DESCRIPTION OF WORK

(version 5, 27-09-2001)

WELCOME

Water, Environment, Landscape Management at Contaminated Megasites

Development of Integrated Management System (IMS) for Prevention and Reduction of Pollution of Waterbodies at Contaminated Industrial Megasites

Programme: **EESD/RTD**

Project acronym: WELCOME

Proposal no.: EVK1-2001-00132

Name	Country
TNO Institute of Energy, Environment and Process Innovation (co-ordinator)	NL
Grossmann Ingenieur Consult (GICON)	D
Institute for Ecology of Industrial Areas (IETU)	PL
Centre for Environmental Research Leipzig-Halle (UFZ)	D
Flemish Organisation for Technology Research (VITO)	B
University of Tübingen	D
Wageningen University	NL
Regional Agency for Site Decontamination of Sachsen-Anhalt (LAF)	D
Mid-Germany Remediation company (MDSE)	D
Quadriga	D
Network Organisation for Quality of Environment (NOK)	NL
Technical University of Czestochowa	PL
Rotterdam Municipal Port Management	NL
International Team of End-users (ITE)	
NICOLE representatives (Network for Industrially Contaminated Land)	All over EU
Regulator network participants (i.e. originating from the ended concerted action project CLARINET, or other regulator networks)	All over EU
Representatives of other Stakeholder Networks	All over EU
Port of Rotterdam	NL
Port of Antwerp	B
Silesian Voievodship Office / Dep. of Environmental Protection & Agriculture	PL

A limited number of other participants, to be assigned during initial months o the project	All over EU

CONTENTS

1. PROJECT SUMMARY

Title of project
Water, Environment, Landscape Management at Contaminated Megasites – WELCOME

Problems to be solved
In Europe, large areas and regions exist with a high density of industry (e.g. sea ports, large scale chemical industry complexes, metal mining areas, military complexes, etc.). In these megasites, soil and groundwater are usually polluted with different classes of pollutants. Complete cleanup within an intermediate timeframe (25 years) is not feasible or may even be impossible for technical and economical reasons. Therefore, such megasites represent steady and long-term potential sources of regional contamination of groundwater, surface water and sediments. Besides the threat to water quality, direct risks can be involved for ecosystems, human health, and for widespread diffuse pollution through contaminated sediment transport in rivers.
The economic impact of regional remediation problems is massive, e.g. remediation costs of large-scale projects is estimated at several billion € per project. With the foreseen expansion of the EU with the Visegrad countries, this becomes ever more pressing since these countries have a large number of extremely polluted megasites. The environmental issues at megasites often coincide with socio-economic barriers, which inhibit progress of economical and spatial planning of the region. A positive impulse into the socio-economic and landscape development, in the perception of the population or users of the area, is often equally important as managing the environmental aspects.
Policy development and management instruments, which are efficient in ecological, economic and social terms, are crucial to megasite rehabilitation.

Scientific objectives and approach
The overall objective is to produce a tool that can help environmental megasite managers in establishing an appropriate management approach for their megasites. Making use of extended scientific research work and experiences of the past decades, a practical and cost-efficient Integrated Management System (IMS) procedure will be developed and tested at the three representative European megasites (Rotterdam/Antwerpen, Bitterfeld and Katowice) cases, which will then be validated and evaluated.
A significant part of the project is natural science based research, aimed at answering questions in support of developing megasite IMS approaches. The subjects involve risk assessment, compliance with the water framework directives, monitored natural attenuation, immobilisation and cost-efficiency assessment.

Expected impacts
The product will be a tool to establish a megasite IMS in the form of a HTML-based software, made available through internet and CD, compatible in data exchange with commercial GIS software. IMS is an overall procedure and together with related tools/methods it can be regarded as a generic framework for the management of fresh water resources, focused on prevention and reduction of pollution of water bodies by contaminated industrial megasites.
Through the appropriate use of the developed IMS, the measures required to completely eliminate all contamination will be no longer necessary. This will lead to large cost savings, which can be used for positive impulses into the socio-economic and landscape development of the area.

2. SCIENTIFIC/TECHNICAL OBJECTIVES AND INNOVATION

2.1 Contaminated Industrial Mega-Sites in EU

In Europe, large areas and regions exist with a high density of industry (e.g. sea ports, large scale chemical industry complexes, metal mining areas, military complexes, etc.). In these sites, we refer to as Mega-sites, soil and groundwater are usually polluted with different classes of pollutants (table b1). The typical pollution profile of megasites consists of: multiple sources, often located near and under industrial production facilities, and/or large sources with dimensions expanding several square kilometres.

Complete cleanup within an intermediate (25 years) timeframe is not feasible or may even be impossible for technical and economical reasons. Therefore, megasites represent steady and long-term potential sources of regional contamination of groundwater, surface water and sediments.

The economic impact of regional remediation problems is massive, e.g. the remediation costs of the large-scale projects in the state of Saxony-Anhalt (former DDR part of Germany) alone estimated at several € billion.

Policy development and management instruments, which are efficient in ecological, economic and social terms, are crucial to the Mega site rehabilitation.

With foreseen expansion of the EU with the Visegrad countries (Poland Czech Republic, Slovakia and Hungary) this becomes ever more pressing since the countries have a large number of extremely polluted Mega sites.

The extent of the effect of megasite pollution on the quality of surrounding aquifers, downstream surface waters and eventual coastal and marine environments depends on the position of the megasite in the river basin (spring area, middle part / river area, delta area), and protective measures that have been taken. Besides the threat to water quality direct risks can be involved for ecosystems, human health, and for widespread diffuse pollution through contaminated sediment transport in rivers.

Table 2.1: Well-known Megasites, basic characteristics, and an estimate of megasite numbers and types

Megasite	River basin position	Type of Industry	Type of pollution	Size (km^2)
Katowice, Poland	Spring	Mining, metallurgy	Toxic metals	20
Ziar, Slovakia	Spring	Mining metallurgy	Toxic metals, cyanide	500
Black triangle, Czech Republic	Spring, middle part	Mining, lignite, organic chemistry	PAH, toxic metal, Halo-organics, cyanide	>1000
Baja Mara, Rumania	Middle part	Mining, Metallurgy	Toxic metals, cyanide	>1000
Donana basin	Middle part	Mining	Cyanide	
Bitterfeld-Wolfen region, one of 22 megasites in Eastern Germany	Middle part	Organic chemistry	Halo-organics	250
Krivoy Rig, Ukraine	Middle part	Mining, Organic Chemistry, metallurgy, Coal	Toxic metals, halo-organics, radio nuclides	>1000
Central Bulgaria	Middle part	Mining	Toxic metals, radionuclides	> 250
Mining sites Eastern Germany	Middle part	Mining	Toxic metals, radionuclides	> 1000
Rotterdam Seaport	Delta	Min. oil/Petro-chemistry	Petrochemicals	1000
Baku, Azerbaijan	Delta	Mineral oil production	Mineral Oil	>1000
Estonia/Latvia/Lithuania	Delta	Military Base	Ammunition/propellants	N A
EU-region	**Estimated number and type of megasites**			
Current EU states	10.000 - 100.000 operational and some former industrial complexes			
Accession states	1.000 - 10.000 heavily contaminated (former) industrial complexes			
Eastern Europe and Russia	> 10.000 heavily contaminated (former) industrial complexes			

2.2 Problems with the management of contaminated Mega-Sites

Water quality and contaminated land regulations are not yet accustomed to megasites.

In many countries, water resource quality and land protection are regulated in separate laws, and controlled by different institutions. At megasites, cost-efficient water quality protection cannot be uncoupled from contaminated land management and regulation. New regulatory

approaches for Mega-sites preferentially as guideline or even a specific directive in line with the new EU Water Framework Directive are essential (Eur-Lex 500PC0219).

Research has insufficiently addressed the megasite level thus far.
During the last two decades much interdisciplinary research has been done on contaminated sites, covering the following themes:

EU contaminated land and water quality research themes	
a) Policy and Legislation	**d)** Risk Assessment and Communication
b) Site investigations and Characterisation	**e)** Remediation Strategies, Concepts & Technologies
c) Behaviour and Fate of contaminants	**f)** Redevelopment and Reuse of Contaminated Land

Although vast improvements have been made, the produced knowledge cannot yet be directly used for establishing environmental management approaches for mega-sites, for the following reasons:

- The research work has mainly been focused on specific and relatively small sites with known single sources of contaminants and migration plumes downstream (e.g. sites of former gasworks, sites of industrial companies). The surface water is usually considered as an object under threat, which has to be protected for specific groups of pollutants but never on mixtures;
- The authorities responsible for soil management and surface water management are not working together in a way that the integral environmental problem is being addressed;
- Legislation on soil pollution and water resource pollution is separated, not taking into account that pollutions will drain from the soil into the surface water through natural processes;
- The gaps in knowledge and lack of available tools have not yet been identified from the perspective of solving water quality problems at megasites as diffuse source regions. Scaling aspects have been scarcely investigated;
- The results and deliverables of the work on the mentioned separate themes a) to f) have not yet been combined into an integrated and coherent package of tools and methods. Neither has such a package been combined with practical experience in a way that it has led to innovative approaches in addressing megasites problems.

Megasites, not only a regulatory/technological problem.
The environmental issues at megasites often coincide with socio-economic barriers, which inhibit progress of economical and spatial planning of the region. A positive impulse into the socio-economic and landscape development, in the perception of the population or users of the area, is often equally important as managing the environmental aspects. Appropriate and successful ways to protect water resources at megasites are therefore those measures that are integrated, and balanced with the socio-economical constraints and needs and spatial planning of the area.

Megasites and the accession states.
Megasites in the western European member states are often well characterised, and their managing authorities have a large amount of data. However, in the past, data acquisition has been driven by single site oriented contaminated land regulations or national water quality regulations. Critical data, which are needed for appropriate integrated contaminated land-water quality management, are therefore insufficiently available.
The Central and Eastern European countries (where the authorities face the management for thousands of heavily contaminated megasites in the coming decades) can benefit from lessons learned in other parts of Europe. Site characterisation and selection of water

protection measures can be done integrated right from the start. From an integrated management perspective of the Mega-site this can be achieved far more cost-efficient than following procedures, which have been used the last decades in Western Europe. The water framework directive will provide the appropriate regulatory tool for streamlining such an integrated approach.

Lack of management instruments.
As result of the above described limitations, megasite managers, representatives of urban governance and regional authorities, which are responsible for the water quality and contaminated land management, face limitations in applying above mentioned research results. This applies especially to making decisions and establishing water quality protection policies for megasites.
Provision of integrated fit-for-use knowledge packages as a decision support system to establish a feasible management approach would be of great help to them. Moreover, this will become more urgent through the adoption and implementation of the EU Water Framework Directive.

2.3 Objectives and (measurable and verifiable) deliverables

The overall objective is to produce a tool that can help environmental megasite managers in establishing an appropriate management approach for their megasites. The product (the final composing deliverable) of the *WELCOME* project will therefore be a tool to establish such an **Integrated Management System (IMS).**

Final deliverable: the WELCOME software tool for establishing an Integrated Management System (IMS) for Prevention and Reduction of Pollution of Water Bodies at Contaminated Megasites

Product output

- *GIS mapped megasite description: current and planned use, potential and actual risks*
- *Boundary conditions for sustainable development: stakeholders interest, funding options and legislative framework (water quality targets set by water framework directive)*
- *Management instruments and effects: risk-function relations and risk reduction measures*
- *Description of Management Options*
- *Option driven megasite characterisation, technical feasibility tests and technical designs*
- *Cost-efficient management scenario's and selection of final IMS*
- *Embedding principles and organisational models for IMS implementation.*

Product form

- *Personal computer HTML based software; made available through internet and CD, compatible in data exchange with commercial GIS software, and with computer codes developed in the WELCOME and other projects (i.e. on risk assessment, cost-efficiency assessment, natural attenuation in plumes and at the groundwater – surface water interface).*

Product users

- *Megasite environmental managers, local authorities / urban government authorities*
- *Private problem owners (e.g. industrial companies)*
- *Megasite developers*

The detailed framework for IMS establishment is given in Paragraph 2.4.

All R&D efforts in ***WELCOME*** are in support of developing the IMS establishment procedure.

- The draft procedure (paragraph 2.4) will be applied to representative model megasites, and will be further developed by adapting the scheme through a process of "learning by doing";
- Integration of knowledge on themes **a) - f)** and translation to the megasite level by active co-operation and involvement of representatives of the major networks from industry

(NICOLE), regulators (i.e. originating from CLARINET, which recently ended), or academia (i.e. like the ANCORE intitiative). Part of the WELCOME budget is reserved to cover costs for these representatives for such interactions. In addition interaction with these networks through concerted action participation is foreseen;

- Research to obtain new insights into knowledge gaps faced in megasite management
  - Integration tools for achieving compliance with national contaminated land/water quality regulations and the EU water framework directive;
  - Risk assessment at the megasite / sub-river basin level;
  - Risk reduction methods for multiple/large scale pollutant sources integrated into the landscape;
  - Natural attenuation at the interface between groundwater and surface water;
  - Natural attenuation and immobilisation of heavy metals in large contaminated sites; At the moment no models do exist concerning the natural attenuation of metals. So this project can also help in such a development.
  - Cost-efficiency assessment at the level of packages of measures for a whole region.

2.4 Innovation

The innovative aspects of the project are present in the following products and activities:

- The produced end product, the IMS establishment tool, as an aid for environmental managers to select and implement groundwater and surface water quality management systems at mega-sites.
- Development of the IMS establishment tool, through a process “learning by doing” using three types of mega-sites selected on industrial and socio-economic background and river basin position, for testing and validation of the IMS procedure.
- Involvement of multidisciplinary and transnational teams of experts and end-users.
- Research on specific RTD priorities of theme 1.4.1 and 1.4.2

End-product IMS establishment tool

The IMS establishment tool will be an generic overall procedure, to be delivered as user friendly HTML based software, and related tools to methods.
This “master procedure” will cover all essential steps and disciplines as given in the framework (see below).

Framework for establishing

An Integrated Ground Water and Surface Water Quality Management System (IMS) for Megasites

Draft Framework of IMS determination, as established in discussion between the project partners during a preparation meetings (i.e. Düsseldorf, DL, December 2000), and another meeting (Gouda, NL, January 2001) with representatives of the Community of Rotterdam, the Port of Rotterdam, and the Netherlands organisation on soil quality management and knowledge transfer (SKB).

This draft framework will be used as a working hypothesis or model procedure in the WELCOME project at the three model megasites (workpackages 2, 3, and 4). The experiences thus obtained will be used as input for the construction of a generic IMS determination procedure for megasites, the endproduct of the WELCOME project (workpackage 11)

Overview

IMS establishment procedure at start of WELCOME project as a working model

A. MEGASITE DESCRIPTION
B. BOUNDARY CONDITION
C. MANAGEMENT INSTRUMENTS and EFFECTS
D. INTEGRATED MANAGEMENT SYSTEM (IMS) DETERMINATION
E. EMBEDDING IMS IN LOCAL WATER QUALITY MANAGEMENT ORGANISATION

Performing and adapting procedure for WELCOME model megasites: learning by doing

Perform A to E for establishing an IMS for

- industrialized harbour areas

Workpackage 2

- organo-chemical complexes

Workpackage 3

- Metal Mining area's

Workpackage 4

IMS establishment procedure for new MEGASITES

- Construct a generic establishment procedure for an IMS for prevention and reduction of water pollution of waterbodies in Contaminated Industrial and Harbour Areas, using the experiences from the three Welcome model megasites: end deliverable of the Welcome project
- End deliverable is up to date ICT software based product and will be available on CD-rom and through internet.

