pilot scale and in full scale applications.

In conclusion, bioremediation technologies together with physicochemical and thermal methods represent an important way of facing the crucial problems of environmental recovery. Research and development efforts are extending their applicability and it is expected that there will be an increased use of these technologies leading, especially in developing countries, to a promising industrial market development.

Following the ICS' general strategy, the main tools for the implementation of the activities within the **Subprogramme of Remediation** of the Area of Pure and Applied Chemistry, are the following:

- ♦ Organization of **Expert Group Meetings (EGMs), Training Courses and Workshops**

All awareness and capacity building activities (workshops, training courses, etc.) are organized at a regional (or sub-regional) level. These training events, which are held either at ICS, in Italy, or in the various interested developing countries, are the main tools for the spreading of information, technology transfer and awareness building in the field of remediation technologies and their applications. The following events have been organized:

- Scientific Planning and Coordination Meeting on “**Bio-remediation**” Trieste, Italy - November 1996.
- Training Course on “**Soil Environmental Assessment and Bio-remediation Technologies**” Budapest, Hungary - June 1997.
- Training Course on “**Technological and Economic Aspects of Soil Bio/Phyto-remediation**” Plovdiv, Bulgaria - October 1997.
- Expert Group Meeting on “**Environmental Pollution and BATEV in Remediation**” Trieste, Italy - March 1998.

- Workshop on “**Waste Management and Remediation of Polluted Sites for Sustainable Development**” Hanoi, Vietnam - May 1998.
- Training Course on “**Remediation Technologies: New Trends and Tools for Soil Decontamination**” Katowice, Poland - December 1998.
- Workshop on “**Remediation Technologies: Applicability and Economic Viability in Northern Africa and the Middle East**” Cairo, Egypt - October 1999.
- Expert Group Meeting on “**POPs and Pesticides Contamination: Remediation Technologies**” Trieste, Italy - April 2000.
- Workshop on “**Persistent Toxic Substances: Environmental Pollution and Remediation Technologies in the Central Asia Region**” Tashkent, Uzbekistan - September 2000.
- Workshop on “**Contamination of Food and Agroproducts**” Varazdin, Croatia - October 2000.
- Workshop on “**Environmental Pollution and Applicability of Remediation Technologies in Latin America Countries**” Cartagena, Colombia – December 2000.
- Expert Group Meeting on “**Food/Agroproducts & Environment. Contamination Monitoring and Prevention**” Trieste, Italy – March 2001.
- EGM on “**Remediation of Polluted Sites in CEE Countries: Current Status and Perspectives**”, Trieste, Italy 4-6 July 2001.
- Workshop on “**Environmental Pollution and Applicability of Remediation Technologies in African Countries**”, Enugu, Nigeria, 16-19 July 2001.

Moreover, the following events are scheduled for the next period (2001- 2002):

- Workshop on “**Advanced Technologies for Cleaning Oil-Polluted Waste Water and Oil Sludge Treatment**”, Moscow, Russia, 10-12 December 2001.
- Workshop on “**Environmental Pollution and Applications of Remediation Technologies**” China, 2002.
- Seminar on “**Remediation Technologies Applications for PTS Contamination**”, Czech Republic, 2002.
- Expert Group Meeting on “**New Technologies for Soil Contamination Investigation and Water Monitoring**”, Trieste, Italy, 2002.

♦ Information Packages, Databases and Publication Activities

Information and data collected are compiled and organized in databases, information packages and in different kinds of publications (such as the books of proceedings of the various events) in the field. The following Information Packages and Publications have been prepared within the subprogramme of Remediation:

- Four Country Reports on “**Pollution Problems, Available Remediation Technologies and their Economic Viability**” (Brazil, Egypt, Russia, Vietnam);
- Compendium on Remediation “**Soil Clean-up Technologies and Soil Remediation Companies**”, 2nd Edition, 2000, published in cooperation with UN-ECE;
- ICS Proceedings of the Expert Group Meetings on “**POPs and Pesticides Contamination: Remediation Technologies**” and on “**Clean Technologies for the Reduction and Elimination of POPs**”,

and a series of papers have been prepared and published in different issues.

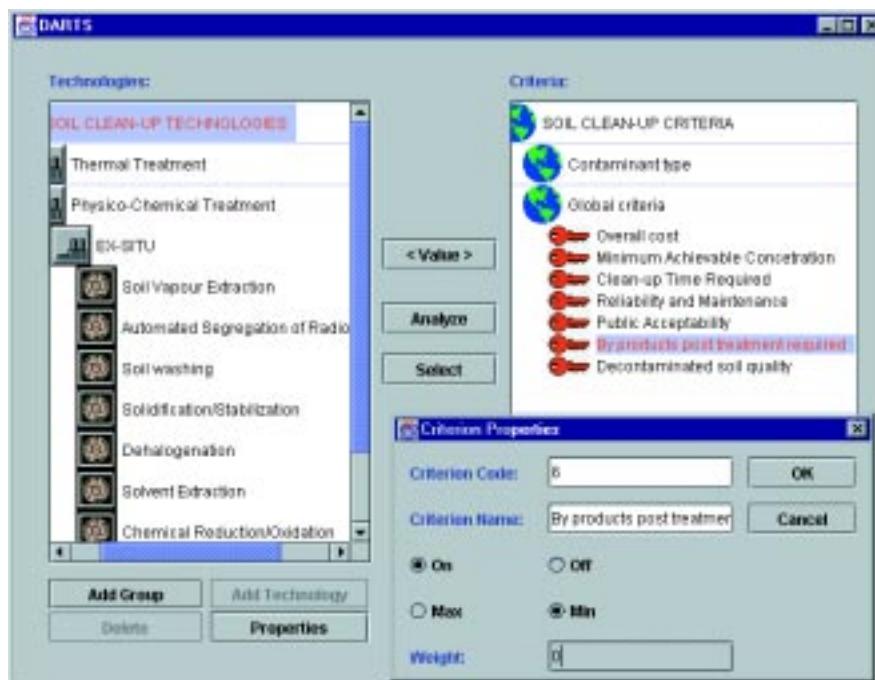
Moreover, among others, the preparation of the following information documents and publications is foreseen for the near future:

- **Country Reports** from China, Thailand, Czech Republic and Mediterranean Countries. By means of these reports, information on specific environmental problems, hot spots, application of remediation technologies, ongoing initiatives in the field, etc., will be collected and published.
- **Compendium on wastewater treatment and water purification technologies.** Specific updated information on wastewater treatment and water purification technologies suitable for developing countries will be collected, assessed, organized and published in compendium form.

