

CLARINET - ACTIVITIES AND RESULTS

Summary

INTRODUCTION

The Concerted Action CLARINET – Contaminated Land Rehabilitation Network for Environmental Technologies – started on 1.7.1998 and terminated on 30.6.2001. It brought together problem holders (RTD demanders) and solution providers (RTD suppliers) to tackle the problems of contaminated land in Europe. It utilised the combined knowledge and expertise from various stakeholders such as policy experts and industrial land owners, researchers and scientists, RTD Programme Planners and technology developers from 20 European Countries.

The overall objective of CLARINET was to identify the means, by which management of contaminated land can be applied effectively in a sustainable manner

- to ensure the safe (re-)use of these lands
- to abate caused water pollution
- to maintain the functionality of soil and (ground-)water ecosystems.

In order to meet this objective, CLARINET analysed current approaches on scientific, environmental and socio-economic topics related to contaminated land management in European countries. It identified priority research needs in this area and stimulated further co-ordinated R&D activities, both on an European and a national level.

This final report summarises major activities, results and conclusions derived within CLARINET.

1 Strengthening the European Research Infrastructure

A main objective for CLARINET activities was the initiation and stimulation of well-focused research activities in order to improve currently existing approaches and technologies for tackling environmental and socio-economical problems posed by contaminated land in Europe.

Related activities have been performed on three strategic levels:

- (1) by supporting the effective implementation of the European Commission's RTD Programmes,
- (2) by stimulating collaboration and co-ordination between national R&D Programmes in European Member States (ref. CLARINET Working Group 4),
- (3) by initiating joint RTD activities between European countries (funded by the national environment ministries).

1.1 CLARINET & the EC Framework Programmes

With regard to the EC RTD Framework Programmes 5 & 6, CLARINET has

- *monitored the progress of already approved FP5 projects;*
- *contributed to the mid-term review of the FP5 work programme*
- *informed the scientific community about the scientific focus of FP5 calls*
- *identified research priorities to be included in related RTD work programmes.*

CLARINET support the European Commission in focusing the Framework RTD Programme to the major gaps of knowledge in the field of contaminated land. In this regard, the CLARINET Steering Group prepared following documents:

- a common framework diagram for a coherent RTD strategy on contaminated land
- a listing of urgent problems perceived with contaminated land by various stakeholders in Europe
- identification of urgent research needs to tackle the perceived contaminated land problems
- suggested formulations for a revised work programme in Area 1.4.1 (“mid-term review”)

In particular, CLARINET supported the effective implementation of the European Commission's RTD Programmes through

- call-specific information provided on the CLARINET Website
- organisation of Workshops and Conferences
- publication of Joint Statements and articles in scientific journals

Discussion within CLARINET related to possible future priorities of Framework Programme and its impact on contaminated land research strategies, such as performing benchmarking exercises, establishing Centres of Excellence, strengthening European research infrastructure, and stimulating research & education networks. First conclusions, how CLARINET could most efficiently contribute to an efficient co-ordination and implementation of these future RTD priorities with regard to risk-based land management and the protection of water resources in Europe have been summarised in the proceedings of the CLARINET Plenum Meeting held in Venice (19./20.10.2000).

In addition, CLARINET provided scientific advises to other contaminated land related discussions, e.g. to the EU White Paper on Environmental Liability and its consequences for the future management of contaminated land problems in Europe. A related statement by CLARINET has been submitted to DG Environment, which reflected scientific concerns about the adequacy of proposed general numerical soil standards for Europe. As a consequence, CLARINET has been invited to participate in the future consultation process regarding the further development of this White Paper.

1.2 Collaboration between RTD Programmes in Europe

To stimulate novel collaboration and co-ordination between RTD programme planners in Europe, CLARINET has established one specific Working Group (WG4) on "Co-ordination of RTD on an European level". One outcome of this WG4 is "An Analysis of National and EU RTD Programmes related to Sustainable Land and Groundwater Management". This analysis evaluates the state of the art in RTD funding on contaminated land issues in Europe, and gives recommendations for a more co-ordinated approach.

1.3 Joint RTD Projects initiated between European Countries

Human Exposure Model Comparison Study

The use of mathematical models to estimate the levels of human exposure to contaminants can lead to a wide range of results, depending upon the model and parameters selected. The consequences in terms of risk assessment of contaminated sites can be far-reaching. Therefore, a better insight into the use and accuracy of human exposure models is required. For this reason exposure calculations using different models from seven European countries are compared on the basis of questionnaires. The calculations are based on twenty different exposure scenarios, with differences in soil use, soil

type and contaminants. In addition, an overview is given of default values for the input parameters used in the different European countries as well as the proposed exposure parameters of NICOLE. The term of submission of model calculations has now expired and the final results of the study will become available during 2001.

- Scientific Publication: "Human exposure model comparison study: state of play", F.A. Swartjes, EPP 2001

BARGE – Bioavailability Research Group in Europe

Chemical compounds ingested in a soil matrix are likely to be less bioaccessible (i.e. extractable in the human gut) than under conditions used for toxicity testing and derivation of tolerable daily intake levels (TDI). However, as detailed knowledge about matrix factors affecting the bioaccessibility of soil contaminants is lacking, the default value for relative oral bioavailability is 100%, i.e. the chemicals are regarded as ingested with food. As a result, sites with relatively high levels of contamination are frequently designated as unsuitable for their actual or intended use even though only a small fraction of the contaminants may be bioaccessible. Establishing the bioaccessibility of toxic chemicals in ingested soil would have a major impact on risk assessment practice and for the setting of soil guidelines. It would consequently greatly reduce the costs of contaminated site remediation and the impact of "alarm reports" in areas where developments have already taken place on moderate contaminated soils.