Workpackage 11

Detailed description of draft IMS determination procedure at start of the WELCOME project

A. MEGASITE DESCRIPTION

A.1 IDENTIFYING STRUCTURE ELEMENTS OF THE MEGASITE (SEM) IN RELATION TO WATER QUALITY

- top soil layer area's
- ground water systems
  - discharging in short term into surface water
  - discharging in long term into surface water
- local water bodies (including sediments)
  - open pit mine
  - harbour arm
  - river segment
- regional water bodies (including sediments)
  - river and floodplain
  - harbour region
  - regional aquifer
- external objects of relevance
  - contaminant sources (upstream river basin/industrial or mining area's)
  - contaminant receptors (downstream river basin/harbours; regional aquifers)
- environmental quality data and water dynamics
  - data available for the structure elements of the region on contamination (type, concentration) and geochemistry and hydrology (soil types, groundwater flows)
  - identification essential missing data
  - limited site investigations,
  - data available on external objects

Deliverable A1: ***GIS based description of Structure Elements of the Megasite and water quality***

A.2 DEFINING CURRENT/FUTURE USE (FUNCTION) OF THE STRUCTURE ELEMENTS OF THE MEGASITE

- industrial
- residential
- agricultural
- recreational,
- nature reserve
- active water resource
- future water resource

Deliverable A2: *GIS maps of current and planned function*

A.3 RISK ASSESSMENT

Workpackage 5

- construct a conceptual model of the region on the basis of A1-A2, and identify locations where detoriation of water (and sediment) quality can be expected on the basis of potential fluxes between structure elements and from/towards external objects
- include potentials for natural retention and attenuation in the elements and at interfaces
- Give estimates of potential risks for groundwater and surface water quality related to current and planned future uses

Deliverable A3: *GIS maps with potential and actual risk profiles for current and planned uses*

B. BOUNDARY CONDITIONS

B.1 DESCRIBING SOCIETY CONTEXT

- Public awareness, support, acceptance towards sustainable development
- Future land/water use or function desired by inhabitants, companies, local authorities of the region
- Support of national and local political institutions for achieving these desires
- Involvement of non-governmental organisations
- Infrastructure for implementing and maintaining integrated ground and surface water quality management in a regional sustainable development programme

Deliverable B1: *Description of stakeholders interest and commitment towards current and future use.*

B.2 IDENTIFICATION OF FINANCIAL RESOURCES

- at international level
- at national/federal authority level
- at regional/local authority level
- at the level of private and company stakeholders in the region
- at the level of re-developers, future settling companies
- boundary conditions set by economic legislation (local/national/EU-level)

Deliverable B2: *Funding options for installing and operation of IMS*

B.3 IDENTIFYING AND DESCRIBING ENVIRONMENTAL LEGISLATION AND REGULATIONS

Workpackage 5

- Boundary conditions set by environmental quality regulations (local, national and EU-level, i.e. the EU water directive

Deliverable B3: *Legislative framework*

C. MANAGEMENT INSTRUMENTS and EFFECTS

Options are considered that can contribute to meeting water quality standards taken into account the boundary conditions of B. The effects of interest are reduced risks, improved environmental, and improved economic and/or ecological value (of structure elements) of the megasite**.**

C.1 EVALUATION OF RISK/FUNCTION CHANGES

- Risk depends on function of the structure element: by changing (current and/or future) use, or function of a structure element of the megasite, risks can be altered
- Function changes by active measures, i.e. renovation of old buildings, reshaping the landscape, redevelop for industrial or other business activities

Deliverable C1: *Risk-function relations: spatial, in time, and effects on asset value*

C.2 INVENTORY OF RISK-REDUCTION MEASURES

- Source oriented measures, i.e. monitored natural attenuation or engineered active measures

- Pathway oriented measures: interception by monitored natural attenuation or engineered active measures
- Receptor oriented measures: reduction of effects at receptor, by natural processes and/or by active measures

Deliverable C2: *Description of applicable risk reduction measures*

D. INTEGRATED MANAGEMENT SYSTEM (IMS) DETERMINATION

D.1 SELECTION OF OPTIONS

- Compose limited number of potential management scenarios (packages of measures to be taken)
- Test against criteria of B
  - Costs, order of magnitude in or out of range
  - Legislation/regulation
  - Public/authority acceptability
- Assessment cost-efficiency by method developed in the Welcome project

Workpackage 10

- Prioritise management scenario's, and select the two best

Deliverable D1: *List and description of options.*

D.2 IDENTIFICATION OF KNOWLEDGE GAPS AND UNCERTAINTIES

- at the level of field information: status quo
- at the level of occurring natural processes, including long term performance
- at the level technical/economical feasibility of technology measures considered, under existing field conditions, and including long term performance
- identify site investigation needs and needs for research into specific relevant phenomena

Deliverable D2: *Research and site investigation needs*

D.3 RESEARCH AND SITE INVESTIGATION PROGRAMME

- Set budgets available for site investigation and research, in balance to the total cost of the measures to be taken
- Establish site investigation and research programme
- Perform site investigation and research programme
- Evaluate results, with respect to reduced uncertainty of the cost-effectiveness of the measures to be taken.

For the WELCOME project this resulted in the following research items:

WELCOME research programme

- **Natural attenuation:**
  - multi-source and mixed contaminants

    Workpackage 6
  - groundwater-surface water interface

    Workpackage 7
- **Immobilisation**
  - Heavy metals

    Workpackage 8
  - Sediments

    Workpackage 9

Deliverable D3: *Resolved bottle necks through the research programme.*
For the WELCOME project deliverables of workpackages 6 - 9

D.4 DEFINE PREFERENTIAL MANAGEMENT SCENARIO

- Define cost-effective management scenario's meeting the criteria of B, by method developed in workpackage 10.

Workpackage 10

Deliverable D4: *Cost efficient IMS for managing megasite water quality*

E. EMBEDDING IMS IN LOCAL WATER QUALITY MANAGEMENT ORGANISATION

- For facilitating the implementation and operational use of the integrated groundwater and surface water quality management system the following product is delivered.

Deliverable E1: *Embedding principles and organisational models for IMS implementation and use*

As far as we know there is no generic, integrated and extended management system available for water quality management at megasites. The IMS built up in this project will integrate results (approaches, experiences, tools, methods) of leading projects in the past. The various international experts involved will bring these results into the project.

IMS establishment tool developed at three types of mega-sites
The project will be based on three field cases through a process of "learning by doing". The megasites are selected on the basis of their position in the river basin and industrial background, i.e.:

- Industrialised harbour area in river deltas
- Organochemical industry complexes in the middle river part
- Metal mining area in the upstream spring region of a river catchment area

For the three sites, the nationality and socio-economic situation is completely different, and will provide sufficient variation to test the practicality under various national conditions of the developed IMS procedure for different EU member and accession states.

Involvement of multidisciplinary and transnational teams of experts and end-users.
The utilization and integration of results of former and current EU projects, is done through interaction with ANCORE, and other networks, when possible under a ANCORE subgroup on megasites. Moreover, a new approach in intensive interaction with end-user/stakeholders will be followed, to steer research on identified knowledge gaps, and produce products that can be used in practice. For the networks like NICOLE, regulator network originating from CLARINET, and accession state representatives have been invited to take part in the international end-user evaluation team.

Research on specific RTD priorities of theme 1.4.1 and 1.4.2
Risk assessment and compliance with the water framework directive. In this project risk assessment is based on a newly developed procedure for megasites. Especially compliance with the water quality targets set by the EU water framework directive, concerning concentrations and fluxes towards surface water systems as dissolved and particle-bound contaminants are at stake. The European and national legislations are not always compatible with regard to Mega sites as emission source areas affecting water quality. Risk assessments and their various regulations need a coherent basis for progressing decision making on risk mitigation and remediation approaches.
This activity aims at providing such a basis.

Monitored Natural Attenuation and Immobilisation. Four work package activities concentrate on natural attenuation and immobilisation at megasites.
- One of the work packages focuses on natural attenuation assessment and application on multi source mixed contaminant situations, typical for megasite problems. The problem there is to identify flow paths, determine contaminant mass profiles along plumes, in order to estimate in-situ attenuation rates, and determine NA protectiveness (i.e. on the basis of

electron donor and acceptor capacities in the subsurface needed to sustain long term natural attenuation). Novel methods will be used to establish the technical feasibility of NA for such situations.

- Another activity is the quantification and application of NA processes at the reactive interface between groundwater and surface water (Figure B5 1). Many organic pollutants are only very slowly degraded in anaerobic groundwater systems. Many of these compounds are readily degraded in the presence of (low amounts of) oxygen. In the groundwater surface water interface, a natural condition exists where a strong increase in contaminant biodegradation rates occurs, which can lead to a situation that groundwater contaminants never reach the surface water system. The research on quantifying NA-interface processes and their usefulness in practice is highly innovative and relevant for megasite water quality management and therefore an important research topic within the WELCOME project.

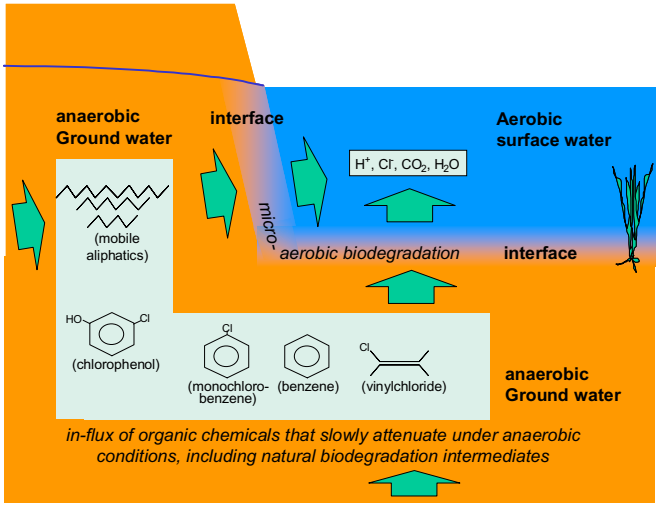


Figure 2.1 Natural attenuation at the reactive interface between groundwater and surface water

- Occasionally, natural attenuation will not be fully protective and in such cases large scale enhanced attenuation and immobilization need to be considered. In these cases, large scale integrated eco-engineering/landscape engineering methods are probably the most cost-effective approaches.
- Concepts for these applications (bioponds, engineered wetlands, etc.) will be further developed and evaluated for their use in practice. These approaches will be tested for organic groundwater contaminants, the immobilization of heavy metals, and for reduction of emissions from sediments contaminated with heavy metals and hydrophobic halogenated organic pollutants (HCH, DDT, PCB's and dioxins). The research activities are in support of these type of large scale applications.

Cost-efficiency assessment, The CEA method will be developed for single risk reduction measures and for complete packages of measures (management options). CEA is becoming increasingly important and for such high cost problems as water quality management at megasites, cost efficiency will be a key element.

3. PROJECT WORKPLAN

3.1 General outline

IMS establishment and model megasites. The general idea of the project is to produce a tool to assists environmental managers to establish an Integrated Management System (IMS) for surface and ground water quality management at megasites. Within the project this will be achieved by testing a draft IMS establishment procedure (paragraph 2.4) at three representative model megasites (Table 3.1). On the basis of the obtained knowledge and experience and the *WELCOME* research programme, an IMS establishment tool will be constructed. This product will be delivered in the form of HTML based software.

Table 3.1: WELCOME MODEL MEGASITES

INDUSTRIALISED HARBOUR AREA AT RIVER DELTA: ROTTERDAM/ANTWERP

Rotterdam Sea Port is situated at the river delta of the rivers Rhine and Meuse. The world's largest harbour handles three hundred million tonnes of goods annually, while thirty-two thousand ocean-going vessels call at the port every year. These goods movements take place in an area of 10,000 hectares, 40 kilometres long, extending from Rotterdam to the North Sea. Industry has developed into one of the main aspects of the port economy. Industries located in and around the port currently generate around 50% of all added values. Plants and factories employ about 20,000 people. Approximately 60% of the 4,800 hectares of available port sites are leased to the (petro)chemical industry. The following industrial sectors are represented in the port complex: Agri-products, oil and chemical, maritime industry and recycling. Although not the only one, the (petro)chemical industry is the most important industrial cluster in the port.

Antwerp Sea Port stretches for twenty kilometres along the banks of the Scheldt River. It benefits from a strategic geographic location in the delta of Scheldt, Rhine and Meuse. With an international maritime traffic of over 110 million tonnes per year, Antwerp is in the top five of the world's biggest ports. With an overall storage and handling space of 1,200 ha the port provides work for about 57,200 people. Industries, which are situated in this area comprise (petro)chemical plants, metallurgic industry, insurance industry and services such as inspection and surveys, packaging, further processing, protection, etc. of goods.

Due to the nature of the past and ongoing maritime and industrial activities, the environmental quality of both the Rotterdam and Antwerp regions is at risk. At the old industrial areas, soil contamination with chlorinated hydrocarbons, oil spillages, polycyclic aromatic hydrocarbons and heavy metals are no exception. The mobility of the pollutants poses serious threat to the water quality in the these regions

ORGANOCHEMICAL INDUSTRY COMPLEX AT MIDDLE AREA OF RIVER: BITTERFELD

In the Bitterfeld/Wolfen region, in the former GDR, lignite mining has been performed for over more than a century. These mining activities required a lowering of the groundwater table, at some locations with 10 to 15 m. In GDR times, the centre of the chemical industry was built in old mining areas with an artificially low groundwater table. These industrial activities caused major subsurface pollutions, i.e. with chemicals like HCH, DDT, PCB's, Chlorinated Dioxines and Furanes, chlorobenzenes, chlorinated aliphatics, etc. At present an area of about 25 km^2 subsurface and groundwater is polluted to a depth of several tenths of meters and forms a large scale contaminant source threatening surrounding aquifers, lakes and the rivers Mulde and Elbe.

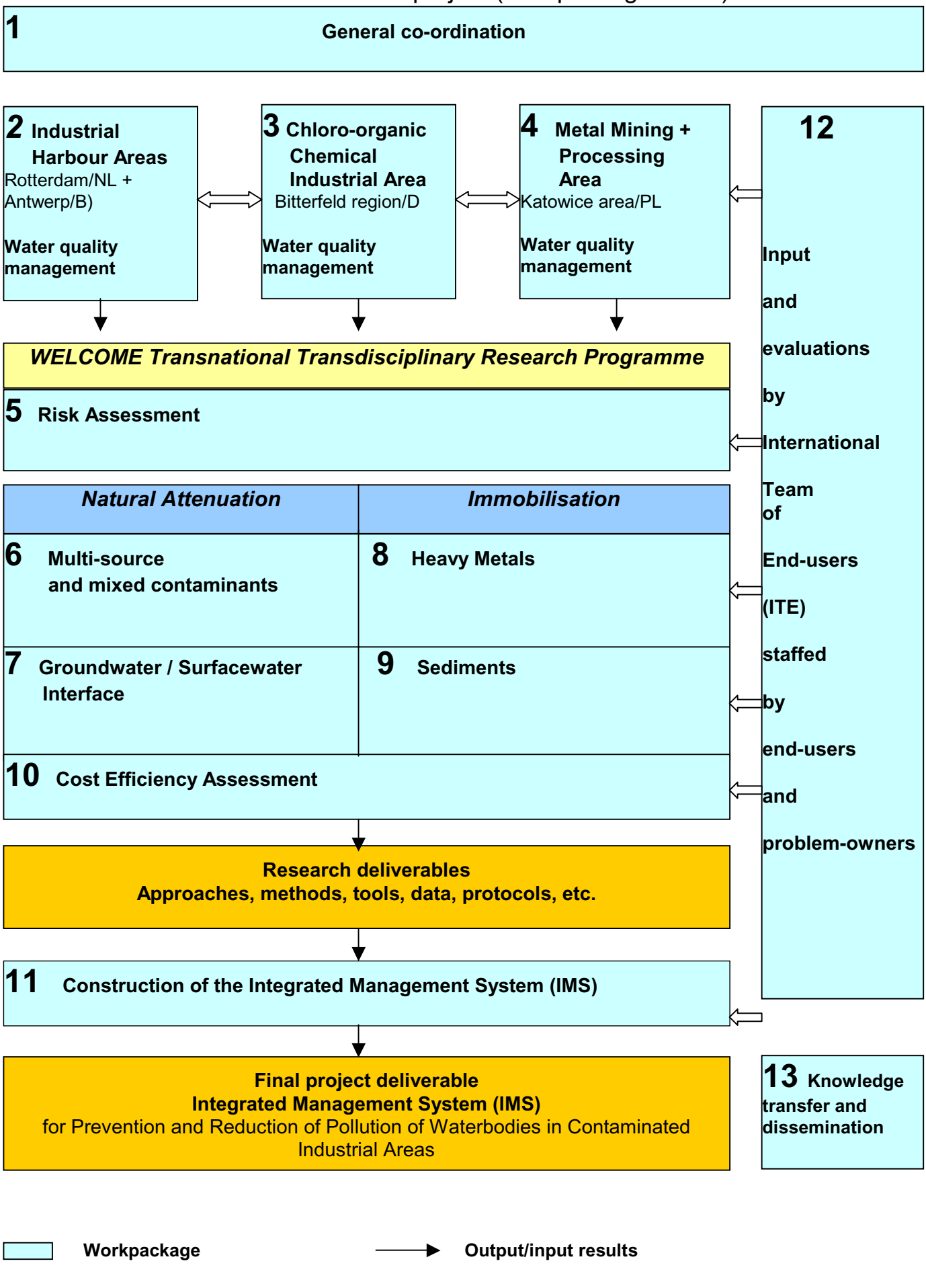
The need for suitable containment/remediation techniques applicable in the Bitterfeld-Wolfen region has been increased by the foreseen changes in the hydrological situation. At present the lignite mining activities have ceased and the large scale groundwater extraction wells are being shut down. The groundwater level will rise dramatically (locally with 15 meters) to its original natural level. This will causes a strongly enhanced mobilisation of the pollution out of the contaminant source area towards surrounding lakes and rivers. For an ecological, social and economical redevelopment of the region a large scale containment / remediation plan has to be made and implemented. In addition to the groundwater problems, sediments of small streams close to the industrial area are heavily polluted with strongly sorbing chlorinated organic hydrocarbons, creating a source of contamination for the down stream areas of the rivers Mulde en Elbe.