♦ Development of “In-House” Expertise Tools

ICS is developing a series of decision-support instruments, built-up in-house. As core elements, these are used in training technical experts from target countries and are also diagnostically applied in the formulation of project proposals by enabling technological, economic, environmental and social pre-assessments. In particular, within the subprogramme of remediation, databases of best available technologies economically viable and a decision aid for remediation technology evaluation and selection are being developed:

- with the objective to create new tools for technical evaluation and analysis of applicability of remediation technologies and for helping decision makers dealing with remediation initiatives, a prototype software called “**Decision Support Tool on Remediation Technologies - DARTS**” is being developed at ICS. The software is continuously upgraded according to the latest developments in the field by using assessed latest information/data on applications of remediation technologies and data from advanced research of world recognized centres/institutes.



♦ Evaluation and Development of Project Proposals

Project promotion and formulation is obviously a key area at ICS. After assessment for economic, environmental, technological and social viability, projects are put forward for funding to possible donors. The following projects have been and are being prepared within the subprogramme of Remediation:

- The above-mentioned ICS in-house project “**Decision Support Tool on Remediation Technologies - DARTS**” will be further developed. Together with its continuous updating, the validation of the system by means of a series of test runs utilizing data gathered from assessed full scale applications and case studies is foreseen.
- With the aim to carry out feasibility studies, evaluate suitable and viable remediation technologies and to develop selected pilot projects and disseminate knowledge and information in the field of used oil treatment, a preliminary project on “**Development and Application of Novel Technologies for Used Oil Treatment in NIS and CEE Countries**”, particularly addressed to face the problems of used oil management in CEE and NIS countries, has been prepared.
- With the aim of surveying POPs’ polluted sites and to select hot spots, to evaluate suitable and viable remediation technologies, to carry out feasibility studies and develop selected pilot projects and to disseminate knowledge and information, a preliminary project on “**Remediation of Contaminated Sites in NIS and CEE Countries**” has been prepared.
- With the aim of collecting and assessing the latest information and data in the field of POPs destruction technologies, a project on “**Survey and Assessment of POPs (PCBs) Destruction Technologies**” is also being developed.

♦ Fellowships

ICS grants fellowships (lasting from 6 months to 1 year) for junior researchers coming from developing countries. Their job at ICS focuses on issues related to follow-up project proposals (or case studies), on the assistance in the preparation of databases (e.g. survey of technologies) and on the preparation of information packages and publications.

Within the subprogramme of remediation, **fellows** coming from Nigeria, Mexico and Colombia have been hosted at ICS and trained on remediation technologies and their applications.

♦ Networking and Participation of ICS in International Initiatives

ICS participates in international initiatives and events and, in addition to its cooperation with UNIDO, promotes the development of multilateral collaboration. The activities relevant to the Area of Pure and Applied Chemistry are being developed within the framework of a number of global and regional initiatives and in co-operation with several international bodies. Within the subprogramme of Remediation, projects and initiatives are promoted in the context of major international effort, e.g.: UN-ECE, OECD, EU Programmes, CEI, UNEP Chemicals, etc. To further promote information and know-how transfer and define possible co-operation, operational relationships with already defined networks of organizations/institutions (e.g. US-EPA, NATO/CCMS, CLARINET, Ad Hoc International Working Group on Contaminated Land, etc.) is also encouraged, in particular regarding the issues relevant to Persistent Toxic Substances contamination problems in EU, CEE and NIS countries.

NATO/CCMS PILOT STUDY ON EVALUATION OF DEMONSTRATED AND EMERGING TECHNOLOGIES FOR THE TREATMENT AND CLEANUP OF CONTAMINATED LAND AND GROUNDWATER

Speaker: *Mr. Harald Kasamas*
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Background

The Council of North Atlantic Treaty Organisation (NATO) established the Committee for Challenges to Modern Society (CCMS) in 1969. The CCMS was charged with developing meaningful environmental and social programmes that complement other international initiatives in solving specific problems of the human environment. A fundamental precept of the CCMS is the transfer of technological and scientific solutions and experiences among nations with similar environmental challenges. In 1997, the CCMS adopted a proposal from the USA and Germany for this Pilot Study on treatment technologies. It is the third in a series of Pilot Studies examining remediation technologies, which began in 1986 following an earlier UK-led Pilot Study on contaminated land issues in general. It will run from 1998 to 2002, with a final report in 2003.

Objectives

The pilot study is designed to identify and evaluate innovative, emerging and alternative remediation technologies and to transfer technical performance and economic information on them to decision makers and potential users. Innovative remediation projects are selected by the Pilot Study Group and their performance annually reported. Actual developments in the participating countries are continuously reported and published.

Results

The Pilot Study published various excellent reports (Proceedings of Technical Conferences, Final Reports) which are available for download from <http://www.clu-in.com/intup.htm#International>. All reports are also available at the NATO web site <http://www.nato.int/ccms>.

EU INITIATIVES ON SOIL PROTECTION (EU SOIL FORUM)

Speaker: *Mr. Onno van Sandick*
Ministry of the Environment
Netherlands

EU Initiatives on Soil Protection is not only of importance for European Union members. Countries like Switzerland for example are also participating. It was an initiative of the European Commission, in Germany, to invite a lot of people to Bonn a couple of years ago to talk about soil in general. There was a memorandum made and it was stated that one of the forgotten media of the environment is soil, and that political awareness of the importance of soil should be raised and put on the political agenda.

Following that, a meeting was held in Berlin where about 80 people participated and presented a lot of information on soil. It was also made clear that the focus of the European Soil Forum (ESF) would be very wide.

A wide range of aspects are related to soil. Contamination is one of the aspects, but also erosion, desertification, loss of fertility, eutrophication, acidification, even earth and mud slides like what happened in Italy recently. This wide focus means that there is a relation to many aspects of society like: agriculture, water management and spatial development. The aim of the European Soil Forum is to bring these things together and raise awareness in general but more specific, develop a European strategy on soil.

The European Commission has issued a new environmental action programme. In this action programme one of the items the European Commission will do in the next years is to develop a thematic strategy on soil relating to all of these aspects. The European Soil Forum is one of the media that the European Commission considers as an important means to have good relations with the countries and with the science and information base below it.

