Experience and Best Practice in Land Improvement

NW England (UK)
Huelva (SPA)
Ida Viru (EST)
Lombardy (ITA)
NE England (UK)
North-Rhine Westphalia (GER)
E England (UK)
Hessen (GER)
Piedmont (ITA)
Saxony-Anhalt (GER)
NW England Environment Agency (UK)

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North East South West INTERREG IIIC

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ECRN: The "European Chemical Regions Network" (ECRN) has the objective of exchanging experiences about the joint challenges for chemical regions and to initiate a mutual learning process for the strengthening of the chemical sector. Joint positions on relevant policy issues are developed to raise the regional voice in the European decision making process. The partner regions are Saxony-Anhalt, acting as the coordinator, North Rhine Westphalia and Lower Saxony, (GER), Huelva, Asturias and Catalunya (SPA), Lombardia and Piemonte (ITA), North East and North West of England (UK), Limburg (NL), Masovia (PL), and Ida-Viru (EST). Contacts with further chemical regions have been established to enlarge the network and become a stakeholder at European level. Rhineland Palatinate and Schleswig Holstein have recently joined the network. The total project budget is 1,639,000 €, 61% of which is funded by the European Union. More details about the ECRN can be found on its website at www.ecrn.net.

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1.0 Introduction

One feature of change is that the chemical industry is shrinking in area due to the reduction in the number of older large scale plants and replacement with smaller scale higher efficiency operations. This is creating a substantial area of derelict and underused land, both within the boundaries of continuing factory activity and also as abandoned sites. Most of it has been contaminated to some extent because even best practice in the past failed to recognise the environmental legacies that were being created. For many companies the management of their derelict land is a major issue. In some cases it can represent a potential commercial opportunity for new industrial use and sale of services but in others it represents an asset of negative value on the balance sheet.

In general land that can be economically redeveloped has already been brought back into beneficial use or there are plans for this to take place. This study relates to land that is underused or derelict and for which there is no economic case to take forward for any form of beneficial use without some form of external support. If contamination of land is posing a threat to groundwater or neighbouring properties in general the responsibility to mitigate the problem lies with the owner. There are however many sites where the firm producing the contamination has gone out of business or the current owner does not have the resources to undertake remediation. In these cases there is no possibility of remediation being undertaken other than through external funding. This study seeks to identify a way forward for all areas of underused land from the chemical industry to bring them back into some form of beneficial use.

Policies, authority involvements, the scale of problems and work already undertaken will vary between regions as well as many other related topics. The study is needed to attempt to gather data together to form a better understanding of the current situation and the potential ways forward.

2.0 Objectives.

The objective of the study is to understand the main problems and opportunities in each region and to assess the best way to bring back land into some form of beneficial use. This will involve different approaches depending on the nature of the ground, level of contamination and potential for land reuse. Where possible the land should be improved to a condition where it is practicable for it to be reused and therefore be able to be largely funded by developers. There are however many sites where this will be impractical for technical, financial and community interest reasons. In this case the best that can be achieved is likely to involve some form of greening and where appropriate availability for public access. This greening will have the benefit of improving areas particularly where they form gateways for areas for further development and also alongside transport corridors where the perception of an area could be enhanced. There will still be some sites where although there is no threat to surrounding land it would not be appropriate to

consider public access for safety and insurance reasons. In this case some very restricted form of access could be considered for the development of sites as bird sanctuaries or areas of biological or ecological interest. This would still provide some public benefit.

The understanding of the opportunities and experience in each region when combined together will give a better picture of what is possible and the best ways to achieve improvement.

2.1 Information collected

The issues that the report seeks to answer are as follows:

What are the most cost effective ways of making sustainable environmental improvements to underused and derelict chemical industry (DUN) land to:

- attract developers
- improve the quality of life for local communities
- raise the image of the regions and assist in attracting inward investment

What regional or EU policies or regulations help or hinder improvements.

Are there EU policies or regulations which need to be introduced/amended.

What are the most viable alternative technologies for the treating, rendering harmless, stabilising and retaining contaminants on site.

We are extremely grateful for the detailed responses provided by the project partners which have provided a great amount of valuable data relating to the reuse of brownfield sites.

1.0 What Derelict and Underused Land Exists in the Region

1.1 NW England

In the NW England the oldest sites in the Region are located in the Halton and Mid Cheshire areas. Much of the historical waste remaining in these areas results from the Le Blanc process which produced large volumes of highly alkaline wastes which were spread over the countryside surrounding the Works and now form a legacy which restricts local development. In Mid Cheshire the highly alkaline waste results from the later Solvay production of soda ash. This is in the form of very soft and variable material disposed of in landfills

Another large area of brownfield land from the chemical industry in the region is at Fleetwood which is the site of a shadow factory from the second world war which was developed adjacent to a soda ash works. Most of the land from the more recent developments is only lightly contaminated and is being redeveloped for industry and housing. There are however some large landfills and lagoons remaining.

There is also a large site of approximately 100 hectares at Whitehaven in Cumbria which was used for the manufacture of washing powders and by-products which has recently been closed and is in the process of demolition. Long term planning for bringing this site back into beneficial use involves large areas of greening with public access as it is situated adjacent to a very deprived community. There will also be a smaller area available for industrial development.

1.2 NW Environment Agency

The Derelict and Underused Land in the NW Regional survey undertaken as part of the Newlands project identified 3,800 'DUN' sites of more than one hectare in size, of which 1,600 were 'brownfield' (some 14,913 hectares) and have been previously developed. This survey was of all potential DUN land across the region not just land associated with the chemical sector.

It should also be noted that some chemical industry land may have contamination issues due to previous activities but may not be derelict, underused or neglected.

We have recently published a report on indicators for land contaminated land[1]. Data from the National Land Use Database (2002) indicated that there was around 3,199 hectares of previously developed land associated with former industrial use.

Department of Environment industry profiles provide developers, local authorities and anyone else interested in land contamination, with information

[1] Indicators for land contamination, science report SC03000/SR, Environment Agency 2005.

on the processes, materials and wastes associated with individuals industries. They are not definitive studies but they introduce some of the technical considerations that may prove helpful at the start of an investigation for possible contamination.

1.3 NE England

(data for this study was compiled by a group working only on the Tees Valley sub region so that this submission should be considered as coming from the Tees Valley rather than the NE Region).

Exact figures are not available but there is a concentration of problem areas around the River Tees corridor. For some petrochemical dominated areas there could still be expansion. Some of the sites have developed an interesting and valuable biodiversity because they are protected from regular trespass and the substrates have particular chemical characteristics that lead to biological value. Industry is generally aware of this and will undertake environmental assessment before undertaking development or potentially damaging activity. Any proposals for remediation will need to include environmental assessment to identify benefits or disadvantages and to weigh the balance of development against the status quo and the need for any mitigation measures.

1.4 E England (Humberside)

Waters' Edge Country Park is located at grid reference TA032231 adjacent to the Humber Bridge on the south bank of the Humber Estuary. The site consists of approximately 35 hectares of mixed wildlife habitat including open water, reedbed, wet grassland and woodland habitats. The recently completed state of the art visitor centre with opportunities for environmental education as well as commercial office space will be officially opened in early 2006.

Until 1983 the Waters' Edge site was the location of an agrochemical production plant. Upon closure of the plant, the site was sold to Glanford Borough council. In later years the site was determined to be heavily contaminated with a range of substances from residual fertilizers to heavy metals. This lead to problems with eutrophication of local water courses and pH ranges from 2.4 to 9.9.

Given the site's proximity to the Humber Estuary, which is recognised as being internationally important for wildlife, and the potential for pollution of the underlying chalk aquifer, the owners (now North Lincolnshire Council) were required to carry out works to remediate the contaminated areas of the site.

1.5 Estonia

The history of the chemical industry relates back to Soviet times when there were 2 companies classified as chemical industry.

1 Oil-Shale industry in Kohtla-Jarve and in Kivioli. (approximately 80 hectares of unused land).
2 Factory No 7 (all factories with soviet military interest had codenames) in Sillamae. (approximately 10 hectares of derelict land).

1.6 Huelva

The province of Huelva was until relatively recently heavily associated with the mining industry. This was mainly for the extraction of pyrites which with chemical treatments enabled the separation of copper gold sulphur etc. The area now has widespread deserted mining activities with degraded landscapes of dumps and ruined facilities that stay as testimony of these activities. But these problem areas can be rescued as cultural patrimony and recreated to stimulate the local sustainable development, by means of operations of territorial improvement.

The history of the mining industry is like the history of the province of Huelva. Centuries of extraction have not exhausted the reserves of these lands, but currently they do not enjoy good economic health. This does not hide the many hectares where the land shows its wastes. Riotinto, Tharsis, Nerva, Mina Herrerías, are only a few of the places where the human avidity for metals have left exposed geological structures, but also human and social structures. Also industrial architecture that has been the most advanced in the world and related industries which formed the nucleus for the origin of the chemical and industrial activity of the peninsula. The presence and wealth of raw materials were a determining factor for the creation of the Growth Point of Huelva, with areas dedicated to the chemical industry involving the plants for sulphuric acid, explosives factories and mineral roasting. These are only a few of the activities demonstrating the "artificiality" of the Areas and the administrative performance. Diagnosis of the existing problems in the whole productive chain has been carried out as well as a set of alternatives and solutions, with a view to the revitalization of historic industries. The role of the IFA belongs especially as a revitalizing agent, adviser, investor and subventioning agent, being indispensable with the active participation of the principal agents in the sector.

1.6.1 Listing of Principal Chemical and Basic Industries (AIQB)

Companies	Principal productions	Municipality
Air Liquide	Oxygen, nitrogen, argon and carbonic dioxide	Huelva
Algry	Basic products of organic chemistry	Palos Fra.
Aragonesas	Chlorine and derivated substances	Huelva
Atlantic Copper	Anodes and cathodes (copper), sulphuric, electrolytic muds	Huelva
Cepsa Ertisa	Methilamine, dimethilacetamide... phenol...	Huelva
Cepsa Rábida	Fuels, asphalts, petrochemical and lubricants	Palos Fra.

Enagas	Storage and gas sale	Palos Fra.
Ence	Cellulose, paper of impression and derivated	Huelva
Endesa	Production of electricity	Huelva
Fertiberia	Sulphuric acid, phosphoric acid, phosphate...	Palos Fra.
Fertiberia	Ammonia and urea	Huelva
FMC Foret	Phosphoric acid, tripolisulfates, phosphates...	Huelva
Hustsman Tioxide	Pigment of dioxide of titanium, ferric and ferrous sulfate	Palos Fra.
Repsol Butano	Packed and sale of Butane	Palos Fra.
Roída	Tripoliphosphate	Huelva
Unión FENOSA	Regasification and gas transport	Palos Fra.

Source: AIQB, 2005

The location and permanency of these industries has been discussed for a long time by experts and the population of the city of Huelva. In spite of everything, it has certain logic, with the availability of the area (properties of the Port Authority of Huelva) and its location close to the natural port of Huelva, traditional exit of the mineral of the province and route of excellent communication for the industries with their markets of origin and destination. The industrialization in Andalusia and the province of Huelva has been based, initially, in pillaging the rich mining deposits, to which a rachitic basic chemistry was annexed, always following the so called Primary Exporting Model.

During the politics of "Desarrollismo" during the 60's, based on theoretical frames from Perroux, indicative plans of development were created, trying to relieve the emigration and the lack of employment. In the case of the province of Huelva, the practical lack of industry advised in 1964 the creation of a Area of Industrial Promotion, which turned in 1968 into Industrial Growth Points, in the municipalities of Huelva and Palos de la Frontera.

From the politics of indicative planning there arose a industrial complex of basic chemistry that, with diverse vicissitudes, exists today something that did not happen to the mining activity.

The wide industrial space of the municipalities of Huelva and Palos de la Frontera are located on the edges of the estuary of the Tinto river and they have been located close to the port facilities, in order to benefit from economies of agglomeration and synergies in the sector of transport. The enormous tonnage of the imports of raw materials (oil, copper, gas, wood...) makes it necessary to rely on these port infrastructures, without which it would be very difficult to support the strong international competition.
The industrial activity, besides its productive infrastructure, has needed space for operations that includes warehouses of stocks, wastes, by-products etc., that have shaped the industrial profile of the area far beyond its own factories.

In this context, the marshes, considered erroneously as places without use and without functions, were used as landfills of wastes and of plaster-phosphorus for many facilities of the Industrial Area of Huelva: The smelting copper, nowadays managed by Atlantic Copper and the manufacture of fertilizers, belonging to Fertiberia and Foret. Also uncontrolled spillages occurred in the estuary before 1992 and have converted the marsh of the Tinto and the estuary into a place of repulsion. Some marsh is already filled and other is on the verge of it happening, an extensive polemic has been originated about how the future of these spaces should be controlled. Many of them, impossible to rescue and deserted, have joined the urban dynamics, or are proposed to adjust to environmental uses.

Several spaces can be distinguished that were deserted by the pressure of the chemical industry:

1 - Rafts of plaster-phosphorus refilled: in Mendaña's Marsh.
2 - Rafts of ashes of pyrite and plaster-phosphorus refilled: in the Marsh of El Pinar.
3 - Shores of the Tinto river in the tour of the Avenue Francisco Montenegro, scantily used because of pollution.
4 - Lagoon system of the Nuevo Puerto harassed by the factories and the expansion of the agrarian border, which remained isolated as a landfill.

Industry of the Province of Huelva
5 - The Industrial Zone Tartessos, where involving Cellulose, which caused continued episodes of environmental deterioration, and pollution in the estuary of Tinto river.
Marsh of Tinto river and Punta del Sebo
Source: CSIC, 2004

Conclusions

The chemical industrial spaces in disuse or scantily used occupy in the province of Huelva a wide surface. They can be considered to be 8 big sectors as clear examples of this situation:
1- Rafts of plaster-phosphorus
2- Marsh of El Pinar
3- Industrial Zone Punta del Sebo
4- Industrial Zone Nuevo Puerto
5- Industrial Zone Tartessos
6- Industrial Zone of Niebla
7- Mines of Riotinto and Nerva
8- La Torerera

The abandonment of the industrial use of these areas has been for the following reasons:
a. Productive restructurings, related to the depletion of Fordism.
b. Environmental pressures against the extensive and degrading use of particular areas.

c. Loss of international competitiveness in a context of globalization and international market.

1.7 Lombardy

The estimates of derelict land for the Region relate to all land which has become derelict or underused from all industries. The total is believed to be approximately 2400 hectares with 36.2 % situated in the Milan Region.

There are approximately 780 industrial sites to be reclaimed as shown on the official registers from 2004 but it is believed that this number should be increased to 1200 including ones not yet registered.

1.8 NRW.

North Rhine Westfalia (NRW) is a federal state with a long industrial history, which includes winning of raw materials and chemical production.
Former sites where contamination may be present were inventoried. The following table summarizes the state of the investigation and/or remediation. The figures refer not only to land formerly used by the chemical industry but to all kinds of activities that may cause pollution (industrial production, small business, landfills).

Sites where it can be assumed on the basis of the activity that contamination is present, not investigated yet	58.829
Sites where contamination is present or suspected (business sites: 33.420, landfills: 21.003)	54.419
Sites where a risk assessment has been performed	12.190
Sites where a remediation investigation has been performed	2.090
Sites where remediation measures are undertaken or completed	4.693
Source: Ministry of Environment, Protection of Nature, Agriculture and Consumer protection, date: 31.1.2004	

Although many of these sites are small, there are several sites that have a size in the order of magnitude of 10-100 ha or even more. Dependent on the local situation, they may be reused as industrial sites, business parks, for trade (Centro Oberhausen) or recreation purposes (e.g. Phoenixsee Dortmund or the Garden Exposition Leverkusen (a former chemical landfill). Derelict chemical land is often situated within the factory area of an existing chemical company. Several companies attempt to make this land attractive to other firms by founding a “chemical park”. One of the major operators of a chemical park is the Bayer Industry Services that runs chemical parks on four different sites. In the chemical park Leverkusen 8.5 ha were redeveloped for new industrial purposes.

1.9 Hessen

Hessen has been carrying out significant remediation of industrial and warfare related sites for a number of years having expended in total 515Mio DM between 1992 and 2001. Since 2002 to the end of 2005 approximately 360Mio Euros have been expended and 26Mio euros are scheduled to be spent each year 2006/7. It is of interest that the costs of remediation associated with armaments/warfare related contamination are included in these figures separately.

2.0 What Work Has Already Been Done in Each Region

(including examples of successes and failures).

2.1 NW England.

The main work carried out and with the greatest wider potential for other areas so far has been the work carried out in Widnes by Halton Borough Council. This involves the cement stabilization of the soft alkaline wastes of which there are 2 million tons to form an impermeable crust which can be used for storage, playing fields etc but not for buildings. The work done has to be very adaptable as the wastes are very variable and therefore the learning from this work gathered over a number of years should be of use in a number of other sites. The process is described in more detail in the NW England report.

Other sites have involved the capping with clay and impermeable sheeting of a 30 hectare alkaline landfill in Northwich and converting to a public park. From the deposition of waste from the Solvay process in mid Cheshire 164 ha of land have been reclaimed to provide an award winning sustainable development as a woodland/nature park, known as Northwich Community woodlands. A key feature of the remediation is environmental improvement, which compliments the natural regeneration and diversity of the area. At Fleetwood a large part of the Hillhouse site has been redeveloped for industry and housing with minor site remediation including the removal of buried drums.

At the ex Shell Chemicals site at Carrington a significant number of research projects are being carried out to deal with the various chemicals in the ground.

The Forestry Commission has developed a project in conjunction with the North West Development Agency estimated at £23m that will reclaim large areas of derelict and underused land across the NW of England. It will deliver new recreational areas, benefits for business, a boost to healthy living and a significant increase in the woodland cover of the area.

2.2 NW Environment Agency

Over the years there has been a number of successful remediation initiatives across the region. Most notable has been the regeneration by authorities such as Halton, which has a significant legacy of contamination associated with former chemical manufacturing. However it is important to note that remediation standards can change especially with better assessment and understanding of land contamination source – pathway – receptor relationships. This has lead to the closure of the St Michael's golf course in Halton which was created from the remediation of the infamous Ditton Alps. On a positive note Halton's regeneration team have championed in-situ surface solidification treatment processes to tackle the extensive land

contamination issues associated with the former chemical industries in the borough.

The Northwest Development Agency set out its strategic approach to the soft end regeneration in Reclaim the North West

In the region important initiatives are the Forestry Commission Newlands project and the original DUN survey undertaken to identify potential sites. The survey identified DUN land by using drawing together existing data sets (National Land Use Database) and aerial photographs. The identified land was validated by the local authorities and via stakeholder workshops. The survey was also used as a baseline for most of the sub-region soft end regeneration initiatives (Remade, Revive, Newlands approaches, New Leaf, New Approaches, Cumbria Strategic Partnership). It should however be noted that some of the initiatives failed to get to the implementation stage due to financial constraints.

The Mersey Forest and Red Rose Forest initiatives are good examples of how DUN land can be improved and prove of lasting benefits to local communities. At a local level there have been a number of community regeneration projects over last 3 decades which have been brought about by partnerships involving organisations like Groundwork and the British Trust for Voluntary Conservation.

The Site for Innovative Research into Monitored Natural Attenuation (SIReN) is a National Facility for research into Monitored Natural Attenuation (MNA) under UK conditions. SIReN is a joint initiative between AEA Technology, CL:AIRE, Environment Agency and Shell Global Solutions International. The SIReN research facility is located at the Shell, refinery, Carrington. The following research reports are available:

Project SIREN: Phase 1 Report. Environment Agency 2000. R &D Technical Report P358, Environment Agency;
Project SIREN: Benchmarking of Monitored Natural Attenuation Procedures. Environment Agency 2001. R&D Technical Report P2-208/TR/1, Environment Agency;
Project SIREN: Conceptual Site Model. Environment Agency 2001. R&D Technical Report P2-208/TR/2, Environment Agency; and
Project SIReN: Phase 2b. Further Investigation (Phase 2b) of the SIReN (Site for Innovative Research on Natural Attenuation) Site. R&D Technical Report P2-208/TR/3, Environment Agency.

Further information on the project can be found at
http://www.claire.co.uk/siren.php

Sustainable Urban Brownfield Regeneration: Integrated Management (SUBR:IM). This is four-year programme, which involves nine academic and research institutions to develop technical solutions and tools for the restoring

brownfield land in urban areas. One of the projects is considering the particularly challenging issue of the restoration of acid tar lagoons in Salford. The project team is developing a centre of excellence for acid tar lagoon sites and has created a website (www.sheffield.ac.ac.uk/acidtars/) to pool their resources and expertise.

National

Contaminated Land: Application in Real Environments (CL:AIRE) provides a link between the main players in contaminated land remediation in the UK.

2.3 NE England

The following are examples of some current work that is under way to bring back DUN land back into use.

Saltholme is an International Nature Reserve that is being developed jointly by the Royal Society for the Protection of Birds and by the Teesside Environmental Trust. The Trust is a charitable body that was formed in 1998 to establish the Nature Reserve and visitor facilities. A site of 380 hectares of former industrial land is being developed to become the nature reserve. It will use many of the elements of nature conservation projects that have been proven on a smaller scale and replicate them on a larger scale. It will become the largest wetland creation project in the north of England.

Work has involved major earthmoving and landscaping of hundreds of thousands of tonnes of soil, clay and industrial waste to create wild flower meadows and reedbeds that will attract wildlife. This was particularly important on land that was reclaimed from the marsh, sandbank and mudflats of the estuary. The project aims to improve the environmental image of the Tees Valley, through promotion of its wildlife. Apart from the intrinsic value of the sites around the estuary, they support water bird populations that attract Natura 2000 status.

Often the poor substrate of DUN land is ideal for wildflower growth and the colours can have a dramatic visual impact. The planting of wildflower seed on DUN land can improve its appearance and biodiversity value. However, part of the consideration for any temporary use pending future development is that temporary sites must be designed in such a way to minimise the risk of colonisation of the more valuable species that could ultimately, limit development opportunities.

Another project has been greening derelict land through the development of wood and other biomass fuels as a source of renewable energy. The project partners are Teesside and Durham Universities and the North East Community Forests working with industrial landowners, planting contractors and soil scientists. This collaborative venture of so called “in-situ phytoremediation” has the potential to provide low cost remediation compared to other forms of bio and mechanical remediation. Work has been ongoing to

develop the skills and capability to cultivate energy crops on derelict or contaminated land, particularly with the development of 'safener compounds' applied to energy crops growing in contaminated land. These are mostly well-known agrochemicals that are applied in extremely low concentrations, to protect the plants against pollutants present in the soil and enhance their tolerance to soil contaminants. Investigations are also underway on the use of soil amendments (compost, digested sewage sludge, etc) to stimulate microbial breakdown of soil contaminants.

Tests were undertaken in 2004 on the growing of energy crops in soil from contaminated sites in laboratory and greenhouse pots. With assistance from Renew Tees Valley and English Partnerships the phytoremediation trials have been scaled up. Further owners of derelict land are being sought and the partners are most interested in land with organic chemical contaminants only (heavy oils, aromatics etc) as they have the best prospect to be completely broken down through the growing of the crops.
EU LIFE III Environment funding has been obtained by the Clean Environment Management Centre (CLEMANCE) of Teesside University, for a project called BioReGen (Biomass, Remediation, re-Generation): that will reuse brownfield sites for renewable energy crop production. An industrial scale trial will evaluate the commercial feasibility of growing energy crops on 10 DUN sites in the NE Region. Uncertainties remain about the productivity of the land and testing will be required on emissions. In addition to restoring and generating income from sites this approach has the potential to divert biodegradable wastes from landfill and stimulate regeneration and local employment.

An area of contaminated land that has been successfully reused, formerly belonged to ICI and now houses a Municipal Waste to Energy Plant. The former municipal incineration plant needed to be replaced to keep pace with changing environmental legislation. A site selection study was undertaken by the former Teesside Development Corporation, and a site at Haverton Hill was chosen. An Environmental Assessment was carried out on the site in 1993.

The site had formerly belonged to ICI and was used to produce sulphuric acid and cement clinker from anhydrite (calcium sulphate). Proposed development was in an area designated for industrial use and did not conflict with local plans. It fitted in at the time with both the Structure Plan and the Cleveland County Waste Plan. The surrounding area is mostly industrial with some residential and is located 2.5 km from Billingham Town Centre and 2.5km from Middlesbrough Town Centre. A consultation on the proposed development found the site to be acceptable to the public.

Under the Environment Protection Act 1990 Local Authorities were required to set up Waste Disposal Companies. Cleveland County Council established a Joint Venture Company with Northumbrian Environmental Management Ltd (NEM) a waste treatment and disposal company that is part of Northumbrian

Water. It was the Joint Venture Company that developed the Municipal Waste to Energy Plant.

Prior to development there were visible signs of residual surface contamination and signs of underlying soil and shallow groundwater contamination, but no obvious habitat of particular ecological value. The Environmental Impact Study undertaken required that comprehensive contamination investigations be carried out and all waste from the site be chemically characterised to determine suitable disposal options. The Environmental Assessment was assisted by historic records from ICI who had commissioned the drilling of boreholes on the site over a period from 1951 – 1979 that provided detail on the nature of deposits on site. Spoil from the site was predominantly disposed of via Landfill.

The benefits of this scheme were that it provided a necessary public amenity that replaced outdated provision, on a site that was acceptable to the public, and fitted in with local plans and reused land that had been stood unused for some time. It is a shared amenity for four of the now Unitary Authorities in the Tees Valley.

Negative elements of the scheme are that it relied too heavily on landfill. This is a less viable option in current day terms as legislative controls and costs have increased. The previous incinerator was placed closer to the main transport corridors than its replacement. The replacement is not as accessible and some authorities have longer journeys than previously to deposit municipal waste.

Some larger scale developments have been in preparation for a number of years and have only come to fruition following long-term decontamination and preparation of sites and Single Pot funding becoming available. The problems and delays have usually been funding. Private investment in redevelopment is more easily secured for Greenfield sites or pre-remediated sites and Local Authorities cannot always fund or take on the liability for contaminated sites.

2.4 E England

The remediation of the Waters' Edge site was carried out by removing the contaminated soil to landfill. The landfill site was then capped using clay purchased from nearby land owned by Lincolnshire Wildlife Trust. This method of remediation afforded a number of opportunities to create new wildlife habitat.

Firstly, the areas where contaminated soil was removed from Waters' Edge are now water bodies and reedbeds adding to the already significant resources of these habitats in this area. Secondly the area of Lincolnshire Wildlife Trust land where clay was sourced from has been planted with reeds as an extension to the Far Ings Nature reserve. Finally the capped landfill site is being sown with a plant species mix which will in time create lowland heath / acid grassland habitat, which is characteristic of the area around the landfill

site. Surface water from the site was treated with activated carbon and passed through reedbed filtration systems installed in containers on site.

There have been a number of positive spin-offs from carrying out the remediation work:
The site is now developing into valuable wildlife habitat part of the new Country Park has already been notified as a Site of Special Scientific Interest for its breeding bird community.
The construction of the visitor centre has attracted business into the area as well as improving the area for the local community.
Water quality on the site is now the same as for other water bodies in the area.

2.5 Estonia

Oil-shale Industry

Effort has been concentrated on reducing the production of wastes from current operations and monitoring contaminated soils. Some sites on public property are proposed for use for waste deposits or for sale to private firms. One site in Kivioli has already been opened as a green park which because of its height has good views over a large area. Other similar sites are under review for a recreation centre.

2.6 Huelva

The recovery of derelict land areas have been essentially for environmental reasons. Although substantial recovery projects have been undertaken in general it has not been possible to recreate the original landscape. In particular the acid rains and runoff from the mining operations has lead to a great part of the local vegetation being damaged and the water qualities of the estuaries of the Tinto and Odiel adversely affected.

There have been 2 major driving forces leading to the recovery and improvement of derelict industrial areas. These are;

a) Enforcing environmental requirements in the case of industrial land abandoned since 1960.

b) Presenting the remains of industrial archaeology as a valuable resource for tourist development.

The most difficult projects for recovery have been associated with marsh areas. Here the geological structure has been modified changing tidal flows, the topography has risen with landfilling, the plant ecology has changed and certain areas have been incorporated in the extension of the urban fringe.

Details of remediation activities already undertaken and planned for the areas highlighted as having the most significant environmental problems are shown in detail in the Annexe to the Huelva report in the appendices

2.7 Lombardy

EX – ACNA RECLAMATION (1990 – 1999) For full details of this large scale reclamation see the Lombardy appendix.

Due to its scale, former industrial production and high concentration of a wide range of existing contaminants, the ex-ACNA industrial area situated in Cesano Maderno, Ceriano Laghetto and Bovisio Masciago (north of Milan's municipality) can be considered as one of the most complex cases of contaminated sites cleanup in the environmentally highly burdened Province of Milan.

In December 1983 ACNA stopped operations and closed its plant.
The site occupies a surface area of 1.200.000 sq.m.; the plant took up in 1971 about 480.000 sq.m. of which:
137.000 sq.m. is indoor;
234.000 sq.m. is internal streets, squares and parking area;
107.000 sq.m. were destined as green area.

Today the remediation operations have been completed, and for all the completed remediation more than € 75.000.000 has been spent by the private companies involved (that now own the property of the area), excluding private parties' and public bodies' personnel costs, as well as the expenses for treating the water pumped from the barrier

2.8 NRW

The Ruhr area has faced a structural change in the last decennia. Many coal mines - and the associated processing activities - have been abandoned. Therefore, large areas were and are still to be redeveloped.
An estate fund (Grundstückfonds) was founded in 1979 with the objective of the recycling of abandoned sites. The fund gets financial support from the federal state and from the EU. Within this program, about 190 sites with a total area of 2650 ha were bought by the fund, remediated and prepared for future use, and resold to investors or to communities. 610 ha were used for business, 50 ha for housing and 884 ha for recreational use.
So far, problems with contamination outbreak and required additional work have not been observed. Nevertheless the way to deal with liability and unknown risks is crucial in the marketing process.

2.9 Saxony Anhalt

An important link in considering the improvement of chemical brownfield sites is to another Interreg 3C project 'Experiences and Competences in Landfill Remediation and Closure'. Many of the most complex sites to consider for improvement are derelict landfills and lagoons where often the wastes are complex and not fully understood. This study was worked out within the Interreg 3C European Waste Management. Within this project the study belongs to the main focus 'Landfill and Reuse'.

First a survey about the current situation of waste management in Germany is given. The study focuses on the ten best practices of Central German companies in the area of landfill remediation, treatment and recovery of different waste streams, calculated site development at landfill sites. The objective of the study is to describe how the process of closure or adjustment of old landfills can be economically realised and how at the same time the site as a waste treatment centre with treatment and recovery capacities for different types of wastes can be maintained. The study is particularly based on experiences collected at the site Halle-Lochau, which is one of the biggest landfills in Germany in the closure phase.

Not least the Competence Centre which is being developed is to actively assist in the organisation and implementation of closure and aftercare concepts for landfills, the connection of closure and remediation with site development. It will develop and present the competences of companies in the area available innovative solutions for the completion and closure of landfills.

2.10 Hessen

A detailed example of a very successful project with a large amount of useful learning for other sites is the Pioneer Park at Muehlheim.

The site is located in Muehlheim, a town with a population of 26.200 in the greater Frankfurt area. It is located between the picturesque valley of the river Main and the centre of the town. The site was severely contaminated in the 1920s by the operation of a chemical production facility and a Manufactured Gas Plant (MGP). During subsequent years, the site was used by the German Army for the barracks of pioneer troops. After WW II the US Army used the site as the location for the printing of Stars&Stripes, the newspaper for US troops stationed overseas.

The contamination on the site, mostly arsenic, has recently been remediated and the site is now redeveloped as a residential area which includes private homes for young families and an apartment building especially designed for retired citizens. As such, the project is a successful example of sustainable redevelopment by providing a long-term benefit for the community. The overwhelming support for the project by the town’s citizens was evidenced by the fact that they purchased the parcels on the site before the remediation had even started.

The soil contamination on the site was mainly arsenic with maximum concentrations of about 60,000 ppm (60 grams per kilogram). Highly contaminated soil was disposed off site but a large portion of the 292,000 metric tons of excavated soil was treated by using an immobilization process. The treatment was subject to strict QA/QC requirements and combined the arsenic contaminated soil with cement, which was then buried at a depth of 10 foot below grade on the site. The groundwater remediation is still ongoing

and is scheduled to be complete within the next years because of the source removal of the arsenic contaminated soil.

The State of Hessen, within which Muehlheim is located, took responsibility for the clean-up of the site including the major portion of the costs. The City of Muhlheim paid its share of the costs of adapting the remedial strategy to the community's desire for a residential area on the site by bringing in the sites value after the remediation. The site was parcelled and the city marketed the parcels to local residents who intended to set up homes for their families. The purchasers made interim financing for cleanup costs by making a down-payment of 50 % for the parcels. The faith of the citizens to buy these contaminated parcels is one of the most remarkable successes of the remedial-portion of this redevelopment project.

For decades, the site had been like an open wound in the urban environment. It is now a lively part of the city, a newly created definition of the town's rim that adjoins the river valley and directs attention to the beauty of this open space and substantially enhances its preservation. The sites orientation between a vibrant city and the green corridor at the river has found its expression in the motto "City at the river- Life at the river". Offering the site (11 acres) for residential use by locally employed people has saved an estimated 45 acres of open space and helps to save an estimated half a million miles of car traffic on motorways and local roads every year.

About 80 private housing units have already been completed at the site and 20 others are being finalized. The homes cover a wide spectrum of living options, from premier family homes to rented affordable apartments. One apartment building is especially designed for retired citizens and helps to establish inter-generational living at the site. The buying power that has been brought to this part of town as a result of the development allows commercial stores and other neighbourhood-shopping locations to stay in business. A sight that was once blighted and in decline now promotes a balanced social life that is one of the major factors that enhances the quality of life that has come back to this part of town. Most of the residents of Pionierpark work in town and the redevelopment helped to keep them as tax-payers, while private income-tax is also one of the most important money-sources for the city. The economic benefits of the project have increased the land-value in the vicinity and has prompted the city to upgrade affordable housing nearby, and has helped to launch new projects such as the refurbishing of the boat house for the local rowing-club. A terrace bar-café has also been constructed which overlooks the river. In addition, there is a ferry-boat access that connects Muehlheim to its neighbouring town Maintal.

The increase in land-value is estimated to amount to several million $. Public investment in the project has leveraged about three times more private investment-money (about 26.5 mio $), and has stabilized the city's tax-revenues by contributing about 300,000 $ per year.

With all the short-term economic success of the redevelopment project, the long-term perspective is perceived as the biggest benefit. It insures a liveable urban environment that is at a crossroads of built-up land and nature and it promotes social responsibility which is a prerequisite for sustainable development in Muehlheim. By balancing environmental issues with sound economic conditions, Muehlheim's goal of a sustainable society has been reached. These goals are carried out by the "Agenda 21 Group", a group that was both founded and is carried by Muelheim citizens. The Pionierpark redevelopment is an example of state and local cooperation to achieve this goal of sustainable development. Responsible protection of the environment and social balancing have proved to be the main factors for long-term economic viability which benefits all citizens of Muehlheim.

3.0 What are the Barriers to Improving DUN Land.

3.1 NW England.

The principal barrier is the lack of funding for this work as the cost of any remediation and greening activities is in general significantly greater than the value of the land after completion of improvements.

The potential liabilities are often difficult to assess and future legislation may add further costs.

Unless there is a threat to offsite areas there is no incentive for a company to invest funds in derelict land restoration.

The increase in landfill tax has increased the cost of site reclamation.

Negotiation with land owners is often protracted and uncertain of obtaining a positive outcome.

The key issue that acts as a barrier to the regeneration of brownfield land is development economics. The barriers to regeneration outlined above have impacts on costs and as such impact on the developer's bottom line. As discussed developers are, in general, happy to undertake archaeological surveys, environmental works (including flood defences and remediation) and assemble land interests as long as they feel that the end sales values of their product are high enough to support the costs associated with the works. This does not mean that they are not worried about the initial outlay of large capital sums on which they have to service the finance over longer periods of time.

The geography of a site can also act as a key barrier to regeneration. The traditional property maxim of 'Location, location, location' being the key determinant of value, has by and large proved to be true. At the national level there is a pronounced difference between sites in the south and those in the more remote areas of the north and west of England. The southern sites are usually able to overcome issues such as site contamination and ecology, due to the land values that can be generated. This has not proved to be the same in the north, where often intervention funding is required to make sites economically viable.

Local authorities can act as a barrier, often lacking the skills required to fully interact and deal with the regeneration process. The planning application process often throws up issues which frustrate developers. The lack of clarity that is a result of the lack of skills and poor forward planning tends to confuse both the authority and developer, leading to poor communication and a tendency to confrontation, with the perception of an 'us and them', despite the fact that both sides wish to see brownfield land brought back into a use which can benefit the whole community.

Local authorities should take a much more proactive stance in bringing forward sites for redevelopment. This means the production of development briefs, interaction with the community and also reskilling, to carry out CPOs and negotiate land acquisition. RDAs and EP should also take a much greater role in giving aid to local authorities, sharing their own experiences and knowledge.

The social barriers to the redevelopment of brownfield land should be taken seriously and not just as an afterthought. The acquired uses of brownfield land (through leisure uses etc) and their historical uses and associations can often have a special meaning for local communities and generate socio-cultural barriers. On the reverse, some sites have become synonymous with anti social barriers and local communities are often supportive of efforts to redevelop. The creation of comprehensive development briefs for sites would also act to clarify the local authority's position for developers.

Getting clear title on unregistered land is a problem for a number of sites.

There is a general lack of knowledge of all the alternative funding streams which are also frequently being modifies.

3.2 NW Environment Agency

Land contamination issues are often cited as a barrier to regeneration of DUN land. The contaminated land regime places the responsibility on the companies (or appropriate persons) who caused the historical pollution.

Contaminated land is defined in the regime as land that is posing an unacceptable risk to human health or the wider environment. It is also based on the establishment of pollution linkages between the source – pathway – receptor. Once established it is the role of the local authority (or the Environment Agency for certain site defined as special) to apportion liability, seek the appropriate remediation.

In the majority of cases voluntary remediation is undertaken before the land is statutory defined and remediation enforcement notices are served. Remediation objectives will normally be applied as a condition of the land use planning consent.

The overriding factor in the dealing with land remediation is the actual costs associated with the remediation. This will include site investigation, preparation and assessment of a proposed remediation strategy, its implementation (including the obtaining of any necessary regulatory controls) and consideration of any future liability.

There are a variety of techniques for remediation of contaminants these fall into three categories physical, chemical and biological. However due to the relative low cost of landfill disposal a significant proportion of remediation schemes have involved wholescale removal of contaminated to landfill

facilities. This is commonly referred to as the “dig and dump” approach. Developers have often cited this option as being virtually risk free from future liability claims. The Government policy has also encouraged landfill disposal option by exempting contaminated soils from the landfill tax levy. This exemption also supports the Government policy of using brownfield land for at least 60% of all proposed developments.

The waste management licensing and now other waste management controls (Pollution, Prevention and Control regime) have over the years commonly been cited as barriers to brownfield regeneration. This is mainly associated with waste management activities, which are being carried out on site. Many disputes have been based on the definition of waste and generally where such material may be put to beneficial use.

It would be beyond the scope of this response to consider in detail the definition of waste but it is important to note that it is a dynamic process and regard must be given to the relevant domestic and European case law. There is usually a clear distinction between the disposal of waste and its recovery. Where materials are being excavated and re-deposited into a containment area, due to contamination issues, within a site would clearly be considered a disposal activity and would require waste management controls. Where wastes are being put to beneficial use, for example, used to construct a screening bund or other similar structure it would be considered to be a recovery activity. In such cases there are provisions in the form of exemptions from full waste management licensing controls.

We do however acknowledge that the waste management exemptions do not cover all potential recovery activities on remediation sites. In addition to this we have over the last five years sought to simplify the licensing process for process based remediation technologies that can be employed via mobile plant. This has included the development of a generic licensing application pack and a number of enforcement positions (allowing certain small-scale treatment activities and the reuse of stabilised waste without applying waste controls). We are currently considering further amendments to our approach to the licensing of mobile remediation technologies and associated activities such as the re-use of remediated material where there is no appropriate exemption. The new system would also allow a single licence authorising several pieces of mobile plant to be used at the same time but at different sites. Further information of this current consultation can be found at: www.environment-agency.gov.uk/commondata/acrobat/mtl_consultation_1205817.pdf

Our policy on regulatory control of remediation has always acknowledged the limitations of the current waste controls and the need to develop a separate regulatory regime for such activities. This was a recommendation of the Lord Rogers Urban Task Force report, the former waste permitting review (including provisions for a signal permitting regime) by DEFRA, now being

taken forward by the land remediation task force established by the Cabinet Office.

In addition we are developing a Modernising Regulation programme which will make environmental regulation more effective at improving the environment, reduce the cost of delivery and minimise bureaucracy. We have been successful in establishing ourselves as a leading forward-looking player amongst regulators and government departments. The Chancellor referred, by name, to our publication "Delivering for the Environment – a 21st Century Approach to Regulation" in the last Budget Speech.

Industry has responded favourably to our intentions. But, as many initiatives are yet to be put into operation they are reserving final judgement until they see the results.

Overall we are radically overhauling the established and traditional 'inspect and enforce' approach to regulation and, instead, we are looking at a much smarter way of regulating businesses on a risk basis. This means that companies, which demonstrate good performance and low environmental risk, are now beginning to benefit from a lighter touch and lower regulatory fees.

As stated above the barriers to improving DUN land will depend on a number of factors. Where hard development is proposed there is likely to be a greater economic driver for the development however this may not always be the case. The Royal Institution of Chartered Surveyors in association with the South of England Regional Assembly prepared a useful report on overcoming the financial barriers to mixed use brownfield development.

In summary the report cited a wide range of obstacles to development including:

The cost and complexity of site;
The financial risk associated with developing mixed schemes on urban brownfield sites;
Restrictions on gap funding;
The risk averse nature of the property investment institutions; and
An uncertain planning framework.

Copy of the report is available at:

http://www.southeast-ra.gov.uk/publications/policy.html

3.3 NE England

In most cases where it has been economically viable to bring land back into use, then this has been done by commercial enterprises. Barriers in bringing land back into use are issues such as negative equity; i.e. the land costs more than it will be worth following remediation. Available funding streams

often stipulate outputs that would not be achievable from the type of project envisaged. A requirement of being granted funding is often that jobs must be created and this cannot be achieved through greening land to improve the image of the area.

Ownership that is remote from the site can also create problems. The international nature of the chemical sector can mean that decisions on justifying and sanctioning expenditure are made at a remote location with no appreciation of wider local issues. Often the cheapest option is to leave land sitting inside a security fence where it poses little threat. The unknown content of DUN land and the potential liability may require evaluation of potential hazardous and safety precautions before anything can be done with the site. This can provide a disincentive to do anything other than leave it inside the security fence.

3.4 E England

The main barriers in reclaiming derelict sites are often the complexities involved in drawing together the funding packages to allow projects to go ahead.

3.5 Estonia

The most important barrier for improving DUN land is the indefinite land ownership. Most areas have changed ownership several times since the collapse of the Soviet Union. In some cases the plant has been removed but the land remains in the ownership of the state. Previously there was no control of polluters and responsibility was not accepted. The problem therefore is who was the polluter and land owner when the pollution was caused. There are the cases of pollution during the Soviet time and pollution in the period since independence. If purchase documents do not exist then the owner of the pollution is the state. In this complex situation responsibility depends on audits and agreements with authorities.

3.6 NRW

The value of the site may be lower than the remediation costs. In this case, public funding is required but limited.
Unknown contamination may be present even after remediation or there may be regulations in the future that go further than the present requirements. Because the investor has to take over the full responsibility for the site, he is not interested in the site because there is a surplus of alternative sites without contamination.
These problems can be partially solved with treaties between the authorities and the investors. Agreements concerning the scope of the work to be performed and liability questions reduce the risk for the investor.

4.0 What policies help or hinder

planning, environmental, polluter pays

4.1 NW England

4.1.1 Planning

The adopted County Structure Plans contain broad policies which emphasise recycling land and outline the role of Derelict Land Reclamation in the context of Environmental Improvements.

Where brownfield land is allocated for business employment it can place a restriction on its development for permanent recreational or similar environmental improvement. It is important that flexibility is maintained relating to the proportions of a site allocated to industry and greening to increase the saleability of the site and also enhance the local environment and quality of life for those working and living nearby.

4.1.2 Environmental

There is a lot of additional regulation as a result of Part 2A of the Environment Protection Act and the waste management Licensing regulations.

4.1.3 Polluter pays

Difficult to trace polluters and cost of remediation is prohibitive. Potential legacy of ‘Orphan’ sites. None of the policies that rely on contributions from companies will work if the remediator has to rely on proving that pollution was caused by Xplc’s actions.

4.1.4 Cost of disposal

Landfill availability is reducing and Landfill tax is increasing to encourage developers to avoid landfill and deal with problems on site. However, it should be noted that in certain situations (i.e. where the contamination is above the threshold level which is acceptable for the proposed development) removal of contaminated material from a derelict land reclamation site to a landfill facility qualifies for exemption from Landfill Tax.

4.2 NW Environment Agency

It is important to understand the reasoning behind the regulatory regimes.

The contaminated land regime was introduced to tackle the legacy of land contamination issues associated with previous land use. The regime defines contaminated land, which, poses an unacceptable risk to human health (death) and the wider environment and apportions liability to ensure its remediation in accordance with the “polluter pays principle”.

The waste management licensing regime places controls on waste management activities to ensure the reduction of the danger to human health and risk of pollution of the environment in particular;

Without-
risk to water, air, soil, plant or animal; or
causing nuisance through noise or odours; or
adversely affecting the countryside or places of special interest.

The National planning policy sets a target of 60% development on brownfield sites to encourage the bringing back into beneficial use previously developed land and reduce pressure on greenfield sites. At a regional level emerging regional spatial strategies have land management policies which acknowledge the role and importance of green infrastructure. These policies ultimately inform the local development frameworks.

4.3 NE England

- planning
- environmental
- polluter pays
- cost of disposal
- policies or regulations which need amending or to be introduced

Positive comment:

The Tees Valley Structure Plan (adopted February 2004) contains a number of broad policies that encourage the redevelopment and recycling of derelict and underused land, including redundant chemical industry land. Regeneration of both urban and rural areas is a key aim. The Plan encourages maximising the reuse of previously developed land, the renovation and refurbishment of existing buildings, and the reclamation and reuse of derelict land.

This aim is supported through the spatial strategy of the Plan. This aims to guide the majority of new development to within existing urban areas with preference given to previously developed sites, particularly along the Tees Corridor.

The plan also recognises the importance of the chemical industry to the economy of the Tees Valley and identifies a number of main locations where potentially polluting or hazardous industrial development is appropriate, although no new land is identified.

Other relevant policies in the Plan include:
Encouraging measures to improve biodiversity and contribute towards BAP targets (ENV3a)
Improving the urban environment by encouraging redevelopment and reuse of vacant and derelict sites, including landscaping and management (including wildlife habitats) where appropriate (ENV21)

Where derelict and disused land is unlikely to be developed in the short term sites should be used for suitable temporary uses, including new recreational and wildlife habitats (ENV22)
Encouraging renewable energy projects, subject to meeting certain criteria (EN2)

The pressure to increase and improve the Biodiversity of the area has worked to ensure that previously utilised land is given over to nature conservation on the back of protecting certain habitats or species or providing "green space" in areas of need.

Negative comment:

There has been pressure to de-allocate or re-allocate industrial land in the Tees Valley to reduce an over-supply and bring the employment land portfolio more into line with current and potential requirements. However there is also a view that de-allocation or re-allocation may give a negative impression to both existing companies and potential investors (often multi-national companies in the petro-chemicals sector) regarding the commitment of local authorities in encouraging future investment. A representation has therefore been made to the submitted Regional Spatial Strategy (RSS) for the North East (which will eventually replace the Tees Valley Structure Plan) for greater commitment to be given to supporting and providing alternative 'soft' end uses for such land, including nature conservation and 'greening'. Dual designation of sites for both nature conservation and industry has worked in the Tees Valley in the past and recognition in the RSS could help to support local authorities and other organisations in seeking funding for the treatment of such sites.

4.4 E England

The proximity of the Waterside Edge site to an internationally important wildlife site meant that the Habitats Regulations had to be adhered to. Whilst this did not prevent the project from going ahead, restrictions were placed on the working period to prevent disturbance to the area's wildlife.

In this case the polluter pays principle was not applicable as the site was sold to Glanford Borough Council prior to the contaminated land regulations coming into force. There was only a relatively small financial input into the remediation works from the original owners.

The planning process was seen as fairly straight forward, although it was time consuming.

The costs associated with disposal of the contaminated material were reduced as the receptor landfill site was owned by North Lincolnshire Council.

4.5 Huelva

The chemical industry as elsewhere has been affected by increasing environmental legislation. Companies have been gradually incorporating legislation partly due to market drive related to image and competitiveness. The most difficult issue is the defining of responsibilities for derelict land and defining the potential impact of land that is likely to become derelict. It is an improvement that the impact of site closures is being taken into account prior to activity ceasing. There is particular importance attached to contamination crossing state boundaries.

The operation of environmental legislation as it operates in the Huelva region are covered in section 5 of the Huelva appendix.

The diagnosis of weaknesses strengths, threats and opportunities for the bringing of derelict land back into beneficial use are described in detail in section 6 of the Huelva appendix under the following headings.

Internal factors that impede land improvement – weaknesses.

Internal factors that stimulate land improvement – strengths

External factors that impede land improvement – threats

External factors that stimulate land improvement – opportunities.

In summary the original reasons leading to the formation of derelict land can be summarised as the restructuring of production, environmental pressures and loss of competitiveness in international markets. The driving forces for the reuse of derelict land are coming under the general heading of sustainability. The redevelopment of land leads to economic growth, creates employment and enriches biodiversity.

4.6 Lombardy

Following the acknowledgment of the international most common right related to the topic (known as Polluter Pays Principle) in the Italian legal system in the Law 349/86 (art.18), in the past the Lombardy Region, due to the existing environmental situation and to the lack of an incisive national legal framework, tried to regulate some of the most critical aspects concerning DUN lands with DGRL n° VI/17252, 1st of August 1996.
Later on the Legislative Decree n. 22/97 (otherwise known as “Ronchi Decree”) and the derivated Ministerial Decree (DM 471/99) implementing it, finally have introduced fundamental concepts as liability for damage, risk analysis, clear definition of the soil and groundwater acceptability limits related to the user final destination, investigation procedures and safety placement of the area, reclamation and reuse; allowance for private deals to be signed.

More recently the Lombardy Region authority approved the Regional Law 12/12/2003 n.26, specifically designed to boost interest in the reclaiming of contaminated areas by private subjects, allowing them to economically reuse it.

4.7 NRW

The German Soil Protection Law and the adjacent regulations state that the polluter is responsible for the clean-up of contaminated sites. If the polluter is not able to pay (because the company does not exist any more), the present owner (who may have bought the site without knowledge of the contamination), is also liable. In cases where there have been different owners in the past and/or a number of present owners, this may lead to a very complex situation. As a consequence, remediation is hindered or delayed due to liability questions.

In the regulations concerning urban planning and construction, it is stated that brownfield sites have to be preferred to Greenfield sites in the development process. This may help improving DUN land. Still, the development of brownfield sites has to be attractive to the investor from an economic point of view.

4.8 Saxony Anhalt

The Competences of the European Waste Management relevant to this project are;

Competence field A Waste Treatment and Recovery;

Development of remediation construction materials

Production and test of replacement construction materials for the landfill Halle-Lochau

Competence field B Landfill Remediation;

Landfill remediation ‘sub aquatic landfill’

Alternative surface sealing systems and reuse of landfills

Development of a compendium on landfill closure

Competence field C Site development /establishing;

organisational structures and management systems

5.0 What are the problems of Long Term Ownership and Maintenance.

5.1 NW England

5.1.1 Ownership

To date this has generally been handled by acquiring the land for a specific scheme and either retaining the land after remediation or the sell/lease of land following remediation depending on the nature of the scheme. However, more onerous environmental legislation and a risk averse approach by local authorities will dissuade future acquisition and alternative arrangements will be required e.g. the involvement of The Land Restoration Trust (LRT) or some such arrangement

5.1.2 Management

In the past in house teams from local authorities have generally procured and managed projects from conception to completion. However, few local authorities now have dedicated land regeneration teams and hence the capacity to deliver through local authorities will be limited. Similarly, after-management arrangements for soft end use schemes have traditionally been provided by local authorities but budget pressures on future revenue consequences are and will continue to constrain this commitment.

5.1.3 Maintenance

Needs to be thought out as part of the procurement of the scheme (i.e. who will do it and pay for it). Again, traditionally local authorities have funded future maintenance of soft end use schemes but budget pressures will limit this in the future.
The policy of the Forestry Commission for projects that they take on is to provide 15 years maintenance but this still leaves a longer term management and ownership requirement.

5.1.4 Liability

Desk studies, investigations and risk assessments are carried out before a commitment is made to reclaim a site to determine liabilities before proceeding with land acquisition and scheming. Again potentially onerous environmental liabilities and the associated risks will dissuade most local authorities from taking ownership and hence other arrangements like the LRT or the creation of individual Trusts and/or the provision of environmental insurance will have to be considered. It should be stressed that the single biggest constraint on the regeneration of DUN land by local authorities is likely to be the issue of future ownership and liability.

The forestry commission has a document which sets out the principles of accepting tenure.

5.2 NW Environment Agency

The majority of these issues are handled through the establishment of appropriate partnerships of landowners, local and regional authorities and agency's, voluntary and community groups and funding providers. We have seen a number of good examples of this in the region such as the community forest initiatives, Newlands project and the sub-regional land regeneration projects like REMADE in Lancashire. Despite the success of these projects there has been some failures of similar projects due to the removal of funding and issues surrounding long-term liability having not been resolved. We have yet to see whether initiatives such as the Land Restoration Trust can resolve such issues.

The long-term maintenance of any site is not as much an issue as the land contamination and the potential transfer of liabilities. The transfer of liabilities will be dependent upon the agreement of the transfer of land ownership. There are currently discussions taking place with respect to piecrust leasing of the proposed project area. In this case no liability is being accepted from the land below the imported piecrust. There are still a number of uncertainties as any potential contamination issue will be the responsibility of the current owner or former polluter if identified as statutory defined contaminated land. The full implications of the EC Environmental Liabilities Directive with respect to land contamination are also not fully known at this time.

5.3 E England

The Waters' Edge site is owned and managed by North Lincolnshire Council, therefore all liabilities lie with the council. It is intended that the construction of the visitor / business centre will in time help to offset some of the costs of both the remediation work, as well funding the ongoing management of the site's developing habitats.

5.4 Estonia

In general derelict sites will only be used for future industry or as waste sites i.e. landfills to prevent the pollution of greenfield areas. Abandoned semi-coke areas are seen as green areas for recreation, sporting and spare time activities. There are some possibilities for social housing on certain areas.

Polluted groundwater and poor quality water has to be cleaned up by the polluter, or if not possible to determine the polluter by the owner of the water body or in the case of an aquifer by the state.

5.5 NRW

If the recycling of land takes place within chemical parks or for business purposes, there will be no maintenance problems.
In case of the sites that are redeveloped by the Grundstückfonds, the communities are obliged to buy the areas for infrastructure and public green space and to take over the responsibility for the maintenance.

Private owners have no interest in the development of sites with a low commercial value, so they will prefer the “big fence approach” with low maintenance activities. Unsolved property or responsibility questions and lack of public funding for the purchase of these sites may have the same effect.

6.0 What Financial Support is Available

6.1 NW England

Grant aid or subsidy - Regional Development Agencies fund the regeneration of brownfield land to a greater or lesser degree depending on the region but there is an inconsistent approach across UK

English Partnerships support regeneration of DUN land where it fits their strategies and priority programmes but these currently are mainly concerned with ex coal field sites.

DEFRA Contaminated Land Capital Projects Programme – provides support for the investigation and remediation of contaminated land aimed at Part IIA responsibilities.

European funding e.g. Single Regeneration Budget funding can contribute to the regeneration of DUN land but this is limited to particular objective areas and this is likely to reduce from 2007 to reflect the impact of less prosperous new member states.

Other funding – landfill tax credits and lottery funding can sometimes be attracted to support DUN land regeneration.

6.2 NW Environment Agency

The majority of funding for soft end regeneration projects and initiatives in the region is via the Regional Development Agency.

English Partnerships (EP) provide some financial support for some soft end initiatives through its established programmes. EP have just announce a £4million funding for the regeneration of Haig colliery, near Whitehaven in Cumbria with potential links to an adjacent chemical site.

DEFRA's Supplementary Credit Approval (SCA) scheme provides funds for local authorities or the Environment Agency to deal with land affected by contamination. The SCA sites are a small sub-set of land that is affected by contamination, where the site needs remediation or investigation to assess the level of contamination and the risk posed.

A useful summary of potential funding sources can be found at on the DEFRA website:

http://www.defra.gov.uk/environment/land/contaminated/funding.htm

6.3 NE England

Tees Valley is mainly a European Objective 2 area and ERDF funding has been utilised in combination with Single Pot funding from the Government to

fund remediation and development work of DUN land. The availability of European funding will decrease post 2006. It is expected that additional funding will become available through a UK Government project called the Northern Way, which aims to reduce the gap in economic performance between the southern and northern areas of the UK.

Some additional funding is available from English Partnerships and from Landfill Tax Credits.

6.4 E England

A number of different funding sources were used at Waters' Edge, these include:

Single Regeneration Budget
Landfill Tax credits - a contribution from the site's original owners was used as match funding to help secure these funds
European Regional Development Fund
Yorkshire Forward (the regional development agency) funds
North Lincolnshire Council's own funds
DEFRA Supplementary credit for dealing with contaminated land.

6.5 Estonia

Past pollution remediation is supported under water protection and waste handling programmes in the Environmental Investment Centre. Certain firms regularly do work from their own funds. Local governments are usually capable of supporting projects only for approximately 10%. Where possible work is linked to large infrastructure projects.

6.6 NRW

There are two main institutions that provide financial support for recycling of brownfield sites.
The Grundstücksfonds (Refer also to answer 2) has invested 1,7 milliard Euro in the redevelopment of abandoned sites. It is financed by support from the federal state, from the European Union, and to lesser extent by programs for urban development.

7.0 What is the Relationship between Authorities and Chemical Companies

7.1 NW England

Chemicals Northwest is an industry led organisation promoting amongst other things the benefits of image enhancement to the chemical industry and provides an effective link between the RDA, local authorities and individual companies. Good working relations have existed between some key chemical companies and the local authority.

7.2 NW Environment Agency

We welcome the relationship we are developing with Chemicals Northwest and support the pro-active initiatives to tackle land contamination and dereliction associated with the region's chemical sector. This is a good example of a strategic sector approach to ensure beneficial environmental outcomes within the appropriate regulatory frameworks. I am not aware of any other sector group of this nature.

We have traditionally had a significant regulatory and consultative role in regeneration, but we also have a strategic role in seeking to influence development policy to ensure that land use planning fully takes account of the many principles of sustainability. This is particularly relevant in the Northwest where many DUN sites are designated for soft end use. In addition it is important to ensure that we fully identify the links with other strategic initiatives in which we are involved so that the advice we offer takes into account the full range of environmental issues.

7.3 E England

There are a number of groups around the Humber Estuary which promote close working between industries and regulatory authorities. These include:

Humber Chemical Focus (HCF) – an umbrella group for the chemical industry around the Humber Estuary which offers industry support in dealing with the implications of various legislation on businesses. Several sub-groups have been set up to deal with specific issues e.g. COMAH and regular meetings of Humber Bank Environmental Managers are held.

Humber Industry Nature Conservation Association (Humber INCA) – a membership organisation with members from industry, regulatory authorities and NGOs. Humber INCA's main goal is to help find a balance between the needs of industry and the needs of wildlife around the Humber estuary and thereby help industry to meet its wider obligations relating to the environment. Humber INCA is based in the new Visitor centre at Waters' Edge.

National Industrial Symbiosis Program (NISP) – set up to help find more sustainable solutions to waste management and resource location problems

faced by industry. The main focus of NISP is that the 'waste' product from one industrial process may become the raw material for another. By linking up industries with matching waste/raw material outputs/requirements NISP helps to deliver sustainable development and improve industry's efficiency.

7.4 NE England

The North East Process Industry Cluster (NEPIC) works closely with the Local Authority and are active members of the Authority run Development Initiative for Chemical Dependent Areas (DICIDA). Two way exchanges of information occur between NEPIC and the Tees Valley Joint Strategy Unit on a regular basis.

Industry representatives have also been collaborating closely with the Tees Valley Joint Strategy Unit on influencing the development of REACH proposals. Regular meetings and electronic communications have led to the development of Position Papers and briefing sessions with European, National and Local Politicians on the proposed Regulation. The Centre for Process Innovation have also been closely involved in collaboration on the issue of REACH and they are also supportive of the work of the DICIDA network.

The Industry Nature Conservation Association (INCA)[2] brings together representatives of the Chemical companies and the relevant authorities in round table discussions over the use and utilisation of land. Both sides use INCA as an informal and non-threatening forum for discussion about proposals.

7.5 NRW

To our knowledge, there are no specific groups that coordinate the relationship between companies and authorities. Chemical companies and local authorities usually work together on a long term basis.
The AAV constitutes a forum for information exchange and knowledge transfer, since both companies and communities are members in the AAV. However, it has no political function.

[2] http://www.inca.uk.com/

8.0 What are the relationship between Chemical Companies.

Do they work together and share experience.

8.1 NW England

There is a working group made up of representatives of the larger chemical companies that shares experience within the chemical industry. There is also the CIA Chemical Industry Association which links the industry with central government.

8.2 NW Environment Agency

The Chemical Northwest initiative and the European Chemical Regions Network appear to be a good example of engaging chemical companies, local authorities, regulatory agencies and voluntary organisations and facility the exchange of best practices

8.3 NE England

In 1988 the Industry Nature Conservation Association (INCA) was founded by the then Nature Conservancy Council and ICI to address the problems and opportunities of nature conservation in the industrial areas of the Tees Valley. Members of INCA include industry representatives, local authorities and regulatory and conservation organisations. The Association aims to ensure that industry growth occurs in partnership with nature conservation.

With representatives from most of the chemical companies in the Tees Valley, INCA acts as a forum for exchange of ideas and good practice. Companies will share the cost of some INCA projects – e.g. where a project is sited on land owned by one company and paid for by another.

8.4 NRW

Operators of chemical parks have funded an organisation with the objective to share experience, which may include but is not limited to recycling of land.

9.0 What viable technologies are there for retaining contaminants on site.

9.1 NW England

The remediation of chemically contaminated land varies greatly depending on the type and levels of contamination. In the UK, the cost of 'dig & dump' techniques for remediation has now become extremely expensive and new environmental regulations are restrictive to such practices. The use of 'alternative technologies' to remediate, stabilise and make safe contamination is seen as the way forward, proving to be both financially economical and environmentally sustainable. The treatment and retention of contamination on sites saves moving a waste from one site to another (a tip!). Another important financial and environmental consideration is the fact that a high proportion of these technologies actually improve the ground strength as well as locking up the contaminants, this saves the importation of quarried stone for ground improvement and road bases. Altogether the reduction in lorry movements taking waste to tip and the importation of stone back to the site adds greatly to the environmental benefits package.

There is a very wide range of 'Alternative Technologies' available, each has it's own properties, applications and limitations. It is very important to work closely with the environmental regulatory body to ensure that the proposed use of 'technologies' does not fall foul of current environmental regulations. It is recommended that any proposed technology is site trialled to prove to the regulators that the technology works and is sustainable; laboratory testing can be very different to actual site based practice!

The choice of which technology/ blend of technologies to use, is determined by extensive site testing and evaluation. It is very important to understand the 'source-pathway-receptor' model for the particular site and to carry out intensive environmental impact assessments before identifying any technology solution. The technology should also provide a proven permanent solution that is guaranteed and allows the proposed after use of the site without onerous constraints.

It is unlikely that one technology on it's own will solve all the environmental issues on a particular site, so a blend of several is usually required to completely eliminate all of the 'pathways'. Certain technologies also provide a degree of stabilisation or ground strength improvement which can be used to found roads and car parking areas on. This saves importing aggregates, which again contributes to sustainability by reducing lorry movements and reducing the requirement for quarried stone.

There are many different technologies and new ones arriving as technology advances, so to try and detail each one would be impossible within this short report. However there is a very useful web site, which gives details of all the current processes. This is: - http://www.frtr.gov/matrix2/section1/toc.html

In some circumstances the cost of remediation may be prohibitive in relation to the risk of pollution. A 'cost benefit analysis' for the remediation options has been accepted by the Environment Agency in particular circumstances, as a way of identifying 'fit for purpose' remediation at a reasonable cost. This may be one way forward, particularly where relatively low level pollution of controlled waters is taking place.

9.2 NW Environment Agency

Contaminated Land Report 11[3] provides the technical framework for structured decision making about land contamination. It encourages the formalisation of outputs from the process in the form of written records that contain specific project objectives, decision assumptions, as well as recommendations and other specific outputs. The procedures are intended to assist all those involved with, or interested in risk management of land affected by contamination.

Further detailed information on remediation techniques are included in the NW Environmental Agency appendix.

9.3 NE England

Bioremediation (the degradation of hydrocarbons through microbial action has been successfully used by the RDA on large coalification sites for a number of years (e.g. Hawthorn Colliery). Soil washing has been used to treat chemically contaminated dredged sediments (Middlehaven).

Technologies proposed in the Region

The BioReGen Project (See Question 2) is a proposed method of managing contaminated sites without excavation and removal. Long-term energy crop production is likely to assist with the in situ passive remediation of contaminants in the surface soil zone.

Research work in hand

Laboratory-based research on soil-washing using biosurfactants (microbial secretions) is underway at CLEMANCE on behalf of DEFRA to investigate the extension of this established process-based method of soil remediation to more difficult organic contaminants in soils and other granular hazardous wastes.

