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NICOLE

NICOLE (Network for Contaminated Land in Europe) was set up in 1995 as a result of the CEFIC “SUSTECH” programme which promotes co-operation between industry and academia on the development of sustainable technologies. NICOLE is the principal forum that European business uses to develop and influence the state of the art in contaminated land management in Europe. NICOLE was created to bring together problem holders and researchers throughout Europe who are interested in all aspects of contaminated land. It is open to public and private sector organisations. NICOLE was initiated as a Concerted Action within the European Commission's Environment and Climate RTD Programme in 1996. It has been self-funding since February 1999.

NICOLE’s overall objectives are to:

- Provide a European forum for the dissemination and exchange of knowledge and ideas about contaminated land arising from industrial and commercial activities;
- Identify research needs and promote collaborative research that will enable European industry to identify, assess and manage contaminated sites more efficiently and cost-effectively; and
- Collaborate with other international networks inside and outside Europe and encompass the views of a wide range of interest groups and stakeholders (for example, land developers, local/regional authorities and the insurance/financial investment community).

NICOLE currently has 112 members. Membership fees are used to support and further the aims of the network, including: technical exchanges, network conferences, special interest meetings, brokerage of research and research contacts and information dissemination via a web site, newsletter and journal publications. NICOLE includes an Industry Subgroup (ISG) – with 25 members; a Service Providers Subgroup (SPG) with 41 members; 31 individual members from the academic sector/research community; and 15 members from other organisations, including research planners, non profit making organisations, other networks, funding organisations. Some members are involved in both the ISG and the SPG. For further general information, further meeting reports, network information and links to contaminated land related web sites, please visit NICOLE's web site: www.nicole.org.

Membership fees are currently 3,500 EURO per year for companies (1,750 EURO for smes), and 150 EURO per year for academic institutions. For membership requests please contact:

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Executive Summary

Historic land contamination has arisen through a variety of past practices that did not take account of the environment, including processes of industrial change as businesses changed on a site. These changes may have been triggered by a forced closure (for example as a result of an industry going out of business), a planned sale or a planned relocation. These processes of change continue today. It is important that these changes to do not give rise to land contamination of the future. Consequently disengagement from a site needs to be handled as an environmental management process.

The objective of this workshop was to understand how site closure can be conducted in a smooth and effective manner. Its topics included:

- Examples of remediation cases under complex site closure conditions
- Cases of site closure that either went as planned or cases where there were lessons were to be learned.
- Social, environmental, legal/contractual or financial aspects

Closure of a site or sites is a uniquely painful form of organisational change. It is frequently a decision of last resort, precipitated by some form of organisational or economic crisis. All the same it is essential that those responsible for the closure of a site recognise that they have a social obligation, to the former workers in the closed facility and to their communities, to effect a rapid, efficient and effective disengagement from the site, so that it can be redeveloped by others and returned to a beneficial use in as short a time as possible. It is also vital that professionals engaged in facilitating the technical aspects of site closure recognise, and take responsibility, for this mission.

Having a “clear end vision” for the closure process and a dedicated project team are essential to be able to plan and execute a closure of a site. In this context, it is perhaps better to perceive this as a process of transition rather than closure. Where neither a vision (goal) nor a clear plan is in place, the closure will not go smoothly. A number of closure options are usually available and time should be taken to assess the opportunities and risks associated with each one and to make a decision aligned with a desirable end-vision; rather than taking a rushed decision based on the most obvious and/or cheapest solution. Where the site closure is part of the restructuring of an ongoing company it may have a major impact on corporate reputation. It is therefore in the organisations best interest to manage the closure process in a way that as far as possible mitigates its external consequences.

Senior management buy-in and clear strategy was seen to be key to stop internal conflicts derailing the closure process. Having access to a team of specialists (e.g. legal, human resources, technical, financial, public relations etc) reduces the chance of an unexpected issue derailing the closure process. Clear lines of communication are needed with all of stakeholders identified as having a legitimate interest. Partnering with them in the development and implementation of the project plan was seen as an effective way of smoothing a closure process.

Not all regulatory contexts are predictable. In some countries experience implies that regulatory agencies cannot agree with one another, hence no clear end-vision on for a site is possible, hence remediation and redevelopment may be delayed or even prevented.

Conclusions

There are some very wide extremes in outcome from a site closure process. In some circumstances the site closure is part of a smooth transition in the use of a site that brings widely recognised benefits. In other circumstances the site closure may be unplanned and unanticipated and lead to a chaotic situation where a site remains unused and a blight for a long period of time. While economic circumstances are clearly a determining factor for where a site closure will fall across this spectrum, it also appears that poor anticipation and planning play a major role in poor outcomes.
The ideal approach is that the objectives and an end state vision for a site closure process should be carefully defined, with realistic targets. The closure process needs a single point of project management and rigorous programming of activities. The management of the closure process needs access both to the skills and experiences of site employees and or specialised service providers. Organisations undertaking site closure should recognise their social responsibility to facilitate re-use of site and avoid blighting communities. There was a clear mood in the meeting to move away from a perception that site closure was a negative process where site owners were trying to wash their hands of a site and disengage with it as expeditiously as possible, to a position of trying to find a shared vision for a positive outcome and a process of transition and re-use for a site.