A Steering Committee, formed in Berlin met a couple of times and its intention is to have another plenary meeting within the near future (end of this year or beginning of the next year). Italy is presently taking the lead.

One of the clear results is that the European Commission has presented an outline of working documents that could lead to the soil strategy. This outline is available on its web site and also on CLARINET's, which is another source of information and this outline is very interesting as it tries to cover all the wide area.

I can point out the importance to the Ad Hoc International Working Group on Contaminated Land. It's important to be aware not only of the relation between contaminated sites, soil policy in general and the land management approach, but also the relation to water management and sustainable development. These relations can be developed in many aspects. The European Soil Forum is one of the ways in which these relations within these contaminated sites and sustainable development could be developed. I think it is important to have an exchange of information between these fora.

If someone wants more information, please contact me at Onno.vansandick@minvrom.nl

Note: This text was prepared by the compilers from Mr. van Sandick's recorded presentation.

COMMON FORUM ON CONTAMINATED LAND IN THE EUROPEAN UNION

Speaker: *Mr. Eddy van Dyck*
OVAM
Belgium

I am Eddy van Dyck from the Public Waste Agency of Flanders, OVAM. I was asked to give a little presentation, or rather an announcement of the next “Common Forum on Contaminated Land in the European Union” which will take place in Antwerp in October of this year. This forum will be organised in the framework of the Belgian Presidency of the EU and is accepted by our government as a side event of this presidency.

The former Common Fora took place in Bonn, Germany in 1994 when Germany was president of the EU; the next annual meetings were in Maastricht, Stockholm, Amsterdam, Edinburgh and Copenhagen.

The Common Fora give first of all, possibilities for information exchanges but are also discussion fora. The participants of the meetings are the regulators and policy makers of the European Union Member States, delegates of the EU administration (the DG Research and the DG Environment) and also the European Institute like the EEA.

In Antwerp, the first six Accessing Countries, the EFTA Countries and also the most important networks in the EU will be present.

The objectives of the Common Forum came out of the documents from Bonn, Maastricht and Stockholm. First of all, the identification of thematic areas for the EU-wide co-operation to enhance the dialogue between the different international activities, networking, etc., collection and discussion of the results of these activities, making recommendations on technical issues and practical aspects to the European Commission and the European Environmental Agency and facilitation of the understanding of each Member State’s approach. These are the objectives written down in former workshop documents.

We can say that the main results were CARACAS (Risk Assessment network) followed by CLARINET (Risk Management network). They were funded by the Environmental and Climate Programme and followed up by the DG Research.

What are now the topics for Antwerp? One of the main topics is the future structure of the Common Forum. We want to have it together with the EU Presidency in the future, so every six months if possible. Also organised by three countries, a troika, let’s say the former, the existing and future presidents. Another topic for Antwerp is the necessity of new networks, or the support of existing ones. CLARINET comes to an end and what are we going to do with the results?

The expectations of the Member States from the EU institutes and administration and on the other hand what the EU institutes want. It is a free and open discussion on the EU Soil paper, the Liability paper and state aid on environmental issues.

For more information, you can always contact me at: eddy.van.dyck@ovam.be

Note: This text was prepared by the compilers from Mr. van Dyck’s recorded presentation.

CLARINET: A EUROPEAN NETWORK ON THE SUSTAINABLE REHABILITATION OF CONTAMINATED LAND

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Abstract

Experiences with Concerted Actions like CLARINET and its predecessor project CARACAS have shown that the close co-operation between European Member States and the European Commission are powerful tools to tackle the perceived problems with contaminated land and groundwater. Such technical-scientific collaboration networks can competently utilise the expertise and resources already available and can prepare common grounds where European-wide procedures could be applied successfully. This in turn will lessen the existing differences in the practice of dealing with land contamination in the various European countries and the resulting economical distortion of the common market.

Concerted Actions are efficient tools to share knowledge on the subject and to understand the backgrounds for diverse approaches in use in European countries and the various perceptions by different stakeholder groups. They are essential to coordinate multinational RTD activities, to avoid unnecessary duplication of R&D activities on a national basis and to develop jointly a broader basis for scientific peer review. These networks are important for developing the international state of the art and identifying priority research needs. The results from these international partnerships provide useful sources of information for practitioners in the field.

The Concerted Action CLARINET provides such an interdisciplinary network on the sustainable management of contaminated land in Europe. It brings together the combined knowledge of various stakeholders such as scientists, government experts, and industrial land owners from 20 European countries. The major objective is to develop a sound basis for competent decision making on contaminated land management aspects in Europe. This paper highlights major developments and results achieved during the course of the CLARINET network. For a comprehensive overview, the reader is referred to the CLARINET web site at <http://www.clarinet.at>.

1. Introduction

Twenty or so years ago land contamination was usually perceived in terms of relatively rare incidents, with poorly known but possibly catastrophic consequences for human health and the environment. Several incidents attracted major media attention, e.g. Love Canal, New York State; Times Beach, Missouri; Lekkerkerk, the Netherlands. As a result politicians responded by seeking maximum risk control: pollution should be removed or contained completely.

Today land contamination is no longer perceived in terms of a few severe incidents, but rather as a widespread structural problem of varying intensity and significance. It is now widely recognised that drastic risk control, for example, cleaning up all sites to background concentrations or to levels suitable for the most sensitive land use, is neither technically nor economically feasible. To

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give an example, in 1981, about 350 sites in the Netherlands were thought to be contaminated and possibly in need of remedial action. By 1995, the number had grown to 300,000 sites with an estimated cleanup cost of 13 billion ECU. Similar circumstances exist in most other industrialised countries. Consequently, although the need for policies to protect soil and groundwater is recognised, strategies for managing “historical” contaminated land – legacies from past industrial activities – have moved towards integrated solutions based on *suitable-for-use* concepts (Ferguson, 1999).

However, effective and responsible risk-based management approaches require substantial research efforts to provide a reliable scientific basis for sound decision making. Related research activities are already supported by some European countries and the European Commission. Obtained results and experiences from these activities may be very beneficial to other stakeholders. Therefore, international networks for sharing information, developing case studies, disseminating research results and identifying research priorities have been launched during the last years. These networks are essential to avoid unnecessary duplication of R&D activities and to develop a broader basis of scientific peer reviews. The results from these international initiatives provide useful sources of information for practitioners in the field (Ferguson & Kasamas, 1999).