An European network organisation, BARGE (Bio-Availability Research Group Europe), has been established within CLARINET in order to address these issues. BARGE combines important European institutes and research groups who study the human bioavailability of priority contaminants, such as lead, cadmium and arsenic. The first goal of BARGE is to compare and value the many models and systems that have been developed over the years to estimate bioavailability. The ultimate goal is to arrive at more realistic bioavailability factors to be used in site specific risk assessment and for policy making.

An initial study within BARGE involved five European research institutes using different physiologically based extraction techniques to assess the bioaccessibility of arsenic, cadmium and lead in three different soil samples.

- Results available at the BARGE web-page: <http://www.cremers.demon.nl/barge/>
- Scientific Publication: "*BARGE, Bioavailability Research Group Europe: European co-ordination on risk assessment of soils*", R.A. Schelwald, EPP 2001

Eco Risk – Research Group & Workshops

Ecological problems associated with contaminated land are mainly addressed under the heading "ecological risk assessment". Compared to human health risk assessment ecological risk assessment is a new field of interest. Like human health risk assessment, it may be used for setting priorities in soil use and management, for drawing up standards and guidelines and as tool for site specific risk management decisions.

Until now ecological risk characterization has focused greatly on standard setting, based on laboratory research data and theoretical extrapolation methods. These standards may be used as a yardstick to assess ecological impact "in general". This approach is too limited for a site specific assessments of the impact of soil pollution on specific ecosystems. One might still be able to perform a ranking of sites based on general theoretical considerations, but when it comes to specific decisions about clean up goals, generalized ecological risk assessment will be of little value. Therefore there is a great need for the development of procedures for the assessment of site specific ecological risks.

Current ideas on site specific ecological risk assessment approaches differ from country to country or even between regions, they normally consist of a combination of three general approaches:

- A comparison of chemical data with generic guideline values, quality criteria, target values etc., derived from toxicity data obtained in standardized ecotoxicological test. This is widely used in many countries.
- Bioassays with solid material or soil extracts from the contaminated site as a supplement for chemical analysis. This is commonly used in some countries.
- Biological monitoring of biomarkers, bioconcentration, indicator species, changes in community structure etc. These indicators are seldom used in current risk assessment practice, but may be covered in research projects.

A major stumbling block for the further development of generic and site specific ecological risk assessment is the lack of an appropriate "ecosystem theory" that can serve as a framework for interpretation of laboratory and field data. Although human health risk assessment is also largely based on lab experiments with animals, there is a framework for interpretation in medicine, sociology and psychology, which is lacking in the ecological approach. The results of ecotoxicological laboratory research are often quite clear, but may not be relevant under field conditions. On the other hand every ecological ob-

servation in the field in a polluted area is relevant but not easy to interpret in terms of adverse effects of pollutants. The term "ecosystem health" may be used to denote the theoretical framework for interpretation of ecological and ecotoxicological data which has to be developed by an integration of ecotoxicology with ecosystem theory.

Contaminated land risk assessment is - almost by nature - focusing on the **problems** associated with soil contamination. However, in the CLARINET project the main interest is on the **solutions** of contaminated land problems. If risks are well defined, "risk reduction" may lead to acceptable solutions, but for ecological risks, which are mostly defined in terms of rather qualitative indices, this procedure may be questioned.

Looking at the solutions for contaminated land problems, most countries advocate a "fitness for use" approach. In a "fitness for use" approach the ecological aspects of the required soil quality depend on the way the soil is used by man. For instance gardens, parks, and agricultural land are unnatural or manmade ecosystems that do require a certain ecological soil quality. Current practice in risk assessment tends to neglect these ecological requirements and only addresses human health risks, which lead to "acceptable" levels of certain substances (for instance heavy metals) that seriously affect the capacity of the soil to support plant and animal life.

Within the Concerted Action CLARINET, the RTD initiative ECORISK has been established. The main objective of ECORISK is to support sound integration of ecological issues in contaminated land risk assessment and solution design. It is also promoting the R&D needs identified by the former CARACAS project relevant for ecological aspects and stimulates international R&D co-operation in this field. ECORISK organised an International Workshop on Ecological Risk Assessment in Nunspeet/Netherlands in April 2001.

- Scientific Publication: *"Ecological Risk Assessment for Contaminated Sites in Europe"* – Trudie Crommentuijn et. al.
- Proceedings of the ECO Risk Workshop

Workshop on Environmental Epidemiology of Contaminated Land

Environmental exposure assessment is an important analytical tool for evaluating the likelihood and extent of actual or potential exposure of receptors to the sources of environmental hazards. Examining the causality of adverse effects, however, requires closer attention to the mechanisms of toxicological action and a statistical analysis of effects

by reference to the potential source of hazard. Environmental epidemiology supports this type of analysis.