The workshop set out to develop some kind of ‘road-map’ which can be used in site closure situations. Many of the delegates felt that this was a useful idea, and that a generic “project management” framework could be used (a stepwise process) with specifics relating to closure (checklists / tools in each stage). The overall consensus was that NICOLE should take a stepwise approach. As a first step NICOLE could produce a short leaflet on site closure providing some initial guidance. Given the wide range of regulatory jurisdictions and economic circumstances across Europe, providing a detailed piece of guidance for site closure does not seem very feasible. However, as a second step NICOLE could identify a set of common principles to guide decision making in site closure processes, which users could then fit to their local circumstances. Across its membership NICOLE has a large body of experience and expertise which could be applied to supporting these principles with checklists to support particular technical issues, in particular the “4-D’s”: Dismantling, Deconstruction, Demolition and “Depollution”. This activity was felt to fall into the remit of the NICOLE Brownfields Working Group, with linkages to other Working Groups (such as those for waste and sustainable remediation). The full report provides summaries of the papers given, along with a discussion based on points raised during the meeting, and comments from a number of delegates after the meeting.
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1. Introduction

NICOLE was set up in 1995 as a result of the CEFIC ‘SUSTECH’ programme, which was to promote cooperation between industry and academia on the development of sustainable technologies. NICOLE has become the principal forum that European business uses to develop and influence the state of the art in contaminated land management in Europe.

Historic land contamination has arisen through a variety of past practices that did not take account of the environment, including processes of industrial change as businesses changed on a site. These changes may have been triggered by a forced closure (for example as a result of an industry going out of business), a planned sale or a planned relocation. These processes of change continue today. It is important that these changes do not give rise to land contamination of the future. Consequently disengagement from a site needs to be handled as an environmental management process.

There are also important business and economic reasons for a managed site closure process. Typically an exit from a site will include a sale or termination of lease and will include a range of permit and regulatory notifications for environmental and social purposes. An ideal situation for the former industry, from some perspectives, is that this exit is complete so that it no longer has rights or responsibilities towards its land use. This implies that there are no residual (potential) liabilities in respect of the site, both now and what will be seen as liabilities in the future.

While there is some dispute such a situation will be generally achievable, a variety of interventions may be used to limit current and future liabilities from environmental contamination. These include building cleaning, decommissioning, remediation of land contamination to various plans and timelines, and/or the arrangement of various agreements and covenants. There are numerous processes and sometimes barriers which must be overcome, and there may be a need to satisfy several stakeholders to come to an agreement on a remediation project termination. Invariably these affect (or may affect) the manner in which land contamination is handled and remediation obligations are effected.

The objective of this workshop was to understand how site closure can be conducted in a smooth and effective manner. Its topics included:

- Examples of remediation cases under complex site closure conditions
- Cases of site closure that either went as planned or cases where there were lessons were to be learned.
- Social, environmental, legal/contractual or financial aspects

NICOLE has workshops twice a year, and also publishes Position Papers and a newsletter. Recent outputs are listed in Table 1, below.
<table>
<thead>
<tr>
<th>Year</th>
<th>Report Title</th>
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<td>2007</td>
<td>Report of the NICOLE Workshop: Redevelopment of sites – the industrial</td>
<td>perspective, Akersloot, the Netherlands. See <a href="http://www.nicole.org/publications/library.asp?listing=1">www.nicole.org/publications/library.asp?listing=1</a> and Land Contamination and Reclamation, 16 (1) 50-75</td>
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2. Presentations

2.1. Setting the scene, Neil Foster, WSP, Romania and Olivier Maurer, CH2M-Hill, France

Site closure is a multifaceted issue (illustrated in Figure 1), with a range of drivers and/or pressures leading to the closure, a series of challenges created by the closure and also potentially opportunities created by the closure. Closure itself involves a large number of individual actions, for example: dealing with permitting, environmental status reporting, dismantling, demolition, waste management, social planning, communication, real estate management, and many others. Closure of industrial sites may be for large sites with long and complex histories and a high profile within the regulatory and public communities and complex legal issues associated with permitting.

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Figure 1  The multi-faceted nature of site closure

The workshop concept is to consider the transition between closure to disengagement, where closure means “the permanent ending of a business or activity”, and disengagement means “the release of somebody or something from an attachment.” Closure encompasses the cessation of activities, the surrender of permits and staff relocation or redundancy. Disengagement encompasses the complete or partial removal or transfer of liabilities, the separation of the community from the business and a managed legacy for the site. Not all industry delegates support the view that disengagement should only be viewed from the perspective of the industry as this undermines the moral responsibility a business may have to an area which has provided workers and resources over many years.

2.2. Site Closure and Redevelopment: A cumbersome journey over obstacles and pitfalls

Thomas Mezger and Peter Spierenburg, AkzoNobel, The Netherlands

AkzoNobel have managed a number of closure processes resulting from the concentration of industrial manufacturing in large units. In a number of cases this has led to the closure of factories traditionally built near to residential areas. Local spatial development plans may require upgrading of these former industrial areas to other re-uses such as light industrial, commercial or residential. This presentation provided six case studies of closure of these smaller units and the lessons learnt from the closure process.