METAL MINING REGION AT SPRING AREA OF RIVER SYSTEM: KATOWICE

The site of the former Chemical Plant is located in Tarnowskie Góry, Poland, 30 km northwest of Katowice. The site has been under anthropogenic pressure already since the 16^{th} century, as in that period extraction of silver and lead ores was carried out at the site. In the early 19^{th} century, a paper mill had operated at the site. The paper mill was rebuilt into an iron-works factory and in 1922 into a chemical plant. From 1922-1990, as much as 0.8-1.2 million m^3 of wastes were deposited on the 30 ha site, such as barium, arsenic and strontium compounds. At present, a hazardous waste disposal site is being constructed in compliance with all relevant standards. Once the wastes have been removed to the disposal site, a layer of contaminated soil will left. The problem that remains unsolved is the risk posed by the contaminated soil to the Quaternary layer, which is situated over the Triassic reservoir of drinking water. The reservoir plays a strategic role in supplying drinking water to a large part of the Katowice Province.

Development of the IMS establishment tool, research activities, and end-user interaction. The work programme aimed at developing the IMS establishment tool will be supported by -and integrated with- research on the RTD priorities mentioned in section 2 and 4, and will be supervised by end-users and other stakeholders. This will be done through a workpackage organisation as depicted in Figure 3.1.

Structure of WELCOME - project (workpackages 1-13)



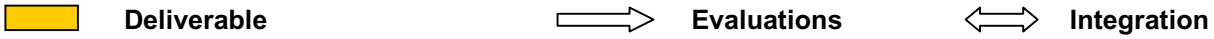


Figure 3.1: Organisation scheme of WELCOME work packages: integration of IMS tool development, assisting research, and continuous interaction with end-users

As can be seen in figure 3.1, workpackage 12 guarantees integration and exchange with other EU research and end-user involvement, throughout the project, by involvement of representatives from NICOLE, regulator-networks, (i.e. from the CLARINET concerted action that recently ended, or other networks), and networks from academia (i.e. in line with ANCORE initiative), and megasite end-users from the accession states. At the start of the project this ITE will be formed.

The first step in developing the IMS establishment tool will be the testing of the draft version (paragraph 2.4) at the model megasites (work package 2, 3 and 4). The research program performed in workpackages 5 – 10, feeds into this IMS development process carried out for the model megasites.

A basic element in the research program is on risk assessment and investigating the regulatory requirements as imposed by the water framework directive (WP 5). This will be carried out for all model megasites, and will set water quality targets to be achieved at the various model sites.

Detailed process research and development of risk reduction measures based on eco-engineering or landscape-engineering is performed in workpackages 6 to 9. These have different relevance for the various types of megasites. Monitored natural attenuation and enhanced natural attenuation at multi-source mixed pollutant problems (WP6) feeds in workpackages 3 and 4. Natural attenuation of organic chemicals at the ground water–surface water interface (WP 7) is of importance for the model sites studied in workpackages 2 and 3 (industrialised harbours; organochemical industrial complexes). The immobilisation aspects of heavy metals (WP8) are highly relevant for the mining area megasite (WP 4). The research on contaminated sediment particles and the mitigation of bioavailability and diffuse contamination of down stream river basin areas (WP 9) is important for the organochemical industry megasite (WP 3; concerns sediments contaminated with hydrophobic halogenated organic compounds), the mining area megasite (WP 4: concerns sediments contaminated with metals), and the industrialised harbour areas (WP 2, these megasites are receptors of upstream emitted contaminated sediment particles that settle in these harbours and need to be dredged for nautical reasons).

A special workpackage will develop a cost-efficiency assessment method for megasite water quality management options (WP 10). It will establish the cost-efficiencies of individual risk reduction measures with site data provided by workpackages 2, 3, and 4, and technical efficiency and engineering data provided by workpackages 6 to 9. In addition to that, cost efficiencies will be determined for total sets of measures, i.e. megasite management options, to facilitate the selection of the most cost-effective IMS.

A general IMS establishment procedure will be developed (WP 11) using the learning experiences obtained by testing the IMS establishment framework at the various megasites (WP 2, 3 and 4) and the additional inputs form the research activities of workpackages 5 to 10. This procedure will be put into a user-friendly (HTML-based) software package to be tested and evaluated by the end-user groups involved in WP12, and to be made available through Internet or CD-ROM for personal computer use.

Knowledge dissemination will be done through the end-user evaluation team (WP 12), and activities described in WP 13, i.e. special sessions at conferences (Consoil 2003, etc.) and through an internet webpage.

Graphical presentation of the project's components

The workpackage interactions are schematically shown in Figure 3.2. A more detailed presentation of interactions between workpackages and deliverables, and workflow over time have been added.

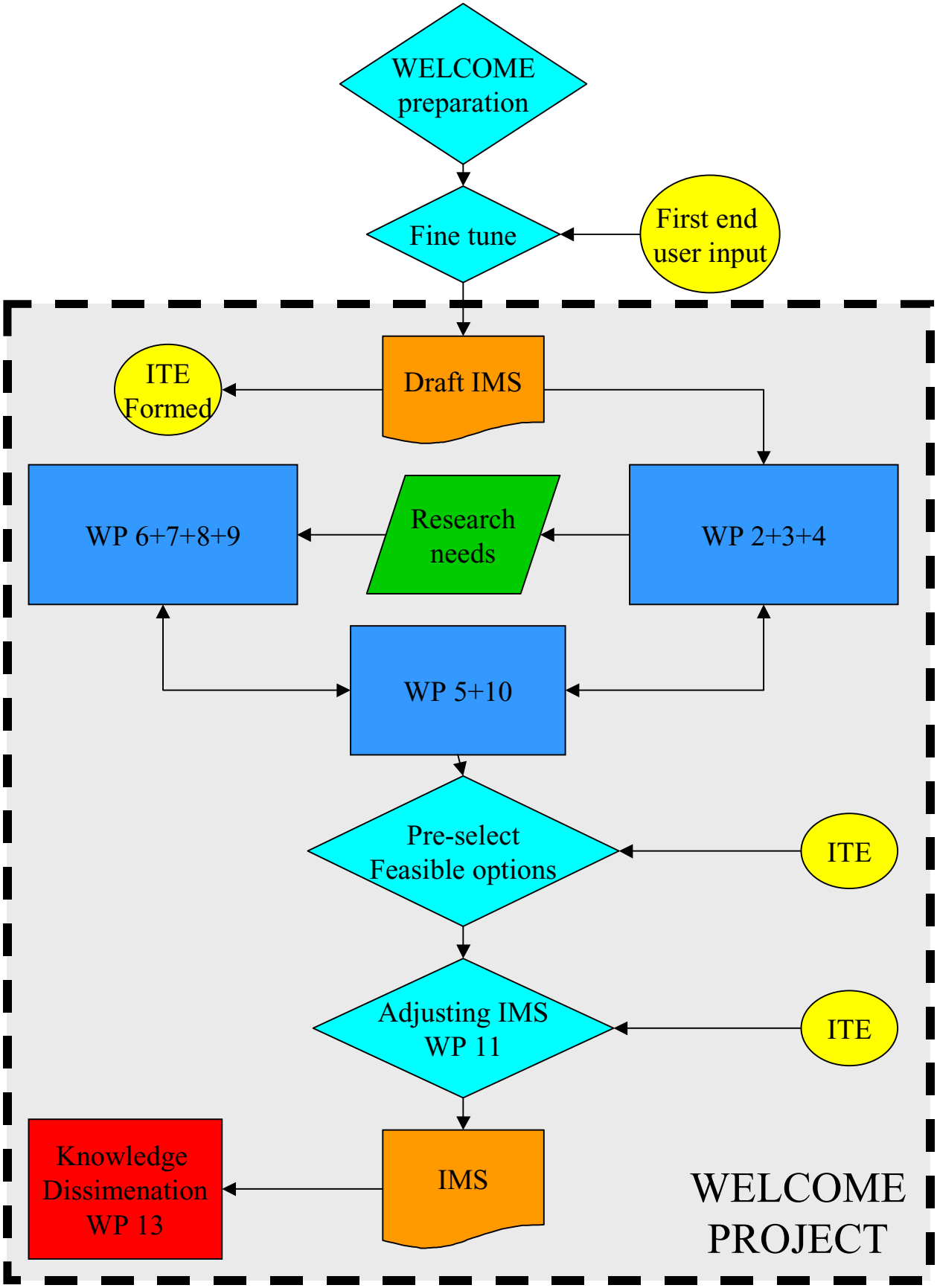


Figure 3.2 Welcome workpackage interactions.

Table 3.2 Workflow and production of deliverables

ID	Task Name	Start	successors	Predecessors
1	**WP1-general coordination**	**Thu 1-11-01**		
2	**D1.1 Semi-annual progress report**	**Sat 1-6-02**		
8	D1.2 proceedings ConSoil 2003	Thu 1-5-03		112
9	D1.3 final report IMS	Fri 1-10-04	115;116	80;81;82;83;84;85;86;87;88;89;90;91;92;93;103
10	**Meetings**	**Thu 1-11-01**		
11	Kick-off meeting	Thu 1-11-01		
12	**Inter WP meeting (coord.+WPL)**	**Sun 31-3-02**		
13	Inter WP meeting (coord.+WPL) 1	Sun 31-3-02		
14	Inter WP meeting (coord.+WPL) 2	Mon 30-9-02		
15	Inter WP meeting (coord.+WPL) 3	Mon 31-3-03		
16	Inter WP meeting (coord.+WPL) 4	Tue 30-9-03		
17	Inter WP meeting (coord.+WPL) 5	Wed 31-3-04		
18	Inter WP meeting (coord.+WPL) 6	Thu 30-9-04		
19	**GB-meeting (coord.+WPL+ITE+owners)**	**Tue 1-10-02**		
20	GB-meeting (coord.+WPL+ITE+owners) 2	Tue 1-10-02		101
21	GB-meeting (coord.+WPL+ITE+owners) 3	Wed 1-10-03		102
22	GB-meeting (coord.+WPL+ITE+owners) 4	Fri 1-10-04		103
23	**WP2-industrial harbour areas**	**Wed 3-4-02**		
24	D2.1 GIS megasite description	Tue 2-7-02	80;81;82;86;63	48
25	D2.2 boundary conditions sustainable development	Wed 3-4-02	93;85;86;62;77	
26	D2.3 management instruments and effects	Wed 2-4-03	51	62
27	D2.4 description management options	Wed 2-4-03	88;102	
28	D2.5 rehabilitation scenarios	Mon 2-2-04	73	63;62;57;49
29	D2.6 management scenarios and final IMS	Mon 2-2-04	90;78;56	77
30	D2.7 Embedding and implementation of IMS	Mon 2-2-04	91	63
31	**WP3-(chloro)organic chemicals**	**Mon 1-4-02**		
32	D3.1 GIS megasite description	Mon 1-7-02	80;81;82;86;63;68	48
33	D3.2 boundary conditions sustainable development	Mon 1-4-02	83;85;86;62;77	
34	D3.3 management instruments and effects	Tue 1-4-03	51	62
35	D3.4 description management options	Tue 1-4-03	88;102	
36	D3.5 rehabilitation scenarios	Mon 2-2-04	73	49;57;62;63;68
37	D3.6 management scenarios and final IMS	Mon 2-2-04	90;78;56	77
38	D3.7 Embedding and implementation of IMS	Mon 2-2-04	91	
39	**WP4-metal processing, mining**	**Mon 1-4-02**		
40	D4.1 GIS megasite description	Mon 1-7-02	80;81;82;86;68	48
41	D4.2 boundary conditions sustainable development	Mon 1-4-02	83;85;86;77	
42	D4.3 management instruments and effects	Tue 1-10-02	51	
43	D4.4 description management options	Fri 1-11-02	88;102	
44	D4.5 rehabilitation scenarios	Tue 1-4-03	68	49
45	D4.6 management scenarios and final IMS	Mon 2-2-04	90;78	77
46	D4.7 Embedding and implementation of IMS	Mon 2-2-04		63
47	**WP5- risk assessment**	**Fri 1-2-02**		
48	D5.1 procedure for risk assessment	Fri 1-2-02	24;32;40	
49	D5.2 function-oriented risk assessment system	Mon 3-6-02	28;36;44	
50	D5.3 Guideline groundwater	Mon 2-6-03	91;92	
51	D5.4 risk assessment megasites	Mon 3-11-03	87	26;34;42
52	D5.5 evaluation of risk assessment	Thu 1-4-04	86;92	
53	**WP6-NA multi sources, minxed pollutants**	**Tue 1-1-02**		
54	D6.1 MNA criteria for IMS	Tue 1-1-02	82;86;90;92	
55	D6.2 guideline implementation MNA	Mon 2-6-03	92	59;61
56	D6.3 report applicability protocols/guidelines	Mon 2-2-04	90;91;92	29;37
57	D6.4 protocol implementation MNA	Mon 2-2-04	28;36;92	
58	**WP7-NA ground/surface water interface**	**Tue 1-1-02**		
59	D7.1 procedures collection field data	Tue 1-1-02	55	
60	D7.2 reactive transport model	Mon 1-7-02		
61	D7.3 macro(bio)chemical model	Tue 1-10-02	55	
62	D7.4 systematics groundwater impact	Mon 3-2-03	28;36;86;26;34	25;33
63	D7.5 NA-interface assessment system	Wed 1-10-03	28;36;30;46;92	24;32
64	**WP8-heavy metal pollution**	**Thu 1-8-02**		
65	D8.1 Simple method risk identification	Thu 1-8-02		
66	D8.2 bioavailabbility/immobilisation method	Tue 1-10-02		
67	D8.3 Analysis rocks Katowice	Tue 1-4-03		
68	D8.4 investigation kinetics self cleaning	Mon 2-2-04	36;86;92	44;32;40
69	**WP9-Emission control sediments**	**Fri 1-2-02**		
70	D9.1 description characteristics mega-sites	Fri 1-2-02		
71	D9.2 HOC desorption method	Tue 1-7-03		
72	D9.3 contaminated sediment transport tool	Wed 1-1-03		
73	D9.4 model reduction/prevention contaminant transport	Mon 2-2-04	87	28;36
74	D9.5 concept emission control technology	Mon 3-5-04	91;92	
75	**WP10-cost efficiency assessment**	**Mon 2-12-02**		
76	D10.1 pre-selection tool	Mon 2-12-02		
77	D10.2 Cost-estimate tool	Wed 1-10-03	45;29;37	25;33;41
78	D10.3 analysis cost-efficiency	Thu 1-4-04	90;92	29;37;45
79	**WP11-Integrated management system**	**Tue 1-1-02**		
80	D11.1 GIS procedure structure elements	Mon 2-9-02	9	24;32;40
81	D11.2 procedure GIS maps function	Tue 1-10-02	9	24;32;40
82	D11.3 procedure GIS maps risk	Mon 2-6-03	9	24;32;40;54
83	D11.4 procedure stakeholder	Fri 1-11-02	9	33;41
84	D11.5 procedure public interest	Mon 2-12-02	9	
85	D11.6 procedure legislative framework	Thu 1-8-02	9	25;33;41
86	D11.7 procedure risk-function relations	Thu 1-4-04	9	24;25;32;33;40;41;52;54;62;68
87	D11.8 procedure risk reduction	Mon 1-3-04	9	51;73
88	D11.9 procedure management options	Wed 2-4-03	9	27;35;43
89	D11.10 procedure research/investigation requirements	Tue 1-1-02	9	
90	D11.11 procedure cost efficient IMS	Tue 1-6-04	9	29;37;45;54;56;78
91	D11.12 procedure implementation principles/models in IMS	Thu 1-7-04	9	30;38;50;56;74;102
92	D11.13 guideline IMS approach	Mon 2-8-04	9;103;115;116	50;52;54;55;56;57;63;68;74;78;102
93	D11.14 ICT product	Fri 1-10-04	9;115;116	25
94	**WP12-International team of end-users**	**Mon 1-7-02**		
95	**D12.1 semi-annual evaluation report**	**Mon 1-7-02**		
101	D12.2.1 evaluation report draft IMS	Mon 2-9-02	20	
102	D12.2.2 evaluation report draft IMS	Mon 1-9-03	91;92;21	27;35;43
103	D12.3 IMS evaluation report	Tue 31-8-04	9;22	92
104	**WP13-knowledge transfer and dissemination**	**Thu 1-11-01**		
105	D13.1 welcome internet site	Tue 1-1-02		
106	**D13.2 spreading WELCOME results**	**Mon 1-7-02**		
112	D13.3 Welcome session ConSoil 2003	Mon 3-2-03	8	
113	D13.4 publications	Thu 1-11-01		
114	D13.5 Presentations	Thu 1-11-01		
115	D13.6 end-users training course	Wed 10-11-04	116	9;92;93
116	D13.7 IMS management course booklet/cd	Wed 10-11-04		9;92;93;115