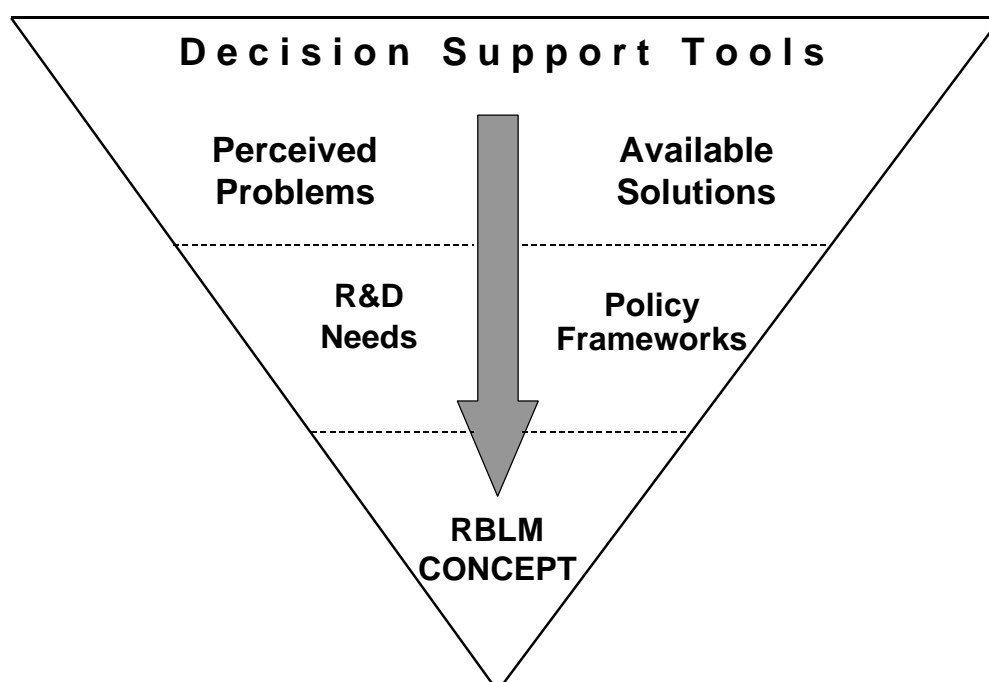
Issues of research and practical implementation associated with the use of environmental epidemiology tools for land contamination problems have been identified during a joint workshop between the Environmental Agency of England and Wales and the Concerted Action CLARINET in March 2001.

- Scientific Publication: *“Research Issues for the Environmental Epidemiology of Contaminated Land”* – Simon Pollard et. al.
- Proceedings of the *Workshop on Environmental Epidemiology of Contaminated Land*

2 TOWARDS SUSTAINABLE STRATEGIES FOR CONTAMINATED LAND MANAGEMENT IN EUROPE

2.1 CLARINET ANALYTICAL FRAMEWORK

To ensure effective overall conclusions and to meet the aimed project results, the CLARINET Steering Committee used an integrative “Analytical Framework” as a basis for the overall recommendations towards a concept of sustainable contaminated land management (RBLM). The figure below indicates the analytical procedure:



The “Analytical Framework” is based on information and data compiled in the three underlying documents:

The Conceptual Paper

This document highlights strategic considerations for contaminated land management. It aims to provide an intellectual basis for the subsequent analytical phase. The conceptual paper “maps” the key-issues relevant in current decision making; taking into account the existing policy aspects in the European countries.

List of perceived problems

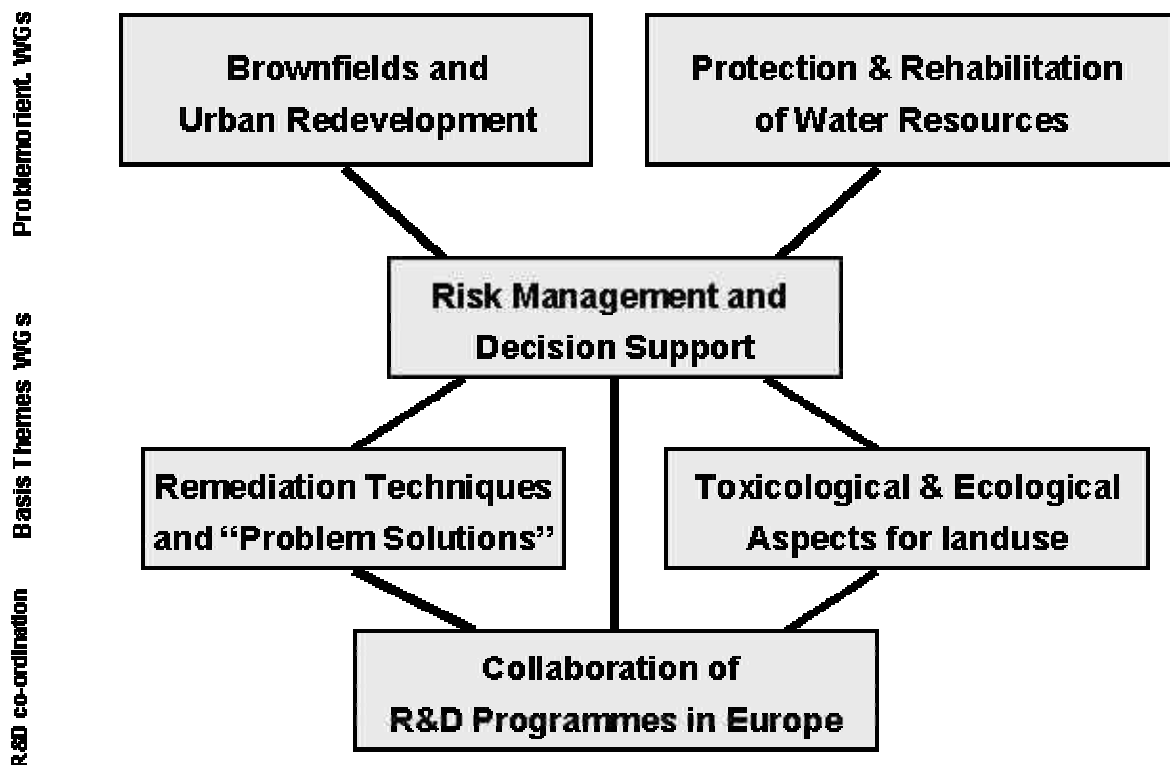
CLARINET summarised major concerns perceived by various stakeholders with contaminated land in Europe, where well-focused and integrated RTD initiatives are highly needed to support problem-solution strategies. This list has been used for setting priorities within the CLARINET Working Groups.