Case 1: Paint factory 1, Belgium. The site is located on a historical wetland close to Brussels in a river valley and lies half in Flanders and half in the Brussels Region. Initial industrialisation took place around the time of WW1. The wetland filled with material of unknown origin, and the site was used for the production of fertilisers until around 1925. Gypsum waste resulting from the fertiliser production
process was stockpiled on site. In 1926 land and buildings were acquired by a private paint company. Some site redevelopment took place in the 1970’s, including relocation of a creek through the property, equalisation of the area and other earth movements, and reconstruction of buildings. This business was acquired by Nobel industries in 1992. Production ceased in 1994 and the plant was closed. In 1993 the Flemish soil decree put a remediation duty on any pollution-causing landowner. Site investigation revealed the presence of mineral oils, heavy metals, chlorinated solvents, cyanides, and so the site could not be divested because it lacked suitable remediation certification. The site was deadlocked from 1995 to 2007 by a dispute with the Flemish regulator (OVAM) about responsibility for the cyanide found. In 2007 AkzoNobel received an order to pay a non utilisation tax for their buildings on their site, so these buildings were demolished.

By 2007 AkzoNobel could prove that the cyanides were from historic waste deposits from a gas works outside its responsibility, meaning that the Flanders province accepted 95% of the remediation obligation on a cost basis. However, OVAM wish to deal with the contamination by excavation – which has an estimated duration of two years, but OVAM do not have funding in place to support this work yet. The Brussels Region area of the site is separately regulated and is mainly affected by contamination migrating from the area in Flanders. However Brussels Region is satisfied with control of cross boundary migration.

AkzoNobel have a potential buyer for the site, however, sale and purchase negotiations have been going on for nearly 10 years, and cannot yet be resolved because of uncertainty about the timing of cyanide excavation.

**Case 2: Paint factory 2, Belgium (Flanders Region).** Industrial production on the southern area of the site is began in 1911, manufacturing gelatine and phosphate, which continued until 1970, until the business went bankrupt. Production of paint and varnish began in 1924 on the north part of the site. From 1926 to 1956 animal bones were used as the raw materials for the gelatine and phosphate industry. In 1970 the paint factory bought the southern area for expansion producing mainly water based paints. Its production was mainly for the automotive industry. AkzoNobel bought the paint company in 1985. In the mid-1990s AkzoNobel moved out of automotive paint production and as a result of this restructuring the site was put up for sale. The resulting land transactions required soil certificates, and AkzoNobel began site investigation and remediation work. Remediation for a BTEX was required, and this is close to finalisation. However, spills by the new site owner have also caused groundwater pollution. Two chlorinated hydrocarbon plumes have been found to be migrating off site to a distance of several km. The origin of one of them (in the Southern part of the site) appears to be the old bankrupt animal bones factory. To the north the site is partly surrounded by a residential area. Residents have sought nuisance and damage claims during demolition of buildings and excavations. Major communication efforts have now been put in place to deal with concerns about vapours in residential cellars, and to provide a better basis for regulatory sign-off which still appears to be “some way off”.

**Case 3: Paint factory, Denmark.** The site was a petrol retail site in the 1920s. This was then taken over for the industrial production coatings on the southern area of the site. Overall the site contains some 30 underground storage tanks (USTs) of different ages. The plant was decided in 2003 and the site management started sale negotiations. In 2005 plant closure was postponed to maintain capacity because of a fire in another plant. Around that time the local regulator issued a warning notice about plumes escaping from the USTs and AkzoNobel agreed to excavate the tanks. The sale of the site has been hampered by local planning (zoning) decisions; these were due in 2009 but have been postponed. The consequence of this is twofold. Firstly remediation targets are unclear. Secondly the site value is unclear. There is a buyer interested in the site, who wishes to pay a previously (low) agreed price before the zoning discussions began. Currently there are no attractive redevelopment possibilities due to zoning plan restrictions, and it is not clear when these will be reconsidered. The site has a prime location and could offer a valuable commercial use, but currently remains zoned as industrial. It appears that a zoning decision will not take place until 2013.

**Case 4: Paint factory, Germany.** The site is a former paint plant in industrial area divested by AkzoNobel to an automotive paint supplier in mid 1980s. The sales contract included an
indemnification for contaminated land remediation, backed by an insurance policy. The buyer subsequently discovered contamination, and claimed under the insurance policy: a BTEX plume arises on site which then mixes with a chlorinated hydrocarbon plume from adjacent areas. The insurers and the regulatory authorities entered into a legal dispute over the nature of the remediation solution that should be employed, and this has lasted for more than 20 years. Approximately two years ago agreement was reached to use in situ chemical oxidation for free phase treatment.

Case 5: Paint factory, Spain. The site is a paint factory close to beach by the Mediterranean Sea. The area is to be redeveloped for residential use. This sales contract included indemnification for site remediation to industrial related use based on what was the current legislation in Spain. The developer would then carry out remediation to residential use requirements. Shortly after the sale contract was agreed new Spanish soil and groundwater legislation came into force which includes more stringent criteria for groundwater quality, leading to uncertainty about to assess the cost boundary in the original contract. The decision about dividing costs is to be based on the judgement of three indeoendent consultants.

Case 6: Textiles fibre factory, France. The site is a former factory for viscose and rayon production, which was closed in the 1980s. The site included industrial production and also an on-site landfill. The industrial zone of the site was divested by AkzoNobel. A separate legal entity was created to won the landfill, which was capped according to the standards prevailing in early 1990s. The landfill covers a large area and is bordered on some sides by residential areas. Currently there are concerns about managing problems in the site from CS₂ (used in viscose production). AkzoNobel is in dispute with the regulator about the scope and targets for remediation/containment. The regulator wants the entire site to be recapped. The site has no significant land redevelopment in the foreseeable future, and there are problems in keeping the capped area secure.