CLARINET – *The Contaminated Land Rehabilitation Network for Environmental Technologies in Europe* - offers such opportunities for contaminated land researchers and practitioners to learn about the current technologies and practices used in European countries, and also to bring their own expertise and experiences to the attention of a European audience.

2. CLARINET

The Concerted Action, CLARINET, is a network of 20 European countries, coordinated by the Austrian Environmental Agency and supported by the European Commission’s Environment & Climate Programme. CLARINET brings together the combined knowledge of academics, government experts, consultants, industrial land owners and technology developers. It provides an interdisciplinary network on the sustainable management of contaminated land in Europe, analyses key issues in decision-making processes and identifies priority research needs on technical, environmental and socio-economic topics. CLARINET focuses on the scientific basis of currently applied risk-based procedures in European countries, aiming to evaluate the current state of the art and to stimulate scientific collaboration on identified research needs in Europe.

3. Objectives

The primary objective can be broken down into three activities:

- (1) Analysis of key issues in decision-making processes and identification of priority research needs for the sustainable management of contaminated land in Europe. This analysis integrates risk assessment, decision-support issues and remediation aspects and takes the underlying policy frameworks and different concerns and requirements in the various European countries into account.
- (2) Creation and maintenance of a network for exchange of information on available methods, technologies and policy approaches.
- (3) Stimulation of international co-operation, especially for RTD, training and education networks and research infrastructures.

4. Themes and Initiatives

To yield an integrated approach within the project, seven interlinked working groups are addressing problem- and solution-related aspects for contaminated land management. The following themes are addressed by the CLARINET Working Groups:

- ◆ Brownfields Redevelopment
- ◆ Impacts of Contaminated Land on Water Resources
- ◆ Risk Management and Decision Support
- ◆ Remediation Technologies and Techniques
- ◆ Human Health Aspects
- ◆ Ecological Aspects Related to Land Reuse
- ◆ Collaboration of R&D Programmes in Europe

Analysis of strategic and technical aspects have been performed on these issues within the respective working groups. Based on the identified state of the art in these areas, integrative concepts and recommendations for tackling contaminated land problems have been investigated, taking country-specific requirements and circumstances (such as geographical, social, economical, political aspects) into consideration.

Furthermore, priority research needs have been identified, and multinational R&D projects between European countries have been initiated to support their realisation. For example, the Dutch Environment Ministry (VROM) launched the international R&D co-operation BARGE, which is addressing research on “*Human Bioavailability of Contaminants in Ingested Soil*”.

One of the CLARINET Working Group stimulates collaboration between various R&D Programme planners in Europe to enable effective coordination of available resources and research facilities in Europe. A strategic analysis of EU and national R&D Programmes relevant for contaminated land have been performed and published. One outcome of this analysis is the recommendation to strengthen the European research area and infrastructure with regard to a future EU Framework Programme.

5. Sustainable Contaminated Land Management - A Risk-Based Land Management Approach

Besides the individual themes covered in the CLARINET Working Groups, a broader concept on sustainable contaminated land management has been developed within CLARINET (*Risk-Based Land Management*). The need for such concept has been regarded necessary to organise the decision-making process for assessment and solutions of contaminated land problems in general. This concept is based on comprehensive inventories performed in the CLARINET participating countries.

These inventories have been published with the following documents (available for download on the CLARINET web site <http://www.clarinet.at>):

- ◆ *Problem/Solution Catalogue*, which summarises contaminated land related problems perceived by various stakeholders and currently available ways to deal with those.
- ◆ *RTD Catalogue*, which combines identified research needs for improved problem solution strategies; and the related RTD themes currently covered by various RTD programmes.
- ◆ *Conceptual Analysis*, which “maps” the key issues for decision making on contaminated land management.

The risk-based land management concept stresses the importance of integrative sustainable solutions, which are needed to restore the usability and economic value of the land. These solutions can be characterised by three elements: (1) risk reduction, (2) protection of the environment and (3) reduction of aftercare. The first two issues describe the environmental goals in relation to land uses and functions and soil and groundwater protection, including the spatial planning aspects. The third describes the way these goals should be achieved.

The risk-based land management concept is the overall outcome from the CLARINET project beside the individual Working Group results. This conceptual framework for sustainable management of contaminated land is considered necessary to organise this decision-making process.

6. Information Sources

6.1 Web site <http://www.clarinet.at>

This web site aims to provide actual and comprehensive information for all parties concerned with contaminated land management in Europe. The web site offers relevant information on various aspects such as EC 5th Framework and national RTD Programmes, Policy Frameworks in 20 European countries, other international networks on contaminated land, and many more. A web library offers key papers for download, and a comprehensive collection of hyperlinks refers to relevant web sources in all European countries.

6.2 Publications

Recently, first results developed in the CLARINET network have been published with various key-note papers in a special issue of the scientific journal "Land Contamination and Reclamation" (see references). This special publication highlights recent activities of CLARINET and the progress that is being made towards the establishment of better risk-based land management protocols and practices in the EU. It provides an overview of current research programmes including the current call for EU research under Framework 5, and identifies commonly perceived research needs among stakeholders in European countries. All articles are available for download at the CLARINET Web site <http://www.clarinet.at>

7. Conclusion

In recent years we have made great strides in Europe in forging a common understanding of the problems left by our industrial heritage. It is now recognised that the emerging disciplines of environmental risk assessment and management are vital in helping us tackle the contaminated land problem. It is a common view that risk-based approaches are vital to allow governments and industry to deal with contaminated land (*Ferguson et al, 1998*).

However, as in any science-based endeavour, there are numerous areas where additional research and technology development would significantly improve and advance the current use of Risk Assessment and Risk Management. Currently, contaminated land management is underpinned largely by scientific research done for other purposes. Further development and integration of these scientific building blocks is of the utmost importance. In a fully integrated approach, choices of toxicological endpoints must have consequences for the design of sampling schemes and exposure models, and vice versa. Uncertainties at each stage in the assessment should be recognised and may lead to the use of probabilistic or other techniques for dealing with uncertainty. Decision-support tools may provide guidance for risk managers to help

balance reduction of uncertainties against the costs of additional investigation. Integrated risk assessment procedures have yet to be fully developed.

However, only the close co-operation between European Member States and with the European Commission will provide the needed tools to tackle these challenges towards a sustainable management for contaminated land and water resources in Europe.