RTD Needs Paper

This paper summarises RTD Needs for improved Contaminated Land Management as identified by the CLARINET Network. It has been delivered to DG Research to support in the revision of the FP5 RTD Work Programme.

2.2 CLARINET WORKING GROUPS

To yield an integrated approach within CLARINET, seven working groups have been established.



Specific analysis have been completed and published by these individual CLARINET Working Groups. Beside thematic reviews and analysis studies, CLARINET Working Groups have taken individual initiatives such as stimulating international RTD collaboration on priority RTD needs, organising international workshops and conferences, launching their own websites, developing and publishing decision support tools and databases. All these individual WG initiatives have resulted in a wide range of CLARINET deliverables.

The working group "Groundwater & Surface Water Protection" focuses on groundwater contamination affecting groundwater and drinking water resources, aquatic ecosystems etc. These problems address a "regional" scale. With regard to the EC Framework Programme, it addresses the Key-action "Sustainable Management and Quality of Water".

The working group "Brownfields and Redevelopment of Urban Areas" focuses on problems at a "local" scale and will integrate specific aspects of human risks and ecological risks together with selection of appropriate remediation technologies in a sound risk management and decision support systems. With regard to the EC Framework Programme, it addresses the Key-action "City of Tomorrow".

One working group in CLARINET aims to stimulate collaboration between national R&D programmes in Europe and realisation of identified RTD needs on contaminated land related scientific issues.

The co-ordination of the seven specific Working Groups towards the aimed overall conclusions and recommendations for contaminated land management is in the responsibility of the CLARINET Steering Committee.

2.2.1 *Brownfield Redevelopment in Urban Areas*

Brownfields are derelict or underused land that have real or perceived contamination problems. They are one of the negative results due to the breakdown of core industries during the periods of industrial changes in Europe. They now often require intervention to bring them back into beneficial use. National and regional policymakers are faced with the challenge of

- rehabilitation of industrial sites and the elimination of hazards to human beings and the environment as well as
- reintegration of rehabilitated sites into the economic cycle

Brownfield redevelopment in this context is a common task of environmental restoration, land planning and economic policy.

The CLARINET Working Group "Brownfield Redevelopment in Urban Areas" focused its discussion and activities on the evaluation of the best practice approaches in brownfield redevelopment across Europe. Therefore this WG has examined national and regional concepts and requirements regarding environmental, economic and planning permission issues and procedures as part of the redevelopment and soil remediation process. On the basis of an evaluation of real cases and the identification of promoting and inhibiting factors, practice-orientated decision making tools and criteria for brownfield redevelopment have been developed.

In particular, this Working Group

- investigated and compiled country-specific frameworks and approaches for brownfield redevelopment including facts and figures for describing the environmental aspects;
- made an inventory of brownfield redevelopment projects across Europe and evaluated current practices;

- recommended activities at an international level and future (research) needs;
- established an international network of expertise

As a result, this working group

- performed a survey among the European countries;
- developed a "Check List" for land recycling;
- published a scientific paper on "Urban Brownfields in Europe"
- organised an International Workshop on "Redevelopment of Derelict Land" , in Duisburg, Germany October 4-6 1999, organised by the German Ministry for the Environment and the German Environmental Agency;
- successfully submitted two project proposals to the EC 5th Framework Programme, Key-Action "City of Tomorrow";

2.2.2 Contaminated Land and its Impact on Water Resources

Water resources used for different purposes such as drinking supply, industrial processes, irrigation, etc. are threatened in many European countries due to widespread contaminations originating through different sources (point sources by accidental or industrial spot sources, or diffuse sources by agricultural practices).

The CLARINET Working Group "Contaminated Land and its Impact on Water Resources" evaluated current national approaches for water resources protection, particularly on groundwater protection.

In particular, this Working Group focused on

- Definitions & protocols on natural attenuation in legal frameworks (national and EU level)
- Monitoring and control networks
- Key parameters for decision making

As a result, this working group

- performed a survey among the European countries, and analysed the received information and data;
- published a scientific paper on key issues identified by the working group, such as regulatory approaches (technical and procedural) between water resource protection & rehabilitation of contaminated land; the future influence of the Water Framework Directive in groundwater and contaminated land remediation; the point of compli-

ance for both protection & remediation of groundwater resources (at the water table, the site boundary or the receptor); the acceptance of natural attenuation in remediation.

- will organise an International Conference on "Protecting Groundwater" in Birmingham (UK) on 4-5 October 2001, organised by the UK Environmental Agency;

2.2.3 Decision Support & Risk Management

What is "Decision Support"? The assistance for, and substantiation and corroboration of, an act or result of deciding; typically this deciding will be a determination of optimal or best approach. Several "layers" of decision support can be distinguished: the input information, tools to assist particular decision making issues, and the overall system in which decision making is applied. Decision support codifies specialist expertise in a way that allows its reproducible use by many. It integrates specific information about a site and general information such as legislation, guidelines and know-how, to produce decision-making knowledge in a way that is transparent consistent and reproducible.