These six case studies illustrate some common lessons learned. Sites located close to residential areas pose particular problems due to nuisance from the redevelopment process and the management of contamination. Tensions may be exacerbated by the loss of employment in the vicinity of the sites. If the situation leading up to closure is chaotic or not well organised than important documentation and information may be lost, for example drawings and historic files, as well as the loss of employees with site specific knowledge and information. Normal management routines may breakdown, and there may be a lack of motivation for dealing with environmental management issues. There may be a need to involve and coordinate external resources from outside the facility. Their working conditions may be hostile as people seek new positions. Key personnel may leave before a dedicated site closure management team can be established and incentivised.

There are a number of economic issues associated with site closure. There may be high upfront costs for demolition and cleanup and complex tax issues to be managed. The business will be seeking to realise maximum value for minimum expenditures and achieve a maximum real estate valuation. This requires knowledge of public and investor interests and local markets and constraints, which needs to resourced. Legal issues arising from site closure include uncertainties concerning liabilities, lack of trust from potential buyers, difficulties in formulating clear indemnities and ensuring an adequate level of knowledge and experience for the lawyers involved and internal experts.

Common lessons about environmental issues arising from site closure are that it is difficult to predict project duration and cost, and there are likely to be surprises during environmental management. Regulatory requirements may be moving targets and decision processes within regulatory authorities (and within the company) may be protracted. It is very important to involve local management. Many problems have been created in the past by inadequate site closure and divestment management. The involvement of a central body of expertise within the regulatory agencies and within the companies undergoing restructuring could greatly facilitate remediation planning and negotiation.

General conclusions are that multidisciplinary involvement, internal and external is crucial. Sale/purchase agreements need careful consideration and unclear indemnifications and the use of hypothetical scenarios should be avoided. Time horizons should be clearly identified.
2.3. Site Closure: the example of the UMICORE site in Viviez, France Gilles Deslauriers, UMICORE, Belgium

The site is located in Viviez, in the Department of Aveyron, southern France. The site is located in a small steep valley. Activities started in 1855 as a primary zinc refinery using pyrometallurgical processes. In 1930 zinc refining was switched to an hydrometallurgical process. Later, the production of zinc based chemicals for the paint industry was added. Both the primary pyrometallurgical and the primary hydrometallurgical process resulted in pure metallic zinc that was the primary material to manufacture end products such as gutters, roofing sheets. Zinc refining ceased in 1987.

The refinery was located to take advantage of the nearby presence of energy sources (coal basin of Decazeville), the presence in the region of zinc-lead ore deposits and the presence of a railroad which made it possible to bring concentrates from more remote regions (the Cévennes).

The pyrometallurgical operation consisted of a roaster in which the ore was calcinated in order to free the metals from the sulphide context. Initially, sulphur dioxide was emitted freely to the air, later the gases were captured to produce sulphuric acid. The roasted ore was then heated to allow the zinc to evaporate and to be redistilled again in a pure form. The residue of this pyrometallurgical process was a slag that was simply stored along a hill slope behind the plant (Dunet). From 1870 to 1930 approximately 1 million m$^3$ of slag were deposited in Dunet. The later hydrometallurgical process consisted of putting the calcined ore into an acidic solution. The valuable metals were separated from the solution through an electrolytic process. The waste generated by this process is an acidic iron rich sludge, called goethite, which was pumped into ponds. Because of the lack of open space those ponds were built on Umicore land in a nearby narrow valley (Igue du Mas). The ponds were not lined. 600,000 m$^3$ of goethite stored in three ponds at Igue du Mas. 100,000 m$^3$ of lead sulphate was also generated by the hydrometallurgical process which was deposited in pits dug into the slag heap at Dunet.

In addition, over 1930 to 1987 170 000 m$^3$ of flotation residues from paint production (lithopone, barium sulphate) were deposited at Cérons and 120 000 m$^3$ of ore storage residues accumulated at Laubarède.

In the mid 1980's, it was decided to close down the primary zinc refining activity. The reasons for the closure were the difficult metals market and the nearby coal mines and regional lead-zinc mines were closed. The location was difficult to use for imported raw materials and for exporting finished products and had no space to store waste safely. The closure of the facility ended a lot of industrial activities in the same period, and the entire region underwent sudden social change. Therefore, the company decided to keep on site a small activity (a zinc rolling mill, still operated by Umicore) and to create other activities such as recycling of plastic bags and the manufacturing of aluminium windows. Those activities are still in operation.

All of the industrial installations were demolished, but the waste deposits remained in place. These deposits were subsequently found to be releasing unacceptable amounts of metals (mainly cadmium) into the environment, especially to surface water. Consequently Umicore carried out a range of environmental management actions in agreement with the surface water authority (Agence de l’Eau Adour Garonne). A groundwater investigation was carried out. Part of the lead residues stored in Dunet was excavated and transferred to the ponds at Igue du Mas. The remaining lead residues in Dunet and the three ponds at Igue du Mas were covered. Leachate from the ponds is now diverted to a waste water treatment plant and a hydraulic barrier has been installed downstream of this plant.

Following a revision in its corporate environmental policy 2003, Umicore decided to further tackle the contamination caused by soil contamination at the nearby railway station due to the former storage of ore; surface water contamination from the waste deposits; surface water contamination from the three goethite sludge ponds. The Dunet would then be landscaped.