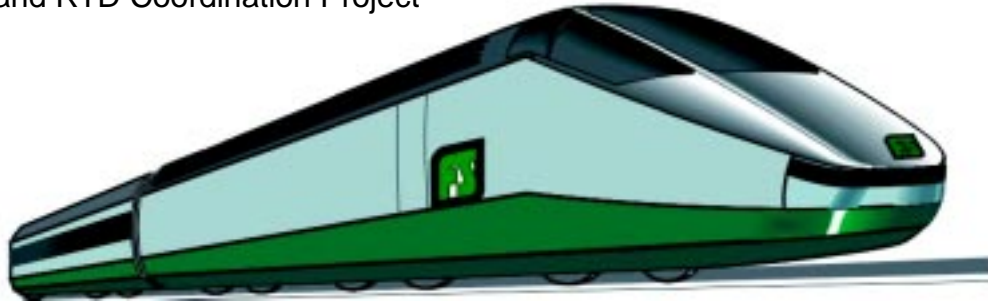
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IMAGE-TRAIN

Speaker: *Mr. Dietmar Müller*
Federal Environment Agency
Austria

Innovative **M**anagement of **G**roundwater Resources in **E**urope
Training and RTD Coordination Project



Accompanying Measure under the 5th EU Framework Programme for Research and Technology Development.

Coordinated by the Austrian Federal Environment Agency.

Accompanying Measures

- ◆ Accompanying Measures add value to running RTD projects → conferences, seminars, advanced study courses, workshops.....
- ◆ IMAGE-TRAIN is connected to 3 RTD projects (INCORE, PEREBAR, PIRAMID) in the field of groundwater management and aims at taking other projects on board.

Scientific Objectives

- ◆ To establish topic links between RTD projects dealing with innovative groundwater management and to promote their practical application.

➡ 3 CLUSTER MEETINGS

The projects INCORE, PEREBAR, PIRAMID of the 5th EU Framework Programme (Key Action Water) will form the basis to establish such topic links.

Other relevant research projects shall be identified and integrated along the course of the project.

- ◆ To transfer existing and emerging knowledge to young scientists and academics in the European Union and the EU Accession Countries.

➡ 3 ADVANCED STUDY COURSES

The knowledge and expertise from the core projects (PIRAMID, INCORE, PEREBAR) and closely related RTD projects will be utilised for the training of young scientists. Key findings of the cluster meetings shall be communicated to the study courses.

Focus of the ASC's

- Integral groundwater investigation
- Passive methods for *in situ* remediation of groundwater such as: permeable reactive barriers & monitored natural attenuation
- Remediation and safeguarding of mine tailing ponds

The Core Projects

- ♦ INCORE tackles the integral investigation, assessment and remediation of large aquifers and the localisation of sources of pollution.
- ♦ PEREBAR and PIRAMID both tackle passive *in situ* remediation.
 - PIRAMID focuses on acid drainages from mining sites.
 - PEREBAR deals with the implementation of permeable reactive barriers, their long-term performance and the improvement of barrier materials.

Project Overview

- ♦ **Duration:** 3 years – Start Sept. 1st 2001
- ♦ **Partners:** Austrian Federal Environment Agency (AT)
Institute for Ecology in Industrial Areas (PL)
University of Newcastle (UK)
University of Karlsruhe (DE)
University of Tübingen (DE)
- ♦ **Key Components:** 3 Cluster Meetings (CM)
3 Advanced Study Courses (ASC)/min. 35 students
Case Studies
IMAGE-TRAIN web site

Cluster Meetings

- ♦ **Participants** Partners of the core projects + external experts
- ♦ **Description**
 - to link specific topics of RTD projects dealing with cost effective management of European groundwater resources;
 - to identify existing "bottlenecks" in the practical implementation of innovative remediation technologies (—> recommendations for elimination);
 - to provide input to the advanced study courses;
 - to establish a platform for knowledge and information transfer, and
 - to identify subjects for technical meetings, including specific case studies of general interest.

Advanced Study Courses

- ♦ **Participants**
 - Approx. 35 junior scientists
 - 1/3 from EU Countries
 - 2/3 from EU Accession Countries
- ♦ **Description**
 - ASC's will be organised in EU Accession Countries (Katowice, Pécs, Ljubljana).
 - Participants will be selected according to criteria set by the IMAGE-TRAIN Scientific Coordination Team.
 - No participation fee
 - Financial support for accommodation and travelling for participants from EU Accession Countries (max. 55%).

Technical Meetings - Case Studies

- ♦ 6 Technical Meetings
 - ... elaboration of case studies referring to the practical application of innovative measures for remediation of contaminated land and groundwater:
 - in working groups
 - open for interested participants
 - involvement of local experts (e.g. local authorities)
- ♦ **Examples**
 - ... efficient structuring of field experiments (—> input for decision making)
 - ... use of results of immission pumping tests with regard to the implementation of permeable reactive barriers by optimising efficiency of barriers

Web Site - <http://www.image-train.net>

- ♦ **General project information**
 - IMAGE-TRAIN partners
 - IMAGE-TRAIN members and working areas
- ♦ **Announcement of events and conferences**
 - Advanced Study Courses
 - Cluster Meetings
 - Technical Meetings & Case Studies
- ♦ **IMAGE-TRAIN products**
 - Reports, proceedings, & course material
- ♦ **Core projects**
 - Organisations involved
 - Progress reports of core projects
- ♦ **Links to other relevant web sites**

Expected Impacts

The clustering process is expected to establish a comprehensive and coherent groundwater management strategy by:

- ... bringing together scientists working on related and complementing scientific topics,
- ... reviewing achieved results in view of economic and social requirements,
- ... better use of available resources along the development of specific scientific topics through information exchange between researchers working on related topics,
- ... increase of cost-effectiveness of groundwater management through combination of innovative technologies currently under development, and
- ... improvement of applicability of currently developed technologies through a combined analysis of relevant case studies.

Contact & Co-ordination

Austrian Federal Environment Agency

Umweltbundesamt

Gundula Prokop

prokop@ubavie.gv.at

EVENTS

1st Announcement

Advanced Study Course on Innovative Management of Groundwater Resources in Europe

IMAGE-TRAIN

A free course supported by the Key Action "Sustainable Management and Quality of Water"

Date: June 2002

Place: Institute for Ecology of Industrial Areas, Katowice

Description: The knowledge and expertise from three RTD projects (PIRAMID, INCORE, PEREBAR) which are currently funded by FP5 and other closely related RTD projects will be utilised for the training of young scientists. The focus will be on integral groundwater investigation and passive *in situ* groundwater remediation technologies (permeable reactive barriers, natural attenuation). More details about the programme will be available by the end of the year.