9.4 NRW

A variety of technologies is available for the remediation of contaminated sites. The choice of technology depends on the chemical properties of the pollutants, the location of the contamination (soil and/or groundwater) and the size of the contaminated area.

[3] Model Procedures for the management of land contamination (Contaminated Land Report 11), 2004, Environment Agency and DEFRA.

Former sites where chemical production has taken place are frequently contaminated with solvents (chlorinated and aromatic hydrocarbons). In landfills of chemical companies where all kind of production debris was dumped a wide range of pollutants is present.

In the case of specialized industry, contamination with various heavy metals can be found. Heavy metals are also often associated with ashes, cinders and other waste products.

In the Ruhr area there are many coalmines where the coal was processed in the vicinity of the pits, resulting in contamination with (polycyclic) aromatic hydrocarbons and tar oil. Similar contamination is associated with the former gasworks present in almost every town.

Due to shallow groundwater level, the contamination is very often spreading from soil to groundwater, resulting in plumes of various sizes. Therefore, the technologies mentioned below focus mainly on the removal of mobile contaminants from soil and groundwater.

Soil excavation and dumping on a **landfill** is frequently applied in cases where the contamination is shallow and the size of the contaminated area is small or medium. Due to comparably low prices for dumping, treatment measures for excavated soil (e.g. soil washing, incineration, ex situ immobilisation) that were developed one decennium ago did not gain much attention in the last years. However, several plants exist where soil (mainly fuel contaminated soil) can be washed, incinerated or treated biologically.

In situ treatment methods have been widely used for the remediation of volatile and biodegradable contaminants.

Soil vapour extraction is the standard technique for the removal of aromatic and chlorinated solvents (which are very frequent pollutants on DUN sites) from the unsaturated zone. Vacuum is applied through extraction wells to remove gas-phase volatiles. The insertion of the cleaned exhaust from the extraction pipes into the ground may improve the efficiency of this method, as the hot air increases the volatilisation rate of the contaminant pools.

Some trials were made with **soil heating** or **steam injection**, with the same objective of thermic enhancement of volatilization. However, high energy costs are involved with this technology. This makes it favourable at sites that are still in use where steam production facilities are present because steam is used for operation purposes.

The injection of air into the saturated zone (**air sparging**), combined with soil vapour extraction, and eventually combined with the addition of nutrients in the cases of biodegradable pollutants (**bioventing**) is a viable technique for the removal of volatile and biodegradable contaminants from groundwater.

Many groundwater contaminations have been treated by "**pump and treat**" or **hydraulic containment** to prevent pollutants from leaving the site. Due to constant release of pollutants from residual pools, it is regularly observed that there is a point of stagnation during the remediation process. To overcome this shortcoming, several techniques have been tested in order to tackle these reservoirs. All of these techniques require a good or at least moderate permeability of the aquifer to ensure sufficient distribution of additives.

Chemical oxidation by Fenton's reagent, permanganate or ozone has been used in other countries for a variety of pollutants. In NRW, encouraging results have been obtained on a site contaminated with chlorinated hydrocarbons.

Cosolvent/surfactant flushing has also been successfully applied in other countries, but to date practical application of this technology in NRW is scarce.

Biological in situ-treatment is a viable technology for groundwater contaminated with organic biodegradable contaminants, such as aromatic, aliphatic or chlorinated hydrocarbons. Groundwater is supplied with oxygen or hydrogen peroxide and nutrients in order to stimulate aerobic degradation processes (in the case of aromatic and aliphatic hydrocarbons). Organic substrates are added to the aquifer to create reducing redox conditions and thus stimulate the degradation of chlorinated hydrocarbons. Recently, other methods for the degradation of chlorinated hydrocarbons have been proposed. This includes the addition of suspensions of **nano-iron** to improve the redox conditions and of **methane** to stimulate methanotrophic organisms.

There are a number of sites where tremendous costs are involved with the implementation of remediation measures. The German law states that measures for the decontamination of soil and groundwater have to be necessary to avoid risks, suitable to achieve the objective, and reasonable with regard to the relation between costs involved and results achieved.

In view of this, the focus has shifted in the last years to procedures that assure risk minimization rather than full clean-up.

In cases where all these technologies are not applicable, **encapsulation** rests as a means to prevent further spreading of contaminants. Sheet piling, bentonite and/or cement slurry walls and combined systems that include organic compounds or membranes to prevent diffusion are used. Usually, long-term groundwater containment and control have to be applied to ensure the lasting stability of the slurry walls.

Permeable walls constitute another passive method of risk prevention. They may be installed in a groundwater plume so that groundwater is cleaned by adsorption or degradation while passing the wall. Several walls have been

installed throughout Germany. Control measures have shown that in several cases the permeability of the wall is insufficient, resulting in groundwater passing along the sides of the wall. The experience in NRW with a permeable barrier with iron as reactant in a plume of chlorinated hydrocarbons is positive so far.

The use or enhancement of **natural attenuation** processes is intensively investigated on many sites, especially concerning groundwater plumes. After removal of the source areas (or emission control through encapsulation), the contamination may stay on the site if it is proven by groundwater monitoring that the plume is stable or shrinking.

An overview over the technologies applied so far is given in the table below.

Remediation technology/measure	Percentage of all cases (5094 measures on 3719 sites)
Deposit on landfill	66,8 %
Deposit on site	7,6 %
Hydraulic containment	1,6 %
Pneumatic containment	1,2 %
Immobilization	0,6 %
Hydraulic remediation	11,9 %
Washing/Extraction	0,3 %
Biological treatment	3,7 %
Incineration	2,0 %
Source: Ministery of Environment, Protection of Nature, Agriculture and Consumer protection, date: 31.1.2004	

10.0 Summary of key points from questionnaires.

10.1 What Works

10.1.1 NW England

Cheshire County Council has reclaimed over 800 hectares of derelict land since the early 1970s, much of which was former chemical industry land. Halton Unitary Authority has also reclaimed areas of severely contaminated land from the chemical industry. About 75% of this has been for soft end uses. This work has been facilitated by the provision of government funding primarily through Derelict Land Grant and by the commitment to this process through the provision of dedicated land reclamation teams.

Authorities recognise that land is a finite resource and reusing derelict, underused and neglected land is a sustainable activity that can reduce the burden of development on greenfield land. When reclaiming for soft end use, this can enhance the quality of life of local people whilst also improving the image of the area and the region and hence contributing to the economic wellbeing of the County.

There should be a continued recognition that public funding is needed to release DUN land into public benefit. Whilst there is a strong argument for adoption of the polluter pays principle and for individual land owners and industries to put something back into the land, the reality is that unless the land is causing a problem off site then nothing will be done with the land and the 'big fence' approach will be taken to protect the owners from occupiers liability risks, and this benefits no one.

Landowners can be encouraged to contribute to the process but this should be pragmatic and recognise that providing public benefit is not a core business activity for the companies and any contribution from them is likely to relate to potential gain for the company through the removal of perhaps limited maintenance costs associated with the land and perhaps more importantly in some cases, the release of long term liabilities. However, for this to work an alternative arrangement for ownership and long term liability and maintenance and management must be found.

The Forestry Commission has developed a project in conjunction with the North West Development Agency estimated at £23m that will reclaim large areas of derelict and underused land across the NW of England. It will deliver new recreational areas, benefits for business, a boost to healthy living and a significant increase in the woodland cover of the area.

10.1.2 Lombardy

The financial resources needed for successfully reclaiming the local DUN lands are huge and contrast with the available cash of Regional Governments, considering the budget constraints that nowadays bind public

bodies and compared to the number of potential sites and the contamination level attained by them in Lombardy.

Last year the Lombardy Region provided 20 million € as financial resources to be destined for the required reclamations, suggesting further financial needs should be searched for by Local Administrations (Municipalities and Provinces) among private interested partners, as better allowed by the latest legislative measures.

Therefore the problem faced (financial constraint) should be solved by attracting developers and promote private investments by industrial, residential and commercial enterprises.

An important role could be successfully played by public companies which still are majority-owned by Public Body as the Municipality (this is the case of Fiera Milano and its project of the New Trade Fair).

10.1.3 NRW

The availability of public funding is crucial for the redevelopment of sites with a low commercial value.
The estate fund has been very successful in buying, improving and selling of abandoned sites.
The support of the private economy to the solution of community problems is very valuable when public funding is limited.
Limiting the liability for the investor enhances the possibilities of private engagement in the recycling of brownfield sites.
The development of assurance models for these cases may be helpful. However, to date there is not much experience with assurance polices for risks of contamination.

10.2 What doesn't work:

10.2.1 NW England

There is some evidence that attempts to place over-onerous or unreasonable conditions on land owners in respect of protection of public investment and potential claw back of funding can result in failure of the project and loss of up front project development costs. These costs can be considerable, not only in direct investment from funding agencies but also in time provided by the companies involved and in the local authority and other partnership organisation time. This can be considerable but often unmeasured.

Recent years have seen an increasing move to competitive bidding for the limited funding available. Whilst it is reasonable to expect funding agencies to identify a range of measure to be achieved, not least how proposals fit with agencies' strategies and priorities and of course to ensure good value for money. Nevertheless there appears to be a huge amount of effort and hence cost, by applicants, partners, collaborators and the agencies themselves, in this lengthy process and sometimes the 'goal posts have moved' before the

application for funding is determined. This dilutes confidence in the process, is inherently inefficient, and wastes money that would be better spent on delivery of projects.

10.2.2 Lombardy

The Polluter Pays Principle ("PPP") alone, for different reasons, does not provide a great help in order to improve the situation.

Given the broadness and complexity of the topic in Lombardy, therefore we should not be surprised if the application of the PPP has encountered at least great obstacles while trying to solve the related financial problems while searching the necessary resources, due in part for the difficulties to economically evaluate and appraise compensations and in part due to the entrepreneurial and financial crisis that often accompany the polluting company.

Another limit to the improvements of DUN lands, that sometime in the past lead to the abandonment of the area, is considered the heavy guarantees requested by the law to the owner/developers of the land subject to reclamation:

- a real guarantee, weighing over the property;
- a financial guarantee, to be assured in favour of the Region as soon as the Definitive Reclamation Project has been approved by the invested commission.

After the enforcement of the revolutionary "Ronchi legislation", some of its weaknesses have been clearly denounced, in particular pointing out the rigidity of the concentration limits that allow the release of the area that, considered precautionary, could lead to undesirable and irrational effects as preventing a calm and realistic evaluation of the best effective way to intervene and solve the problem and imposing excessive burdens and constraints to territory's reuse.

As an example, consider the Italian legislative provision that today require to evaluate the pollution of a land measuring a sample which granulometric fraction must be less than 2 mm, a condition that does not reflect the likely dilution of the pollutants in the land.

A questionable approach recently assumed by some speculative investors is to "cherry-pick" the less-contaminated portions of polluted areas in order to promote investment without regard to the local requirements and without having a look at the real problem represented by the whole area to be reclaimed and returned to the territory.

Parcelling out of the area to be reclaimed doesn't help: the problem should be addressed as a whole.

In particular, latest “fashion” consists in the promotion of power-plant projects in the recently liberalised energy market, favoured contingently by central governments due to the negative balance existing in Italy in the sector.

10.3 What needs to be changed or developed:

In order to deal with remaining underused and derelict sites it is important for the authorities and site owners to work together to review the possibilities for each site. In many cases it will not be economically practicable to meet all the strict regulations that may be applied to the site. It is therefore essential that a pragmatic view is taken of the best practical options for the site by completing a risk assessment. In this way sites where there can be some improvement possibly by greening without remediation can be supported. This can only be achieved by close cooperative working of all the parties concerned from the initiation of the project.

More efficient and effective funding mechanisms need to be developed. In particular changes in priorities and lack of continuity cause significant problems.

There needs to be a greater sharing of practical experience between land owners and authorities. In particular the previous experience of the specialist project managers working for the authorities and owners needs to be shared to ensure that the practical experience of similar work already undertaken is effectively shared.

Parcelling out of the area to be reclaimed doesn’t help: the problem should be addressed as a whole.

On many sites that have been derelict for a number of years a new ecology has established itself due to the activities on the site which have introduced foreign materials to the natural environment. This new ecology is sometimes considered of significant value and needs to be considered in any proposals for the site.

Orphan sites run the danger of becoming abandoned and efforts to retain site data should be addressed.

Resolution of ‘sins of the father’ need to be considered to prevent an increase in abandoned sites.

There is interest from the UK manager of another EU project SNOWMAN covering cooperation in research activities on brownfield land, in potentially linking this project with theirs as the two seem potentially complementary. This will be investigated in the New Year.

This is an interim report as further inputs have been promised which will take more time to complete. Other Regional partners are also potentially joining the project.

A view needs to be taken on how information already gathered can best be shared and how additional information can be fed into a continuation of this project. As a large number of relevant remediation and greening projects are in hand across Europe a lot of further information is becoming available.

11.0 Conclusions

There is general recognition that land is a finite resource and that reusing derelict, underused and neglected land is an important sustainable activity that can reduce the burden of development on greenfield land. Reclaiming land that is only suitable for soft end use can enhance the quality of life for local people whilst improving the image of the area and the region where full remediation is not practicable.

Sites that can be economically redeveloped generally have been or are in the process of being developed usually for some form of industrial use or under favourable circumstances for new housing. For the remaining sites which form the majority some form of public funding support is required to bring these sites back into beneficial use. Whilst there is a strong argument for the adoption of the polluter pays principle the reality is that unless the land is causing a problem off site then normally no action will be taken and it will remain fenced off. This protects the owners interests but can remain a blot on the landscape. Many of the largest derelict sites are owned by firms that are in decline or in some cases have ceased to trade so that the adoption of this principle is not realistic.

Land owners are often prepared to contribute to the process but this should be on a pragmatic basis recognising that providing public benefit is not a core activity for them. International competitive pressures generally are also reducing the scope for owner financial support. The savings through the reduction of maintenance costs are usually small but the principle obstacle is the long term liabilities associated with sites particularly where a change of ownership is involved. The issues relating to the reuse of derelict land are many and complex but experience has shown that a general understanding and agreement on long term maintenance and ownership is essential in the early stages of a project before any detailed work starts on the reuse of a site. Failure to do this can result in wasted time and effort at a later stage.

In some regions estate funding exists in some form with local authorities prepared to take on maintenance of sites and this has been very successful particularly in North Rhine Westfalia. If the liabilities of investors can be limited this can encourage the recycling of derelict land. In this respect there is a developing insurance industry which can provide cover for long term liabilities which will have to include possible changes of environmental regulations in the future affecting sites.

In general the financial resources required for successfully reclaiming DUN land are huge and contrast with the available cash resources of regional and government agencies due to budget resources. The number of potential sites and the closing of industrial operations in many areas continues in many cases to more than match areas being brought back into beneficial use.

The regulations relating to remediation of land to prevent threats to adjoining land via groundwater contamination are very detailed and for many historic sites particularly landfills and lagoons they cannot practically be met in full. To attempt to do so would in many cases be economically impossible and would also involve disturbing ill defined wastes leading to greater problems. These sites met regulatory requirements that existed during the time of their operations but do not meet current regulations.

There is some evidence that attempts to place over onerous conditions on land owners in respect of the protection of public investment and potential claw back of funding can result in failure of the project and loss of up front project costs. These costs can be considerable not only in direct investment from funding agencies but also in time provided by the companies involved and the local authority and other partners.

11.1 Key Factors for Successful Derelict Land Improvement

Site Greening

When derelict land cannot be economically redeveloped some form of public funding is essential to avoid it simply being fenced off and remaining a blot on the landscape. As the cost of full scale remediation is likely to be prohibitive some form of greening is the preferred option in most cases.

Funding

The potential cost of redevelopment of the existing large areas of industrial brownfield land is huge particularly in the new EU member states. The scale of funding support required will have to be dramatically increased if substantial progress is to be made in reducing these areas.

Public access

There is no incentive for owners and many disincentives to allow public access to a site therefore the liabilities and increased maintenance must be taken into account in setting up a project.

Maintenance and Ownership

Agreements on the maintenance and long term ownership of sites needs to be addressed at an early stage to avoid time and money being wasted when difficulties can arise at a later stage.

Polluter Pays

The polluter pays principle has limited applicability on many sites where businesses either have inadequate funds particularly for historic problems or may have ceased to trade. A more flexible approach needs to be considered where this situation arises.

Improving Community Life

Bringing back derelict land adjacent to communities into some form of beneficial use can have major positive impacts. Even where public access is not possible greening can improve the local environment and sites can be used for some form of nature conservation.

Risk Assessment

Where regulatory requirements cannot be fully met for technical or environmental reasons risk assessment can be used to obtain an optimum outcome.

Use of Insurance

Long term liabilities which may become more onerous with further regulatory changes are a disincentive to redevelopment. The increasing availability of environmental insurance policies to cover these aspects is a potential solution.

11.2 Making Use of Interregional Best Practice.

The information already obtained demonstrates the many varied approaches and wide experience available in the different Regions which have already contributed to this study. The following aspects are of particular importance.

Remediation Techniques

All regions have experience of different forms of remediation dealing with a wide variety of contaminants in soil and groundwater. In particular NRW has the greatest width of experience in many of the more advanced remediation techniques. Lombardy has also undertaken a number of large scale remediation projects on ex chemical sites bringing them back into a condition where reuse of the sites for large scale developments has been possible. Estonia has had to address a number of large scale problems from the previous soviet occupation which have required substantial works to avoid large scale contamination of groundwater

Partnership Working

There are many examples of different partnership groupings. The NE England and Humberside have good links between environmental bodies and owners that have led to the rehabilitation of large sites for reuse for public access and nature conservation. The NW England is involved in the master planning of a large area of the Mouth of the River Weaver at Runcorn. Hessen has redeveloped a large heavily contaminated site with local authority and regional support to bring a significant area back into use for housing.

Landfills and Lagoons

Halton in NW England has developed over a number of years techniques for the reuse of sites covered by large scale soft landfills and lagoons using cementation techniques There has also been considerable work carried out in the same Region by Cheshire County Council returning lagoon areas to

forestry and public access. One of the largest landfill projects is that developed on the Baltic shore in Ida Viru containing uranium wastes. Saxony Anhalt is heavily involved with another Interreg 3C project on Waste Management. Much of the data associated with the closure and reuse of landfill sites is very relevant to chemical landfills.

Funding and Authority Support.

All Regions have some forms of support funding and it is important to understand the differences and particularly the successes that have been achieved. The largest scale of work has been undertaken in NRW where there is a good working relationship between all the different parties and in particular a willingness by local authorities to provide long term support for greened areas.

Regulatory Requirements

It is important to understand the differences in regulatory requirements and their local interpretation. In particular the input from the NW England Environment Agency has been extremely valuable as it sets out the views of the Agency on the best working processes for the redevelopment of sites which is particularly relevant to the more complex sites that are now being considered.

Treatment of Mined Minerals

Many of the major derelict sites in Huelva relate to mine wastes and the treatment of the mined minerals. Certain mine sites have been recovered so they can be used for tourist and heritage purposes although the original geology cannot be fully restored.

Research

The majority of the sites that this project is concerned with involve some form of greening as this is the only economic way to improve them as full remediation is not practicable. Appropriate research is being carried out by a number of universities and public bodies on the best processes for the greening of the artificial soils and very varied site covers that exist on brownfield sites. Already identified are a number of experimental sites in the UK where there is now several years of experience of best practices for the planting of poor quality soils.

12.0 Evaluation and Recommendations

The volume of brownfield land in the EU particularly in the eastern area countries that have more recently joined is immense and the funding available to reduce this is limited relative to the scale required to make substantial and early progress. This being so it is vital that the resources that are available are used to achieve the maximum benefit. To achieve this two project themes are proposed which would include the consideration of the issues already identified and indicate the optimum way to develop future projects.

12.1 Partnership Working.

The importance of partnership working has been demonstrated by all project partners. For any project involving brownfield land partnership working is beneficial but for the more complex economically unviable sites it is essential if a practical solution is to be reached. In many cases a pragmatic solution will have to be reached which only goes part way towards meeting all the potential regulations that may apply.This is often difficult for regulatory authorities to agree to as it may be seen as setting precedents for other sites where the same conditions may not apply. The best solution will usually be to use a risk assessment process involving a review of the best technical options.

Some form of greening without remediation may be able to be supported. There will be a range of potential long term solutions from making a site available for public access to not allowing any public access but with improved appearance and including some benefit to nature such as a bird reserve.

In order to maximise the benefits from partnership working it is recommended that the outline work carried out in this project is developed to review in more detail the experience of partnerships already undertaken. From information particularly relating to successes achieved and the different forms of partnership that have operated a set of guidelines to achieve best results can be drawn up. This study would also involve understanding the different forms of financial and regulatory support available in different regions and which have led to the greatest successes. It is clear that the variations in funding regimes and in many cases their short term duration are major issues that will need to be understood. The forms of partnership can be very varied depending on the form of the site which may cover ex operating sites to the mineral treatments on old mine sites. A process to make this information readily available to ECRN members would need to be developed.

12.1.1 Key Aspects

Understanding Existing Partnerships

The importance of improving derelict land is widely highlighted by regional and local authorities to encourage economic development in their areas. In order to achieve this partnership working is essential as we are now

considering the more complex brownfield sites. These partnerships are very varied but establishing in more detail experience in their make up and methods of operation is extremely important to establish best practice.

Funding

The very varied and numerous regional funding sources need to be fully understood to be able to maximise support for land improvement projects as there is great competition for the limited funds available to funders. Also funding support opportunities are continuously varying with some new possibilities emerging and others disappearing. Understanding funding processes and having a number of sites with outline projects already agreed are fundamental to being able to develop new projects.

Linking to Regulatory Authorities.

Working closely with regulatory authorities is vital to develop the type of new projects that we are now concerned with. Understanding the requirements and interpretation of regulations is critical as well as being aware of forthcoming changes to ensure that regulatory requirements are met. Meeting appropriate authority representatives as part of a partnership at the early stages of a project is crucial to its eventual success.

Development of Master Plans.

For the redevelopment of large areas of underused land it has been found that working with owners, local, regional and regulatory authorities to review the potential improvements including land not owned by the chemical industry is assisted by the formation of a master plan for the area. This involves work by a number of different agencies but gives the opportunity to bring in a variety of funding support that would not be available to purely chemical land owners. This is potentially a powerful process and would normally have to be planned over a long time scale but can produce dramatic results.

12.2 Incorporating existing experience and research in new projects

The current project has developed a large volume of information on site improvement work that has already been carried out on major sites in a number of regions. This needs to be collected into a format that is more readily available to existing and potential new partners. There is also a steadily increasing scale of work being carried out across the EU the experience from which could be included as it becomes available. The next steps proposed are to first establish what other EU and Regional projects contain information that would be relevant to this ECRN initiative. Following these initial discussions approaches would be made to establish links with appropriate groups. The initial view is that SNOWMAN (sharing information between EU Environment Agencies), EUGRIS (a web based platform for sharing contaminated land and groundwater information) and the EU Soils Strategy project should be considered. The Interreg 3c project European Waste Management also contains useful information on the abandonment and reuse of landfills. There are also a number of university research

initiatives based on practical trials for the greening of difficult and artificial land surfaces covering brownfield sites. Many of these initiatives could contribute to a package of links to information that would be useful to partnerships being established to promote the reuse of complex brownfield sites.

Because the number of technical solutions to the wide range of contamination issues is very large and the processes are technically complex the main interest should be concentrated towards processes that have a wide application such as the cement stabilisation of soft materials. Information on costing, programming etc and links to project managers so that detailed information can be obtained directly would be of assistance. Also information on the reuses that sites have been put to and the maintenance requirements involved would be helpful for the development of projects. A relatively new aspect of site regeneration is the development of liability insurance to cover liabilities when an exchange of ownership takes place. This could remove a potential blockage to the promoting of a project but information and experience of this needs to be collected and made available.

Research interest is likely to concentrate on the greening of sites rather than full scale remediation as this is the area of most relevance to the majority of sites for which full scale remediation is economically and technically impracticable. It is also the area where least work has been done and has for the most part been concentrated in local academic groups.

12.2.1 Key Aspects

Existing Projects

There are a number of projects in hand both nationally and across the EU associated with the reuse of brownfield land. It is important to understand which of these projects we could usefully link with to obtain data on a wide variety of associated research and experience. The main possibilities appear to be SNOWMAN, EUGRIS. the EU Soils Strategy and the Interreg 3C Waste Management Topic. A number of universities and public bodies also have ongoing research associated with the greening of ‘difficult’ soils.

Experience in Remediation

All Regions have experience in the remediation and greening of sites to different degrees. There are a vast number of different processes in use for specialist problem sites but some are of wide application such as for the clean up of tar lagoons and the sealing of soft landfills and lagoons. Making available the most relevant processes for wide application and having the contacts to get direct to project managers who have been responsible for specific works would be extremely helpful. To do this a database of key projects already handled is needed.

Reuse of Waste Materials.

The opportunity exists to consider the reuse of waste materials which will arise from processes to reduce waste going to landfill i.e. incineration. There

is the possibility to reuse some wastes to improve site contouring and drainage. As the sites that are part of this project are considered as brownfield these wastes may be able to be used when they cannot be used on greenfield sites. This could be a very economic way of obtaining fill where it is required for site regeneration.

Staying up to Date.

Because so much work is ongoing in the area of land improvement it is important to keep up to date with the key activities that are taking place and ensure that the learning is adequately shared with interested parties. The key ECRN partners have already been identified and new partners have shown interest in joining in the process so that the opportunity to achieve a project to achieve this process exists. Thought now needs to be given as to how to best achieve this.

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APPENDICES

NW England

NW Environment Agency

NE England

E England

Estonia

Huelva

Lombardy

NRW

Saxony Anhalt

Hessen

NW England

European Chemical Regions Network

NW Response for Topic 5 Land Improvement.

Based on the completed questionnaires the experience of the NW Region can be summarised as follows.

The questionnaires were responding to the following questions.

> What are the most cost effective ways of making sustainable environmental improvements to underused and derelict chemical industry (DUN) land to
>
> - attract developers
> - improve the quality of life for local communities
> - raise the image of the regions and assist in attracting inward investment
>
> What regional or EU policies or regulations help or hinder improvements.
>
> Are there EU policies or regulations which need to be introduced/amended.
>
> What are the most viable alternative technologies for the treating, rendering harmless, stabilising and retaining contaminants on site.

Based on the completed questionnaires the experience of the NW Region can be summarised as follows.

Questionaire

1.0 Question 1

What DUN chemical industry land is there in the region

What is the scale (ha) and are there common site histories and problems

There is about 1000 hectares of derelict and underused land relating back historically to the chemical industry.

In the NW England the oldest sites in the Region are located in the Halton and Mid Cheshire areas. Much of the historical waste remaining in these areas results from the Le Blanc process which produced large volumes of highly alkaline wastes which were spread over the countryside surrounding the Works and now form a legacy which restricts local development. This waste is in the form of very soft and variable material stored in lagoons.

Another area of brownfield land from the chemical industry in the region is at Fleetwood which is the site of a shadow factory from the second world war which was developed adjacent to a soda ash works. Most of the land from the more recent developments is only lightly contaminated and is being redeveloped for industry and housing. There are however some large landfills and lagoons which still have some capacity to take further waste.

There is also a large site of approximately 100 hectares at Whitehaven in Cumbria which was used for the manufacture of washing powders and by products which has recently been closed and is in the process of demolition. Long term planning for bringing this site back into beneficial use involves large areas of greening with public access as it is situated adjacent to a very deprived community.

2.0 Question 2

What work has been done in dealing with DUN land

Examples of success and failure

2.1 Successes

The main work carried out and with the widest potential for use on other areas so far has been the work carried out in Widnes by Halton Borough Council. This involves the cement stabilization of the soft alkaline wastes of which there are 2 million tons in the Widnes area to form an impermeable crust which can be used for storage, playing fields etc but not for buildings. The work done has to be very adaptable as the wastes are very variable and therefore the learning from this work gathered over a number of years should be of use in a number of other sites. The process is described in more detail in the NW England report.

Other site reclamation has involved the capping with clay and impermeable sheeting of a 30 hectare alkaline landfill in Northwich and its conversion to a public park. At Fleetwood a large part of the Hillhouse site has been redeveloped for industry and housing with minor site remediation including the removal of buried drums.

At the ex Shell Chemicals site at Carrington a significant number of research projects are being carried out to deal with the various chemicals in the ground.

2.2 Failures

These include certain sites that were reclaimed many years ago (e.g. 1970s), when reclamation standards and environmental awareness were less developed and also where funding at the time was limited. Consequently some sites have experienced subsequent problems of contamination break out and have required additional works.

3.0 Question 3

What are the barriers to improving DUN land.

The key issue that acts as a barrier to the regeneration of brownfield land is development economics. The barriers to regeneration have impacts on costs and as such impact on the developer's bottom line. As discussed developers are, in general, happy to undertake archaeological surveys, environmental works (including flood defences and remediation) and assemble land interests as long as they feel that the end sales values of their product are high enough to support the costs associated with the works. This does not mean that they are not worried about the initial outlay of large capital sums on which they have to service the finance over longer periods of time.

The geography of a site can also act as a key barrier to regeneration. The traditional property maxim of 'Location, location, location' being the key determinant of value, has by and large proved to be true. At the national level there is a pronounced difference between sites in the south and those in the more remote areas of the north and west. The southern sites are usually able to overcome issues such as site contamination and ecology, due to the values that can be generated. This has not proved the same in the north, where often intervention funding is required to make sites economically viable.

Local authorities can act as a barrier, often lacking the skills required to fully interact and deal with the regeneration process. The planning application process often throws up issues which frustrate developers. The lack of clarity that is a result of the lack of skills and poor forward planning tends to confuse both the authority and developer, leading to poor communication and a tendency to confrontation, with the perception of an 'us and them', despite the

fact that both sides wish to see brownfield land brought back into a use which can benefit the whole community.

Local authorities should take a much more proactive stance in bringing forward sites for redevelopment. This means the production of development briefs, interaction with the community and also reskilling, to carry out CPOs and negotiate land acquisition. RDAs and EP should also take a much greater role in giving aid to local authorities, sharing their own experiences and knowledge.

The social barriers to the redevelopment of brownfield land should be taken seriously and not just as an afterthought. The acquired uses of brownfield land (through leisure uses etc) and their historical uses and associations can often have a special meaning for local communities and generate socio-cultural barriers. On the reverse, some sites have become synonymous with anti social barriers and local communities are often supportive of efforts to redevelop. The creation of comprehensive development briefs for sites would also act to clarify the local authority's position for developers.

The principle barrier is the lack of funding for this work as the cost of any remediation and greening activities is in general significantly greater than the value of the land after completion of improvements.

The potential liabilities are often difficult to assess and future legislation may add further costs.

Unless there is a threat to offsite areas there is no incentive for the owning company to invest funds in derelict land restoration.

The increase in landfill tax has increased the cost of site reclamation.

Negotiation with land owners is often protracted and uncertain of obtaining a positive outcome.

4.0 Question 4

What policies or regulations help or hinder improving DUN land

4.1 Planning

The adopted County Structure Plans contain broad policies which emphasise recycling land and outlines the role of Derelict Land Reclamation in the context of Environmental Improvements.

There are a number of outline planning permissions that have been given for greenfield sites which were granted before the current more restrictive climate limiting the use of greenfield sites. These sites are still being developed and reduce the pressure to use brownfield sites.

Currently, there is too much brownfield land allocated for business employment. This places a restriction on development of this brownfield land for permanent recreational or similar environmental improvement, but could open up opportunities for temporary greening to improve image, increase the saleability of the site and also enhance the local environment and quality of life for those working and living nearby.

4.2 Legislation Hindering Reclamation.

The environmental (EPA 1990 - Waste Management licensing regulations, interpretation for permanent site license or 'Pollution Prevention Control' permit)

4.3 Polluter Pays.

The requirement that the polluter pays for reclamation of contaminated sites limits the sites that can be considered for reclamation as in most cases unless there is a threat to the surrounding land there is no incentive for the land owner to proceed with reclamation. The costs can be prohibitive and any returns minimal. There is also the problem of orphan sites where no owner is currently in existence or cannot be traced.

It is difficult to trace polluters and cost of remediation is prohibitive. None of the policies that rely on contributions from companies will work if the remediator has to rely on proving that pollution was caused by Xplc's actions for sites with a complex ownership history.

4.4 The Cost of Disposal.

Landfill availability is reducing and Landfill Tax is increasing to encourage developers to avoid landfill and deal with problems on site. However, it should be noted that in certain situations (ie where the contamination is above the threshold level which is acceptable for the proposed development) removal of contaminated material from a derelict land reclamation site to a landfill facility qualifies for exemption from Landfill Tax.

Policies or regulations which need amending or to be introduced

'Remediation Permits' may help to overcome WML regulations site license or Pollution Prevention Control permit

5.0 Question 5

Previous DUN land can have low commercial value leading to long term ownership and maintenance problems. How are Ownership/ management/maintenance/liabilities managed.

5.1 Ownership

To date ownership has generally been handled by acquiring the land for a specific scheme and either retaining the land after remediation or sell/leasing

land following remediation depending on the nature of the scheme. However, more onerous environmental legislation and a risk averse approach by local authorities will dissuade future acquisition and alternative arrangements will be required e.g. the involvement of The Land Restoration Trust (LRT) or some such arrangement

5.2 Management

In the past in-house teams from local authorities have generally procured and managed projects from conception to completion. However, few local authorities now have dedicated land regeneration teams and hence the capacity to deliver through local authorities will be limited. Similarly, after-management arrangements for soft end use schemes have traditionally been provided by local authorities but budget pressures on future revenue consequences are and will continue to constrain this commitment.

5.3 Maintenance

Needs to be thought out as part of the procurement of the scheme (ie who will do it and pay for it). Again, traditionally local authorities have funded future maintenance of soft end use schemes but budget pressures will limit this in the future.

The policy of the Forestry Commission for projects that they take on is to provide 15 years maintenance but this still leaves a longer term management requirement.

5.4 Liability

Desk studies, investigations and risk assessments are carried out before a commitment is made to reclaim a site to determine liabilities before proceeding with land acquisition and scheme. But again, potential onerous environmental liabilities and the risks associated with this will dissuade most local authorities from taking ownership and hence other arrangements like the LRT or the creation of individual Trusts and/or the provision of environmental insurance will have to be considered. It should be stressed that the single biggest constraint on the regeneration of DUN land by local authorities is likely to be the issue of future ownership and liability.

6.0 Question 6

What financial support is available in dealing with DUN land

Grant aid or subsidy - Regional Development Agencies fund the regeneration of brownfield land to a greater or lesser degree depending on the region but there is an inconsistent approach across the UK;

English Partnerships – support regeneration of DUN land where it fits their strategies and priority programmes but these currently are mainly concerned with ex coal field sites.

DEFRA Contaminated Land Capital Projects Programme – provides support for the investigation and remediation of contaminated land aimed at Part IIA responsibilities.

European Funding- e.g. Single Regeneration Budget funding can contribute to the regeneration of DUN land but this is limited to particular objective areas and this is likely to reduce from 2007 to reflect the impact of less prosperous new member states.

Other funding – landfill tax credits and lottery funding can sometimes be attracted to support DUN land regeneration.

7.0 Question 7

What is the relationship between authorities and Chemical companies

Are there groups working together – give examples

Chemicals Northwest is an industry led organisation promoting amongst other things the benefits of image enhancement to the chemical industry and provides an effective link between the RDA, local authorities and individual companies. In general relationships between chemical firms and authorities is limited and has been adversely effected by the frequent changes of ownership that have taken place over recent years.

8.0 Question 8

What is relationship between Chemical companies – do they work together to improve chemical industry DUN land particularly related to sharing experience – give examples

There is a working group made up of representatives of the larger chemical companies that shares experience on the reclamation of chemical sites within the chemical industry. There is also the CIA Chemical Industry Association which links the industry with central government agencies..

9.0 Question 9

What viable technologies are there for retaining contaminants on-site

The remediation of chemically contaminated land varies greatly depending on the type and levels of contamination. In the UK, the cost of 'dig & dump' techniques of remediation has now become extremely expensive and new environmental regulations are restrictive to such practices. The use of 'alternative technologies' to remediate, stabilise and make safe contamination is seen as the way forward, proving to be both financially economical and environmentally sustainable. The treatment and retention of contamination on sites saves moving a waste from one site to another (a tip!). Another important financial and environmental consideration is the fact that a high proportion of these technologies actually improve the ground strength as well as locking up the contaminants, this saves the importation of quarried stone

for ground improvement and road bases. Altogether the reduction in lorry movements taking waste to tip and the importation of stone back to the site adds greatly to the environmental benefits package.

There is a very wide range of 'Alternative Technologies' available, each has it's own properties, applications and limitations. It is very important to work closely with the environmental regulatory body to ensure that the proposed use of 'technologies' does not fall foul of current environmental regulations. It is recommended that any proposed technology is site trialled to prove to the regulators that the technology works and is sustainable; laboratory testing can be very different to actual site based practice!

The choice of which technology/ blend of technologies to use, is determined by extensive site testing and evaluation. It is very important to understand the 'source-pathway-receptor' model for the particular site and to carry out intensive environmental impact assessments before identifying any technology solution. The technology should also provide a proven permanent solution that is guaranteed and allows the proposed after use of the site without onerous constraints.

It is unlikely that one technology on it's own will solve all the environmental issues on a particular site, so a blend of several is usually required to completely eliminate all of the 'pathways'. Certain technologies also provide a degree of stabilisation or ground strength improvement which can be used to found roads and car parking areas on. This saves importing aggregates, which again contributes to sustainability by reducing lorry movements and reducing the requirement for quarried stone.
There are many different technologies and new ones arriving as technology advances, so to try and detail each one would be impossible within this short report. However there is a very useful web site, which gives details of all the current processes. This is: - http://www.frtr.gov/matrix2/section1/toc.html
The following is a very brief summary of the main technologies, properties and uses: -

- In Situ/Ex Situ Biological Treatment - involves the introduction of microbes into contaminated soils to degrade organic contaminants or immobilize inorganic contaminants.
- Chemical Addition/Reaction – Contaminated soils are mixed with a chemical extractant thereby dissolving the contaminant allowing separation and future reuse.
- Air sparging – Air is injected into saturated ground to remove contaminants through volatilisation.
- Heating/steam injection – similar to air sparging but heat increases volatilisation rate to facilitate extraction.
- Pump & treat – withdrawal of non-aqueous phase liquid for treatment.
- Soil Vacuum Extraction – Vacuum is applied through extraction wells to remove gas-phase volatiles.
- Permeable Reactive Barrier – an engineered treatment zone of reactive material to treat contaminated fluids as they flow through it.

- Impermeable Barriers – a vertical impermeable barrier to retain horizontal moving fluids within the site.
- Soil washing – Contaminants sorbed onto fine soil particles are separated in an aqueous solution ex-situ.
- Magnetic/chemical separation – contaminants are separated using magnets and chemical means.
- Landfarming/biopiling – Contaminated soils are placed in windrows and are turned over periodically to aerate the waste similar to composting.
- Bioreactors/sludge treatment – contaminants are mixed with sludge to form biological reactors to encourage microorganisms.
- Cement Stabilisation and Solidification – contaminants are physically bound within a stabilized mass to reduce their mobility and to encapsulate them in a monolithic solid.
- Vitrification - heat to 1,200 C is used to melt the contaminants into glass and crystalline products.
- Incineration – high temperatures are used to burn contaminants.
- Phytoremediation – the use of plants to reduce contaminants in soils.
- Monitored natural attenuation – allowing nature to remediate itself, closely monitored to show progress without affecting the wider environment.

There are advantages and disadvantages to all the above processes, which should be investigated thoroughly before deciding which process is best to deal with your particular site. Some are very expensive and some are cheap, making a cost benefit analysis exercise essential.

In some circumstances the cost of remediation may be prohibitive in relation to the risk of pollution. A 'cost benefit analysis' for the remediation options has been accepted by the Environment Agency in particular circumstances, as a way of identifying 'fit for purpose' remediation at a reasonable cost. This may be one way forward, particularly where relatively low level pollution of controlled waters is taking place.

Summary of Key Findings from Questionnaires.

1.0 What works.

Cheshire County Council has reclaimed over 800 hectares of derelict land since the early 1970s, much of which was former chemical industry land. Halton Unitary Authority has also reclaimed areas of severely contaminated land from the chemical industry. About 75% of this has been for soft end uses. This work has been facilitated by the provision of over £50 million (historic value) of government funding primarily through Derelict Land Grant and by the commitment to this process through the provision of dedicated land reclamation teams.

Authorities recognise that land is a finite resource and reusing derelict, underused and neglected land is a sustainable activity that can reduce the burden of development on greenfield land. When reclaiming for soft end use, this can enhance the quality of life of local people whilst also improving the image of the area and the region and hence contribute to the economic wellbeing of the County.

There should be a continuing recognition that public funding is often needed to release DUN land into public benefit. Whilst there is a strong argument for adoption of the polluter pays principle and for individual land owners and industries to put something back into the land, the reality is that unless the land is causing a problem off site then nothing will be done with the land and the 'big fence' approach will be taken to protect the owners from occupiers liability risks, and this benefits no one.

Landowners can be encouraged to contribute to the process but this should be pragmatic and recognise that providing public benefit is not a core business activity for the companies and any contribution from them is likely to relate to potential gain for the company through the removal of perhaps limited maintenance costs associated with the land and, perhaps more importantly in some cases, the release of long term liabilities. However, for this to work an alternative arrangement for ownership and long term liability and maintenance and management must be found.

2.0 What doesn't work.

There is some evidence that attempts to place over-onerous or unreasonable conditions on land owners in respect of protection of public investment and potential claw back of funding can result in failure of the project and loss of up front project development costs. These costs can be considerable, not only in direct investment from funding agencies but also in time provided by the companies involved and in the local authority and other partnership organisation time. This can be considerable but often unmeasured.

Recent years has seen an increasing move to competitive bidding for the limited funding available. It is reasonable to expect funding agencies to

identify a range of measures to be achieved, not least how proposals fit with agencies strategies and priorities and of course to ensure good value for money. Nevertheless there appears to be a huge amount of effort and hence cost, by applicants, partners, collaborators and the agencies themselves, in this lengthy process and sometimes the 'goal posts have moved' before the application for funding is determined. This dilutes confidence in the process, is inherently inefficient, and wastes money that would be better spent on delivery of projects.

3.0 What needs to be changed or developed

More efficient and effective funding mechanisms need to be developed.

The development of 'protocols' for dealing with waste management licensing exemptions, landfill tax exemptions and contaminated land regime issues, particularly in relation to projects providing non-commercial public benefit e.g. amenity areas, parks etc.

There needs to be a greater sharing of practical experience between land owners and authorities.

4.0 Threats to the current way of working:

Changes in priorities, of key funding agencies, is a key threat to the current way of working.

Inflexible regulatory demands could threaten progress.

NW

Environment Agency

Topic 5 land improvement Questionnaire
Comments from Environment Agency, North West region

General comment

It will be important to acknowledge that there will be a board spectrum of land contamination issues will be associated with DUN land. The most significant land contamination is likely to be addressed by the contaminated land regime. However much of the land affected by contamination will be remediated on a voluntary basis or as a consequence of land development. In such cases, requirements to carry out an appropriate site investigation, establish and validation of agreed remediation objectives may be conditions of the planning consent. The level of contamination will determine the extent to which regulatory are applied.

Question 1
What DUN chemical industry land is there in the region?

The DUN survey undertaken as part of the Newlands project identified 3,800 'DUN' sites of more than one hectare in size, of which 1,600 were 'brownfield' (some 14,913 hectares) and have been previously developed. This survey was of all potential DUN land across the region not just land associated with the chemical sector.

It should also be noted that some chemical industry land may have contamination issues due to previous activities but may not be derelict, underused or neglected.

What is the scale (ha)?

We have recently published a report on indicators for land contaminated land[1]. Data from the National Land Use Database (2002) indicated that there was around 3,199 hectares of previously developed land associated with former industrial use.

Are there common site histories and problems?

Yes these are associated with the previous manufacturing process. The former Department of Environment industry profiles provide developers, local authorities and anyone else interested in land contamination, with information on the processes, materials and wastes associated with individuals industries. They are not definitive studies but they introduce some of the technical considerations that may prove helpful at the start of an investigation for possible contamination. The profiles cover a number of chemical processes and can be downloaded as PDF documents from http://www.environment-agency.gov.uk/subjects/landquality/113813/1166435/?version=1&lang=_e

Question 2
What work has been done in dealing with DUN land?

Northwest

Over the years there has been a number of successful remediation initiatives across the region. Most notably has been the regeneration of authorities such as Halton, which has, as significant legacy of contamination associated with former chemical manufacturing. However it is important to note that remediation standards can change especially with better assessment and understanding of land contamination source – pathway – receptor relationships. This has lead to the closure of the St Michael's golf course in Halton which was the created from the remediation of the infamous Ditton Alps. On a positive note Halton's regeneration team have champion

[1] Indicators for land contamination, science report SC03000/SR, Environment Agency 2005.

in-situ surface solidification treatment processes to tackle the extensive land contamination issues associated with the former chemical industries in the borough.

The Northwest Development Agency set out its strategic approach to the soft end regeneration in Reclaim the North West[2]

In the region recognition should go to the Forestry Commission Newlands project and the original DUN survey undertaken to identify potential sites. The survey identified DUN land by using drawing together existing data sets (National Land Use Database) and aerial photographs. The identified land was validated by the local authorities and via stakeholder workshops. The survey was also use as a baseline most of the sub-region soft end regeneration initiatives (Remade, Revive, New approaches, New Leaf, New Approaches, Cumbria Strategic Partnership). It should however be noted that some of the initiatives failed to get to the implementation stage due to financial constraints.

The Mersey Forest and Red Rose Forest initiatives are good examples of how DUN land can be improved and proved lasting benefits to local communities. At a local level there have been a number of community regeneration projects over last 3 decades which have been brought about by partnerships involving organisations like Groundwork and British Trust for Voluntary conservation.

The Site for Innovative Research into Monitored Natural Attenuation (SIReN) is a National Facility for research into Monitored Natural Attenuation (MNA) under UK conditions. **SIReN** is a joint initiative between AEA Technology, CL:AIRE, Environment Agency and Shell Global Solutions International. The **SIReN** research facility is located at the Shell, refinery, Carrington. The following research reports are available:

Project SIREN: Phase 1 Report. Environment Agency 2000. *R &D Technical Report P358, Environment Agency;*
Project SIREN: Benchmarking of Monitored Natural Attenuation Procedures. Environment Agency 2001. *R&D Technical Report P2-208/TR/1, Environment Agency;*
Project SIREN: Conceptual Site Model. Environment Agency 2001. *R&D Technical Report P2-208/TR/2, Environment Agency; and*
Project SIReN: Phase 2b. Further Investigation (Phase 2b) of the SIReN (Site for Innovative Research on Natural Attenuation) Site. *R&D Technical Report P2-208/TR/3, Environment Agency.*

Further information on the project can be found at http://www.claire.co.uk/siren.php

Sustainable Urban Brownfield Regeneration: Integrated Management (SUBR:IM). This is four-year programme, which involves nine academic and research institutions to develop technical solutions and tools for the restoring brownfield land in urban areas. One of the projects is considering the particularly challenging issue of the restoration of acid tar lagoons in Salford. The project team is developing a centre of excellence for acid tar lagoon sites and has created a website (www.sheffield.ac.ac.uk/acidtars/) to pool their resources and expertise.

National

Contaminated Land: Application in Real Environments (CL:AIRE) provides a link between the main players in contaminated land remediation in the UK. It facilitates the development of cost-effective methods of investigating and remediating contaminated land in a sustainable way.

[2] Reclaim the North West, North West Development Agency, 2001.

CL:AIRE's activities span across five key areas: Site Portfolio, Project Brokerage, Development of a Strategy for Research in the UK, Information Dissemination, and Procurement of Funding.

Further information can be found at http://www.claire.co.uk/index.php

The Land Restoration Trust was established in 2003. It has taken on responsibility for most of English Partnerships former coalfield regeneration programme sites portfolio.

European

The European Information System for Soil and Groundwater (EUGRIS) portal is a web based user-friendly information platform for contaminated land and groundwater information. EUGRIS allows all stakeholders from industry, administration and research equal access to information of high quality from a single point of access. The meta-database intends to direct any user to the most appropriate source rather than store vast amounts of information itself. EUGRIS offers technical content and overviews of policy and regulations, management schemes, research funding, research projects and their outputs and library & links on a European and national level.

Registered users can submit information in all parts of the gateway simply using a web browser. For example, news, courses and conferences, library resources, who does what entries, project and funding information can be directly submitted online in minutes. EUGRIS as dissemination tool aspires to act as a "central broker" for information in Europe. EUGRIS is closely linked to other ongoing European activities. The modular structure of the system allows a quick integration of further technical content and new country pages.

http://www.eugris.info/AboutEUGRIS.asp?&EUGRISID=5269&Category=Other

Question 3
What are the barriers to improving DUN land?

This is not a straightforward question as the answer will depend on a number factors such as location, level and type of contamination, associated clear up and proposed future use.

In the context of DUN land associated with the chemical sector the above factors are however, still relevant.

Land contamination issues are often cited as a barrier to regeneration of DUN land. The contaminated land regime places the responsibility on the companies (or appropriate persons) who caused the historical pollution.

Contaminated land is defined in the regime as land that is posing an unacceptable risk to human health or the wider environment. It is also based on the establishment of pollution linkages between the source – pathway – receptor. Once established it is the role of the local authority (or the Environment Agency for certain site defined as special) to apportion liability, seek the appropriate remediation.

In the majority of case voluntary remediation is under taken before the land is statutory defined and remediation enforcement notices are served. Remediation objectives will normally be applied as a condition of the land use planning consent.

The overriding factor in the dealing with land remediation is the actual costs associated with the remediation. This will include site investigation, preparation and

assessment of a proposed remediation strategy, its implementation (including the obtaining of any necessary regulatory controls) and consideration of any future liability.

There are a variety of techniques for remediation of contaminants. These fall into three categories physical, chemical and biological. However due to the relative low cost of landfill disposal a significant proportion of remediation schemes have involved whole scale removal of contaminated to landfill facilities. This is commonly referred to as the “dig and dump” approach. Developers have often cited this option as being virtually risk free from future liability claims. The Government policy has also encouraged landfill disposal option by exempting contaminated soils from the landfill tax levy. This exemption also supports the Government policy of using brownfield land for at least 60% of all proposed developments.

The waste management licensing and now other waste management controls (Pollution, Prevention and Control regime) have over the year commonly been cited as barrier to brownfield regeneration. This is mainly associated with waste management activities, which are being carried out on site. Much of disputes have been based on the definition of waste and generally where such material may be put to beneficial use.

It would be beyond the scope of this response to consider in detail the definition of waste but it is important to note that it is a dynamic process and regard must be given to the relevant domestic and European case law. There is usually a clear distinction between the disposal of waste and its recovery. Where materials are being excavated and re-deposited into containment area, due to contamination issues, within a site would clearly be considered a disposal activity and would require waste management controls. Where wastes are being put to beneficial use, for example, used to construct a screening bund or other similar structure it would be considered to be a recovery activity. In such cases there are provisions in the form of exemptions from full waste management licensing controls.

We do however acknowledge that the waste management exemptions do not cover all potential recovery activities on remediation sites. In addition to this we have over the last five years sought to simplify the licensing process for process based remediation technologies that can be employed via mobile plant. This has included the developed of a generic licensing application pack and a number of enforcement positions (allowing certain small-scale treatment activities and the reuse of stabilised waste with out applying waste controls). We are currently considering further amendments to our approach to the licensing mobile remediation technologies and associated activities such as the re-use of remediated material where there is no appropriate exemption. The new system would also allow a single licence authorising several pieces of mobile plant to be used at the same time but at different sites. Further information of this current consultation can be found at: www.environment-agency.gov.uk/commondata/acrobat/mtl_consultation_1205817.pdf

Our policy on regulatory control to remediation has always acknowledged the limitations of the current waste controls and the need to develop a separate regulatory regime for such activities. This was a recommendation of the Lord Rogers Urban Task Force report, the former waste permitting review (including provisions for a signal permitting regime) by DEFRA, now being taken forwarded by the land remediation task force established by the Cabinet Office.

In addition we are developing a Modernising Regulation programme will make environmental regulation more effective at improving the environment, reduce the cost of delivery and minimise bureaucracy. We have been successful in establishing ourselves as a leading forward-looking player amongst regulators and government

departments. The Chancellor referred, by name, to our publication *"Delivering for the Environment – a 21st Century Approach to Regulation"* in the last Budget Speech. Industry has responded favourably to our intentions. But, as many initiatives are yet to be put into operation they are reserving final judgement until they see the results. Overall we are radically overhauling the established and traditional 'inspect and enforce' approach to regulation and, instead, we are looking at much smarter way of regulating businesses on a risk basis. This means that companies, which demonstrate good performance and low environmental risk, are now beginning to benefit from a lighter touch and lower regulatory fees.

As stated above the barriers to improving DUN land will depend on a number of factors. Where hard development is proposed there is likely to a greater economic driver for the development however this may not always be the case. The Royal Institution of Chartered Surveyors in association with the South of England Regional Assembly prepared a useful report on overcoming the financial barriers to mixed use brownfield development.

In summary the report cited a wide range of obstacles to development including:

- The cost and complexity of site;
- The financial risk associated with developing mixed schemes on urban browfield sites;
- Restrictions on gap funding;
- The risk averse nature of the property investment institutions; and
- An uncertain planning framework.

Copy of the report is available at:

http://www.southeast-ra.gov.uk/publications/policy.html

Question 4
What policies or regulations help or hinder improving DUN land.

It is important to understand the reasoning behind the regulatory regimes.

The contaminated land regime was introduced to tackle the legacy of land contamination issues associated with previous land use. The regime defines contaminated land, which, poses an unacceptable risk to human health (death) and the wider environment and apportion liability to ensure its remediation in accordance with the “polluter pays principle”.

The waste management licensing regime place controls on waste management activities to ensure reduce the danger to human health and risk of pollution of the environment in particular;

With out-
- risk to water, air, soil, plant or animal; or
- causing nuisance through noise or odours; or
- adversely affecting the countryside or places of special interest.

National planning policy set a target of 60% development on brownfield sites to encourage the bring back in beneficial used previously developed land and reduce pressure on greenfield sites. At a regional level emerging regional spatial strategies have land management policies which acknowledge the role and importance of green infrastructure. These policies ultimately inform the local development frameworks.

Question 5
Previous DUN land can have low commercial value leading to long term ownership and maintenance problems. How are ownership, management, maintenance and liability handled?

The majority of these issues are handled through the establishment of appropriate partnerships of landowners, local and regional authorities and agency's, voluntary and community groups and funding providers. We have seem a number of good examples of this in the region such as the community forest initiatives, Newlands project and the sub-regional land regeneration projects like REMADE in Lancashire. Despite the success of these projects there has been some failures of similar project due to the removal funding and issues surrounding long-term liability have not been resolved. We have yet to see whether initiatives such as the Land Restoration Trust can resolve such issues.

The long-term maintenance of any site is not as much an issue as the land contamination and the potential transfer of liabilities. The transfer of liabilities will be dependent upon the agreement of the transfer land ownership. There are currently discussions taking place with respect to piecrust leasing of the proposed project area. In this case no liability is being accepted from the land below the imported piecrust. There are still a number of uncertainties as any potential contamination issue will be the responsibility of the current owner or former polluter if identified as statutory defined contaminated land. The full implications of the EC Environmental liabilities Directive with respect to land contamination are also not fully known at this time.

Question 6
What financial support is available in dealing with DUN land.

The majority of funding for the soft end regeneration projects and initiatives in the region is via the Regional Development Agency.

English Partnerships (EP) provide some financial support for some soft end initiatives through its established programmes. EP have just announce a £4million funding for the regeneration of Haig colliery, near Whitehaven in Cumbria.

DEFRA's Supplementary Credit Approval (SCA) scheme provides funds for local authorities or the Environment Agency to deal with land affected by contamination. The SCA sites are a small sub-set of land that is affected by contamination, where the site needs remediation or investigation to assess the level of contamination and the risk posed.

A useful summary of potential funding sources can be found at on the DEFRA website:

http://www.defra.gov.uk/environment/land/contaminated/funding.htm

Question 7
What is the relationship between authorities and chemical companies? Are there groups working together.

We welcome the relationship we are developing with Chemicals Northwest and support the pro-active initiatives to tackle land contamination and dereliction associated with the region's chemical sector. This is a good example of a strategic sector approach to sure beneficial environmental outcomes within the appropriate regulatory frameworks. I am not aware of any other sector group of this nature.

We have traditionally had a significant regulatory and consultative role in regeneration, but we also have a strategic role in seeking to influence development policy to ensure that land use planning fully takes account of the many principles of sustainability. This is particularly relevant in the Northwest where many DUN sites are designated for soft end use. In addition it is important to ensure that we fully identify the links with other strategic initiatives in which we are involved so that the advice we offer takes into account the full range of environmental issues.

Question 8
What is relationship between chemical companies – they work together to improve chemical industry DUN land particularly related to sharing experience?

Chemicals Northwest and the European Chemical Regions Network appears to a good example of engaging chemical companies, local authorities, regulatory agencies and voluntary organisations and facility the exchange of best practices.

Question 9
What viable technologies are there for retaining contaminants on-site?

Contaminated Land Report 11[3] provides the technical framework for structured decision making about land contamination. They encourage the formalisation of outputs from the process in the form of written records that contain specific project objectives, decision assumptions, as well as recommendations and other specific outputs. The procedures are intended to assist all those involved with, or interested in risk management of land affected by contamination.

The model procedures report lists fifteen types of land contamination remediation processes. Each of these has been summarised in the form of remediation positions statements below:

Civil Engineering Methods
1. Cover systems
2. Containment barriers
3. Excavation & Disposal

Biological Methods
4. Monitored Natural Attenuation
5. Biopiles, windrow turning and landfarming
6. In-situ Bioremediation
7. Bioventing

Chemical Methods
8. Soil Flushing
9. Solvent Extraction
10. Transformation by chemical treatment

Physical Methods
11. Soil Vapour Extraction
12. Soil Washing
13. Permeable Reactive Barriers

Stabilisation & Stabilisation Methods
14. Solidification & Stabilisation

Thermal Methods
15. Thermal Desorption

The full statements are set out in Appendix 1 and provide:
a brief description of the technology;

[3] Model Procedures for the management of land contamination (Contaminated Land Report 11), 2004, Environment Agency and DEFRA.

the applicability of the treatment process to different types of contaminated materials and contaminant groups; and
regulatory position.

We are currently consulting on our regulatory approach to licensing of mobile plant and the application of waste controls to associated activities. Details of the consultation can be found at http://www.environment-agency.gov.uk/commondata/acrobat/mtl_consultation_1205817.pdf

In most cases the treatment of contaminated waste on a site would normally be subject to waste management controls. Most remediation treatment activities can be authorities by a mobile plant (treatment) licence.

We have a number of enforcement positions which set out our position with respect to not applying regulatory controls to small scale remediation activities (less than 1000 cubic metres) and remediation activities in-situ stabilisation remediation activities.

Exemption from fully waste management controls do exist for certain recovery activities such as land reclamation and the use of the waste for improvement or construction of a building or transport infrastructure.

Appendix 1 Remediation Position Statements

Remediation Position Statement No. 1			
Technology Title:	**Cover Systems**		
Similar Techniques:	**Horizontal barriers, liners**		
Technology Description			
Cover systems involve the placement of natural and/or synthetic materials over the contaminated ground. They are designed to isolate the contaminated ground from direct contact by receptors and reduce the transfer of gases and the infiltration of water thereby reducing or eliminating contaminant migration.			
Typical Contaminant Groups Treated			
Organic Contaminants		Inorganic Contaminants	
VOCs	✓	Heavy Metals	✓
Halogenated hydrocarbons	✓	Inorganics (NO_3, SO_4)	✓
Non-halogenated hydrocarbons	✓	Asbestos	✓
PAHs	✓	Miscellaneous	
Dioxins/Furans	✓	Corrosives	✓
PCBs	✓	Cyanides	✓
Pesticides/ Herbicides	✓	Explosives	✓
Regulatory Position			
The placement of a cover system using “clean” material is not effecting the treatment of waste; therefore there are no permitting implications. Consequently, no enforcement positions are applicable to this type of remediation. If the cover system uses ‘waste materials’ in its construction waste management licensing exemption paragraph **9A** may be applicable to its installation. If the installation of the proposed cover system does not meet the criteria for registration of this exemption, the activity may be regulated through a waste management site licence.			

Remediation Position Statement No. 2

Technology Title: **Containment Barriers**

Similar Techniques: **Vertical barriers, In-ground barriers, cut-off walls**

Technology Description

Barriers are used to prevent the lateral migration of contaminants. The techniques available for the formation of barriers include:

displacement techniques such as sheet pilling, to introduce the barrier into the ground but where the ground is left relatively undisturbed

excavation of the ground to construct a trench or similar structure in which the barrier is formed or installed

injection of materials into the ground which react/interact with the soil to change its properties and create a barrier in-situ but with minimal disturbance of the ground.

Typical Contaminant Groups Treated

Organic Contaminants		Inorganic Contaminants	
VOCs	✓	Heavy Metals	✓
Halogenated hydrocarbons	✓	Inorganics (NO_3, SO_4)	✓
Non-halogenated hydrocarbons	✓	Asbestos	✓
PAHs	✓	Miscellaneous	
Dioxins/Furans	✓	Corrosives	✓
PCBs	✓	Cyanides	✓
Pesticides/ Herbicides	✓	Explosives	✓

Regulatory Position

Where the construction of a containment barrier around or through the waste is not effecting the recovery of waste, there are no permitting implications. Consequently, no enforcement positions are applicable to this type of remediation.

Where the construction of a barrier around the waste involves the removal and subsequent re-deposition of the waste, then this is considered a disposal operation and should be regulated through a PPC permit, except where enforcement position 2.7 (trials) applies.

Where the construction of the barrier involves the recovery/use of in-situ waste, then this should be regulated through a mobile treatment licence, except where enforcement positions 2.7 (trials) and 2.8 (new techniques) apply.

Where the construction of the barrier involves partial excavation and recovery of waste, this should be regulated through a mobile treatment licence, except where enforcement positions 2.7 (trials) and 2.8 (new techniques) apply.

Remediation Position Statement No. 3

Technology Title: **Excavation for Disposal / Recovery**

Similar Techniques:

Technology Description

Excavation is the process preceding the recovery or disposal of contaminated soils or materials.
Excavated material may be subjected to:
Off-site disposal to landfill
On-site disposal to landfill
Off-site treatment to soil recovery centre
On-site treatment for recovery or disposal
On-site re-use without treatment under a licensing exemption

Typical Contaminant Groups Treated

Organic Contaminants		Inorganic Contaminants	
VOCs	✓	Heavy Metals	✓
Halogenated hydrocarbons	✓	Inorganics (NO_3, SO_4)	✓
Non-halogenated hydrocarbons	✓	Asbestos	✓
PAHs	✓	Miscellaneous	
Dioxins/Furans	✓	Corrosives	✓
PCBs	✓	Cyanides	✓
Pesticides/ Herbicides	✓	Explosives	✓

Regulatory Position

Remediation Position Statement No. 3

Excavation
Excavation of contaminated material, substances or products, for the purpose of remedial action with respect to land or controlled waters is not effecting the treatment of waste; therefore there are no permitting implications. Consequently, no enforcement positions are applicable to this type of activity. However, if the overall remediation scheme is permitted under PPC and excavation is an associated activity then it may be included in the permit.

Segregation of contaminated material
Appropriate levels of site investigation to characterise and delineate contamination on site should be undertaken to reduce the need for movement and/or recovery or disposal of contaminated materials. Segregation of excavated material doesn't fall within scope of a MTL unless it forms an integral part of it, and may require separate authorisation.

Classification of materials
Excavated material needs to be classified in accordance with the EWC and to determine whether it is hazardous waste.

Duty of Care
Should waste be removed from the site for disposal or recovery elsewhere, the waste producer must take all reasonable steps to ensure there is no unauthorised treatment, storage or disposal of controlled wastes. They should also ensure that it does not escape from their control and is only transferred to an authorised person together with a written description of the waste. The Duty of Care Regulations (as amended by the Landfill Regulations 2002) require that:

a) a full written, accurate description of the waste is provided to the next holder;
b) where the waste is destined for landfill, holders must establish whether or not it is hazardous;
c) wherever reasonably practicable the description should include the relevant EWC code(s).

Recovery operations
The recovery of excavated materials should be regulated through an appropriately authorised waste management facility. The treatment of waste may be regulated through a mobile treatment licence in accordance with the relevant Remediation Position Statements, unless any of the following apply:

where the remediation is carried out using fixed plant, the waste is hazardous and the plant has a capacity of more than 10 tonnes per day, this should be regulated through a PPC permit;

where the remediation is carried out using fixed plant and the waste is non-hazardous, this should be regulated through a waste management site licence;

where the waste is non-hazardous and is being pre-treated prior to disposal and the plant has a capacity of more than 50 tonnes per day.

The conditioning of soil, not containing dangerous substances, to improve its geotechnical properties is not affecting the treatment of waste; therefore there are no permitting implications. Consequently, no enforcement positions are applicable to this type of activity.

Storage of waste
The storage of waste materials, for the purposes of reclamation, restoration or improvement of land, is associated either with deployment of MPL, or the subsequent use of material as part of an enforcement position or a waste management licensing exemption.

The temporary storage of waste prior to collection for disposal or recovery off-site may be done under exemption paragraph **41.**

Remediation Position Statement No. 3

Use of Treated Waste:

If having gone through the recovery operation the waste remains waste, the Agency will apply a risk-based decision to the use the treated materials. We will take account of the following aspects, when reaching this decision:-

the use of treated material is suitable for the purposes of reclamation, restoration or improvement at that site; and

the use of treated material is carried out at its place of production; and

the treated material has been tested both physically and chemically to demonstrate that it will not cause pollution of the environment, harm to human health or serious detriment to amenities within the overall remediation scheme and that this is consistent with the need to attain the relevant objectives listed in paragraph 4(1)(a) of Schedule 4 of WML.