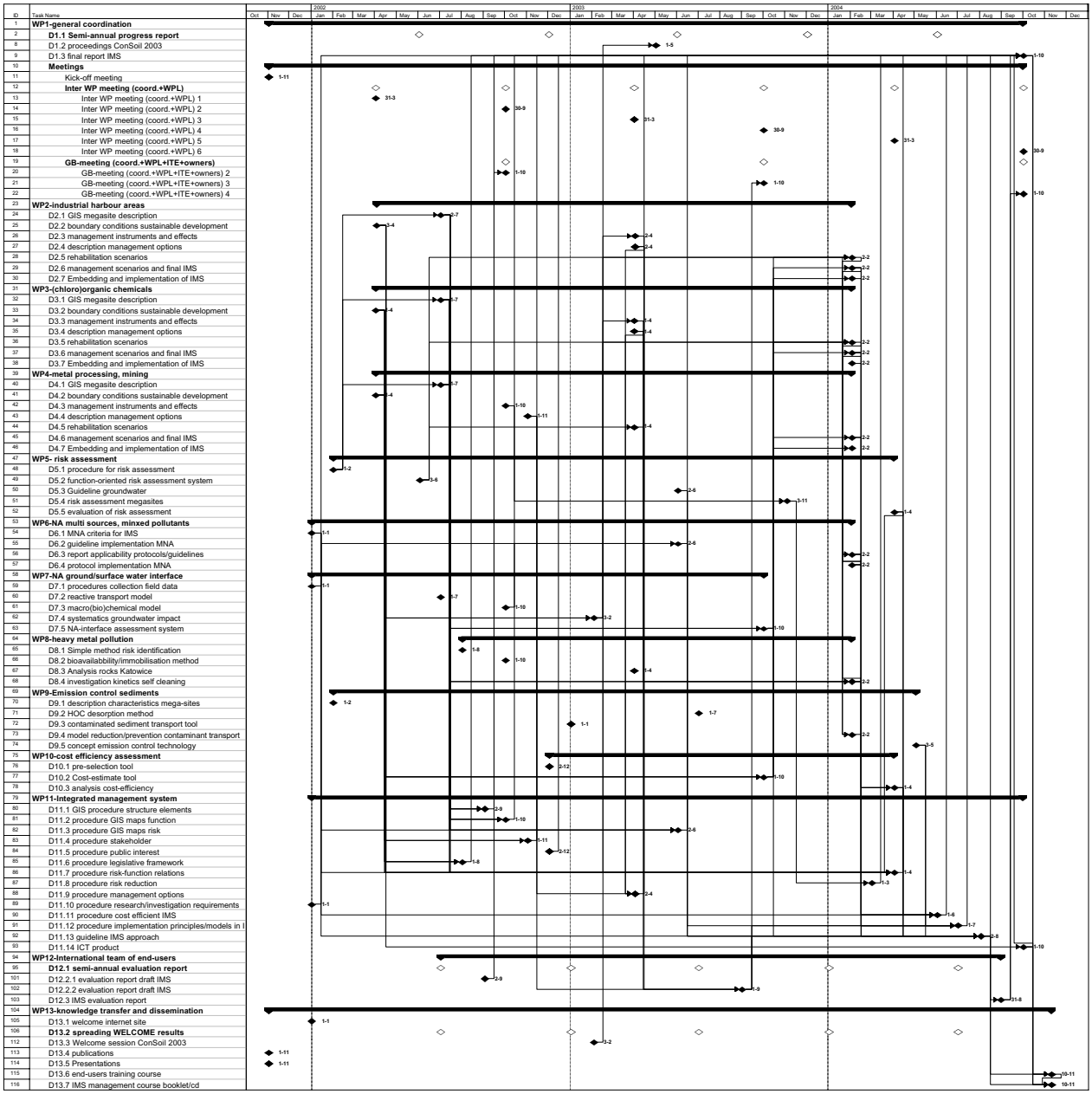


Figure 3.3 **Interactions and interdependence between workpackages and deliverables: a print out of the MS project management chart as constructed for WELCOME**

3.2 Detailed description of the workpackages.

WPL	Workpackage list					
Work-package No	**Workpackage title**	**Lead Participant No**	**Person-months**	**Start month**	**End month**	**Deliverable No**
1	**General Coordination**	**1**	**15**	**0**	**36**	**D1.1-D1.3**
2	**Water quality management at industrial harbour areas**	**1**	**10.5**	**0**	**28**	**D2.1-D2.7**
3	**Water quality management at a (chloro)organic chemicals industrial area**	**2**	**27**	**0**	**28**	**D3.1-D3.7**
4	**Water quality management at a metal processing and mining area**	**3**	**44**	**0**	**28**	**D4.1-D4.7**
5	**Uniform Megasite risk assessment**	**2**	**69**	**0**	**30**	**D5.1-D5.5**
6	**Natural Attenuation of multi-sources and mixed pollutants**	**4**	**75**	**1**	**28**	**D6.1-D6.2**
7	**Natural attenuation at the reactive interface between groundwater and surface water**	**1**	**37**	**1**	**25**	**D7.1-D7.5**
8	**Heavy metal pollution**	**5**	**85**	**4**	**28**	**D8.1-D8.2**
9	**Emission control of contaminated sediments**	**7**	**68.5**	**1**	**32**	**D9.1-D9.5**
10	**Cost Efficiency Assessment**	**6**	**63**	**2**	**30**	**D10.1-D10.2**
11	**Composition of an Integrated Management System (IMS).**	**1**	**82.5**	**0**	**36**	**D11.1-D11.14**
12	**Work of the International Team of End-users (ITE)**	**1**	**12**	**0**	**36**	**D12.1-D12.3**
13	**Knowledge Transfer and Dissemination**	**1**	**11.7**	**0**	**36**	**D13.11-D13.5**
	TOTAL		**599,5**			**D1.1-D13.5** **67 deliverables**

Deliverables

DL	Deliverable list			
Deliverable No	**Deliverable title**	**Delivery month**	**Nature**[1]	**Dissemination level**[2]
D1.1	Semi-annual progress reports compiled from the information obtained from the project partners	6, 12, 18, 24, 30	Re	PU
D1.2	Proceedings of the International Workshop (at ConSoil 2003).	16-20	Re	PU
D1.3	Final report of Integrated Management System (IMS).	36	Re	PU
D2.1	GIS mapped megasite description: current and planned use, potential and actual risks	9	Da	RE
D2.2	Boundary conditions for sustainable development: stakeholders interest, funding options and legislative framework (water quality targets set by water framework directive)	6	Da, Re	PU
D2.3	Management instruments and effects: risk-function relations and risk reduction measures	18	Me, Re	PU
D2.4	Description of Management Options	18	Da	PU
D2.5	Option driven rehabilitation scenarios, technical feasibility tests and technical designs	18	Da	RE
D2.6	Cost-efficient management scenario's and selection of final IMS	28	Me	PU
D2.7	Embedding principles and organisational models for IMS implementation.	28	Me, Re	PU
D3.1	GIS mapped megasite description: current and planned use, potential and actual risks	9	Da	RE
D3.2	Boundary conditions for sustainable development: stakeholders interest, funding options and legislative framework (water quality targets set by water framework directive)	6	Da, Re	PU
D3.3	Management instruments and effects: risk-function relations and risk reduction measures	18	Me, Re	PU
D3.4	Description of Management Options	18	Da	PU
D3.5	Option driven rehabilitation scenarios, technical feasibility tests and technical designs	18	Da	RE

[1] Please indicate the nature of the deliverable using one of the following codes:
Re = Report; **Da** = Data set; **Eq** = Equipment; **Pr** = Prototype; **Si** = Simulation;
Th = Theory; **De** = Demonstrator; **Me** = Methodology; **O** = other (describe in annnex)

[2] Please indicate the dissemination level using one of the following codes:
PU = Public
RE = Restricted to a group specified by the consortium (including the Commission Services).
CO = Confidential, only for members of the consortium (including the Commission Services).

Deliverable No	Deliverable title	Delivery month	Nature	Dissemination level
D3.6	Cost-efficient management scenario's and selection of final IMS	28	Me	PU
D3.7	Embedding principles and organisational models for IMS implementation.	28	Me, Re	PU
D4.1	GIS mapped megasite description: current and planned use, potential and actual risks	9	Da	RE
D4.2	Boundary conditions for sustainable development: stakeholders interest, funding options and legislative framework (water quality targets set by water framework directive)	6	Da, Re	PU
D4.3	Management instruments and effects: risk-function relations and risk reduction measures	12	Me, Re	PU
D4.4	Description of Management Options	13	Da	PU
D4.5	Option driven rehabilitation scenarios, technical feasibility tests and technical designs	18	Da	RE
D4.6	Cost-efficient management scenario's and selection of final IMS	28	Me	PU
D4.7	Embedding principles and organisational models for IMS implementation.	28	Me, Re	PU
D5.1	Procedure for risk assessment and evaluating the proportionality of hazard prevention measures in mega-projects.	4	Me	PU
D5.2	Assessment system for hazard appraisal and measure ranking in Megaprojects with regard to subsequent utilisation (function-orientated risk assessment).	8	Me	PU
D5.3	Guideline for monitoring and predicting the temporal and spatial behaviour of groundwater contamination for cost-effective procedures based on the risk-related management of sites.	20	Me	PU
D5.4	Risk assessment of the three Welcome Megasites	24	Re	RE
D5.5	Evaluation study on the Welcome Mega sites risk assessments comparing national requirements versus the new harmonised procedure	30	Re	PU
D6.1	Set of criteria for the suitability assessment of MNA as a site remediation measure as input for the IMS	3	Da	PU
D6.2	Technical guideline for the implementation of MNA for the management of multiple contaminated Megasites	20	Me	PU
D6.3	Report on the applicability of existing protocols/guidelines for EU Megasites	27	Re	PU
D6.4	Protocol/technical guideline for the implementation on MNA	28	Re	PU

Deliverable No	Deliverable title	Delivery month	Nature	Dissemination level
D7.1	Special instruments and procedures for collecting field data at the groundwater - surface water interface.	3	Eq, Me	PU
D7.2	A reactive transport model for pollutants in the groundwater – surface water interface	9	Th, Si	PU
D7.3	A model describing the macro(bio)chemistry of the sediment for conceptual model building, interpretation of field data and quantification and prediction of NA-interface performance.	12	Th, Si	PU
D 7.4	Systematics for evaluation of the relative impact of groundwater contamination on surface water quality, using NA-interface knowledge and with respect to other sources of contaminant in-flux to water systems.	16	Me, Re	PU
D 7.5	NA-interface assessment system in contaminated megasite water quality management, in compliance with national/EU water directive standards.	24	Me, Re	PU
D8.1	A simple method of risks identification (actual and potential) due to the presence of heavy metals	10	Me	PU
D8.2	Screening and selection method for the evaluation of reduction in bioavailability and the selection of immobilising agents	12	Me, Re	PU
D8.3	Analysis of sample rocks at the Katowice site from various water-saturated layers. Assessment of the immobilisation of heavy metals in chemical and biological processes.	18	Da, Re	RE
D8.4	Investigation of kinetics of surface water self-cleaning	28	Da, Re	PU
D9.1	Description of characteristics of three Mega-sites	4	Da, Re	RE
D9.2	A method for rapid determination of the fraction of HOC that will desorb to the surface water.	21	Me	PU
D9.3	A tool for describing and predicting the transport of contaminated sediment particulates.	15	Re	PU
D9.4	A simulation model for selection and evaluation of measures to reduce or prevent contaminant transport to the water system.	28	Si	PU
D9.5	A concept for an engineered emission control technology.	31	Re	PU
D10.1	Pre-selection tool	13	Me	PU
D10.2	Cost-estimation tool (CET)	24	Me	PU
D10.3	Comparative analysis of cost-efficiency	30	Re	PU

Deliverable No	Deliverable title	Delivery month	Nature	Dissemination level
D11.1	Procedure for GIS based description of Structure Elements of the Megasite and water quality	11	Da	RE
D11.2	Procedure for GIS maps of current and planned function	12	Da	PU
D11.3	Procedure for GIS maps with potential and actual risk profiles for current and planned uses	20	Da	PU
D11.4	Procedure for description of stakeholder's interest and commitment towards current and future use.	13	Da, Re	PU
D11.5	Procedure for description of public interest and commitment towards current and future use	14	Da, Re	PU
D11.6	Procedure for description of the legislative framework	10	Da, Re	PU
D11.7	Procedure for assessing risk-function relations: actual and potential risk in space and time, and effects on asset value	30	Re	PU
D11.8	Procedure for the description of applicable risk reduction measures	30	Da, Re	PU
D11.9	Procedure for listing and describing of management options	16	Da, Re	PU
D11.10	Procedure for listing research needs and site investigation requirements	3	Da, Re	PU
D11.11	Procedure for making a cost efficient IMS for managing megasite water quality	32	Me, Re	PU
D11.12	Procedure for embedding principles and organisational models for IMS implementation and use for (stakeholders, public, authorities)	33	Me	PU
D11.13	A guideline for an IMS approach for prevention and rehabilitation of pollution of water bodies at Mega sites.	35	Me, Re	PU
D11.14	Up to date ICT software based product, available on CD-ROM and through internet.	36	Eq	PU
D12.1	Series of semi-annual evaluation reports	7, 13, 19, 25, 31	Re	PU
D12.2	Evaluation report of the draft version of IMS and advise on research needs	3, 23	Re	PU
D12.3	IMS evaluation report	35	Re	PU
D13.1	A WELCOME Internet Website	3-4	De	PU
D13.2	Spreading of WELCOME results through the CLARINET and NICOLE networks	1-36 and afterwards	Re	PU
D13.3	Special WELCOME session at ConSoil 2003	12 and 16	De	PU
D13.4	Publications in national/international magazines/journals	1-36 and afterwards	Re	PU
D13.5	Presentations at national/international conferences/seminars	1-36 and afterwards	De, Re	PU
D13.6	End User Training Course	36	Th, Me	PU
D13.7	IMS Management Course, Booklet, CD	36	Me	PU

	ROM			

3.4 Detailed description of the workpackages

DWP 1 Workpackage description														
Workpackage title:	**General Coordination**													
Workpackage number:	**1**													
Starting month no.	**0**													
Participants	**TNO**													
Participant codes:	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**Total**
Person-months per participant:	**15**													**15**