All of the waste heaps will be excavated, stabilised and stored in a newly constructed landfill with a capacity of 1.3 million m$^3$. More than 1 million m$^3$ of waste will be removed, treated and stored.
Excavated material will be transported by conveyor to avoid disturbance by excessive truck traffic. The total length of the conveyer belt will be approximately 2 km. 2.5 km of road will also need to be built in order to transport the zinc chemicals waste to its final destination. Umicore chose a strategy that in its view meant that further future action would be unlikely to be required. The remediation works re predicted to cost €35 million.

The first phase of the project consisted of the excavation of the contaminated soil at the nearby railway station and was completed in 2007 at a cost of €4 Million. The second of the project will start soon.

Obtaining the final regulatory permitting was a protracted process which involved a large number of different stakeholders because of the sale of the remediation project and its consequent capacity to impact the day-to-day business of the commune of Viviez (at least for the duration of the project) Stakeholders involved included:

- The DREAL (former DRIRE) and Préfecture who deliver the final regulatory permit. The local population and the local authorities of Viviez and the surrounding communities
- Water authorities
- Agriculture and Forestry
- Public health and social affaires
- Cultural affaires
- Road constructions affaires
- Environmental affaires
- Department for protection of labelled products (Bleu de Causse) – concerned over project impacts on local cheese production.

A stumbling block was staff rotations at the DRIRE and the “Préfecture”, resulting each time a need to restate the project. An important tactic was to act to create of a climate of trust with stakeholders, and this was seen as the corner stone for successful negotiations. From the beginning, the project was supported by the water agency (Agence de l’Eau Adour Garonne), even with financial subsidies, amounting at approximately 5% of the total remediation cost. Equally important were the local stakeholders, such as the major of Viviez and the surrounding communes (Aubin, Decazeville…) and the entire population. Although informal information of the local community happened rather early in the process, formal communication campaigns were launched early 2009, once the scope and extent of the overall project were known. The local communes had to give their approval on the project, especially since a new landfill was to be constructed. Communication activities are centrally co-ordinated by a dedicated member of staff.

In 2009 regulatory permission was given for the full project after two years of negotiation.

2.4. The IPPC Recast / IED Directive - Update and Industry Concerns, Dominique Darmendrail, BRGM, France; and Sarah MacKay, WSP, UK.

There is a wide range of EU policy and legislation affecting contaminated land management (illustrated in Figure 2). This presentation focused on the proposed Industrial Emissions Directive (IED) which supersedes the revisions to the existing Integrated Pollution Prevention and Control (IPPC) Directive and will also incorporate exiting Directive governing large combustion plants, waste incineration, solvents and titanium dioxide.

The draft IED contains some soil and groundwater protection related elements, including requirements for periodical monitoring of sites, baseline reporting and requirements affecting site closure and consequent remediation. The draft Directive gained acceptance by the Council of Ministers on June 25th 2009 and could be in force by the end of 2010, pending discussion and changes agreed between the Council and the European Parliament. Requirements are based on “best available technique” (BAT)
which will be specified at an EU level BAT Reference Documents (known as BREFs). These will be developed by a comitology process via the European Integrated Pollution Prevention and Control (IPPC) Bureau\(^1\). This bureau has produced over 30 BREF documents to date.

**Figure 2** Common Forum assessment of EU level policy and legislation affected contaminated land management

Key definitions in Article 3 of the IED relate to:

18) "Baseline report" means information on the state of soil and groundwater contamination by relevant hazardous substances;


20) "Soil" means the top layer of the Earth's crust situated between the bedrock and the surface. The soil is composed of mineral particles, organic matter, water, air and living organisms;

Article 11 prescribes general principles governing the basic obligations of the operator (of a regulated process / site). This requires that Member States take the necessary measures to provide that installations are operated in accordance with a series of principles. Included amongst these is a specification that: “the necessary measures are taken upon definitive cessation of activities to avoid any risk of pollution and return the site of operation to the satisfactory state”, which is defined elsewhere in the IED (Article 22)\(^2\).

Article 12 governs permitting which includes a requirement for baseline reporting (also defines in Article 22). Permitting needs to take account of all measures necessary for compliance with the IED, including as a minimum:

- “Appropriate requirements ensuring protection of the soil and groundwater and measures concerning the monitoring and management of waste generated by the installation”;

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\(^2\) This was Article 23 in the last version of the IPPC Directive Revision
• “Appropriate requirements for the regular maintenance and surveillance of measures taken to prevent emissions to soil and groundwater pursuant to point (b) and appropriate requirements concerning the periodic monitoring of soil and groundwater in relation to relevant hazardous substances likely to be found on site and having regard to the possibility of soil and groundwater contamination at the site of the installation”; and

• “Measures relating to conditions other than normal operating conditions such as start-up, leaks, malfunctions, momentary stoppages and definitive cessation of operations”.

Article 16 describes monitoring requirements. The frequency of the periodic monitoring referred to in is to be determined by the national competent authority in a permit for each individual installation or in general binding rules. However, periodic monitoring is expected to be carried out at least once every five years for groundwater and ten years for soil, unless such monitoring is based on a systematic appraisal of the risk of contamination. Periodic monitoring is not required for all installations, but is required for those where reference “dangerous substances” (defined in Article 15) are likely to be found. Guidance on monitoring procedures will be provided as BREF. There are also monitoring requirements related to the process integrity.