CLARINET' s Working Group on "Decision Support & Risk Management" has reviewed and catalogued decision support for contaminated land management in Europe. Its aim was to provide recommendations for research needs for decision support strategies and to identify & evaluation key factors for decision support and development of the state of the art.

As a result, this Working Group

- performed a survey of decision support issues in European countries;
- derived a conceptual framework for Decision Support Tools (DSTs);
- catalogued available DSTs (a web linked catalogue has been installed);
- organised a workshop at the annual NATO/CCMS Conference on "Remedial Technologies for Contaminated Soil and Groundwater" (webinformation established at <http://www.nato.int/ccms/info.htm>);
- organised a workshop on DST at the Consoil 2000 conference;
- published a status report and scientific papers, e.g. *"Framework for decision support used in contaminated land management in Europe and North America"*, R.P. Bardos et al.

2.2.4 Remediation Technologies

The CLARINET Working Group on "Remediation Technologies" has reviewed and analysed the present status on use of remediation technologies in Europe. Remediation technology is defined as "*A specific technology, a set of technologies or a technological solution or approach used to reduce risks from a contaminated site. This can possess a chain of different technologies as well as broader approaches incorporating elements that cannot be properly described as technologies, such as the imposition of land-use restrictions*".

As a result, this Working Group evaluated

- status on implementation of remediation technology in European countries;
- suitability of different technologies;
- experiences on operation and cost figures;
- technology development approaches;
- It published an analysis report and made available to European R&D groups, technology developers, and policy makers.
- It published a scientific paper together with the Working Group "Decision Support" on "*Towards a framework for Selecting Remediation Technologies for Contaminated Sites*" in the Journal "Land Contamination & Reclamation".

2.2.5 Human Health Aspects

The primary objective of this working group was to identify research areas which, alone or in conjunction with other areas, can be carried forward through national or international funding. The following areas have been identified:

- Comparison of human exposure models.
- Human bioaccessibility of contaminants ingested in soil.
- Human toxicity criteria used for selected chemicals (As, Cd, PCBs, trichloroethylene, benzene) in contaminated site risk assessment.

As a result, this Working Group carried out

A. Human exposure comparison study

The comparative study on "Human exposure models" reviews various human exposure models used in various European countries and investigates the existing differences in input parameters. The calculations are based on twenty different exposure scenarios,

with differences in soil use, soil type and contaminants. In addition, an overview is given of default values for the input parameters used in the different European countries as well as the proposed exposure parameters of NICOLE. The main objective of this comparison study is to understand and minimise existing differences of scientific data underlying risk assessment procedures used in European countries. This international review study is co-ordinated by the Dutch RIVM

- Study published by RIVM/Netherlands
- Scientific Publication: "*Human exposure model comparison study: state of play*", F.A. Swartjes, EPP 2001

B. Human bioaccessibility of contaminants ingested in soil.

This international RTD collaboration has been initiated by the Netherlands within the CLARINET Working Group 6 (Human Health Aspects). The research study "Human bioavailability of ingested soil" is a scientific collaboration of well-acknowledged researchers in Europe with the support of various environment ministries. The study focuses on the differences in intake and uptake of contaminants in the human body, and will have considerable impact for improved and scientifically sound risk assessment practices. BARGE organised expert meetings to set-up and co-ordinate the future RTD programme and launched its own website at <http://www.schelwald.nl/pages/barge/>

- Scientific Publication: "*BARGE, Bioavailability Research Group Europe: European co-ordination on risk assessment of soils*", R.A. Schelwald, EPP 2001

C. Comparison of human toxicity criteria used for selected chemicals in contaminated site risk assessment.

Twelve countries responded to the distributed questionnaire. Most countries use internationally acknowledged TDI values, such as those established by WHO. Differences in TDI values used may be due to policy decisions, for instance whether or not a chemical should be regarded as a genotoxic (no threshold) carcinogen.

- Study published by RIVM/Netherlands

2.2.6 Ecological Requirements for Land Reuse

The main objective of this Working Group is to support sound integration of ecological issues in contaminated land risk assessment and solution design. It is also promoting the R&D needs identified by the former CARACAS project relevant for ecological aspects and stimulates international R&D co-operation in this field.

In particular, this working group has addressed following key-issues

Ecological Risk Assessment: How to quantify and evaluate site-specific ecological risks of polluted soil?

Ecological requirements related to land use: What soil quality is required for "non-natural situations" like parks, gardens, greenbelts, etc. Are these requirements the same as for soil in natural reserves or is some pollution acceptable? What are the critical substances?

Ecological Health: Requirements (for contaminated land solutions) and problem definition (risk assessment) may be related to an theoretical framework like "Ecosystem Health". Such concept needs further exploration, which will support the communication about ecological aspects of soil contamination with non-ecological specialists in the field of contaminated land.

As a result, this Working Group

- explored available information and scientific approaches in this field.
- provided a conceptual framework for the practical application of current ecological knowledge in decision making
- made specific research recommendations and supported their realisation
- organised an International Workshop ECORISK on the subject in the Netherlands.

Inventory: An inventory was launched to study the use and needs of ecological risk assessment (ERA) in the field of contaminated land management in Europe. The study is being carried out on behalf of the Dutch Ministry of Housing, Land-use Planning and Environment (VROM) by S-tec BV Environmental Consulting. A questionnaire with key questions was sent to all country representatives of the CLARINET-network. It requested details on ongoing projects on site specific ecological risk assessment and contact details on key-players in this field. Also an Internet-search and further telephone and literature inquiry was performed.