	Objectives General coordination of the whole project, particularly: • Co-ordination of scientific, administrative and financial work • Facilitation of the process to converge the results of the workpackages into the final deliverable (IMS) • Liaison with EU and participating networks **Note:** The coordination of workpackages 12 (International Team of End-users/ITE) and 13 (Knowledge Transfer and Dissemination) that has close links with the General Coordination is part of the specific work-packages. The descriptions of these specific coordination activities are given in the corresponding workpackages.
2	**Methodology / work description** The project management will be carried out by TNO and will be undertaken within the quality management system of the project coordinator, whose quality management arrangements have been accredited under ISO 9001. This uses a formal work file system for managing projects and the project management arrangements will be subject to external audit. All project partners (WP partners and leaders) will be required to submit semi-annual progress reports to the project manager; these will summarise progress in relation to the milestones of the project plan (see detailed description: C.5 Project Management). Formal project review meetings will be held every six months. Special objective of these 6 months meetings is the confirmation by the end-users (in an International Team of End-users) and the Megasite owners, that the project proceeds in a way that conforms the user requirements. At the start of 2003 an international workshop will be held with representatives from EU networks (i.e representatives that participated in the CLARINET concerted action project that recently ended or other networks, NICOLE, Academia, and with key players from Eastern Europe) to enlighten the progress of the project and to enhance discussion with relevant key players. This workshop will be held in as part of the program of the International Conference on Contaminated Soil "ConSoil 2003", which is the leading EU-conference on contaminated Land and Groundwater. The produced scientific papers will be distributed to all partners to react on. TNO will do the editing of the scientific contributions of the participants, which have been pre-edited by the specific WP-leaders. The draft IMS (deliverable D11.14) and the final version of IMS will be edited by TNO.
3	**Deliverables including cost of deliverable as percentage of total cost of the proposed project** D1.1 Semi-annual progress reports to be compiled from the information obtained from the project partners D1.2 Proceedings of the International Workshop (at ConSoil 2003). D1.3 Final report of Integrated Management System (IMS).
4	**Milestones including cost of the Milestone as percentage of total cost of the proposed project** M1.1-5 Series of semi-annual progress reports M1.6-8 Proceedings of the International Workshop (at ConSoil 2003). M1.9 Final report of Integrated Management System (IMS)

DWP 2 Workpackage description

Workpackage title:	**Water quality management at industrial harbour areas**
Workpackage number:	**2**
Starting month no.	**0**
Lead contractor no.	**TNO (lead),** VITO, PORT OF ROTTERDAM

Participant codes :	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**Total**
Person-months per participant:	**5.5**				**4**								**1**	**10.5**

1 Objectives

To apply and verify the IMS for industrialised harbour areas using the example of the Rotterdam/Antwerp Seaport as model megasite.

To provide systematically site characteristic data (environmental as well as spatial planning data) for establishing the IMS, and test the innovative elements (research workpackages 6-9) for practical use in the IMS.

To support validation of megasite risk assessment procedure (workpackage 5) and the cost-efficiency method (workpackage 10) in establishing cost efficient water quality management approaches.

2 Methodology / work description

The draft IMS procedure (see **Paragraph 2.4**) will be applied to the model site "Rotterdam/Antwerp Seaport area".

3 Deliverables including cost of deliverable as percentage of total cost of the proposed project

- D2.1 GIS mapped megasite description: current and planned use, potential and actual risks
- D2.2 Boundary conditions for sustainable development: stakeholders interest, funding options and legislative framework (water quality targets set by water framework directive)
- D2.3 Management instruments and effects: risk-function relations and risk reduction measures
- D2.4 Description of Management Options
- D2.5 Option driven rehabilitation scenarios, technical feasibility tests and technical designs
- D2.6 Cost-efficient management scenario's and selection of final IMS
- D2.7 Embedding principles and organisational models for IMS implementation.

4 Milestones including cost of the Milestone as percentage of total cost of the proposed project

- M8.1 Establishment of list of necessary parameters for data collection
- M8.2 Selection of the feasible management options for the specific site
- M8.3 Designing of cost-efficient management scenarios

DWP 3 Workpackage description

Workpackage title:	**Water quality management at a (chloro)organic chemicals industrial area**
Workpackage number:	**3**
Starting month no.	**0**
Participants:	**GICON (lead),** UFZ, LAF, MDSE, QUADRIGA

Participant codes :	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**Total**
Person-months per participant:		**3**		**2**				**10**	**7**	**5**				**27**

1 Objectives

To apply and verify the IMS to large organochemical industry complexes using the example of the "Bitterfeld area" project. To provide systematically site characteristic data (environmental as well as spatial planning data) for establishing the IMS, and test innovative elements (research workpackages 6-9) for practical use in the IMS. To support validation of megasite risk assessment procedure (workpackage 5) and the cost-efficiency method (workpackage 10) in establishing cost efficient water quality management

2 Methodology / work description

The draft IMS procedure (see **Paragraph 2.4**) will be applied to the model site "Bitterfeld area". During the process both scientific and socio-economical inputs will come from all other workpackages. The performance will involve the following aspects:

- Pre-processing of data from ÖGP Bitterfeld on both technical parameters of the megasite and the economic viability and hazard prevention schemes
- hazard assessment (using the method of WP 5, (D 5.1)) and for assessing whether the mediation measures for regionally affected groundwater remain cost-effective (WP 10, D 10.2).
- The databases will be structured such that relevant data can be accessed for all interdisciplinary topics.

	- The data material will be used as entry for the research in the interdisciplinary topics (D 5.5, D 6.4, D 7.4, D 7.5).
3	**Deliverables including cost of deliverable as percentage of total cost of the proposed project** D3.1 GIS mapped megasite description: current and planned use, potential and actual risks D3.2 Boundary conditions for sustainable development: stakeholders interest, funding options and D legislative framework (water quality targets set by water framework directive) D3.3 Management instruments and effects: risk-function relations and risk reduction measures D3.4 Description of Management Options D3.5 Option driven rehabilitation scenarios, technical feasibility tests and technical designs D3.6 Cost-efficient management scenario's and selection of final IMS D3.7 Embedding principles and organisational models for IMS implementation.
4	**Milestones including cost of the Milestone as percentage of total cost of the proposed project** M3.1 Remediation concept for the mega-project in Bitterfeld assuming the strict implementation of the EU Water Framework Directive and the usage of the scientific and technical expertise acquired in the interdisciplinary topics (WP 5–10) and WP 11 M3.2 Verification of the technical and economic impact of the EU Water Framework Directive on the remediation concept for Bitterfeld, including discussion of whether the remediation measures concluded are commensurate M3.3 Verification of the findings of the interdisciplinary topics using the concrete example M3.4 A procedure for concluding measures for such projects, verified using the example of Bitterfeld

DWP 4 Workpackage description

Workpackage title: **Water quality management at a metal processing and mining area**
Workpackage number: **4**
Starting month no. **0**
Participants: **IETU (lead),** TNO, VITO, TUC

Participant codes :	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**Total**
Person-months per participant:	**2**		**31**		**1**							**10**		**44**

1	**Objectives** To apply and verify the IMS to Metal Mining areas, using the example of the "Katowice area" as example megasite. To provide systematically site characteristic data (environmental as well as spatial planning data) for establishing the IMS, and test the innovative elements (research workpackages 6-9) for practical use in the IMS. To support validation of megasite risk assessment procedure (workpackage 5) and the cost-efficiency method (workpackage 10) in establishing cost efficient water quality management approaches
2	**Methodology / work description** The preliminary IMS procedure (see **Paragraph 2.4**) will be applied to the model site "Katowice area". The performance will in addition involve the following aspects: • Collection of historical data on the Chemical Plant and other potential contamination sources situated in the vicinity of the Triassic water reservoir • Collection of data on water users • Carrying out geostatistic analyses to determine distribution of chemical compounds in Quaternary rocks, Quaternary waters and Triassic waters • The data required for geostatistic analyses will be obtained from local monitoring of waters and soils as well as regional monitoring of the Triassic reservoir waters. Data obtained from the analyses will be integrated in the Geographical Information System (GIS), developed for the specific needs of the project: o hipsometric surface model of anthropogenic and Quaternary formations, Triassic layer model, lithological model of the Triassic reservoir o metal distribution model for Quaternary and Triassic formations o map of groundwater users describing the quality of the consumed water o completion of data by conducting additional tests and measurements o The analyses and characteristics will be carried out for two spatial scopes: local - on the territory of the Chemical Plant, and regional - on the territory of the Triassic water reservoir impacted by the Chemical Plant
3	**Deliverables including cost of deliverable as percentage of total cost of the proposed project** D4.1 GIS mapped megasite description: current and planned use, potential and actual risks D4.2 Boundary conditions for sustainable development: stakeholders interest, funding options and D

	legislative framework (water quality targets set by water framework directive) D4.3 Management instruments and effects: risk-function relations and risk reduction measures D4.4 Description of Management Options D4.5 Option driven rehabilitation scenarios, technical feasibility tests and technical designs D4.6 Cost-efficient management scenario's and selection of final IMS D4.7 Embedding principles and organisational models for IMS implementation.
4	**Milestones including cost of the Milestone as percentage of total cost of the proposed project** M.4.1 Characterisation of sources contaminating the reservoir M.4.2 Characterisation of water users M.4.3 Characterisation of the inorganic and heavy metal impacted industrial site

DWP 5 Workpackage description

Workpackage title: **Uniform Mega site risk assessment**
Workpackage number: **5**
Starting month no. **0**
Participants: **GICON (lead),** TNO, IETU, VITO, LAF, MDSE, TUC

Participant codes :	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**Total**
Person-months per participant:	**3**	**32**	**5**		**6**			**14**	**7**			**2**		**69**

1	**Objectives** The aim is to: 1. Develop/harmonise procedures for risk assessment and the conclusion of suitable countermeasures in mega-projects using an approach, which is uniform or at least comparable over large regions and in line with the new EU Water Framework directive. 2. Assess the risks at the three Welcome Mega sites based on the harmonised risk procedure
2	**Methodology / work description** The generic risk assessment model for mega sites will consider situations where large-scale groundwater contamination already has occurred and offer a multi-step approach regarding the valuation of the decontamination is required, and the assessment of remediation measures for areas already affected by groundwater contamination. The system comprises a holistic approach including the terms 1) Contaminant release (source), 2) Contaminant transport incl. the receptor surface water (transfer), 3) Decontamination of polluted groundwater (removal of secondary source), 4) Threat for natural resources and human health (effect). The required steps that will be performed are • Analysis of existing risk assessment systems (RAS) incl. the required data bases • Analysis of existing tools for the description of contaminant release and transfer • Examination of assessment criteria for water protection within EC and Poland • Analysis of consistency of these criteria with ground-/surface water balances • Evaluation of RAS for the assessment of extensive groundwater contaminations • Derivation of monetary and non-monetary criteria for the proportion of remediation measures for contaminant sources and contaminated water bodies incl. sustainability aspects • Validation of numeric and stochastic optimisation tools for RAS • Elaboration of a generic RAS for mega sites • Sensitivity analyses of RAS with regard to primary data and derived recommendations for data supply • Application, verification and validation of RAS with the participating mega sites The evaluation systems will be verified and objectified in an iterative process in close co-operation with WP 2–4 and WP 10, as well as using the results from WP 6–9. Special attention will be paid to identifying the effects of using the method on the evaluation results in comparison with previous assessments.
3	**Deliverables including cost of deliverable as percentage of total cost of the proposed project** D.5.1. Procedure for risk assessment and evaluating the proportionality of hazard prevention measures in mega-projects, taking into account the specific characteristics of these projects (usually groundwater pollution which has already occurred, the large scale of contamination, the degree to which a number of different natural resources are affected) D.5.2. Assessment system for hazard appraisal and measure ranking in Mega-projects with regard to subsequent utilisation (function-orientated risk assessment). D.5.3. Guideline for monitoring and predicting the temporal and spatial behaviour of groundwater contamination for cost-effective procedures based on the risk-related management of sites. D.5.4. Risk assessment of the three Welcome Megasites D.5.5. Evaluation study on the Welcome Mega sites risk assessments comparing national requirements

	versus the new harmonised procedure
4	**Expected results and corresponding Milestones including costs as percentage of total cost.** The results of WP 5 will provide an imperative pillar for the IMS as the IMS objectives are risk driven. WP5 will provide a harmonised concept for risk assessment at Mega-projects Relevant milestones of the WP: M.5.1. Drafting of the assessment concept M.5.2. Verification of the assessment concept using the individual mega-sites M.5.3. Harmonisation of the assessment concept M.5.4. Definition of principles for the proportionality of the elimination of groundwater pollution. To summarise: taking into account the stipulations of the EU Water Framework Directive and the relevant national regulations, with special attention to the sustainability of remediation and landscape rehabilitation while evaluating the possibilities and limitations of natural attenuation of pollutants.

DWP 6 Workpackage description

Workpackage title:	**Natural Attenuation of multi-sources and mixed pollutants (MNA)**
Workpackage number:	**6**
Starting month no.	**1**
Participants:	**UFZ (lead),** VITO, TU, MDSE, NOK, TUC

Participant codes :	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**Total**
Person-months per participant:				**31**	**4**	**12**			**15**		**3**	**10**		**75**

1	**Objectives** 1. Development and validation of novel methodologies for the quantification of MNA processes and potentials at field scale at Megasites characterised by multi-source and multi-component contamination 2. Assessment of suitability and limitations and development of a performance model for MNA as a remediation option for multiple contaminated Mega sites
2	**Methodology / work description** • Review of existing site data. In the -most probable- case of certain knowledge gaps, additional and site specific analytical and modelling work will be executed • Review of existing concepts and protocols for MNA implementation • Assessment of methodological approaches for the identification and evaluation of MNA proof criteria ("lines of evidence"), quantification and predictive modelling including • Identification of contaminants, metabolites and hydrogeochemical parameters indicating biodegradation and estimation of NA rates • Characterisation of geological and hydrogeological site properties and spatial contaminant distribution • Quantification of contaminant mass flux rates from sources to receptors • Application and optimisation (site/scenario-specific) of deterministic and stochastic hydraulic and reactive transport models • Monitoring systems for long-term supervision of the effectiveness of MNA • Enhanced MNA options integrated in landscape development or rehabilitation.
3	**Deliverables including cost of deliverable as percentage of total cost of the proposed project** D.6.1. Set of criteria for the suitability assessment of MNA as a site remediation measure as input for the IMS D.6.2. Technical guideline for the implementation of MNA for the management of multiple contaminated Mega sites D.6.3. Report on the applicability of existing protocols/guidelines for EU Mega sites D.6.4. Protocol/technical guideline for the implementation on MNA
4	**Milestones including cost of the Milestone as percentage of total cost of the proposed project** M.6.1. Evaluation of the existing data bases for the model sites M.6.2. Development of performance criteria for the acceptability for MNA as an alternative to intensive remediation actions

DWP 7 Workpackage description

Workpackage title:	**Natural attenuation at the reactive interface between groundwater and surface water systems.**													
Workpackage number:	**7**													
Starting month no.	**1**													
Participants:	**TNO (lead),** UFZ, VITO													
Participant codes :	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**Total**
Person-months per participant:	**21**			**8**	**8**									**37**

1 Objectives

To quantify the contribution of natural degradation processes at the groundwater - surface water interface (NA-interface) to emission reduction towards surface water systems, under different field conditions.
To investigate the potential contribution of the NA-interface as a part of a cost-effective integrated water quality management at contaminated megasites and its compliance with national and EU water directive standards.

2 Methodology / work description

For contaminants like BTEX, monochlorobenzene, vinyl chloride, the light fraction of mineral oil, the Nautral degradation will be assessed in the anaerobic-aerobic interface between groundwater and surface water. Until now, no straightforward assessment and quantification of biodegradation at NA-interfaces has been performed. Especially at megasites it is expected that the NA-interface can be of great importance. The following research items and knowledge gaps will be addressed:

- Assessment of conditions in the reactive interface (i.e. an interface with a sufficient redox-gradient, anaerobic-aerobic), and the width of the zone?
- Assessment of the dynamics of the interface (i.e. tidal influences versus stationary riverbed situations)
- Development of method for demonstration, quantification and monitoring NA-interface processes in the field.
- Assessment of the boundary conditions for beneficial NA-interface processes to take place.
- Assessments of the distribution of different bacterial species and activities, involved in natural attenuation (using molecular biology tools) as a function of the redox gradient (partner 5)
- Assessment of the degree of protection of the aquatic ecosystem by NA-interface processes.