In addition, where treated materials are liable to release substances listed under the GW Regulations the following conditions apply:

use of treated material must not cause the discernible entry of List I substances into groundwater or pollution by List II substances within the defined area of remediation, however this may take into account the presence of any such substances already in the groundwater provided that this is determined acceptable within the overall remedial objectives;

use of treated material must not cause the movement of groundwater from the area subject to the remedial scheme into other groundwater such that List I substances enter those other groundwaters or that pollution of those other groundwaters is caused by List II substances;

the potential for discharge into groundwater arising from the use of treated material must be subject to adequate investigations and risk assessment to demonstrate that (a) and (b) can be complied with;

full justification is required to demonstrate that, in conjunction with any other aspects of the remediation scheme the proposed method and level of treatment and use of treated material is consistent with achieving the overall defined remedial objectives;

details of the overall scheme of remediation along with the results of investigation and risk assessment must be provided to the Agency prior to commencement of any re-deposition;

the use of treated material must be subject to sufficient monitoring to ensure compliance with the requirements of the Groundwater Regulations.

Remediation Position Statement No. 3

Disposal Operations

The disposal of excavated materials should be regulated through a PPC permit. The excavated material may be disposed of to an inert, non-hazardous waste or hazardous waste landfill and will have to comply with the Waste Acceptance Criteria. Note that it is not permissible simply to dilute or mix with other waste to meet the relevant Waste Acceptance Criteria.

At the present time, in the case of disposal to a hazardous waste landfill pre-treatment is required prior to disposal. The treatment must fulfil three criteria (three-point test):

It must be a physical, thermal, chemical or biological process including sorting.
It must change the characteristics of the waste
It must do so in order to:
- reduce its volume, or
- reduce its hazardous nature, or
- facilitate its handling, or
- enhance its recovery

In the case of contaminated land, this may be achieved by segregation through proper site investigation. The site investigation should identify the potential for segregation by separate excavation of areas with different levels of contamination. Recovering the soil for re-use diverts one of the waste streams from landfill and can be considered as segregation so no pre-treatment is required for the soil that goes to landfill as long as it meet the Waste Acceptance Criteria. If the waste is already separate, both are subject to the treatment requirements *[Guidance for waste destined for disposal in landfills - Interpretation of the Waste Acceptance Requirements of the Landfill (England and Wales) Regulations 2002 (as amended)].*

Remediation Position Statement No. 3

Remediation Position Statement No. 3A

Technology Title: **Removal of Groundwater for Disposal / Recovery**

Similar Techniques:

Technology Description

Groundwater is removed for treatment above ground (pump and treat) using treatment methods such as:

Chemical treatment
Biological treatment
Air stripping
Filtration
Carbon adsorption

Typical Contaminant Groups Treated

Organic Contaminants		Inorganic Contaminants	
VOCs	✓	Heavy Metals	✓
Halogenated hydrocarbons	✓	Inorganics (NO_3, SO_4)	✓
Non-halogenated hydrocarbons	✓	Asbestos	✓
PAHs	✓	Miscellaneous	
Dioxins/Furans	✓	Corrosives	✓
PCBs	✓	Cyanides	✓
Pesticides/ Herbicides	✓	Explosives	✓

Regulatory Position

Removal or pumping of contaminated groundwater for the purpose of remedial action with respect to land or controlled waters is not effecting the treatment of waste; therefore there are no permitting implications. Consequently, no enforcement positions are applicable to this type of activity.

Where subsequent remediation is carried out ex-situ by mobile plant it should be regulated through a mobile treatment licence, except where enforcement positions 2.7 or 2.8 apply. If not using a mobile plant then a Waste Management Licence or PPC permit is required.

Remediation Position Statement No. 4

Technology Title: **Monitored Natural Attenuation**

Similar Techniques:

Technology Description

Natural attenuation (NA) is the effect of naturally occurring physical, chemical, and biological processes or any combination of these processes to reduce the load, concentration, flux or toxicity of polluting substances in groundwater. For natural attenuation to be an effective remedial treatment action, the rate at which these processes occur, must be sufficient to prevent polluting substances impacting on identified receptors and to minimise expansion of contaminant plumes into unpolluted groundwater. Dilution within a receptor, such as a river or borehole, is not natural attenuation. Natural attenuation therefore describes the effect of natural processes, whilst **monitored natural attenuation** (MNA) is used to refer to the remedial technique, which by definition is a monitored activity. MNA requires sufficient evidence to demonstrate that the attenuation processes are occurring and will continue to occur so as to achieve the required remedial objectives within an agreed time frame and that the wider environment is protected.

Typical Contaminant Groups Treated

Organic Contaminants		Inorganic Contaminants	
VOCs	✓	Heavy Metals	✓
Halogenated hydrocarbons	✓	Inorganics (NO_3, SO_4)	✓
Non-halogenated hydrocarbons	✓	Asbestos	×
PAHs	✓	Miscellaneous	
Dioxins/Furans	×	Corrosives	✓
PCBs	×	Cyanides	×
Pesticides/ Herbicides	✓	Explosives	✓

Regulatory Position

Although natural attenuation is effecting the treatment of waste there is no human intervention and therefore there are no permitting implications. Consequently, no enforcement positions are applicable to this type of remediation.

You should ensure that the design, installation and monitoring regime is undertaken in line with good practice as outlined in the relevant Agency R&D report.

Remediation Position Statement No. 5

Technology Title: **Biopiles, Windrow turning and Landfarming**

Similar Techniques:

Technology Description

Bioremediation is a process that exploits the ability of natural soil microbial populations (eg. bacteria and fungi) to biodegrade or biotransform toxic environmental organic and inorganic pollutants to less toxic or innocuous products (eg. CO_2 and H_2O). Bioremediation processes may be operated under aerobic (with oxygen) and / or anaerobic (no oxygen) conditions to restore contaminated soils to a state suitable for use.

A bioremediation process operated as a soil treatment bed is a process in which excavated soil is placed in an above ground treatment area and stimulated to enhance the biodegradation of contaminants present. Aeration of the soil and the addition of nutrients are effective measures to enhance this process. Soil treatment beds may be either temporary installation on-site or as fixed installations (on-site or off-site) to which batches of soil are transported for treatment. Pre-treatment may be necessary to remove objects and to produce a feedstock of the correct physical form and consistency for biotreatment. Typical waste streams generated during treatment include;

1. Volatile vapour emissions
2. Vapour and liquid residual after treatment of waste streams (eg. spent GAC filters)
3. Generation of contaminated soil leachates and process effluents
4. Generation of toxic intermediates in soils
5. Solid rejects

Typical Contaminant Groups Treated

Organic Contaminants		Inorganic Contaminants	
VOCs	✓	Heavy Metals	✓
Halogenated volatiles	✓	Inorganics (NO_3, SO_4)	×
Non-halogenated semi-volatiles	✓	Asbestos	×
Dioxins/Furans	×	Miscellaneous	
PCBs	×	Corrosives	×
Pesticides/ Herbicides	×	Cyanides	×
		Explosives	✓

Regulatory Position

These types of bioremediation processes are **waste recovery operations** and no waste management licensing exemptions apply. Where the remediation is carried out by mobile plant it should be regulated through a mobile treatment licence, except where enforcement positions 2.7 or 2.8 apply. If not using mobile plant then a Waste Management Site Licence or PPC permit is required.

Remediation Position Statement No. 5

Storage of Treated Waste:
The Agency considers that storage of waste materials, for the purposes of reclamation, restoration or improvement of land, to be associated either with deployment of MPL, or the subsequent use of material as part of an enforcement position or a waste management licensing exemption.

Use of Treated Waste:
If having gone through the recovery operation the waste remains waste the three exemptions that could be relevant to the subsequent use of that waste are paragraphs **7A**, **9A** and **19A.**

Where these exemptions don't apply, the Agency will apply a risk-based decision to the re-use of materials. We will take account of the following aspects, when reaching this decision:-

the use of treated material is suitable for the purposes of reclamation, restoration or improvement at that site; and

the use of treated material is carried out at its place of production; and

the treated material has been tested both physically and chemically to demonstrate that it will not cause pollution of the environment, harm to human health or serious detriment to amenities within the overall remediation scheme and that this is consistent with the need to attain the relevant objectives listed in paragraph 4(1)(a) of Schedule 4 of WML.

In addition, where treated materials are liable to release substances listed under the GW Regulations the following conditions apply:

use of treated material must not cause the discernible entry of List I substances into groundwater or pollution by List II substances within the defined area of remediation, however this may take into account the presence of any such substances already in the groundwater provided that this is determined acceptable within the overall remedial objectives;

use of treated material must not cause the movement of groundwater from the area subject to the remedial scheme into other groundwater such that List I substances enter those other groundwaters or that pollution of those other groundwaters is caused by List II substances;

the potential for discharge into groundwater arising from the use of treated material must be subject to adequate investigations and risk assessment to demonstrate that (a) and (b) can be complied with;

full justification is required to demonstrate that, in conjunction with any other aspects of the remediation scheme the proposed method and level of treatment and use of treated material is consistent with achieving the overall defined remedial objectives;

details of the overall scheme of remediation along with the results of investigation and risk assessment must be provided to the Agency prior to commencement of any re-deposition;

the use of treated material must be subject to sufficient monitoring to ensure compliance with the requirements of the Groundwater Regulations.

Remediation Position Statement No. 6

Technology Title: **In-situ Bioremediation**

Similar Techniques: **Intrinsic Bioremediation, Biorestoration, Biostimulation (Bioaugmentation)**

Technology Description

Bioremediation is a process that exploits the ability of natural soil microbial populations (eg. Bacteria and fungi) to biodegrade or biotransform toxic environmental organic and inorganic pollutants to less toxic or innocuous products (eg. CO_2 and H_2O). Bioremediation processes may be operated in-situ or ex-situ under aerobic (with oxygen) and/or anaerobic conditions (no oxygen) to restore contaminated soils to a state suitable for use.

In-situ bioremediation is the enhancement or stimulation of biological processes to degrade, transform or remove contaminants present in soils and groundwaters. This process involves stimulating the biodegradative activities of soil bacteria by adding nutrients such as nitrogen and phosphorus as well as oxygen and other electron acceptors to the soil to enhance its microbial activity. In some cases, suitable soil microbes may be absent and microbial cultures are added to the soil to help the degradation processes. This process is known as Bioaugmentation. In-situ bioremediation processes can be applied to surface or near-surface soils or at greater depths in the unsaturated zone.

Surface Treatment – Application of in-situ bioremediation to surface or near-surface soils, may require amendments to be made using inorganic nutrients (nitrogen, phosphorus, etc.) and / or organic materials (manure, sewage sludge). In some situations, more concentrated nutrient solutions or “specialists additives” (e.g. surfactants, chelating agents, enzymes) may be added.

At-depth Treatment - In-situ bioremediation techniques to treat contaminated soil at a depth normally involve the use of water recirculation systems. Aerated water containing nutrient amendments are percolated through the contaminated zone whilst water containing degradation products and residual contaminants are simultaneously extracted for further treatment above ground.

Typical waste streams generated during treatment include:
Volatile vapour emissions
Generation of process effluents
Generation of toxic intermediates in soils

Typical Contaminant Groups Treated

Organic Contaminants		Inorganic Contaminants	
Non-halogenated volatiles	✓	Heavy Metals	×
Halogenated volatiles	✓	Inorganics (NO_3, SO_4)	✓
Non-halogenated semi-volatiles	✓	Asbestos	×
Non-halogenated semi-volatiles	✓	**Miscellaneous**	
Dioxins/Furans	×	Corrosives	×
PCBs	×	Cyanides	×
Pesticides/ Herbicides	×	Explosives	✓

Regulatory Position

Remediation Position Statement No. 6
These types of bioremediation processes are **waste recovery operations** and no waste management licensing exemptions apply. Where the remediation is carried out by mobile plant it should be regulated through a mobile treatment licence, except where enforcement positions 2.7 or 2.8 apply. If not using mobile plant then a Waste Management Site Licence or PPC permit is required.

Remediation Position Statement No. 7

Technology Title: **Bioventing**

Similar Techniques:

Technology Description

Bioventing is an is-situ process whereby active aeration of the contaminated area within the unsaturated zone provide a means of stimulating and enhancing biological transformation of volatile and semi-volatile organic compounds. Air flow within the unsaturated zone is enhanced by air injection, air extraction or a combination of the tow through a network of injection and/or extraction well, pipes or trenches which provides and enhanced flux and distribution of air through the zone of contamination.

This type of treatment is often combined with Soil Vapour Exrtraction (SVE) (Remediation Position Statement 11). For SVE the aim is to optimise the removal of contaminants through volatilisation. For bioventing, the focus of the treatment is on stimulating in-situ degradative processes.

Typical Contaminant Groups Treated

Organic Contaminants		Inorganic Contaminants	
VOCs	✓	Heavy Metals	×
Halogenated volatiles	✓	Inorganics (NO_3, SO_4)	×
Non-halogenated semi-volatiles	×	Asbestos	×
PAHs	×	Miscellaneous	
Dioxins/Furans	×	Corrosives	×
PCBs	×	Cyanides	×
Pesticides/ Herbicides	×	Explosives	×

Regulatory Position

These types of bioremediation processes are **waste recovery operations** and no waste management licensing exemptions apply. Where the remediation is carried out by mobile plant it should be regulated through a mobile treatment licence, except where enforcement positions 2.7 or 2.8 apply. If not using mobile plant then a Waste Management Site Licence or PPC permit is required.

Remediation Process Template No. 8

Technology Title: **Soil Flushing**

Similar Techniques: **Soil Leaching**

Technology Description

Soil flushing is an in-situ process that uses aqueous solutions to dissolve and recover contamination from the ground. Commonly used additives include acids, alkalis, chelating agents, and surfactants. Infiltration and recover of the aqueous solutions can be carried out using galleries, sprayers, trenches or wells depending on the depth of contamination. Above ground the recovered solution is treated to remove the dissolved contamination and can be reused.

In a typical configuration weakly acidic solutions may be sprayed over an area of contamination and be allowed to infiltrate the ground. The low pH of the aqueous solution encourages the transfer of soil-bound metals into solution. The solution is then pumped back to the surface via a borehole or intercepted by a trench. The recovered solution is then treated via an effluent treatment plant to concentrate and recover the metals. The water may then be re-acidified and re-used or once acceptable standards have been reached, it may be discharged to the ground or to sewer.

Typical waste streams during the operation of this process include:

Process effluents resulting from the addition of reagents or following recovery from the ground
Concentrated sludge, filters, and free product from the effluent treatment plant

Typical Contaminant Groups Treated

Organic Contaminants		Inorganic Contaminants	
VOCs	✓	Heavy Metals	✓
Halogenated volatiles	✓	Inorganics (NO_3, SO_4)	×
Non-halogenated semi-volatiles	✓	Asbestos	×
PAHs	✓	Miscellaneous	
Dioxins/Furans	×	Corrosives	×
PCBs	✓	Cyanides	×
Pesticides/ Herbicides	✓	Explosives	✓

Regulatory Position

These types of bioremediation processes are **waste recovery operations** and no waste management licensing exemptions apply. Where the remediation is carried out by mobile plant it should be regulated through a mobile treatment licence, except where enforcement positions 2.7 or 2.8 apply. If not using mobile plant then a Waste Management Site Licence or PPC permit is required.

Remediation Position Statement No. 9

Technology Title: **Solvent Extraction**

Similar Techniques:

Technology Description

Solvent extraction is normally an ex-situ based system used for the removal of contaminants from soil. Contaminated soils are mixed with a solvent in a reaction vessel in order to transfer the soil-bound contaminants into the solvent, which is then separated from the soil for further treatment. Typical solvents are organic chemicals (including many common industrial reagents) and aqueous solutions. Once separated from the soil the used solvent is normally treated to recover the solvent and concentrate the contaminants in a sludge or free phase extract in a separate chamber. Process streams generated during this treatment include concentrated contaminants either as free phase, concentrated in the solvent, or as a sludge, as well as recycled solvent.

Typical Contaminant Groups Treated

Organic Contaminants		Inorganic Contaminants	
VOCs	✓		
Halogenated volatiles	✓	Heavy Metals	×
Non-halogenated semi-volatiles	✓	Inorganics (NO_3, SO_4)	×
PAHs	✓	Asbestos	×
Dioxins/Furans	✓	Miscellaneous	
PCBs	✓	Corrosives	×
Pesticides/ Herbicides	✓	Cyanides	×
		Explosives	✓

Regulatory Position

These types of processes are **waste recovery operations** and no waste management licensing exemptions apply. Where the remediation is carried out by mobile plant it should be regulated through a mobile treatment licence, except where enforcement positions 2.7 or 2.8 apply. If not using mobile plant then a Waste Management Site Licence or PPC permit is required.

Storage of Treated Waste:
The Agency considers that storage of waste materials, for the purposes of reclamation, restoration or improvement of land, to be associated either with deployment of MPL, or the subsequent use of material as part of an enforcement position or a waste management licensing exemption.

Remediation Position Statement No. 9

Use of Treated Waste:
If having gone through the recovery operation the waste remains waste the three exemptions that could be relevant to the subsequent use of that waste are paragraphs **7A**, **9A** and **19A.**

Where these exemptions don't apply, the Agency will apply a risk-based decision to the re-use of materials. We will take account of the following aspects, when reaching this decision:-

the use of treated material is suitable for the purposes of reclamation, restoration or improvement at that site; and

the use of treated material is carried out at its place of production; and

the treated material has been tested both physically and chemically to demonstrate that it will not cause pollution of the environment, harm to human health or serious detriment to amenities within the overall remediation scheme and that this is consistent with the need to attain the relevant objectives listed in paragraph 4(1)(a) of Schedule 4 of WML.

In addition, where treated materials are liable to release substances listed under the GW Regulations the following conditions apply:

use of treated material must not cause the discernible entry of List I substances into groundwater or pollution by List II substances within the defined area of remediation, however this may take into account the presence of any such substances already in the groundwater provided that this is determined acceptable within the overall remedial objectives;

use of treated material must not cause the movement of groundwater from the area subject to the remedial scheme into other groundwater such that List I substances enter those other groundwaters or that pollution of those other groundwaters is caused by List II substances;

the potential for discharge into groundwater arising from the use of treated material must be subject to adequate investigations and risk assessment to demonstrate that (a) and (b) can be complied with;

full justification is required to demonstrate that, in conjunction with any other aspects of the remediation scheme the proposed method and level of treatment and use of treated material is consistent with achieving the overall defined remedial objectives;

details of the overall scheme of remediation along with the results of investigation and risk assessment must be provided to the Agency prior to commencement of any re-deposition;

the use of treated material must be subject to sufficient monitoring to ensure compliance with the requirements of the Groundwater Regulations.

Remediation Position Statement No. 10

Technology Title: **Transformation by Chemical Treatment**

Similar Techniques: **Redox Reactions, Reduction, Oxidation, Hydrolysis, Neutralisation, Dehalogenation**

Technology Description

Chemical treatment may be applied directly to soils or, be employed as part of a broader remedial strategy (eg after thermal desorption, soil washing or soil flushing processes) to either destroy the contaminants, reduce their toxicity, increase or decrease solubility, or to increase their susceptibility to other forms of treatment (eg. biological). Principal chemical treatment processes include: oxidation, reduction, hydrolysis, dehalogenation and precipitation which may be operated either in-situ or ex-situ.

Typical waste streams generated during both in-situ and ex-situ chemical treatments include:
Emissions of volatile compounds during the pretreatment stages
Vapour and liquid residuals following waste stream treatment (eg. spent GAC filters)
Generation of process effluents
Generation of toxic intermediates in soils

Typical Contaminant Groups Treated

Organic Contaminants		Inorganic Contaminants	
VOCs	✓	Heavy Metals	✓
Halogenated volatiles	✓	Inorganics (NO_3, SO_4)	✓
Non-halogenated semi-volatiles	✓	Asbestos	×
PAHs	✓	Miscellaneous	
Dioxins/Furans	✓	Corrosives	✓
PCBs	✓	Cyanides	✓
Pesticides/ Herbicides	✓	Explosives	✓

Regulatory Position

These types of processes are **waste recovery operations** and no waste management licensing exemptions apply. Where the remediation is carried out by mobile plant it should be regulated through a mobile treatment licence, except where enforcement positions 2.7 or 2.8 apply. If not using mobile plant then a Waste Management Site Licence or PPC permit is required.

Storage of Treated Waste:
The Agency considers that storage of waste materials, for the purposes of reclamation, restoration or improvement of land, to be associated either with deployment of MPL, or the subsequent use of material as part of an enforcement position or a waste management licensing exemption.

Remediation Position Statement No. 10

Use of Treated Waste:
If having gone through the recovery operation the waste remains waste the three exemptions that could be relevant to the subsequent use of that waste are paragraphs **7A**, **9A** and **19A.**

Where these exemptions don't apply, the Agency will apply a risk-based decision to the re-use of materials. We will take account of the following aspects, when reaching this decision:-

the use of treated material is suitable for the purposes of reclamation, restoration or improvement at that site; and

the use of treated material is carried out at its place of production; and

the treated material has been tested both physically and chemically to demonstrate that it will not cause pollution of the environment, harm to human health or serious detriment to amenities within the overall remediation scheme and that this is consistent with the need to attain the relevant objectives listed in paragraph 4(1)(a) of Schedule 4 of WML.

In addition, where treated materials are liable to release substances listed under the GW Regulations the following conditions apply:

use of treated material must not cause the discernible entry of List I substances into groundwater or pollution by List II substances within the defined area of remediation, however this may take into account the presence of any such substances already in the groundwater provided that this is determined acceptable within the overall remedial objectives;

use of treated material must not cause the movement of groundwater from the area subject to the remedial scheme into other groundwater such that List I substances enter those other groundwaters or that pollution of those other groundwaters is caused by List II substances;

the potential for discharge into groundwater arising from the use of treated material must be subject to adequate investigations and risk assessment to demonstrate that (a) and (b) can be complied with;

full justification is required to demonstrate that, in conjunction with any other aspects of the remediation scheme the proposed method and level of treatment and use of treated material is consistent with achieving the overall defined remedial objectives;

details of the overall scheme of remediation along with the results of investigation and risk assessment must be provided to the Agency prior to commencement of any re-deposition;

the use of treated material must be subject to sufficient monitoring to ensure compliance with the requirements of the Groundwater Regulations.

Remediation Position Statement No. 11

Technology Title: **Soil Vapour Extraction (SVE)**

Similar Techniques: **Soil Venting, Vacuum Extraction, Air Stripping**

Technology Description

Soil Vapour Extraction (SVE) is used to physically remove volatile compounds from the unsaturated zone. Air injected into subsurface causes volatile contaminants adsorbed, dissolved or present as free-phase in the soil to volatilise. This air injection stage is coupled with the removal of contaminated air streams under vacuum through a series of extraction wells. Extracted air is treated above ground using a number of processes such as granular activated carbon filters (GAC filters) or catalytic oxidation processes. The application of SVE processes can be enhanced depending on the site conditions and the type of contaminant present, to include, for example bioventing (Remediation Position Statement 7)

Typical waste streams generated during SVE include:
Vapour and liquid residuals following waste stream treatment (e.g. spent GAC filters)
Free product if system is adapted to remove free product.
The application of SVE processes can be adapted in a number of ways depending upon the site conditions and the contamination present.

The combined removal of soil gas and contaminated groundwater is known as dual phase vacuum extraction.

Typical Contaminant Groups Treated

Organic Contaminants		Inorganic Contaminants	
VOCs	✓	Heavy Metals	×
Halogenated volatiles	✓	Inorganics (NO_3, SO_4)	×
Non-Halogenated semi-volatiles	✓	Asbestos	×
PAHs	×	Miscellaneous	
Dioxins/Furans	×	Corrosives	×
PCBs	×	Cyanides	×
Pesticides/ Herbicides	×	Explosives	×

Regulatory Position

These types of bioremediation processes are **waste recovery operations** and no waste management licensing exemptions apply. Where the remediation is carried out by mobile plant it should be regulated through a mobile treatment licence, except where enforcement positions 2.7 or 2.8 apply. If not using mobile plant then a Waste Management Site Licence or PPC permit is required.

Remediation Position Statement No. 12

Technology Title: **Soil Washing**

Similar Techniques: **Physical or mechanical screening, mineral processing**

Technology Description

Soil washing is an ex-situ process to mechanically separate contaminants from uncontaminated soils and in rarer cases, for example with lead shot, to separate the contaminants themselves from the contaminated soil. Soil washing plants use a number of pieces of plant in order to exploit differences between soil particles in terms of their size, density, surface chemistry, or magnetic properties. Soil washing is normally used as a volume reduction process in order to maximise the reusable soil by separating out the contaminated fraction. The contaminated fraction, often the silt, clay, and/or the organic fraction require further treatment or disposal.

Simple physical separation can be achieved dry but normal soil washing plants add water to the soil to form slurry, which results in greater separation efficiency. The water used by a soil washing plant is often recirculated and will require treatment before being discharged because it will contain dissolved contaminants and process chemicals. Although separation is usually achieved using physical processes, chemicals can be added to enhance the separation effect including surfactants, acids, alkalis, complexing agents, flotation reagents, flocculation, and coagulation chemicals.

Soil washing processes produce a number of waste streams including:
A recovered soil fraction with lower contamination levels than the bulk material.
A concentrated soil fraction containing higher contamination levels than the bulk material.
A liquid effluent

Typical Contaminant Groups Treated

Organic Contaminants		Inorganic Contaminants	
VOCs	✓	Heavy Metals	✓
Halogenated volatiles	✓	Inorganics (NO_3, SO_4)	✓
Non-halogenated semi-volatiles	✓		✓
PAHs	✓	Asbestos	
Dioxins/Furans	×	Miscellaneous	
PCBs	✓	Corrosives	×
Pesticides/ Herbicides	×	Cyanides	✓
		Explosives	✓

Regulatory Position

This type of processes is a **waste recovery operation** and no waste management licensing exemptions apply. Where the remediation is carried out by mobile plant it should be regulated through a mobile treatment licence, except where enforcement positions 2.7 or 2.8 apply. If not using mobile plant then a Waste Management Site Licence or PPC permit is required.

Remediation Position Statement No. 12

Storage of Treated Waste:
The Agency considers that storage of waste materials, for the purposes of reclamation, restoration or improvement of land, to be associated either with deployment of MPL, or the subsequent use of material as part of an enforcement position or a waste management licensing exemption.

Use of Treated Waste:
If having gone through the recovery operation the waste remains waste the three exemptions that could be relevant to the subsequent use of that waste are paragraphs **7A**, **9A**, **13** and **19A.**

Where these exemptions don't apply, the Agency will apply a risk-based decision to the re-use of materials. We will take account of the following aspects, when reaching this decision:-

the use of treated material is suitable for the purposes of reclamation, restoration or improvement at that site; and

the use of treated material is carried out at its place of production; and

the treated material has been tested both physically and chemically to demonstrate that it will not cause pollution of the environment, harm to human health or serious detriment to amenities within the overall remediation scheme and that this is consistent with the need to attain the relevant objectives listed in paragraph 4(1)(a) of Schedule 4 of WML.

In addition, where treated materials are liable to release substances listed under the GW Regulations the following conditions apply:

use of treated material must not cause the discernible entry of List I substances into groundwater or pollution by List II substances within the defined area of remediation, however this may take into account the presence of any such substances already in the groundwater provided that this is determined acceptable within the overall remedial objectives;

use of treated material must not cause the movement of groundwater from the area subject to the remedial scheme into other groundwater such that List I substances enter those other groundwaters or that pollution of those other groundwaters is caused by List II substances;

the potential for discharge into groundwater arising from the use of treated material must be subject to adequate investigations and risk assessment to demonstrate that (a) and (b) can be complied with;

full justification is required to demonstrate that, in conjunction with any other aspects of the remediation scheme the proposed method and level of treatment and use of treated material is consistent with achieving the overall defined remedial objectives;

details of the overall scheme of remediation along with the results of investigation and risk assessment must be provided to the Agency prior to commencement of any re-deposition; and

the use of treated material must be subject to sufficient monitoring to ensure compliance with the requirements of the Groundwater Regulations.

Remediation Position Statement No. 13

Technology Title: **Permeable Reactive Barriers**

Similar Techniques:

Technology Description

A Permeable Reactive Barrier (PRB) is an engineered treatment zone of reactive material that is placed within the saturated zone in order to remediate contaminated groundwater as it flows through it. A PRB has a negligible overall effect on bulk fluid flow rates in the subsurface strata, which is typically achieved by construction of a permeable reactive zone, or by construction of a permeable reactive 'cell' bounded by low permeability barriers that direct the contaminant towards the zone of reactive media.

A PRB prevents or reduces contaminant flux whilst allowing groundwater to flow through the barrier. The reactive materials either immobilise or transform the pollutants, such that the treated groundwater down hydraulic gradient of the PRB should not represent an unacceptable risk to water resources or other receptors.

The most common design of PRBs used to date are 'funnel and gate' and 'continuous' reactive barriers. 'Funnel and gate' PRBs comprise impermeable walls, such as sheet piles and slurry walls, which direct contaminated groundwater to 'gate(s)' containing the reactive material. 'Continuous' PRBs transect the pollutant plume flow-path with an unbroken wall of permeable materials, which are combined with the reactive materials (e.g. a pea-gravel and reagent filled trench that is constructed across the groundwater flow direction).

Typical Contaminant Groups Treated

Organic Contaminants		Inorganic Contaminants	
VOCs	✓	Heavy Metals	✓
Halogenated hydrocarbons	✓	Inorganics (NO_3, SO_4)	✓
Non-halogenated hydrocarbons	✓	Asbestos	×
PAHs	✓	Miscellaneous	
Dioxins/Furans	✓	Corrosives	✓
PCBs	✓	Cyanides	✓
Pesticides/ Herbicides	✓	Explosives	✓

Regulatory Position

This type of processes is a **waste recovery operation** and no waste management licensing exemptions apply; though enforcement positions 2.7 or 2.8 may apply.

Where these enforcement positions don't apply, the Agency will apply a risk-based decision to the treatment of groundwater in-situ by a Permeable Reactive Barrier and will take account of the following aspects, when reaching this decision:-

a site risk assessment covering emissions to air has been undertaken as part of the remediation project and full details of that risk assessment are submitted to the Agency area office where the remediation project is to take place at least five working days (or such other period as agreed by the Agency) before that project begins, and

the treatment of the groundwater will not cause pollution of the environment, harm to health or serious detriment to amenities, and is consistent with the need to attain the relevant objectives listed in paragraph 4(1)(a) Schedule 4 of WMLR.

Remediation Position Statement No. 13

Remediation Position Statement No. 14

Technology Title: **Solidification and Stabilisation (S/S)**

Synonyms: **Immobilisation, Fixation**

Technology Description

Solidification and stabilisation are discrete processes that are often used together in order to reduce the mobility of contaminants in soils. Solidification achieves a reduction in mobility by converting the soil into a solid monolithic mass thereby reducing the permeability of the material to environmental agents such as rainwater. Stabilisation reduces the availability of contaminants by changing their chemical form (for example, precipitating metals in an insoluble compound) or increasing the strength of their binding to the solid matrix. Common processes that combine both solidification and stabilisation include cement, flyash, lime, and asphalt systems.

Solidification and stabilisation can be applied ***ex situ*** using batch processing or in-drum techniques, and ***in situ*** using a rotating auger or jet injection method.

Process streams generated during solidification / stabilisation processes include:
Gaseous and particulate emissions during mixing and setting
Process effluents during mixing

Typical Contaminant Groups Treated

Organic Contaminants		Inorganic Contaminants	
VOCs	×		
Halogenated volatiles	×	Heavy Metals	✓
Non-halogenated semi-volatiles	×	Inorganics (NO_3, SO_4)	✓
PAHS	×		✓
Dioxins/Furans	×	Asbestos	
PCBs	✓	Miscellaneous	
Pesticides/ Herbicides	×	Corrosives	×
		Cyanides	✓
		Explosives	×

Regulatory Position

This type of processes is a **waste recovery operation** and no waste management licensing exemptions apply. Where the remediation is carried out by mobile plant it should be regulated through a mobile treatment licence, except where enforcement positions 2.7 or 2.8 apply. If not using mobile plant then a Waste Management Site Licence or PPC permit is required.

Storage of Treated Waste:
The Agency considers that storage of waste materials, for the purposes of reclamation, restoration or improvement of land, to be associated either with deployment of MPL, or the subsequent use of material as part of an enforcement position or a waste management licensing exemption.

Remediation Position Statement No. 13

Use of Treated Waste:
If having gone through the recovery operation the waste remains waste the exemptions that could be relevant to the subsequent use of that waste are paragraphs **9A** and **19A.**

Where these exemptions don't apply, the Agency will apply a risk-based decision to the re-use of materials. We will take account of the following aspects, when reaching this decision:-

the use of treated material is suitable for the purposes of reclamation, restoration or improvement at that site; and

the use of treated material is carried out at its place of production; and

- the treated material has been tested both physically and chemically to demonstrate that it will not cause pollution of the environment, harm to human health or serious detriment to amenities within the overall remediation scheme and that this is consistent with the need to attain the relevant objectives listed in paragraph 4(1)(a) of Schedule 4 of WML.

In addition, where treated materials are liable to release substances listed under the GW Regulations the following conditions apply:

use of treated material must not cause the discernible entry of List I substances into groundwater or pollution by List II substances within the defined area of remediation, however this may take into account the presence of any such substances already in the groundwater provided that this is determined acceptable within the overall remedial objectives;

use of treated material must not cause the movement of groundwater from the area subject to the remedial scheme into other groundwater such that List I substances enter those other groundwaters or that pollution of those other groundwaters is caused by List II substances;

the potential for discharge into groundwater arising from the use of treated material must be subject to adequate investigations and risk assessment to demonstrate that (a) and (b) can be complied with;

full justification is required to demonstrate that, in conjunction with any other aspects of the remediation scheme the proposed method and level of treatment and use of treated material is consistent with achieving the overall defined remedial objectives;

details of the overall scheme of remediation along with the results of investigation and risk assessment must be provided to the Agency prior to commencement of any use of treated material;

the use of treated material must be subject to sufficient monitoring to ensure compliance with the requirements of the Groundwater Regulations.

Remediation Position Statement No. 15

Technology Title: **Thermal Desorption**

Similar Techniques:

Technology Description

Thermal desorption is an ex-situ based process. Thermal desorption involves the low temperature heating of contaminated soils in order to desorb volatile contaminants from soil. Contaminated soils are mixed and blended to ensure they exhibit consistent physical and chemical properties before being heated (up to 450^{O}C) in a reaction vessel in order to volatilise contaminants. The exhaust gases from the chamber are extracted and heated to a higher temperature for the abatement of emissions and treated using appropriate Air Pollution Control systems prior to discharge to atmosphere from a stack. Treated soil is cooled and stockpiled for reuse, further treatment, or off-site disposal.

The principal waste streams generated during this process include:
Gaseous emissions after desorption and treatment
Solid and aqueous residues from abatement systems

Typical Contaminant Groups Treated

Organic Contaminants		Inorganic Contaminants	
VOCs	✓	Heavy Metals	×
Halogenated volatiles	✓	Inorganics (NO_3, SO_4)	×
Non-halogenated semi-volatiles	✓	Asbestos	×
PAHs	✓		
Dioxins/Furans	✓	Miscellaneous	
PCBs	✓	Corrosives	×
Pesticides/ Herbicides	✓	Cyanides	×
		Explosives	✓

Regulatory Position

This type of processes is a **waste recovery operation** and no waste management licensing exemptions apply.

Section 2.4.3 of Defra's guidance on directive 2000/76/EC on the incineration of waste (2nd edition), states the remediation of contaminated soil and the use of an afterburner for the abatement of emissions from plant which is not an incineration plant are excluded from WID as these operations are not considered incineration processes.

Where the remediation is carried out by mobile plant it should be regulated through a mobile treatment licence, except where enforcement positions 2.7 or 2.8 apply. If not using mobile plant then a Waste Management Site Licence or PPC permit is required.

Storage of Treated Waste:
The Agency considers that storage of waste materials, for the purposes of reclamation, restoration or improvement of land, to be associated either with deployment of MPL, or the subsequent use of material as part of an enforcement position or a waste management licensing exemption.

Remediation Position Statement No. 15

Use of Treated Waste:
If having gone through the recovery operation the waste remains waste the exemptions that could be relevant to the subsequent use of that waste are paragraphs **7A**, **9A, 13** and **19A.**

Where these exemptions don't apply, the Agency will apply a risk-based decision to the re-use of materials. We will take account of the following aspects, when reaching this decision:-

the use of treated material is suitable for the purposes of reclamation, restoration or improvement at that site; and

the use of treated material is carried out at its place of production; and

the treated material has been tested both physically and chemically to demonstrate that it will not cause pollution of the environment, harm to human health or serious detriment to amenities within the overall remediation scheme and that this is consistent with the need to attain the relevant objectives listed in paragraph 4(1)(a) of Schedule 4 of WML.

In addition, where treated materials are liable to release substances listed under the GW Regulations the following conditions apply:

use of treated material must not cause the discernible entry of List I substances into groundwater or pollution by List II substances within the defined area of remediation, however this may take into account the presence of any such substances already in the groundwater provided that this is determined acceptable within the overall remedial objectives;

use of treated material must not cause the movement of groundwater from the area subject to the remedial scheme into other groundwater such that List I substances enter those other groundwaters or that pollution of those other groundwaters is caused by List II substances;

the potential for discharge into groundwater arising from the use of treated material must be subject to adequate investigations and risk assessment to demonstrate that (a) and (b) can be complied with;

full justification is required to demonstrate that, in conjunction with any other aspects of the remediation scheme the proposed method and level of treatment and use of treated material is consistent with achieving the overall defined remedial objectives;

details of the overall scheme of remediation along with the results of investigation and risk assessment must be provided to the Agency prior to commencement of any use of treated material;

the use of treated material must be subject to sufficient monitoring to ensure compliance with the requirements of the Groundwater Regulations.

NE England

Topic 5 Land Improvement Questionnaire

Reference should be made to the Land Improvement and Land Improvement documents on the member area of the ECRN website.

Background

What are the most cost effective ways of making sustainable environmental improvements to underused and derelict chemical industry (DUN) land to

- attract developers
- improve the quality of life for local communities
- raise the image of the regions and assist in attracting inward investment

What regional or EU policies or regulations help or hinder improvements.

Are there EU policies or regulations which need to be introduced/amended.

What are the most viable alternative technologies for the treating, rendering harmless, stabilising and retaining contaminants on site.

QUESTION 1 - What DUN chemical industry land is there in the region?

- what is the scale (ha)
- are there common site histories and problems

The five Unitary Authorities in the Tees Valley have records on previously developed and contaminated land and Stockton Borough Council is currently working on a decontamination strategy. It has not been easy to determine precisely the overall scale of the problem in the Tees Valley, but it would appear that the area surrounding the corridor of the river Tees contains a large proportion of the region's problem areas.

Historically Tees Valley employment was predominantly in either the Steel or the Chemical Industry and much of the DUN land has been caused by the restructuring of these industries. In some cases it is hoped that land may be brought back into use by the chemical sector. For some petro-chemical dominated areas there could still be potential for expansion and this potential may have increased significantly recently due to current oil prices and the devastation caused to US oil by hurricanes.

Some of the sites have developed an interesting and valuable biodiversity because they are protected from regular trespass and the substrates have particular chemical characteristics that leads to biological value. Industry is generally aware of this and will undertake environmental assessment before undertaking development or potentially damaging activity. Any proposals for remediation may need to include environmental assessment to identify benefits or disadvantages and to weigh the balance of development against the status quo and the need for any mitigation measures.

QUESTION 2 - What work has been done in dealing with DUN land

- examples of success and failure

The following are examples of some current work that is underway to bring back DUN land back into use.

Saltholme is an International Nature Reserve that is being developed jointly by the Royal Society for the Protection of Birds and by the Teesside Environmental Trust.[1] The Trust is a charitable body that was formed in 1998 to establish the Nature Reserve and visitor facilities. A site of 1000 acres (380 ha) of former industrial land is being developed to become the nature reserve. It will use many of the elements of nature conservation projects that have been proven on a smaller scale and replicate them on a larger scale. It will become the largest wetland creation project in the north of England.

Work has involved major earthmoving and landscaping of hundreds of thousands of tonnes of soil, clay and industrial waste to create wild flower meadows and reedbeds that will attract wildlife. This was particularly important on land that was reclaimed from the marsh, sandbank and mudflats of the estuary. The project aims to improve the environmental image of the Tees Valley, through promotion of its wildlife. Apart from the intrinsic value of the sites around the estuary, they support waterbird populations that attract Natura 2000 status.

Often the poor substrate of DUN land is ideal for wildflower growth and the colours can have a dramatic visual impact. The planting of wildflower seed on DUN land can improve its appearance and biodiversity value. However, part of the consideration for any temporary use pending future development is that temporary sites must be designed in such a way to minimise the risk of colonisation of the more valuable species that could ultimately, limit development opportunities.

Another project has been greening derelict land through the development of wood and other biomass fuels as a source of renewable energy. The project partners are Teesside and Durham Universities and the North East Community Forests working with industrial landowners, planting contractors and soil scientists. This collaborative venture of so called "in-situ phytoremediation" has the potential to provide low cost remediation compared to other forms of bio and mechanical remediation. Work has been ongoing to develop the skills and capability to cultivate energy crops on derelict or contaminated land, particularly with the development of 'safener compounds' applied to energy crops growing in contaminated land. These are mostly well-known agrochemicals that are applied in extremely low concentrations, to protect the plants against pollutants present in the soil and enhance their tolerance to soil contaminants. Investigations are also underway on the use of soil amendments (compost, digested sewage sludge, etc) to stimulate microbial breakdown of soil contaminants.

Test were undertaken in 2004 on the growing of energy crops in soil from contaminated sites in laboratory and greenhouse pots. With assistance from Renew Tees Valley[2] and English Partnerships the phytoremediation trials has been scaled up. Further owners of derelict land are being sought and the partners are most interested in land with organic chemical contaminants only (heavy oils, aromatics etc) as they have the best prospect to be completely broken down through the growing of the crops.

[1] (http://www.rspb.org.uk/england/north/about/saltholme/index.asp)
[2] http://www.renewteesvalley.co.uk/main.asp?

EU LIFE III Environment funding has been obtained by the Clean Environment Management Centre (CLEMANCE) of Teesside University, for a project called BioReGen (Biomass, Remediation, re-Generation): that will reuse brownfield sites for renewable erergy crop production. An industrial scale trial will evaluate the commercial feasibility of growing energy crops on 10 DUN sites in the NE Region. Uncertainties remain about the productivity of the land and testing will be required on emissions. In addition to restoring and generating income from sites this approach has the potential to divert biodegradable wastes from landfill and stimulate regeneration and local employment.

An area of contaminated land that has been successfully reused, formerly belonged to ICI and now houses a Municipal Waste to Energy Plant. The former municipal incineration plant needed to be replaced to keep pace with changing environmental legislation. A site selection study was undertaken by the former Teesside Development Corporation, and a site at Haverton Hill was chosen. An Environmental Assessment was carried out on the site in 1993.

The site had formerly belonged to ICI and was used to produce sulphuric acid and cement clinker from anhydrite (calcium sulphate). Proposed development was in an area designated for industrial use and did not conflict with Local plans. It fitted in at the time with both the Structure Plan and the Cleveland County Waste Plan. The surrounding area is mostly industrial with some residential and is located 2.5 km from Billingham Town Centre and 2.5km from Middlesbrough Town Centre. A consultation on the proposed development found the site to be acceptable to the public.

Under the Environment Protection Act 1990 Local Authorities were required to set up Waste Disposal Companies. Cleveland County Council established a Joint Venture Company with Northumbrian Environmental Management Ltd (NEM) a waste treatment and disposal company that is part of Northumbrian Water. It was the Joint Venture Company that developed the Municipal Waste to Energy Plant.

Prior to development there were visible signs of residual surface contamination and signs of underlying soil and shallow groundwater contamination, but no obvious habitat of particular ecological value. The Environmental Impact Study undertaken required that comprehensive contamination investigations be carried out and all waste from the site be chemically characterised to determine suitable disposal options. The Environmental Assessment was assisted by historic records from ICI who had commissioned the drilling of boreholes on the site over a period from 1951 – 1979 that provided detail on the nature of deposits on site. Spoil from the site was predominantly disposed of via Landfill.

The benefits of this scheme were that it provided a necessary public amenity that replaced outdated provision, on a site that was acceptable to the public, and fitted in with local plans and reused land that had been stood unused for some time. It is a shared amenity for four of the now Unitary Authorities in the Tees Valley.

Negative elements of the scheme are that it relied too heavily on landfill. This is a less viable option in current day terms as Legislative controls and cost have increased. The previous incinerator was placed closer to the main transport corridors than its replacement. The replacement is not as accessible and some authorities have longer journeys than previously to deposit municipal waste.

Some larger scale developments have been in preparation for a number of years and have only come to fruition following long-term decontamination and preparation of sites and Single Pot funding becoming available. The problems and delays have usually been funding. Private investment in redevelopment is more easily secured for Greenfield sites or

pre-remediated sites and Local Authorities cannot always able to fund or take on the liability for contaminated sites.

QUESTION 3 – What are the barriers to improving DUN land

In most cases where it has been economically viable to bring land back into use, then this has been done by commercial enterprises. Barriers in bringing land back into use are issues such as negative equity; i.e. the land costs more than it will be worth following remediation. Available funding streams often stipulate outputs that would not be achievable from the type of project envisaged. A requirement of being granted funding is often that jobs must be created and this cannot be achieved through greening land to improve the image of the area.

Ownership that is remote from the site can also create problems. The international nature of the chemical sector can mean that decisions on justifying and sanctioning expenditure are made at a remote location with no appreciation of wider local issues. Often the cheapest option is to leave land sitting inside a security fence where it poses little threat. The unknown content of DUN land and the potential liability may require evaluation of potential hazardous and safety precautions before anything can be done with the site. This can provide a disincentive to do anything other than leave it inside the security fence.

QUESTION 4 - Policies or regulations that help or hinder improving DUN land

- planning
- environmental
- polluter pays
- cost of disposal
- policies or regulations which need amending or to be introduced

Positive comment:

The Tees Valley Structure Plan (adopted February 2004) contains a number of broad policies that encourage the redevelopment and recycling of derelict and underused land, including redundant chemical industry land. Regeneration of both urban and rural areas is a key aim. The Plan encourages maximising the reuse of previously developed land, the renovation and refurbishment of existing buildings, and the reclamation and reuse of derelict land.

This aim is supported through the spatial strategy of the Plan. This aims to guide the majority of new development to within existing urban areas with preference given to previously developed sites, particularly along the Tees Corridor.

The plan also recognises the importance of the chemical industry to the economy of the Tees Valley and identifies a number of main locations where potentially polluting or hazardous industrial development is appropriate, although no new land is identified.

Other relevant policies in the Plan include:

- Encouraging measures to improve biodiversity and contribute towards BAP targets (ENV3a)
- Improving the urban environment by encouraging redevelopment and reuse of vacant and derelict sites, including landscaping and management (including wildlife habitats) where appropriate (ENV21)
- Where derelict and disused land is unlikely to be developed in the short term sites should be used for suitable temporary uses, including new recreational and wildlife habitats (ENV22)
- Encouraging renewable energy projects, subject to meeting certain criteria (EN2)

The pressure to increase and improve the Biodiversity of the area has worked to ensure that previously utilised land is given over to nature conservation on the back of protecting certain habitats or species or providing "green spece" in areas of need.

Negative comment

There has been pressure to de-allocate or re-allocate industrial land in the Tees Valley to reduce an over-supply and bring the employment land portfolio more into line with current and potential requirements. However there is also a view that de-allocation or re-allocation may give a negative impression to both existing companies and potential investors (often multi-national companies in the petro-chemicals sector) regarding the commitment of local authorities in encouraging future investment. A representation has therefore been made to the submitted Regional Spatial Strategy (RSS) for the North East (which will eventually replace the Tees Valley Structure Plan) for greater commitment to be given to supporting and providing alternative 'soft' end uses for such land, including nature conservation and 'greening'. Dual designation of sites for both nature conservation and industry has worked in the Tees Valley in the past and recognition in the RSS could help to support local authorities and other organisations in seeking funding for the treatment of such sites.

QUESTION 5 - How are ownership, management, maintenance and liability problems dealt with

QUESTION 6 – What financial support is available in dealing with DUN land

- grant aid or subsidy
- other funding
-

Tees Valley is mainly a European Objective 2 area and ERDF funding has been utilised in combination with Single Pot funding from the Government to fund remediation and development work of DUN land. The availability of European funding will decrease post 2006. It is expected that additional funding will become available through a UK Government project called the Northern Way, which aims to reduce the gap in economic performance between the southern and northern areas of the UK.

Some additional funding is available from English Partnerships and from Landfill Tax Credits.

QUESTION 7 – What is the relationship between authorities and chemical companies

- are there groups working together – give examples
-

The North East Process Industry Cluster (NEPIC) works closely with the Local Authority and are active members of the Authority run Development Initiative for Chemical Dependent Areas (DICIDA). Two way exchanges of information occur between NEPIC and the Tees Valley Joint Strategy Unit on a regular basis.

Industry representatives have also been collaborating closely with the Tees Valley Joint Strategy Unit on influencing the development of REACH proposals. Regular meetings and electronic communications have led to the development of Position Papers and briefing sessions with European, National and Local Politicians on the proposed Regulation. The

Centre for Process Innovation have also been closely involved in collaboration on the issue of REACH and they are also supportive of the work of the DICIDA network.

The Industry Nature Conservation Association (INCA)[3] brings together representatives of the Chemical companies and the relevant authorities in round table discussions over the use and utilisation of land. Both sides use INCA as an informal and non-threatening forum for discussion about proposals.

QUESTION 8 – Do chemical companies work together on DUN land

– give examples

In 1988 the Industry Nature Conservation Association (INCA) was founded by the then Nature Conservancy Council and ICI to address the problems and opportunities of nature conservation in the industrial areas of the Tees Valley. Members of INCA include industry representatives, local authorities and regulatory and conservation organisations. The Association aims to ensure that industry growth occurs in partnership with nature conservation.

With representatives from most of the chemical companies in the Tees Valley, INCA acts as a forum for exchange of ideas and good practice. Companies will share the cost of some INCA projects – e.g. where a project is sited on land owned by one company and paid for by another.

QUESTION 9 – What viable technologies are there for retaining contaminants on site

- technologies used in the region

Bioremediation (the degradation of hydrocarbons through microbial action has been successfully used by the RDA on large coalification sites for a number of years (e.g. Hawthorn Colliery). Soil washing has been used to treat chemically contaminated dredged sediments (Middlehaven).

- technologies proposed in the region

The BioReGen Project (See Question 2) is a proposed method of managing contaminated sites without excavation and removal. Long-term energy crop production is likely to assist with the in situ passive remediation of contaminants in the surface soil zone.

- research work in hand

Laboratory-based research on soil-washing using biosurfactants (microbial secretions) is underway at CLEMANCE on behalf of DEFRA to investigate the extension of this established process-based method of soil remediation to more difficult organic contaminants in soils and other granular hazardous wastes.

[3] http://www.inca.uk.com/

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Topic 5 Land Improvement Questionnaire

Case study: Water's Edge Country Park

Question 1: What DUN chemical industry land is there in the region

- **what is the scale (ha)**
- **are there common site histories and problems**

Waters' Edge Country Park is located at grid reference TA032231 adjacent to the Humber Bridge on the south bank of the Humber Estuary. The site consists of approximately 86 acres of mixed wildlife habitat including open water, reedbed, wet grassland and woodland habitats. The recently completed state of the art visitor centre with opportunities for environmental education as well as commercial office space will be officially opened in early 2006.

Until 1983 the Waters' Edge site was the location of an agrochemical production plant. Upon closure of the plant, the site was sold to Glanford Borough council. In later years the site was determined to be heavily contaminated with a range of substances from residual fertilizers to heavy metals. This lead to problems with eutrophication of local water courses and pH ranges from 2.4 to 9.9.

Given the site's proximity to the Humber Estuary, which is recognised as being international important for wildlife, and the potential for pollution of the underlying chalk aquifer, the owners (now North Lincolnshire Council) were required to carry out works to remediate the contaminated areas of the site.

QUESTION 2 What work has been done in dealing with DUN land

- **examples of success and failure**

The remediation of the Waters' Edge site was carried out by removing the contaminated soil to landfill. The landfill site was then capped using clay purchased from nearby land owned by Lincolnshire Wildlife Trust. This method of remediation afforded a number of opportunities to create new wildlife habitat.

Firstly, the areas where contaminated soil was removed from Waters' Edge are now water bodies and reedbeds adding to the already significant resources of these habitats in this area. Secondly the area of Lincolnshire Wildlife Trust land where clay was sourced from has been planted with reeds as an extension to the Far Ings Nature reserve. Finally the capped landfill site is being sown with a plant species mix which will in time create lowland heath / acid grassland habitat, which is characteristic of the area around the landfill site. Surface water from the site was treated with activated carbon and passed through reedbed filtration systems installed in containers on site.

There have been a number of positive spin-offs from carrying out the remediation work:

- The site is now developing into valuable wildlife habitat part of the new Country Park has already been notified as a Site of Special Scientific Interest for its breeding bird community.
- The construction of the visitor centre has attracted business into the area as well as improving the area for the local community.
- Water quality on the site is now the same as for other water bodies in the area.

QUESTION 3 What are the barriers to improving DUN land

The main barriers in this case were the complexities involved in drawing together the funding package to allow the project to go ahead.

QUESTION 4 What policies or regulations help or hinder improving DUN land

- **planning**
- **environmental**
- **polluter pays**
- **cost of disposal**
- **policies or regulations which need amending or to be introduced**

The proximity of the site to an internationally important wildlife site meant that the Habitats Regulations had to be adhered to. Whilst this did not prevent the project from going ahead, restrictions were placed on working period to prevent disturbance to the area's wildlife.

In this case the polluter pays principle was not applicable as the site was sold to Glanford Borough Council prior to the contaminated land regulations coming into force. There was only a relatively small financial input into the remediation works from the original owners.

The planning process was seen as fairly straight forward, although it was time consuming.

The costs associated with disposal of the contaminated material were reduced as the receptor landfill site was owned by North Lincolnshire Council.

QUESTION 5 Previous DUN land can have low commercial value leading to long term ownership and maintenance problems. How are

- **ownership**
- **management**
- **maintenance**
- **liability**

handled

The Waters' Edge site is owned and managed by North Lincolnshire Council, therefore all liabilities lie with the council. It is intended that the construction of the visitor / business centre will in time help to offset some of the costs of both the remediation work, as well funding the ongoing management of the site's developing habitats.

QUESTION 6 What financial support is available in dealing with DUN land

- **grant aid or subsidy**
- **other funding**

A number of different funding sources were used at Waters' Edge, these include:

- Single Regeneration Budget
- Landfill Tax credits - a contribution from the site's original owners was used as match funding to help secure these funds
- European Regional Development Fund
- Yorkshire Forward (the regional development agency) funds
- North Lincolnshire Council's own funds
- DEFRA Supplementary credit for dealing with contaminated land.

QUESTION 7 What is the relationship between authorities and Chemical companies

- **are there groups working together – give examples**

There are a number of groups around the Humber Estuary which promote close working between industries and regulatory authorities. These include:

Humber Chemical Focus (HCF) – an umbrella group for the chemical industry around the Humber Estuary which offers industry support in dealing with the implications of various legislation on businesses. Several sub-groups have been set up to deal with specific issues e.g. COMAH and regular meetings of Humber Bank Environmental Managers are held.

Humber Industry Nature Conservation Association (Humber INCA) – a membership organisation with members from industry, regulatory authorities and NGOs. Humber INCA's main goal is to help find a balance between the needs of industry and the needs of wildlife around the Humber estuary and thereby help industry to meet its wider obligations relating to the environment. Humber INCA is based in the new Visitor centre at Waters' Edge.

National Industrial Symbiosis Program (NISP) – set up to help find more sustainable solutions to waste management and resource location problems faced by industry. The main focus of NISP is that the 'waste' product from one industrial process may become the raw material for another. By linking up industries with matching waste/raw material outputs/requirements NISP helps to deliver sustainable development and improve industry's efficiency.

QUESTION 8 What is the relationship between Chemical companies – do they work together to improve chemical industry DUN land particularly related to sharing experience – give examples

As question 7.

QUESTION 9 What viable technologies are there for retaining contaminants on-site

- **technologies used in the region**
- **technologies proposed in the region**
- **research work in hand**

In this case all contaminants were removed from the site as this was seen as the most cost effective solution.

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Report No 5133

Experience and Best Practice in Land Improvement; Ida-Viru region, Estonia

Derelict land from former chemical industry

Responsible composer

Karl Kupits

Tallinn
2005

Report is composed in Maves Ltd

Member of management board Mati Salu

Composer Karl Kupits

Report consists of 10 pages of text and 4 maps.

INDEX

1 METHODOLOGY

Aim of study was to find derelict, underutilized, or neglected (DUN) land and find possibilities for bringing these back to some form of beneficial use.

For finding these lands conversation with local authorities (Kohla-Järve, Kiviõli and Sillamäe city governments) and representatives of companies situated in former chemical industry areas (Silmet, Nitrofert, Velsicol Eesti, Viru Keemia Grupp and Kiviõli Keemiatööstus) were carried through. For identifying, questions concerning land use, remediation measurements and communications with others were asked. List of contact persons is presented in references chapter.

Legislation and barriers concerning improving DUN land has been taken from legislation and Maves's experiences.

In technologies section most often used practices has been described.

2 OVERVIEW OF TERRITORIES AND HISTORY

In Soviet time there were two companies classified as chemical industry:

1. Oil-shale industry in Kohtla-Järve and in Kiviõli
2. Factory No 7 (all factories with Soviet military interest had codenames) in Sillamäe.

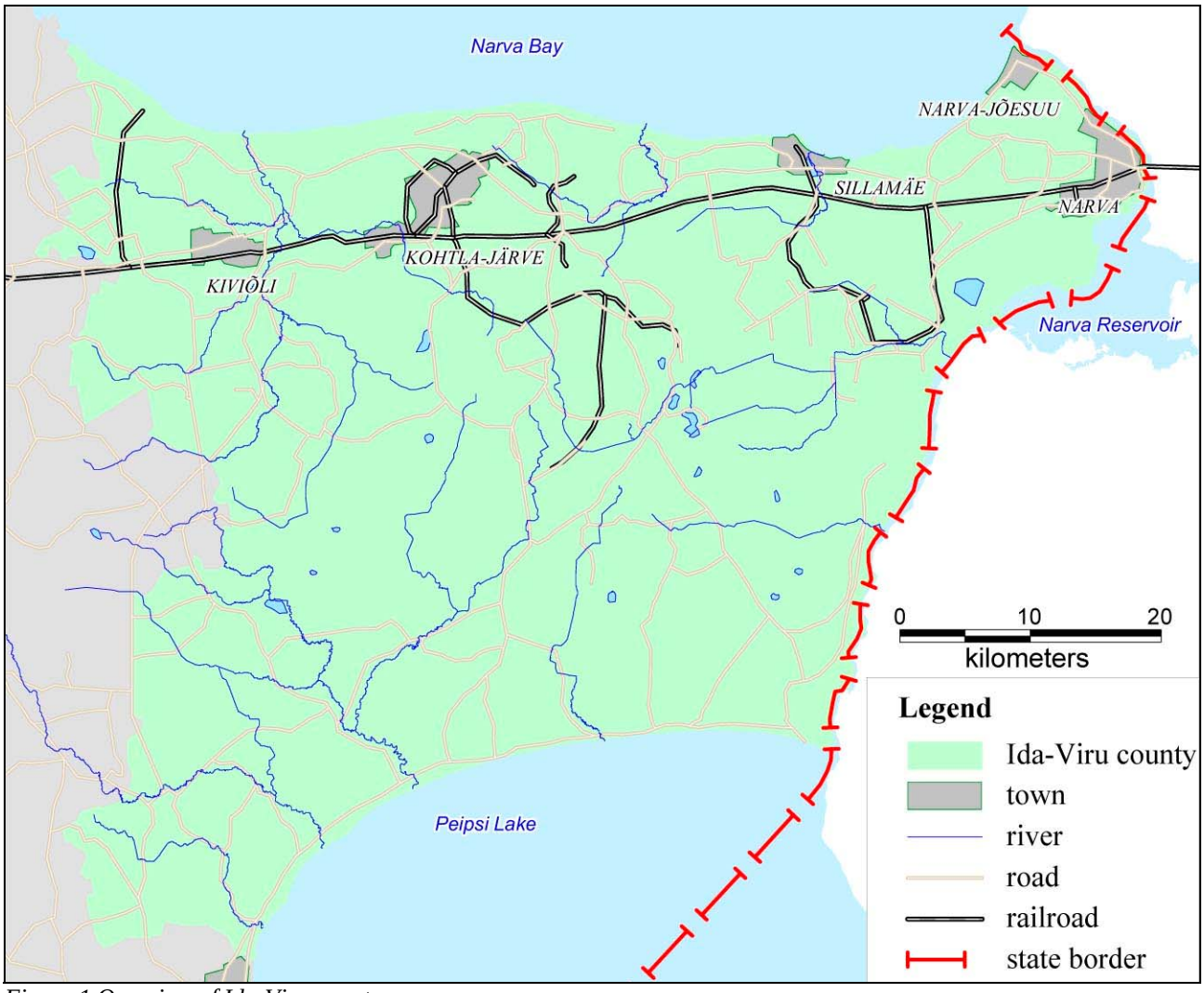

Figure 1 Overview of Ida-Viru county

According to inquiries from private companies and local authorities, unused land exists in oil-shale industry. As a sum approximately 79 ha (48.5 ha in Kohtla-Järve and 30.5 ha in Kiviõli) of unused land is in this region (see maps 1 and 2).

In factory No 7 approximately 9.8 ha has been estimated as land without use (derelict).

Brief history

Oil-shale industry

In May 1916 geological surveys were carried out for starting mining. 25th November 1918 Estonian oil-shale industry was established. After that many companies were formed and closed till occupation. Then all companies were combined in to one oil-shale industry. Productions were: varnishes, petroleum, oils, household gas, formalin and some other chemical compounds. Names and forms in occupation period changed several times ("First Estonian Oil-Shale industry", „Oil-Shale Processing Factory" etc). In re-independence AS Kiviter was formed in bigger part of the area, other part was divided between several chemistry enterprises (see previous chapter).

Factory No 7

Before II World War oil-shale factory was in Sillamäe. After war, in year 1945, "Factory No 7" was formed for producing uranium from dictyonema argillite. In 1952 dictyonema argillite mine was closed. Uranium ore was imported from East-Europe. From beginning of 1970 uranium was produced from concentrate derived by chemical enrichment. In 1980 additionally to concentrate the nuclear plants fuel was used for producing uranium. About 4 million tons of raw material was used. "Factory No 7" was renamed to Silmet and it stopped processing uranium. Sulphuric acid, bicarb, ammonia, ammonium hydroxide, ammonium carbonate and berthollet salt has been used in production process. In end of 1960s production of rare metals (Ce, Pr, Nd, Sa, Eu, Gd, Ta and Nb) from loparite, tantal, stannic slag, niobium hydroxide, electronic industry wastes (etc) was started. Sulphuric acid, ammonium hydroxide, ammonium carbonate, ammonium sulphate, barium nitrate, nitric acid and flour compounds were used as reagents in production.

Common problems

Common problems in oil-shale industry areas are related with contaminated Ordovician (O) and Ordovician-Cambrian (O-Cm) groundwater aquifer. It is problem in entire Ida-Viru County. Other problem is related with contaminated watercourses and soil. Both problems are derived from ash fields and semi coke fields. Most common pollutants are phenols and PAH (poly aromatic hydrocarbons).

Common problems in factory No 7 area are related with radioactive wastes (contaminated packaging, uranium from production process, pulp containing thorium and radium, solutions containing previously described element, contaminated protective equipments, solutions used for deactivating radioactive scrap metals). Highest radiation is on radioactive wastes landfill near coast. In some places problems with heavy metals may occur. In 1996 when three soil samples from potential contaminated areas were taken, the analyses didn't show contamination. Groundwater might be contaminated with nitrogen and heavy metals. Also there is possibility of oil pollution is some areas.

3 DONE WORKS DEALING WITH DUN LAND

Problem with pollution caused by activities in Soviet time (called past pollution) exist in entire Estonia. Most of past polluted sites are situated in Ida-Viru County it is because of dense industry in region.

In several former years surveys of past pollution sites has been carried out. Reports of these surveys give overview of environmental situation in these sites. Chemical industry is one part of these. List of other past pollution sites is presented in chapter 10.

There is no information about remediation works exactly on derelict areas. But there are general works on past pollution sites and measures adopted in chemical industry areas used by private companies.

Oil-shale industry

Since middle 1990s many surveys has been carried out for chemical industry area situated in Kohtla-Järve (monitoring of organic compounds on groundwater, monitoring of contaminated soil; surveys of semi-coke disposal, environmental audits etc). No other major measures have been adopted for remediation. Some measures for reducing contamination arising from today activities are in process. In former semi coke was transported on field (see map 2) and swept off with water. Sweeping is ended now. Thereby the amount of contaminated leeching water is decreased. In chemical factory in Kohtla-Järve, technology causing liquid wastes (contains phenols) flow to water courses (Kohtla river) has been changed. Depositing of fusses (heavy semi liquid oil-shale wastes) has been ended. Project for closing semi coke landfill (also in Kiviõli) is in beginning phase.

These few sites that are in state property are planned to be used as waste deposits or to be sold to private sector. Area in north of semi-coke field is planned to be used as wastes disposal area. Inert waste handling facility is designed to it.