From the initial findings it appears that in an ecological science context dealing with "ecological quality" is difficult, because there is no general accepted definition. Further development of a suitable ecosystem theory as well as a common framework seems to be an important focus of future research. In policy decision making recommendations for the usage of laboratory toxicity data, bioassays on contaminated material, biological monitoring, and other parameters seems to be urgently needed, because there are no general standards.

International Workshop on Ecological Risk Assessment:

An ecological risk assessment workshop ECORISK has been organised by this Working Group in the Netherlands in April 2001. Proceedings of this ECORISK Workshop have been published by VROM.

2.2.7 Collaboration of European Research Programmes

Many countries stimulate the development of the tools needed for sound contaminated land management with national R&D programmes. The thematic focus of these R&D programmes is based on particular concerns in the country at a certain time. Currently, multinational collaboration is limited to certain research projects, but there is no co-operation on a broader level of R&D programmes. This CLARINET working group aims to stimulate collaboration and co-ordination between national R&D programmes on contaminated land issues.

This has been performed through

- investigating ways for collaboration between various R&D programme leaders in Europe, which has resulted in an effective co-ordination of contaminated land research on a European level.
- a survey on ongoing research topics (and projects) in Europe related to contaminated land
- a review of research needs.

As a result, this Working Group "Collaboration of European Research Programmes"

- developed a strategic analysis paper incl. relevant information on R&D Programmes
- establish information network on European R&D Programmes on WWW
- stimulated international R&D collaboration, e.g. to address priority research needs identified by CARACAS and NICOLE

Publications:

- *"An analysis of national and EU research programmes related to sustainable land and groundwater management"* - H.J. van Veen, J. Büsing and H. Kasamas
- *"Scientific and Research needs for contaminated land management"* - J. Vegter
- *"Contaminated land research under the EU RTD Programme 'Environment and Sustainable Development'* - J. Büsing
- *"Management of Contaminated Land for the Protection of European Water Resources"* - Joint Statement of the Concerted Actions CLARINET, NICOLE, ETCA, SENSPOL (October 2000)

3 INFORMATION & KNOWLEDGE TRANSFER

CLARINET Final Conference in Vienna (21./22.6.2001)

The International CLARINET Conference has been held in Vienna on 21st and 22nd of June 2001. Major objective of this conference was to present conclusions and recommendations derived in CLARINET to a broader audience. More than 250 stakeholders participated at this conference. The proceedings of this conference are attached in the appendix to this report.

CLARINET WEBSITE

The CLARINET Website <http://www.clarinet.at> has been considerably revised and updated. This information source is open to all interested parties and provides actual and comprehensive information concerned with contaminated land in Europe:

- **NEWS** (conferences, recent developments in RTD programmes and regulations)
- **CLARINET NETWORK** (objectives, progress and results)
- **RESEARCH** (FP5 and RTD Programmes in Europe for contaminated land research)
- **POLICY FRAMEWORKS** (contaminated land policies in 16 European Countries)
- **INTERNATIONAL INITIATIVES**
- **WEB LIBRARY** (relevant documents and articles)
- **Contacts & Hyperlinks**

FP5 Workshops

CLARINET participants reviewed and discussed objectives and first achievements with various project leaders which are managing EU-funded RTD projects approved for the FP5-Key Action "Management and Quality of Water".

Joint Statement on "Sustainable Management of Contaminated Land for the Protection of European Water Resources"

CLARINET published a Joint Statement on the "*Management of Contaminated Land for the Protection of European Water Resources*" together with the networks NICOLE, SENSPOL, and ETCA. The publication is based on the conclusions derived with the CLARINET Conceptual Paper. It offers a framework to focus and utilise the results from FP5 RTD projects towards the sustainable management of perceived contaminated land problems in Europe

Publications in Scientific Journals

CLARINET published various key note papers (*see publication list at the end of this report*). For example, a special issue of the UK scientific journal "Land Contamination & Reclamation" was dedicated to the conclusions and recommendations derived within the CLARINET network towards the establishment of better risk-based land management in the EU. It provides an overview of current research programmes including EU research under Framework 5, and identifies commonly perceived research needs among stakeholders in European countries.

FP5 Information on the CLARINET Website

With regard to the EC Framework Programme, CLARINET has substantially supported the call for proposals in the contaminated land related area 1.4.1 of the Key-action "Sustainable Management and Quality of Water" by informing potentially interested parties about the scientific focus and requirements via the CLARINET Website at <http://www.clarinet.at>.

4. NETWORKING WITH INTERNATIONAL INITIATIVES

CLARINET has established a fruitful co-operation and information exchange among other Concerted Actions (NICOLE, SENSPOL, ETCA), Eastern European Countries (CEE Forum), US-EPA, and major international initiatives on contaminated land:

4.1 With Pre-Accession Countries and Central and Eastern European Countries

- The **CEE-Forum on Contaminated Land** has been initiated by the Ad Hoc Internat. Working Group with support by CLARINET. A preparation meeting has been organised in Warsaw on 18.9.1998; and the Inaugural Meeting with more than 20 CEE countries took place in combination with the CLARINET Plenum Meeting in Copenhagen on 14./15.6.1999. At this meeting, CEE countries introduced their major national problems and concerns with contaminated land and discussed possibilities of future co-operation with EU countries.
- CLARINET and the Joint Research Centre organised an international workshop for **the pre-accession States** (Hungary, Poland, Check Republic, Estonia, Slovenia) on "Land Recovery and Man-Made Risks" in Vienna on 16-18.11.1998. Conclusions

from this workshop have been recommended to the European Commission for possible activities towards solutions of future member states situations.