Activities:

Conceptual model and hypothesis building.

- Identification of different NA interface types at 3 industrial sites .
- Indicative field measurement programme/Building conceptual model of interface for the selected cases.
- Model construction using geohydrological computer models, a geochemical transport model, concentration profiles of contaminants and macrochemical parameters (e.g. nitrate, sulphate etc.).
- Model input data gathering: bacterial degradation activity, from *in situ* microcosms assessing contaminant degradation rates and by applying molecular biology tools (e.g. PCR/TGGE, RT-PCR/TGGE and 16S rDNA sequence analyses (partner 5).
- Representative sites will be selected and subjected to a biota toxicity assessment; concentration data will be compared to literature toxicity thresholds.

Characterisation and modelling of NA-interface processes.

- Detailed characterisation: two sites will be selected for which a measurement/monitoring programme will be performed defined in order to make a close characterisation of the NA-interface processes.
- Existing models will be extended to a reactive interface model, in which water transport, diffusion, sorption, bioturbation, and chemical/biological degradation are incorporated.
- Cyclic design of a monitoring scheme and process interpretation. For this a number of model codes will be used i.e. RT3D, a geochemical transport model (MODBIO), PHREEQ and an inverse model code, which can be used for modelling (bio)geochemical processes at microscale (centimetres-meters).
- Based on the resulting NA-interface model, an optimisation of the monitoring will be performed, after which an extensive measurement programme will be set up and carried out using special multi-sample monitoring techniques, i.e. minifilters that can be placed in the reactive interface and can take samples over distances of centimetres to decimetres and oxygen and redox-penetration electrodes to monitor the redoxprofiles over these interfaces.

Implementation of the results and definition of further research.

The results of the previous activities will be used to:

- Adapt to and match with conditions set by water managers (national and EU water directives).
- Make an inventory of missing parameters/ weaknesses and uncertainties in NA-interface assessment
- Extend and apply the NA-interface model to the megasites in this project
- Incorporate the NA-interface assessment system as a sub-element of the IMS, which will be developed

	in WP2 and WP11
3	**Deliverables including cost of deliverable as percentage of total cost of the proposed project** D7.1 Special instruments and procedures for collecting field data at the groundwater - surface water interface. D7.2 A reactive transport model for pollutants in the groundwater – surface water interface, including geohydrological, geochemical and biological processes. D7.3 A comparison of the results of D 7.2 with models describing the macro(bio)chemistry of the sediment: a procedure for conceptual model building, interpretation of field data, and quantification and prediction of NA-interface performance. D 7.4 Systematics for evaluation of the relative impact of groundwater contamination on surface water quality, using NA-interface knowledge and with respect to other sources of contaminant in-flux to water systems D 7.5 NA-interface assessment system in contaminated megasite water quality management, in compliance with national/EU water directive standards.
4	**Milestones including cost of the Milestone as percentage of total cost of the proposed project** M7.1 Report on the characterisation and quantification of the natural degradation processes of organic pollutants occurring at the groundwater – surface water interface. M7.2 Publication of a NA-interface decision support system, which will facilitate acceptance and application of NA-interface processes by both the regulating authorities and site owners. M7.3 Publications in international, peer reviewed journals and conference proceedings

DWP 8 Workpackage description

Workpackage title: **Heavy metal pollution**
Workpackage number: **8**
Starting month no. **4**
Participants: **VITO (lead),** TNO, IETU, TUC

Participant codes :	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**Total**
Person-months per participant:	**3**		**44**		**22**							**16**		**85**

1	**Objectives** - Definition of a general approach in order to manage the risks related to heavy metals contamination in soils and groundwater of large contaminated areas - Definition of the high risk areas in function of metal mobility and bioavailability - Risk reduction based on reduction of bioavailability of the metals by sustainable immobilisation technologies - Reduction of the dissemination and bioavailability of heavy metals in the unsaturated zone - Reduction of the dissemination of heavy metals in contaminated groundwater plumes
2	**Methodology / work description** The risks related to the presence of heavy metals in the soil is the spreading of metals containing dust by the wind and the leaching of metals to the groundwater finally contaminating the surface water. The approach will make a difference between diffuse pollution (low concentration) due to emissions and dust spreading over more than 100 years and the source pollution (high concentration) due to the presence of waste heaps or old landfills. First, a simple method will be developed to make an overview of possible risks (actual and potential) due to the presence of heavy metals. In the IMS approach it is not possible to remove the metals due to the extreme costs and the related waste problems (as metals persist). In order to decide on remediation priorities a simple method, based on the measurement of heavy metals bioavailability by specific biosensors, will be used to draft an overview of the affected site. Partner 3 will use the biosensor-test to evaluate the bioavailability of the metals in the total area in order to identify the high-risk zones and the design of a management system for these specific site zones. The following research items and knowledge gaps will be addressed: 1) Risk assessment of metal availability by using biosensors (Biomet), 2) Immobilisation of heavy metals in soil, 3) Immobilisation of heavy metals in groundwater **<u>Activities</u>** • **Immobilisation of heavy metals in the unsaturated zone** Immobilisation of low concentrations of heavy metals in the soil top layer will be tested using addition of additives (silicates, chists, iron grids, cyclone ashes and other agents). Several of these additives like e.g. chists and cyclone ashes are low cost waste products to be in the vicinity of old industrial areas. • **Evaluation of immobilisation tests** After a first survey of presence of applicable compounds immobilisation tests will be performed using biosensors and column leaching tests. Thus, the feasibility to use cheap waste or geochemical products,

	available in the area to manage this problem, will be assessed. • **Immobilisation by phytostabilisation** Non-covered land test aimed at inhibiting wind erosion and dissemination of contaminants will be conducted: area's will be seeded with grasses or other plants in order to assess the feasibility of phytostabilisation. Partner 5 has experience in the selection of immobilising agents and in the use of biosensors for the evaluation of the bioavailability reduction. • **Immobilisation of heavy metals in the saturated zone (fysico-chemical process)** At heavy metal polluted sites it is reasonable to expect several dumpsites spread over the surface area. Resulting in many heavy metals sources to contaminate the groundwater. Especially the landfills leaching to the groundwater flowing in the direction of the surface water (rivers) cause a severe problem for human health. An a-biotic NA (=ANA) assessment method will be developed, which will evaluate the soil and rock capacity to immobilise the metals by sorption ion exchange and pH changes. ANA will verified in batch experiments with soil and crushed rocks in contact with the contaminated groundwater, delivering the data for ANA prediction by partner 3 including the dispersion risks of the heavy metal pollutions. • **Immobilisation of heavy metals in the saturated zone (biological process)** The biological capacity of the aquifer material to reduce the metals (e.g. reduction of iron and co-precipitation of As) or sulphate will be investigated. Sulphate can be used as electron acceptor and some cheap carbon sources can be added as electron donor. Two potential carbon sources will be selected and tested from available materials such as methanol, ethanol, acetate, lactate or waste products like molasses or compost leachates.. An inventory of local waste products will be performed and included in the selection. On such a material will be included in the immobilisation tests. • **Design of taylor made small PRBs for treatment of landfill run-off water** A small PRB pilot will be designed. The overall Megasite management programme with integrated landscape development and ecological engineering foresees the construction of easily permeable barriers at one edge of the landfill in the direction to the river. Such barriers form a hydraulic filter for the landfill material and the leachate can slowly permeate through the barrier in which carbon sources will be added to stimulate the sulphate reduction process followed by a metal sulphide precipitation and *in situ* immobilisation of the heavy metals. • **Transformation and propagation model of heavy metals in groundwater** Development of a model for the transformation and propagation of the heavy metals in a time period enabling to observe phenomena resulting from solution, self cleaning and immobilisation of heavy metals.
3	**Deliverables including cost of deliverable as percentage of total cost of the proposed project** D8.1 A simple method of risks identification (actual and potential) due to the presence of heavy metals D8.2 Screening and selection method for the evaluation of reduction in bioavailability and the selection of immobilising agents D8.3 Analysis of sample rocks the Katowice site from various water-saturated layers: • Analysis of the content of heavy metals and their forms in the environment; • Assessment of the immobilisation of heavy metals in physical (sorption) processes; • Assessment of the immobilisation of heavy metals in chemical and biological processes. D8.4 Investigation of kinetics of surface water self-cleaning (based on the analysis of water and sediments taken simultaneously at several profiles):processes of oxidation, reduction, chemical and biological decomposition • Coagulation and immobilisation of pollutants in sediments • Assessment of sediments and acquifer material ability to accumulate and immobilise heavy metals • Data-input for ANA prediction for heavy metals in groundwater system (WP 4, D 4.6) • PRB design for heavy metal immobilization, using local or other immobilization materials (WP 4, D 4.6)
4	**Milestones including cost of the Milestone as percentage of total cost of the proposed project** M8.1 GIS overview of possible reductions in bioavailability of metals over the whole site area. M8.2 An immobilisation test of applicable abatement compounds using biosensors and column leaching tests.

DWP 9 Workpackage description

Workpackage title:	**Emission control of contaminated sediments**
Workpackage number:	**9**
Starting month no.	**1**

Participants:	**WU (lead),** TNO, IETU, LAF, NOK, TUC													
Participant codes:	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**Total**
Person-months per participant:	**3**		**6**				**32**	**10**			**1.5**	**16**		**68,5**

1 Objectives

- To determine which management measures should be undertaken to minimise the effects of contaminants to the surface water quality in a cost effective way.
- To study the processes responsible for migration of contaminated sediment particulates.

2 Methodology / work description

The aim of this workpackage is to describe the mechanisms and factors influencing emission of contaminants from sediments into aquatic systems. The principal routes for spreading of contaminants in sediment are:

1. Desorption of the contaminants to the surface water
2. Transport of contaminated sediment particles as such.

The following research items and knowledge gaps will be addressed:

- Which are the critical parameters that enhance or hamper the release of contaminants from sediments to the aquatic environment?
- To which extent they may influence contaminants emission from sediments?
- What is the fate of contaminants in sediments depending on varying environmental and hydraulic conditions?
- Is it possible to predict the long-term behaviour of contaminants in sediments?
- What is the minimum set of protocols for risk assessment and evaluation?
- What engineering tools can function in a concept to reduce contaminant emissions to the aquatic environment?

Activities

Review of typical source areas.

- High concentration source areas will be selected for sampling to study desorption of contaminants as well as transport of contaminated sediment. The high concentration zones are important because they pose a high potential risk, as highly contaminated sediment migration may affect sediment and water quality through a wide spread area with diffuse pollution in down stream river basin areas.
- Characteristics of rivers at the WELCOME sites and the external targets for which they may form a risk according to the river basin approach will be adopted, as identified in work packages 2,3,4 and 5.

Assessment of Desorption of Contaminants.

A selection of Hydrophobic Organic Contaminants (HOC) with a persistent character is made. If these contaminants desorb to the surface water they determine a potential risk due to their low degradability. Therefore the assessment of the desorption of contaminants will address the following elements:

- Desorption of Hydrophobic Organic Contaminants (HOC) like PCBs, chlorinated dibenzodioxins, DDT and HCH from sediments of the megasites will be determined by solid phase extraction (SPE) (i.e. Tenax-based extraction).
- Persulphate oxidation will be tested for assessing the bioavailability of HOC. For aged PAH contamination persulphate oxidation was already proven to be a good predictor for its availability.
- The kinetics of sorption behaviour of HOC will be used for the design of risk controlling measures. Heavy metals are in most cases bound to sulphide precipitates in the sediment particles and will be studied in WP8.
- Contaminants that show high desorption rates will be studied for their biodegradation potential.

Assessment of transport of contaminated sediment.

The study of sediment transport phenomena will address the following topics:

- Re-suspension and re-deposition of sediment particles
- Convective transport of sediment particles into the sediment layer caused by turbulence in this layer
- Transport from the top of the sediment layer to the water phase above this layer
- Transport of pollutants or polluted particles by aquatic organisms

The following factors that may influence this transport, will be studied:

- Sediment particle size and size distribution,
- Composition of the sediment particles (organic matter/inorganic matter),
- pH, redox potential, temperature
- Water level and flow rate fluctuations (high water – floods and low water – dry periods)

Experiments will be carried out:

- On lab-scale using artificial sediment layers,
- On bench scale with sampled layers of natural sediments from the Megasite.

The study in sediment transport will lead to a better understanding in order to design control measures.

	Assessment Contaminants mobilisation/immobilisation in aquatic sediments. The most relevant parameters/factors of the desorption characteristics of the contaminants and of the transport of contaminated sediment will be used for evaluation and validation of theoretical simulation models. The models will be a valuable tool for selecting and evaluation of measures to reduce or to prevent contaminant transport to the aquatic environment. – Models for contaminants transport, immobilisation and release from sediments to the water body will be developed to predict the potential and actual hazard to aquatic environment. – Simplified models will be selected in which the most important parameters describe the risk of contaminant emission. – Experimental results will be compared with those obtained from modelling to validate the developed models. **Design of Engineered emission control measures** – Hydrological parameters will be determined to study whether engineering tools like sediment traps or stimulated capping of contaminated sediment can be applied in specific cases. Such engineering tools will reduce risks that are directly related to the spreading of sediment as such. – A concept of a more technological approach will be made in which sediments are treated in a sediment trap leading to a biological conversion of contaminants. Here trapping or capping sediment is not only an intermediate step in the reduction of risks, but moreover, contaminant conversion may further reduce potential risks. Such a process can be included in a more technological approach.
3	**Deliverables including cost of deliverable as percentage of total cost of the proposed project** D9.1 Description of characteristics of three Mega-sites D9.2 A method for rapid determination of the fraction of HOC that will desorb to the surface water. This bio-available fraction causes the main risk for deterioration of the aquatic system. D9.3 A tool for describing and predicting the transport of contaminated sediment particulates. D9.4 A simulation model for selection and evaluation of measures to reduce, or to prevent contaminant transport to the water system. D9.5 A concept for an engineered emission control technology will be presented.
4	**Milestones including cost of the Milestone as percentage of total cost of the proposed project** M9.1 Description of rapid method to determine HOC desorbing fraction. M9.2 Delivery of a simulation model for selecting and evaluation of measures to reduce, or to prevent contaminant transport to the water system. M9.3 Description of a concept for an engineered emission control technology.