For Kiviõli some surveys has been done (environmental audit, surveys of semi-coke disposal). No measures for remediation have been adopted. Some measures are adopted for reducing contamination arising from today activities. In 2001 pitch disposal to semi-coke field was ended. From beginning of 1998 water is not used for sweeping semi-coke on field.

One (older) of two biggest semi-coke fields (see map 1) is abandoned by chemical industry in Kiviõli. Skiing and recreation centre is planned on the field. Surveys to this plan have been carried out already. Despite of chemical compounds greenery grows on these fields and older one is opened to public for having view over Ida-Virumaa (highest created by man hill in Baltics). Because of this the land isn't included to list of land without usage.

Factory No 7

Landfill of radioactive wastes is in closure process (see map 3). Dams near shore are strengthened already. Closure works are in finishing stadium. End of landfills covering works are planned to year 2006. Because of active works it hasn't been included to list of lands without usage.

In one derelict area the landfill was planned by authorities but project was abandoned.

4 BARRIERS IMPROVING DUN LAND

Most important barrier for improving DUN land in Estonia is indefinite land ownership. Ownership sets responsibility.

As appeared from conversations with local authority, there is no restriction caused by contamination in chemical industry area.

Responsibility

Problems of responsibility occur in areas that have been used during independence time but were polluted in Soviet time. Most of such areas have changed owners several times since collapse of Soviet Union. Some of facilities have been bought as movables. In this case state remained as land owner and basically formal responsibility was still laid on state. There was no control of polluters and real responsibilities. Hence the question rises – who was polluter and land owner in time when pollution was caused (past pollution when Soviet time, pollution when in independence time).

Company is responsible for pollution caused by company itself and has to direct its activities on better environment. In practice it is not possible to induce company to remediate old (past) pollution. If buying or selling documents don't exist, then the owner of pollution is state.

In some cases at present problem between ownership of movable and immovable exist. For example on land used by Viru Keemia Grupp VKG basically the movables are owned by company and land is owned by state.

Some areas without usage are polluted by former and today activities. E.g. area between wastewater treatment plant (WWTP) and Kohtla-Järve Soojus is over moisture. Water and soil is contaminated in there. Probably it is caused by sewage pipe leakages connecting WWTP and VKG. It can be presumed that contamination was caused in Soviet time also and does it additionally today.

In other past pollution sites (e.g. asphalt-concrete factories) there is problem with people awareness. Cheap prise flatter people to by areas with past pollution. But certain responsibility is bought with land. If area contains facilities (e.g. reservoirs) which contain pollutants, then new owner has to guarantee that pollution doesn't spread anymore. Also neighbours have right to demand cleaning/remediation works if contamination has threat to their land.

In basics with land the ownership of pollution in/on it is bought also. Responsibility concerning past pollution in these areas depend on audits/expertises and agreements with authorities.

5 POLICIES OR REGULATIONS

General planning

It is suggested to use derelict sites as industrial areas or deposits (e.g. landfills). In general contaminated areas should be used by industry which may cause contamination itself. Such principle decreases possibility to pollute clean sites.

Kiviõli According to general planning in Kiviõli town main development potentials are education, social care, services, protection of environment and business development on basis of free production power and infra structure. Chemical industry area is seen to be as industrial land or industrial and perspective green and recreation area. Abandoned semi-coke field with derelict land in north of it (see map 1), is seen to be sporting and spare time area. Derelict land between old and new semi-coke field is seen to be industry and warehouse land. Derelict area in west of Kiviõli Keemiatööstus is seen to be green land. Derelict land in east of Kiviõli Keemiatööstus is seen to be land of social buildings.

According to phone conversation with of Kiviõli town government land expert, area of planned social buildings is in good status today (park). It was used as park in Soviet time as well, when it was part of oil-shale industry.

There is no exact information of pollution in other derelict areas in Kiviõli.

Sillamäe According to general planning in Sillamäe most of factory No 7 area is seen to be industrial territory. Between industrial areas net of green land is planned. Some area Silmet Ltd territory is set as wasteland according to general planning.

Business, trading and services area is planned to derelict site situated in east of factory No 7 territory. Derelict site in west of factory No 7 is seen to be industrial area.

General plan for Kohtla-Jäerve is in composing process.

Legislation concerning responsibilities

In Estonian Environmental Strategy one objective is the past pollution remediation. Many legislations set responsibility for caused contamination:

Constitution sets: Everyone has a duty to preserve the human and natural environment and to compensate for damage caused to the environment by him or her. The procedure for compensation shall be provided by law.

Water act sets groundwater protection general principles: The status of polluted, poor or bad, water shall be remedied by the polluter or, if it is not possible to determine the polluter, by the owner of the water body or, in the case of an aquifer, by the state.

According to administrative offences code, fines are set for infringement of soil and land protection. Today, fines are not equal with amount of damage.

Waste act sets that polluters shall compensate fully for the damage caused by the pollution. If a polluter fails to perform the obligation, the owner of the polluted immovable shall organise removal of the waste and remedy of the effects of the pollution resulting from the waste at the polluter's expense.

6 MANAGEMENT

Environmental legislation is moving to principle polluter pays but it doesn't have retroactive effect.

Now most area of former chemical companies is used by private companies (e.g. Silmet, Kiviõli Keemiatööstuse OÜ) or is in acquisition process (e.g. area of former washing powder factory in Kiviõli, enlargement of Remex in Kohtla-Järve). Basically in all these cases the question is, if past pollution is bought with land. It is recommended to make surveys or audits to fix land status before buying. In this case remediation of former (past) pollution is less complicated.

Problems with factories, that are remained the same from Soviet time (Kiviõli Keemiatööstuse OÜ, Viru Keemia Grupp and Silmet) are more complicated. In these companies owners have been changed but the production and land have remained. There is very difficult to draw the line between past pollution and pollution caused by current company/owner. For determine purposes according to former environmental impact assessment and environmental auditing act the environmental audit was mandatory for companies with high environmental risk. In the same act activities of high environmental risk were listed. It included production of substances through chemical processes. Now the act is not valid anymore and environmental audits are not mandatory.

Commitment to environmental audit is set in environmental management system. Implementing this system is voluntary.

All derelict land detected during this study is state owned.

7 FINANCIAL SUPPORTS

Past pollution remediation is supported under water protection and waste handling programme in Environmental Investment Centre.

Beside of this following possibilities are applicable:

It is possible to use company funds. For example, Eesti Energia does purification works regularly.

Local governments are usually capable supporting project only in minimum amount of self-financing – 10 % of works costs.

Because of big amount of liquidation of past pollution these works should be linked to other infrastructure projects. But all past pollution sites can't be related with bigger development projects. Because of this separate Cohesion found project for liquidation of past pollution sites is necessary.

Big past pollution remediation projects can be co-founded by international projects (closure of Sillamäe radioactive deposit).

In 2003 Ministry of Environment made proposal to link past pollution remediation to list of ISP TA projects. Today the proposal is accepted.

8 RELATIONSHIPS

In Sillamäe and Kiviõli no workgroups between authorities and chemical companies exist. All communications are through inquiries and answers on paper.

According to answer from Nitrofert Ltd in Kohtla-Järve the company belongs to one working group formed by city authority (details not specified).

Communication between private companies is inactive. It means that there are no active groups or meetings between them. If any activity concerning company interests is planned, then representatives of enterprise are participating in it.

In Estonia the federation of the Estonian chemical industry exists. It is a non-profit organization that represents its members in government organizations, participates in creating relevant legislative acts, develops international relations, changes information, organizes co-operation with the similar organizations and cambers of commerce in other countries, looks for co-operation partners, supports common activities and provides training.

From Sillamäe Silmet is member of federation. Silmet is situated in former factory No 7 territory.

From Kohtla-Järve Nitrofert, Velsicol Eesti, Viru Keemia Grupp, Viru Liimid and TTÜ Institute of Oil Shale (deals with development and research of oil shale processing and products) are members of federation. All these, except TTÜ Institute of Oil Shale is situated in former oil-shale territory.

From Kiviõli the Kiviõli Keemiatööstuse Ltd is member of federation. Kiviõli Keemiatööstuse Ltd is situated in former oil-shale industry territory.

9 AVAILABLE TECHNOLOGIES

In some areas most important move for reducing contamination is to verify pollutant and eliminate it. For example it is necessary to exchange sewerage pipe connecting WWTP and VKG. Most probably today this is the cause of contamination in the area. Project of Kohtla-Järve storm water and sewage drainage system is in process now.

In some cases because of too high expenses it is not advisable to remediate pollution but to isolate it from environment. For example semi-coke landfill in Kohtla-Järve (isn't derelict today but will be abandoned soon) will be covered with screen. After covering, the greenery will be planted on it. Name of project is Closing Down of Industrial waste and semi-cocke landfills in Kohtla-Järve and Kiviõli 2003/EE/16/P/PA/012. So part of it can be opened for public use (hill in relatively flat Ida-Viru county gives good view and alternation).

General remediation technologies can be divided in two sections removal and remediation on place (in situ).

<u>Removing possibilities</u>

It is possible to excavate contaminated soil and send to hazardous wastes landfill, burn or compost. Hole can be filled with clean soil.

Plusses are: guarantee of clean soil on place and short time of receiving result.

One of minuses is that water can't be cleaned this way.

<u>In situ</u>

Bio-ventilation is not common practice in Estonia (but it is used for example in Tallinn). Soil is ventilated with air (in some cases specific gels with addition of natural bacteria flora, nutrients and

oxygen are used). For ventilation numerous drilling holes are needed (ones for pumping air in and ones for sucking it out). In this case certain soil porosity is needed. It is applicable in sands and gravels. Mostly it is used in places which are situated shallowly between some constructions and where excavation works can't be done. In this case result can't be received in short time (it may take even years).

Product named Bio-Gel™ is useful for poly aromatic hydrocarbons, chlorinated solvents, cyclic hydrocarbons, gasoline and oil products, organic cyanide, heavy metals and strong acids.

For cleaning groundwater there is possible to pump it out and clean from oil fraction. Purifying groundwater to its natural level is mostly impossible. Time of result is quite long because contamination in groundwater spreads quickly to large area and gathering all contaminated water takes time. If groundwater is close to soil surface, then it is possible drain the water and direct to oil separator. It is possible to direct contaminated water to WWTP. It depends on WWTP properties.

In any cases areas with contaminated soil should be drained for avoiding pollution spreading to other areas by water.

10 OVERVIEW OF PAS POLLUTION SITES IN IDA-VIRU COUNTY

Most important past pollution sites in Ida-Viru county are shown in table and in map 4.

SETTLEMENT	NAME	CONTAMINANTS
Jõhvi town	Oil-shale mining No 2 wallrock disposal	oils-shale tailings, PAH, phenols, oils
Kohtla municipality	Kukruse oil-shale mining wallrock disposal	oils-shale tailings, PAH, phenols, oils
Kohtla-Järve town	Käva 2 oil-shale mining wallrock disposal	oils-shale tailings, PAH, phenols, oils
Kiviõli town	Kiviõli semi-coke field	oil-shale oil, phenols, toluene, xylene, styrene, naphthalene, PAH,
Kohtla-Järve town	Ahtme mnt 86 asphalt concrete factory	oil-shale oil, bitumen, asphalt, light fuel oil
Kohtla-Järve town	Ahtme mnt 86 asphalt concrete factory	oil-shale oil, heavy fuel oil, naphtha products, bitumen
Kohtla-Järve town	Rutiku wallrock disposal	oils-shale tailings, PAH, phenols, oils
Kohtla-Järve town	Sompa oil-shale wallrock mining	oils-shale tailings, PAH, phenols, oils
Kohtla-Järve town and Lüganuse	Kohtla-Järve semi-coke field	oil-shale oil, phenols, toluene, xylene, styrene, naphthalene, PAH
Narva town	Narva asphalt concrete factory	bitumen, oven fuel, heavy fuel oil, naphthabitumen, asphalt
Narva town	Balti Powerplant ashfields 1 and 2	oil-shale bottom ash, water with high pH, naphtha products, PAH, phenols, CrVI
Sillamäe town	Radioactive wastes disposal	heavy metals, radioactive wastes, acids, chlorides, fluorides
Vaivara municipality	Eesti Powerplant ashfield	oil-shale bottom ash, naphtha products, phenols, PAH, VOC
Vaivara municipality	Ida-Viru naphta base	naphtha products, phenols, aromatic compounds

11 REFERENCES

1. Regulation of Kiviõli town council 26.04.2001.y No 21 Kiviõli linna üldplaneeringu kehtestamine.
2. Regulation of Sillamäe town council 26.09.2002.y No 43/102-m Sillamäe linna üldplaneeringu kehtestamine.
3. Regulation of Sillamäe town council 30.09.2003.y No 14/28-m Sillamäe town development plan.
4. Ohtlike jääkreostuskollete kontroll ja uuringud. Maves Ltd. November 2004, Tallinn.
5. Ohtlike jääkreostuskollete järelvalve ja kontroll (asphalt concrete factories). Maves Ltd. October 2003, Tallinn.
6. Ohtlike jääkreostuskollete järelvalve ja kontroll. Maves Ltd. February 2002, Tallinn.

Contact persons

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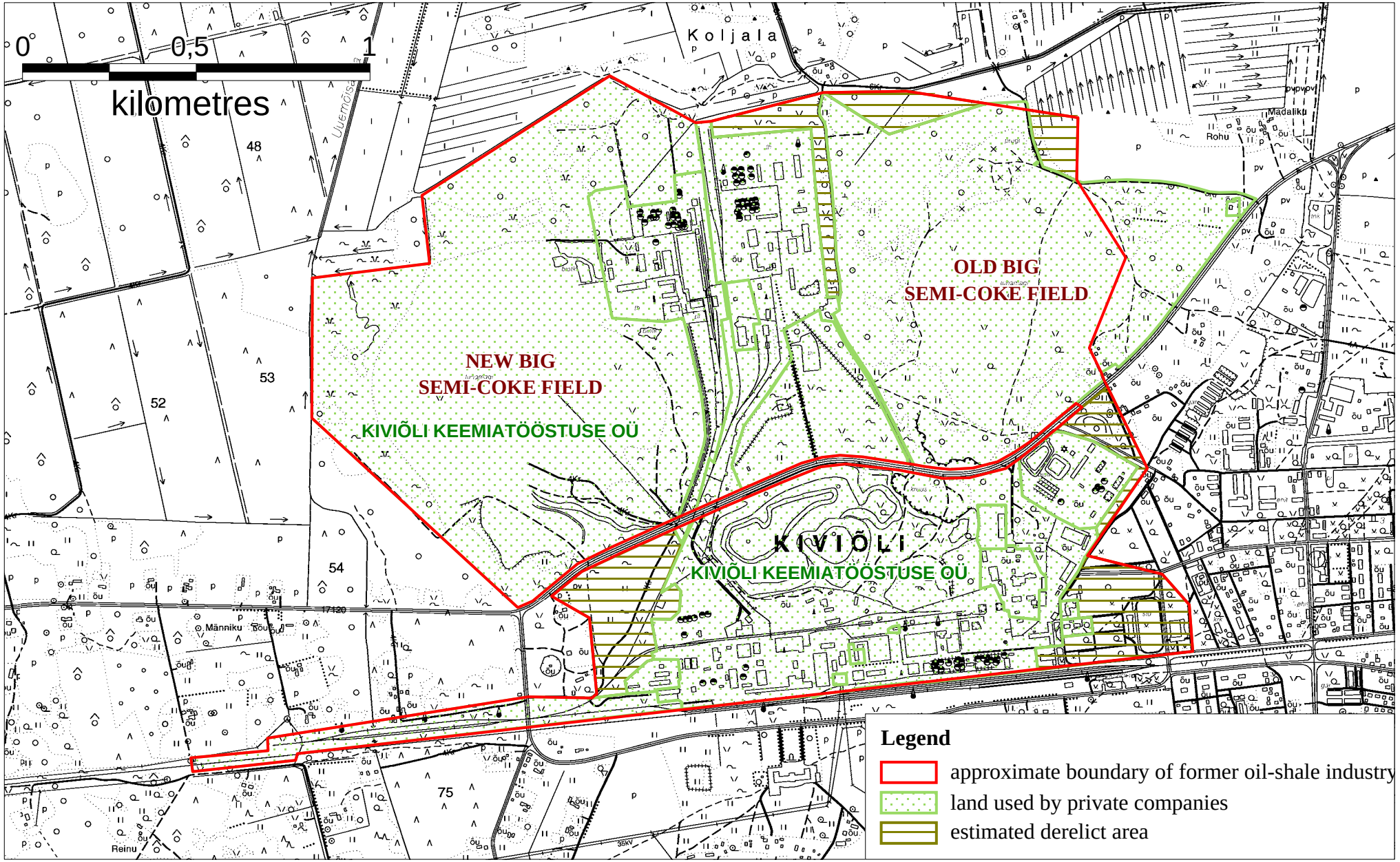
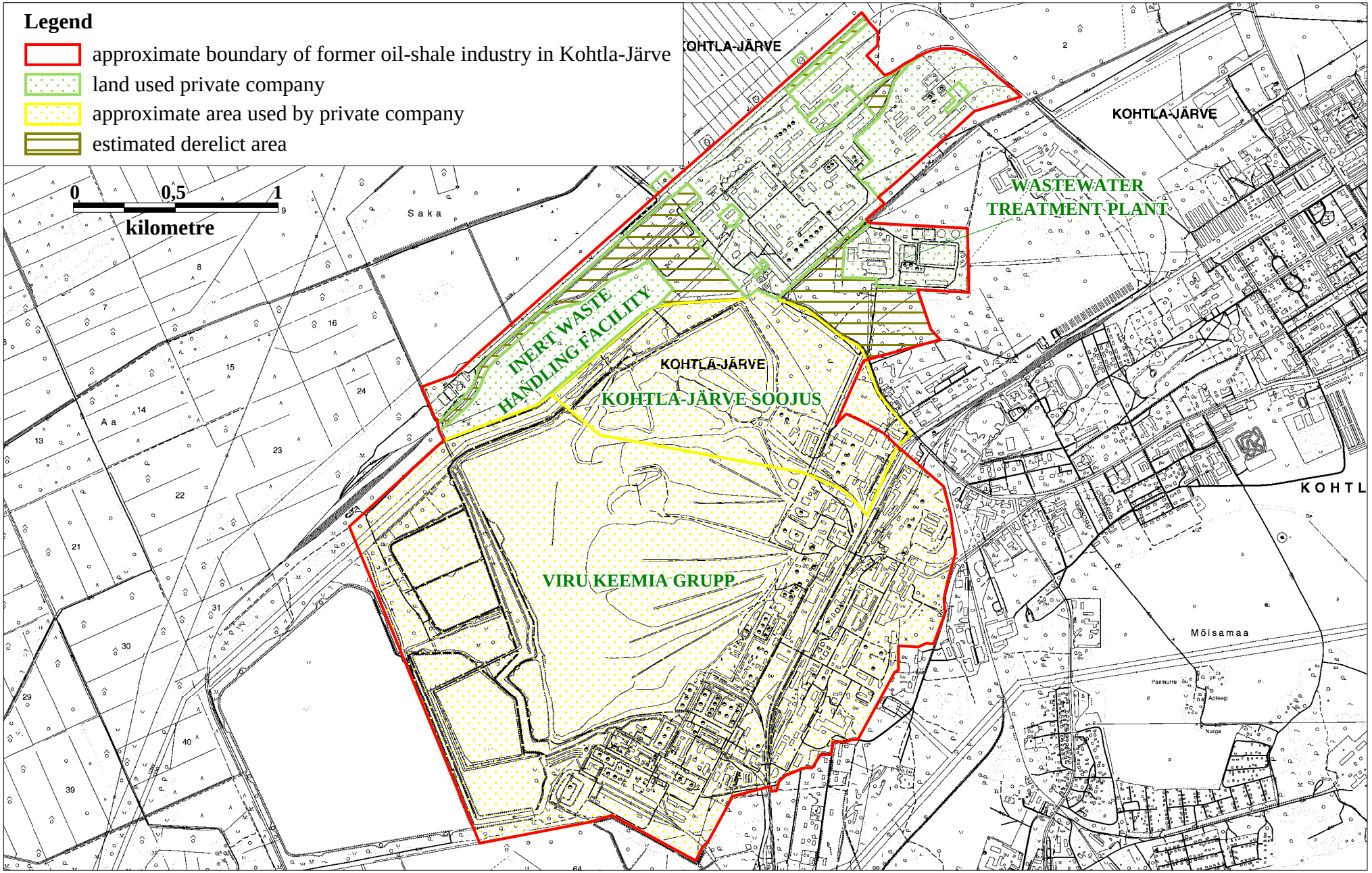
Kersti Salulaid – chief specialist in environmental issues. Kiviõli Keemiatööstuse Ltd, phone 335 9559

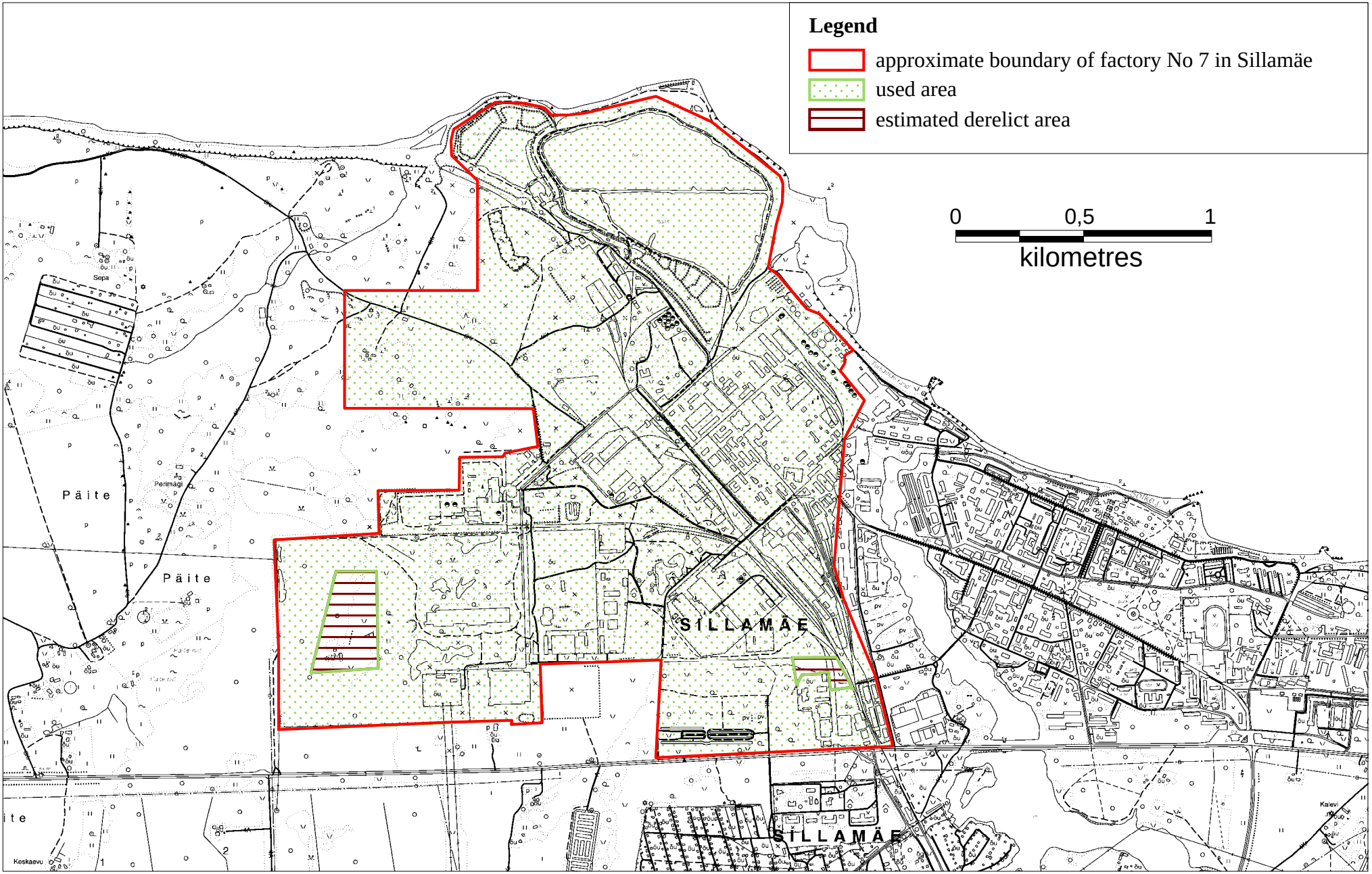
Aleksei Nikolajev - director general. Nitrofert Ltd, phone 337 8310



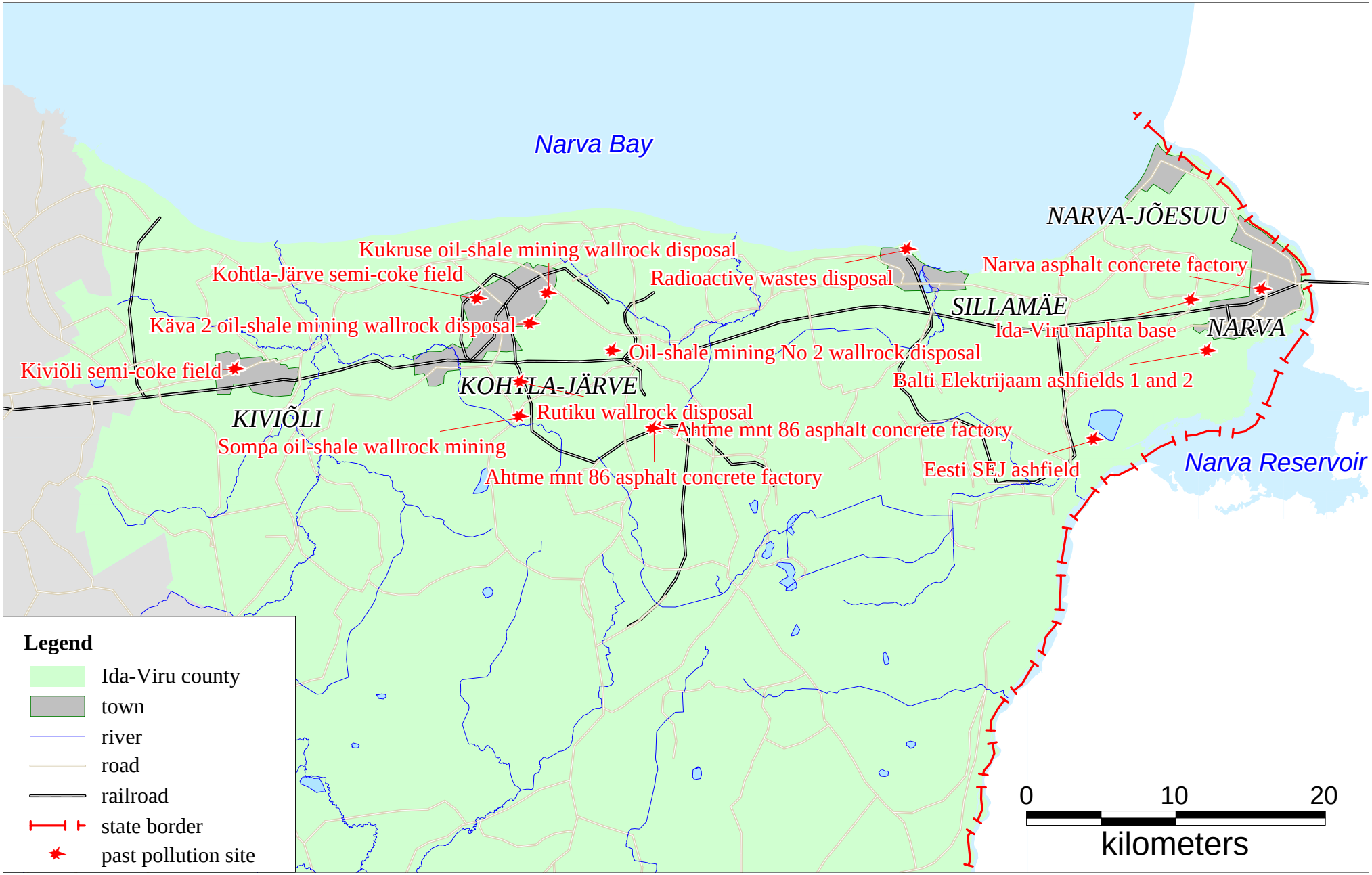
Map 1 Oil-shale industry in Kiviõli town SCALE 1 : 15 000



Map 2 Oil-shale industry in Kohtla-Järve town SCALE 1 : 20 000



Map 3 Factory No 7 in Sillamäe town SCALE 1 : 20 000



Map 4 Past pollution sites in Ida-Viru county

The Sillamäe radioactive tailings pond remediation

Background

The Sillamäe Metallurgical Plant was built in 1946...1948 to meet needs of Soviet nuclear program.
Since plant's launch until early 50s local Estonian alum-shale, containing about 0.026% of uranium, was processed; later the production was switched to richer ores from Central and East European countries.
Uranium ore processing continued to 1977, totally 4,013,000 tons of uranium ore was processed at the plant. Since late 70s to 1990 the plant refined nuclear fuel (enriched uranium) which had been produced in Russian plants.

Until 1959, when the tailing pond was established, the waste from the processing was transported to a marine terrace nearby the plant and stored just on the surface. The tailings pond, located at the shore of the Finnish Gulf, has been constructed on a slope, consisting of several layers, tilted into the direction of the sea. The pond covers an area of nearly 50 ha, with a built-up height of about 25 m (see photo below).

The tailings pond contains about 12 million tons (about 8 million m^3) of waste. Based on estimates, the pond contains 6.3 million tons of uranium processing residues and 6.1 million tons of oil-shale residue and waste from processing of loparite. These wastes contain some 1,830 tons of pure uranium and 850 tons of thorium. The total amount of radium is estimated to 7.8 kg, corresponding to 2.9×10^{14} Bq of ^{226}Ra.

Environmental concern

Measurements showed that the dam of the tailing pond was sliding down along a layer of clay into the Baltic Sea. The waves of the sea, at high tides and in bad weather, attacked the foot of the dam. As this wave activity could have enhanced the sliding of the dam, stabilization the dam was considered necessary to prevent the collapse of the dam and subsequent landslide of the tailings pond into the Baltic Sea.

A second problem encountered that the pond behaved as a large-scale filter: water entering the pond moved rather quickly into the sea through the tailings and gravel layers, located at the bottom of the pond.
Rainwater and wastewater seeped through the tailing pond and this seepage resulted in a continuous flow of various pollutants to the Baltic Sea.
The annual discharge of nitrogen from the tailing pond – calculated ca 1200 tons annually in late 1990s made the pond one of the largest point sources of nitrogen to the Baltic Sea in Estonia.

Remediation initiative

After the end of Soviet period, Sillamäe tailings site appeared to be in unique position: country, responsible for creating environmental damage – Soviet Union - existed no longer.
At the same time it was obvious, that Estonia remains responsible for its entire territory, including historically contaminated sites, even if they could have become a property of a private owner.

In summer 1997 Dr. Tõnis Kaasik – as an experienced environmental expert – was invited by Estonian Government and Silmet Group to initiate a project for remediation of Sillamäe tailings pond, to create relevant institutional framework and work out a master plan.

In July 1998 on initiative of Dr. Kaasik, Estonian Government issued an order to establish a public-private partnership company Ökosil Ltd for carrying out preparatory work and being responsible for implementation of Sillamäe tailings pond remediation project.

Legally is Ökosil Ltd a joint venture, owned 35 % by the Government of Estonia and 65% by Silmet Group. The main task of Ökosil was the decommissioning and environmental remediation of radioactive tailing pond and other contamination in the territory of the same uranium complex; it was foreseen that ÖkoSil would act as the project co-ordination and implementation agency for all remediation steps. It was also clear that Estonia was not able to solve the problem by itself because of lack of pertinent experience and funds for the financing of this project.

In late 1997 the Sillamäe International Expert Reference Group (SIERG) was organised which united experts of Nordic countries through which Dr. Kaasik

introduced the nature of the Sillamäe problem to wide International audience.
As the follow-up to the above, an Advanced Research Workshop was carried out under auspices of NATO in October of 1998, which brought together already experts all over the world.
Co-directors of the Workshop were Dr. Kaasik and Cheryl K. Rofer from the Los Alamos National Laboratory, USA.

The international forum grew quite naturally over to a circle of deeply interested parties, willing to financially contribute to solution of this environmental problem: the first meeting of project financers took place in early summer 1999 and already in autumn 1999 a Memorandum of Understanding was signed in Tallinn on Sillamäe radioactive Tailings Pond Remediation Project implementation, bringing together governments of Estonia, Finland, Sweden, Norway and Denmark, as well as the European Union.

Remediation planning

The concept of Sillamäe radioactive tailing pond remediation foresaw following steps to be taken:

- shore protection
- dam stabilization
- control of the ground water inflow from hinterland
- reshaping, contouring and covering of the tailings

Technical solution and financing

Technical solutions were site specific, selected after thorough screening and evaluation for each of the above described remediation steps:

1. Shore protection – construction of the shore protection embankment – a gravel dam (4.5 m above sea level) with granite reinforcement on sea-side, along the entire wave activity endangered shoreline;

2. Dam stabilization – placement of the double row of piles on the coast, sea-side of the dam. More than 400 reinforced concrete piles of the 0,6 m diameter and 15...18 m length were placed into the pre-drilled boreholes;

3. Control of the ground water inflow – concrete-bentonite diaphragm wall with the width of ca 0,6 m and length of ca 500 m and a deep drainage trench, preventing ground and surface water inflow from the hinterland (opposite to the sea-side) was constructed;

4. Reshaping, contouring and covering of the tailings – the minimal reshaping of the dam by cutting off the crest of the dam, combined with shallow valley contouring

of the tailing pond surface and a final cover.

The works started in 1999 shall be ongoing till late 2007.
The estimated total cost of the favored set of options is ca EUR 20 million.

The financing scheme is based on a projected cost with the following elements:
- Estonian Government allocations;
- Grants from bilateral donors; Denmark, Finland, Norway, Sweden;
- Grant from the Nordic Environment Finance Corporation (NEFCO);
- Loan from Nordic Investment Bank (NIB);
- European Union grant.

Achievements / milestones

- By spring 2004 the nitrogen discharges from the tailings pond have decreased from 1200 t/a to negligible; effluents to the pond were completely stopped and pipelines dismantled in late summer 2003;

- Plant has implemented a new waste management system, which involves production start of two new secondary product from former waste – ammonium fertilizer and ammonium bi-floride. Plant current discharge meets Helcom recommendations for chemical industry;

- The tailings pond shoreline is secured, dams are stabilized and water inflow from hinterland is stopped;

- All remediation measures before final cover placement were completed by autumn 2004:

  - ✓ shore protection
  - ✓ dam stabilization
  - ✓ control of the ground water inflow from hinterland
  - ✓ reshaping, contouring and interim cover placement

  The tailings pond top surface is covered with interim cover (up to 13 meters in middle part), rain water inflow into the tailings pond is terminated and seepage of nutrients and other soluble pollutants to the Baltic sea stopped; the radioactive dust emission is stopped (see photo below);

- Placement of the multi-layer final cover was started with material investigations and test-field construction in late autumn 2004 and has been ongoing with more testing through spring and summer 2005.

International recognition

It was well understood from the beginning of the project, that without considerable support from the European Union and bilateral donors this international environmental problem could not be solved.

The European Union financed through Phare LSIF the first phase of the project – tailings pond dam stabilisation works.
These works were successfully completed by spring 2003 and highly evaluated by European Union project auditors.
As the follow-up to the successfully completed project, the achievements were presented as EC Phare exemplary project at the international dissemination workshop in spring 2004, which was targeted to international stakeholders and interested community in both Central and Eastern Europe, as well in the Commonwealth of Independent States.

Huelva

Territorial Improvement In the Chemical Industry of the Province of Huelva

Scene of the Industrial Area “Punta del Sebo” from the city of Huelva
Foto C. P.

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Instituto de Desarrollo Local
Group of Research of the University of Huelva

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Images and maps

1. Presentation

Introduction

The definition of Chemical Region of the "European Chemical Region Network" (ECRN) corresponds with those spaces where the Chemical Industry plays a determinant role in the economic structure, its growth and employment. Undoubtedly, a province like Huelva enters in this definition. Nevertheless, the differences are great if we refer to one or other depart of the provincial geography. In spite of it, the interrelationships and synergies untied around the industry of the capital and surrounding area are evident and manifest in the whole province, and its economy might not be explained without this presence.

The County Council of Huelva (*Diputación de Huelva*) forms a part of the European Chemical Region Network (www.ecrn.net), a net coordinated by the German region of Sachsen-Anhalt, which agglutinates 14 regions of the whole Europe that possess a strong presence of chemical industry: Sachsen-Anhalt, Niedersachsen y Nordrhein Westfalen (Germany); Mazowieckie (Poland); Ida-Viru (Estonia); North-East and North-West of England (United Kingdom); Limburg (Nederlands); Piemonte and Lombardia (Italy); Cataluña, Asturias and Huelva (Spain).

Inside the program of activities and objectives that are proposed in the Network, the completion of several studies is expected, about different subjects, in which there is realized an analysis of the current situation in the province of Huelva, as contribution to one `report of benchmarking' of supra-regional character. Likewise, there is foreseen the celebration of two meetings of local character by the principal actors and social involved agents.

To make concrete these studies and under the Agreement *Diputación* - University of Huelva, a contract was signed by the Institute of Local Development (*Instituto de Desarrollo Local*), Group of Research of the Andalusian Plan of Investigation (PAI), to carry out research on "the territorial improvement of the chemical industrial space in the province of Huelva".

Process of extraction of the copper in Riotinto's Mines
Foto C. P.

Objectives

The research takes as a general objective the identification of the experiences and practices in recovery and restructuring of chemical-industrial spaces that constitute a frame of reference, economic, social or ecological, for the future improvement of the industrial spaces nowadays in use.

Also, some specific objectives are prosecuted:

- To identify and calculate the chemical-industrial area in disuse or little used.
- To analyze the reasons of abandon of the chemical-industrial space.
- To examine the unsuccessful or successful works and technologies of recovery.
- To study the existing obstacles and impediments for the improvement of the areas in disuse or little used.
- To observe the politics and regulations of the territorial planning that should concern the industrial spaces.
- To check the management, the maintenance, the property and juridical responsibility of the areas.
- To indicate politics and legislation that should be modified for a suitable territorial improvement.

Methodology

The Group of Research *Instituto de Desarrollo Local*, whose professionals come essentially from Geographical Regional Analysis, approaches the territorial studies in three different stages. A first one of analysis, a second of diagnosis and the third one of proposals.

The stage of the territorial analysis relies on powerful instruments of spatial recognition, to turn the information into knowledge, such as the aerial photography, cartography, images satellites and Geographic Information Systems. Nevertheless, it is not an homogeneous stage, since in it, three phases can be differentiated:

-Phase of compilation of documentation: Images, cartography, statistics and bibliography.

-Phase of social and territorial contacts: Interviews with responsible actors for the industrial development and fieldwork, moving to the studied sectors.

-Phase of production and treatment of the geographical information: Design of texts, cartography and graphs.

Only from a solid analysis it is possible to carry out an accurate diagnosis, removing weaknesses, facing threats, leaning on strengths and taking advantages of opportunities (SWOT analysis), and to propose actions for the territorial improvement. In this respect, the *Instituto de Desarrollo Local* relies on a wide experience in analysis and territorial strategies, which can help to design ways of success for the studied territories.

Structure

On the basis of the general and specific objectives, and the methodology, the work of research has been organized by the following structure:

1. PRESENTATION. Territorial improvement of the chemical-industrial space.

2. CONFORMATION. The chemical provincial industry and the international context.

3. ABANDON. Industrial areas in disuse and scantily used. Causes.

4. RECOVERY. Works and technologies of territorial improvement.

5. MANAGEMENT. Planning and public and private responsibilities.

6. DIAGNOSIS. Weaknesses and strengths, threats and opportunities.

7. PROPOSALS. Design for the improvement of the areas in disuse or little used.

8. DOCUMENTARY SOURCES.

Image satellite of the city of Huelva and surrounding area
Landsat image

2. Conformation of the chemical industry in the province of Huelva and the international context

Precedents

Andalusia enters the 20th century as a region centred on agriculture and mining industry, immersed in a model of primary exporting underdevelopment. In 1900, 43% of the whole national output was going out of the Andalusian mines. In case of the province of Huelva, many municipalities of the "Cuenca Minera" (main mining territory in Iberian Pyritic Belt), as Nerva and Minas de Riotinto, passed of being small villages into big labour (mining) centers, where 90% of the generated wealth was for the multinational "Riotinto Company Ltd.". In this context, the complex of Zarandas, in the municipality of Minas de Riotinto, constitutes the most well-known testimony of productive deserted fabric, which related the function of the copper extraction to the chemical attached industries.

The creation of the National Institute of Industry (*Instituto Nacional de Industria* –I.N.I.–) in 1941, and the autarkic politics of the dictatorship, did not improve in much the Andalusian industry, partly, due to the shortage of raw materials and the international isolation. Only from 1959, with the policy of opening-up during *Desarrollismo* (phase of intense promotion of the economic and industrial growth) and the beginning of a neoliberal politics, there were glimpsed changes that gave place to a dismantled Andalusian industry, based on Indicative Plans of Development (*Planes de Desarrollo Indicativos*), elaborated from Madrid.

The industrial development of Andalusia and Huelva is limited in a territorial context of globalization, which begins in 1959 with the Plan of Stabilization (*Plan de Estabilización*) and the break of the autarkic system. The expansive capitalist cycle is taken advantage by Spain, which was buying at the time a relatively cheap energy. The foreign capital is inverted in Spain by major facility, at the same time as the country takes advantage of the savings of the emigrants and the earnings of the development of the tourism. Spain is constituted on an attractive market, in expansion, where the costs of production were low and did not exist (or they were not demonstrating) labour conflicts, joining to our country the multinationals with relative affection.

The national capital also will expand, due to a major internal demand, the increase of the standard of living, the abundant manpower (rural exodus) and the cheap money... The National Institute of Industry received new impulse, designing in 1964 so called "Plans of Development" (*Planes de Desarrollo*), which were stimulating to the state-owned and private companies in order to locate them in concrete points, selected from the state administration, and not yet developed industrially. This one was the case of Huelva that got benefited of the fiscal improvements of an Area of Industrial Promotion (*Polo de Promoción Industrial*) in 1964 and of an Industrial Growth Point (*Polo de Desarrollo Industrial*) in 1968, stimulating an industrialization based on the chemical and basic industry.

In the 70's the difficulties for the exportation due to the competition of other countries that were also rejoinning to the international markets (Korea, Chile, Thailanda, Taiwan, Hong Kong), and the exterior indebtedness of many companies that was taking place, specially from the crisis of 1973. The industrial crisis is felt very specially from 1975, when took place the bankruptcy of the process of the rising phase known till then.


Study nº3: Territorial Improvement
Province
European Chemical Regions Network
Badajoz
PORTUGAL
Sevilla
Cádiz
HUELVA
1 Castaño del Robledo
2 Corteconcepción
3 Fuenteheridos
4 Galaroza
5 Linares de la Sierra
6 Los Marines
7 Puerto Moral
8 Santa Ana la Real
Legend
Hydrographic net
Water sheets
Stream
River
Estuaries and tidal channels
Roads and ways
Highway
Main road
2nd level road
3rd level road
Population (inhabitants)
0 - 100
101 - 500
501 - 1500
1501 - 5000
5001 - 10000
10001 - 25000
25001 - 150000
Sources: Mapa Digital de Andalucía 1:100.000. ICA-JA, 1999. Landcover. ICA-JA, 1999. SCRN, 2005. Production Panos, F.J., 2006.
Km

A mutation of the productive structures began, with a deep crisis, of which there will go out an industrial, manifest change in what it has been given in calling "3rd industrial revolution". The incorporation of technology to the productive processes and the subcontractation reduces the staff of the industry.

Mining complexes

The province of Huelva was (not many time ago) distinctively mining. The image of mining capstans, fellings and other mining modals does not turn out to be isolated, but they have articulated and determined the communications, specially railroad, the ways of inhabiting in the territory, the industrial zones and town planning. From the capital to the last mining deserted village, from the spurs of the *Sierra* (mountain range territories) to the coast, the province is fulled up with mining testimonies. On a clearly agrarian base, the mining industry sat the bases of the industrial boom. Though, the mining exploitation was, in its most, of extraction of pyrites, its complexity and been far from the main centers of market, they demanded chemical processes, which were selecting or enriching the wished mineral (copper, gold, sulphur...).

The benefits of mining industry in Huelva spread until the years of 1930. After the depression happened during the decade of the 40's, a period of reactivation happened in the 50's. This is the moment when in Tharsis is built the so called "*Casas Nuevas*", the Mining Recreative Circle, the church ... and the field of football.

Nevertheless, the political moment that Spain lives through, is the best for the international trade, neither to support cordial relations with United Kingdom. In 1954 the mines were nationalized. "This year of 1954 marks a date, the most important for centuries in the history of the city. Already we can go from Huelva to La Rábida without crossing the English border" (*Odiel* n º 4881 14-7-1954, press report).

The decade of the sixties started with a general fall of the prices of the mineral, and difficulties for the exportation. Without the existence of a subsidiary industry, the mining activity had to face a process of mechanization and drastic measurements of regulation of employment, early retirements or the stimulated leaves. The excessive manpower emigrated and a great part of the center and north of the province suffers still the consequences of the mining disaster.

The indicative planning that presided at the politics of "*Desarrollismo*" of the Dictatorship from 1964 to 1976, tried to lessen the rough blow of the mining crisis, creating an Industrial Area, with basic chemistry, which would reactivate the mines of pyrite. To hard sorrow there was kept a precarious mining industry that was not achieving competitive prices on the international market. It was and it is still cheaper to import the mineral that to extract it in the same province. In 1982 the mining industry of the copper was deactivated and was not a possible re-open because Kio - FreePort McMoran (owners of the smelter in Huelva) were not estimating profitable Riotinto. In 1996, the province attended an unusual experience, *Minas de Riotinto Sociedad Anónima Laboral* (Mines of Riotinto Anonymous Labour Society) got constituted. But the miners did not cope with the mine, which was closed in 2000.

Of the mining activity today only stays the degraded landscape of dumps and ruined facilities... that stay as testimony of last epochs. But these testimonies can be rescued as cultural patrimony and recreated to stimulate the local sustainable development, by means of operations of territorial improvement.

Principal mines and mining areas exploited recently in the province of Huelva			
Nº	Name	Substance	Municipality
1	Cueva de la Mora	Pyrite iron-coppery	Almonaster la Real
2	San Miguel	Pyrite	Almonaster la Real
3	Mina Concepción	Pyrite	Almonaster la Real
4	Mina Soloviejo	Manganese	Almonaster la Real
5	La Lapilla	Gold and silver	Alosno
6	Lagunazo	Pyrite	Alosno
7	Minas de Tharsis	Pyrite, rind of copper	Alosno
8	La Aurora	Manganese	Alosno
9	Minas de Cala	Lodestone (copper)	Cala
10	La Zarza	Pyrite	Calañas
11	Torerera	Pyrite	Calañas
12	Rodrigana	Manganese	Calañas
13	Sotiel	Polymetallic sulphurs	Calañas
14	Calañesa	Manganese	Calañas
15	Tinto y Santa Rosa	Pyrite	Calañas
16	San José	Silvered lead-sulfide	Castaño del Robledo
17	San Telmo	Coppery pyrite	Cortegana
18	Grupo Coballos	Manganese	El Campillo / Campofrío
19	Nerón	Stibnite	El Cerro del Andévalo
20	Santa Catalina	Manganese	El Granado
21	María Luisa	Copper, zinc	La Nava
22	Cerro Colorado	Copper	Minas de Riotinto
23	San Dionisio-Corta Atalaya-Alfredo	Chlorite, pyrite	Minas de Riotinto
24	Peña de Hierro	Pyrite	Nerva
25	Pepito	Manganese	Nerva
26	Nuestra Señora del Carmen	Coppery pyrite	Paymogo
27	La Romanera	Coppery pyrite	Paymogo
28	Grupo Malagón	Copper, lead, zinc	Paymogo
29	La Preciosa	Pyrite, copper, lead, zinc	Paymogo
30	La Sierrecilla y Peñuelas	Sulphurs of copper	Puebla de Guzmán
31	Mina del Toro	Manganese	Puebla de Guzmán
32	Mina Isabel	Manganese	Puebla de Guzmán
33	Santa Bárbara	Coppery slates	Puebla de Guzmán
34	Las Herrerías	Pyrite	Puebla de Guzmán
35	Minas de Teuler	Lodestone	Santa Olalla de Cala
36	El Cuervo	Manganese	Valverde del camino
37	La Ratera	Copper	Valverde del Camino
38	Río Corumbel	Lead-sulfide, pyrite, chalcopyrite	Villalba
39	Oriente, San José, Palanco, Guadiana	Manganese	Zalamea la Real

Source: Márquez, J. A. (1998)

The history of the mining industry is like that, the history of the province of Huelva. The Bible is one of the texts that identifies these lands with the most important source of metals of the antiquity, and the archaeological finds sinks its roots in the first remnants of the metallurgy in Europe. All the big civilizations of the Mediterranean have wanted to control the deposits of the peninsular south, anyhow, the weapon of the war or by means of trade. Centuries of extraction that have not exhausted the entrails of these lands, but that do not enjoy good health in the last times, this does not hide the miles of hectares where the land shows its entrails. Riotinto, Tharsis, Nerva, Mina Herrerías, they are only a few of the places where the human avidity for metals have left exposed geological structures, but also human and social structures, industrial architecture that has been of the most advanced in the world, and related industries that turn to these lands in a nucleus of origin of the chemical and industrial activity of the peninsula. It is not necessary doubt that this presence and wealth of raw materials were a determinant factor for the creation of the Growth Point of Huelva, and without being spaces eminently dedicated to the chemical industry, the plants of sulphuric, factories of explosives, toasting of the mineral... they are only a few of the activities of clear chemical component that has to be took into account in a study of these characteristics.

Politics of industrial intervention

They have been presided by the search of the economic efficiency more than the equity. They begin in the sixties, very linked to Rostow's postulates. This philosophy of the development was adapted, spread and experienced in France after the writings of Friedman and Perroux, who, across their industrial Areas, were supporting a punctual development in the space that, later, would turn into an area of diffusion of the development. Nowadays these theories are in discredit and we speak about diffuse development or local sustentable development.

In the frame of the Plans of Development of the sixties, it was approved from the Central Administration, the Law of preferential industries (*Ley* 152/1963, of December 2nd and *Decreto* 2853/1964, of September 8th). In it, a set of benefits are established, applicable to the companies for their installation or amplification of their industrial establishments in sectors or qualified zones of preferential interest. In Andalusia the following instruments, created in this legal frame, have been of application and dissapeared with the entry of the *gaeias*:

- Areas of Promotion and Industrial Development: Huelva, Seville, Granada and Cordova.
- Zone of Preferential Industrial Agrarian Location: Campo de Gibraltar.
- Zone of Preferential Industrial Mining Location: Mining area of Huelva and Seville.
- Protection Zones for Handcrafted Production: Provinces of Almeria and Jaen.

In this context, to the Andalusian industry a classic role was assigned from the central administration, since this situation was thought to be able to create the conditions of industrial "takeoff". The Areas were generated by means of an Indicative Planning that arose after the crisis of the autarkic system during dictatorship and the economic opening that begins in 1959. The life of this Indicative Planning is from 1964 to 1975, and, we can differ three periods, which correspond with the Five-year Plans (*Planes Quinquenales*):

First Five-year Plan 1963-1967: the First Plan of Development is implemented, being a copy of the French one, even in the most minimal details. The Areas of Promotion are installed, there

where the industry was practically non-existent or was splitting from very low levels, the Areas of Promotion of Huelva and Burgos arise, as five Growth Points, where an industrial structure already existed: A Coruña, Seville, Valladolid, Vigo and Saragossa. Finally the category of Programming of Integral Plans is assigned to the territories of Tierra de Campos, Campo de Gibraltar and Canaries, not only for the industrial development, but also integrally.

Second Five-year Plan 1968-1972: these dates correspond with the Second Plan of Development and the beginning of the Growth Points of Huelva, Granada, Cordova, Oviedo, Logroño and Vilagarcia de Arousa.

Properties of the Port Authority of Huelva
Source: A. P. de Huelva

In Huelva, the Port constituted undoubtedly a fundamental element for the internationalization of the chemical and basic industry. The situation and emplacement allowed, from very early, to provide Huelva with clear competitive advantages, as well as the import of energetic matter –oil and gas– and their transformation.

Third Five-year Plan 1973-1977: during this plan, the strategy of Areas is admitted to had remained isolated in a rigid territorial demarcation, because, the strong investments had not been followed by that supposed substantial demand of employment, either a territorial diffusion of the development. Furthermore, they had originated strong urban, industrial and economic agglomerations that have destroyed the small local economies and caused the sterilization of wide

Nuevo Puerto
Source: A. P. de Huelva

provincial spaces in favour of small zones. Actually, the philosophy of "*Desarrollismo*" was raised badly in Andalusia, because an industry scantily connected with its endogenous potentials was being generated, just in agreement with foreign interests, which after the industrial international crisis of 1973, did not have interest to support a peripheral industrialization.

Since 1975, up to now, with the well-known energetic crisis, a decrease of the expansive pace of the industry takes place, and a technological change of the whole industrial process happens, with a deep restructuring. The restructuring provokes a change of the system, which ends in a strong crisis that causes strikes, manifestations... The development of some regions, specialized in the Heavy Industry as the Bay of Cadiz, becomes exhausted and the classic processes are decentralized, receiving importance the endogenous development.

The diverse incentives to the industrialization, such as easy access to equipments, non-fiscal taxation, cheap industrial soil, etc., gave place to strong non-competitive investments, sheltered by this umbrella of protection.

Opposite to the strategy of the industrial development, the agroindustrial development, tied to the endogenous potential, might have saved the dichotomy agriculture/industry and initiate a process of balanced development on Andalusia.

As result, due to the fact that the Andalusian industry is a sector induced by erratic performances of the Administration, at least in the approaches of the diffusion of the regional development, and after the experiences passed, the Autonomous Andalusian Community (*Comunidad Autónoma de Andalucía* –CCAA–) begins to have a more flexible concept of the industrialization. This way, the program Great Area of Industrial Expansion of Andalusia (*Gran Área de Expansión Industrial de Andalucía*), in force from 1977 to 1983, concerning a great part of the Andalusian territory, was offering similar benefits than the Areas of Industrialization. In the same way, the Zones of Preferential Industrial Location (*Zonas de Preferente Localización Industrial*), the Zones of Handcrafted Protection (*Zonas de Protección Artesanal*), the Zones of Special Performance (*Zonas de Actuación Especial*, in Andevalo y Linares), Zones of Economic Promotion (*Zonas de Promoción Económica*), Zone of Urgent Reindustrialization (*Zona de Urgente Reindustrialización*) in the Bay of Cadiz, were novel experiences. Nevertheless, what turns out to be clear is that the optics has changed in benefit of approaches that look in the industrialization for a fair territorial and social balance.

Repealed the *gaeias* and before the entry of Spain in the European Community, it was established, to forced marches and urgently, at the end of 1985, one new Law of Regional Incentives for the alteration of economic interterritorial imbalances (*Ley* 50/1985 of December 27th; BOE n º 3 of January 3rd, 1986). The Law defines the regional incentives as "the financial helps to foment the managerial activity towards certain zones, in order to reduce the economic territorial differences, distributing a balanced economic development and reinforcing the endogenous potential" (PADE, 1986). This reform has supposed simplifying the previous modalities of incentives, which has made eliminate great part of the previous in force figures.

The effects have not been, at the moment, the waited ones with the new orientation and strategy. The industrial crisis and the "restructuring" have originated that numerous zones of industrial expansion remain empty among the least wealthy Andalusian municipalities, with this, it is demonstrated the "artificiality" of the Areas and the administrative performances, which

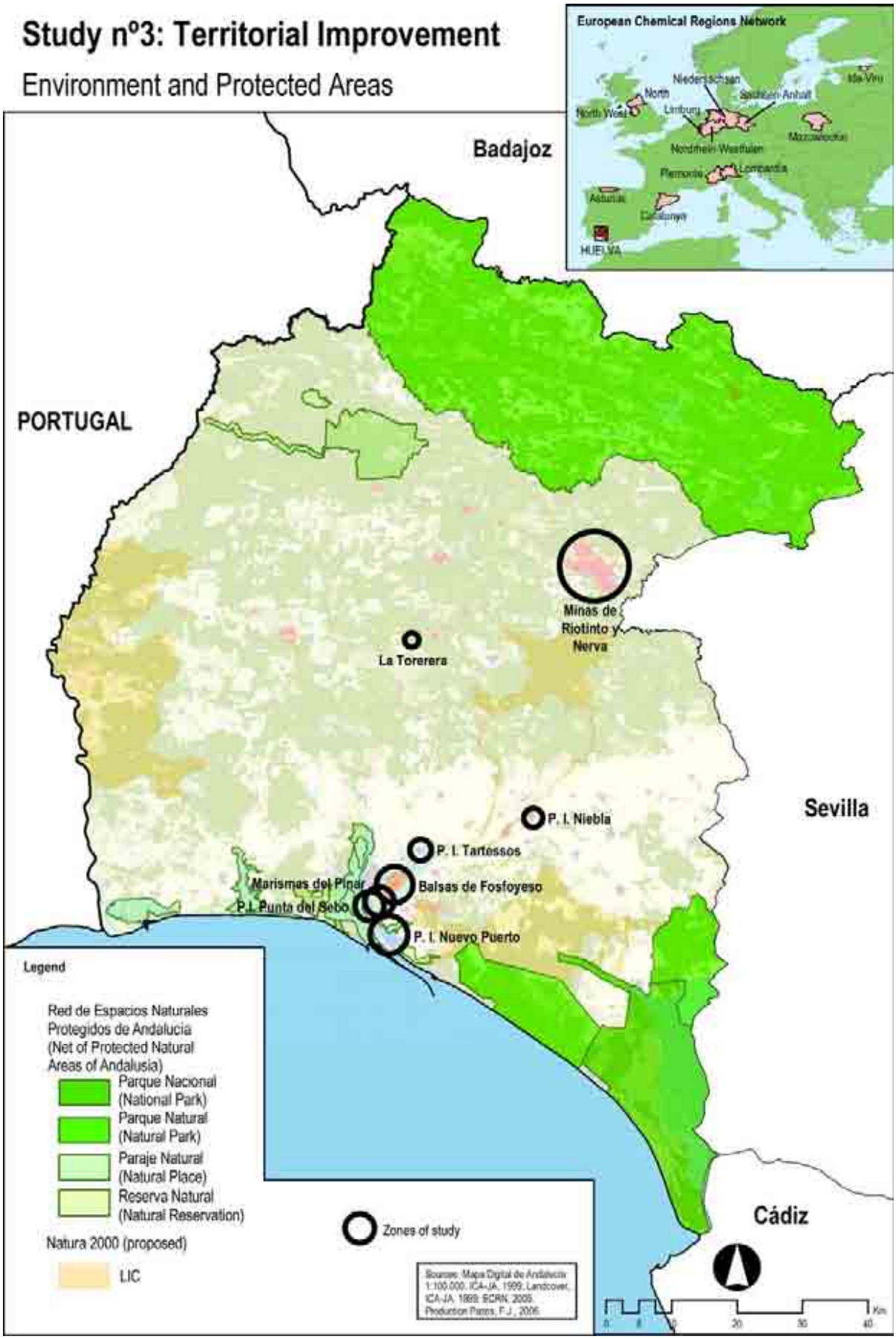
though they are valid for moments of economic growth, do not answer in moments of crisis. Today, politics that favors the endogenous potential of the region and of the private initiative there where exists is glimpsed, "industrialization to the demand", being attended less to the strategy of Areas or to the idea of regional balanced development, especially because is observed a slight decrease of the importance of the industrial sector in Andalusia and a change tending to stimulate the development from below (from the endogenous demand).

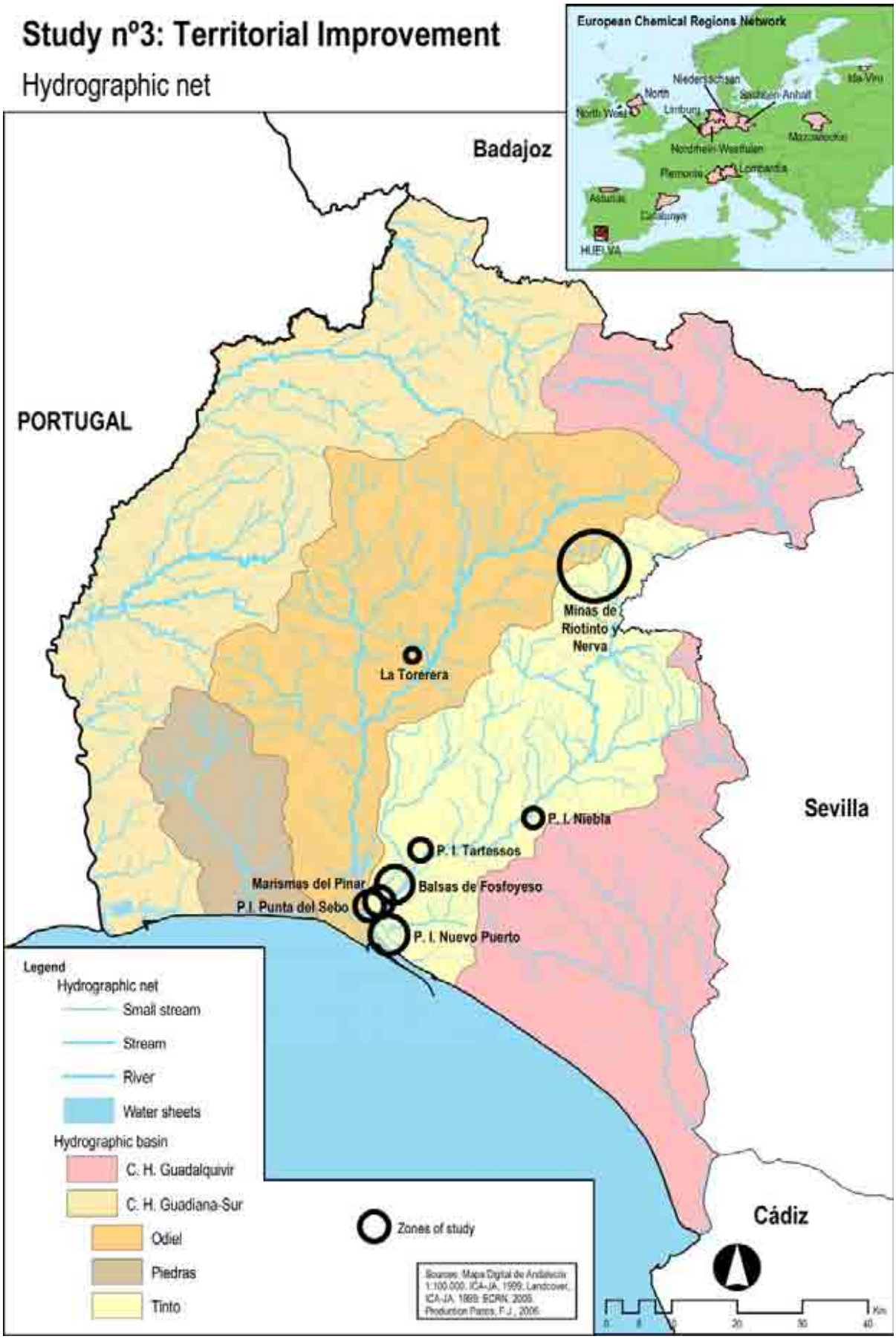
The *Junta de Andalucía* (regional government) created organisations of management of the capital for the help to managerial initiatives, which nowadays have come together in the Institute of Promotion of Andalusia (*Instituto de Promoción de Andalucía* –IFA–). The sectors on which it has intervened answer to the transformation of prime matters (marble, cork, pine, clay...) or the existence of industries of former implantation and tradition (leatherwork, jewelery, furniture...). In every Plan, a diagnosis of the existing problematics in the whole productive chain is done, as well as a set of alternatives and solutions, with a view to the revitalization of such industries. The role of the IFA belongs especially to revitalizing agent, adviser, investor and subventioning agent, being indispensable also the active participation of the principal agents in the sector.

Association of Chemical and Basic Industries (AIQB)		
Companies	Principal productions	Municipality
Air Liquide	Oxygen, nitrogen, argon and carbonic dioxide	Huelva
Algry	Basic products of organic chemistry	Palos Fra.
Aragonesas	Chlorine and derivated substances	Huelva
Atlantic Copper	Anodes and cathodes (copper), sulphuric, electrolytic muds	Huelva
Cepsa Ertisa	Methilamine, dimethilacetamide... phenol...	Huelva
Cepsa Rábida	Fuels, asphalts, petrochemical and lubricants	Palos Fra.
Enagas	Storage and gas sale	Palos Fra.
Ence	Cellulose, paper of impression and derivated	Huelva
Endesa	Production of electricity	Huelva
Fertiberia	Sulphuric acid, phosphoric acid, phosphate...	Palos Fra.
Fertiberia	Ammonia and urea	Huelva
FMC Foret	Phosphoric acid, tripolisulfates, phosphates...	Huelva
Hustsman Tioxide	Pigment of dioxide of titanium, ferric and ferrous sulfate	Palos Fra.
Repsol Butano	Packed and sale of Butane	Palos Fra.
Roída	Tripoliphosphate	Huelva
Unión FENOSA	Regasification and gas transport	Palos Fra.