4.2 With other Concerted Actions

- **NICOLE** - CLARINET has established close co-operation with NICOLE, the Network for Industrially Contaminated Land in Europe. NICOLE is a network initiated by industrial land owners. Together, CLARINET and NICOLE co-operated in the development of RTD proposals to Framework 5, published Joint Statements on RTD Needs for Contaminated Land & Groundwater; and organised joint workshops on various key-issues, e.g. on “Monitored Natural Attenuation (Copenhagen, 9.6.1999).
- **ETCA** – The Concerted Action ETCA (Environmental Technology Concerted Action) distributes actual CLARINET information via its Website service.
- **SENSPOL** – CLARINET co-operated with the Concerted Action SENSPOL (Biosensors for environmental monitoring/environmental technology) in discussing future developments for improving currently available monitoring techniques for contaminated land, e.g. with regard to “Monitored Natural Attenuation”, “Verification of In-Situ Remediation Technologies” etc.

4.3 With major international initiatives on contaminated land

- **NATO/CCMS Pilotstudy on Innovative Remediation Technologies** – CLARINET collaborated with the NATO/CCMS Pilotstudy in expert workshops, e.g. on “Monitored Natural Attenuation” (Angers/France in May 1999) and “Technology Selection - Decision Support Approaches & Criteria” (in Duisburg in May 2000).
- **ConSoil 2000 Conference in Leipzig (18-22.9.2000)** - CLARINET participants have been actively engaged in the thematic procedure of the CONSOIL 2000 Conference in Leipzig/Germany, the largest European Conference on Contaminated Land. Various presentations and workshops on CLARINET conclusions have been provided, and a comparison study of remedial plans from different European countries for the Spittelwasser site has been organised by the CLARINET Steering Committee (“benchmarking exercise”)

CLARINET PRESENTATIONS

Results and conclusions achieved within the CLARINET network so far have been presented within the reporting period on following occasions:

Internat. Workshop organised by ANPA in Rome (20.10.1998)
Internat. Workshop organised by Joint Research Centre in Vienna (16.11.1998)
National Workshop organised by Umweltbundesamt in Vienna (10.12.1998)
National Meeting with R&D Program Planners in Vienna (13.12.1998)
DG XII-Scientific Panel in Brussels (14.12.1998)
CLARINET Introduction to the Joint Research Centre in Ispra (21.12.1998)
RACE Conference in Katowice (21.01.1999)
FW5 Meeting at DG XII in Brussels (03.03.1999)
Americana Conference in Montreal (24.03.1999)
NATO/CCMS Conference in Angers (14.05.1999)
NICOLE Steering Group Meeting in Bilbao (20.05.1999)
R&D Programme Planner Meeting in Gouda (03.06.1999)
EU-Common Forum Meeting in Copenhagen (13.06.1999)
Ad Hoc Internat. WG & CEE Forum in Copenhagen (15.06.1999)
DG XII Workshop in Dresden (18.06.1999)
NICOLE Network Meeting in Helsinki (22./23.5.2000)
DG RESEARCH WS in Venice (21.-23.6.2000)
NATO/CCMS Conference in Wiesbaden (25.-30.6.2000)
CEE Environment Symposium in Prague (12.-14.9.2000)
CONSOIL Conference in Leipzig (18.-22.9.2000)
NICOLE Network Meeting on Brownfields (9./10.11.2000)
Contaminated Land Management Conference in Milan (10.11.2000)
NICOLE Steering Group Meeting in Brussels (7.12.2000)
RTDF Scientific Consortium in Runcorn (14.2.2001)
UN/ECE Workshop on Remediation Technologies in Paris (13-15.3.2001)
IHPA Conference in Poznan (20./21.3.2001)
NORSOIL Conference in Oslo (23. - 24.4.2001)
SENSPOL Workshop in Madrid (9-11.5.2001)
KA Water – RTD Project Review Workshop in Leeds (21.-23.5.2001)
CLARINET Final Conference in Vienna (21./22.6.2001)
Ad Hoc Internat. WG on Contaminated Land in Genf (17./18.9.2001)
International Soil Science Congress in Vienna (3.-7.9.2001)
Internat. Conference Groundwater Protection in Birmingham (4./5.10.2001)
EU Common Forum on Contaminated Land in Antwerp (18./19.10.2001)

CLARINET Network meetings

CLARINET Workshop and Plenum Meetings took place at following occasions:

Plenum Meeting in Athens/Greece (1./2.10.1998),
Steering Group Meeting in Katowice/Poland (21./22.1.1999)
R&D Programme Planners Meeting in Gouda/Netherlands (3./4.6.1999)
Plenum Meeting in Copenhagen/Denmark (10./11.6.1999)
Steering Group Meeting in Duisburg/Germany (6./7.10.1999)
Plenum Meeting in Dublin/Ireland (11./12.11.1999)
CLARINET SG Meeting in Orleans (2./3.3.2000)
CLARINET Plenum in Helsinki (18./19.5.2000)
CLARINET SG Meeting in Wiesbaden (29./30.6.2000)
CLARINET Plenum in Venice (19./20.10.2000)
CLARINET Final Meeting/Conference in Vienna (May/June 2001)
SG Meeting in Vienna (2./3.10.2000)
Plenum in Venice (19./20.10.2000)
CLARINET SG Meeting in Alicante (2./3.4.2001)
CLARINET Plenum Meeting in Vienna (19./20.6.2001)