DWP 10 Workpackage description

Workpackage title:	**Cost-Efficiency Assessment**
Workpackage number:	**10**
Starting month no.	**2**
Participants:	**TU (lead),** GICON, IETU, UFZ, LAF, QUADRIGA, NOK

Participant codes:	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**Total**
Person-months per participant:		**9**	**5**	**10**		**27**		**3.5**		**7**	**1.5**			**63**

1	**Objectives** The main objectives of this workpackage are: - Development of a tool for pre-selection of preferable management options for individual Structural Elements of the Megasite (SEM). - Development of a methodology to estimate total costs for different management scenarios on a net present value basis. - Comparative cost-analysis of preferable management scenarios for the three WELCOME sites.
2	**Methodology / work description** - Pre-selection tool: To achieve an efficient decision process, only the technically preferable management options for each SEM shall be considered in the cost-analysis. For this pre-selection of options, an appropriate tool has to be developed. The pre-selection will be based on the identification and description of possible options within the preceding WP 6, 7, 8, and 9. - Methodology for cost-estimation: As a management system that is generally applicable to contaminated mega sites the proposed IMS requires a site-independent methodology for estimating the total management costs. Site-independency implies that the method to be developed must consider all

	relevant site-specific cost-driving parameters as input variables. This also includes factors specific to the respective EU member states such as unit costs for certain services, discount rates or price increase rates.To guarantee that these requirements will be met, the concept of the methodology shall be jointly worked out by all partners in WP10 and will be based on a general agreement of all partners in the WELCOME project. The methodology will then be transformed into a manageable tool (software). For the integration of this cost-estimation tool (CET) into the IMS, appropriate interfaces between the cost-estimation and other IMS modules, which either provide input to the CET or process the results of the CET will be developed. - Comparative cost-analysis. By means of the CET, a dynamic cost-analysis will be performed for different management options at each WELCOME site (WP 2, 3, 4; D 2.6, D 3.6, D 4.6). The results of the cost-analysis will then be used for an integrated assessment of the respective options within the IMS (WP 11, D 11.11) in order to relate the management costs to the environmental benefit of each option (cost-efficiency assessment).
3	**Deliverables including cost of deliverable as percentage of total cost of the proposed project** D10.1 Pre-selection tool D10.2 Cost-estimation tool (CET) D10.3 Comparative analysis of cost-efficiency
4	**Milestones including cost of the Milestone as percentage of total cost of the proposed project** M10.1 Pre-selection tool [by end of 10th month] M10.2 General concept of the methodology to estimate total management costs [by end of 12th month] M10.3 Cost-estimation tool (CET) [by end of 21st month] M10.4 Interfaces and integration of the CET into the IMS [by end of 24th month] M10.5 Comparative analysis of cost-efficiency [by end of 30th month]

DWP 11 Workpackage description

Workpackage title: **Composition of an Integrated Management System (IMS).**
Workpackage number: **11**
Starting month no. **0**
Participants: **TNO (lead),** GICON, IETU, UFZ, VITO, TU, WU, LAF, MDSE, NOK, TUC, PORT OF ROTTERDAM**)**

Participant codes :	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**Total**
Person-months per participant:	**13.5**	**18**	**12**	**12**	**3**	**7**	**3**	**3**	**3**		**1**	**5**	**2**	**82.5**

1 Objectives

Development of an Integrated groundwater and surface water quality Management System (IMS) for environmental rehabilitation of Megasites. The objectives of the IMS are:
- Clarification of the causes, nature and magnitude of pollution
- Minimising the effects of pollution on the ecosystem and human health
- Minimising the effects of pollution on surface water quality
- Identifying remediation technologies for reducing soil pollutant impact on (ground)water quality
- Abatement and prevention of future environmental damage through ecological engineering
- Controlling threats to the continuous supply of clean drinking water
- Delivering a public/stakeholder participation instrument (Aarhus-convention).

2 Methodology / work description

The Welcome project has several interdependencies, preliminary results of work packages functions as guidance documents while others have to be fine-tuned in an iterative working approach. The work breakdown is as follows: 1) Development of IMS, and 2)Implementation of IMS. Both activities have designated links to the other Welcome work packages

Development of the IMS

1. Construct a draft working model of the IMS concept as guidance procedure for the Welcome project (paragraph 2.4)
2. Execution and adaptation procedure for IMS model: learning by doing WP 11
   - 2.1. The IMS data gathered in WPs 2-4 are used as input parameters for the finalising of the draft IMS. Priority tiered criteria are defined on the analysis of the results of WPs 2-4.
     - Industrialised harbour areas WP 2
     - Halo-organo-chemical sites WP 3
     - Metal mining area's WP 4
   - 2.2. Risk assessment is imperative for the definition of the boundary conditions the end-users of a site are faced with, since the aim is cost-efficient risk management. For this the new EU Water framework directive will be a guiding document for the criteria definitions as well as end-user needs. WP5. This

	work package is closely linked to the cost-estimation tool development in WP 10 2.3. The end-user needs will be gathered from the ITE and Welcome end-user participants using a Delphi technique followed by specific workshops on the prevention and reduction of water pollution of water bodies at industrial Mega-sites. WP12 2.4. The results of WPs 6-9 and 10 on resolved knowledge gaps and cost effectiveness will be integrated into the final IMS. 3. The WELCOME cases at the three sites will be used to evaluate the preliminary IMS, after which complementary elements or refinements can be incorporated in the IMS. WP 11 ***Implementation of IMS for new MEGASITES*** 1. Develop a generic establishment procedure for an Mega-site IMS, utilising the experiences from the three Welcome model Mega-sites WP 11 2. End deliverable of the Welcome project is up-to-date ICT software product and will be available on CD-ROM and the Internet. WP 11 **3.** Training programme for IMS usage WP 13
3	**Deliverables including cost of deliverable as percentage of total cost of the proposed project** D11.1 Procedure for GIS based description of Structure Elements of the Megasite and water quality D11.2 Procedure for GIS maps of current and planned function D11.3 Procedure for GIS maps with potential and actual risk profiles for current and planned uses D11.4 Procedure for description of stakeholder's interest and commitment towards current and future use. D11.5 Procedure for the description of public interest and commitment towards current and future use. D11.6 Procedure for the description of the legislative framework D11.7 Procedure for assessing risk-function relations: actual and potential risk in space and time, and effects on asset value D11.8 Procedure for the description of applicable risk reduction measures D11.9 Procedure for listing and describing of management options D11.10 Procedure for listing of research needs and site investigation requirements D11.11 Procedure for making a cost efficient IMS for managing megasite water quality D11.12 Procedure for embedding principles and organisational models for IMS implementation and use for (stakeholders, public, authorities) D11.13 A guideline for an IMS approach for prevention and rehabilitation of pollution of water bodies at Mega sites. D11.14 Up to date ICT software based product, available on CD-ROM and through internet.
4	**Milestones including cost of the Milestone as percentage of total cost of the proposed project** M11.1 Draft version (paragraph 2.4) updated M11.2 IMS establishment procedure tested at model megasites: we have learned by doing M11.3 Integration of resolved knowledge gaps through the research programme into the draft IMS M11.4 IMS establishment procedure transferred to ICT software package M11.5 Tutorial Course on IMS tool usage and demonstration to wider audience completed

DWP 12 Workpackage description

Workpackage title:	**International Team of End-users**
Workpackage number:	**12**
Starting month no.	**0**
Participants:	**TNO (lead),** GICON, IETU, UFZ, VITO, TU, WU, NOK, TUC

Participant codes :	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**Total**
Person-months per participant:	**2**	**1**	**3**	**1**	**1**	**1**	**0.5**				**0.5**	**2**		**12**

1	**Objectives** The activities of the International Team of End-users (ITE) in the project are aimed to ensure that the project proceeds in a way that conforms the user requirements, in particular the applicability and practicality of the IMS (end-deliverable) for end-users. The members of the ITE will be recruited of members of the EU networks CLARINET and NICOLE (mainly problem-owners of contaminated land and groundwater).
2	**Methodology / work description** The ITE will carry out the following tasks in the project: - **Input of information and data material from field experiences and projects** The ITE will bring experiences, data material and knowledge into the project. This material will be used in the various work packages, in particular the work packages under the WELCOME Research Programme (WP 6-10).

	- **Evaluations of the project progress and the results** The semi-annual reports of the workpackage leaders will be evaluated by the ITE with special attention to: 1) quality and consistency of the project, 2) interim adjustment of the project, 3) converging results and opinions. These evaluations will be focused on the end user requirements. The evaluations will be semi-annual reported by the ITE. - **Evaluation of the draft IMS** All Work in the project (laid down in all semi-annual progress reports) will culminate to the Integrated Management System (IMS). The draft version of IMS will be intensively evaluated by ITE to ensure that the IMS will meet the end user requirements at all parts of the management of protection and prevention of water bodies. It has to be emphasised that the involvement of the ITE is an essential element in the project, due to the following features: 1) Deliverance of input of knowledge, experienced during a long time by the ITE-members, into the project, that will broaden up the scientific and managerial basis of the IMS, 2) Match of the project results with the end-users requirements.
3	**Deliverables including cost of deliverable as percentage of total cost of the proposed project** D12.1 Series of semi-annual evaluation reports D12.2 Evaluation report of the draft version of IMS and advise on research needs D12.3 IMS evaluation report
4	**Milestones including cost of the Milestone as percentage of total cost of the proposed project** M12.1 Kick-off meeting M12.2 Semi-annual meetings M12.3 Final IMS construction meeting

DWP 13 Workpackage description

Workpackage title:	**Knowledge Transfer and Dissemination**													
Workpackage number :	**13**													
Starting month no.	**0**													
Participants:	**TNO (lead),** GICON, IETU, UFZ, VITO, TU, WU, LAF, MDSE, NOK, TUC													
Participant codes :	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**Tot**
Person-months per participant:	**2**	**1**	**2**	**1**	**1**	**1**	**0.5**	**1**	**0.2**		**1**	**1**		**11.7**

1	**Objectives** The work in this WP will be focused on the wide spreading of the (interim) results of the project, in particular the Integrated Management System (IMS) as final deliverable. Special actions will be prepared for information to Eastern European countries.
2	**Methodology / work description** The transfer and dissemination of the (interim) results of the project, in particular the end-deliverable IMS will be made through a combination of the following means. **1. WELCOME Website** A WELCOME Website will be built up. During the running of the project relevant information will be put on this site. **2. By networks from regulators and industry (NICOLE)** The EU networks from regulators (i.e. arising form the previous concerted action project CLARINET**)** and NICOLE (EU concerted actions), who are members of the International Team of End-users (WP 12), are particularly equipped for spreading the knowledge gained in this project. Both networks have secretariats that effectively inform their network members (mainly end-users). The members are spread all over the EU member states. **3. ConSoil 2003 Conference: special WELCOME session** Partner no. 1 (project coordinator) is co-organiser of the International Conference on Contaminated Soil "ConSoil 2003", which is the leading EU-conference on contaminated Land and Groundwater. TNO is responsible for the Scientific Secretariat of the ConSoil Conferences and has already scheduled a special WELCOME session is in the programme (in preparation). The ConSoil Conferences are a meeting place of about 1000-1200 experts from about 20 countries. A separate WELCOME report will be organised especially for spreading the IMS procedure at ConSoil 2003. **4. National and international journals** The project partners will deliver publications for national and international magazines. The project co-ordinator will coordinate these publications. **5. Presentations at national/international conferences/seminars** Beside the special presentation at ConSoil 2003 (see 3) project partners will present papers at national and international conferences/seminars. The project co-ordinator will coordinate these presentations.
3	**Deliverables including cost of deliverable as percentage of total cost of the proposed project**

	D13.1 A WELCOME Internet Website D13.2 Spreading of WELCOME results through the regulator and NICOLE networks D13.3 Special WELCOME session at ConSoil 2003 D13.4 Publications in national/international magazines/journals D13.5 Presentations at national/international conferences/seminars D13.6 End User Training Course D13.7 IMS Management Course (Book, CD ROM) ready to use for others (i.e. EU accession states)
4	**Milestones including cost of the Milestone as percentage of total cost of the proposed project** M13.1 Building of the WELCOME Website M13.2 Special WELCOME session at ConSoil 2003 Production of deliverables M13.2, M13.4 and M13.5 will be a continuous activity throughout the project

4. CONTRIBUTION TO OBJECTIVES OF PROGRAMME / CALL

The WELCOME project contributes to the main objectives of Key action 1: Sustainable Management and Quality of Water:

- *To protect high quality water at affordable costs.* The main goal of the IMS is to protect freshwater resources
- *To support the implementation of EU policy related to sustainable management of water resources* The project will facilitate the implementation of the EU water framework directive and national regulations on contaminated land and water quality assurance. Additionally, through WELCOME, a significant investment in policy implementation can be achieved with regard to future new member states.
- *To achieve goals through multidisciplinary research efforts and demonstration with the involvement of stakeholders and end-users of results* The project, end-users, industrial site owner representatives, contractors, service providers, university groups from various disciplines, and research organisations work together, in a problem solving/product producing way.
- *To establish a bridge between fundamental research results and water policy, and an improved synergy between separately executed research approaches*
- *Pollution prevention*. The project and its deliverables are aimed at megasite water quality management which is in line with the 1.4 objective "to develop comprehensive approaches to prevent pollution of water bodies, to assess and minimise pollution originating from contaminated sites, waste disposal sites and sediments as well as to prevent or reduce diffuse pollution". *1.4.1 Abatement of water pollution from contaminated land, landfills and sediments,* and *1.4.2 combating diffuse pollution*
- *Integrated management and sustainable use of water resources at catchment/river basin or sub-basin scale*, since megasite water quality management will be addressed at the regional sub-river basin scale. Compliance with the water framework directive is in this the major boundary condition and sub-theme *1.1.1 Strategic planning and integrated management methodologies and tools at catchment/ riverbasin scale* are also addressed.

5. COMMUNITY ADDED VALUES AND CONTRIBUTION TO EU POLICIES

The scope of the Welcome project is Mega-sites. Rehabilitation of such sites places high demands on the implementation of national and EU regulations, as many different areas are involved (e.g. water legislation, soil protection legislation, police and public order issues, and pollution laws) while universal regulations do not exist. Furthermore, large-scale remediation projects stretch financial resources to the limit owing to the enormous dimensions of pollution involved, and hence mean that the measures required to completely eliminate all contamination are no longer commensurate. Mega-sites by definition are sites with a vast surface area combined with source originating and diffuse soil pollution affecting water quality at river basin level either through:

- Primary fluxes of pollution directly into surface water,
- Secondary fluxes of by polluted groundwater (at soil pollution sites) mixing with surface water.

From a water catchment/river basin approach three distinctive different situations occur:

I Secondary water pollution at fresh water / marine environments (predominantly at harbours);

II Secondary and primary water pollution inland on a river level;

III Secondary and primary water pollution at stream and riparian level.

The first type of these problems currently occurs in the EU predominantly at the Seaports, (e.g. Hamburg, Rotterdam, Antwerp, Le Havre, Bilbao, Lisbon, Marseille, Turin, Venice). The second and third type can be found in various parts of Europe, including the eastern part of Germany and the Former East bloc countries (the so called accession states Poland, Czech Republic, Slovakia and Hungary) as a result of environmental mismanagement of the planned economy era. The number of Mega-sites in the European Union including the Visegrad countries is in the order of 5.000 to 10.000, in numbers about 5 to 10 % of the 300.000 potentially contaminated sites in Europe (EEA-ECTS), and representing 30% or more of the overall land and groundwater reclamation costs. Thus development of cost-efficient risk reduction approaches for such areas will result in a major cost-reductions in management and remediation approaches through out Europe.

The Welcome project addresses all policy relevant aspects of risk-management and control of polluted Mega-sites by Natural Attenuation and Ecological Engineering/ including landscape integrated cost-efficient risk reduction approaches. Thus compliance with the water framework directive and cost effectiveness will be combined, and innovative approaches (natural attenuation and immobilisation) and integrated management (IMS Framework in **Paragraph 2.4**) will be promoted.

6. CONTRIBUTION TO COMMUNITY SOCIETAL OBJECTIVES

Considering the abovementioned dimension of the problem of industrial soil pollution and the potential impact on the quality of water, the contribution of the *WELCOME* project to the EU social objectives is straightforward:

- the methods and management system developed, will help to define the most cost-effective solution for megasite water quality management;
- establishing cost-effective risk reduction and ecological engineering technologies and methods, will help to resolve socio-economic bottle-necks in megasites redevelopment
- cost-effective approaches will save financial resources thus promoting productive investments in industry or, public services, and other economic restructuring;
- the availability of those new and effective technologies will pose the base for the development of new EU based companies entering a potential vast market (that of soil and groundwater remediation), create new jobs and improve employment. Manpower often made redundant at contaminated industrial sites because of recent industry restructuring may be channelled towards new jobs in the remediation business right at the same sites;
- the quality of life, health and safety of populations living close to industrial areas and depending on ground and surface water for their fresh water supply will be improve by the technologies and management approaches developed within WELCOME project

7. ECONOMIC DEVELOPMENT AND S&T PROSPECTS

The implementation of megasite water quality management can have three economic effects:

Economically Successful Megasites. Such sites have a major effect on the regional / national economies involved. The success of the site is, due to its activities, at the same time generating the environmental problems. Access to the problem areas, however, is limited and remediation is hampered due to the presence of buildings and equipment. Production loss is one major stumbling block in the remediation of these sites. Moreover, regulation and contaminated land management are oriented at single sites and liable site owners. Diligence costs limit ownership transition and therefore further industrial development of the area. An approach beyond single site liability oriented regulation and management, aimed at the effects on water quality, is expected to remove a number of bottlenecks in further economic/industrial development. Of course, this will require major changes in the organisation of environmental management and regulation in some countries and states. The IMS procedure developed in *WELCOME* is expected to facilitate such a process.