Source: AIQB, 2005

The location and permanency of these industries has been discussed for a long time by some experts and the proper population of the city of Huelva, and though, it obeyed more a mandate from the dictatorial power that to studies of location (on the other hand, slightly frequent in this epoch). In spite of everything, it has certain logic, the availability of the area (properties of the Port Authority of Huelva) and its location close to the natural port of Huelva, traditional exit of the mineral of the province, and route of excellent communication of the industries with their markets of origin and destiny. Other curiosity of the industries of Huelva is their proximity to two Reserves of the Biosphere, one, to scanty meters, the Marsh of the Odiel, other one, the most important of Europe, to scanty 40 Km, Doñana. An environment favoured in spite of the aggressions, dredgings, spilt...


Study nº3: Territorial Improvement
Environment and Protected Areas
European Chemical Regions Network
Niedersachsen
North
Sachsen-Anhalt
Limburg
Nordrhein-Westfalen
Piemonte
Lombardia
Asturias
Catalunya
HUELVA
Badajoz
PORTUGAL
Minas de Riotinto y Nerva
La Torerera
Sevilla
P. I. Niebla
P. I. Tartessos
Marismas del Pinar
Balsas de Fosfoyeso
P.I. Punta del Sebo
P. I. Nuevo Puerto
Cádiz
Legend
Red de Espacios Naturales Protegidos de Andalucía (Net of Protected Natural Areas of Andalusia)
Parque Nacional (National Park)
Parque Natural (Natural Park)
Paraje Natural (Natural Place)
Reserva Natural (Natural Reservation)
Natura 2000 (proposed)
LIC
Zones of study
Km


Study nº3: Territorial Improvement
Hydrographic net
European Chemical Regions Network
Niedersachsen
North
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Catalunya
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La Torrerera
Sevilla
P. I. Niebla
P. I. Tartessos
Marismas del Pinar
Balsas de Fosfoyeso
P.I. Punta del Sebo
P. I. Nuevo Puerto
Cádiz
Legend
Hydrographic net
Small stream
Stream
River
Water sheets
Hydrographic basin
C. H. Guadalquivir
C. H. Guadiana-Sur
Odiel
Piedras
Tinto
Zones of study
Km

Conclusions

The industrialization in Andalusia and the province of Huelva has been very late and based, initially, in pillaging the rich mining deposits, to which a rachitic basic chemistry was annexed, always following the so called Primary Exporting Model.

During the politics of "*Desarrollismo*" during the 60's, based on theoretical frames from Perroux, indicative plans of development were created, trying to relieve the emigration and the lack of employnment. In case of the province of Huelva, the practical lack of industry advised in 1964 the creation of a Area of Industrial Promotion, which turned in 1968 into Industrial Growth Point, into the municipalies of Huelva and Palos de la Frontera.

From the politics of indicative planning there arose a polemic industrial complex of basic chemistry that, with diverse vicissitudes, has come until our days, something that did not happen to the missing mining activity.

Punta del Sebo and Marsh of Tinto river in 1956
Source: Vuelo Americano de 1956, ICA, 2005

3. The abandon of industrial areas in disuse and scantily used

Depletion of Fordism and productive restructurings

The technological revolution that comes preparing from the middle of the XXth century, emerges of intense form in the 80's, generating an increase of the relation production/man unthinkable before, but also increases the gap between the man and the society who dominates the technology and those that do not. The changes of the manners of production of Fordism to a flexible one, precipitated the fall of Communism and the imposition of the Neoliberalism. The model of development of the elite of this ideology, is based on supporting the Democracy and the decrease of the State.

The redefinition of the government bond passes for guarding over the purity and transparency of the market and detaching the economic decisions of the State. In this context, the development of the market is constituted as objective and essential paradigm of the neoliberalist thought, because theoretically, the interchange is to choose, a free act. The State must not deform the market with the indicative planning.

Then, in free trade and the market competition, the comparative advantages of regions and the international division of the work are not consolidated in the time, but they answer to competitive dynamics in continuous mutation.

The depletion of Fordism has driven to productive restructurings where forms of production coexist in previous technological phases, but the technological changes are imposed, taking advantage of niches of segmented markets and eliminating the captive markets.

The deregulation of the market of work and the loss of power of the worker's unions, the adaptative capacity of the small and medium companies and subcontractation, and the elimination of the managerial vertical organization of the production, has made eliminate the natural advantages and has put in value the learning, the experience and the action of the human groups inside the European Union and the globalization of markets.

In this context, the industries of the province of Huelva have experienced productive restructurings in the resizing of the companies and in the orientations and strategies of the market, but also being able to adapt to the new environmental requirements and the (till now broken) Kyoto's protocol.

This way, productive restructurings, strategies of market and environmental care have been three vectors that have originated industrial deserted spaces, in disuse or scantily used.

Mining area: Zarandas in Riotinto and La Torerera in Calañas

Though the extraction and mineral exportation were the essential activities of the wide mining territory of the province of Huelva, there existed places where there were realized elementary transformations tied to industrial complexes, which disappeared as the crisis was appropriating of the mine.

Today, the coarse mining territory of the province turns out to be deserted, and in it, also the places that were related to the industry: Zarandas in Minas de Ríotinto, and La Torerera in Calañas.

Mining capstan of La Torerera
Foto C. P.

In the middle of the XIXth, the reactivation of the mining industry concerned a great quantity of deposits of the territory of Calañas, placing some of them among the most important of the province. Their pyrites were very requested by its wealth in copper and sulphur, increasing their production constantly, specially after the creation of the railroad...

From 1866 to 1940, Sotiel's deposit was one of the most active mines, but in 1941 it was acquired by the Spanish Union of Explosives (*Unión Española de Explosivos*) that dismantled the facilities, using it just to have more water in its exploitation of La Torerera. This mine was characterized for being one of the first ones in the province that used the system of toasing pyrites in "*teleras*" (open-air toasting). This system provoked serious environmental problems, being source of an intense acid rain and problems of health among the population, and spark that provoked the popular emergence of the "*Año de los Tiros*" (Year of the Shots), the first episode of social revolt for environmental motives of the Spanish history.

The mine “La Torerera”, was exploited until 1960 by the Spanish Union of Explosives, manganese being extracted fundamentally and being the base of a factory of sulphuric, nitric acid, TNT, nitroglycerine and other explosives.

La Torerera
Source: Márquez, J. A. (1998)

Minas de Riotinto, in the center of the Pyritic Belt of the peninsular Southwest, has been historically the principal mines of gold, silver and copper of the country. The practical totality of its territory is occupied and altered by mining developments, facilities and dumps of mineral. Nevertheless, Riotinto's "Mines" goes beyond the administrative limits of the municipality sharing activity with others, as Nerva and El Campillo. In this wide space we can distinguish opened-sky exploitations like Cerro Colorado and Corta Atalaya, a spectacular "crater" with more than 1.200 meters of diameter in its broader part, for 345 of depth, excavated on bench-covers of 12 meters, where up to 12.000 miners worked.

To the South of the municipality, it stands out Zarandas. Crossed by the river Tinto, it raises on a sterile hill of three beaks that shelters dumps, former dumps of molten mineral, old railway routes and very old industrial facilities, constructed around 1902 by the Rio Tinto Company Ltd. where a part of the pyrite was transforming. The rest was transported to Huelva by railroad for its direct craft towards United Kingdom.

In Zarandas there were realized industrial chemical and hidro-metallurgical processes. In the facilities the wash of pyrites was realized by means of the channeling of the waters of rain and the residual waters of the mine. The conversion of the sulphurs to soluble sulfates was

liberating the rind of copper for rainfall. This rind was molded in the Smelting Plant; whereas the ferrous sulfate, which was staying dissolt in the water, was recovering by means of a process of crystallization. The resultant gases of the process of smelting were treated in the chemical facilities, turning them into sulphur and sulphuric acid.

Finally, the mineral and the products of Zarandas were removing by railroad up to Niebla, from where the sulphuric acid was changing to Renfe's coaches, whereas the mineral was transported by trucks. During more than 60 years, complex miner-metallurgist processes were developed: smelting of copper, chemical obtaining of sulphur, sulphuric acid and sulfate. The progressive abandon of Zarandas shaped one of the zones of more interesting industrial archaeology of Spain.

Other mining spaces that have relied on chemical industry of certain entity, and beyond the primary treatments of the mineral, are for example, the mines of Cueva de la Mora (Almonaster La Real), where a small smelting of mineral existed (moved from Los Silillos, in Valverde del Camino, and that was a former property of "*Sociedad de Minas de Cobre de Nerva*"), that was in functioning scarcely 20 years, from 1914 to 1932, it worked taking advantage of the metal need in Europe during the Great War, and fed by several mines of small size and the proper felling of Cueva de la Mora, and closing after the world crisis of the copper.

Of similar form, *Almagrera S.A.*, in Sotiel Coronada (Calañas) was producing concentrates of copper, lead, zinc, floated pyrite, sulphuric acid, oleum or sulfate of copper. The installation, from 1983, closed only 3 years ago, and it counted with between 300 and 350 workers in staff.

Cement works in the city of Niebla

In Niebla a cement works complex exists, built by ASLAND, which was the only anchorage of this municipality with the modern industry. The cement plant was constructed in 1963, marking a real milestone in the development of a rural area.

The wealth in limy of Niebla's subsoil and the facility for the transport of the prime matters and the elaborated product, both by railroad and by road, were determinant for its location in Niebla. The production and exportation of the factory reached its higher level in 1982 with 498.716 tons, of which 40% were exported abroad.

Nevertheless, the entry in the international market of the productions proceeding from countries of Eastern Europe, with cheaper manpower, reduced the exportation to negligible levels. This loss of market meant a progressive reduction of the production and the working places. It passed of an staff of 203 personnel in 1983, to scarcely 90 in 1995. The factory was closed, which meant a rough blow in the zone. A closing propitiated caused by the depletion of Fordism, the globalization of the market and the productive restructurings. Meanwhile, close to the Port of Huelva, a new factory, El Monte, took advantage of the strategy of the facility of transport of raw materials and products of import and exportation.

Recently, Portuguese CIMPOR (*Cimentos de Portugal*) acquired the factory of Niebla, that was not in functioning, but it was continuing in property of *Readymix Asland*, and another factory in Cordova, continuing this way with their expansion in Spain, begun already in 1992 when they acquired the Galician holding company "*Corporación Noroeste*".

Industrial areas of Huelva and Palos de la Frontera: Rafts of ashes and Plaster-phosphorus, estuary of Tinto River, Nuevo Puerto and Tartessos

The wide industrial space of the municipalities of Huelva and Palos de la Frontera places in the edges of the estuary of Tinto river, and they have been located closely together of the port facilities, in order to benefit from economies of agglomeration and synergies in the sector of transport. The enormous weight of the imports of raw materials (oil, copper, gas, wood...) makes necessary to rely on these port infrastructures, without which it would be very difficult to support the strong international competition.

Industrial Area of Punta del Sebo
Source: COAH. 2005

Marsh of Tinto river – Plaster-phosphrus
Source: COAH, 2005

The industrial activity, besides its productive infrastructure, had needed from a space of alleviation that works as warehouse of stocks, drosses, by-products etc., that have shaped the industrial profile of the Area far beyond of the own factories.

In this context, the marsh, considered erroneously as places without use and without functions, were used as warehouses of drosses and of plaster-phosphorus for many facilities of the Industrial Area of Huelva: The smelting copper, nowadays managed by Atlantic Copper and the manufacture of fertilizers, belonging to Fertiberia and Foret. But besides, spilt uncontrolled that were realized in the estuary before 1992, they have converted the marsh of the Tinto and the estuary into a place of repulsion. Some marsh is already filled and other stands on the verge of doing it, an extensive polemic has been originated about how should be the future of these spaces. Many of them, impossible to rescue and deserted, have joined to the urban dynamics, or are wanted to “re-behave” to environmental uses.

Several spaces can be distinguished that were deserted by the pressure of the chemical industry:

1 - Rafts of plaster-phosphorus refilled: in Mendaña's Marsh.
2 - Rafts of ashes of pyrite and plaster-phosphorus refilled: in the Marsh of El Pinar.
3 - Shores of the Tinto river in the tour of the Avenue Francisco Montenegro, scantily used because of pollution.
4 - Lagoon system of the Nuevo Puerto harassed by the factories and the expansion of the agrarian border, which remained isolated as a landfill.

5 - The Industrial Zone Tartessos, where it stands the Cellulose, which caused continued episodes of environmental deterioration, and pollution in the estuary of Tinto river.

Marsh of Tinto river and Punta del Sebo
Source: CSIC, 2004

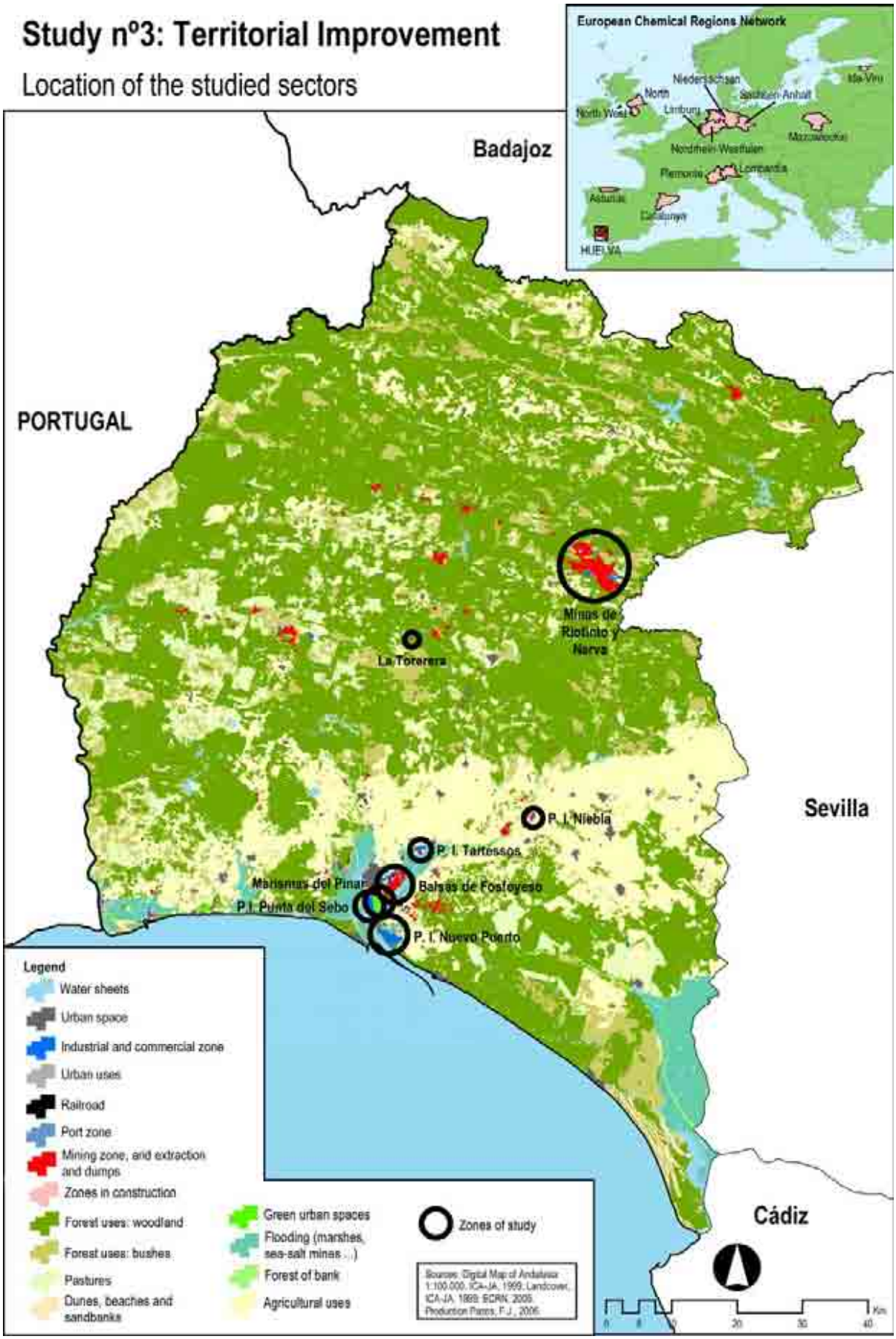
Conclusions

The chemical industrial spaces in disuse or scantily used occupy in the province of Huelva a wide surface. They can be considered to be 8 big sectors as clear exponents of this situation:

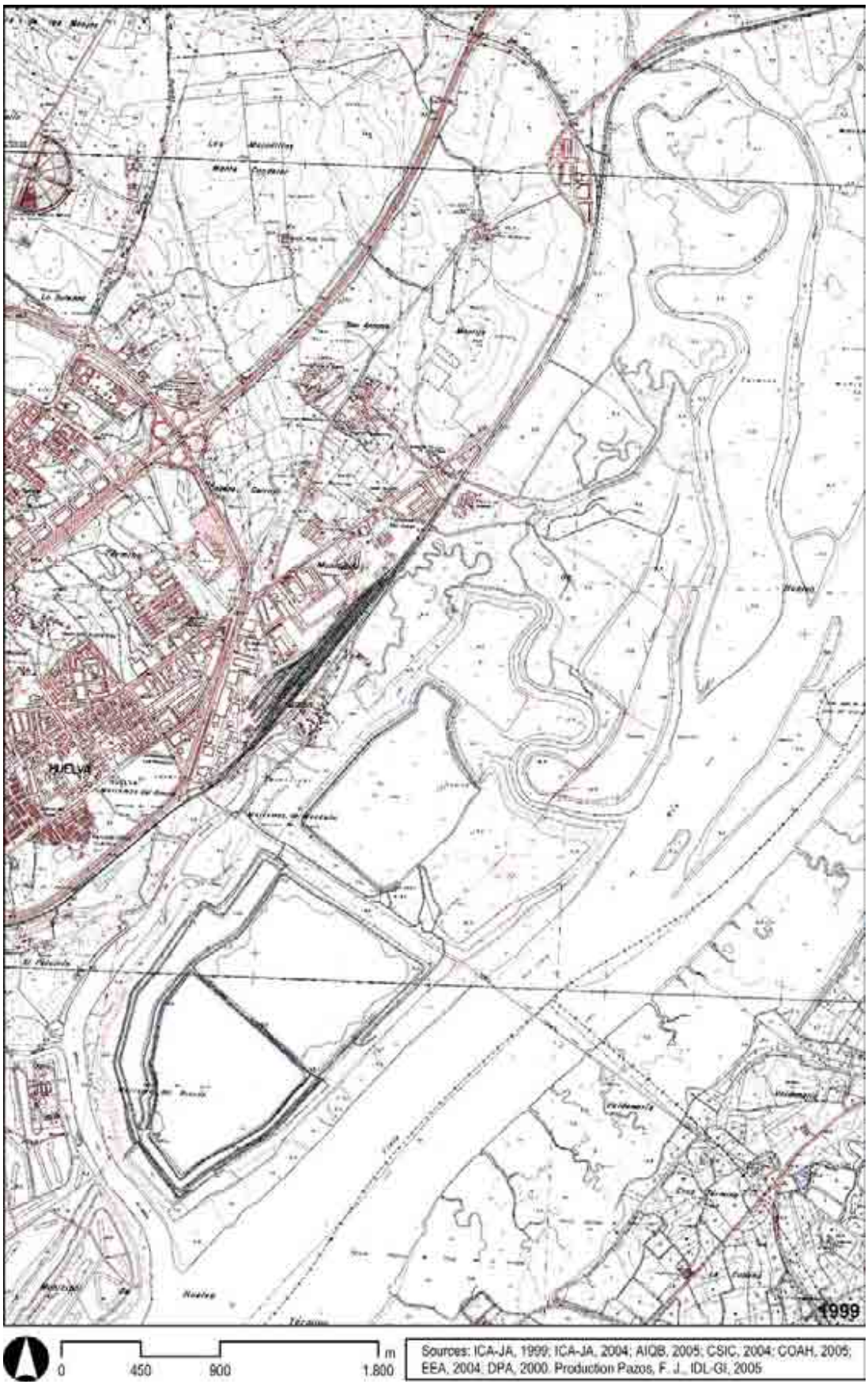
1- Rafts of plaster-phosphorus
2- Marsh of El Pinar
3- Industrial Zone Punta del Sebo
4- Industrial Zone Nuevo Puerto
5- Industrial Zone Tartessos
6- Industrial Zone of Niebla
7- Mines of Riotinto and Nerva
8- La Torerera

The abandon of the industrial use of these areas has as reasons:

a. Productive restructurings, related to the depletion of Fordism.
b. Environmental pressures for the extensive and degrading use of spaces.
c. Loss of international competitiveness in a context of globalization and international market.

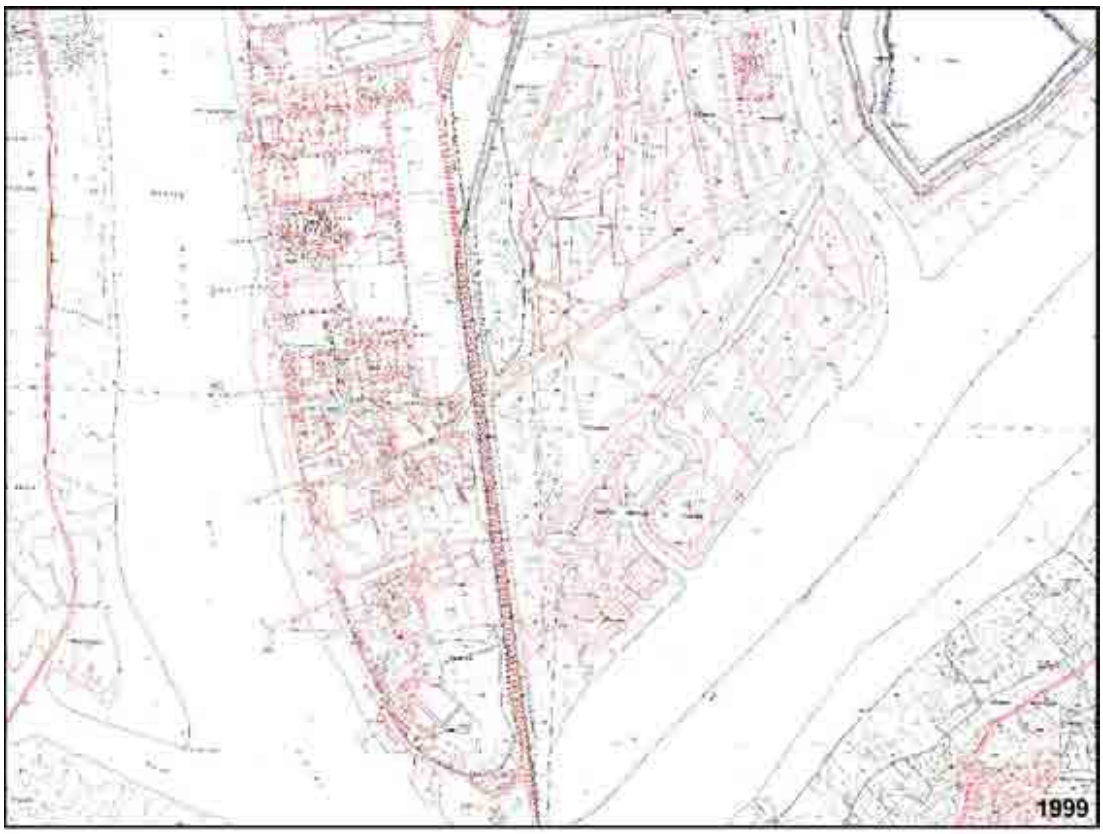

Study nº3: Territorial Improvement
Location of the studied sectors
European Chemical Regions Network
Niedersachsen
North
Sachsen-Anhalt
Limburg
Nordrhein-Westfalen
Piemonte
Lombardia
Asturias
Catalunya
HUELVA
Badajoz
PORTUGAL
Minas de Riotinto y Nerva
La Torrerera
P. I. Niebla
P. I. Tartessos
Marismas del Pinar
Balsas de Fosfoyeso
P.I. Punta del Sebo
P. I. Nuevo Puerto
Sevilla
Cádiz
Legend
Water sheets
Urban space
Industrial and commercial zone
Urban uses
Railroad
Port zone
Mining zone, arid extraction and dumps
Zones in construction
Forest uses: woodland
Forest uses: bushes
Pastures
Dunes, beaches and sandbanks
Green urban spaces
Flooding (marshes, sea-salt minas...)
Forest of bank
Agricultural uses
Zones of study
Km

Rafts of Plaster-phosphorus

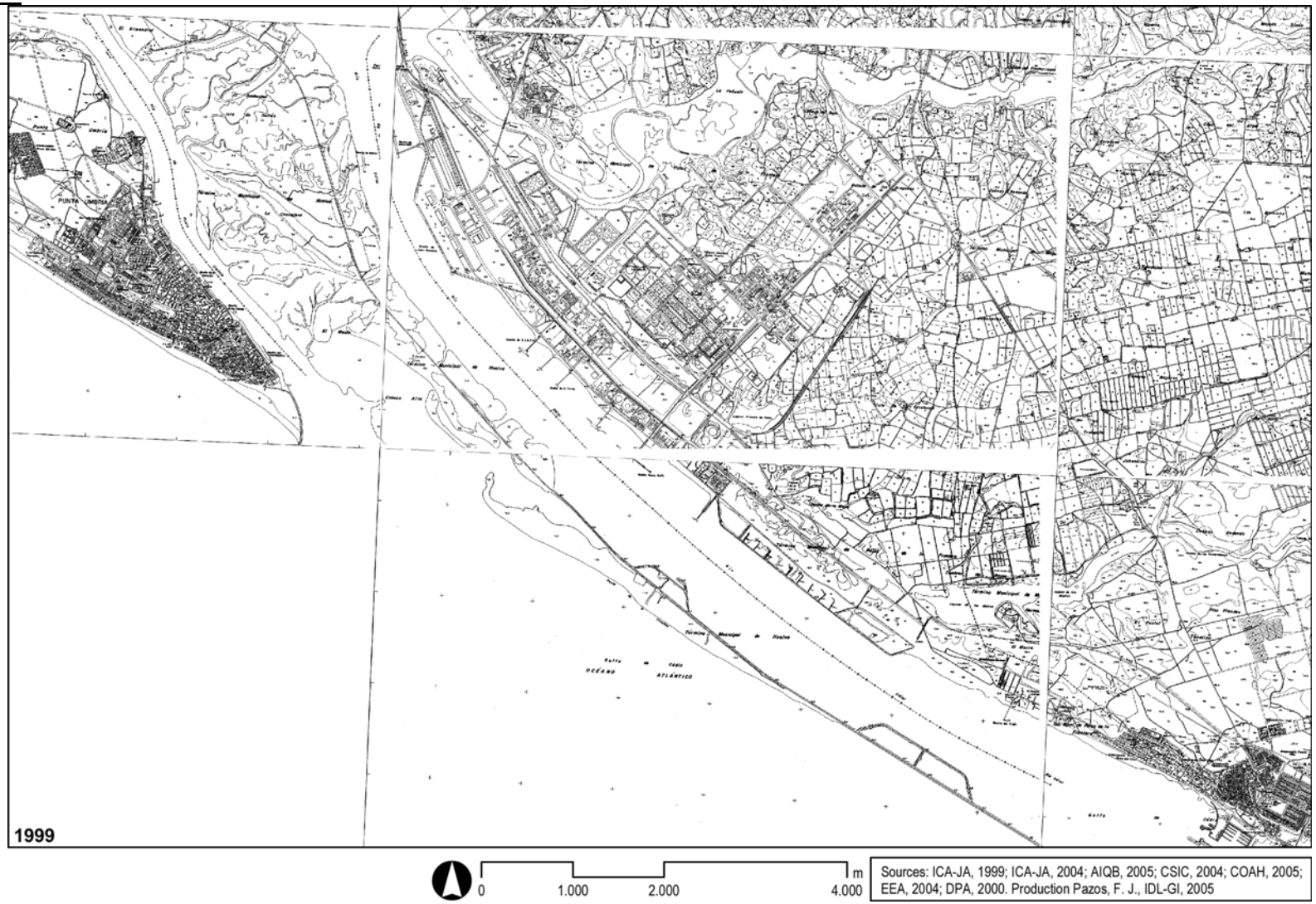



2002
0
450
900
m
1.800
Sources: ICA-JA, 1999; ICA-JA, 2004; AIQB, 2005; CSIC, 2004; COAH, 2005; EEA, 2004; DPA, 2000. Production Pazos, F. J., IDL-GI, 2005

Marsh of El Pinar and Punta del Sebo

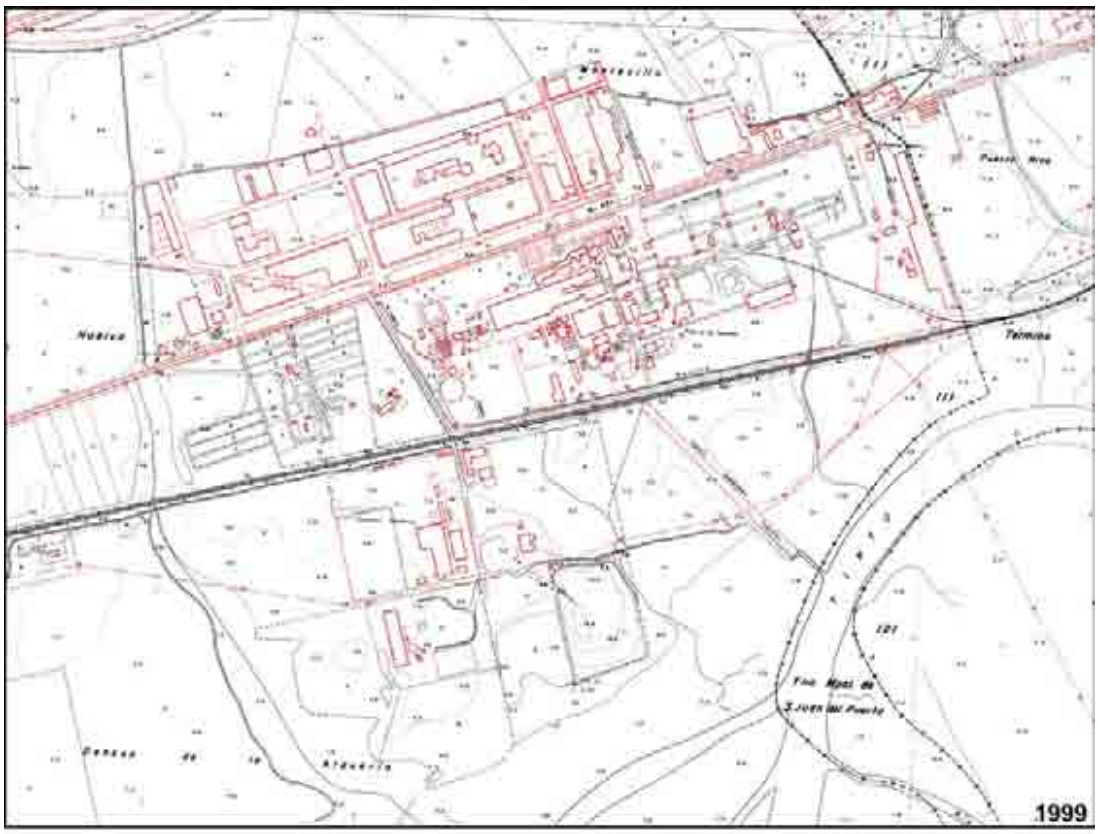


Nuevo Puerto




2002
0
1.000
2.000
4.000
m
Sources: ICA-JA, 1999; ICA-JA, 2004; AIQB, 2005; CSIC, 2004; CCAH, 2005; EEA, 2004; DPA, 2000. Production Pazos, F. J., IDL-GI, 2005

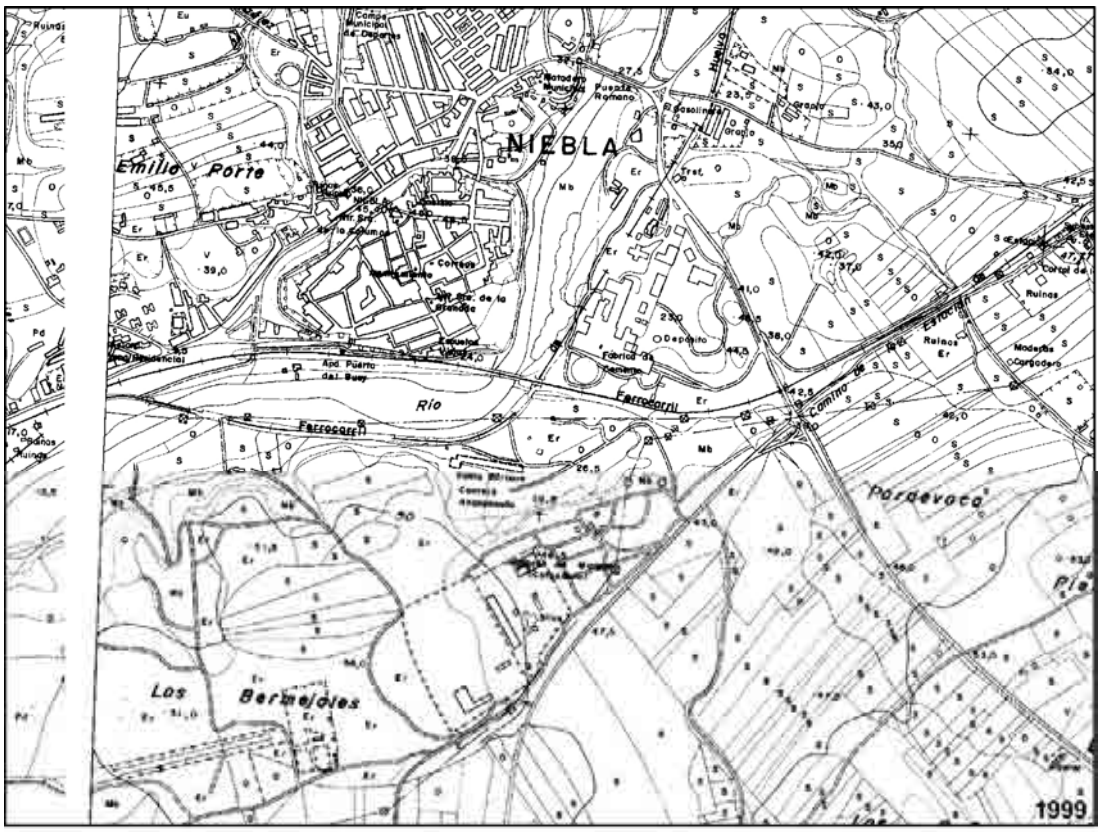
Tartessos

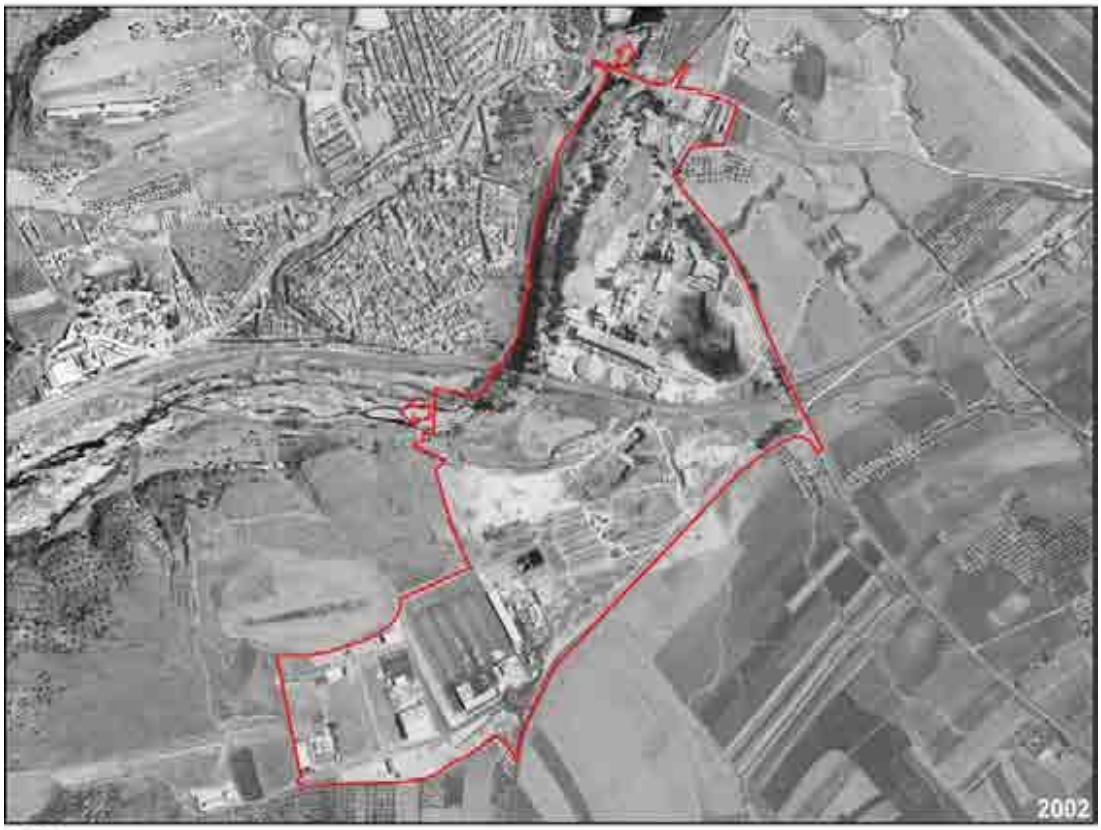

1999


2002
2002


0
225
450
900
m
Sources: ICA-JA, 1999; ICA-JA, 2004; AIQB, 2005; CSIC, 2004; COAH, 2005; EEA, 2004; DPA, 2000. Production Pazos, F. J., IDL-GI, 2005

Niebla


NIEBLA
Emilio Porte
Río
Ferrocarril
Los Bermejales
Porgevaca
1999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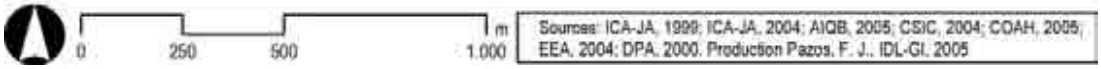
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250
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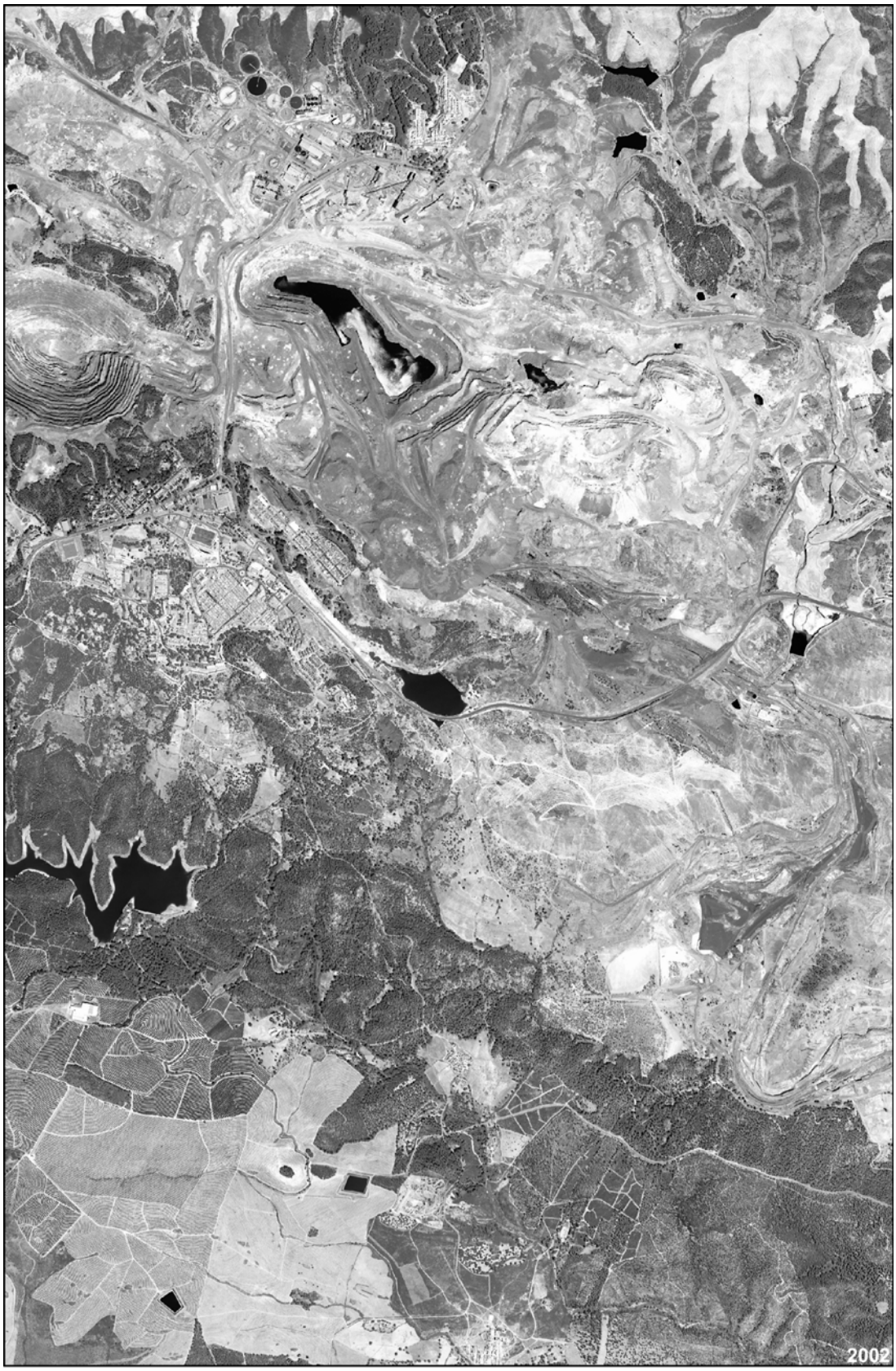
Sources: ICA-JA, 1999; ICA-JA, 2004; AIQB, 2005; CSIC, 2004; COAH, 2005; EEA, 2004; DPA, 2000. Production Pazos, F. J.. IDL-GI, 2005

Minas de Riotinto


2002
0
375
750
1.500
m
Sources: ICA-JA, 1999; ICA-JA, 2004; AIQB, 2005; CSIC, 2004; COAH, 2005;
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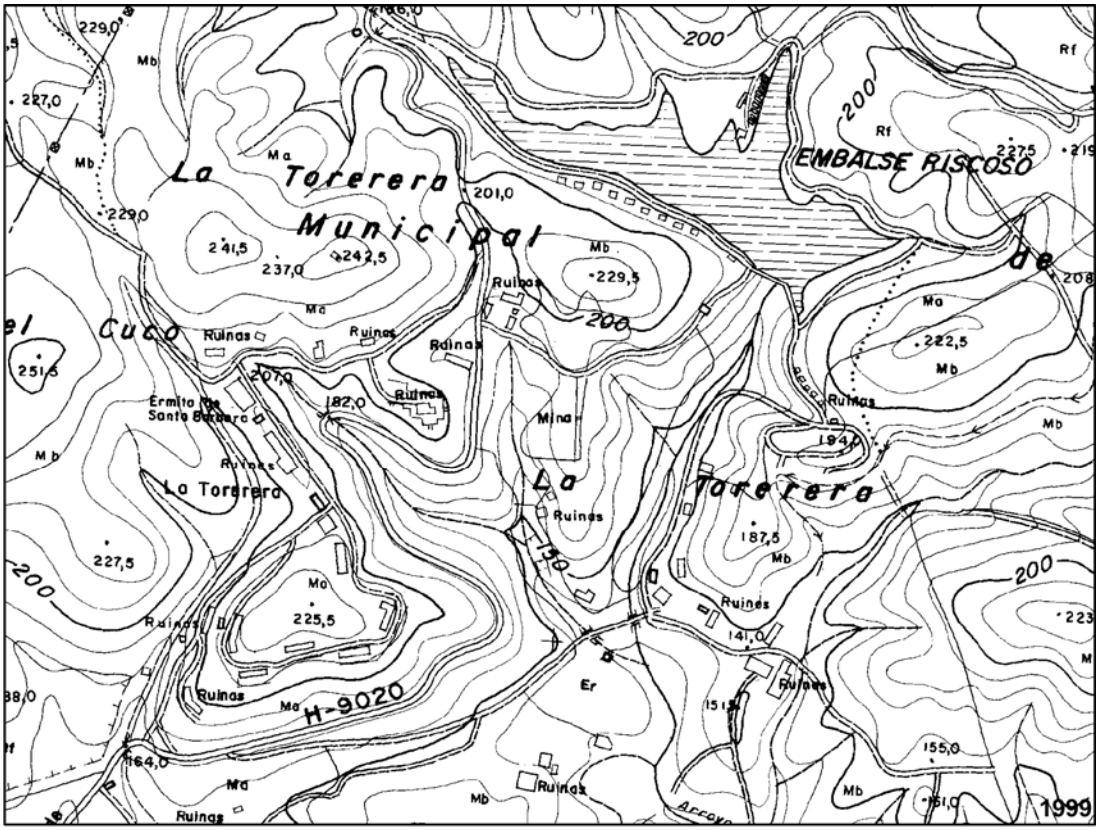
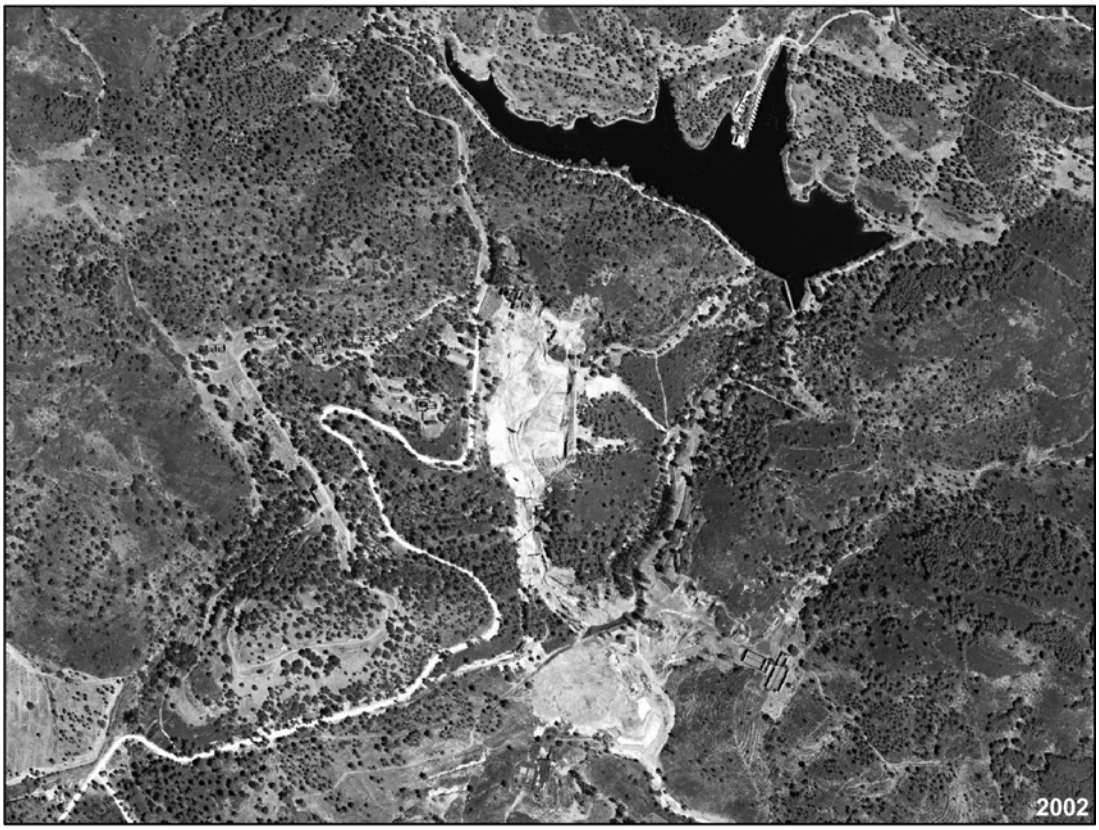
La Torerera





0 150 300 600 m

Sources: ICA-JA, 1999; ICA-JA, 2004; AIQB, 2005; CSIC, 2004; COAH, 2005; EEA, 2004; DPA, 2000. Production Pazos, F. J., IDL-GI, 2005

4. Recovery. Works and technologies of territorial improvement

Strategies and areas of recovery

The recovery of industrial deserted or in disuse spaces in the province of Huelva, has had essentially an environmental reason. The different aggressions and environmental impacts that the chemical basic industry originated, supposed changes in landscape, most of which are today irreversible. Though initiatives have been realized for the recovery of industrial spaces, with a notable territorial improvement, in most of the cases, the original landscape could never have been recreated.

From this point of view, the image of the chemical industry has been very polemic, so much in the spaces clearly of mining development, where the acid rains provoked by the system of exploitation in "*teleras*", finished with great part of the natural vegetation and the agriculture, as in the industry of the Areas in Huelva, which provoked the ruin of the beaches of the municipality of Huelva and surrounding area, and the destruction of the physical and natural qualities of the estuary of the Tinto and Odiel.

Anyway, the role that the industrial spaces have played and still play in the economy of the province is well-known. The total abandon of industrial spaces, since it was the case of Zarandas, met continued by the emigration and the extension of the blight of the unemployment...

With these precedents two have been the strategies that have orientated the recovery and/or territorial improvement of industrial deserted spaces:

a) Implying environmental elements, like in the cases of spaces deserted of recent industrialization, from 1960.

b) Stirring the area into action economically, presenting "the remains of industrial archaeology" as a patrimony that it is possible to put in value, like in case of the initiatives of tourist development in the municipality of Minas de Riotinto and the surrounding area of Zarandas.

The vast territories occupied and destroyed by the mining activities relies on a patrimony of important attraction. An assets that tries of being put in value concerning the rural tourism and the so called industrial archaeology.

The alternatives have gone through different routes, the putting in tourist value (patrimonial routes, mining museum, net of paths and green routes...), the putting in environmental value (landscape recovery, geological observation, walks to the fellings...) and the creation of tourist infrastructures (mining settlements, rural houses...). Everything is, nevertheless, a recent "industry", and with only some cases of certain success (Museum and Riotinto's Mining Train).

Mining capstan in Mina Herrerías raised on the drosses and remains of mineral
Foto Pazos, F. J. 2005

Green route of the Guadiana, in its arrival to Puerto de las Lajas
Foto García Delgado, F. J. 2005

In spite of everything, few ones are the initiatives of a clear territorial improvement that affect directly to the mining zones where an chemical industrial activity has existed, emphasizing Zarandas or La Torerera. Opposite to these attempts or successes of the territorial improvement, there turn out to be different many others that are not considered in this study by the absence or shallow presence of chemical industry, since the majority of the mines have relied on some primary or initial treatment of the extracted mineral, but not chemical industry in strict sense (cases as Minas de Cala[1], Minas de Tharsis[2] and many other ones of the province).

Of the analyzed areas, with present or past recent existence of chemical industry, all of them have been affected by some process of recovery, in a total or partial form. This way, it can be analyzed the different works and technologies of territorial improvement in:

1- Rafts of plaster-phosphorus in Mendaña's Marsh
2- Rafts of ashes of pyrite and plaster-phosphorus in the Marsh of El Pinar
3- Alteration of liquid and atmospheric spilt in the Industrial Area of Huelva and surrounding area
4- Landscape restoration of the shores of the estuary of Tinto and Odiel in the tour of the Avenue Fco. Montenegro
5- Lagoon system of Nuevo Puerto
6- Riotinto's mining area
8- La Torerera

Works and technologies of the territorial improvement

Understanding the variety and singularity of spaces where the territorial improvement has taken place, it is not possible to establish common works and technologies applied to the improvement. Nevertheless, we can speak about technologies and works orientated to the conservation, as in case of Zarandas and that fits with the strategies of economical stirring into action of the zone, with programs of local development, opposite to the works of environmental improvement in the rest of the cases and that answers to the strategy of improvement of environment. However, the recovery of the marsh is practically irreversible since:

- Its geological structure has been modified by the incorporation of new materials.
- Different infrastructures have been created, disabling the arrival of the tidal flows.
- The topography has risen with different landfills of rubbles, sands and slimes.
- Improper vegetable communities have installed and vegetated the marsh.
- It has been used as a functional space intimately tied to the dynamics and the urban morphology.

[1] Deserted the activity, on having been inside a Natural Park, The *Junta de Andalucía* gave priority for its regeneration (foreseen for before 2009). At least, 280 Ha affected by the "Project of Recovery of the stream Herrerías and Plan of Restoration for the closing and abandon of the Minas de Cala (Huelva)" promoted by PRESUR. Includes the revegetation, and regeneration of the soils, by ending before 2009, year that expires the term to execute the protocol of abandon that it is included in. Parallel, it has been installed an arid extraction platform that takes advantage of the mine. The project has as double objective the cleanliness of the riverbed, which has been spoilt by the mining activities (it is located inside a LIC and ZEPA zone) and the closing and ecological recovery of the mine. The scanty concentration of acids in the water and soil of the surrounding area has propitiated the growth of the vegetation. Besides, a dike of sterile residues is being recovered for agricultural use, sealing the raft, and realizing an hidro-sowing in the banks to fix the area and to diminish the visual impact. The length of riverbed on which the operations of cleanliness are going to be realized is 2.500 m. It includes the revegetation of the shores and banks.

[2] In the exploitation deserted of Tharsis it has taken to end a walk along the perimeter of the mine, a viewing-point and park around the mining fellings, and a project of putting in tourist value exists that would include both, the industrial zone (approximately 60 Ha) and the mine (486 Ha). In other mines there are similar projects, specially directed to tourist use, such as Puerto de las Lajas's Project or Mina Herrerías', also in project. Apart, there are several projects of closed of mines and of recreative adequacy (walks and areas of rest around the developments and fellings in Valdelamusa, San Telmo, Tharsis ...). In whole, the mining surfaces of the Andévalo add at least 1.500 ha not yet recovered.

The works and technologies orientated to strengthening the social and productive fabric has predominated over the strategy of economic development, claiming and preserving the industrial space as a testimony of identity of the past, which can be touristly exploited to show the enormous transformations that man has realized along history. It is a question of integrating a rich "anthropic" patrimony in the productive local systems.

Meanwhile, in the strategies of environmental improvement applied, the works and technologies are related to the design, reforestation and integration of the space degraded in its environment, as suitable as possible, to offer an image "of normal" landscape.

Due to all this, to know in depth the works and technologies applied to the territorial improvement, it is precise to analyze each of the locations where it has taken place.

Sector I. Rafts of Plaster-phosphorus

Mendaña forms a part of the complex shaped by the marsh of El Polvorín, Del Rincón and De Mendaña. Part of these marsh has been incorporated into the urban process, whereas others have been used as warehouse and dump of plaster-phosphorus[3] and other industrial and urban residues. In case of Mendaña, the spilt of plaster have reached such a considerable height, that it is considered to be a refilled marsh.

This zone of spilt has its origin in a grant of the Headquarter of Coasts to Fertiberia and Foret. Nowadays, the management of the recovered space depends of (depending on the affected sector) the Public Enterprise named EGMASA, the Municipality of Huelva and the proper Fertiberia and Foret. Nowadays it can be differed two parts, the industrial dump and a zone in recovery, which is in use as urban dump (solid and inert). The recovery of the degraded space began in 1997 (of form parallel to its exploitation like industrial dump), and it is realized fundamentally by means of the revegetation and landscape adequacy of closed spilts. The activity of territorial improvement as such, begins for requirements of the environmental regulation, under the patronages of the "Corrector Plan of Liquid Spilt to the Estuary of Huelva" (*Plan Corrector de Vertidos Líquidos a la Ría de Huelva*) that includes a "Project of Reordering of the Spilt of Plaster" (*Proyecto de Reordenación de los Vertidos de Yeso*). In this project, the previous system of spilt, directly on the marsh, is modified by a new system of piling-up the plasters, which reduces to the minimum the spilt to the estuary, which has had so pernicious environmental consequences. The current system, despite everything, causes an important landscape impact (hills of approximately 30 meters of height are created, modifying the horizon) in spite of the revegetation, as well as environmental, and a strong social answer to the maintenance of the spilt (in spite of the minor impact of the new form of spilt). This has stimulated nothing less than 8 reports of the CSIC (Superior Council of Scientific Research of Spain) under the generic name of "Report of the Study on the Environmental and Sanitary Diagnosis of the Estuary of Huelva" (from epidemiological studies to radiological) and several more from other organisations (University of Huelva, *Consejería de Medio Ambiente*…).

At least, 67,7 Ha have been recovered, though the project continues in execution. The system used nowadays consists of two big rafts of decantation, that are creating hills of soft slopes, which are recovering a naturalized landscape by means of the application of a fertile coverage and its

[3] The plaster deposited in this sector and the following one, is the residue that ensues from the manufacture of phosphoric acid for humid route in the companies Fertiberia-Huelva and FMC-Foret. The process consists fundamentally of the attack of the phosphoric rock with sulphuric acid, which gives place on the one hand to the phosphoric acid and for other one to the residue of plaster (sulfate calcicum di-hydrated). This residue turns out to be impregnated with phosphoric acid and other substances that accompany on the phosphoric rock (including arsenic, lead, mercury, cadmium ...).

revegetation. The zone of spilt, in use or not, includes a whole of 800 Ha of former marsh, being the surface in use of 170 Ha (Raft 1) and 150 Ha (Raft 2). Approximately 2.700 trees and 5.500 bushes have been planted, which are feed by bio-solids and polished waters of the neighboring Plant of Treatment of Residual Water (located in the sector of Marsh of El Pinar).

Of the zones without recovering there stay the distant ones and fewer contaminated marsh of La Nicoba, which presumably will be regenerate naturally, and the zone of spilt urban (zone of warehouse of inert and rubbles) that once closed, will be recovered. The bordering zone to the city (Marsh of El Polvorín and Tideland of El Rincón) is tried to be regenerated to their original state by means of their own capacity of autopurification and the cessation of the spilt, as well as a treatment of the urban edge, formed by the marsh and the railway, facing its incorporation to the green system of the city. In this zone there are still the remains of a Warehouse of Explosives, a loading/unloading platform of mineral and drosses for railroad, and a factory of sulphur, ruins, all of them, of certain archaeological industrial interest, and on that interests of conservation exist.

Sector II. Marsh of El Pinar

This former marsh was an uncontrolled dump of ashes and plaster (uninterrupted from 1968 to 1997), before the execution of the "Corrector Plan of Liquid Spilt" and its already commented "Project of Reordering of the Spilt of Plaster". Already in 1990, the Agency of the Environment of Andalusia (AMA) initiated the process of regeneration of the zone. To the impossibility (because of its economic cost) of withdrawing the deposited residues, a vegetable tapestry has been generated in the shape of meadows and small forests. The Corrector Plan corrected the type of spilt, that was restricted to the Rafts of Plaster-phosphorus nowadays in use. This zone, with the hills of ashes of pyrites of smelting, was regenerated by means of the application of a fertile coverage and revegetation.

It was claimed, with this zone nearer to the factories and already filled for the spilt, the recovery of a space very degraded by the deposition of very pollutant residues (ashes and muds). The pollution remains in the subsoil and this is testified by the visible filtrations. The recovery of this space has not been translated in a minimal public use, which is considered to be unhealthy both, by its origin and by the nearness to the factories, smells and smokes of these. It is in use as mere absorber of the industrial zone, and the revegetation has failed in many parts, since the vegetation does not resist the levels of pollution as soon as their roots reach the low caps where remain the residues.

In these areas there was included the construction of the Plant of Treatment of Residual Waters that gives service to the city, and a store of crafts impeded of the Port Authority. The whole surface have been revegetated by species of different freightage and "characteristical" of the zone, to create a naturalized image[4].

The intervention has needed particularities depending on the different zones. In the deposits of muds, of very soft surface, an agreement was established with the Town hall of Huelva to cover them with urban rubbles (similar way to what is done nowadays in the sector commented before). The deposits of ashes were remodelled topographically, covering them with impermeable clay and vegetable land. The hills and artificial lagoons serve as milestones of landscape. There have been invested approximately 10,67 millions of €, planting 19.500 trees (pines, eucalyptuses...) and

[4] Some of the used species have been called autochthonous, when there are eucalyptus and many others species from far away. And it is difficult to call naturalized recovery to a marsh that rises now several meters on its original level.

78.000 bushes. The volume of aported land is of 1.758.000 m^3. There have executed, likewise, 35 Km of ways and other 29 of pipelines of irrigation.

In short, of the 400 Ha, the Plant of Treatment occupies scarcely 6,4 Ha, and the rest have been recovered. This former grant of the Port Authority of Huelva and Headquarter of Coasts to Fertiberia, Atlantic Copper and Foret is now a green space, though the mystery is kept on the model of management of the area once rehabilitated, whose juridical ownership corresponds to the Port Authority of Huelva (nowadays it can be qualified of abandon).

Sector III. Punta del Sebo

More than forty years have passed from the irruption in 1964 of the First Plan of Development; and other two more than came after. Among 1964 and 1972, eleven Areas were created, seven of them with the first plan, and one of those was the Area of Huelva. Since then, many things have changed. Of a fishermen's small city and port of exportation of mineral, it passed to an industrial Area of the most important of the country, which today relies on more than 16 plants of Chemical and Basic production, and more than 16.000 working places directly related to these companies. It is evident that great part of the economic provincial fabric has been created concerning this Area.

Punta del Sebo, Ría del Odiel and Avenue Francisco Montenegro, before the implantation of the industry
Foto C. P.

The Province of Huelva is the least populated from Andalusia, and only over Lugo if we refer to the coastal provinces of Spain, as well as a low population density. Great part of the population of the capital is from outside the province, population who came attracted by a forceful industrial sector, an Area that was born in the Punta del Sebo, then decentralized in search of major spaces towards Nuevo Puerto, in Palos de la Frontera, the Industrial Zone of Tartessos, close to San Juan del Puerto, where it is installed the current plant of cellulose and the plant of metallic carbides (already closed), and the small zone created around ASLAND's cement works, today in Portuguese hands (CIMPOR), in the city of Niebla.

An abandon of the activity has not taken place, just punctually, but there has taken to end a strong improvement of the environment of the zone, across the stipulated in two key-documents of territorial and environmental improvement, so much for this sector as the three following ones:

a) Corrector Plan of Liquid Spilt: With an investment closely of 44 millions of €. To the internal measurements to start in the different companies, other external correcting measurements were added, financed with FEDER funds (more than 18 millions of €). These have covered environmental infrastructures as a Plant of Industrial Residues (*Planta de Inertización de Residuos Industriales*), the Laboratory of Pollutants' Analysis (*Laboratorio de Análisis de Contaminantes*), a craft of alertness and control, the Net of Alertness of Atmospheric Pollution (*Red de Vigilancia de Contaminación Atmosférica*), etc.

b) Corrector Plan of Atmospheric Spilt: It has consumed an investment near to 42 millions of €. They have gone fundamentally to technological improvements facing the reduction of the emission of gaseous pollutants, as the SO_2.

With the application of the measurements taken on the basis of both documents, the contribution of acid to the estuary of Tinto and Odiel rivers proceeding from the industry descended during the force of the plans of 23.000 Tm of 1989 to the 3.500 of 1994.

Besides, they incorporated a "Plan of Landscape Restoration of the external boundary of the chemical zone of Punta del Sebo (Avenue Francisco Montenegro and road Huelva-Palos de la Frontera)" (*Plan de Restauración Paisajística de la linde externa del polígono químico de la Punta del Sebo –Avenida Francisco Montenegro y carretera Huelva-Palos de la Frontera–*), for the recovery of the estuary of the city of Huelva. A new tracing of the avenue Francisco Montenegro has been realized, with several rotundas, which facilitate the access to the factories and improve the visual and environmental situation of the riverside, including the gardening and the creation of vegetable screens that reduce the visibility of the industries, as well as a regulation of the spilt to the estuary and tidelands, that has given evident effects, on being repopulated the shores of the typical vegetation of the coast and fish species that years ago dissapeared reappearing . It included also, the recovery of the wharf of the Tinto, the involution of the maritime club as civic center of sports activities and the maintenance and amplification of the environment of the monument to Colombus. Many critical voices have raised against the scanty level fulfillment of both plans, especially in the measurements of accompaniment before commented. The part that stays for executing of the purely urbanistic performance runs at the expense of the amplification of the city towards the South, in the zone named "*Ensanche Sur*", that will complete the recovery of the estuary of the Odiel with a maritime walk from the end of the industrial zone, up to the Port of Huelva adjacent facilities in the city.

In whole, an industrial zone that occupies 270 Ha, of which, the industrial activity covers 215 Ha, with an important surface of industrial lots (35,5 Ha), and approximately 15 Ha recovered for the maritime walk and another 4,5 Ha of the riverside of the estuary of Odiel and Tinto rivers.

Sector IV. Nuevo Puerto

This industrial zone is located in a kind of sandy peninsula that has stayed between the Natural Place (*Paraje Natural*) of Domingo Rubio's Tideland (to the north), in Natural Place of Laguna Primera de Palos and Las Madres (eastwards), the estuary of Tinto river (on the west) and the Channel of the Santo Padre, exit of the port of Huelva and the estuary of Tinto and Odiel rivers.

The needs of growth of the Industrial Area of Huelva derived in the jump to the other riverside, to the municipality of Palos de la Frontera, with the construction of a bridge. The new industrial space includes today approximately 1.195 Ha, not all of them occupied by the industry, which compete of direct form with three different utilizations, the agriculturalist (the new agriculture exploits industrial spaces without occupying), the tourism, of Mazagón's nearby coastal nucleus and the of Columbus places, and the environmental uses, understandable based on the wealth in wetlands of this part of the Spanish coast. As a part of the measurements of environmental improvement, and concretly the refinery CEPSA-La Rábida and the Andalusian Council of Environment (*Consejería de Medio Ambiente*) have taken to end the ecological restoration and adjustment to the public use of the Lagoon Primera de Palos. In the year 2001 the works of restoration began, with an investment of more than 510.860 €, realized by CEPSA with the collaboration of the *Junta de Andalucía*. The transformation and degradation of the zone in the last decades had been notable. Fundamentally because of the development of an intensive culturing nearby the wetlands and the occupation of soil for industrial activities. The improvement includes the promotion of the public use, specially as a pedagogic resource, with the creation of a botanical itinerary, two bird-life observatories, the signposting and a notebook of activities. Program in which already more than 12.000 persons have taken part. The lagoon is placed in properties of the refinery La Rábida, in where this enterprise has constructed four big tanks of crude oil, and whose Study of Environmental Impact included this restoration as a compensatory measurement.