Article 22 governs site closure. It requires the national competent authority to set permit conditions following the cessation of activities. These are additional to any requirements from other EU legislation relating to soil or groundwater protection. This is based on restoration of the site to its baseline condition. Where an activity involves the use, production or release of specified hazardous substances the operator is required to submit a “Baseline Report” to the national competent authority that contains the information necessary to determine the state of the soil and the groundwater so as to make a quantified comparison with the state upon definitive cessation of activities. A baseline report is required before starting operation of an installation or before a permit for an installation is updated for the first time. The minimum content of a baseline report will be:

• Information about the present use and, where available, on past uses of the site;

• Available existing information on soil and groundwater measurements that reflect the state at the time the report is elaborated or, alternatively, new soil and groundwater measurements having regard to the possibility of soil and groundwater contamination by those hazardous substances to be used, produced or released by the installation concerned.

The report may incorporate information produced under other regulatory requirements. The Commission will produce guidance on the content of the baseline report, which is to be published in the Official Journal by two years after the IED comes into force.

The IED states that a baseline report is necessary “where applicable”, but applicability has yet to be fully elaborated. Applicability appears to relate to the use, production or release of dangerous substances having regard to the possibility of soil and GW contamination at the site of the installation. The IED also refers to determination of the ‘initial state’ for baseline reports, but is unclear on what would be regarded as an initial state when updating a permit. The exact content of the baseline report has also yet to be specified and it is not yet known how closely it will match the requirements of the “Soil Status Report” of the proposed Soil Directive.

The IED requires remediation to initial state (described in the baseline report) upon cessation of activities:

*Upon definitive cessation of the activities, the operator shall assess the state of the soil and groundwater contamination by relevant hazardous substances used, produced or released by the installation. Where the installation has caused significant pollution of soil or groundwater by relevant hazardous substances compared to the state established in the baseline report referred to in paragraph 2, the operator shall take the necessary measures to address that pollution so as to return the site to that state. For that purpose, the technical feasibility of such measures may be taken into account.*
Without prejudice to the first subparagraph, upon definitive cessation of the activities, and where the contamination of soil and groundwater at the site poses a significant risk to human health or the environment as a result of the permitted activities carried out by the operator before the permit for the installation is updated for the first time after ..., and taking into account the conditions of the site of the installation established in accordance with Article 12(1)(d), the operator shall take the necessary actions aimed at the removal, control, containment or reduction of relevant hazardous substances, so that the site, taking into account its current or approved future use, ceases to pose such risk.

Hence the IED sets out zero-tolerance contamination of soil or groundwater as a principle. However, this may be an over specification for dealing with small elevation of concentrations that do not reach environmental quality standards. The IED is also unclear about how to deal with incremental contamination for example with the update of a permit. The implication of the IED approach appears to be that all operators have to conduct a soil investigation at definitive cessation.

A risk based approach is only allowable in circumstances where a baseline report was not necessary. In this case the IED allows that: Where the operator is not required to prepare a baseline report referred to in paragraph 2, the operator shall, upon definitive cessation of the activities, take the necessary actions aimed at the removal, control, containment or reduction of relevant hazardous substances, so that the site, taking into account its current or approved future use, ceases to pose any significant risk to human health or the environment due to the contamination of soil and groundwater as a result of the permitted activities and taking into account the conditions of the site of the installation established in accordance with Article 12(1)(d).

The current approach to implementing the IED gives rise to a number of concerns, related to these areas on uncertainty. For example, in the UK there has been an unprecedented level of site closure. The Chemical Industry Association (CIA) in the UK has commented that they believe there is a need to ensure that the risk to soil and groundwater is properly assessed and that appropriate measures are taken to prevent soil contamination. The CIA further believes that a soil baseline report is a useful tool to achieve this. In other words the CIA view is that they fully support baselines as long as these are risk based.

However, the CIA also states that baseline reporting (by inference for soil) will not necessarily give a good indication of the state of the environment because only part of the soil will be checked. They point out that it is not practical to monitor underneath industrial installations, as they are often sealed. Therefore they do not support mandatory quantitative assessment of soil. They would like to see baseline reporting and monitoring which are risk-based and to ensure that soil is adequately protected.

Baseline reporting requirements in the existing PPC Directive as transposed in the UK can cause difficulties during site closures. Some examples follow.

- **Site 1.** A speciality chemical company in the UK is closing in 2009. A baseline reporting plan was presented 5 years previously, but UK regulators could not agree on what was a satisfactory monitoring or sampling regime. Consequently, the operator did not feel able to proceed with baseline reporting without regulatory approval. On site closure, regulator now holding up permit hand back, as there is no baseline to compare it to. The regulator now requiring very comprehensive site condition report, and is disregarding the facilities existing environmental management systems in place to monitor spills, volume. The site owner has two conditional offers for sale of the site pending permit surrender but cannot progress either of them. There is concern by all parties as jobs are at stake in the area.

- **Site 2.** At a different UK speciality chemical site location a company is in the process of buying a demolished site on which to construct and expand currently licensed operations. The regulator has not required a baseline report.

- **Site 3.** A baseline plan was presented five years ago, and accepted by regulator. Works included trial pits, boreholes, etc and the scope was agreed to be limited to accessible areas. On closure of the site (2009), the regulator is now demanding that baseline is repeated following demolition with additional sampling is undertaken underneath all the building footprints, slabs infrastructure etc.
This is holding up permit hand back. The implication of this decision is that a site operates under permit until after all demolition works have been completed.