The course addresses young scientists, already involved in research related to innovative groundwater management. The participation of scientists from EU Accession Countries is encouraged. The course will be limited to 35 participants which will be selected according to criteria set by the IMAGE-TRAIN Scientific Coordination Team.

There are no participation fees for the Advanced Study Course. Participants from EU Countries have to cover travel and accommodation on their own. For participants from EU Accession Countries some financial support for accommodation and travelling will be available (max. 50%).

The application form and more information on the course will be available by the end of the year at: <http://www.image-train.net>

Further questions related to the course should be addressed to:

Mrs. Gundula Prokop

Umweltbundesamt / Austrian Federal Environment Agency

Abteilung Altlasten / Contaminated Sites Department

Spittelauerlaende 5; A – 1090 Vienna

Phone: +43 1 31304 – 3380 Fax: –5400

prokop@ubavie.gv.at

INTERNET-BASED INFORMATION SYSTEM ON GROUNDWATER AND CONTAMINATED LAND - EUGRIS

Speaker: *Mr. Andreas Bieber*
Federal Ministry of the Environment
Germany

Development of a Central European Hub

Collation of European contaminated land and groundwater information on the World Wide Web

EUGRIS - Why?

- ♦ Internet is a tremendous information resource for contaminated land and groundwater.
- ♦ Information available on the Internet is fractured and not structured.
- ♦ Information cannot be used as efficiently as it might be.

EUGRIS - Added Value

- ♦ Comprehensive collation of European contaminated land and groundwater information
- ♦ Guided, scalable and holistic approach to providing information
- ♦ Linkage of stakeholder networks and national initiatives
- ♦ Research management tool

EUGRIS – Scope

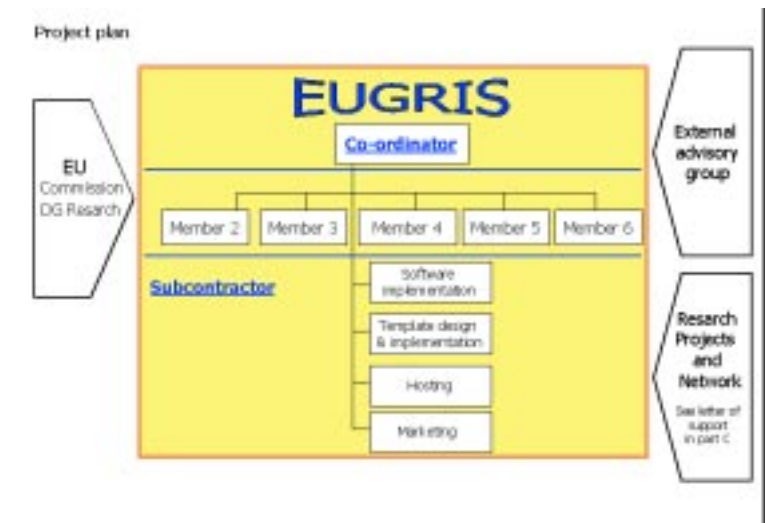
- ♦ Policies, strategies, legislation
- ♦ Site characterisation
- ♦ Fate and transport of pollutants
- ♦ Risk assessment
- ♦ Remedial technologies & strategies
- ♦ Monitoring & performance control
- ♦ Risk management & communication
- ♦ Socio-economic aspects
- ♦ Decision making

EUGRIS – Work


- ◆ Design and implementation of system and software
- ◆ Design of templates
- ◆ Production and use of information digests
- ◆ Development of the Foundation Version
 - ➡ Establishment of an external advisory group

EUGRIS – Developers

- ◆ Denmark
- ◆ Germany
- ◆ Hungary
- ◆ United Kingdom



EUGRIS - The Final Product

 <h3>EUGRIS: European Groundwater and Contaminated Land Information System</h3>		<p>Quick Find</p> <p>Issues: Contaminated Land Groundwater Protection Contaminated Sediments Landfills/ waste dumps Brownfields development</p> <p>Tools Investigation Risk assessment Contaminant behaviour Risk Communication Remedial approaches Decision Making Sustainability aspects Natural Attenuation Monitoring techniques</p> <p>Resources Guidance & Regulations Technical books & reports Standards Research & Case Studies Decision support tools Networks & Events Discussion groups Education & training</p> <p>Countries EU overall Denmark Germany Hungary UK</p>
<p>Your Location</p> <p>tells the user where he or she is on the site / warnings & messages, e.g. when the user is about to leave the site, if the user is in the hub or a national gateway etc</p>	<p>Site Tool Box Site Map Search Engines Set level of detail Register Logbook Contact Us Add Information Help</p> <p style="text-align: center;">Welcome to EUGRIS</p> <p>We warmly welcome you to this "one stop shop" for contaminated land and groundwater information in Europe. You can click on one of these questions to enter the site, or if you are an experienced user you might like to use the "quick find" menu or "tool box".</p> <p>As you use this web site more you may find that you would like to customise it to your needs. The "Site Tool Box" allows you to change the level of detail provided, the default setting is "general", but you may choose also between "intermediate" and "advanced". You can also register with the site to be notified of any important developments via our news group, to use the site's discussion groups and to use the logbook. However, you do not need to register to use the site's other services.</p> <p>The logbook is a means of remembering items in the web site that you might wish to go back to, and of keeping a record of what you have already seen. It can also be set so that it will automatically notify you of any changes to areas that you have visited previously. The logbook information is stored on your computer as a "cookie".</p> <p>Important note: by using this site you accept its terms and conditions.</p> <ul style="list-style-type: none"> • Tell us the problem site you need to know more about... • Tell us the contaminant(s) that you want to know more about... • Tell us the industry that you want to know more about... • Tell us the country you want to know more about... • Give me a general overview as a starting point <p>Details of the web site authors, funders and web master etc</p>	