This lagoon is included, together with nearby others, in the Net of Protected Areas of Andalusia (*Red Espacios Naturales Protegidos de Andalucía -RENPA-*) as Natural Place (*Paraje Natural* with category RAMSAR). The project of recovery proceeded to the retreat of the intensive illegal culturing in its shores. A revegetation of the lagoon perimeter was realized, with more than 7.000 specimens and a whole of 34 autochthonous species. The walls were also withdrew, because they were preventing the flood of certain zones, recovering more than 3 floodable Ha. A fence rounding the lagoon has been created, replacing the electrical air wires with other undergrounded and creating visual vegetable screens that reduce the impact of the nearby Industrial Area and the road, protecting the fauna of noises and inconveniences. Even the tanks of storage located in the surrounding area of the lagoon have been painted in blue to simulate the color of the sky. Other environmental measurements have been the creation of burrows for otters, innkeepers for lads, artificial islets for aquatic birds, nest eggs, etc.

In whole, scarcely the half of the surface is really occupied by industrial and/or port activities, with 613 Ha, and other 388 Ha of lots, ready to be occupied. The new agriculture occupies approximately 38 Ha (actually, the areas that the industry did not occupy in its moment, being these 38 hectares those that are unequivocally in industrial zone). Approximately 1,3 Ha of gardens (hedges, dividing, rotundas) and 61 Ha of zones with natural uses (dunes, bushes, marsh) and the almost 95 Ha of the Lagoon Primera de Palos and surrounding area.

View of "Nuevo Puerto" And Domingo Rubio's Tideland from the Punta del Sebo before the implantation of the industry and the bridge
Foto C. P.

Sector V. Tartessos

The Industrial Zone "Tartessos" is born in the municipality of Huelva, adjacent to the neighboring San Juan del Puerto on the riverside of the Tinto river, as part of the expansion of the Industrial Area of Huelva. ENCE's cellolluse factory is the most evident industry of the zone, and that have determined, according to its needs, the location of the zone. There existed also a factory of Metallic Carbides, principal chemical activity of this sector, already missed since it closed only a few years ago (the Plant was in deep crisis, and it scarcely supposed a loss of working places, for the scanty staff that was kept after the privatization). The adjacent space with the Public Maritime-Terrestrial Space has been recovered, and most of the facilities of the former Spanish Society of Metallic Carbides (*Sociedad Española de Carburos Metálicos*) have been dismantled. In spite of everything, it remains as a very degraded environment, so much for the chemical activity that has developed in it, as for the spilt and contribution of pollutants of the proper Tinto river. Close to these industries an important industrial and commercial nucleus has developed, occupying nowadays a whole of 168 Ha, of which 87 are destined for the industrial facilities and commercial ships, with an important surface of lots, 42 Ha (~15 Ha of the factory of metallic carbides), and culturing is kept in its surrounding area. Besides, a small *arboretum* of the cellolluse factory and the gardens of the proper factories compose the whole of the green zones and free spaces of the sector (approximately 9 Ha), adding the 8,6 Ha destined to parkings and similar.

Project of the Huelva Bussiness Park and Tartessos.
Sorce: GMU, 2005.

Neighboring this sector, the pasture, or *Dehesa*, and marsh of the Alquería puts of manifest the common use before the implantation of the industry in this area. More recently, the Town hall of

Huelva has stimulated the creation of a great zone, today known as Huelva Bussiness Park (*Parque Huelva Empresarial*)[5]. The intention of the ambitious project is to provide to the city and surrounding area of Huelva of a logistic and managerial park for the present and future needs.

Sector VI. Niebla

The cement works of Niebla was located near the former Santa Barbara (abandonned warehouse of explosives), on Tinto's riverside, by the railway, and contiguous to an arids extraction that feeds to the proper factory during its activity. The strong crisis and descent of prices that took place with the opening of the market of the cement to the countries of Eastern Europe, with lower costs, took the, at that time ASLAND factory, to the disability to compete on the market.

Recently, *Cimentos de Portugal* (CIMPOR) bought the factory of Niebla and put it again in activity. Besides, a commercial and industrial zone has been developed, taking advantage of the axis of the highway A-49, promoting the local economy.

In whole, together with the new zone, this sector includes approximately 80 Ha, of which 28,6 Ha correspond to industrial and commercial uses (~19 Ha of the cement factory), remaining 35,3 Ha of lots without occupying, the majority belonging to the former Santa Barbara and the arids extraction.

Sector VII. Minas de Riotinto

The increasing interest of the society to know and enjoy the industrial patrimony as a sign of historical identity, has made come together in this sector, diverse initiatives and professionals, since in the productive local systems, synergies take place among diverse sectors that are interrelated, and that stimulate the development.

The endless mining crisis that rushed forth at the lands of the Andévalo was not indifferent for the great mine into which a great part had turned, of now so called Andévalo Minero or Cuenca Minera. The disability to compete on the market with the prices of the copper and other minerals, lead to a rapid and strong crisis of the mining in Huelva, in spite of many attempts and investments to refloat the sector. The cessation of the mining activity has supposed a strong degradation on the control of the liquid splits from the mines and dumps, and on the pumping of the waters that flood already many of the mining fellings, though, given the environmental previous situation, the abandon of the metallic mining industry has not supposed a serious environmental impact, but it has supposed a strong blow for the economy of a region overturned with this activity for thousands of years.

To remedy the strong social and economic crisis of this mining region, authorities have chosen for a process of economic diversification[6], inside which is registered the "Project Phoenix". Tourism and agriculture are specially promoted, with a project of putting in culturing big extensions. In 1.989 the society Riotinto Fruit, initiated its activities, with the plantation of

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[5] A strip of land of 3 Km of length located close to the A-49 (highway) and in the confluence of the N-341 and the N-435 (national roads). In whole, 183 Ha and a total investment that will overcome 234 millions of €. It is a question of a joint initiative between the Town hall of Huelva and the state society SEPES, of the *Ministerio de Fomento*, and that will shelter a part dedicated to the agro-food industry, a logistic center of transport, a central business district, hotels, a mixed complex of health, sports zones, industrial zone ... (logistic activity and of transport, 271.856 m^2; agro-food zone, 805.605 m^2; manufacturer, 805.605 m^2; services, 66.453 m^2).

[6] Indirect measurements have been for example the election of Riotinto's Mines for the High Resolution Regional Hospitable Center (*Centro Hospitalario de Alta Resolución comarcal –CHARE–*).

more than 1.000 hectares of citrus fruits, which have been extended later to 1.600 (1.100 already in exploitation). Accompanying to the plantation, in 2004, a new head office of 15.000 m^2 is opened, placed in El Campillo, with the financial support of the *Junta de Andalucía* (Regional Government), and substituting the previous ones (of lower capacity and size), burned in a fire (in 2003). The staff is today around 600 people (up to 1.500 during the epoch of compilation). Up to 3.500 Tm of fruits can be stored, and about 30.000 Kg of fruit can be packed per hour.

Characteristics of the Leader II and Proder in the province of Huelva

Program	LEADER II			PRODER	
Territory	Cuenca Minera	Andévalo Occidental	Sierra de Aracena	Condado	Costa
Number of municipalities	7	16	28	18	7
Extension (Km^2)	640	2.650,2	3.016	1.888,6	947
Inhabitants	20.247	42.687	42.020	96.108	100.214
Tax of unemployment (%)*	35,0	23,7	31,0	11,0	10,0
% primary sector	6,36	38,3	38,10	40,3	46,8
% secondary sector	42,06	29,4	28,65	19,2	9,7
% tertiary sector	51,58	32,3	33,25	40,5	43,5
* Must be observed the high tax of unemployment of the Cuenca Minera, where the recovery of the industrial patrimony can constitute an interesting base for its development.					

Source: Mantecón, J. (2005): Documentación aportada para la Maestría en Desarrollo Local. Estrategias territoriales y ambientales. Universidad Internacional de Andalucía. Director. Márquez, Juan A.

As mechanism of defense and of creation of employment, the Foundation Riotinto designed a project for a Mining Museum and tourist itineraries, including the visit to the industrial ruins at the complex of Zarandas. This project, already done a reality, has managed to attract more than 25.000 visitors, with the design of a tourist original and alternative offer. It is constructed on the basis of the "Mining Park", with a thematic offer that crosses more than 5.000 years of history of the mining industry in the region, and that includes visits to the Mining and Railway Museum, Corta Atalaya, the interior mining industry of Pozo Alfredo, archaeological deposits as the Roman Necropolis of La Dehesa, the English Neighborhood of Bellavista, besides a railway tour in the former mining train up to the surrounding area of Zarandas and the station and alighting-place of Los Frailes; recovering approximately 18 kilometres of railway route that crosses the martian landscapes, only and unusual, parallel to the Tinto river.

Mining capstan relocated on the verge of the Mining Museum "Ernest Lluch"
Foto García Delgado, F. J. 2005

The tourism turns this way into another prop of the development of the region. On *Orden* of October 15th, 1987, of the Minister of Culture, the Foundation Riotinto for the History of the Mining industry and the Metallurgy was created. Important mining spaces have been recovered since then for its tourist and cultural use, being its flagship the commented Museum and Mining Train. Among its activities, includes the maintenance of the Mining Park, nothing less than 900 Ha, besides the facilities. The museum contains also the Historical File of Minas de Riotinto, which has been filed and catalogued, creating a documentation center. The museum is located in the former English Hospital, with 1.800 m² of an integral explanatory area of the cultural patrimony of this territory. A part is also dedicated to the railway patrimony, plus a room of audio-visual, room of exhibitions, cafe and a shop.

The mining train crosses 11 Km up to the station of "Los Frailes" in mining coaches of the beginning of the XXth century. The train, restored and equipped, passes parallel to the Tinto river, supporting in use this part of the railway line constructed in 1873 by the English company Rio Tinto Co. Ltd. and closed in 1984. Also a steam locomotive has been recovered (year 1875), which works on Sundays and special occasions.

Inside of the Railway Museum
Foto García Delgado, F. J. 2005

But not all the activities have had a good social reception. It is well known the polemic arisen when it was decided to install in Nerva's municipality the Environmental Complex of Andalucía (*Complejo Medioambiental de Andalucía –CMA–*), known popularly as Dump of Nerva, a society created in 1996 for the construction and management of a safety warehouse for industrial, dangerous and not dangerous residues, which activity started in June, 1998.

The safety warehouse for toxic and dangerous residues has a minimal capacity of 300.000 Tm, while the industrial inert one has a minimal capacity of 3.000.000 Tm. In whole, the CMA occupies a surface of 140 Ha.

The CMA[7] manages residues of 100% of the industry of Huelva, Seville and the Campo de Gibraltar, having besides presence in the rest of the national market (included Canaries and Balearics) and Portugal, with mediation of the great industry and the intermediate agents. Its presence provokes an important social answer in against in this territory, though it has

[7] In December, 2002, *Alianza Medioambiental S.L.* acquires 100% of the share capital of the CMA, for what it passes to belong to *Befesa Medio ambiente S.A.* and to be an anonymous individual society.

supposed an important improvement in the management of dangerous residues and a contribution of employment to a depressed region.

On the other hand, the polemic on the future of the industrial and mining patrimony of the region continues, and it is not much less definite. Nowadays, the grant of the infrastructures of Minas de Riotinto are in *Mantesur Andévalo S.L.*'s hands.

In whole, the sector relies on 111 Ha of industrial areas in disuse and a mining zone that reaches the extension of 2.595 Ha.

Sector VIII. La Torerera

The closing of the mining facilities wherefrom fundamentally manganese was obtained, bore the closing of the industry of *Unión Española de Explosivos, S.A.* that extracted the mineral until approximately 1960. The closing of the mine and industry transported the disappearance of the mining settlement, as many other ones along the rest of the Pyrite Belt.

In the first half of the decade of the 80's, the administration proceeded to the dismantlement of the factory of explosives, and several actions were realized inside the Dangerous Plan of Waste Management of Andalusia (*Plan de Gestión de Residuos Peligrosos de Andalucía*), staying only the ruins on behalf of the arsenals (some of them were demolished too). More than 160.000 m^3 from contaminated lands have been moved back, with an expense of 196.000 € and the reforestation of 5 Ha has been proceeded to, as well as to the installation of a trap of limy to minimize the acid liquid spilt to the riverbeds.

Likewise, the rural tourism in the zone has been tried to promote, by means of the creation of a tourist camp, which was taking advantage of the infrastructures that had stayed, and that never managed to open. The "Project of Tourist Camp La Torerera" was born for an agreement between the *Junta de Andalucía (COPT)* and the union UGT, close to the reservoir of El Riscoso. The camp was constructed in the year 1991, and it was accompanied of a project of putting in tourist value, never executed, and even it was accompanied of an intense advertising campaign. The facilities remain closed, incomplete, and abandoned. The initial budget of these facilities was of 1.803.036 €, including the restoration, adjustment to the tourist use and the construction of a series of bungalows and a zone of encamped free.

According to a proposition-non-law published in the *BOPA* n º 232 of December 21th, 2001, the Parliament of Andalusia urged to the *Consejo de Gobierno* to undertake, as brief term as possible, the necessary actions in order that the tourist existing facilities in "La Torerera" could be incorporated into the net of tourist facilities that offers the province of Huelva, "providing it with a high environmental quality and with systems for its harmonic integration with the surrounding environment". For wich was necessary, between other aspects, to proceed to solve the deficiencies and to execute new actions. Nevertheless, the breach of the Public Hydraulic Domain keeps paralyzed any attempt of recovery of the constructed, and in addition it is not possible to grant license of opening because:

a) There is not solved the elimination of architectural barriers.
b) Counter-fires System does not exist in spite of being placed in a considerable ecological and landscape value.
c) It does not rely on report of environmental impact.

d) It does not have electrical current on not having relied on the necessary center of electrical transformation.
e) It does not rely on drinkable water.
f) Inscription does not exist in the Record of Tourism of Andalusia.
g) The roads of access present bad conditions.

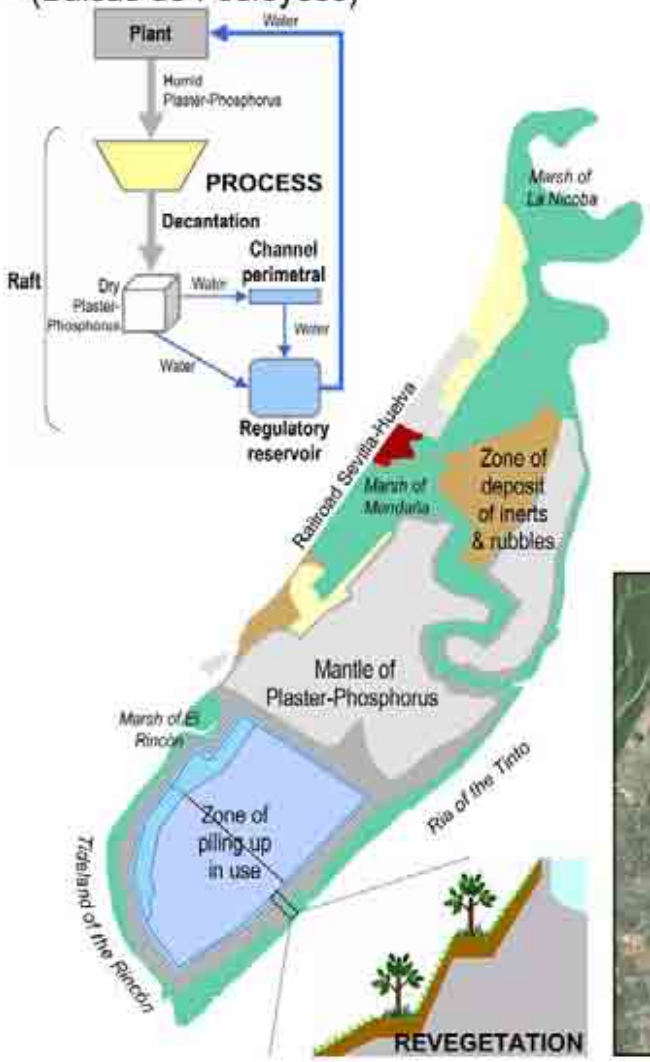
Bungalows and pub-restaurant
Source: COPT, 2005

The unsuccessful camp is divided in two triangular parts, one contains the buildings of common services (shops, baths, bathrooms) and the other one corresponds with the zone of encamped free. The parking places are at the entry of the camp, and all the infrastructures have been realized with a modern architectural project that included palafitic bungalows and a restaurant on the waters of the reservoir.

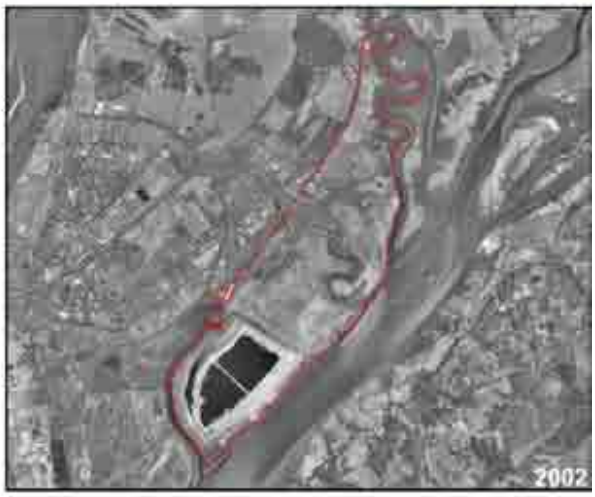
Zone of calcinations. "Teleras"
Foto C. P.

Study nº3: Territorial Improvement

Sector I. Rafts of Plaster-Phosphorus (Balsas de Fosfoyeso)



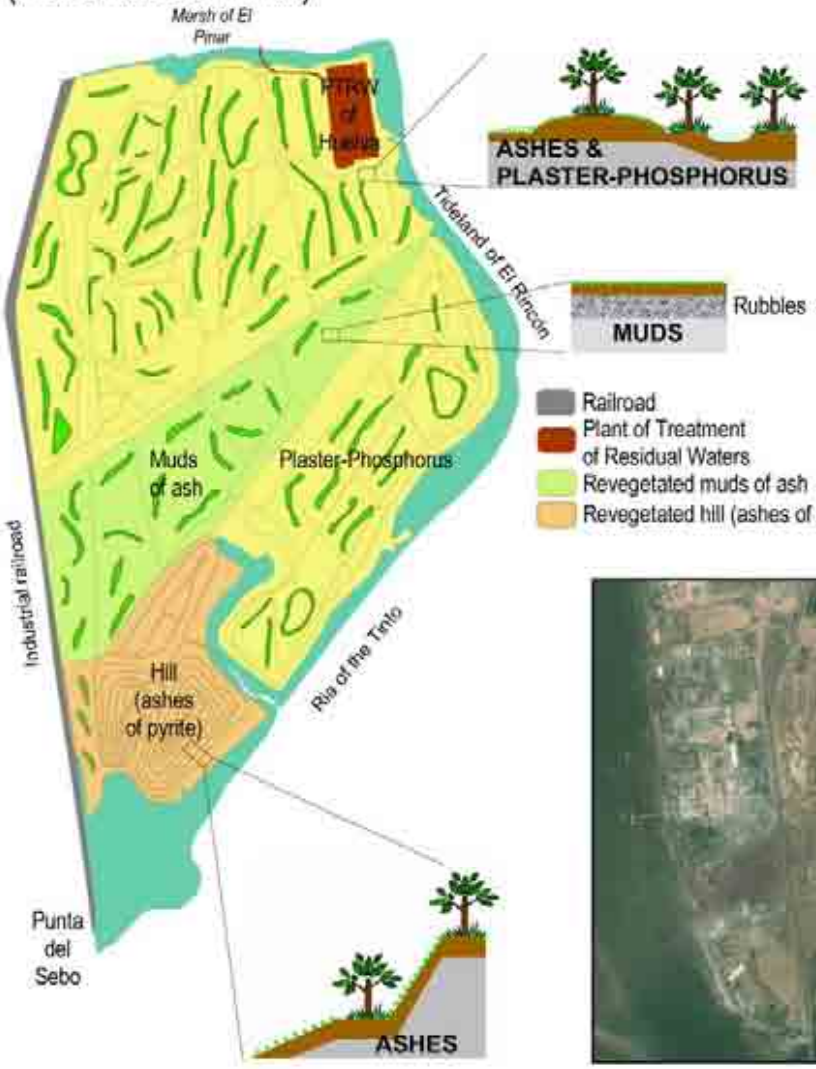
Piling-up raft
Channel perimetral and reservoir of regulation
Herbaceous
Plaster-Phosforus
Inerts
Piling-up hillside
Marshes
Factory of Sulphur

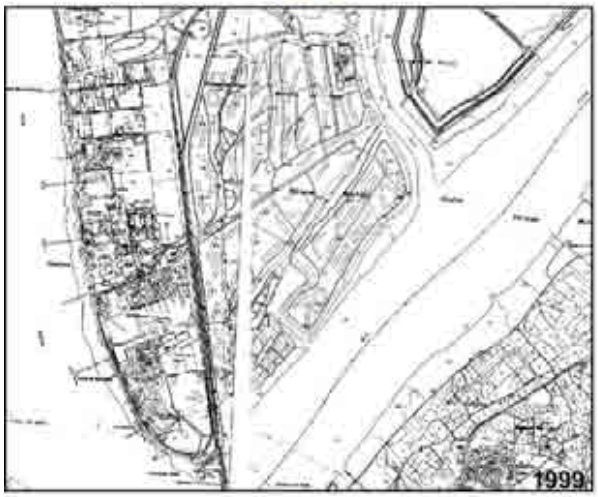


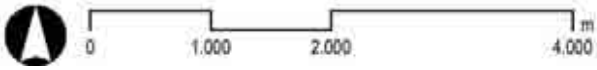
Sources: ICA-JA, 1999; ICA-JA, 2004; AIOB, 2005; CSIC, 2004; COAH, 2005; EEA, 2004; DPA, 2000. Production Pazos, F. J., IDL-GI, 2005

Study nº3: Territorial Improvement

Sector II. Marsh of El Pinar (Marismas del Pinar)



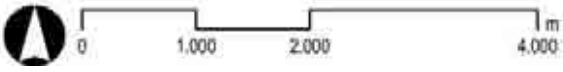




Sources: ICA-JA, 1999; ICA-JA, 2004; AIQB, 2005; CSIC, 2004; COAH, 2005; EEA, 2004; DPA, 2000. Production Pazos, F. J., IDL-GI, 2005

Study nº3: Territorial Improvement

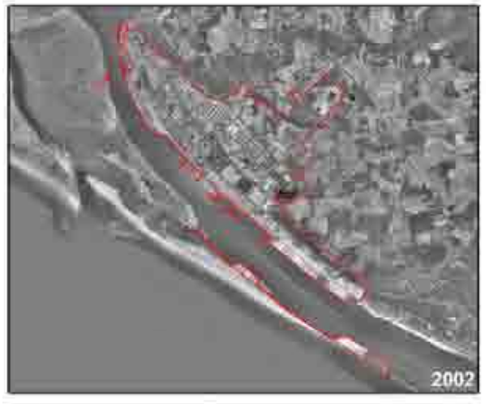
Sector III. Punta del Sebo

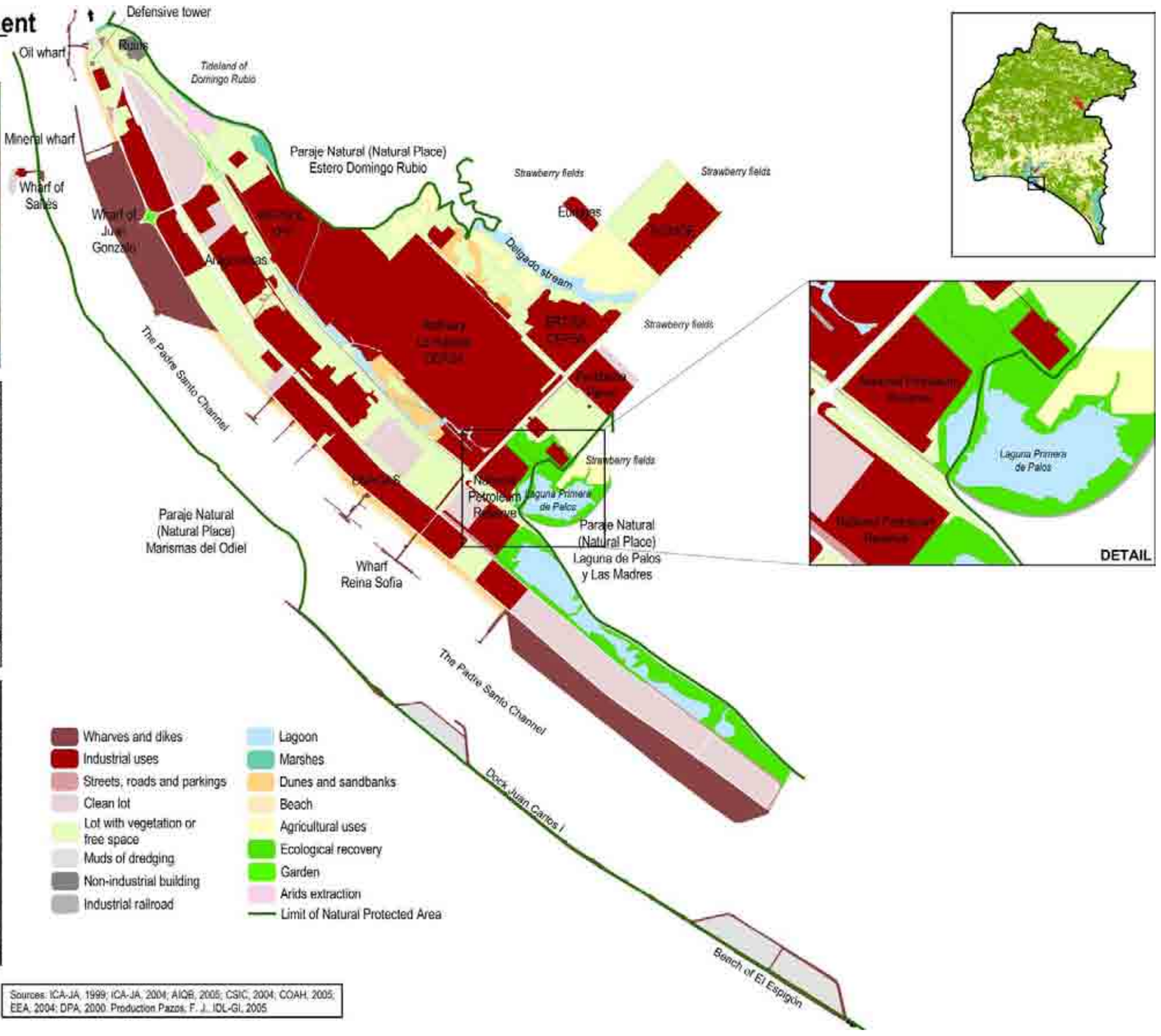


Sources: ICA-JA, 1999; ICA-JA, 2004; AIQB, 2005; CSIC, 2004; COAH, 2005; EEA, 2004; DPA, 2000. Production Pazos, F. J., IDL-GI, 2005

Study nº3: Territorial Improvement

Sector IV. Nuevo Puerto

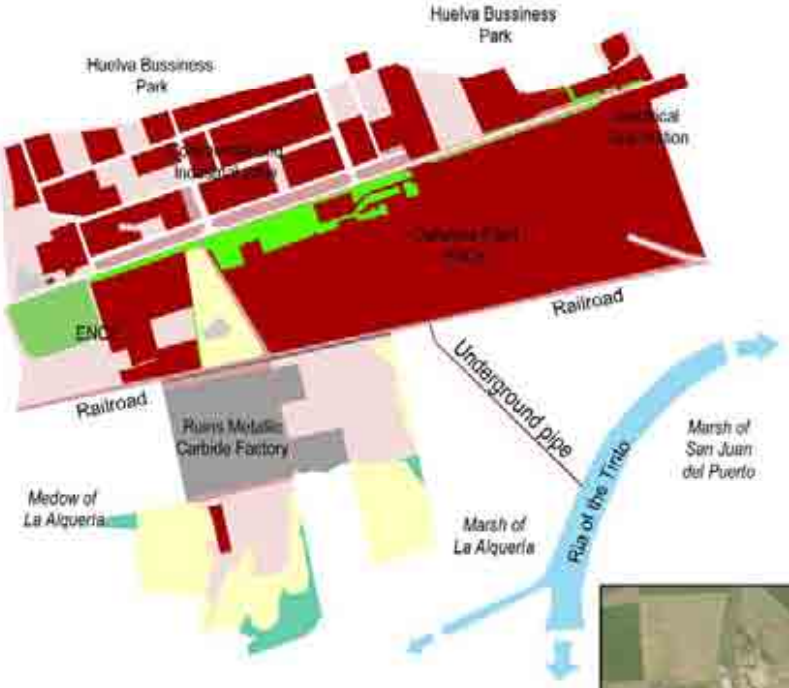




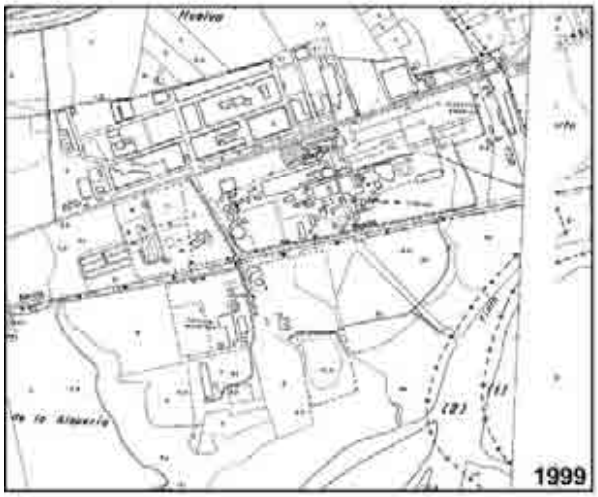
Sources: ICA-JA, 1999; ICA-JA, 2004; AIQB, 2005; CSIC, 2004; COAH, 2005; EEA, 2004; DPA, 2000. Production Pazos, F. J., IDL-GI, 2005

Study nº3: Territorial Improvement

Sector V. Tartessos



Industrial uses
Streets, roads and parking
Lot
Railroad
Ruins
Houses
Agricultural uses
Eucalyptus
Garden
Marshes
Tideland



0 500 1.000 m 2.000

Sources: ICA-JA, 1999; ICA-JA, 2004; AIQB, 2005; CSIC, 2004; COAH, 2005; EEA, 2004; DPA, 2000. Production Pazos, F. J., IDL-GI, 2005

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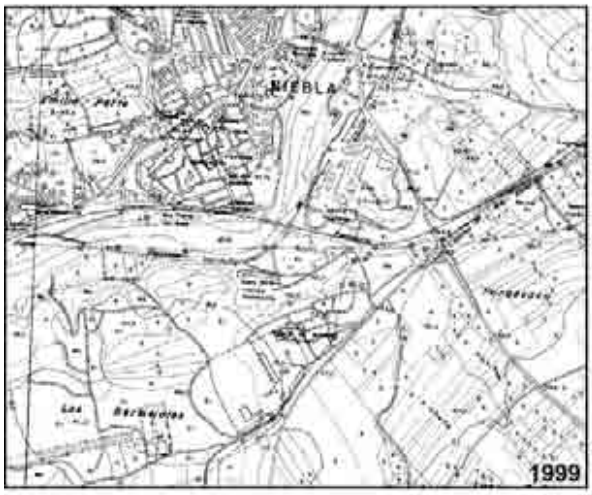
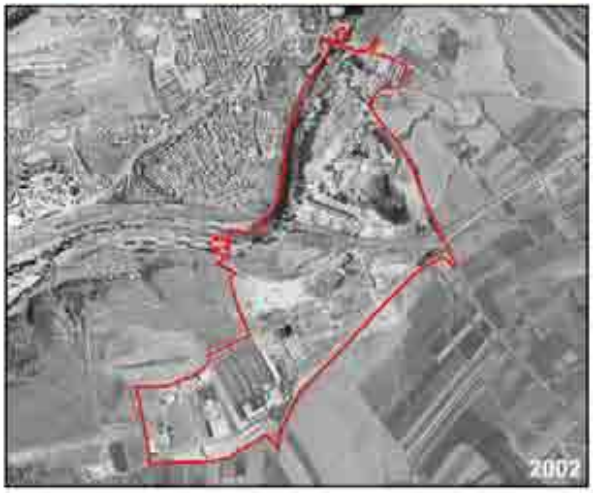
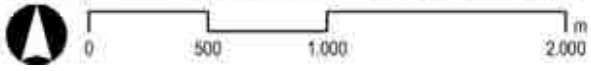
Sector VI. Niebla





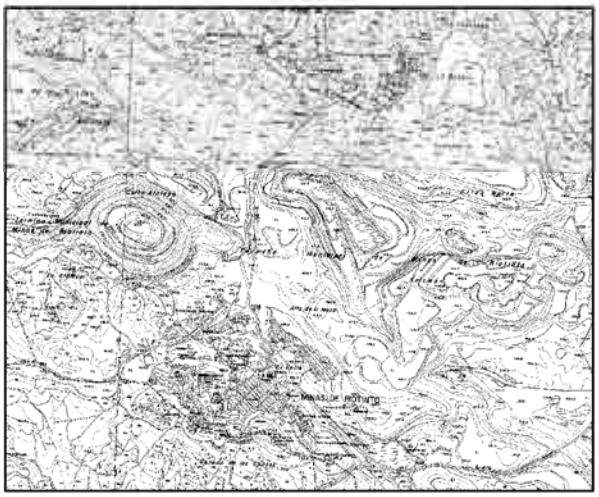


Sources: ICA-JA, 1999; ICA-JA, 2004; AIQB, 2005; CSIC, 2004; COAH, 2005; EEA, 2004; DPA, 2000. Production Pazos, F. J., IDL-GI, 2005

Study nº3: Territorial Improvement

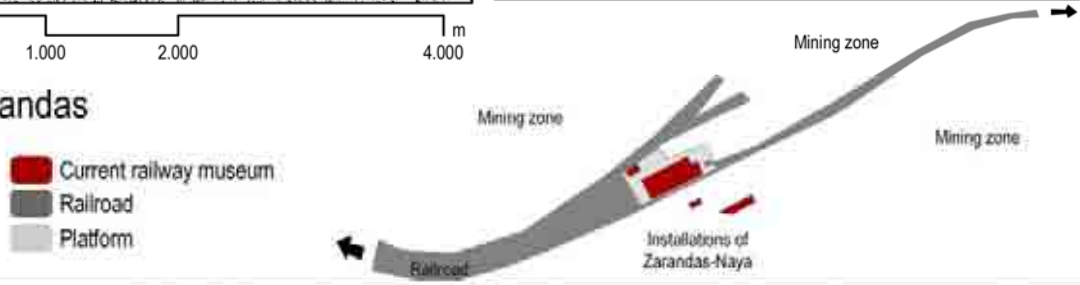
Sector VII. Minas de Riotinto

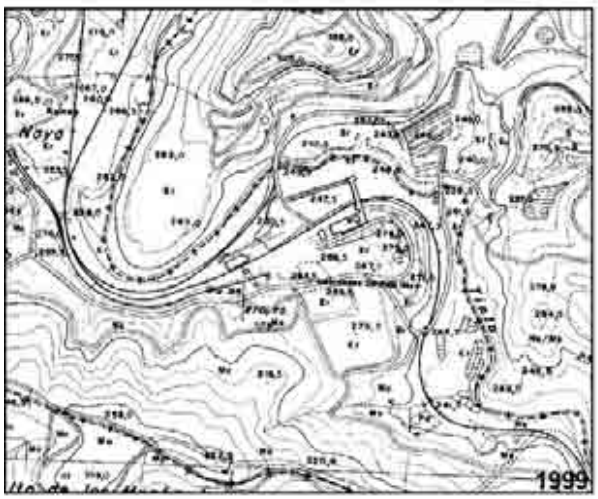
a. Minas de Riotinto



0 1.000 2.000 m 4.000

b. Zarandas



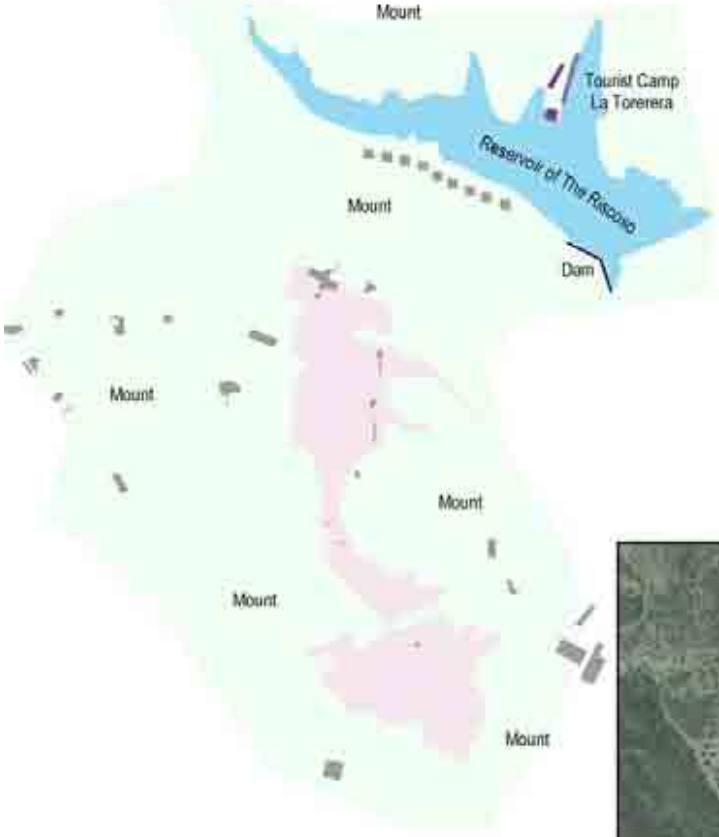


0 300 600 m 1.200

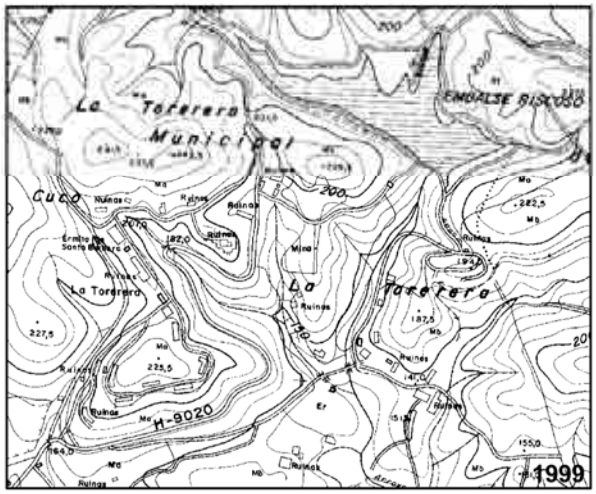
Sources: ICA-JA, 1999; ICA-JA, 2004; AIQB, 2005; CSIC, 2004; COAH, 2005; EEA, 2004; DPA, 2000. Production Pazos, F. J., IDL-GI, 2005

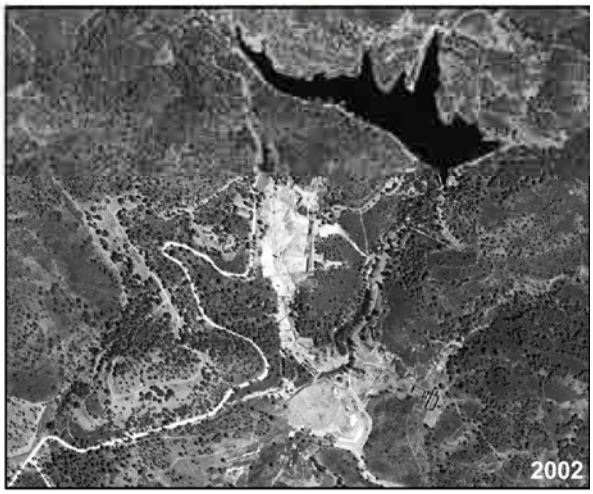
Study nº3: Territorial Improvement

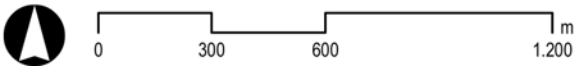
Sector VIII. La Torerera



Water surface
Tourist camp
Lot
Ruins of the settlement, warehouse of explosives and factory
Mount







Sources: ICA-JA, 1999; ICA-JA, 2004; AIQB, 2005; CSIC, 2004; COAH, 2005; EEA, 2004; DPA, 2000. Production Pazos, F. J., IDL-GI, 2005

5. Management. Planning and public and private responsibilities

Several decades have passed already from the awakening of the environmental conscience in the modern western society. The first international agreements on what today we know as "environmental questions" appeared already in the middle of the XXth century, as response to those environmental aggressions that were affecting beyond the sovereignty of the political borders.

The chemical industry has been probably one of the sectors that has had to confront the major changes. In spite of everything, the environmental cost continues crawling as a minor evil on the part of many states and companies, especially when the laws come late, and certainly, in case of the industrial spaces in declivity.

The strategic planning of the companies, little by little, has been incorporating environmental aspects and of environmental interest, often as response to the "false conscience" of the market, which has given place to the "green marketing", but also to strong positive synergies related directly to the improvement of the industrial environments (image and competitiveness). Likewise, the public administration in its different levels has understood the great importance of the territorial and environmental planning, but also the economic one, as a fundamental tool of conservation of the environment and the territorial improvement.

Nevertheless, in spite of the major interest, and to the great number of created interests, many uncertainties of the public and private responsibilities are still hanging on. One of the major problems that the industrialized societies are facing is of defining the responsibilities of management of the deserted spaces, but also of others where there exists an activity that will stop some day, of environmental evident impacts, and of which management, once the activity finishes, nothing is determined. Not many years ago, measurements of closing mine were not contemplated, what is evident in the Pyritic Belt, and the abandon was the most common end for zones of spilt or industrial use. This situation has changed already, thankfully, but many of the uncertainties in the matter continue.

The administrative responsibility is regulated by all the countries of some form, more or less protectionist. One of the principles almost always observed is that of "Responsibility and repair of environmental damages", taken of one of the general principles that govern the International Law, source of right of great relevancy in what to the environment refers, but facing the evident technical difficulties and the political and economic reticences, in practice, we have come towards forms attenuated of responsibility (the economic repair of the damage is the "standard" mechanism, in spite that there have not yet been developed the technologies of repair of the environmental damage and their economic valuation). Other of the classic principles on the administrative responsibility is the "Principle of restorability", that joins both, damage and prejudice, and that the public ownership of the environmental goods does not buckle.

From the International Law, when the activities produce a damage to other states and neighboring territories foreign to the sovereignty of the causer, the responsibilities are clear, the State is responsible not only for its own actions, but also for any activity realized in its sovereign territory that have caused a damage, independently of the private character of the authors, the State turns into the guarantor of the protection of the environment and of its repair. The public

responsibilities are not, nevertheless, so clear when the damage does not reach the category of “international conflict”. Then is usually to allude the principle of "the polluter pays".

In the practice it is difficult, in the current legislative frame, to apply this principle. Though, important advances were done in the last years, and the efforts are great to fit this principle to the basic ones of the environmental protection. In this respect, it is necessary to emphasize the role of the EU and its Directives[8], some of which, nowadays in elaboration, will clarify surely much better the responsibilities on the management, in order to improve its effectiveness and viablelity. One of the problems is how to face this aphorism when the pollutant activities already pay a few taxes for polluting, supposedly, because the authorized issues must not exceed the capacity of autorregeneration or the limits for the technics destined to eliminate the negative effects of the pollution. Definitively, the one who can pay, contaminates. Different it is the case of the measurements of closing or cessation of activity, and the measurements of monitoring and recovery of the contaminated spaces, today, a part of the production process itself, but new not many years ago. We can say that the proper generating activity of the contaminated space have to proceed to its closing and remediation as well as possible, avoiding these costs to be run at the expense of the administration, and establishing the measurements of monitoring that were necessary.

Of the studied sectors, we can differentiate three types. On the one hand, the zones of spilt of the chemical industry, for other one, the proper industrial emplacements, and the third group, that contains the industries established in the mining zones.

The Port of Huelva (Port Authority) is the holder of a great part of the areas today occupied by the chemical industry, and its role was determinant in the management and creation of the current Industrial Areas. The property of the areas obeys generally grants, of the town halls, or of the Headquarter of Coasts, or, since as said before, the Port Authority of Huelva. Whereas the management and the maintenance of the spaces remains clear in case of the industries, it does not happen the same with the zones of spilt, once finished the restoration (case of the Marsh of El Pinar), or with the mining deserted spaces. In the concrete case of La Torerera, for example, the management and the maintenance of the facilities of the deserted tourist project is not clear, or even suggested.

To guard by the fulfillment of the norm corresponds to the *Consejería de Medio Ambiente*, nevertheless, this lacks of effective instruments for the environmental improvement, since the conflicts between wills and objectives of public and private initiatives, often, appear divergent.

[8] White Paper of 9 February 2000 on environmental liability and Directive 2004/35/EC of the European Parliament and of the Council of 21 April 2004 on environmental liability with regard to the prevention and remedying of environmental damage (Official Journal L143 of 30/4/2004). The solution put forward by the Commission in the White Paper was accepted, and the process which started over ten years before finally culminated in the adoption of this Directive, the first piece of Community legislation in which implementing the polluter pays principle is one of the main objectives.

Passage Chart of the Port of Huelva 1981-1983 (*Comisión Hidrográfica Española*, 1983)
Source: A. P. de Huelva, 2005

6. Diagnosis. Weaknesses and strengths, threats and opportunities

Internal factors that impede the territorial improvement. Weaknesses:

1. Lack of activities to develop in the deserted chemist - manufacturer areas.
2. Difficulties / inviability for the recovery of the environmental affected areas (case of the marsh and river mouth of the Tinto).
3. Confuse situation of the juridical property of the affected areas, which makes complex the activities of recovery (and the competitions on them), especially about marsh.
4. Abandon, without any type of treatment, of residues and spaces affected by the chemical activities.
5. Existence of big rafts deserted of acid waters.
6. Financial disability to approach the recovery of the chemical degraded areas.
7. Dispersion of degraded areas, which impedes an unitary performance.
8. Scanty competitiveness of some chemical current productions, which make foresee their abandon to short - half term.
9. Fears, tensions, prejudices and social complexes concerning the kindness of the Industrial Area.

Internal factors that stimulate the territorial improvement. Strengths:

10. Advance of the ecological conscience (social and political).
11. Interest for the recovery of degraded spaces.
12. Existence of important chemical industries in the Industrial Area (Huelva-Palos de la Frontera), that can contribute to the recovery of the degraded spaces.
13. Concentration of the current chemical activities, which facilitates the recovery and treatment of the degraded areas.
14. Development of the tourism (from the point of view of the thematic and didactic function) in some chemical areas (Zarandas).

External factors that impede the territorial improvement. Threats:

15. Scanty alertness of the fulfillment of regulations in force.
16. Disinterest for these areas, marginal to the current sources of wealth (tourism and new agriculture).
17. Productive restructuring and closing of industries still functioning and abandon of new degraded spaces without a previous recovery.

External factors that stimulate the territorial improvement. Opportunities:

18. Application of the European (EU) regulation.
19. Accomplishment of studies for territorial improvement.

20. Utilization of the degraded areas for the installation of chemical industries of small size (what has been realized successfully in some cases).
21. Advance of Kyoto's offers to muffle the climatic change.

Conclusions

Obstacles have been identified to the territorial improvement, which concentrate specially in the internal weaknesses, whereas the principal factors for its development are stimulated from external opportunities. In this context, it seems to be suitable to centre on offers that are orientated facing a better labor of research, formation, use and disclosure of the territorial improvement, as viable alternative to construct local environments of major quality, and to eliminate the prejudices and complexes that have been detected in the social fabric at the moment of confronting this task in the chemical industrial space.

7. Proposals for the improvement of the areas in disuse or little used

Undoubtfully the benefits that the chemical industry has had in the province of Huelva, though, the prejudices are equally evident. The great extension of spaces that along the brief industrial history of the province have been mere dumps or “back-street" places to the development are today reservations of uncultivated areas that can be put in value, being on the verge of the cities, and shaping a wide net of spaces that can play an important role in the improvement, not only territorial, but also social and economic, of spaces in crisis.

As we have seen, several are the reasons that have led to the abandon of the industrial use of these areas:

- Productive Restructurings.
- Environmental Pressures.
- Loss of competitiveness on the international market.

At the same time, the recovery of the industrial little used spaces or in disuse, in the province of Huelva, has had, essentially, an environmental motivation. The economic utilization of these spaces, where it has been tried, has had also very positive effects.

Informative illustration of the *Generalitat de Catalunya* on contaminated spaces
Source: *Departament de Medi Ambient i Habitatge*, 2005

With this conclusions in mind, of the diagnosis of territorial improvement, the fears, prejudices and tensions that the chemical "question" provokes in the province of Huelva, constitute the thickness of the portfolio of problems to solve.

In this respect, is considered to be prior objectives the research, formation, utilization and publication of the processes of territorial improvement developed in Huelva, which will act as battering-rams of the territorial improvement.

Once approached to these essential objectives, we can propose concrete performances and measurements adapted to every studied local area, which will be necessarily raised from the Sustainable Development:

- Economic growth, the territorial improvement mobilizes resources.
- Social projection, the territorial improvement creates employment.
- Environmental Sustaintability, the territorial improvement takes care and enriches the biodiversity.

Production Pazos, F. J. 2006

☑ AXIS 1: RESEARCH AND INTERPRETATION

❶ Provincial Observatory for the Territorial Improvement

Objective: Creation of an Observatory that acts as channel for the knowledge of experiences in similar spaces, promoter of the measurements, and monitoring responsible, which serves also as a revitalizing and social participation mechanism. It must rely on the participation of the public implied administrations, the social interested agents and certainly, the private company and their associations (AIQB), relying on the direction and/or coordination of the University. Among other tasks, it would be the manager of developing and coordinating:

- Program of Alertness of industrial contaminated and/or left spaces
- Program of Prevention. To elaborate the information and implantation of measurements, to warn the appearance of new contaminated emplacements and to minimize the negative effects of the spaces left, on the environment, and the urban and industrial plot.
- Program of Publication. Diffusion of information about the realized experiences and opening of public contests of ideas for the reutilization of the spaces.

Promoter: AIQB, EU, *Diputación de Huelva*, University, Town halls...

Execution: *Diputación de Huelva*

Consignee: Public in general

Location: In the former ENCE's Mill of Wood of pine in Tartessos's Zone.

Funding: 100.000 €

❷ Center of Research and Recovery of Industrial Left Spaces

Objective: To promote the creation of a specific center of studies for the Territorial Improvement, with clear participation of the companies and industries and the University of Huelva, as factor of knowledge. It would be a real laboratory of activities and technologies for the territorial improvement, and a center of I+D+I that would end up as big benefits both the companies and the University as well as the society of Huelv. It must work in narrow collaboration with the Observatory:

- Program of Research and definition of industrial contaminated and/or left spaces: to define, to characterize and to study the spaces that the industrial activity liberates (or retire) for other uses.
- Program of Recovery. Coordination, control and monitoring of the measures of decontamination, change of use, etc.

Promoter: AIQB, EU, *Diputación de Huelva*, University, Town halls...

Execution: University and *Diputación de Huelva*

Consignee: Public in general, public administrations, scientifics

Location: In the former ENCE's Mill of Wood of pine in Tartessos's Zone.

Funding: 300.000 €

❸ Creation of an Astrobiology's Permanent Center of the CSIC in the Tinto river

Objective: To propose that this chemical environment should turn into the center of research on astrobiology par excellence of the CSIC, provided that are its physicochemical characteristics those that have woken up the interest of organisations of research of the fret of the NASA (to study its forms of life, for the probable similarity between this environmental conditions and those who might give on planet Mars).

Promoter: CSIC, *Ministerio de Educación y Ciencia*, *Consejería de Medio Ambiente*, *Consejería de Innovación, Ciencia y Empresa*, *Diputación de Huelva*

Execution: CSIC, *Ministerio de Educación y Ciencia*

Consignee: scientifics, public administrations

Location: Minas de Riotinto, Nerva

Funding: 1.250.000 €

☑ AXIS 2: TRAINING AND PUTTING IN VALUE

❶ Course of Ecological Footprint and Territorial Improvement

Objective: To teach to a set of licentiates and professionals, that will turn into futures experts in the matter, the philosophy and the instruments for the territorial improvement

Promoter: AIQB, *Diputación de Huelva*, *Consejería de Obras Públicas y Transportes*, *Consejería de Medio Ambiente*

Execution: University

Consignee: Licentiates

Funding: 40.000 €

❷ Route of the Tinto river "Mars on Earth"

Objective: To signpost and to enable for visiting an itinerary around the Tinto river to observe the qualities that turn it into a unique environment, and this way, to promote and to support the declaration (already requested) as Patrimony of the Humanity.

Promoter: *Mancomunidad Cuenca Minera*, *Diputación de Huelva*, Town halls, Foundation Riotinto

Execution: Foundation Riotinto

Consignee: Public in general

Funding: 300.000 €

❸ Interpretive Route of the mining industry (Route of "Las Teleras")

Objective: To signpost and to enable for visiting an itinerary around the former system of calcination in "teleras", the systems of "canaleo", that will allow to give to know a few technologies that form a part of the history of the region and that have originated its peculiar morphology.

Promoter: *Mancomunidad Cuenca Minera, Diputación de Huelva*, Town halls, Foundation Riotinto

Execution: Foundation Riotinto

Consignee: Public in general

Funding: 500.000 €

❹ Great Green Park of the Tinto river

Objective: to turn the degraded zone into a great peripheral park around the city, providing it with infrastructures, regenerating tidelands and shores, creating landscapes and attractive spaces and agreeable for scattering.

The recovery in the Rafts of Plaster-phosphorus can be taken advantage in the creation of a great green space that acts as forest lung of the city. Specially because its nearness to the industrial spaces in use, and avoiding this way the scanty success of the public function that has been given in Marshes of El Pinar, because of the deficient reforestation of the space, and the excessive nearness to the industrial zone. In any case, it will be time and the social custom the one that will establish the values added of this future green area, and that's why will be suitable therefore, a design that is orientated more towards the fulfillment of ecological functions and a complementary public use.

The establishment of a new green space should be the opportunity to complete a green urban plot designed to be operative on the metropolitan area. On the other hand, its existence would create a new horizon to the east of the city at the time that the benefits of a green mass that absorbs the harmful effects of the neighboring industrial space would be obtained.

Promoter: Fertiberia, Foret, *Ayuntamiento de Huelva*

Execution: EGMASA, *Consejería de Obras Públicas y Transportes, Consejería de Medio Ambiente, Dirección General de Costas*

Consignee: Public in general

Funding: 25.000.000 €

☑ AXIS 3: UTILIZATION AND PUBLICATION

❶ Production of an informative and educational dossier and publication, about the Territorial Improvement in Huelva

Objective: To take to end a labor of publication the results, by means of a dossier of half-yearly or annual character, with the experiences and realized activities. To give to know the role of the chemical industry in the development of the society and its impacts, negatives and positives, and how to solve the first ones (the need to realize tasks of territorial improvement) and to take advantage of the second ones.

Promoter: EU, AIQB, *Consejería de Medio Ambiente, Diputación de Huelva*

Execution: Private company of marketing and advertising

Consignee: Public in general

Funding: 40.000 €

❷ Improvement and recovery of La Torerera like tourist camp

Objective: To adapt to the in force regulation and to the tourist current market the truncated tourist camp of La Torerera, including a tourist-mining itinerary connecting with other mining areas and possible locations of new infrastructures, and the utilization of left mining settlements for a tourist function.

To promote this kind of tourist offer as alternative and complementary offer to the traditional Sun-and-beach and the tourism of interior, and promoting the active tourism, sports and nature (speleology, climbing, aquatic sports in the damming, decrease of ravines...) as well as patrimonial visits to the interior of the mines, green routes, mining museum...). All of them coordinate and integrate into a net composed bay this new infraestructures and the existing ones, being able to promote a whole destiny for the Pyritic Belt, with a wide varied offer

Promoter: *Consejería de Obras Públicas y Transportes, Consejería de Turismo, Diputación de Huelva*

Execution: *Consejería de Obras Públicas y Transportes, Consejería de Turismo, Diputación de Huelva*

Consignee: Public in general

Funding: 2.000.000 €

❸ Urban re-utilization of the industrial left spaces

Objective: Having in mind other experiences realized in many urban areas, especially of the big European and North American cities (the boom of lofts and diaphanous spaces for offices, housings, centers of culture and leisure ...), it should shuffle the possibility of re-using the industrial left infrastructures as new inhabitable spaces: centers of leisure, centers of conventions, cultural spaces, housings...

With the correct treatments, many of these spaces can transform in authentic urban spaces of design. The great modal is the current and polemic Austrian initiative to transform, of the hand of the big architects, the gas tanks of Vienna into a spectacular set of housings[9]. To go beyond the museums and the merely patrimonial recoveries, facing a new concept of reutilization and recovery of the industrial patrimony. Besides, the loss of territorial identity will be avoided this way, especially in an environment like the from Huelva one, generated around the industry and the mining activities.

Promoter: *Colegio Oficial de Arquitectos de Huelva, Consejería de Obras Públicas y Transportes, Consejería de Medio Ambiente,* AIQB

Execution: *Colegio Oficial de Arquitectos de Huelva, Consejería de Obras Públicas y Transportes, Consejería de Medio Ambiente,* AIQB, Town halls

Consignee: Public in general

Funding: 10.000.000 €

9 In functioning until 1986, four bigger deposits of gas of Europe were declared after the closing, historical patrimony, but they remained without use. In 1995 the Town hall decided to transform them in a conglomerate of housings of low price. The dimension of the deposits gave for 600 housings, offices, a students' residence, a child-care, a regional file, rooms of spectacles and a mall, between other urban equipping. This performance, beside revaluing the structures, is having important repercussions in Simmering's industrial neighborhood, and around the deposits are arising centers of leisure, trade, offices... (García-Pola, 2002).

Proposals for the territorial improvenment. Summary				
Objective	Promoter	Execution	Consignees	Funding
Axis 1: Research and Interpretation				
1. Provincial Observatory	AIQB, UE, Diputación, University, Town halls...	Diputación	Public in general	100.000 €
2. Center of Research	AIQB, UE, Diputación, University, Town halls...	Diputación	Public in general, administrations, scientifics	300.000 €
3. Astrobiology's Center	CSIC, MEC, CMA, CICE, Diputación	CSIC, MEC	Scientifics, administrations	1.250.000 €
Axis 2: Training and Putting in value				
1. Course of expert	AIQB, Diputación, COPT, CMA	University	Licenciates	40.000 €
2. Route "Mars on Earth"	Mancomunidad, Diputación, Town halls, Fundación Riotinto	Fundación Riotinto	Public in general	300.000 €
3. Route of Las Teleras	Mancomunidad, Diputación, Town halls, Fundación Riotinto	Fundación Riotinto	Public in general	500.000 €
4. Great Park of Tinto river	Empresas, Town hall	EGMASA, COPT, CMA, D. G. Costas	Public in general	25.000.000 €
Axis 3: Utilization and Publication				
1.Informative dossier	UE, AIQB, CMA, Diputación	Private company	Public in general	40.000 €
2. Tourist camp La Torerera	COPT, CTD, Diputación	COPT, CTD, Diputación	Public in general	2.000.000 €
3. Urban re-utilization	COAH, COPT, CMA, AIQB	COAH, COPT, CMA, AIQB, Town halls	Public in general	10.000.000 €

Annexe

EUROPEAN CHEMICAL REGION NETWORK - HUELVA Study nº3: Territorial Improvement			
Chart 1. Industrial areas in disuse			
Sector	Origin	Actual use	Actions of environmental recovery and territorial improvement
I. Rafts of Plaster-phosphorus	Industrial dump*	Industrial/urban dump	▪ Revegetation and landscape restoration initiated in 1997 (paralell to working).
II. Marsh of El Pinar	Industrial dump	Green space	▪ Ended. Revegetation and landscape restoration.
III. Punta del Sebo	Industrial Area	Industrial Area	▪ Urban-environmental improvement.
IV. Nuevo Puerto	Industrial Area	Industrial Area	▪ Urban-environmental improvement.
V. Tartessos	Industrial Area	Industrial zone	▪ Urban-environmental improvement.
VI. Niebla	Industrial Area	Industrial zone	▪ Urban-environmental improvement.
VII. Minas de Riotinto	Mining	Abandonned / Turism	▪ Putting in tourist value. Mining Museum, Park and train. ▪ Fruit plantation. Río Tinto Fruit. ▪ Complejo Medioambiental de Andalucía.
VIII. La Torerera	Mining	Abandonned	▪ Abandon. Project of putting in tourist value **

* Fertiberia and Foret obtained in 1968 a grant for the spilt of plasters. In 1995 the Consejería de Medio Ambiente authorized the "Reordering of Spilt of Plasters" to reduce the pollution, preventing the occupation of new surfaces, allowing the storage in height, but recovering the areas by means of revegetation, and establishing a closed water system. Marsh of El Pinar was in origin, a part of this zone of spilt, though later its landscape has been recovered.

** Paralyzed Tourist Camp of La Torerera (UGT).

EUROPEAN CHEMICAL REGION NETWORK - HUELVA Study nº3: Territorial Improvement				
Chart 2. Afected area				
Sector	Total area		Area in use	Recovered area
I. Rafts of Plaster-phosphorus	Spilt area 800 Ha		Raft 1: 170 Ha (in use) / Raft 2: 150 Ha Useless: ~400 Ha	67,7 Ha (rafts' slope)
II. Marsh of El Pinar	Spilt area 400 Ha		PTRW: 6,4 Ha (64.083 m^2)	400 Ha
III. Punta del Sebo	Industrial area 270 Ha		Industrial area: 215 Ha Lots: 35,5 Ha	Maritime walk: 15 Ha Riverside: 4,5 Ha
IV. Nuevo Puerto	Industrial area 1.195 Ha		Industrial area: 613 Ha / Lots: 388 Ha Cultivation: 38 Ha / Natural uses: 61 Ha	Lagoon and surrounding area: 94 Ha Gardens: 1,3 Ha
V. Tartessos	Industrial area 168 Ha		Industrial area: 87 Ha / Roads and parking: 8,6 Ha Lots: 42 Ha (~15 Ha Metallic Carbide factory ruins) Cultivation and Natural uses: 21 Ha / Gardens: 9 Ha	-
VI. Niebla	Industrial area 80 Ha		Industrial area: 28,6 Ha (~19 Ha Cement works) Lots: 35,3 Ha / Cultivation: 6,4 Ha / Roads and parking: 9,5 Ha	-
VII. Minas de Riotinto	Industrial area 111 Ha	Mining 2.595 Ha	Nerva Dumping: 140 Ha	Riotinto Fruit: 1.100 Ha / Museum: 0,2 Ha Mining Park: 900 Ha / Train: 11 Km
VIII. La Torerera	Industrial area Ha	Mining Ha	-	-

EUROPEAN CHEMICAL REGION NETWORK - HUELVA Study nº3: Territorial Improvement			
Chart 3. Causes and consequences			
Sector	Causes	Environmental consequences	Socioeconomic consequences
I. Rafts of Plaster-phosphorus	Application of the environmental regulation. Corrector Plan of Liquid Spilt: Project of Reordering of the Plaster-phosphorus Spilt.	Split system is modified to a new one piling-up the plasters, reducing to the minimum the spilt. Strong landscape impact (hills of 30 meters on the marsh) in spite of the revegetation. The spilt is carried out on a space belonging to the Maritime-terrestrial Public Domain.	The spilt increases in price of for the affected companies, though this increases the need of manpower. Strong social opposition to the maintenance of the spilt (in spite of the minor impact of the new form of spilt), this has stimulated nothing less than 8 reports of the CSIC under the name of "Informes del estudio sobre el diagnóstico ambiental y sanitario de la ría de Huelva".
II. Marsh of El Pinar	Application of the environmental regulation. Corrector Plan of Liquid Spilt: Project of Reordering of the Plaster-phosphorus Spilt.	Recovery of very degraded a space by the deposition of industrial residues (ashes and muds). The recovery just applies a coverage and revegetates the zone, the pollution remains in the subsoil and this is testified for spilts.	The recovery of this space has not been translated in a minimal public use of the space, which is considered to be unhealthy both by his origin and by the nearness to the factories, smells and smokes of these. It is in use as mere absorber of the industrial zone.
III. Punta del Sebo	An abandon of the activity has not taken place. Only punctually.		
IV. Nuevo Puerto			
V. Tartessos	The factory of Metallic Carbides, principal chemical activity (the cellullose industry remains) closed only two years ago.	The space adjacent with the Public Domain has been recovered, and most of the facilities of the former Spanish Society Metallic Carbides have been removed. In spite of everything, the space remains as a very degraded environment.	The Metallic Carbide Plant was in crisis during years, and its closing has scarcely supposed a loss of working places, for the scanty staff with that was kept after the privatization.
VI. Niebla	Opening the cement market to the countries of the East, with minor costs brought to disability to compete on the market. Remains left the former Santa Barbara and an arid extraction area.	Important landscape and urban degradation. Important problems of erosion, specially the shores of the Tinto river with the ruins of the Santa Barbara and the arid extraction area.	The closing had a strong negative impact on the employment in the municipality, which industrial activity was almost exclusively dependent of this factory. Next to the Industrial area, Niebla has developed a commercial and industrial zone taking advantage of the axis of the A-49.
VII. Minas de Riotinto	Mining crisis. The disability to compete on the market with the prices of the copper and other minerals lead to a rapid crisis of the mining, in spite of many attempts and investments to refloat the sector.	The cessation of the mining activity has supposed a strong degradation, especially with spilts and pumping of the mining fellings. But knowing the previous environmental situation, it has not supposed a serious impact.	The abandon of the mining activity has supposed a strong blow for the economy of a region overturned with the metallic mining industry for thousands of years, which has finished in a deep crisis from which the region does not stop going out in spite of many attempts.