CLARINET Publication List

Bardos R.P., Mariotti C., Marot F., Sullivan T. (2001) *Framework for Decision Support used in Contaminated Land Management in Europe and North America*; Land Contamination & Reclamation, 9 (1) pp. 149, EPP Publications

Bardos P., Vik E. *Key Findings on Risk Management Solutions and Decision Support in Europe*; CLARINET Conference Proceedings, pp.81, UBA Schriftenreihe

Büsing J. (2001) *Contaminated Land Research under the EU RTD Programme 'Environment and Sustainable Development'*; Land Contamination & Reclamation, 9 (1) pp. 55, EPP Publications

Cortesi P., Kasamas H., Lewis A.(2001) *European Networks for Sustainable Concepts and Research Needs*; Land Contamination & Reclamation, 9 (1) pp. 47, EPP Publications

CLARINET Website (2001): <http://www.clarinet.at>

Crommentuijn T., Bierkens J., Herrchen M., Jensen J., Loibner A., Schelwald R., van Wensem J., Rutgers M., Weeks J. *Ecological Risk Assessment for Contaminated Sites in Europe*; CLARINET Conference Proceedings, pp.78, UBA Schriftenreihe

Darmendrail D., Harris R. (2001) *Water Resource Protection Issues in Relation to Contaminated Land*; Land Contamination & Reclamation, 9 (1) pp. 89, EPP Publications

Ferber U. (2001) *Building on Contaminated Land – Problems and Solutions*; CLARINET Conference Proceedings, pp.42, UBA Schriftenreihe

Ferguson C. (1999) *Assessing Risks from Contaminated Sites: Policy and Practice in 16 European Countries*; Land Contamination & Reclamation, 7 (2) pp. 33, EPP Publications

- Ferguson C., Darmendrail D., Freier K., Jensen B.K., Jensen J., Kasamas H., Urzelai A. and Vegter J. (eds.) (1998) *Risk Assessment for Contaminated Sites in Europe; Volume 1, Scientific Basis*. LQM Press, Nottingham
- Ferguson C., Kasamas H. (eds.) (1999) *Risk Assessment for Contaminated Sites in Europe; Volume 2, Policy Frameworks*; LQM Press, Nottingham
- Grima J., López J. (2001) *RTD Needs for Improving Groundwater Remediation Technologies*; CLARINET Conference Proceedings, pp.38, UBA Schriftenreihe
- Grimski D., Ferber U. (2001) *Urban Brownfields in Europe*; Land Contamination & Reclamation, 9 (1) pp. 143, EPP Publications
- Grimski (2001) *Brownfields and Sustainable Development in the Context of Urban Planning*; CLARINET Conference Proceedings, pp.45, UBA Schriftenreihe
- Harris B. (2001) *The European Water Framework Directive with regard to Contaminated Land Management*; CLARINET Conference Proceedings, pp.25, UBA Schriftenreihe
- Kasamas H., Vegter J. (2001) *Scientific and Research Needs for Contaminated Land Management*; Land Contamination & Reclamation, 9 (1) pp. 79, EPP Publications
- Kasamas H., Vegter J., Schamann M. (2001) *Towards Sustainable Rehabilitation of Contaminated Land in Europe*; CLARINET Conference Proceedings, pp.12, UBA Schriftenreihe
- Lowe J. (2001) *Enhanced Rehabilitation of Brownfield Sites – European Visions for the Future*; CLARINET Conference Proceedings, pp.48, UBA Schriftenreihe
- Müller D. (2001) *Monitored Natural Attenuation – A New Protection Strategy?*; CLARINET Conference Proceedings, pp.35, UBA Schriftenreihe
- Pollard S., Duarte-Davidson R., Humphrey S. *Research Issues for the Environmental Epidemiology of Contaminated Land*; CLARINET Conference Proceedings, pp.74, UBA Schriftenreihe
- Quercia F., Vegter J. (2001) *Priority Research Needs for Risk Based Land Management*; CLARINET Conference Proceedings, pp.51, UBA Schriftenreihe
- Schelwald R.A. (2001) *BARGE, Bioavailability Research Group Europe: European Co-ordination on Risk Assessment of Soils*; Land Contamination & Reclamation, 9 (1) pp. 107, EPP Publications
- Swartjes F.A. (2001) *Human Exposure Model Comparison Study: State of Play*; Land Contamination & Reclamation, 9 (1) pp. 101, EPP Publications
- van Veen H.J., Büsing J., Kasamas H. (2001) *An Analysis of National and EU Research Programmes Related to Sustainable Land and Groundwater Management*; Land Contamination & Reclamation, 9 (1) pp. 71, EPP Publications
- van Wezel A., Vegter J. (2001) *Human Health and Ecological Considerations in Contaminated Land Management*; CLARINET Conference Proceedings, pp.61, UBA Schriftenreihe
- Vegter, J. (2001) *Sustainable Contaminated Land Management: a Risk-based Approach*; Land Contamination & Reclamation, 9 (1) pp. 95, EPP Publications
- Vik E.A., et. al. (2001) *Towards a Framework for Selecting Remediation Technologies for Contaminated Sites*; Land Contamination & Reclamation, 9 (1) pp. 119, EPP Publications
- Wylie J. et. al. (2001) *Risk Communication for Contaminated Land : Developing Guidelines from Practical Observations and Case Studies*; Land Contamination & Reclamation, 9 (1) pp. 165, EPP Publications