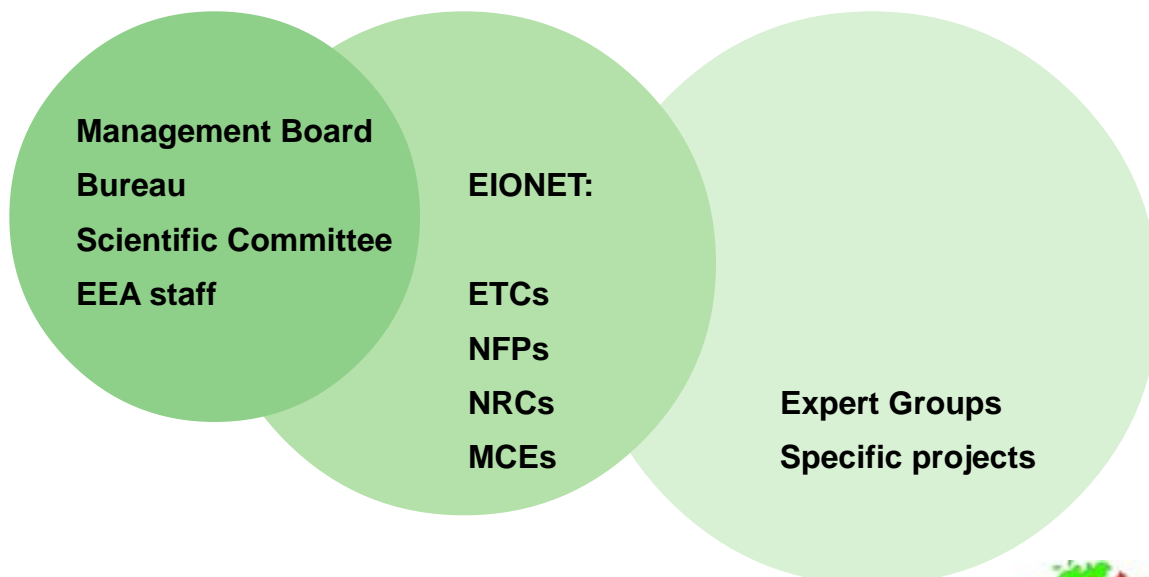
THE EUROPEAN TOPIC CENTRE ON TERRESTRIAL ENVIRONMENT

Speaker: *Mr. Urs Ziegler*
Swiss Agency for the Environment
Switzerland

Outline of Presentation

- ♦ About EEA and European Topic Centers
- ♦ Objectives ETC on Terrestrial Environment
- ♦ Main activities
- ♦ Institutional collaboration
- ♦ Time planning

EEA Bodies

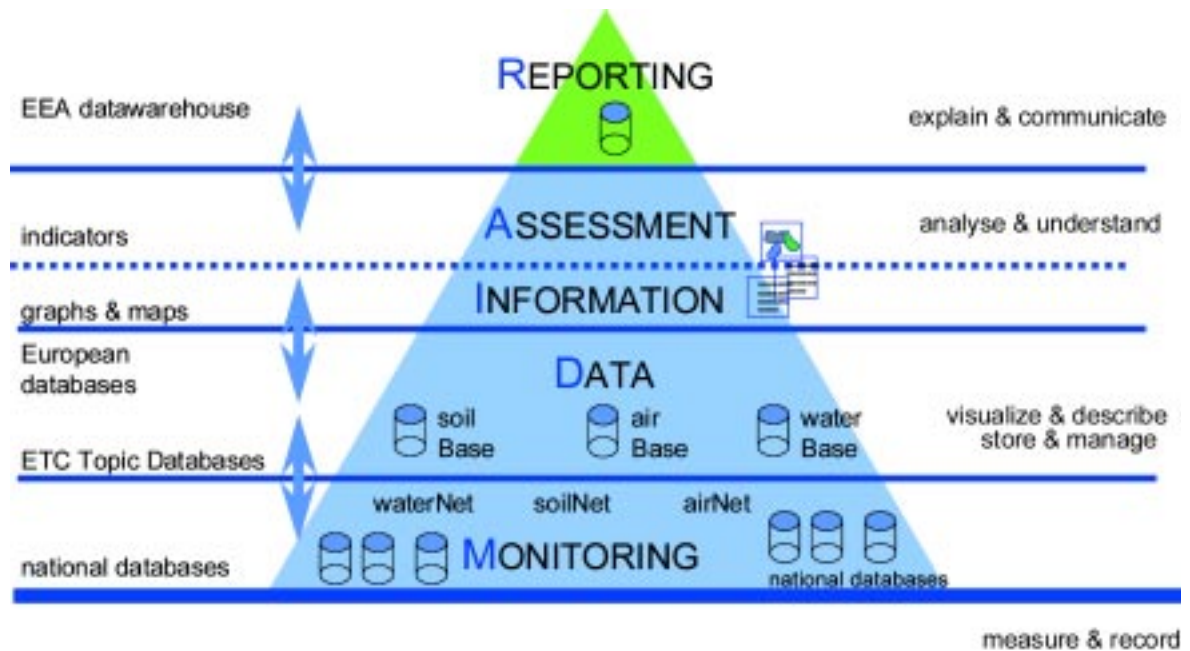


Geographical coverage

- ♦ **EU15 Member States**
- ♦ **Norway, Iceland, Liechtenstein**
- ♦ **Phare10 Accession Countries**
- ♦ **Candidate countries Cyprus, Malta, Turkey**
- ♦ **Non-Accession Countries**
(Albania, Bosnia-Herzegovina, FYRO Macedonia, Croatia)
- ♦ **Russia**
- ♦ **Switzerland**
- ♦ **Serbia-Montenegro**