VIII. La Torerera	Mining crisis. The closing of the mining facilities wherefrom there was obtained fundamentally manganese, base of a factory of sulphuric, nitric acid, trinitotolueno, nitroglycerine and other explosives. It bore the closing of the industry of Spanish Union of Explosives, S.A. that was extracting the mineral until approximately 1960.	The cessation of the mining activity has supposed a strong degradation, especially with spilts and pumping of the mining fellings. But knowing the previous environmental situation, it has not supposed a serious impact. Besides the industry of explosives has become dismantled leaving only part of the warehouses (some of they of them dismantled too).	The closing of the mine and industry led to the disappearance of the mining settlement, as many others in the rest of the Pyritic Belt. A Tourist camp have been tried to be created (UGT and COPT) but it never managed to open, for breach of the Public Domain (the buildings were raised on the proper reservoir).

EUROPEAN CHEMICAL REGION NETWORK - HUELVA Study nº3: Territorial Improvement				
Chart 4. Experiences of territorial improvement				
Sector	Experience	Afected area	State/ execution	Characteristics
I. Rafts of Plaster-phosphorus	Proyecto de Reordenación de los Vertidos de Yeso*: Aprobado en 1997 por CMA y el Ayto. de Huelva, acorde con el Plan Corrector de Vertidos Líquidos a la Ría de Huelva, con el fin de regular los vertidos hasta entonces incontrolados de fosfoyesos en la marisma.	67,7 Ha	En ejecución	El sistema utilizado es de grandes balsas de decantación que crean colinas aterrazadas de suaves pendientes, que se van recuperando paisajísticamente mediante la aplicación de una cobertura fértil y revegetación. Se han plantado unos 2.700 árboles y 5.500 arbustos, que se alimentan con los biosólidos y aguas depuradas de la vecina EDAR. Se crean unas colinas de unos 30 metros de altura, que modifican de forma importante el horizonte marismeño primigenio.
II. Marsh of El Pinar	Proyecto de Reordenación de los Vertidos de Yeso: En 1990 la Agencia del Medio Ambiente de Andalucía inició el proceso de regeneración de la zona. Ante la imposibilidad de retirar los residuos depositados se ha generado un tapiz vegetal en forma de praderas. Se culminó con el Proyecto de Reordenación de los Vertidos de Yeso: Esta marisma era una antigua zona de vertido (de 1968 a 1997) incontrolado de fosfoyesos directamente sobre la marisma. El Plan Corrector de Vertidos Líquidos a la Ría de Huelva corrigió el tipo de vertido, y se restringió a las Balsas de Fosfoyeso actualmente en uso. Esta zona de vertido, conjuntamente con las colinas de cenizas de piritas de fundición, se regeneraron mediante la aplicación de una cobertura fértil y revegetación. En estos terrenos se incluye la construcción de la EDAR que da servicio a la ciudad y un almacén de embarcaciones embargadas por la AP.	400 Ha	Finalizada	Se ha revegetado toda la superficie con especies de distinto porte y características para crear una imagen naturalizada. La intervención ha requerido diferentes particularidades en función de las distintas zonas. En los depósitos de lodos, de superficie muy blanda se estableció un acuerdo con el Ayto. de Huelva para cubrirla con escombros urbanos. Los depósitos de cenizas se remodelaron topográficamente, cubriéndolos con arcilla impermeable y tierra vegetal. Las colina y lagunas artificiales, sirven como hitos de paisaje. Se han invertido 1.776 millones de pesetas, plantando 19.500 árboles (pinos, eucaliptos, acacias...) y 78.000 arbustos. El volumen de tierra aportada es de 1.758.000 m3. Se han ejecutado 35 Km de caminos y otros 29 de tuberías de riego.
III. Punta del Sebo	Plan Corrector de Vertidos Líquidos: Con una inversión de 7.300 millones de pesetas. A las medidas internas a poner en marcha en las diferentes empresas, se suman otras medidas correctoras de carácter externo financiadas con fondos FEDER (más de 3.000 millones de pesetas). Estas medidas externas han cubierto infraestructuras medioambientales como la Planta de Inertización de Residuos Industriales, el Laboratorio de Análisis de Contaminantes, una embarcación de vigilancia y control, la Red de Vigilancia de Contaminación Atmosférica, etc. Plan Corrector de Vertidos Atmosféricos: Ha consumido una inversión cercana a los 7.000 millones de pesetas. Con la aplicación de estas medidas el aporte de ácido a la ría de Huelva procedente de la industria descendió de las 23.000 Tm de 1989 a las 3.500 de 1994.	~20 Ha	Finalizada**	Plan de Restauración Paisajística de la linde externa del polígono químico de la Punta del Sebo (Avenida Francisco Montenegro y carretera Huelva-Palos de la Frontera), actuación piloto para la recuperación de la ría para la ciudad de Huelva. Se ha realizado un nuevo trazado de la Avda. Francisco Montenegro con varias rotondas que facilitan el acceso a las fábricas y mejoran la situación visual y ambiental de la ría. Incluye el ajardinamiento y pantallas vegetales que reduzcan la visibilidad de las industrias, así como una regulación de los vertidos a la ría, de efectos evidentes. Incluía además la recuperación del muelle del Tinto, la potenciación del club marítimo como centro cívico de actividades deportivas, el mantenimiento y ampliación del entorno del monumento a Colón.

IV. Nuevo Puerto	Restauración ecológica y adaptación al uso público de la Laguna Primera de Palos: En el año 2001 comenzaron las obras de restauración realizadas por la compañía CEPSA en colaboración con la Junta de Andalucía, con inversión de más de 510.860 €. La transformación y degradación de la zona en las últimas décadas ha sido muy notable. Fundamentalmente por desarrollo de cultivos intensivos y la ocupación de suelo para actividades industriales. Incluye un plan para el fomento del uso público, especialmente como recurso pedagógico con la creación de un itinerario botánico, dos observatorios, señalización y un cuaderno de actividades, un programa en el que ya han participado más de 12.000 personas. La laguna está situada en terrenos propiedad de la refinería La Rábida de CEPSA, en los que construyó cuatro grandes depósitos de crudo. El Estudio de Impacto Ambiental incluyo esta restauración como una medida compensatoria. Ver III. P.I. Punta del Sebo	~95 Ha	En Ejecución	Es una laguna incluida junto a otras cercanas en la Red de Espacios Protegidos como Paraje Natural (con categoría RAMSAR). Se procedió a la retirada de los cultivos intensivos en sus orillas. Se realizó una revegetación del perímetro lagunar, con más de 7.000 ejemplares y un total de 34 especies autóctonas. También se retiraron los muros que impedían la inundación de determinadas zonas recuperando más de 3 Ha inundables. Se ha creado también un vallado perilagunar, sustituido tendidos eléctricos aéreos por subterráneos y la creación de pantallas visuales vegetales. Los tanques de almacenamiento localizados en las inmediaciones de la laguna se han pintado en azul para simular el color del cielo. Otras medidas ambientales han sido la creación de madrigueras para nutria, posaderos para rapaces, isletas para aves acuáticas, nidales, etc.
V. Tartessos	Ver III. P.I. Punta del Sebo	-	Finalizada	-
VI. Niebla	Ver III. P.I. Punta del Sebo	-	Finalizada	-
VII. Minas de Riotinto	Proyecto Fénix: Para remediar la fuerte crisis económica de la comarca minera, se opta por un proceso de diversificación económica de la Cuenca Minera. Se potencia especialmente el turismo y el sector agrícola, con un proyecto de puesta en cultivo de grandes extensiones de terreno.	1.600 Ha	En ejecución	En 1.989 la sociedad Riotinto Fruit, llevó a cabo el inicio de sus actividades, con la plantación de más de 1.000 hectáreas de cítricos, que se amplían posteriormente a 1.600 (1.100 ya en explotación). En 2004 abre una nueva central hortofrutícola de 15.000 m² situada en El Campillo, con el apoyo financiero de la Junta de Andalucía, sustituyendo a las anteriores, quemadas en un incendio (2003). La plantilla ronda los 600 empleados (hasta 1.500 durante la recolección), y tiene capacidad para almacenar 3.500 toneladas de frutas y se espera que cuando la central se encuentre a pleno rendimiento puedan empaquetarse más de 30 mil kilogramos de fruta a la hora.

	Museo Minero y Tren Minero: Por Orden de 15 de Octubre de 1987 del Ministerio de Cultura se crea la Fundación Río Tinto para la Historia de la Minería y la Metalurgia. Entre otras actividades ha recuperado varios espacios mineros para su uso turístico y cultural, destacando el museo y el tren minero. Incluye el mantenimiento del denominado Parque Minero (unas 900 Ha) además de las instalaciones del museo y el tren minero	900 Ha	En ejecución	El museo incluye el Archivo Histórico de Minas de Riotinto, que se ha archivado y catalogado, creando un centro de documentación El museo se ubica en el antiguo hospital inglés, con 1.800 m² de área expositiva integral del patrimonio cultural de la comarca. También dedica una nave al patrimonio ferroviario, una sala de audiovisuales, sala de exposiciones, cafetería y un punto de venta. El tren recorre 11 Km hasta la estación de "Los Frailes" en vagones mineros de principios del siglo XX. El tren, restaurado y acondicionado, discurre paralelo al río Tinto manteniendo en uso esta parte de la línea ferroviaria construida a partir de 1873 por la compañía inglesa *Rio Tinto Co. Ltd*. clausurada en 1984. También se ha recuperado una locomotora de vapor (año 1875), que funciona domingos y ocasiones especiales.
	Complejo Medioambiental de Andalucía***: También conocido como vertedero de Nerva, fue creado en 1996 para la construcción y gestión de un depósito de seguridad para residuos industriales peligrosos y no peligrosos, abriendo en junio de 1998. Un depósito de seguridad para RTP con capacidad mínima de 300.000 Tm y otro para residuos industriales inertes con una capacidad mínima de 3.000.000 Tm.	140 Ha	En ejecución	CMA gestiona residuos del 100% de la industria de Huelva, Sevilla y el Campo de Gibraltar, teniendo además presencia en el mercado nacional (incluidas Canarias y Baleares) y Portugués, a través de la gran industria y los gestores intermedios. Ha y sigue suscitando una importante contestación social en contra de este tipo de instalación, si bien ha supuesto una importante mejora en la gestión de residuos peligrosos y un aporte de empleo a una comarca deprimida.
VIII. La Torerera	Desmantelamiento de la fábrica de explosivos y acciones del Plan de Gestión de Residuos Peligrosos de Andalucía	-	Finalizado	Se ha realizado la retirada de más de 160.000 m3 de tierras contaminadas, con un gasto de 32.600.000 Ptas y procedido a la reforestación de 5 Ha y la instalación de una trampa con calizas.
	Proyecto de Campamento turístico****: Se construye en el año 1991 un campamento, conveniado entre la Junta de Andalucía y el sindicato UGT, aprovechando el embalse del Riscoso, que se utilizaba como reservorio de agua para la mina y la actividad industrial, se ejecutó un proyecto de puesta en valor turístico mediante la creación de un campamento turístico con una zona de acampada libre.	-	Paralizado	El presupuesto inicial de estas instalaciones fue de 300 millones de pesetas (1.803.036 €). Incluía la restauración, adaptación al uso turístico y la construcción de una serie de bungalows. Estuvo acompañado de una campaña publicitaria, pero las instalaciones permanecen cerradas, inconclusas, y en estado de abandono.

* El yeso depositado es el residuo que resulta de la fabricación de ácido fosfórico por vía húmeda por las empresas Fertiberia-Huelva y FMC-Foret. El proceso consiste fundamentalmente en el ataque a la roca fosfórica con ácido sulfúrico, lo que da lugar por un lado al ácido fosfórico y por otro al residuo de yeso (sulfato cálcico dihidratado). Este residuo aparece impregnado de ácido fosfórico y otras sustancias que acompañan a la roca fosfórica, (incluyendo arsénico, plomo, mercurio, cadmio...).

** La parte que queda por ejecutar corre a cargo de la ampliación de la ciudad hacia el sur, en la zona que se ha venido a llamar como "Ensanhe Sur", que completará la recuperación de la ría del Odiel con un paseo marítimo desde el final de la zona industrial, hasta las instalaciones del Puerto de Huelva adyacentes a la ciudad.

*** En diciembre de 2002, Alianza Medioambiental S.L. adquiere el 100% del capital social del CMA, por lo que pasa a pertenecer a Befesa Medio Ambiente S.A. y a ser sociedad anónima unipersonal.

**** Según una Proposición no de ley publicada en el BOPA nº232 de 21 de diciembre de 2001, el Parlamento de Andalucía instó al Consejo de Gobierno a acometer, en el plazo más breve posible, *las actuaciones necesarias para que las instalaciones turísticas existentes en ''La Torerera'' pudiesen ser incorporadas a la red de instalaciones turísticas que oferta la provincia de Huelva, dotándola de una elevada calidad ambiental y de sistemas para su integración armónica con el medio ambiente circundante*. Para ello, era preciso, entre otros aspectos, proceder a solucionar las deficiencias y ejecutar nuevas actuaciones. Sin embargo, el incumplimiento del DPH mantiene paralizada cualquier intento de recuperación de lo ya construido, y además no se puede otorgar licencia de apertura porque:

a) No está resuelto el tema de eliminación de barreras arquitectónicas.

b) No existe sistema contraincendios a pesar de estar situado en un paraje de considerable valor ecológico y paisajístico.

c) No cuenta con informe de impacto medioambiental.

d) No tiene corriente eléctrica al no contar con el necesario centro de transformación eléctrica.

e) No cuenta con agua potable.

f) No consta inscripción en el Registro de Turismo de Andalucía.

g) Las carreteras de acceso presentan un estado lamentable.

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Chart 5. Planning, politic and legislation
Ayudas para la Promoción y el Desarrollo Industrial (PRODESI)
Aspectos favorables: Se fundamenta en el principio de optimizar el impacto y la eficiencia de los recursos públicos que se aportan para maximizar el potencial de crecimiento del sector, y conseguir entre otros los siguientes objetivos: -Impulsar las inversiones de las empresas en innovación y modernización tecnológica -Fomentar la creación de nuevas empresas tecnológicamente avanzadas. -Simplificar los procedimientos de concesión y gestión de este programa de ayudas -Agilizar la percepción de las subvenciones
Aspectos a mejorar: Debería introducir criterios ambientales, mejora territorial y de restauración ecológica a la finalización de las actividades promovidas como requisitos clave.
Incentivos de la Junta de Andalucía a las inversiones productivas en Andalucía
Aspectos favorables: Esta acción esta configurada como un instrumento de carácter horizontal para incentivar la localización de empresas en determinadas localizaciones, ya sea con objeto de propiciar y fortalecer el tejido industrial de zonas concretas, de corregir desequilibrios económicos territoriales, o de diversificar y modernizar el sector industrial a través de la creación de espacios especializados que concreten centros de I + D y empresas tecnológicamente avanzadas. Los incentivos que se conceden son subvenciones a fondo perdido. Esta acción se concreta en dos actuaciones específicas: -Programa de ayudas a las zonas declaradas de acción especial. -Programa de potenciación de los medios de innovación de Andalucía
Aspectos a mejorar: Si bien no incide directamente sobre la industria química, entre los sectores promocionables se encuentran los servicios de apoyo industrial y los que mejoren significativamente las estructuras comerciales, pero se echa en falta un apoyo económico a la innovación y adquisición tecnológica medioambiental, uno de los grandes retos de una industria tan contaminante como la industria química.
Plan de Corrección de Vertidos Industriales Contaminantes en el litoral de Huelva
Aspectos favorables: Incluye el Plan de Restauración Paisajística destinado a reforestar el entorno industrial, crear áreas recreativas de uso público y dragar las orillas del Odiel para eliminar los residuos allí depositados, cubriéndolas después con arena limpia.
Aspectos a mejorar: Se ha dado por concluido, a pesar del escaso o nulo desarrollo de muchas de las medidas de mejora paisajística que contemplaba.
Plan Energético de Andalucía 2003-2006 (PLEAN)
Aspectos favorables: Concebido como el instrumento estratégico y de coordinación de las políticas sectoriales en materia de infraestructuras energéticas, de fomento de las energías renovables así como de las actuaciones en materia de ahorro, eficiencia y diversificación energética que se desarrollen en Andalucía en el período considerado. Huelva se convierte en un núcleo productor de energía de primer orden a nivel regional, potenciando además su papel como punto de partida de varios gaseoductos y de la infraestructura gasista (se contempla una futura conexión con Portugal por Ayamonte)

Aspectos a mejorar: Pone de manifiesto el interés del sector energético (e industrias asociadas) por la provincia onubense (la segunda en solicitudes, por ejemplo, para los ciclos combinados después de Cádiz), pero no establece medidas de control que regulen una excesiva implantación de industrias emisoras de gases contaminantes, apareciendo cuatro estaciones generadoras sin ningún tipo de estudio de impacto global, pese a que sí "se plantea la necesidad de hacer una consideración diferenciada de los ámbitos metropolitanos con funciones de abastecimiento energético y concentración de actividades industriales (Huelva y Bahía de Algeciras), que requieren planteamientos específicos desde el punto de vista energético y medioambiental, en el sentido de buscar un equilibrio entre las condiciones de vida de la población y la actividad industrial. La extensión de la red de gasoductos y el desarrollo de sus aplicaciones constituye también aquí una pieza clave para la diversificación y mejora de la eficiencia energética en estos ámbitos." (PLEAN, 159:2003)
Plan de Medio Ambiente de Andalucía 2004-2010
Aspectos favorables: Entre sus objetivos: -Minimizar la generación de residuos. -Aplicar procedimientos adecuados de control y gestión para todos los residuos. -Mejorar el entorno ambiental y paisajístico de las poblaciones andaluzas, recuperando los suelos contaminados. -Facilitar la cooperación con la Administración local en materias ambientales. Contiene además un Subprograma de Recuperación de Suelos Contaminados, que integra el Programa de Mejora del Entorno ambiental y paisajístico, y contempla como objetivo específico el "recuperar los suelos contaminados por residuos especiales situados en las cercanías de los grandes núcleos urbanos".
Aspectos a mejorar: Intensificar las medidas de control y la capacidad sancionadora.
Plan Nacional de Recuperación de Suelos Contaminados (1995-2005). Convenio marco de colaboración y el addenda correspondiente entre la Consejería de Medio Ambiente de la Comunidad Autónoma de Andalucía y el Ministerio de Obras Públicas, Transportes y Medio Ambiente, sobre actuaciones de descontaminación de suelos del Plan Nacional de Recuperación de Suelos Contaminados (1995-2005)
Aspectos favorables: Mejora la coordinación administrativa en materia de descontaminación de suelos a nivel de las administraciones regional y central
Aspectos a mejorar: Debería de fomentarse más la coordinación cara a la prevención que a la corrección, especialmente a nivel de la planificación estratégica y territorial. Entre sus actuaciones no figuran las balsas de yesos de las marismas del Tinto, a pesar de situarse en zona de dominio público hidráulico, estar contaminadas con materiales altamente tóxicos y peligrosos que suponen un grave riesgo para los ecosistemas del área y sus recursos naturales y para los habitantes del entorno de la ciudad de Huelva, en algunos puntos con espacios urbanos localizados a menos de 1 Km de los residuos, precisamente las características que definen los emplazamientos con alta prioridad de actuación.
Plan de Ordenación del Territorio de Andalucía
Aspectos favorables: Propugna un "desarrollo solidario, sostenible, equilibrado y cohesionado de Andalucía". Determinante para la mayoría de políticas públicas con incidencia territorial. Su aplicación conlleva una gestión del territorio acorde con unos principios y criterios a los que se presumen eficacia y coherencia cara a un modelo territorial acorde a lo propugnado.
Aspectos a mejorar: Salió a información pública en septiembre de 2005, y todavía no está aprobado definitivamente, pese a que sí se han aprobado ya varios Planes de Ordenación Territorial de Ámbito Subregional, que han utilizado el documento de Bases y Estrategias ante la inexistencia de un plan aprobado.
Prevención y Control Integrados de la Contaminación (IPPC) y Sistema Comunitario de Gestión Medioambiental (EMAS)

Aspectos favorables: Está orientada a la búsqueda de soluciones integradas para prevenir y controlar las consecuencias sobre el medio ambiente de determinadas actividades industriales. La IPPC trata ser un sistema integrado de control de la contaminación y por ello abarca desde las emisiones de contaminantes a la atmósfera, al suelo o al agua, hasta otros aspectos ambientales como ruidos y vibraciones, rendimientos energéticos, minimización de consumos y contaminación, accidentes medioambientales, etc. Se basa en el uso de las "mejores técnicas disponibles", que equilibran los costes de funcionamiento con las ventajas medioambientales. El Reglamento EMAS es el Sistema Comunitario de Gestión Medioambiental que desarrolla a la IPPC. Es un modelo muy conocido para la Implantación de un Sistema de Gestión Medioambiental, y para la certificación independiente del mismo.
Aspectos a mejorar: Aún no ha entrado en vigor (2007)
Proceso de Evaluación de Impacto Ambiental y de Informe Ambiental de la Comunidad Autónoma de Andalucía
Aspectos favorables: Intensifica la prevención, identifica y minimiza los impactos, proponiendo cuando sea necesario medidas correctoras y/o preventivas
Aspectos a mejorar: No se ha desarrollado una Evaluación Ambiental Estratégica de Planes y Proyectos eficiente cara a un ámbito como el onubense donde el problema no procede tanto de las actividades individuales como de la densidad de las mismas. El proceso de EIA tampoco está suficientemente desarrollado aún cara a su función real, y suele quedar demasiado abierto a la intervención de la parte interesada, quedando la administración casi con un papel de policía que no le correspondería de hacerse adecuadamente.
Programa Industrial para Andalucía (PIA III. 2003-2006)
Aspectos favorables: Es un análisis profundo de la realidad de este sector y de los esfuerzo llevados a cabo por la Junta de Andalucía y los agentes económicos y sociales durante los dos programas anteriores. Asimismo, y como consecuencia del diagnóstico, es una apuesta de futuro para conseguir la dinamización, aumentar la competitividad y la generación de riqueza y empleo del sector industrial, poniendo en juego los mecanismos necesarios para que aumente su peso relativo dentro de la economía andaluza. Entre sus objetivos: -Mejorar la competitividad sostenible y aumentar el peso del sector industrial, medidos en incrementos de producción y empleo en términos absolutos y relacionados con el resto de sectores productivos, -Modernizar y dinamizar el tejido productivo industrial, medido en términos de creación, ampliación, adopción, adaptación, desarrollo e incorporación de nuevas tecnologías, especialmente las dedicadas a Información y Comunicación, así como el desarrollo de mecanismos de animación industrial y cooperación intra e intersectorial, promoviendo la cultura emprendedora y la mejora de las condiciones ambientales de la industria, -Cualificar los recursos humanos y fomentar el empleo industrial estable, medido en términos de aumentar la profesionalización de la empresa industrial y en la creación de bases productivas sólidas, -Mejorar las infraestructuras industriales de uso general, y especialmente los espacios para la innovación de cualquier tamaño y localización, así como las redes que permiten un más eficaz intercambio de bienes y servicios, -Fomentar el equilibrio territorial, prestando especial atención al desarrollo de los Sistemas Productivos Locales (SPL's) y a la máxima regionalización de la subcontratación de las grandes empresas ubicadas en Andalucía.
Aspectos a mejorar: No incide con suficiente fuerza sobre las medidas correctoras y regeneradoras de los espacios y suelos industriales contaminados. Debería quizás de incidir en una mejor y mayor aceptación social de las iniciativas de desarrollo industrial, especialmente al nivel informativo.

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Chart 6. Management		
Sector	Property	Management
I. Rafts of Plaster-phosphorus*	Concesión de la D.G.Costas a Fertiberia y Foret	Empresa de Gestión Medio Ambiental (EGMASA), Ayto de Huelva y Fertiberia y Foret
II. Marsh of El Pinar	Concesión de APH y D.G.Costas a Fertiberia, Atlantic Copper y Foret	Se mantiene la incógnita sobre el modelo de gestión del área una vez rehabilitada, cuya titularidad jurídica corresponde a la Autoridad Portuaria de Huelva (actualmente puede calificarse de abandono).
III. Punta del Sebo	Concesión de APH y D.G.Costas a las industrias instaladas	APH e industrias instaladas
IV. Nuevo Puerto	Concesión de APH y D.G.Costas y Ayto. de Palos a las industrias instaladas	APH e industrias instaladas. CEPSA-Consejería de Medio Ambiente (Paraje Natural Estero de Domingo Rubio y Paraje Natural de las Lagunas de Palos y las Madres)
V. Tartessos	Aytos. de Huelva y San Juan del Puerto e industrias instaladas	Aytos. de Huelva y San Juan del Puerto e industrias instaladas
VI. Niebla	Ayto. de Niebla e industrias instaladas	Ayto. de Niebla e industrias instaladas
VII. Minas de Riotinto	Aytos. de Minas de Riotinto, El Campillo, Nerva, Zalamea la Real, Mantesur Andévalo S.L., BEFESA, Riotinto Fruit	Aytos. de Minas de Riotinto, El Campillo, Nerva, Zalamea la Real, Mantesur Andévalo S.L., BEFESA, Riotinto Fruit
VIII. La Torerera	Ayto. de Calañas y COPT	¿?
* Ver "Concesión para el vertido de Fosfoyeso". La concesión del vertido de fosfoyesos ha suscitado una fuerte contestación desde un amplio sector de la ciudad, manifiesta en la batalla judicial emprendida en torno a la concesión del vertido.		

Concesión para el vertido de Fosfoyeso:

Concesión C-470

- 17/05/68: Por Orden Ministerial, se autoriza a "Fertilizantes de Iberia S.A." (en la actualidad Fertiberia) por 99 años, la ocupación de una parcela de 3.600.000 m2 para la construcción de depósitos de decantación para vertido de yeso, subproducto industrial del ácido fosfórico, mediante un documento que contempla 12 condiciones, 1 adicional y 4 prescripciones, tales como:
  - Que la cesión no contempla ningún derecho sobre la propiedad del terreno.
  - El yeso se recogerá en capas de un espesor máximo de 3 metros, y serán cubiertas con una capa de tierra vegetal que permita el crecimiento de la hierba.
  - Los vertidos deberán producirse en una zona determinada de la parcela (según plan quinquenal presentado), la cual una vez cumplida su misión volverá a propiedad de la Administración por "… no haber motivo para que la Empresa retenga unos terrenos que ya han cumplido la misión asignada en la concesión".

- El incumplimiento por parte del concesionario de cualquiera de la condiciones del documento de cesión (excepto la nº 6, la adicional y las prescripciones) será causa de caducidad de la concesión.

Concesión C-469

- 14/03/67: Por Orden Ministerial, se autoriza a "Unión Española de Explosivos, S.A." (en la actualidad Fertiberia), por 50 años, la ocupación de una parcela de 3.600.000 m2 para la construcción de depósitos de decantación para vertido de yeso, subproducto industrial del ácido fosfórico, mediante un documento que contempla 12 condiciones, 1 adicional y 4 prescripciones, tales como:
  - Que la cesión no contempla ningún derecho sobre la propiedad del terreno.
  - Si los terrenos fueran declarados de utilidad pública, el concesionario sólo tendría derecho a ser indemnizado con el valor material de lo invertido en los mismos, previa tasación pericial.
  - Se autoriza un máximo de 3 metros de altura en los depósitos de yeso.
  - Los vertidos deberán producirse en una zona determinada de la parcela, la cual una vez cumplida su misión volverá a propiedad de la Administración.
  - El incumplimiento por parte del concesionario de cualquiera de la condiciones del documento de cesión (excepto la nº 6, la adicional y las prescripciones) será causa de caducidad de la concesión.
- 29/07/67: Mediante recurso de reposición, se autoriza a Unión Española de Explosivos, S.A." aumentar la concesión a 99 años.

01/07/97: Fertiberia presenta un proyecto de reordenación de los vertidos de yeso, disminuyendo la zona de apilamiento y aumentando la altura del mismo. Se entrega en el Servicio de Costas una solicitud de modificación de las concesiones, en virtud del acuerdo suscrito entre el Ayuntamiento de Huelva, EGMASA y Fertiberia para "revegetación del apilamiento de fosfoyesos".

23/09/97: La Junta de Andalucía comunica al Ministerio de medio Ambiente que ha modificado las condiciones de los vertidos de fosfoyesos (y por tanto de la concesión), autorizando el apilamiento hasta una altura de 25 metros.

11/11/98: Se inicia un expediente de caducidad de ambas concesiones en base a:

- Superación de los espesores máximos de yeso.
- No cumplimiento de los planes quinquenales.
- Inejecución del tratamiento superficial de acabado previsto (cobertura con capa de tierra vegetal)
- Utilización de una de las balsas como vertedero de residuos sólidos urbanos de Huelva.
- Utilización de otra de las balsas para la realización de determinadas experiencias por EGMASA.
- Vencimiento del plazo de la conformidad prestada por la Dirección General de Costas para la planta de transbordo de residuos urbanos de la Diputación.

11/06/02: Se concede audiencia a Fertiberia, que entre otras cosas alega que:

- No se puede aplicar la Ley de Costas puesto que esos terrenos ya no pueden considerarse como marismas.
- Que la concesión hablaba de capas de 3 metros, lo cual no impide la superposición de unas capas sobre otras.
- Que Fertiberia no puede hacerse responsable de los incumplimientos de las empresas anteriores poseedoras de la concesión.
- Que la mayoría de los incumplimientos ya han prescrito.

09/01/04: Por Orden Ministerial, se declara la caducidad de la concesión.

04/02/04: Fertiberia presenta recurso de reposición, basado entre otros motivos en:

- Que los terrenos concesionales perdieron las características de marismas hace bastantes años, antes de la entrada en vigor de la actual Ley de Costas. Los terrenos concesionales son del todo irrecuperables como marismas y humedales.
- Que la concesión habla de "capas de yeso de un espesor máximo de 3 metros", lo cual no impide la superposición de unas capas sobre otras, ya "que tras utilizar el plural cuando se refiere a las capas donde se recogerá el yeso, utiliza el singular para referirse a la capa compacta de tierra vegetal"
- Que la mayor parte de los incumplimientos son responsabilidad de otras empresas titulares en su momento de la concesión.
- Que los incumplimientos de los planes quinquenales han prescrito.
- Que el actual sistema de vertido de yeso es mucho más novedoso, y mejora el impacto medioambiental. Así mismo, declara que "sería una deuda con el futuro de Huelva sustituir el actual plan por el inicialmente previsto".
- Que si el expediente sigue adelante, las consecuencias en la comarca serían desastrosas.
- Que el expediente sancionador incoado contra Fertiberia, ha sido calificado como "leve".
- Solicita la suspensión cautelar de la ejecución de la Orden Ministerial, basándose en que de ejecutarse se causarían daños de reparación imposible, ya que supondría el cierre de varias industrias y pérdida de empleo.

Documentary sources

Bibliography

ACOSTA, A. Y URBANO, A. (1991): *El sector industrial en Andalucía*. Instituto de Fomento de Andalucía. Sevilla.

ALBURQUERQUE, F. (1987): "Un informe para una estrategia del desarrollo regional alternativo para Andalucía", en *Revista de Estudios Andaluces*, nº 8, pp. 31-50.

ALCAIDE INCHAUSTI, J. (1988): "Las cuatro Españas económicas y la solidaridad regional". *Papeles de Economía Española*, nº 34. Pp. 62-81.

BENITO, P. (2002): "Patrimonio Industrial y Cultura del Territorio", en Boletín de la AGE, nº34, pág. 213-227.

CARAVACA, I. (1989): "La industria y su espacio en Andalucía"; en CANO, G. (Dir.): Geografía de Andalucía. Vol. V. Edit. Tartessos. Sevilla. Pp. 61-132.

CASTELLS, M. Y HALL, P. (Dirs.) (1992): *Andalucía: innovación tecnológica y desarrollo económico.* Espasa Calpe. Madrid.

CONSEJERÍA DE ECONOMÍA Y HACIENDA (1997): *Plan Económico. Andalucía Horizonte 2000* (PEA 2000). Junta de Andalucía. Sevilla.

CONSEJERÍA DE TRABAJO Y FOMENTO (Varios años): *Índice de Producción Industrial de Andalucía*. Junta de Andalucía. Sevilla.

CUADRADO ROURA, J. R. (Coord) (1987): *Los cambios tecnológicos y el futuro económico de Andalucía*. Instituto de Desarrollo Regional. Sevilla.

DIAZ ZAMORANO, A. (1994): "Una aproximación a la arquitectura industrial onubense", en Aesturia. *Revista de investigación*, nº2, Diputación Provincial de Huelva, pp.86-98.

DOMÍNGUEZ DOMÍNGUEZ, C. (1997): "El Parque minero de Riotinto", en *El Patrimonio Tecnológico de Andalucía*. Consejería de Educación y Ciencia. Junta de Andalucía. Sevilla, pp..207-244.

DOUET, J. (1997): "Arqueología Industrial en Gran Bretaña", en *Boletín del Instituto Andaluz de Patrimonio Histórico*, nº 21, Sevilla, pp.106-117.

ESPAÑA RÍOS, I. (1994): "La articulación de un nuevo orden territorial en la Comunidad Autónoma de Andalucía, a partir del actual sistema de comunicaciones". *Boletín de la A.G.E.*, nº 19. Madrid. Pp. 27-44.

FOURNEAU, F. (1978): *El impacto del Polo de Desarrollo en la provincia de Huelva*. I.D.R.. Sevilla. Pp. 176.

FUNDACIÓN BANCO BILBAO-VIZCAYA (1999): *Renta Nacional de España y su distribución provincial 1997*. Fundación BBV. Bilbao.

GARCÍA-POLA, M.A. (2002): "Viena. La ciudad de los gasómetros", en Boletín INCUNA, nº4, pág. 13-15.

GONZÁLEZ VÍLCHEZ, M. (1978): *El muelle de Riotinto*. Diputación Provincial de Huelva.

- (1981): *Historia de la arquitectura inglesa en Huelva*. Diputación Provincial de Huelva.

I.E.A. (Varios años): *Anuario Estadístico de Andalucía*. Instituto de Estadística de Andalucía. Sevilla.

- (Varios años): *Indicadores Económicos de Andalucía* (varios números). Instituto de Estadística de Andalucía. Sevilla.

INSTITUTO DE FOMENTO DE ANDALUCÍA (1991): *La oferta de suelo industrial en Andalucía*. Instituto de Fomento de Andalucía. Sevilla.

JIMÉNEZ BARRIENTOS, J. (1997): "El Patrimonio Industrial. Algunas consideraciones relativas a su concepto y significado", en *Boletín del Instituto Andaluz de Patrimonio Histórico*, nº 21. Sevilla, pp. 98-105.

JORDÁ BORRELL, R. (1987): "Alternativas a la crisis industrial de la Bahía de Cádiz". *Revista de Estudios Andaluces*, nº 9. Universidad de Sevilla. Pp. 171-180.
- (1989): "Rasgos generales de la economía andaluza", en Cano, G. (Dir.): *Geografía de Andalucía*, vol. V. Edit. Tartessos. Sevilla. Pp. 13-60.
- (1992): "Modernización tecnológica como estrategia de desarrollo para Andalucía". *Revista de Estudios Andaluces*, nº 18. Universidad de Sevilla. Pp. 27-68.
- (1992): *Las relaciones Ciencia-Tecnología Industria en Andalucía y el papel de la Administración*. Instituto de Desarrollo Regional. Universidad de Sevilla. Sevilla. Pp. 262.
- (1997): "Formación del sistema Ciencia-Tecnología-Industria"; en Vallés Ferrer, J. (Dir.): *Economía Andaluza*. Algaida. Sevilla. Pp. 619-682.

JURADO ALMONTE, J. M. (1992): "Evolución reciente de la planificación sectorial y territorial en Andalucía". *IV Reunión de Geografía Industrial*. AGE. Salamanca. Pp. 113-136.

MÉNDEZ, R. (1988): *Las actividades industriales*. Colección Geografía de España. Síntesis. Madrid.

MÁRQUEZ, J. A. (Dir.) (1998): *Artes, Costumbres y Riquezas de la Provincia de Huelva*, Ed. Mediterráneo, Huelva.

MÉNDEZ, R. Y MOLINERO, F. (Dirs.): *Geografía de España*. Ariel. Barcelona. Pp. 379-423.

MIRANDA ENCARNACIÓN, J. A. (1994): "El archivo de nuevas industrias como fuentes escritas para la Arqueología Industrial en España", en *1ª Jornadas Ibéricas del Patrimonio Industrial y de la Obra Pública*. Junta de Andalucía, Sevilla. pp. 307-312.

PAÍS (El): *Anuarios* (Varios años). Diario El País.

RODRÍGUEZ SÁNCHEZ DE ALBA, A. (1982): "Análisis espacial de la industria andaluza". *Estudios Territoriales*, nº 5. Pp. 17-38.

ROMÁN, C. (1985): "Sur en el Sur", en *Revista de Estudios Andaluces*, nº 4, Universidad de Sevilla. Pp. 87-97.

ROSTOW, W. (1961): *Las etapas del crecimiento económico*. F.C.E. Ciudad de México.

SÁNCHEZ AGUILAR, A. (1997): "Sector secundario"; Vallés Ferrer, J. (Dir.): *Economía andaluza*. Algaida. Sevilla. Pp. 437-483.

SOBRINO SIMAL, J. (1994): "El impacto medio-ambiental del desarrollo tecnológico en la Historia de España", en *1ª Jornadas Ibéricas del Patrimonio Industrial y de la Obra Pública*. Junta de Andalucía, Sevilla, pp. 235-242.
- (1996): *Arquitectura Industrial en España*, *1830-1990*. Cátedra.

VÁZQUEZ BARQUERO, A. (1988): *Desarrollo local. Una estrategia de creación de empleo*. Pirámide. Madrid.

Cartographic sources

ESRI (1998): ESRI Data & Maps. Environmental Systems Research Institute Inc. Redlands, California. CD

ICA (1999): Mapa Digital de Andalucía 1:100.000. Instituto de Cartografía de Andalucía, Junta de Andalucía. CD
- (1999): Mapa de usos y coberturas vegetales del suelo de Andalucía 1999. Instituto de Cartografía de Andalucía, Junta de Andalucía. CD
- (2000): Atlas de Andalucía Multimedia. Instituto de Cartografía de Andalucía, Junta de Andalucía. CD
- (2002): Mapa Topográfico de Andalucía. 1:10.000. Provincia de Huelva. Instituto de Cartografía de Andalucía, Junta de Andalucía. CD
- (2003): Ortofotografía Digital de Andalucía. Vuelo fotogramétrico color a escala 1:60.000 y resolución 1 m. Instituto de Cartografía de Andalucía, Junta de Andalucía. DVD

- (2004): Mapa Topográfico 1:5.000. Litoral de Huelva, Cádiz y Málaga. Instituto de Cartografía de Andalucía, Junta de Andalucía. DVD
- (2004): Ortofotografía Digital de Andalucía. Provincia de Huelva. Vuelo fotogramétrico color a escala 1:20.000 y resolución 0,5 m. Instituto de Cartografía de Andalucía, Junta de Andalucía. DVD

Web sites

www.aiqb.es Asociación de Industrias Químicas y Básicas de Huelva
www.camarahuelva.com Cámara Oficial de Comercio Industria y Navegación
www.csic.es Consejo Superior de Investigaciones Científicas
www.ecologistasenaccion.org Federación de las Asociaciones ecologistas de España
www.ecrn.net Red Europea de Regiones Químicas
www.igme.es Instituto Geológico y Minero de España (IGME). Organismo Público de Investigación, con el carácter de organismo autónomo, adscrito al Ministerio de Educación y Ciencia.
www.ine.es Instituto Nacional de Estadística
www.juntadeandalucia.es/innovacioncienciayempresa Consejería de Innovación, ciencia y empresa
www.juntadeandalucia.es/institutodeestadistica Instituto de Estadística de Andalucía
www.juntadeandalucia.es/medioambiente Consejería de Medio Ambiente de la Junta de Andalucía
www.mesadelaria.org Movimiento social que pretende "la recuperación paulatina y progresiva de la Avenida Francisco Montenegro" en la ciudad de Huelva.
www.mityc.es Ministerio de industria, turismo y comercio
www.mma.es Ministerio de Medio Ambiente
www.utopiaverde.org Fundación para la mejora de la realidad política, social, animal y ambiental

Lombardy

ECRN

European Chemical Regions Network

Topic 5

LAND IMPROVEMENT

LOMBARDY REGION

Milan, 26/9/2005

Introduction

In 1999 the Lombardy's "Observatory for dismissed areas" quantified in 24,5 million sq.m. the regional area interested by DUN (Derelict, Underutilised or Neglected) land phenomenon; 36,2% of this land was localized in the province of Milan.
In the same Region exist about 780 industrial sites to be reclaimed (data from the official register kept by ARPA, the public regional agency for the protection of the environment, 2004), but it is estimated that the total number of that sites should be increased to about 1.200 including that ones not yet registered (data from Legambiente, a well-known private think-tank).

Legislative framework

Following the acknowledgment of the international most common right related to the topic (known as Polluter Pays Principle) in the Italian legal system in the Law 349/86 (art.18), in the past the Lombardy Region, due to the existing environmental situation and to the lack of an incisive national legal framework, tried to regulate some of the most critical aspects concerning DUN lands with DGRL n° VI/17252, 1st of August 1996.
Later on the Legislative Decree n. 22/97 (otherwise known as "Ronchi Decree") and the derivated Ministerial Decree (DM 471/99) implementing it, finally have introduced fundamental concepts as liability for damage, risk analysis, clear definition of the soil and groundwater acceptability limits related to the user final destination, investigation procedures and safety placement of the area, reclamation and reuse; allowance for private deals to be signed.
More recently the Lombardy Region authority approved the Regional Law 12/12/2003 n.26, specifically designed to boost interest in reclaiming of contaminated area by private subjects, allowing them to economically reuse it.

What works

The financial resources needed for successfully reclaim the local DUN lands are huge and contrast with the available cash of Regional Governments, considered the budget constraints that nowadays bind public bodies and compared to the number of interested sites and the contamination level attained by them in Lombardy.
Last year the Lombardy Region provided 20 million € as financial resources to be destined for the required reclamations, suggesting further financial needs should be searched for by Local Administrations (Municipalities and Provinces) among private interested partners, as better allowed by the latest legislative measures.
Therefore the problem faced (financial constraint) should be solved by attracting developers and promote private investments by industrial, residential and commercial enterprises.
An important role could be successfully played by public companies which still are majority-owned by Public Body as the Municipality (this is the case of Fiera Milano and its project of the New Trade Fair).

What does not

The Polluter Pays Principle ("PPP") alone, for different reasons, does not provide a great help in order to improve the situation.
Given the broadness and complexity of the topic in Lombardy, therefore we should not be surprised if the application of the PPP has encountered at least great obstacles while trying to solve the related financial problems while searching the necessary resources, due in part for the difficulties to economically evaluate and appraise compensations and in part due to the entrepreneurial and financial crisis that often accompany the polluting company.
Another limit to the improvements of DUN lands, that sometime in the past leaded to the abandonment of the area, is considered the heavy guarantees requested by the law to the owner/developers of the land subject to reclamation:

1. a real guarantee, weighing over the property;
2. a financial guarantee, to be assured in favour of the Region as soon as the Definitive Reclamation Project has been approved by the invested commission.

What needs to be changed.

After the enforcement of the revolutionary “Ronchi legislation”, some of its weaknesses have been clearly denounced, in particular pointing out the rigidity of the concentration limits that allow the release of the area that, considered precautionary, could lead to undesirable and irrational effects as preventing a calm and realistic evaluation of the best effective way to intervene and solve the problem and imposing excessive burdens and constraints to territory’s reuse.
As an example, consider the Italian legislative provision that today require to evaluate the pollution of a land measuring a sample which granulometric fraction must be less than 2 mm, a condition that does not reflect the likely dilution of the pollutants in the land.

Threats to our current ways of working

A questionable approach recently assumed by some speculative investors is to “cherry-pick” the less-contaminated portions of polluted areas in order to promote investment without regards to the local requirements and without having a look at the real problem represented by the whole area to be reclaimed and returned to the territory.
Parcelling out of the area to be reclaimed doesn’t help: the problem should be addressed as a whole.
In particular, latest “fashion” consists in the promotion of power-plant projects in the recently liberalised energy market, favoured contingently by central governments due to the negative balance existing in Italy in the sector.

1. EX – ACNA RECLAMATION (1990 – 1999)

Due to its extension, former industrial production and high concentration of a wide range of existing contaminants, the ex-ACNA industrial area situated in Cesano Maderno, Ceriano Laghetto and Bovisio Masciago (north of Milan's municipality) can be considered as one of the most complex cases of contaminated sites cleanup in the environmentally highly burdened Province of Milan.
The industrial activity started to flourish at the end of 1800 and ACNA (Associated National Chemical Companies, belonging to Montecatini Group) started its chemical production at the beginning of the thirties.
In the thirties, pushed by the fascist regime, the Group build up various chemical plants for the synthesis of a wide range of intermediates and finished products, as colouring agents for fabrics and trichloroethylene, colorants for petroleum and mineral oils, sulphuric acid and oleum, pigments for inks, paints, plastic materials.
In December 1983 ACNA stopped the operations and closed its plant.
The site occupies a surface area of 1.200.000 sq.m.; the plant took up in 1971 about 480.000 sq.m. of which:

- 137.000 sq.m. indoor;
- 234.000 sq.m. as internal streets, squares and parking area;
- 107.000 sq.m. were destined as green area.

First signs of contamination were detected in 1988 due to excavation works made from the new owners. After various municipal and regional ordinances the following operations were carried out:

- **soil investigation:** a coring grid was defined (50x50m later refined in the most contaminated zones), samples were collected and analysed both by the companies and by official laboratories, reaching a total of 1.000 boreholes and about 10-12 km of coring length;
- **groundwater investigation:** monitoring piezometers were installed and water samples were analysed both by the companies and by official laboratories. About 200 control piezometers were drilled, with an estimated coring length of about 8 km.

Investigation in soils and acquifers provided a clear picture of the pollution in the area:

- wastes: classified from inert to toxic, located in recognised dumps or buried in the ground and in the beds of streams and canals;
- soil: contaminated by halogenated compounds, aromatic amines, metals, aromatic hydrocarbons with nitrogen and/or chlorine;
- groundwater: contaminated by halogenated compounds, aromatic amines, metals, nitrogenous and/or chlorinated aromatic hydrocarbons. These contaminants were detected in perched acquifers, in the unconfined acquifer and, in lower concentration, in the semi-unconfined acquifer.

An estimate of the total volume of the contamination, including waste and soils, reached an amount of approximately 700.000 m^3 of material to be remedied.
Therefore, to start up the various remediation projects for the area it was necessary to refer to officials references concerning:

- the level at which a soil is to be considered contaminated;
- the pollutant concentration level at which the soil submitted to remediation operations can be considered decontaminated.

Because at that time the Ronchi Decree wasn't yet in force, thus the Special Projects Technical Unit of the Province of Milan prepared a methodological proposal, to be made available to public and private operators involved or interested, providing a standardised instrument enabling uniform operation in order to evaluate the necessity of soil remediation action in different situations.
Few private firms, in order to settle there decided to implement, in cooperation with the local government, different interventions to reclaim the land in a secure way (among them BASF Italia, the Italian subsidiary of the German chemical conglomerate, Enichem and, with small area, Dibra, C.R.C. and Azienda Agricola Rivetti).
On the basis of the adopted methodology various remediation interventions were carried out in the area.
In order to prevent the penetration of the contaminants in the groundwater were made some barrier wells.
Then the polluted land had to be isolated in order to avoid the contact with rain and river water and the polluted material was removed and stored in an adequate rubbish tip. In some area was used the safety setting in order to prevent the rain water penetration and the diffusion of the contaminants in the ground. It was an important reclamation work. About the chlorurated solvents was used the "Soil Venting" system: the interstitial air was removed with pumps and the solvents absorbed in activated carbon. A special plant recover periodically the solvents from the carbon in order to use again it.
Today the remediation operations have been completed, and for all the undertaken interventions more than € 75.000.000 were spent by the private companies involved (that now own the property of the area), excluding private parties' and public bodies' personnel costs, as well as the expenses for treating the water pumped from barrier wells.

2. EX – AGIP (MILAN FAIR, RHO-PERO)

The area of the ex-refinery of AgipPetroli has a surface of about 130 ha it is situated in the northwest area of Milan, in the territory of the municipalities of Rho and Pero.
The refinery started operations in 1953, pumping from Genova 6.000 tonns of oil per day. After being acquired by Shell in '59, the plant has been expanded: in '61 has been inaugurated the Platforming unit, in '62 started to operate the Tar plant and in '66 the Blending and filling units for the production of lubricating oils, making the refinery one of the most advanced plant in Europe. In 1974 Agip-ENI Group acquired it.
Its pollution activity has started to be questioned by local public authority from '79; therefore the Province of Milan included the site in the public register keeping track of the most dangerous industries, while the company running the plant started to search suitable solutions to contrast the pollution charge originated against.
At the end of 1992 the refinery has been switched off definitively.
The main reason of contamination has been represented by the loss occurred in the storage plant, in the moving platforms for product transfer and in the sewerage system.
The soil and the first ground water (most superficial) have been contaminated by mineral oils and aromatic compounds.
Deeper ground water, used as drinking water, turned out to be not affected by contamination.
In order to attract the necessary financings It has been studied a redevelopment process of the territory and infrastructures of the area envisaging the construction of Milan Trade Fair's new complex.
The grand innovative building in course of completion (before the end of 2005), has been developed on a gross floorspace of 530,000 sq.m. on a land of 2 million sq.m., for a total cost of 550 millions €. (8 exhibition pavilions, 80 conference halls, 20 restaurants, 25 coffee bar, a parking area for 25.000 cars).
The € 750 million cost for the New Complex, which includes the area purchased, was entirely self-funded by Fondazione Fiera Milano, a private entity and the controlling shareholder in Fiera Milano Spa - which in turn leads fifteen companies - and in Sviluppo Sistema Fiera, an engineering and contracting company for large-scale projects.
While approx. € 800 million is the investment met by the national authorities for the infrastructure links necessary to the New Complex (subway, roads and highways, railways).
The goal to terminate the reclamation and building activities on schedule, even if considered too difficult to grasp by many, has been almost reached: it requested about 30 months for total completion (based on a shared estimate, the completion time required using standard technologies and conventional reclamation methodologies would have been 7 year)
The company that carried out the reclamation work on behalf of AgipPetroli has been Foster Wheeler Italia, founded in 1957 and one of the biggest private engineering and construction companies.
The reclamation of land and water, after dismantling the refinery, was set by Fondazione Fiera Milano as an essential condition for the purchase of this area.
The agreement signed by Fondazione Fiera Milano and Agip covered two separate reclamation stages, in order to start building work. This approach contributed to shortening construction times. The first stage (reclamation of the south-eastern area) was completed on December 2001 and the second (reclamation of the remaining area) on June 2003, certified on December 2003 by the Milan Provincial Government, supervisor of the reclamation works.
The reclaimed area has been 1.500.000 sq.m., with 9,5 millions of cubic meters treated with conventional technologies and 350.000 tonns of soil excavated and treated inside the area with "thermal desorption" up to 300°C.
Reclaiming activities have been realized in about one year and a half: the distinctiveness of the process has been that to speed up the whole process and make it possible to reach completion as forecasted it has been carried out side by side with the construction phase of the New Milan Fair.
The reclamation of land and water, after dismantling the refinery, was set by Fondazione Fiera Milano as an essential condition for the purchase of this area.
First actions have been directed to guarantee the safety of the area and consisted in the execution and operation of three hydraulic barriers associated to internal and external monitoring for protection of the external ground water. The following activities carried out include soil reclamation, casting off of the existing civil infrastructures.
The reclamation of the ground water has been now completed, and in order to guarantee the surrounding area about the quality of the environmental intervention one of the hydraulic barrier realized will continue to operate even after the reclamation of the site has been completed.
To properly define reclamation goal and methodologies to be implemented has been used Risk Analysis.

Have been used expensive technologies requiring soil excavation associated with conventional ones that attacked soil and ground water contaminant providing them with oxygen and nutrients without excavation.
In particular for the reclamation of the soil (unsaturated hydrocarbon and transition band unsaturated/saturated) and the superficial ground water have been used different technologies, sometimes implying specific experimental feasibility tests, preferring the technologies that could have been applied in-situ: Soil Vapour Extraction/Bioventing, Vacuum Enhanced Recovery, Bio-sparging, followed by removal, Air sparging and Multiphase-extraction.
The selected technology applied for reclamation of the more polluted excavated soil has been “Thermal desorption”: it consists to warm up the soil using special furnaces to reach very high temperatures (300°C). The heat allows the evaporation of hydrocarbons from the soil; then the hydrocarbons have been sent to a burner provided with a chimney for the almost completed exhaustion of the emissions.
No part of the soil exited the area and all existing concrete has been demolished and smashed in order to consent its reuse as building material.

NRW

Land Improvement Questionnaire

Question 1:
What DUN chemical industry land is there in the region

North Rhine Westfalia (NRW) is a federal state with a long industrial history, which includes winning of raw materials and chemical production.
Former sites where contamination may be present were inventoried. The following table summarizes the state of the investigation and/or remediation. The figures refer not only to land formerly used by the chemical industry but to all kinds of activities that may cause pollution (industrial production, small business, landfills). Refer to answer 9 concerning typical contamination scenarios.

Sites where it can be assumed on the basis of the activity that contamination is present, not investigated yet	58.829
Sites where contamination is present or suspected (business sites: 33.420, landfills: 21.003)	54.419
Sites where a risk assessment has been performed	12.190
Sites where a remediation investigation has been performed	2.090
Sites where remediation measures are undertaken or completed	4.693
Source: Ministery of Environment, Protection of Nature, Agriculture and Consumer protection, date: 31.1.2004	

Although many of these sites are small, there are several sites that have a size in the order of magnitude of 10-100 ha or even more. Dependent on the local situation, they may be reused as industrial sites, business parks, for trade (Centro Oberhausen) or recreation purposes (e.g. Phoenixsee Dortmund or the Garden Exposition Leverkusen (a former chemical landfill).
Derelict chemical land is often situated within the factory area of an existing chemical company. Several companies attempt to make this land attractive to other firms by founding a “chemical park”. One of the major operators of a chemical park is the Bayer Industry Services that runs chemical parks on four different sites. In the chemical park Leverkusen 8,5 ha were redeveloped for new industrial purposes.

Question 2:
What work has been dealing with DUN land, examples of success and failure

Refer to answer 1
The Ruhr area has faced a structural change in the last decennia. Many coal mines - and the associated processing activities - have been abandoned. Therefore, large areas were and are still to be redeveloped.
An estate fund (Grundstückfonds) was founded in 1979 with the objective of the recycling of abandoned sites. The fund gets financial support from the federal state and from the EU. Within this program, about 190 sites with a total area of 2650 ha were bought by the fund, remediated and prepared for future use, and resold to investors or to communities. 610 ha were used for business, 50 ha for housing and 884 ha for recreational use.
So far, problems with contamination outbreak and required additional works have not been observed. Although, the way how to deal with liability and unknown risks is crucial in the marketing process.

Question 3:
Barriers to improving DUN land

The value of the site may be lower than the remediation costs. In this case, public funding is required but limited.
Unknown contamination may be present even after remediation or there may be regulations in the future that go further than the present requirements. Because the investor has to take over the full responsibility for the site, he is not interested in the site because there is a surplus of alternative sites without contamination.
These problems can be partially solved with treaties between the authorities and the investors. Agreements concerning the scope of the work to be performed and liability questions reduce the risk for the investor.

Question 4:
Policies or regulations that help or hinder improving DUN land

The German Soil Protection Law and the adjacent regulations state that the polluter is responsible for the clean-up of contaminated sites. If the polluter is not able to pay (because the company does not exist any more), the present owner (who may have bought the site without knowledge of the contamination), is also liable. In cases where there have been different owners in the past and/or a number of present owners, this may lead to a very complex situation. As a consequence, remediation is hindered or delayed due to liability questions.

In the regulations concerning urban planning and construction, it is stated that brownfield sites have to be preferred to Greenfield sites in the development process. This may help improving DUN land. Still, the development of brownfield sites has to be attractive to the investor from an economic point of view.

Question 5:
Long term ownership and maintenance problems

If the recycling of land takes place within chemical parks or for business purposes, there will be no maintenance problems.
In case of the sites that are redeveloped by the Grundstückfonds, the communities are obliged to buy the areas for infrastructure and public green and to take over the responsibility for the maintenance.
Private owners have no interest in the development of sites with a low commercial value, so they will prefer the “big fence approach” with low maintenance activities.
Unsolved property or responsibility questions and lack of public funding for the purchase of these sites may have the same effect.

Question 6:
Financial support in dealing with DUN land

There are two main institutions that provide financial support for recycling of brownfield sites.
The Grundstücksfonds (Refer also to answer 2) has invested 1,7 milliard Euro in the redevelopment of abandoned sites. It is financed by support from the federal state, from the European Union, and to lesser extent by programs for urban development.

The Altlastensanierungsverband (AAV) NRW (contaminated sites remediation association) gives financial support to communities for the redevelopment of sites where nobody can be hold responsible for the remediation costs. The AAV is co-financed by the federal state and by business members. This way, firms make a contribution to the solution of a public issue and enhance the possibilities of the state to support the communities. More than 100 companies, including the key chemical companies, are members in the AAV.

Question 7:
Relationship between authorities and chemical companies

To our knowledge, there are no specific groups that coordinate the relationship between companies and authorities. Chemical companies and local authorities usually work together on a long term basis.
The AAV constitutes a forum for information exchange and knowledge transfer, since both companies and communities are members in the AAV. However, it has no political function.

Question 8:
Relationship between Chemical companies

Operators of chemical parks have funded an organisation with the objective to share experience, which may include but is not limited to recycling of land.

Question 9:
Viable technologies for retaining contaminants on-site

A variety of technologies is available for the remediation of contaminated sites. The choice of technology depends on the chemical properties of the pollutants, the location of the contamination (soil and/or groundwater) and the size of the contaminated area.

Former sites where chemical production has taken place are frequently contaminated with solvents (chlorinated and aromatic hydrocarbons). In landfills of chemical companies where all kind of production debris was dumped a wide range of pollutants is present.

In the case of specialized industry, contamination with various heavy metals can be found. Heavy metals are also often associated with ashes, cinders and other waste products.

In the Ruhr area there are many coalmines where the coal was processed in the vicinity of the pits, resulting in contamination with (polycyclic) aromatic hydrocarbons and tar oil. Similar contamination is associated with the former gasworks present in almost every town.

Due to shallow groundwater level, the contamination is very often spreading from soil to groundwater, resulting in plumes of various sizes. Therefore, the technologies mentioned below focus mainly on the removal of mobile contaminants from soil and groundwater.

Soil excavation and dumping on a **landfill** is frequently applied in cases where the contamination is shallow and the size of the contaminated area is small or medium. Due to comparably low prizes for dumping, treatment measures for excavated soil (e.g. soil washing, incineration, ex situ immobilization) that were developed one decennium ago did not gain much attention in the last years. However, several plants exist where soil (mainly fuel contaminated soil) can be washed, incinerated or treated biologically.

In situ treatment methods have been widely used for the remediation of volatile and biodegradable contaminants.

Soil vapour extraction is the standard technique for the removal of aromatic and chlorinated solvents (which are very frequent pollutants on DUN sites) from the unsaturated zone. Vacuum is applied through extraction wells to remove gas-phase volatiles. The insertion of the cleaned exhaust from the extraction pipes into the ground may improve the efficiency of this method, as the hot air increases the volatilisation rate of the contaminant pools.

Some proofs were made with **soil heating** or **steam injection**, with the same objective of thermic enhancement of volatilization. However, high energy costs are involved with this technology. This makes it favourable at sites that are still in use where steam production facilities are present because steam is used for operation purposes.

The injection of air into the saturated zone (**air sparging**), combined with soil vapour extraction, and eventually combined with the addition of nutrients in the cases of biodegradable pollutants (**bioventing**) is a viable technique for the removal of volatile and biodegradable contaminants from groundwater.

Many groundwater contaminations have been treated by "**pump and treat**" or **hydraulic containment** to prevent pollutants from leaving the site. Due to constant release of pollutants from residual pools, it is regularly observed that there is a point of stagnation during the remediation process. To overcome this shortcoming, several techniques have been tested in order to tackle these reservoirs. All of these techniques require a good or at least moderate permeability of the aquifer to ensure sufficient distribution of additives.

Chemical oxidation by Fenton's reagent, permanganate or ozone has been used in other countries for a variety of pollutants. In NRW, encouraging results have been obtained on a site contaminated with chlorinated hydrocarbons.

Cosolvent/surfactant flushing has also been successfully applied in other countries, but to date practical application of this technology in NRW is scarce.

Biological in situ-treatment is a viable technology for groundwater contaminated with organic biodegradable contaminants, such as aromatic, aliphatic or chlorinated hydrocarbons. Groundwater is supplied with oxygen or hydrogen peroxide and nutrients in order to stimulate aerobic degradation processes (in the case of aromatic and aliphatic hydrocarbons). Organic substrates are added to the aquifer to create reducing redox conditions and thus stimulate the degradation of chlorinated hydrocarbons. Recently, other methods for the degradation of chlorinated

hydrocarbons have been proposed. This includes the addition of suspensions of **nano-iron** to improve the redox conditions and of **methane** to stimulate methanotrophic organisms.

There are a number of sites where tremendous costs are involved with the implementation of remediation measures. The German law states that measures for the decontamination of soil and groundwater have to be necessary to avoid risks, suitable to achieve the objective, and reasonable with regard to the relation between costs involved and results achieved.

In view of this, the focus has shifted in the last years to procedures that assure risk minimization rather than full clean-up.

In cases where all these technologies are not applicable, **encapsulation** rests as a means to prevent further spreading of contaminants. Sheet piling, bentonite and/or cement slurry walls and combined systems that include organic compounds or membranes to prevent diffusion are used. Usually, long-term groundwater containment and control have to be applied to ensure the lasting stability of the slurry walls.

Permeable walls constitute another passive method of risk prevention. They may be installed at in a groundwater plume so that groundwater is cleaned by adsorption or degradation while passing the wall. Several walls have been installed throughout Germany. Control measures have shown that in several cases the permeability of the wall is insufficient, resulting in groundwater passing along the sides of the wall. The experience in NRW with a permeable barrier with iron as reactant in a plume of chlorinated hydrocarbons is positive so far.

The use or enhancement of **natural attenuation** processes is intensively investigated on many sites, especially concerning groundwater plumes. After removal of the source areas (or emission control through encapsulation), the contamination may stay on the site if it is proven by groundwater monitoring that the plume is stable or shrinking.

On overview over the technologies applied so far is given in the table below.

Remediation technology/measure	Percentage of all cases (5094 measures on 3719 sites)
Deposit on landfill	66,8 %
Deposit on site	7,6 %
Hydraulic containment	1,6 %
Pneumatic containment	1,2 %
Immobilization	0,6 %
Hydraulic remediation	11,9 %
Washing/Extraction	0,3 %
Biological treatment	3,7 %
Incineration	2,0 %
Source: Ministery of Environment, Protection of Nature, Agriculture and Consumer protection, date: 31.1.2004	

Summary

- The availability of public funding is crucial for the redevelopment of sites with a low commercial value.
- The estate fund has been very successful in buying, improving and selling of abandoned sites.
- The support of the private economy to the solution of community problems is very valuable when public funding is limited.
- Limiting the liability for the investor enhances the possibilities of private engangement in the recycling of brownfield sites.
- The development of assurance models for these cases may be helpful. However, to date there is not much experience with assurance polices for risks of contamination.

Saxony Anhalt

Interreg IIIC project
European Waste Management

Experiences and Competences in Landfill Remediation and Closure

Contents

Appendix

Summary:

This study was worked out within the Interreg IIIC project European Waste Management. Within this project the study belongs to the main focus “Landfill and reuse”.

First, a survey about the current situation of waste management in Germany is given. The study focuses on the ten best practices of Central German companies in the area of landfill remediation, treatment and recovery of different waste streams, calculated site development at landfill sites. The objective of the study is to describe how the process of closure or adjustment of old landfills can be economically realised, and how, at the same time, the site as a waste management centre with treatment and recovery capacities for different types of wastes can be maintained. The study is particularly based on experiences collected at the site Halle-Lochau, which is one of the biggest landfills in Germany in the closure phase.

1 Introduction

High amounts of production and consumption have led to the production of more and more waste. In most European countries waste is mainly disposed of on landfills. This leads to the loss of valuable resources, takes a lot of useful space, and enlarges the opportunities for pollution.

However, in Germany the landfill as waste disposal facility has become less important. The disposed quantities have continously decreased. Since June 2005 the storage of untreated wastes in landfills has been actually prohibited.

Although the situation varies in the different countries, for all EU countries it is important to decrease the amount of landfilled waste, to stimulate reuse, and to realise new activities in the areas of waste management as well as remediation and development of landfill sites. Continuous co-operation and exchange of technological and organisational experiences are needed to develop and test new solutions to improve waste management.

European Waste Management (EWM) develops innovative solutions in order to create sustainable waste systems. It is an Interreg IIIC project for a co-operation between twelve regions from seven European countries in order to make waste disposal management systems more sustainable and cost-effective.

The project has three main themes and will be realised in three phases:

The main themes are

- landfill and reuse, incl. recycling of different waste streams and after-care of closed sites,
- separate collection, and
- cost-effective organisational structures for waste management.