Old historical contaminated megasites and abandoned megasites. The redevelopment of the megasites will have a major impact on regional economies. The scale of the investment needed and likewise the activities foreseen at the site will demand heavy labour input. All megasites have in common that they are located in the vicinity of urban areas. Redevelopment has a positive effect on the asset management of the site but also to the value of nearby located properties. The IMS procedure, determining cost-effective water quality management scenarios (preventing waste assets) that keep pace with the regional spatial and economic planning, will the facilitate (and not obstruct!) the redevelopment of such megasites, thus improving the environment as well as the quality of life for the local population.

Megasite management technologies & methods: new products, new markets. Existing technologies are generally incapable of remediating megasite contamination problems. Although significant progress has been made, few technologies are available for treating recalcitrant contaminants (including metals) at the regional scale. Any technology that helps to control and reduce the impact of megasite contamination on the environment is worth a prominent place. Environmental engineering in combination with landscape rehabilitation and monitored natural attenuation can provide new solutions.
The problem of technical environmental science is that the results are often not translated into products with market perspectives. The possibilities for subsequent commercialisation of the results arise only occasionally. In the *WELCOME* project megasites, both land owners and end-users take part, thus creating an optimal situation to adapt the IMS product and the risk-mitigation technologies to market (megasite end-users) needs.

Scientific progress. Several well-known universities and research institutes of different countries in the EU and a EU-accession state work together sharing their knowledge and expertise. Bundling them in the interdisciplinary *WELCOME* approach will have a positive effect on the advancement of implementing new concepts on risk-reduction and remediation / revitalisation of derelict sites. Moreover, it will stimulate the protection of the public for risks relating to the deterioration of the environment and water bodies in particular.

Another important issue is that scientists (academic co-workers, postdocs and PhD's), service providers, and end-users are placed in interdisciplinary teams, in which both fundamental

and applied issues are tackled. Doing so, all team members need to work together, and to learn to approach problems from the other's perspectives. These interactions give rise to creativity by academics as well as end-users, thus leading to optimal scientific and practical results and offspring of new idea's and initiatives.

Dissemination and knowledge transfer. The task of the environmental megasite managers, to implement the IMS, is difficult and tedious. For this reason, stakeholders and end-users are invited to participate in the approach of WELCOME. The final success of the project will be in the robustness of the system and the support for the actual use of the system at real megasites. This goal will be achieved by the process of "learning by doing" on the three model sites and involvement of all stakeholder types (i.e. the international end-user evaluation team (ITE), with representatives of networks like NICOLE, regulator networks, networks of academia, and the accession states) in the crucial steps in the project. Their contribution is twofold: bringing knowledge into the project and give feedback based on experience into the networks.

Six workshop conferences are foreseen in which the partners will present and discuss their results, with the end-user evaluation team, and when possible with the MEGASITE working group of the ACADEMIA networks (possibly Ancore). Aiming for a wider circle of knowledge dissemination, a special session on the project is foreseen at the ConSoil IIX conference 2003. This leading soil and (ground) water conference is the central stage for the discussion of advancements in site remediation science and technology as well as management approaches.

The next level of knowledge dissemination is the distribution through the worldwide web, which will be set up and updated during the project. Public participation as well as stakeholder participation will be stimulated through several activities and campaigns during the progress of the project. The goal of this task is to distribute the results of the project and to convince other organisations that it may be valuable for them to apply the WELCOME techniques and methods.

At the end of the project, IMS establishment tool will be available in user-friendly software. By means of (Internet) tutorial software, using the IMS product as personal computer teaching material, the WELCOME knowledge will be disseminated, to the end-user evaluation team members. A demonstration of the IMS tool to a wider audience from EU and accession states will be given at an appropriate international seminar or conference.

Technology Implementation Plan (TIP). A draft version of the **Technology Implementation Plan (TIP)** will be provided in month 26, as part of Workpackage 13, and further developed to a final version in the period month 26 to month 36.

8. THE CONSORTIUM

The consortium and the ITE are described on the front page. The tasks in the project are described for each partner below.

Partner no.1 TNO	**Person-months**	**Expertise**	**Task in the project**
Senior scientist	23	Environmental biotechnology Programme management	D1.1 – D1.3 D2.1 – D2.7 D4.7 D5.4 D7.1 – D7.5 D8.1, D8.2 D9.1, D9.5 D11.1 – D11.14 D12.1 – D12.3 D13.1 – D13.7
Scientist	16	Environmental biotechnology, risk assessment, microbiology, soil science, GIS, software engineering, geology	
Junior scientist	23	Environmental biotechnology, risk assessment, microbiology, soil science, GIS,	
Technician	5	Analytical chemistry, soil science, geology	
Secretary and financial/ administrative personnel	3		

Partner no.2 GICON	**Person-months**	**Expertise**	**Task in the project**
Senior scientist	20	Environmental engineering, environmental management, risk assessment	D 3.1 - D 3.7 D 5.1 - D 5.5 D 10.1 - D 10.3 D 11.1 - D 11.14 D 12.1 - D 12.3 D 13.1 - D 13.7
Scientist	44	Remediation technology, valorisation of contaminated sites	

Partner no.3 IETU	**Person-months**	**Expertise**	**Task in the project**
Scientist (6)	46	Earth sciences, GIS, Risk assessment, Risk management, Chemistry, Environmental Physics	D4.1 – D4.7 D5.4, D5.5 D8.1 – D8.4 D9.1, D9.3 D10.1 – D10.3 D11.1 – D11.14 D12.1 – D12.3 D13.1 – D13.7
Engineer	46	GIS, Geology, Water management, Environmental management, Chemistry, Economy, Software engineer	
Technician	16	GIS operator, Computer operator, Chemistry	

Partner no.4 UFZ	**Person-months**	**Expertise**	**Task in the project**
Senior scientist	12	Geology, environmental geochemistry, water management,	D 3.1 – D 3.7 D 6.1 - D 6.4 D 7.1 – D 7.5 D 10.1 – D 10.3 D 11.1 – D 11.14 D 12.1 - D 12.3 D 13.1 – D13.7
Scientist	30	Hydrogeology, groundwater modelling, groundwater remediation	
Senior scientist	21	Environmental and analytical chemistry, relational database management systems, software engineering	

Partner no.5 VITO	**Person-months**	**Expertise**	**Task in the project**
Scientists	22	GIS and analytics, Risk assessment, Environmental biotechnology, Environmental management	D2.1 – D2.7 D4.2 D5.2 – D5.3 D6.1 D7.4 – D7.5 D8.1 – D8.4 D11.10 D12.1 – D12.2
Engineers	15	Risk assessment Microbiology	
Technicians	13	Microbiology	

Partner no.6 TU	**Person-months**	**Expertise**	**Task in the project**
Scientist	36	Cost-analysis models, numerical modelling, decision support systems, management tools and management options at contaminated megasites.	D6.1 – D6.4 D10.1 – D10.3 D11.1 – D11.3 D12.1 – D12.3 D13.3 – D13.7
Scientist	12	Implementation of NA in Europe, methodologies for proving NA at field scale, set-up of decision criteria for the implementation of NA	

Partner no.7 WU	**Person-months**	**Expertise**	**Task in the project**
Senior scientist*	2	Environmental biotechnology	D9.1 – D9.5 D11.7 – D11.12 D12.2 – D12.3 D13.2 – D13.5
Scientist	36	Environmental technologist	

*permanent staff member

Partner no.8 LAF	**Person-months**	**Expertise**	**Task in the project**
Senior scientist	15	Soil and groundwater clean-up management, hydrogeology	D 3.1 – D 3.7 D 5.1 - D 5.5 D 9.1 - D 9.5 D 10.1 – D 10.3 D 11.1 – D 11.14 D 13.1 – D 13.7
Scientist	27	Hydraulic and transport modelling in groundwater, GIS	

Partner no.9 MDSE	**Person-months**	**Expertise**	**Task in the project**
Senior scientist	12	Redevelopment of contaminated sites, risk assessment	D 3.1 – D 3.7 D 5.1 - D 5.5 D 6.1 – D 6.4 D 11.1 – D 11.14 D 13.1 – D 13.7
Scientist	20	Economic evaluation of remediation measures, cost-benefit analyses	

Partner no.10 QUADRIGA	**Person-months**	**Expertise**	**Task in the project**
Scientist	12	Environmental chemistry, environmental engineering	D 3.1 - D 3.7 D 10.1 - D 10.3

Partner no.11 NOK	**Person-months**	**Expertise**	**Task in the project**
Engineer	8.5	Environmental engineering	D6.1 – D6.4 D9.3, D9.5 D10.1 – D10.3 D11.3 – D11.12 D12.1 – D12.3 D13.2 – D13.7

Partner no.12 **TUC**	**Person-months**	**Expertise**	**Task in the project**
Professor	5	Environmental technology	D4.2 – D4.6 D5.5 D6.1 – D6.4 D8.1 – D8.4 D9.1 – D9.5 D11.7 – D11.12 D12.2 – D12.3 D13.2 – D13.5
Scientist	23	Environmental protection	
Engineer	23	Microbiology, environmental chemistry	
Technician	11	Analytical chemistry	

Partner no.13 **PORT OF ROTTERDAM**	**Person-months**	**Expertise**	**Task in the project**
Engineer	3	Environmental megasite manager	D2.1, D2.2, D2.5, D2.6

9 PROJECT MANAGEMENT

The project management follows the structure of the workpackages in the project. The structure of the project is given in the scheme in paragraph 3.1.
To achieve an efficient project management organization, the following management and coordination structure will be used.

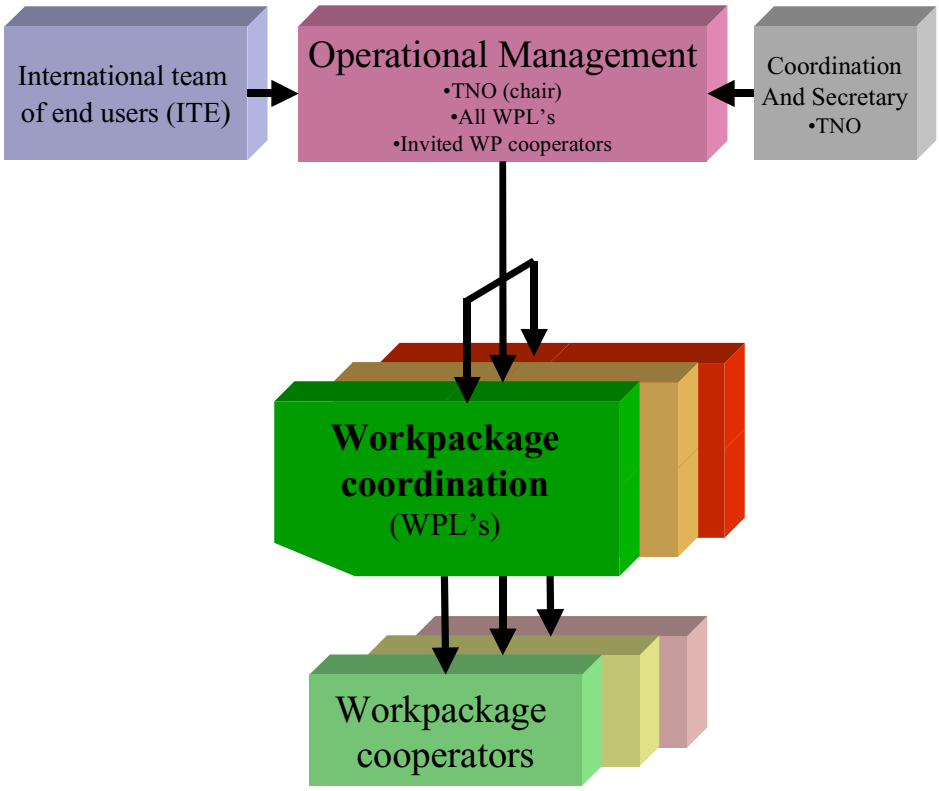


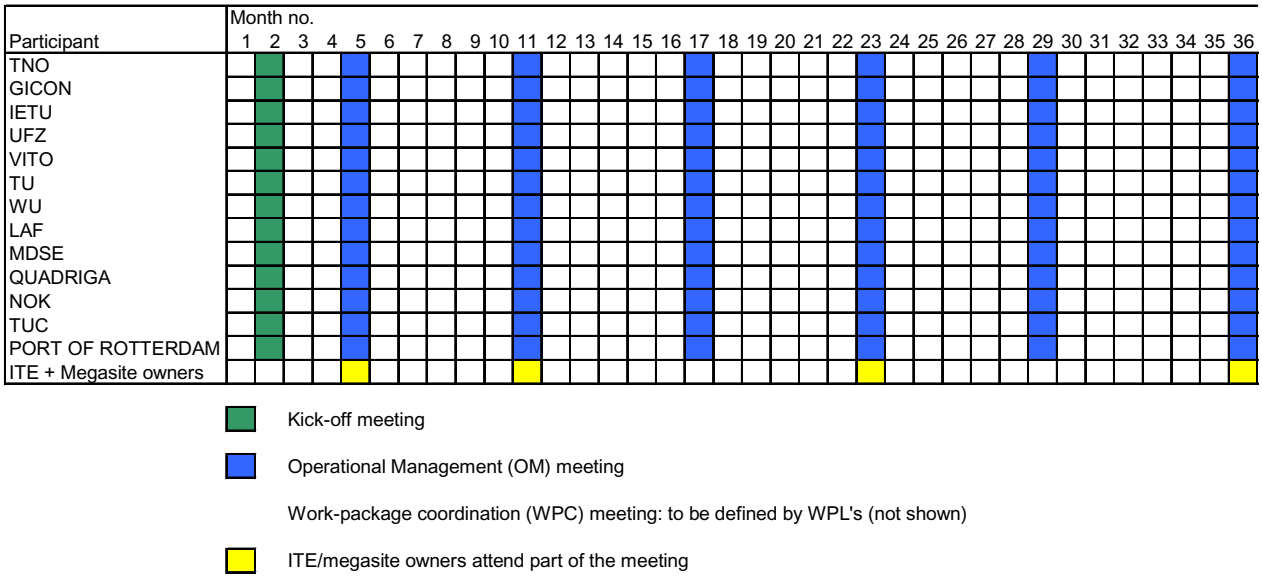
Figure 9.1 Management structure of the Welcome Project

Responsibilities of OM, WPC, coordination and secretary

Operational Management (OM)	Permanent members	Frequency of meetings
Major tasks: – Operational Management of the entire project – Control of quality and consistency of project program; interim adjustment of the project program – Steering work-package coordination – Managing and stimulation of workpackage interaction – Presentation and discussion of the results with ITE (WP 12) – Advise on project performance and synergy Workpackages 2-11 towards PCC – Converging results and opinions on research parts and on IMS construction – Give input for the construction of IMS (end-deliverable)	- TNO (chair) - All WPL's - Invited WP coordinators	Semi-annual

Workpackage management (WPC)	Permanent members	Frequency of meetings
Major tasks: – Management of the specific workpackage – Presentation and discussion of the results within the specific workpackage team – Reporting by WPL to OM concerning work progress according to DoW planning tables – Control of quality and consistency of workpackage; interim adjustment of the workpackage program. – Workpackage deliverables	- Workpackage leaders (WPL) - Workpackage partners	As frequently as needed
Coordination and secretary	**Coordinator**	
Major tasks: – Administrative control – Control of finances	TNO	

The meeting scheme is given below.



An overview of the person months per partner is given below.

Table 9.2 Person-months per WP per partner

	1 TNO	2 GICON	3 IETU	4 UFZ	5 VITO	6 TU	7 WU	8 LAF	9 MDSE	10 Quadriga	11 NOK	12 TUC	13 PORT
WP 1	15												
WP 2	5,5				4								1
WP 3		3		2				10	7	5			
WP 4	2		31		1							10	
WP 5	3	32	5		6			14	7			2	
WP 6				31	4	12			15		3	10	
WP 7	21			8	8								
WP 8	3		44		22							16	

WP 9	3		6				32	10			1,5	16	
WP 10		9	5	10		27		3,5		7	1,5		
WP 11	13,5	18	12	12	3	7	3	3	3		1	5	2
WP 12	2	1	3	1	1	1	0,5				0,5	2	
WP 13	2	1	2	1	1	1	0,5	1	0,2		1	1	
Sum	70	64	108	64	50	48	36	42	32	12	8,5	62	3