- **Site 4.** During closure of several waste sites in 2008-9 handing back permits was a slow time consuming process. The regulator did not require baseline reporting but was inconsistent between different sites.

General industry concerns relating to the IED include the following. The requirements introduce even more uncertainties into site closure and transfer, which makes it more difficult to find buyers. The existing PPG rules are not fully tested as they have only been in place for a few years. There are regulatory inconsistencies on a regional basis. Historically, sites have been decommissioned and sold with information. This appears no longer acceptable, and there is a requirement to decommission and demolish to satisfy the regulator. A future concern is that the site closure process might be extended further from decommissioning, to demolition, and then into site restoration. Specialist brownfield players may be better qualified to carry out remediation than site owners. The IED will change the way in which due diligence is carried out. The IED approach is fundamentally different to our risk based approach to remediation, and as such appears to be counter to sustainable development principles. A technical process of interpreting changes to baseline, given site heterogeneity and analytical variability, does not appear feasible.

There needs to be an inclusive and holistic discussion about what constitutes a baseline. This should be Europe wide and based on industry experience / expertise and involve site owners. More comprehensive research and documentation about the use of statistics and characterisation for baselines needs to be produced. There needs to be a more explicit consideration of sustainability assessment in site closure processes and regulatory requirements. Also helpful would be a case study evidence base showing successes and difficulties in site closure to date and a clearer map or flow chart of closure regulatory processes, including interrelationships with other legislation. Ideally these activities would be included in the formulation of BREF documents.

### 2.5. EU-review on liability transfer

Ian Heasman, Taylor Wimpey, UK / leader NICOLE Working Group Brownfields

Environmental liability is loss due to environmental damage. The loss is typically monetary but can take other forms e.g. reputation. Liability in a legal sense can arise from EU or national environmental legislation, and from other areas of law such civil law or contract law. Liabilities may already be known, for example known risk management needs, or they may be potential liabilities that may occur at some point in the future, and these may not always be known. The NICOLE Brownfield Working Group (BFWG) has been developing a concept of Environmental Liability Management, which is preventing or minimising the risk of loss from environmental damage. Two things are required for an environmental liability to arise: a pollutant linkage (i.e. source-pathway-receptor connection) and legal action. Environmental liability management relates to both of these. Both known liabilities and (as far as possible) potential liabilities need to be considered. The market for brownfield sites plays a major role in how liabilities are managed. If there is no market for a site, then liability will likely be retained by the existing owner and the site “mothballed” in some way. If there is a demand for the site, then there is a choice available between retaining or transferring liability to a new site owner, perhaps with a new use for the site in mind.

The NICOLE BFWG has been conducting research into environmental liability transfer from industrial land holders to brownfield users across Europe. A key consideration for site closure is therefore environmental liability transfer. Organisations closing facilities are sensitive to the possibility that, even with safeguards in place, it could be possible for a post-divestiture contamination problem to end up back with them. Unlike the sale of many assets there can be a continuing liability associated with the sale of land in line with the ‘Polluter Pays’ principle common in European environmental law. Such liability can ‘bounce back’ to the original polluter. This can be a key element of the decision whether the gates of the former factory site remain locked, or whether the site is bought back into a new productive use.
Site owners would benefit from knowing the implications of their site being classified as a brownfield. Most closed sites would normally fall into one or more of the wide variety of brownfield definitions in use across Europe. In some jurisdictions such classifications have positive implications in terms of for example planning or tax breaks, whereas in others it might mean additional regulatory hurdles or stigma to overcome. The NICOLE BFWG is working to “develop a Framework Document for brownfield divestment in Europe, designed to inform industrial land holders of options to secure as clean an exit from liability as possible, and meet their liability management goals.”

Whether a site is put back into productive reuse depends to a significant extent on market conditions for brownfield redevelopment in the host country, and these vary markedly across Europe. At one end of the spectrum the UK is in a unique position with its dynamic and highly incentivised market. Others have for an array of reasons (e.g. population density, industrial history) not prioritised brownfields and have fragile and tentative markets. Between these extremes an array of market conditions have been established. Preliminary findings from the BFWG survey on levels of brownfield market activity are summarised in Figure 3.

The BFWG also found that generally in Southern Europe (the countries indicated south of the red line in Figure 3) for the meaning of “brownfield” is synonymous with “contaminated land”. North of the red line there is a wide variety of brownfield definitions.

Liability transfer is a process where (say) an industrial site owner transfers liability to the buyer of a site. Understanding liability transfer depends on four basic questions: what is the legal context; can liability be transferred and if so what aspects, and how can this transfer be carried out? The BFWG’s research findings are summarised in Figure 4. These are that the most frequently used mechanism for land transactions in the EU is ‘sold with information’ sufficient for a purchaser to take a view on risks. ‘Sold as seen’ with no information (buyer beware), the riskiest approach, is still used surprisingly frequently, but is strongly avoided by many countries. Liability transferable by statute can be important for safe
divestment but is in play in only four of the fifteen countries studied. There are many liability transfer mechanisms available, including some highly sophisticated methods, but only a few are frequently used, and there is considerable scope for more complete approaches to be adopted. The level of risk in transactions found by the BFWG Research is summarised in Figure 5, based on a transaction model from Johnson and Shaw.[3]

![Figure 4 Liability Transfer Findings from the NICOLE BFWG](image1)

![Figure 5 Transaction Risks from the NICOLE BFWG](image2)

The research has identified a highly variable approach to liability transfer in Europe. In some member states it is routine and highly regulated (this is best exemplified by the approaches prevalent in Belgium). In others it is rarely considered in depth and may not be well thought through or controlled. In general across Europe contamination responsibility is rarely comprehensively transferred; non or partial transfer is much more normal. General and country-specific guidance on liability transfer for site closure based on the research findings would be presented. In practice industrial site owners may equip themselves with layers of protection, as illustrated in Figure 6.