During the first phase each region will describe the regional factors, which are important for this subject, and the problems to address, with special regard to their situation. Having analysed the descriptions, the partners provide their comments and suggestions for solutions. Second, each region will use input from other regions to develop possible solutions for the defined problems. Third, each region will work out one or two innovative solutions.

This study focuses on the thematic main aspect “Landfill and reuse”.

The German project partner, the Waste Disposal Company Halle-Lochau, is technically responsible for this study. The company is the leader in the component “Landfill and reuse” and has long-term experiences in the area of waste management. The Waste Disposal Company Halle-Lochau owns the biggest landfill site in the area. The site in all is 305 hectares. 18 millions tons of waste are stored in landfills. By 31 May 2005 the landfill Halle-Lochau had to be closed. Especially during the radical restructuring and redevelopment process of waste management due to the legal requirements in Germany a lot of knowledge and competence has been developed.

2 Initial situation in Germany

Because of the legal requirements in Germany at present a radical restructuring of waste management is carried out. Particularly the Directive 1999/31/EG of the Council of the European Union on waste landfills (Directive on Waste Disposal) **/1**/ caused numerous revisions in the landfill sector.

The implementation of the Directive on Waste Disposal into national law was realised by an alteration of the Closed Substance Cycle and Waste Management Act (2001) **/2**/ and the Ordinance on Environmentally Compatible Storage of Waste from Human Settlements (2001)**/3**/ and the Landfill Ordinance (2002) **/4**/ in conjunction with the Technical Instructions pertaining to Waste **/5**/ and Technical Instructions pertaining to Municipal Waste **/6**/. Additionally, to complete the existing legal requirements concerning the closure of landfills the Ordinance pertaining to the Recovery of Waste at Surface Landfills (2005) **/7**/ has to be mentioned.

The above mentioned regulations have led to the following developments in the area of waste management in Germany **/8**/: Since June 2005 the storage of untreated wastes in landfills has been prohibited. The landfill as a waste disposal facility has become less important in Germany. Both, the disposed quantities as well as the number of landfills have continously decreased. However, the capacities of thermal as well as mechanical-biological residual waste recovery have increased. In Germany the most important available treatment capacity for wastes is the thermal residual waste treatment (ratio of thermal to mechanical-biological treatment capacities for residential wastes: 3:1). Approximately since the year 2000 in Germany a far larger share of residential wastes has been recovered instead of removed (recovery quota for residential wastes in the year 2003: 58 %). Recovery quotas for other types of wastes are collected in the following table **/9**/.

Basis data (as of 2003)	
Total amount of waste approximately constant, incl.: building wastes (incl. excavated earth) mining wastes production wastes residential wastes, incl.: Domestic wastes	approx. 366.4 mio t = 100 %, incl.: approx. 61 % = 223.4 mio t approx. 13 % = 46.7 mio t approx. 13 % = 46.7 mio t approx. 13 % = 49.6 mio t, incl.: approx. 88 % = 43.9 mio t
Recovery quotas (as of 2003)	
Building wastes	approx. 86 % = 192.6 mio t
Production wastes	approx. 42 % = 19.8 mio t
Residential wastes, incl.: domestic wastes, incl.: glas paper, cardboard, cartons	approx. 58 %= approx. 28.8 mio. t incl.: approx. 61 % = 26.9 mio t, incl.: approx. 99 % = 3.3 mio t approx. 99 % = 8.4 mio t
Biowaste	approx. 99 % = 7.2 mio t

Especially the planned closure of landfills which do not meet the legal requirements in accordance with the Landfill Ordinance **/4**/ by the 31 May 2005 and by 15 July 2009 at the latest (limited continued operation) respectively as well as the objective of Germany to stop the disposal of residuals from the treatment of domestic wastes by the year 2020 are considerably important for the competitiveness of waste management companies.

Due to the restructuring of waste management labour and material capacities will be released. This can be avoided by focusing on new innovative techniques for the completion and closure of landfills as well as new waste management techniques and facilities by site development and orientation towards such companies.

Because of the relevance of the economic factor waste management in Germany, the maintenance of available capacities is at least as important as the new establishment of companies.

Main responsibilities in the area of waste treatment and recovery, landfill remediation and site development are pooled. By that pooling methods to secure the volumes necessary for the completion of landfills during the planned periods under economically most advantageous conditions are to be applied in accordance with the legal requirements. Thus the financial burden involved with the completion measures, which is forseeable because of insufficient special reserves, is to be minimised.

Regenerative primary energies are to be utilised under economically advantageous conditions for the generation of energy by innovative waste management units such as bio-power stations, units to produce substitute fuels for the thermal recovery or other facilities for the recovery of waste materials. That allows an efficient recovery of wastes. Beside the energy economical effects involved, labour market and economy effects are to be expected medium- and long-term by new industries and facilities.

Additionaly, by creation of existing synergy effects, such as

- supply of generated energy into already existing facilities,
- ztilisation of waste heat by the facilities that are to be established at the site,
- concerted use of the infrastructural prerequisites,
- complete services in the area of waste and landfill completion, and so
- increasing strength in transfer of know-how

positive economic influencing factors are to be made effective for the individual companies.

By the description of reference objects, opportunities to transfer the know-how to the new EU states from Central and Eastern Europe are to be created. In order to meet the EU standards required for the EU enlargement, measures like those which were realised during the years of transformation in the New Laender are necessary to implement in these states. In this respect, the complex offer of reference objects is an essential opportunity to ensure an economical expansion in these countries, particularly for small and medium-size companies.

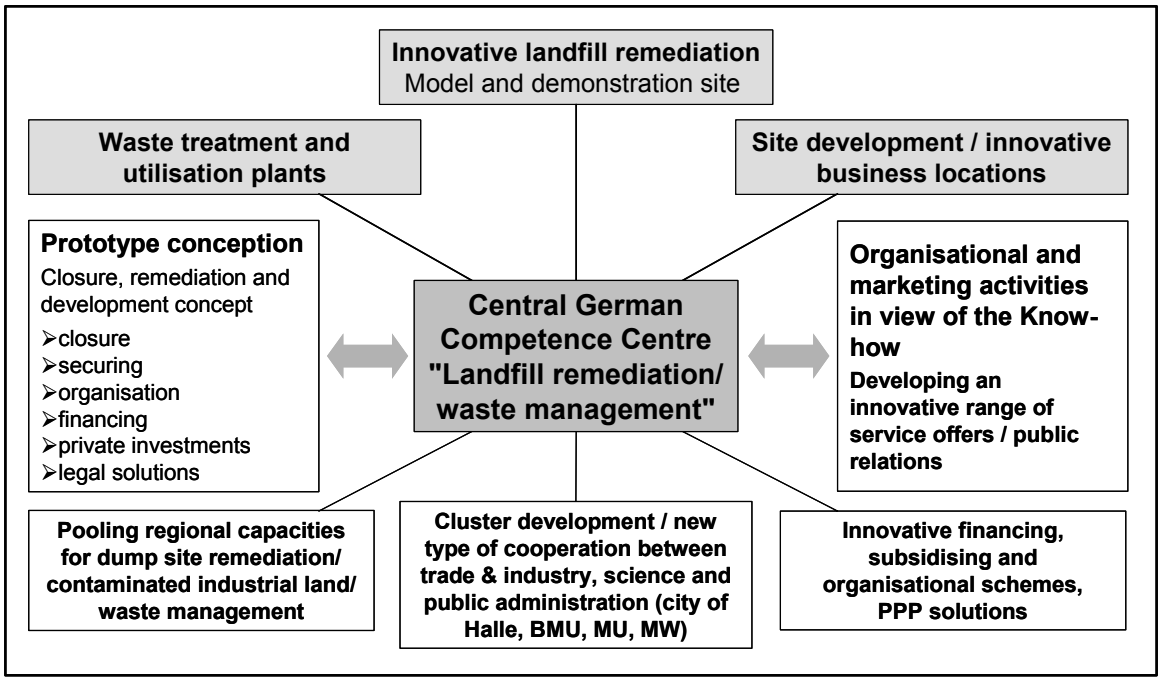
3 Central German Competence Centre "Landfill remediation/ waste management" and survey of marketable innovative solutions from Central Germany

This report introduces best practices for the connection of the remediation process of old landfills with site development as well as with establishing of companies of the waste and closed-substance-cycle management at old landfill sites. These best practices were investigated by the Central German Competence Centre "Landfill remediation/ waste management". In the following the Competence Centre is shortly described, and a survey about the results of its investigations is given.

Within the framework of the programme "Innovative EFRE measures from 2000 to 2006" the initiators RIS Halle – Leipzig – Dessau and the Competence Network "Central German Waste Disposal Sector" developed the Central German Competence Centre "Landfill remediation/ waste management" in Saxony-Anhalt as a demonstration centre for innovative, eonomically acceptable, and environmentally friendly solutions for the remediation of landfills.

By the organisation of such an innovation network – the Central German Competence Centre "Landfill remediation/ waste management" – pooling of the know-how available in Saxony-Anhalt in the areas of waste management/ landfill remediation/ closed-substance-cycle management was realised.

The individual areas of activities and responsibilities of the Competence Centre are summarised in the following graphic.



The municipalities are to be effectively supported during the organisation and implementation of closure and remediation measures for landfills. An efficient and economic utilisation of resources is to be ensured. The Central German Competence

Centre “Landfill remediation/ waste management” serves as a central advice, coordination and control centre.

Not least the Competence Centre is to actively assist at the organisation and implementation of closure and after-care concepts for landfills, the connection of closure and remediation with site development and establishing of companies.

The main objective is to develop and present the competences of companies in the area of waste treatment and recovery and the available innovative solutions for completion and closure of landfills. These innovations are to be involved into the establishing of new productive areas and into the optimal utilisation of existing capacities during the restructuring process of waste management.

In the following a survey about innovative marketable approaches of waste and closed-substance-cycle management companies in Saxony-Anhalt is given. These approaches were collected, examined and presented in a module-like description in a competence compendium **/10/** by the Central German Competence Centre “Landfill remediation/ waste management”.

Based on their content, the different approaches (modules) were classified into three thematic areas (so called competence fields):

- A: waste treatment and recovery
- B: landfill remediation
- C: site development/ establishing.

Competence field A – **waste treatment and recovery** contains the innovative solutions in the area of waste management with special regard to waste treatment and recovery.

Due to the current legislation in Germany numerous landfills are in the closure phase or continue their operation for a short period of time and then have to be closed. Therefore a development of new business areas at these landfill sites is inatienable. Otherwise all economic activities with waste management tasks will stop at the concerning sites for the most part with the respective consequences, among others, for the people who work there.

The objective is to find technical, organisational, and also legally secured economically acceptable new solutions in the area of waste management at landfill sites.

Competence field A includes following modules:

- Development of remediation construction materials – pilot project “Erdenwerk”
- Production and test of replacement construction materials for the landfill Halle-Lochau, completion concept and landfill remediation
- Innovative deconstruction and material flow management – pilot project “Deconstruction and urban redevelopment”
- Utilisation of regenerative primary energies – “Alkaline fermentation plant”
- Production of substitute fuels and co-incineration
- Recovery of valuable materials – recovery of oils from wastes – “Vacuum destillation”

- Sewage sludge – co-incineration
- Leachate purification in municipal sewage treatment plants
- Recovery of wastes/ acids “Acid evaporation plant”
- Method for the highly-efficient drying of sludges
- Substitue fuels from wastes
- Recovery of used grease and waste oils of vegetable origins
- Recovery of REA salts from filter dusts in caverns
- Compression of water sludges and processing to construction materials “Mineral mixing plant”
- Ash recovery for the production of binders and construction materials
- Production of desulphurisation additives from industrial residual materials
- Recovery of metals from dust-like wastes “Production of pellets for the metal recovery”
- Long-term safe waste disposal in salt formations
- Plans for remediation of contaminated landfills in accordance with the Soil Protection Act
- Method to separate mercury from waste combustion gases
- Combustion and gasification of wastes in stationary and circulating fluidised beds
- Thermal treatment of wastes requiring special monitoring in rotary kiln incineration plants

Competence field B – Landfill remediation deals with effective and innovative ways for the closure and remediation of landfills.

With the EU law beginning to take effect and the closure of landfills involved (no longer usable capacity of approx. 12 mio m³ landfill cavity in Saxony-Anhalt), it is necessary to develop site-specific solutions to secure the landfill bodies. It has to be particularly solved how to cover the needed quantities of construction materials that are to be used and how to cost-effectively implement the construction measures in order to take the financial pressure off the municipalities.

It is foreseeable that the high demand for backfill material to seal the landfill surfaces will lead to considerable price increases for construction services and primary construction materials. Therefore it is mandatory to find solutions for the integration of waste materials into new landfill construction materials. Like shown in the following listing, the surface sealing in particular is of special importance.

Competence field B includes following modules:

- Landfill remediation “Sub aquatic landfill”
- Landfill leachate disposal, completion concept, and landfill remediation
- Waste recovery at industrial landfills – system suggestion for a sealing from construction replacement materials
- Alternative surface sealing systems and reuse of landfills

- Production of landfill and secondary construction materials from wastes
- Simplified analysis of protection targets at landfills
- Development of system suggestions for the surface sealing of landfills
- Surface sealing of landfills “System suggestion water balance layer” [MDSE]
- Landfill body conditioning with deep filtering wells
- Development of a compendium on landfill closure
- Production of mineral landfill and road construction materials “Recycling plant for mineral materials”
- Temporary and final surface sealing of landfills to decrease methane emissions
- Landfill degasification – “Modular container concept”
- Surface sealing of landfills “Grain-graded seal from demolition materials”
- Development of site-differentiated layer constructions for surface sealing systems of landfills by the Deutsche Bahn AG

Competence field C – Site development/ establishing focuses on the development of synergy effects in conjunction with landfill sites. All solutions designed to develop and establish industry at landfill sites will be integrated.

The Ordinance on Environmentally Compatible Storage of Waste, the Landfill Ordinance and the Ordinance pertaining to the Recovery of Waste at Surface Landfills have serious effects on the present disposal routes. The majority of landfills had or will have to stop operating by 31 May 2005 or by 15 July 2009. Thus the conventional waste disposal on landfills for residential wastes is actually stopped. The conversion to the waste incineration and subordinate the mechanical-biological treatment of residential wastes are mandatory. The conversion of the operating of residential waste landfills to other waste management units requires a conceptional examination of site-specific possibilities as soon as possible.

Competence field C includes following modules:

- Site development/ establishing of industry
- Organisational structures and management systems
- Interregional transfer of know-how to communities in the region Slask to organise a modern waste management in Poland

4 Presentation of the best practices of Central Germany

In the following selected best practices from the individual competence fields are presented:

Competence field A: Waste treatment and recovery:

- Development of remediation construction materials – pilot project “Erdenwerk”
- Production and test of replacement construction materials for the landfill Halle-Lochau, completion concept and landfill remediation
- Combustion and gasification of wastes in stationary and circulating fluidised beds

Competence field B: Landfill remediation:

- Landfill remediation “Sub aquatic landfill”
- Alternative surface sealing systems and reuse of landfills
- Development of a compendium on landfill closure
- Production of mineral landfill and road construction materials “Processing plant for mineral materials”
- Temporary and final surface sealing of landfills to decrease methane emissions

Competence field C: Site development/ establishing:

- Site development/ industrial establishing
- Organisational structures and management systems

The selected best practices are shortly described. Information on following main aspects is provided:

- contacts,
- initial situation and general conditions
- objectives and approach,
- results,
- responsibilities/ services of the project partners.

4.1 Module 1: Development of remediation construction materials – pilot project "Erdenwerk" (competence field A)

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Initial situation and general conditions

There is an overcapacity of approx. 10-12 mio m³ of cavity for the landfills for residential wastes in Saxony-Anhalt. Due to the upcoming closure measures this landfill cavity needs to be site-specifically filled with appropriate materials. The quantity deficit of appropriate materials to backfill and profile the closing landfills cannot be compensated with conventional construction material such as excavated earth and low contaminated mineral demolition material, for the quantities that are available on the market do not meet the demand in any way.

In addition to the quantity problem, the municipalities face the almost insoluble task of financing the closure and remediation measures as well as the after-care.

Considering the local conditions of the sites, the result is a quantity demand for appropriate materials to ensure an economical backfilling of the landfills. The pilot project "Alternative construction materials for landfills and restoration of open cast mines", "Erdenwerk" for short, is an innovative model concept which deals with the site-specific problems in the area of landfill remediation and offers solutions for these.

The "Erdenwerk" was to help to develop defined landfill construction materials from non-contaminated, mainly mineral mass wastes.

Objectives

The development of backfilling and remediation products (landfill replacement construction material) to seal the landfills was to be technically and technologically as well as economically and ecologically documented by the pilot project. For this purpose, site-specific backfill products were made from commercially available waste materials with a preferably negative market value by technological procedures.

Furthermore, the project was to document and examine the compatibility of the produced landfill construction materials on test fields as well as to develop and produce landfill replacement construction materials by using a modular–built plant.

Another objective, beside the verification of the ecological compatibility, was the review of the economical implementation of the project. That depends on the actual potential of the landfill owners or operators. Here the project focused on the solution of the applicability issue to other landfill sites.

Approach

To realise the objectives the project partners worked, amongst others, on the following tasks:

- determination of the quantity demand of appropriate materials to implement landfill remediation measures,
- selection, documentation, and source determination of backfill materials (waste to recover) to produce site-specifically defined construction materials to remediate and restore landfill bodies as well as the ecological verification of those considering different legal initial positions for the measure,
- estimation of the total expenses for the production and the casting of the replacement construction materials,
- proof of regional-economical effects by the regional co-operation, the pooling of competences, and the activation of synergy effects within the conditions of the pilot project,
- examination of the model approach in following variations:
    a) use of a central “Erdenwerk” on the site Halle-Lochau,
    b) application of the model approach to create decentralised solution models for landfill sealing concepts.

The realisation of the pilot project was carried out in two phases:

Phase 1: Large-scale experiment

Considering current waste legislation requirements, the demands on the in- and output materials of the “Erdenwerk” were formulated, experimental designs were developed and realised in a large-scale test

Phase 2: Application of the results of the large-scale experiment to the site Halle-Lochau

Within the conditions of the site-development concept “Waste management centre Halle-Lochau” the “Erdenwerk” was to be applied as industrial establishment to this site. The conditions for authorisation had to be proved.

Having analysed the project phases, the project partners developed a technological concept about the construction of an “Erdenwerk”. The conditions for authorisation and a decentralised applicability were proved.

Results

Regarding the objectives of the pilot project, three specific methods were developed for the production of replacement construction materials. In test series the project partners examined the production possibilities:

- production of defined material mixtures to use as backfill construction materials to fill the cavities of closed landfills,
- production of landfill replacement construction materials to backfill and secure lower layers – sandwich systems,
- production of substrates that allow a vegetation to seal the landfill bodies.

Following conclusions were formulated within the result analysis:

- The production of the several construction materials does not depend on a site-determined plant technology.
- The several construction materials are mainly produced by the use of crushing and sorting methods. Therefore the process expenses are very low.
- The decentralised applicability of the pilot project strongly depends on economical aspects or influences, which means that the profitability is mainly determined by the material flow structure of the plant input (wastes with a negative market value).
- According to the current legal position for wastes, the recovery of the products for landfill sealing measures is legally covered.

In terms of

- substitution of conventional construction materials for landfill closure measures by landfill replacement construction materials as well as
- legal and sub legal regulations with regard to waste disposal

the pilot project “Alternative construction materials for landfills and restoration of open cast mines (Erdenwerk)” offers an economical and ecological solution concept for a coordination process when closing landfills.

The innovative solution of the pilot project is the result of the technical, organisational but also legally covered and economically justified model approach in the area of landfill remediation/ waste management, including its impacts on the labour market and the regional added value.

Responsibilities/ Services of the project partners

C.A.R.E. Centrum für Abfall-, Recycling und Entsorgungswirtschaft GmbH

Project coordination,

Creation of the conditions for the test series and the implementation of those,

Co-operation in the creation of the conditions for the implementation of the pilot project on the site Halle-Lochau,

Operator of waste management plants

SIG UmweltProjekt GmbH

Conception of site-adjusted mixture systems to produce defined landfill construction materials (soil-mechanical and soil-physical requirements),

Analytic determination of the composition of the material mixtures

Technical assistance, analysis, and optimisation of the test series,

Analysis of the effects of the pilot project on investment, employment, added value, and site development for the industrial site concept Halle-Lochau

Responsible for the authorisation of the implementation of the construction of an "Erdenwerk",

Assistance with engineering experiences

Abfallwirtschaft GmbH Halle-Lochau

Receipt and provision of the waste materials,

Determination of the quantity of the needed backfill materials,

Analysis of the input materials and the produced construction materials, and implementation of soil-mechanical qualification tests of produced construction materials

Operator of waste management plants

Application of the operational experiences from the "Erdenwerk" to future plants

RWE Umwelt Ost GmbH

Provision of waste materials and plant technology

Implementation of logistics services (collection and transport),

Development of a material flow management,

Construction and operation of waste disposal and recovery plants,

Waste sorting and recycling,

Application of the operational experiences from the "Erdenwerk" to future plants

4.2 Module 2: Production and test of replacement construction materials for the landfill Halle-Lochau, completion concept and landfill remediation (competence field A)

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Initial situation and general conditions

According to the current waste legislations large quantities of mineral construction materials are required for backfilling, barrier and supporting body, compensatory layers etc. of landfills. These construction materials have to distinguish themselves by low pollutant eluation, non-existing biological activity (degradation processes, gas production) as well as static suitability (no subsidences).

For wastes with sufficient mineral content a further fractionation seems to be practical. To achieve adequate soil-physical parameters under defined site conditions thus produced or available monofractions can be processed into a replacement construction material by compression and stabilisation.

Appropriate mass wastes are tested regarding their suitability to produce replacement construction materials. These materials are to be used for the remediation, securing, and profiling of landfills.

Objectives

Objective of the project is to produce replacement construction materials which meet the standards of remediation, securing, and profiling of landfills and contaminated lands.

Pollutants are removed by mechanical pre-treatment of municipal and commercial residual wastes. Thus mineral and mineral-organic fractions are to be produced. In addition a chemical-physical treatment of waste fractions by compression and stabilisation methods is included.

Following steps are realised in a large-scale experiment:

- mechanical treatment,
- chemical-physical treatment and
- emplacement on the site.

By generalisation of the model approach and the experiment results the method is to be used for the completion or remediation of landfills at other sites.

Approach

A market analysis regarding type, volume, and current recovery possibilities was implemented for adequate waste materials.

Following waste materials were tested:

- ashes from filter systems as well as incineration ashes/ scoria from incineration plants,
- sands and dusts from technical applications (e.g. foundry sands),
- organic-mineral fractions from mechanical-biological waste treatment plants,
- sludge from the treatment of municipal and industrial waste water or the extraction of raw material,
- mineral fractions from the recycling of commercial and building wastes.

The evaluation of the properties is implemented within a three-stage programme:

1. stage: pilot surveys/ suitability tests under laboratory conditions,

2. stage: small-scale experiment in the lysimeter,

3. stage: large-scale experiment in the test field.

Results

1. The specific conditions under which the tested materials are suitable for the use as replacement construction materials were determined.

   Homogeneous fine-grained materials such as sludges, sands, filter ashes for example can be used without any pre-treatment.
   Heterogeneous materials have to be sorted down to maximally 0-20 mm. They demand a relatively high amount of hydraulic binders. This also concerns the output of mechanic-biological waste treatment plants. Based on these results, the heterogeneous materials were mixed with sludge-like wastes. Considerably more homogeneous basic materials were produced, which allowed a successful chemical-physical treatment.

Because of their self-reactivity incineration ashes can usually be processed into suitable construction materials only by addition of mixing water.

2. The results of the laboratory test were confirmed in large-scale experiments.
3. The mechanical processing is unproblematic in suitable, available plants.
4. The chemical-physical treatment by intermixing with hydraulic binders is easy to implement with only a few modifications of the plant technology.
5. The produced replacement construction materials are good to emplace by conventional technology according to the emplacement criteria.
6. Evidences about the long-term stability can be made only after long-term tests.

Replacement construction materials with defined properties from the selected mass wastes can ususally be produced and emplaced by means of the available plant technology with only a few modifications. If the responsible authorities approve the construction materials, considerable savings of natural resources and financial means will be possible.

The innovative solution of the pilot scheme is the result of the considerable saving potential due to an uncomplicated treatment after a careful selection and analysis of the basic materials.

Responsibilities/ Services of the project partners

SUC Sächsische Umweltschutz Consulting GmbH

Patent for the processing and production of replacement construction materials

Operator of the immobilisation plant to treat heterogeneous waste materials

Services with recovery, treatment, and disposal of wastes in the facilities as well as disposal of hazardous wastes

Sortek GmbH

Processing of mineral fractions

Operator of processing plants for construction wastes

IHU Gesellschaft für Ingenieur-, Hydro und Umweltgeologie mbH

Geologic, hydrological, and analytic examinations of the waste materials

RUG Recycling und Umweltschutz GmbH

Chemical pilot surveys and analysis of waste materials

4.3 Module 3: Combustion and gasification of wastes in stationary and circulating fluidised beds (competence field A)

Contacts

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Initial situation and general conditions

The University Magdeburg focuses in one of their researches on the examination of the burn-up and emission behaviour of waste materials especially in fluidised bed firing systems. Many fuels, biomasses, and waste materials were and are examined in stationary and circulating fluidised bed firing systems. For this purpose, the college of technology built different test plants.

The process parameters for the environmentally friendly combustion of the above mentioned fuels in stationary and circulating fluidised beds are optimised with these test plants.

Objectives/ Approach

The university and the Fraunhofer Institute mainly examine the generation of heat and electrical energy by fluidised bed methods. For this purpose, decentralised plants of small and medium capacity (up to approx. 1 MW) are to be developed. Those plants are especially suitable for small- and medium-sized companies. Part of the examinations are adjusted modular system solutions for turn-key plants as well as spot solutions for the self-sufficient energy-supply of industrial and commercial sites or municipal facilities.

Different multi-valent usable plants have been developed:

- In the test plant for the stationary fluidised bed incineration the environmentally friendly combustion of biomasses is examined. For these examinations it is important to determine the pollutant concentration of the combustion gases of different biofuels from the recycling of biowastes or the treatment of residual waste.
- In the test plant for the circulating fluidised bed incineration the harder combustible constituents are completely burnt-out after several cycles.

- In this conjunction the combustion characteristics of other industrial wastes such as paints containing heavy metals, rubber waste residues, different sewage sludges etc. are also examined in the stationary and circulating fluidised bed incineration.
- In the fluidised bed gasification plant (WSV 400) with post-connected periphery to clean the combustion gases methods for the gasification of wastes and regenerative resources – for the purpose of energy utilisation of gasification gases in combined heat and power plants [BHKW] – are developed and optimised. Biogenic residual and waste materials (straw and hay pellets as well as chips from natural wood or residual wood) are used to examine the gasification.

Results

a) Fluidised bed incineration

The incineration conditions such as temperature in the combustion chamber, air/ fuel ration, air circulation were varied and optimised with regard to combustion and emission. Pollutant formation processes, especially the formation of NO_x were examined. Appropriate reduction methods were developed. The innovative about the stationary and circulating fluidised bed incineration is the primary reduction of the NO_x by supplying staging air at different positions of the reactor.

In the fluidised bed sulphur is bound by the addition of lime. Thus gypsum dust is partly produced. This dust is removed. An additional desulphurisation of the flue gas is no longer required.

b) Fluidised bed gasification

The existing fluidised bed gasification plant (WSV 400) is the prototype of a decentralised power and heat supply plant of small capacity by gasification of old and industrial wood in the form of chips to utilise the energy of residual and waste materials.

The reference plant can be developed further for interested small- and medium-sized companies to utilise the energy of any biogenic residual and waste materials.

c) Further innovative research results

On top of the presented results there are further experiences and researches on the optimisation of incineration processes as well as on the generation of heat and electricity, e.g.:

- “Solarthermie-2000“ demonstration plant (660 m² of flat collectors) to supply the canteen and the student hostels of the university with hot water,
- Stirling motor BHKW for 10 kW_{el}; a test plant to demonstrate the co-generation during the decentralised energy utilisation of norm fuels and biogenic fuel gases (utilisation of biogas, gasification gas, sewage gas is being developed).

Responsibilities/ Services of the project partners

University Magdeburg in co-operation with the Fraunhofer Institute Magdeburg

Technique development/ optimisation for the energy utilisation of regenerative resources and wastes

Development of prototypes/ pilot plants

Fuel tests for the combustion and the gasification

Dimensioning of devices and scale-up

Basic engineering, authority engineering/ approval management

Conceptional and scientific technique development and practical application

Technological and ecological evaluations, surveys

4.4 Module 4: Landfill remediation "Sub aquatic landfill" (competence field B)

Contacts

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Initial situation

The realisation of the research and development project is to find measures for a sustainable and cost-optimised implementation of closure and after-care of landfills below the surrounding groundwater tables (sub aquatic landfills), which meets the demands of the environmental protection.

The legal regulations do not contain a complete technical solution for that, as they refer to landfill sites above the groundwaters.

By the examinations a general concept for the implementation of appropriate closure and after-care measures is developed on the basis of the landfill Halle-Lochau.

The research and development project focuses on:

- final shaping and reuse of the landfill,
- analysis and integration of legal issues,
- sevelopment of technical measures for the landfill closure and the after-care phase,
- modeling of environmental impacts of the closure as well as the modeling of technical measures,
- analysis of environmental protection, sustainability, and profitability,
- deduction of a preferred variant for the closure and the afte-care,
- public relations (population, authorities).

Objectives

The objectives of the project are:

- To prepare the environmentally friendly, sustainable, and cost-optimised closure of the landfill Halle-Lochau,
- To develop a general concept on the approach and the measure determination for the closure of landfills below the groundwater table,
- To develop, examine, and evaluate appropriate closure and after-care measures for sub aquatic landfills,

- To develop a general concept for involving the public and authorities.

Approach

One of the main aspects of the project in conjunction with the final shaping of the landfill area is the development and consideration respectively of possible reuses.

To develop reuse variants, suggestions from the population, especially from the neighbour communities, are integrated.

Taking that as a starting point, the project partners developed appropriate measures for the closure and the after-care phase of the landfill. Considering the objectives sustainability, after-care free landfills, and economic efficiency these measures will result in a reduction of the material leaching from the closed landfill. The measures were legally examined and evaluated with regard to their approvability. The examinations include sealing measures, biochemical inertisation, optimised emplacement of stabilisation materials in the closure phase as well as optimised surface capping measures plus restoration.

As part of a complete evaluation and conception, a preferred variant for the implementation and arrangement of the closure and after-care phase of the landfill Halle-Lochau is deduced from the developed individual measures. At the same time, the methodology and the individual results are prepared to be generally applied to similar cases and provided.

Results

The results of the project are:

- Development and provision of a methodical approach to examine and specifically deduce appropriate closure and after-care measures for sub aquatic landfills, incl. their evaluation
- Development of appropriate technical individual measures for the closure and the after-care of sub aquatic landfills with regard to: final shaping, sealing measures, biochemical inertisation, leachate circulation, property-optimised emplacement of stabilisation materials to reduce the material leaching, surface capping, restoration and reuse, utilisation of waters.
- Development and provision of evaluation approaches to optimise the measures for the criteria sustainability, after-care free landfill, economic efficiency, law conformity, implementation of the measures in clear periods.
- Development of a generalised concept for involving the public and authorities.

The innovative solution is the result of the development of appropriate technical securing measures for sub aquatic landfills, for which the legal regulations have not provided any solutions till now. The results can be applied to other landfill sites with sub aquatic conditions.

Services of the project partners

Abfallwirtschaft GmbH Halle – Lochau

Operator of the landfill Halle-Lochau

Services with the disposal of domestic and commercial waste by storage in the facilities

Advisory service for waste producers and waste carriers with regard to the disposal possibilities at the site Halle-Lochau

Provision of logistic services at the site of the waste management centre Halle-Lochau, amongst others in the area of receipt and supervision of wastes, incl. weighing services, laboratory services, workshop services

Renting and leasing of industrial real estates and offices at the site, incl. infrastructure services

Laboratory services in the area of waste, sewage and landfill gas analytics by a testing laboratory which was accredited according to DIN EN ISO 17025

Project management services, especially in the area of development and examination of closure and after-care concepts for sub aquatic landfills

4.5 Module 5: Alternative surface sealing systems and reuse of landfills (competence field B)

Contacts

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Initial situation and general conditions

The closed landfill “Grube Siegfried” stretches across an area of approx. 12 ha in an old lignite open cut with inserted wastes from the coal refining (coal water, ashes etc.). During the securing and final shaping of the landfill an alternative surface sealing system is to be developed according to landfill category II. The surface sealing system is to be permanently able to work, including the waste materials which are available around the site (e.g. filter ashes from power plants) and considering the existing meteorological conditions (very low precipitation) as well as the planned vegetation (according to the stipulated reuse).

In the course of the final shaping the unsecured open cut with a jetting area of approx. 37 ha and the landfill are scenically reused.

Objectives

The old open cut is to be arranged for a future reuse of the area for landscaping and local recreation with regard to economical aspects and the utilisation of available secondary construction materials.

The objective is to develop a site-adjusted alternative surface sealing system to avoid pollutant leaching caused by rainfall infiltration in the subarea of the landfill.

In detail:

1. Construction of an appropriate water balance layer considering the site-specific and meteorological situations, and
2. Determination of an appropriate system to permanently ensure the bearing capacity, especially in the parts with open jetting areas, and
3. Shaping of the whole site according to the planned reuse.

Furthermore, a commercialisation and application of the solution to other landfill sites is planned after the development and the test of the alternative sealing system.

Approach

First, all materials and waste materials (construction wastes, filter ashes, coarse ashes, REA gypsum, excavated earth, sewage sludge compost etc.), which are available at the site and planned to use for the alternative sealing system, were examined with regard to their physical properties.

The specific conditions of the site were recorded by mathematically modeling the water balance and the water movement.

Thereupon the requirements on the particular layers of the surface sealing system were determined, and an optimised structure of layers in terms of a water balance layer was deduced.

The alternative surface sealing system was built on a test field. The necessary measuring devices were installed (test field on the landfill “Grube Siegfried” in Trebnitz, Administrative District of Weißenfels).

The test field was constructed with a three-layer surface sealing system as water balance layer with a total thickness of 2.25 m. Following layers form the surface sealing system:

- a restoration layer with high water storage capacity and high nutrient provision for the vegetation,
- a storage layer with larger pore volume to store water, and
- a lowly permeable layer with potentials to chemically convert the residual water on the
- compensatory layer on the waste.

Based on the metrological evaluation of the large-scale experiment, the effectiveness of the alternative surface sealing system was evaluated in comparison to the combined sealing according to the Technical Instructions pertaining to Municipal Waste and the Landfill Ordinance (standard sealing system) respectively.

Results

Considering the meterological conditions at the site and the planned vegetation, the surface sealing system is constructed as a water balance layer in a way that allows a permanently working system,

- where the individual layers have enough moisture,
- where the rain water which penetrates into the soil is saved and returned to the atmosphere by capillary action and evapotranspiration.

A drainage layer is not planned, as the rainfall at the site is relatively low and the construction of the system with the used materials and its vegetation consumes the rain water.

Lignite filter ashes were emplaced into the water balance layer. Under the given site conditions, an almost complete consumption of rain water (more than 96 %) is achieved.

The sludge compost was emplaced into the top soil layer of the water balance layer to ensure the high flexibility regarding the reuse of the area (agriculture, forest).

The bearing capacity of the landfill site is ensured under the given conditions.

Collecting the meteorological and soil-hydrological data as well as watching the vegetation allow comparisons to other systems at other sites. So the foundations are laid to extensively use this alternative surface sealing system at the landfill “Grube Siegfried” and to apply it to other sites after modification.

Responsibilities/ Services of the project partners

MUEG Mitteldeutsche Umwelt- und Entsorgung GmbH

Remediation of contaminated lands and treatment and recovery of wastes

Power plant disposal and marketing of power plant residual materials

Logistics and material flow management

Further development of the know-how to determine alternative surface sealing systems at home and abroad

Complex services for remediation, residual material recovery etc.

Complex planning and engineering on above mentioned subject areas as well as waste management, mining, and environmental technology

SIG UmweltProjekt GmbH

Engineering assistance in the development and realisation of the alternative surface sealing system

Project supervision and project management in the areas of waste management, remediation of contaminated lands, environmental impact assessment, soil science, soil hydrology etc.

Waste management planning and waste management concepts, incl. planning of landfills

External monitoring of landfills and other waste management plants

Engineering monitoring of constructing measures in the areas of waste management, remediation of contaminated lands, supply and disposal

IHU Gesellschaft für Ingenieur-, Hydro und Umweltgeologie mbH

Geological, hydrological, and analytic examinations

4.6 Modul 6: Development of a compendium on landfill closure (competence field B)

Contacts

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Initial situation and general conditions

The Directive 1999/31/EG of the Council of 26 April 1999 on waste landfills came into force upon its announcement in the Official Journal of the European Unions on 16 July 1999. Amongst others it manages the prerequisites and the temporal frame for closure and after-care of old landfills. This Directive was implemented into German law upon the alteration of the Closed Substance Cycle and Waste Management Act [KrW-/AbfG](2001) and the decree of Ordinance on Environmentally Compatible Storage of Waste from Human Settlements (2001) as well as the Landfill Ordinance (2002).

The regulations for the closure and after-care concern landfills for inert wastes, for domestic wastes and for wastes requiring special monitoring, incl. industrial landfills.

Until now the administrative regulations Technical Instructions pertaining to Waste and Technical Instructions pertaining to Municipal Waste have stipulated the requirements on construction and operation, closure and after-care for “standard landfills”.

Both Technical Directives pursue the so called multi-barrier concept (geological barrier, bottom liner, pre-treatment of waste “inertisation”, surface sealing). When all “barriers” meet the requirements, the common weal and the protection targets acc. to Section 10 (4) KrW-/AbfG are regarded as secured, so that further analyses no longer will be demanded.

The majority of the operated old landfills do not have all of the required barriers: old landfills often do not have a bottom liner that meets the demands; the landfilled wastes usually do not meet the classification criteria of the Technical Directives. Consequently two or three barriers of the multi-barrier concept do not exist and cannot be constructed afterwards. In these cases the focus has to be on a wise realisation of the requirement for the construction of the fourth barrier, the surface sealing,

The measures for the closure of old landfills are geared to the individual case; they are to apply to the individual situation of the landfill site.

The survey of the actual state of the closing landfill and its environment is very important for the determination of the required measures. Based on the actual state, a forecast of the future development and its evaluation have to be made. A catalogue of measures has to be proposed and reconciled with the authority. This procedure leads to the verification required in Section 14 para. 6 of the Landfill Ordinance.

It has to be developed ecologically and economically adequate technical measures for the closure of old landfills. To seal the surface of old landfills by a surface sealing acc. to the Technical Instructions pertaining to Waste or the Technical Instructions pertaining to Municipal Waste will not often prove to be the optimal way. The protection of the common weal is not always achieved to the desired extend; and, on top of that, the process is often accompanied by an unjustifiable high economical effort. Old landfills are individual constructions. Therefore the measures regarding their closure have to be individually selected.

The renunciation of standardised systems does not mean a renunciation of generally valid guidelines. The various ecological situations of the old landfills in Germany and the narrow time frame (2005) did not allow the decree of an independent ordinance on old landfills for reasons of time and content (individual cases). Besides, an ordinance could not have sufficiently and promptly regulated the fast development, particularly in alternative surface sealings. This would have resulted in problems with the implementation and in slowdowns in investments.

The summary of legal, technical, and economical information in a “Compendium on Landfill Closure” was to fast react to the opportunities created by the Landfill Ordinance and the current task of the closure of old landfills.

Objectives/ Approach

Based on the waste legislation regulations, the compendium pursues the objective to give instructions on how to sustainably secure the common weal by site-specific measures for closure and after-care of old landfills.

The compendium deals with legal and technical possibilities and measures for the closure and after-care of old landfills. It particularly serves as a support for the use of exceptional opportunities acc. to Section 14 para. 6 of the Landfill Ordinance by giving basic information on legal and technical aspects of the landfill closure (Part I to III of the compendium) on the one hand and providing Engineering Specifications (Part IV of the compendium) on the other hand. Furthermore the compendium includes contributions on economical questions (handling of provisions), financing concepts for closures as well as contributions on project control and project management.

The compendium addresses institutions of the Federation and Laender, regional administrative bodies, operators, authorities, companies, and associations who deal with the closure of old landfills.

Results

The compendium supports the implementation of the Landfill Ordinance. It contains not only the standard requirements of Section 12 of the Landfill Ordinance but also legal, technical, and economical information on closure and after-care of old landfills on the basis of Section 14 para. 6 of the Landfill Ordinance, especially for ecologically and economically adequate technical measures.

The compendium provides suggestions on the survey and evaluation of the actual state and the selection of technical measures for closure, especially for surface capping and sealing systems, with respect to their effectiveness to secure the future quality of the protection targets.

The compendium refers to existing technical legislations and offers alternatives in the area of closure of old landfills. It contains information and gives advice on how to achieve the protection targets at the respective site, with special attention to the groundwater protection.

Additionally, technical solutions, for example of authorised surface cappings and surface sealing systems, as well as of implemented closures are presented in the compendium.

With respect to the EU member states and the new EU countries, the compendium offers the opportunity that the solutions developed and authorised in Germany can be applied in these countries as best available technology.

The compendium can be purchased by interested persons. The basic delivery is a loose-leaf-collection. It is planned to be continued.

Responsibilities/ Services of the project partners

SIG UmweltProjekt GmbH

Engineering assistance in the development and the conception of the landfill compendium

Project control and project management in the areas of waste management, remediation of contaminated lands, environmental impact assessment, soil science, soil hydrology etc.

Waste management plannings and waste management concepts, incl. plannings of landfills

External monitoring of landfills and other waste management facilities

Engineering monitoring of construction measures in the areas of waste management, remediation of contaminated lands, supply and disposal et al.

4.7 Module 7: Production of mineral landfill and road construction materials "Processing plant for mineral materials" (competence field B)

Contacts

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Initial situation and general conditions

The scoria which is produced as a residue by the incineration in waste incineration plants has to be recycled. One possibility to do so is the processing in special scoria processing plants.

Objective of the processing is to sort out the ferrous scrap metal, the non-ferrous metals, the unburned material, and the contraries contained in the scoria as well as to produce different grain sizes of inert scorias to use them in the construction industry (road and path construction, railway construction etc.). The material can also be used to cap landfills. The different grain sizes of sorted ferrous and non-ferrous metals can be marketed.

Objectives/ Approach

The objective is to produce mineral landfill and road construction materials from scorias from waste incineration plants. For this purpose a recycling plant (located at the landfill Halle-Lochau, 06184 Döllnitz) was developed.

The scoria is processed in a plant by sorting out impurities and contraries. During the process the scoria passes different sorting, classifying and mixing stages. The output is inert material with most different grain sizes, which can be adjusted before.

Depending on the need and the requirements on the produced landfill construction material the end product is mixed grain-graded to new materials with a defined compound.

Results

According to the contract agreements, a defined construction material for the use in the surface sealing system of landfills is produced in accordance with the intended purpose.

A processing plant for mineral materials with modified processing technology, depending on the local conditions, is used nationwide at several sites and has proved itself for more than 15 years.

The specific know-how of the processing plant for mineral materials consists in the optimisation of the individual modules of the plant parts and their control.

Responsibilities/ Services of the project partners

Baumann & Burmeister GmbH

Operator of the recycling plant for mineral materials

Construction services in earth-moving, civil engineering

4.8 Module 8: Temporary and final surface sealing of landfills to decrease methane emissions (competence field B)

Contacts

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Initital situation and general conditions

During the after-care phase after the closure of landfills (cessation of the waste disposal) residual gas emissions emerge. These emissions have to be reduced down to an environmentally friendly degree by a qualified intermediate capping or final surface sealing.

This landfill gas causes dangers and environmental impacts such as danger of explosion and fire, danger of suffocation, endanger of health, vegetation damages, offensive smell and climate impairments. The landfill gas usually consists of 55 % methane and 45 % carbon dioxide. In addition to this, it may contain traces of organic harmful gases, e.g. aromatic and halogenated hydrocarbons.

The collection and recovery of the landfill gas is problematic, especially for smaller landfills. While larger landfills utilise the methane with a content of 55-65%, which is produced during the conversion processes of the organic compounds contained in the waste, to generate energy or to dispose the gas as a climate-impacting substance by using a gas flare, the amount of landfill gas in smaller landfills is much smaller. The produced gas in smaller landfills does not only considerably fluctuate in its compound, but also often contains less methane than larger landfills. Therefore an optimal recovery or removal of the methane in small landfills cannot be achieved by above mentioned measures.

Furthermore, it has to be made sure that a sealing of the landfill according to the technical instructions and regulations largely stops a regeneration of leachate and thus prevents the biological material conversion in the landfill body. Sealed like that, the landfill body remains dangerous for unlimited time. Therefore a reuse of such a landfill is practically impossible for indefinite periods.

Based on these circumstances, alternative solutions, especially for smaller landfills, have to be found. Considering the long-term protection of the general public, alternatives to the standard sealing system have to be examined for their technical suitability.

Objectives/ Approach

A biologically activated surface sealing appears to be an alternative to the completely closed standard sealing system. Naturally methane oxidising bacteria take over the oxidation of the methane in a surface capping optimised for that process. In contrast to the technically-limited conventional gas disposal systems of larger landfills, the microbial oxidation systems may be an efficient and cost-effective alternative for the use at smaller landfills.

Following requirements can be defined for a biologically activated surface sealing with regard to its structure as well as to the materials planned to use:

- if possible, an undisturbed gas passage from the landfill body into the biologically activated layer,
- a sufficient supply of the methane oxidising bacteria with nutrients (especially nitrogen and oxygen),
- an increased utilisable field capacity to balance the water storage capacity in the microbially effective surface sealing/ capping,
- if possible, a simple structure to be a real alternative to the standard sealing systems.

At present a research project on the use of optimised surface sealings/ cappings with regard to the methane oxidation potential, subsidised by the Land Saxony-Anhalt, is implemented. The examinations on three test fields in comparison to examinations on already closed landfills in Saxony-Anhalt are to broaden the knowledge about temporary and final surface sealings regarding their methane oxidation and to optimise the structure of the layers for landfills.

Results

In contrast to the so-far published examinations in the technical literature, the objective of the research project is to develop a test methodology which allows a secured and transferable proof of the methane reduction. Based on the results, universal instructions on the construction of a biologically activated surface sealing/ capping are to be deduced.

Test fields are planned; a test plant is built and metrologically monitored. The results in accordance with the objective of the research project will be expected for the fourth quarter of 2006.

The method to decrease methane emissions has not been practically used yet in the planned way. When the research project confirms the results in accordance with the objective, there will be an extremely economic surface sealing/ capping system for the temporary and also final surface sealing/ capping of landfills in view to the respective site conditions, which can be universally used.

The results of the research project particularly are the basis for the formulation of principles, which are to be integrated into the internal administrative circular of the Ministry for Agriculture and Environment of 6 April 2004 “Selection of alternative surface sealings”.

Responsibilities/ Services of the project partners

Fördergemeinschaft Kreislaufwirtschaft e.V.

Conception of the methods to decrease methane emissions

Monitoring of the tests on the test fields and the test landfill

Analysis of the results

Marketing of the solution

SIG UmweltProjekt GmbH

Engineering assistance in the conception of the methods to decrease methane emissions

Technical monitoring, evaluation and optimisation of the tests

Monitoring and analysis of the results

4.9 Module 9: Site development/ establishing (competence field C)

Contacts

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Initial situation and general conditions

Within the area of the landfill Halle-Lochau/ 06184 Döllnitz, which was declared as industrial and commercial area in the draft of the land use planning, extensive changes have taken place during the last years. The constructible and non-constructible land areas, the traffic lands, green spaces, and the supply and disposal are shown in the development plans.

The site development and the establishing of companies in this industrial/ commercial area are to cause that the site Döllnitz with its employment rate and investment potential is maintained.

Objectives

To avoid undesirable developments, a conceptional and organisational control of the site development and the industrial establishing in the area of the landfill Halle-Lochau/ 06184 Döllnitz is necessary. In doing so, not only the interests for the development of the industrial area but also the interests of the population and the environmental protection and the nature conservation have to be taken into consideration.

Approach

Due to many research projects regarding old landfills as well as to the applications of companies for establishing, which are connected with the closure and after-care of the landfill, a working group was appointed. This working group treats all concrete questions regarding the intermediate services, sites, development measures, leasing, prices and the like.

Results

In the several development plans planning law regulations were issued, which have to be considered within the framework of the establishings. Complete details on the type of the constructional use, the architecture, the constructible land area, the immission control, and the green area structure of the development plan no. 5 “Industrial area south” and the allocation plan no. 6 “Industrial area east” allow a specific reply to applications for establishing.

Responsibilities/ Services of the project partners

Hallesche Wasser und Abwasser GmbH

Services regarding provisions of:

- offices incl. supply and disposal, furnishing, security service, canteen, administration and car parks
- wash and changing rooms
- weighings, incl. admission control and data processing
- road use, incl. sweeping and winter road clearance

Additionally, if required, following services can be offered: repair services by craftsmen, tire service and transport, filling station for derv, motor vehicles – car-wash, EDP services, laboratory services, business services for financial and wage accounting

4.10 Module 10: Organisational structures and management systems (competence field C)

Contacts

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Initial situation and general conditions

The landfill site Halle-Lochau in 06184 Döllnitz is marked by extensive establishment of industry, partly by using the available waste management units. Upon the legally-stipulated closure of the landfill as from the year 2005, the site is to be maintained as industrial area with waste management added value.

Objectives

The objective is to organise an extensive utilisation of the available infrastructures and to develop the waste management units and businesses further, which are to be created by the activities of the Competence Centre. The completion measures at the landfill body are to be the basis for the establishing of new industry and companies.

It is planned to integrate a centre management. Thus synergies between the currently available waste management companies, the co-operating companies in the network of the Central German Competence Centre “Landfill remediation/ waste management”, and the companies which will be established in the future are to be created.

Based on the concentrated, available know-how of the companies at the landfill site Halle-Lochau, a knowlegde management with regard to closure, remediation, and after-care of landfills is to be organised.

Approach

Establishment of a Central German Competence Centre “Landfill remediation/ waste management”, which functions as a demonstration centre for innovative, economically tolerable, and environmentally sensitive solutions for landfill remediation. The landfill Halle-Lochau serves as a model site for old landfills.

The marketing activities of the companies which co-operate in the Central German Competence Centre “Landfill Remediation/ Waste Management” are pooled by offensive, promotionally effective presentations of the reference objects and the best practices to the public.

Results

Development of synergy effects by management of material life and energy cycles at the site

Concerted market image at home and abroad

Development of organisational concepts, management structures, and service packages within the frame of the Central German Competence Centre “Landfill remediation/ waste management”

Responsibilities/ Services of the project partners

RPL Recyclingpark Lochau GmbH

Responsible for the authorisation,

Development of financing concepts,

Land development and infrastructural integration,

Provision of office fittings as well as material technical services, e.g. supply facilities,

Safety engineering services,

Pooling of supply and disposal services

5 Criteria for the decision on closure or continued operation of a landfill

For the decision on a landfill closure or a landfill adjustment with continued operation following criteria have to be taken into consideration:

- waste management and/ or contractual obligations
- creation of special reserves and residual volume
- market situation, competitiveness
- costs for adjustment and continued operation

That means in detail: It has to be checked to what extent economic obligations for a time-limited continued use exist because there are only insufficient special reserves, a residual volume in a certain dimension still exists, and alternatives for waste treatment/ removal are only medium-term economically available. Furthermore, the costs for continued operation or closure using approvable technical closure or adjustment measures have to be determined. Finally, an analysis of the total profitability has to be implemented in view of the waste management and technical frame conditions.

The closure of landfills especially requires the consideration of risks during the closure and after-care phase. No matter what wastes are backfilled, landfills always appear to be an individual case which includes compromises between protection of the common weal and the latest developments in technology on the one hand, and the long-term safety of technical systems as well as the financially acceptable possibilities on the other hand. The current forseeable after-care periods have to be considered as absolutely speculative. Technical and organisational measures, which are suitable to minimise or suppress these risks, are required.

The continued operation of landfills also requires the consideration of profitability and competitiveness of the landfill site. Often waste management and/ or contractual obligations exist. Furthermore, the landfill operation is the prerequisite for the production and the competitiveness of some of the industrial branches. The usable residual volume appears to be a covering contribution to the creation of more special reserves. Considering the site-specific prerequisites, the costs for landfill adjustment and continued operation can be optimised.

6 Presentation of the synergy effects by means of the landfill site Halle-Lochau

The landfill Halle-Lochau is one of the biggest landfill for residential wastes in Germany. It started operating in 1976 in a former lignite open cut. Since its beginnings approx. 17 mio m³ of wastes have been disposed of on the landfill. Since June 2005 the landfill has been in the closure phase. The emplacement of materials in the landfilling areas is only carried out in order to profile the landfill body and build a surface sealing.

Nevertheless, the site of the landfill Halle-Lochau is also used by waste management companies. The recovery of residential and commercial wastes is implemented at the landfill site. In detail there are:

- composting und fermentation of biowastes,
- sewage sludge processing,
- sorting of valuable materials for mixed construction wastes and residential wastes,
- landfill gas recovery (power generation),
- soil purification,
- temporary store for hazardous wastes,
- ash recovery,
- thermal waste removal.

Synergy effects for the industrial establishments at the landfill site are the result of the management of material and energy cycles. There are especially to mention the transfer of landfill construction materials for the completion measures of the landfill body from the above mentioned treatment facilities, energetic landfill gas utilisation in conjunction with other alternative facilities for energy generation such as wind turbines, photovoltaic facilities, fermentation facilities etc. as well as the use/ exploitation of the available infrastructure (laboratories, workshop complex with filling station, road system, weighing, waste monitoring and sampling as well as offices and rooms like canteen, wash and changing rooms etc.)

The development of innovative technical, organisational, and also legally secured and acceptable solutions in the area of landfill remediation/ waste management substantially influences the competitiveness of the economy, incl. associated impacts on the labour market.

The reduction of the disposal costs will not only affect aspects like cost of living and financial burdens of the municipalities. Growing disposal costs appear to be an essential site factor for almost all economic branches. The costs for infrastructure, incl. disposal costs, are a major site factor which directly influences the site attractiveness for the development of existing companies as well as potential new companies.

7 Results from the other partner regions

Within the framework of this study best practices from the partner regions were to be integrated. A questionnaire was worked out and sent to the project partners. The Recycling Insitute described an innovative solution for the recovery of pulp sludges, whereas Hungary gave information on the current situation of landfills in the country.

Use of pulp sludges as covering materials on landfills (competence field A and B)

Introduction: This response from Recycling Institute (UK) offers a slight variation in that it does not relate to their area. The Institute has been investigating examples of recycling waste materials and came across this example from Finland which may be of assistance.

FINNCAO OY

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40500 JYVÄSKYLÄ

Finland

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Finncao take the waste materials generated at paper and pulp mills. Specifically they take pulp sludges which are difficult to dispose of and treat them to produce a landfill capping material. The Recycling Institute think that the treatment must make the material inert in order to overcome the difficulties associated with storage of biodegradable wastes in landfills. The system has been used throughout Finland. It is considered to be a genuine form of recycling, even though the material still effectively ends up in landfills.

See also 9.5

Initial situation in Hungary

As a result of Hungary's EU accession, EU conform solutions became speeded up and structured in the field of waste management.

As one of the first steps of law harmonisation, the Environmental Ministerial Decree 22/2001 has been created regulating waste landfill, closure, and after-care of landfills.

Subsidised by the Phare pre-accession fund (ISPA Environment), more regional waste management systems linking to larger cities have been established. At the same time, the supervision of more than 2500 landfills has started. According to the results, only some landfills built in the 1990's meet the new regulations. With some modernisation, only 42 landfills from the recent ones in the whole country could continue operating after 2008. According to plans, after 2008 about 74 landfills meeting all regulations could serve the population – this plan also requires the establishment of new landfills.

According to the supervision, most of the landfills have to be closed. Only some of them can operate up to a determined date.

The development of recultivation plans for closed landfills, the implementation of recultivation, and the after-care of recultivated landfills have started at national level, but mostly these are the tasks for the future.

According to the presentations at the Gyula Conference, the recommended technological solutions could ensure the requested result, but their costs are so high that municipalities cannot afford these sums. As a case study, in the Southeast Great Plain Region, where a new municipal partnership for the solution of waste problems is under development, these costs could be ensured mostly by EU (55-60%) and national (30-35%) support.

As a draft plan, the recultivation costs of abandoned landfills in this region would exceed 31 million EUR. The real implementation of recultivation and after-care can be covered only by EU and national resources – the resources of municipalities cannot exceed 5-10%.

In Hungary both, municipalities and regions would like to become acquainted with the best technologies to allow an affordable realisation of the tasks.

8 Bibliography

/1/ Richtlinie 1999/31/EG des Rates der Europäischen Union über Abfalldeponien (Deponierichtlinie) vom 26. April 1999

/2/ Kreislaufwirtschafts- und Abfallgesetz vom 27. September 1994

/3/ Verordnung über die umweltverträgliche Ablagerung von Siedlungsabfällen (Abfallablagerungsverordnung) vom 20. Februar 2001

/4/ Verordnung über Deponien und Langzeitlager (Deponieverordnung) vom 24. Juli 2002

/5/ Technische Anleitung zur Lagerung, chemisch/physikalischen, biologischen Behandlung, Verbrennung und Ablagerung von besonders überwachungsbedürftigen Abfällen (TA Abfall) vom 12. März 1991

/6/ Technische Anleitung zur Verwertung, Behandlung und sonstigen Entsorgung von Siedlungsabfällen (TA Siedlungsabfall) vom 01. Mai 1993

/7/ Verordnung über die Verwertung von Abfällen auf Deponien über Tage und zur Änderung der Gewerbeabfallverordnung (Deponieverwertungsverordnung) vom 25. Juli 2005

/8/ Siedlungsabfallentsorgung. Statistiken und Grafiken. Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit. Juni 2005

/9/ Fakten zur nachhaltigen Abfallwirtschaft. Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit. September 2005

/10/ Dokumentation zum Mitteldeutschen Kompetenzzentrum Deponiesanierung, Abfallwirtschaft. Genesis Projektentwicklungsgesellschaft mbH. Juni 2004

Appendix

Collection of material (Materialsammlung) on the best practices

Questionnaire

Interreg IIIC project European Waste Management Questionnaire, Component: Landfill and reuse
Name of the module/ best practice:
Category ☐ Waste treatment and recovery ☐ Landfill remediation ☐ Site development
Project partners Company name: Company address: Contact person: Tel.: e-mail:
Project description
Current situation at the site, initial position, general conditions:
Objectives:
Approach:
Results:
Characteristics for the technical description of the efficiency:

Interreg IIIC project European Waste Management Questionnaire, Component: Landfill and reuse
Services of the project partners: (responsibilities/ experiences/ services)
Actual state of the project (planning/ realising/ marketing phase)
Selection of reference sites Address: Contact person:

Please return the completed questionnaires by November, 30th 2005 to the following address:

Company address: SIG UmweltProjekt GmbH
Breite Straße 30
39576 Stendal
Germany

Contact person: Diana Theussig
Tel.: +49 (0) 3931 68920
e-mail: d.theussig@sig-up.de

We kindly ask you to enclose to the questionnaires materials of the project partners (presentations of the companies) and also, if possible, additional information (e.g. brochures) on the presented projects.

Completed questionnaire: Recycling Institute (UK)

Interreg IIIC project European Waste Management

Questionnaire

Name of the module/ best practice

Introduction: This response from Recycling Institute offers a slight variation in that it does not relate to our area. We have been investigating examples of recycling waste materials and came across this example from Finland which may be of assistance.

Category

x Waste treatment and recovery

x Landfill remediation

□ Site development

Project partners

Company name: FINNCAO OY

Company address: Ylistönmäentie 24

40500 JYVÄSKYLÄ

Finland

Contact person: Jaakko Soikkeli

Tel.: 014 215 401 tai 0500 311718

e-mail: Jaakko.Soikkeli@finncao.fi

Project description

Current situation at the site, initial position, general conditions:

Finncao take the waste materials generated at paper and pulp mills. Specifically they take pulp sludges which are difficult to dispose of and treat them to make a landfill capping material. It is RI's impression that the treatment must make the material inert to overcome the difficulties associated with depositing biodegradable wastes to landfill.

The system has been used throughout Finland and is seen as a genuine form of recycling even though the material still effectively ends up in landfill.

Objectives: The key objective is to dispose of the difficult waste stream associated with paper and pulp mills. The secondary objective is to produce an acceptable material for closing landfill sites.

Interreg IIIC project European Waste Management
Questionnaire

Approach: The means of treatment should be discussed directly with Finncao.

Results: Results in Finland have been good. However, Finland has a large number of well established paper mills and has local small scale landfill sites. In Germany and other EU countries the options may be more difficult. For example the modern paper mill at Stendal has been designed to minimise waste and the volumes of material will be less. The Stora Enso mills at Brandenburg and Dresden may create reasonable levels of waste although the issue of transport costs to appropriate landfill sites have not been investigated. This works best with small scale, older paper mills.

Characteristics for the technical description of the efficiency: Please contact Finncao directly. Please check www.finncao.fi

Services of the project partners: Finncao are owned by the Finnish paper company UPM Kymmene, who take a full range of responsibilities and provide all services associated with the material. They will liaise directly with landfill operators.

Actual state of the project

Various examples in Finland at different stages

Selection of reference sites:

Address: Ylistönmäentie 24
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Finland

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Hessen

Phoenix Awards Application 2004
Pionierpark Muehlheim
Executive Summary

Pionierpark Muehlheim/Germany

- Arsenic and Stars&Stripes and Private Homes -

The site is located in **Muehlheim, a German town** with a population of 26.200 in the greater Frankfurt area. It is located between the picturesque valley of the river Main and the center of the town. The site was severely contaminated in the 1920s by the operation of a **chemical production facility and a Manufactured Gas Plant (MGP)**. During subsequent years, the site was used by the German Army for barracks of **pioneer troops.** After WW II **the US Army used the site as the location for the printing of Stars&Stripes, the newspaper for US troops stationed overseas.**

The **contamination** on the site, mostly arsenic, has recently been remediated and the site is now redeveloped as a **residential area** which includes private homes for young families and an apartment building especially designed for retired citizens. As such, the project is a successful example of **sustainable redevelopment** by providing a **long-term benefit for the community.** The overwhelming support for the project by the town's citizens was evidenced by the fact that they purchased the parcels on the site before the remeditation had even started.

The soil contamination on the site was mainly arsenic with maximum concentrations of about 60,000 ppm (60 grams per kilogram). Highly contaminated soil was disposed off, a large portion of the 292,000 metric tons of excavated soil was treated by using an immobilization process. The treatment was subject to strict QA/QC requirements and combined the arsenic contaminated soil with concrete, which was then buried at a depth of 10 foot below grade on the site. The groundwater remediation is still ongoing and is scheduled to be complete within the next years because of the source removal of the arsenic contamined soil.

The State of Hessen, within which Muehlheim is located, took responsibility for the clean-up of the site including the major portion of the costs. Because the City of Muehlheim payed its share of the costs of adapting the remedial strategy to the community's desire for a residential area on the site by bringing in the sites value after the remediation. The site was parcelled and the city marketed the parcels to local residents who intended to set up homes for their families. The purchasers made interim financing for cleanup costs by making a down-payment of 50 % for the

parcels. The faith of the citizens to buy these contaminated parcels is one of the most remarkable successes of the remedial-portion of this redevelopment project.

For decades, the site had been like an open wound in the urban environment. It is now a lively part of the city, a newly created definition of the towns rim that adjoins the river valley and directs attention to the precious beauty of this open space and substantially enhances its preservation. The sites orientation between a vibrant city and the green corridor at the river has found its expression in the motto “City at the river- Life at the river”. Offering the site (11 acres) for residential use by locally employed people has saved an estimated 45 acres of open space and helps to save an estimated half a million miles of car traffic on motorways and local roads every year.

About 80 private housing units have already been completed at the site and 20 others are being finalized. The homes cover a wide spectrum of living options, from premier family homes to rented affordable apartments. One apartment building is especially designed for retired citizens and helps to establish inter-generational living at the site. The buying power that has been brought to this part of town as a result of the development allows corner stores and other neighborhood-shopping locations to stay in business. A sight that was once blighted and in decline now promotes a balanced social life that is one of the major factors that enhances the quality of life that has come back to this part of town. Most of the residents of Pionierpark work in town and the redevelopment helped to keep them as tax-payers, while private income-tax is also one of the most important money-sources for the city. The economic benefits of the project have increased the land-value in the vicinity and has prompted the city to upgrade affordable housing nearby, and has helped to launch new projects such as the refurbishing of the boat house for the local rowing-club. A terrace bar-café has also been constructed which overlooks the river. In addition, there is a ferry-boat access that connects Muehlheim to its neighboring town, Maintal.

The increase in land-value is estimated to amount to several million $. Public investment in the project has leveraged about three times more private investment-money (about 26.5 mio $), and has stabilized the cities tax-revenues by contributing about 300,000 $ per year.

With all the short-term economic success of the redevelopment project, the long-term perspective is perceived as the biggest benefit. It insures a livable urban environment that is at a crossroads of built-up land and nature and it promotes social responsibility which is a prerequisite for sustainable development in Muehlheim. By balancing environmental issues with sound economic conditions, Muehlheim’s goal of a sustainable society has been reached. These goals are carried out by the “Agenda 21 Group”, a group that was both founded and is carried by Muehlheim citizens. The Pionierpark redevelopment is an example of state and local cooperation to achieve this goal of sustainable development. Responsible protection of the environment and social balancing have proven to be the main factors for long-term economic viability which benefits all citizens of Muehlheim.

Muehlheim/Main, Germany
May 2004