The EEA Framework to Provide Policy Relevant Information



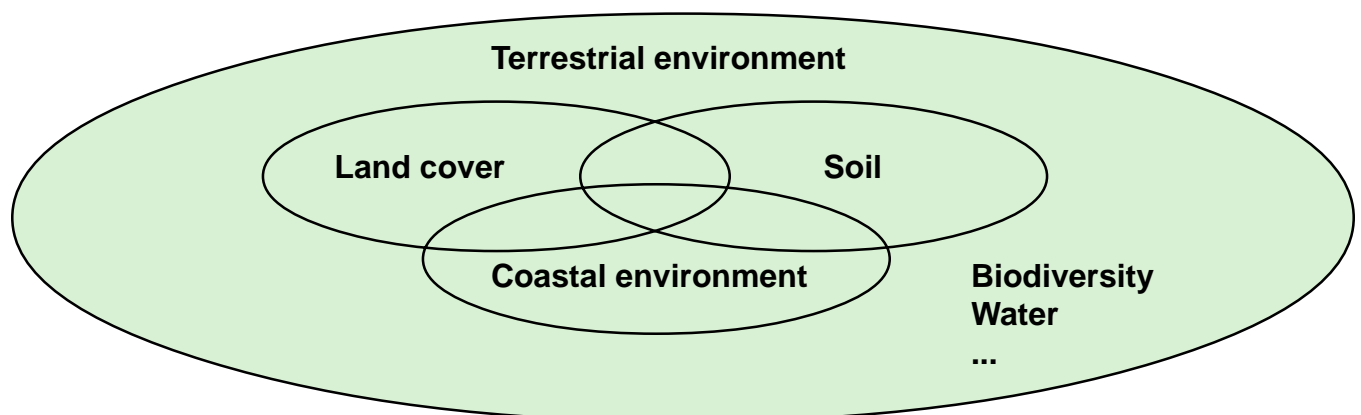
5 ETCs from 2001 onwards

- ◆ ETC on Air and Climate Change
- ◆ ETC on Water
- ◆ ETC on Terrestrial Environment
- ◆ ETC on Nature Protection and Biodiversity
- ◆ ETC on Waste and Material Flow

ETC/TE GOAL

“ To contribute to integrated assessment of the terrestrial environment using in particular spatial analysis tools.”

ETC/TE PRIORITY AREAS



ETC/TE Focus

- ♦ Assessment of past, present, future trends on land use and land cover changes, soil degradation
- ♦ Spatial analysis using existing data (cross-cutting issues nature, water, air, waste)
- ♦ Coastal environment

Support to EU Policy and Legislative Frameworks

- ♦ Environment Policy
 - New Water Framework Directive
 - Habitats Directive
 - Integrated Coastal Zone Management
 - Climate Change Convention
 - Sustainable Land Use Strategy
- ♦ Common Agriculture Policy
 - Impact of Agricultural Policy on the Environment
- ♦ Regional Policy
 - European Spatial Development Perspective

Development of Assessment Tools

- ♦ Assessments to be based on relevant environmental reporting units (instead of administrative units):
 - River catchments
 - Biogeographic regions
 - Soil regions
 - Urban zones
 - Coastal zones
- ♦ Tools to be used for IEA:
 - Geographic Information System (EEA-GIS)
 - Models for redistribution of statistical data to environmental reporting units

Information and Indicator Development

- ♦ Core set of indicators (DPSIR) for
 - Land use and land coverage change
 - Soil quality and soil degradation
 - Coastal environment

- ◆ In close collaboration with other ETCs, eg.:
 - Pressure (urbanisation, agriculture, transport, tourism), state (mapping) and impact (fragmentation) on habitat ecosystems
 - Analysis of River Basin Management Plans (catchments)
 - Estimation of carbon sinks in soil and vegetation

Data Handling

- ◆ CORINE land cover update
- ◆ Development of Soilbase in collaboration with JRC
- ◆ Feasibility study CORINE coastal erosion update
- ◆ Collaboration with Eurostat/GISCO
- + Public access to information

Support to EEA Reporting Cycle

- ◆ Contribution to EEA environment reports
 - Indicator-based reporting (Environmental Signals + TERM)
 - Land use change
 - Fragmentation and connectivity of habitats
 - Land take, urban sprawl
 - Soil erosion
- ◆ Europe's State and Outlook reports
 - Land cover and land use change
 - Soil degradation
 - Spatial chapters on urban, coastal, rural and mountain environment



Collaboration with EC Services

- ◆ Eurostat
 - Land use statistics (bridging mapping/statistics)
 - LUCAS
 - GISCO
- ◆ JRC
 - Institutional collaboration with SAI and EI (European Soil Bureau)
 - IMAGE2000/CLC2000, MOLAND, LACOST
 - GI/GIS (reference system, quality control)
- ◆ DG ENV
 - Sustainable land use (land use headline indicator)
 - Support to DG ENV-GIS (geo-referenced data on terrestrial environment)
- ◆ DG AGRI
 - Landscape indicators DG AGRI-GIS

Collaboration with other ETCs

- ♦ Nature Protection and Biodiversity
 - Habitat/ecosystems mapping
 - Spatial assessment of pressures on habitat/ecosystems
- ♦ Water
 - Spatial assessment of diffuse and local pollution by river catchment area
 - Identification of coastal zone reporting units and river basin districts
- ♦ Air and Climate Change
 - Spatial assessments of territorial carbon sinks
- ♦ Waste and Material Flow
 - Spatial assessments of soil waste issues (e.g. sewage sludge)

Tasks

- ♦ Integrated assessment of the policies and reporting
 - Signals 2002, Sectorial reporting (Agriculture, Transport)
- ♦ Indicators, data flow and databases
 - Core set of territorial indicators
 - TERRIS: a GIS-based information system
 - Update and maintenance Databases: CLC 2000, coastal zones, soil sealing, soil diffuse and local contamination
 - Data access via www
- ♦ Support to European Commission services
 - CAP
 - Integrating Coastal Management
 - European Spatial Development perspective
 - GMES (Global Monitoring for Environment Security, remote sensing)
- ♦ ETC Management and networking
 - Administration
 - Links to EIONET
 - Organisation of a Seminar (March 2002, with the Council of Barcelona), co-operation with other ETCs

ETC/ TE Projects

Land Use and Cover Change

- ◆ Landscape analysis, patterns, zoning & typology: general approach and methodology
- ◆ Land Cover/Land Use structures and changes
- ◆ Spatial approach to main ecosystems types
- ◆ External pressures on designated areas

Coastal Zones

- ◆ Coastal landscape analysis
- ◆ Landscape analysis by river basins
- ◆ Integrated Assessment of Coastal Zones

Soils

- ◆ Soil point contamination
- ◆ Soil sealing
- ◆ Soil contamination from diffuse sources
- ◆ Soil erosion
- ◆ Contribution to assessment of EU sequestration carbon balance
- ◆ Potential acceptance of sewage sludge by soils

CORINE2000 Quality Control, Based on Satellite Images IMAGE2000

- ◆ CLC2000 Technical Follow-up
- ◆ Feasibility Study of CORINE Coastal erosion updated

EEA - European Environment Agency



<http://www.eea.eu.int>