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The NICOLE BFWG has been developing Environmental Liability Management concepts further. It suggests that two things are required for an environmental liability to arise: a pollutant linkage and a liability linkage. Therefore environmental liability management is the management of pollutant linkages and liability linkages. The three components of the liability linkage, conceptually, are: a claimant, a claim, and a liable party, without all three components a liability does not exist, e.g.:

- **Claimant** – receptor or representative of the receptor e.g. local or national authority
- **Claim** – under law
- **Liable party** – polluter, land owner, occupier or another party

A site may include a number of liability linkages (as illustrated in Figure 7). Each may be managed at the level of its component parts, for example managing the position of claimants (for example that there needs are met or they are compensated), by managing the claim for example reducing human health impacts to acceptable levels, or by managing the liable party – for example by transfer of liability agreements.

Environmental Liability is a key consideration for site closure. The NICOLE BFWG has set out to understand four basic questions:

1) **Do I have confidence that I understand the risks?** Liabilities are either known or potential. Known liabilities are remediation costs. Potential liabilities can be due to errors or omissions (fault based) or due to unforeseeable factors. Typically potential liabilities do not materialise and so are zero but they can be very substantial

2) **Can I transfer the site?** This depends on national and local market conditions, which in turn depends on country-specific factors including supply and demand, incentives and blockers. If site transfer is not possible the risks of a ‘mothballed’ site will need to be managed

3) **If I do have a choice to transfer the site, should I sell it for redevelopment?** This depends. A detailed analysis would need to take into account both known liabilities, and (as far as possible) potential liabilities. The Polluter Pays Principle means that you may not be able to shed 100% of the liability. However you may be able to manage liability sufficiently that the residual risk is small enough and meets the liability management objectives of your organisation. In this case the rewards outweigh the risks and the site could be transferred – realising substantial sustainability benefits including financial.

4) **How do I conduct that analysis?** Analysis needs to be based on a survey of pollutant linkages and the potential for legal claims. NICOLE BFWG is looking at the concept of ‘liability linkages’ to assist this
analysis. An environmental liability management framework would then include management of both pollutant linkages and liability linkages.

![Diagram of Liability Linkages](image)

**Figure 7** Illustration of Liability Linkages (claimants as coloured ellipses, claims in rectangular boxes and liable parties in pale blue circles)

2.6. **Reuse in demolition** Kristian Kirkebjerg and Rune Haven, Grontmij, Denmark

Two real world case studies of site closure, demolition and handover procedures on brown field sites were presented: a fertiliser production plant and a concrete element production plant.

**Site 1.** This was the site of a fertiliser production plant. It was 18 ha and had been used for various industrial activities since 1800. Fertiliser production began in 1908. Soil contamination on the site includes: fluorides, heavy metals (As, Pd, Cd) and Total Hydro Carbons (THC). Industrial activities stopped in 2004. Site closure and demolition activities are ongoing. The future use of the site will be for mixed housing, office and cultural activities. The site is adjacent to city centre and the sea and so has a high redevelopment value due to its location. The re-use of the site had an estimated potential to reuse >100,000 m³ concrete on-site. However, investigations showed contamination in the crushed concrete from the demolition work, so offsite storage and reuse of all concrete was adopted.

**Site 2.** The site of the concrete production plant was 11 ha. It had been used for brick and concrete production since 1900. Industrial activities stopped in 2005. Soil contamination on the site includes: oil products, heavy metals and chlorinated solvents in groundwater. Site closure and demolition activities are ongoing. The future use of the site will be for mixed housing, office and cultural activities and possibly a new railway station. The site has a very high public profile.

Demolition work on the site included segregation at source of construction materials as far as possible. Some of this was contaminated by PCB, asbestos and THC/chemicals, so it was important to avoid cross contamination of materials designated for reuse.

PCB contamination is an issue that is gaining an increasing profile in Denmark. In older buildings (such as those found on this site which was abandoned in 1976) it is found in concrete element joints, thermo windows, paints and floor coatings and is a persistent and toxic compound. It can also be relatively mobile to air and materials and so is also seen as an indoor climate risk. The PCB contamination was an unforeseen problem. Subsequent investigation found >2 km of joints, putting at risk the re-use of 50,000 m³ of concrete, and potentially a source of soil contamination by PCB. Controls performed showed contents at >80,000 ppm. The remediation process comprised sealing of concrete elements and cutting of 10 cm edges on all elements. Soil and PCB is a limited problem we found <200ppm, and only just around the joints. The buyers contract required that all contamination of
building materials to be handled by the seller. The seller pointed out the unforeseen in this PCB contamination and the large amount of unanticipated effort

**Common lessons.** In both cases the buyer is a developer. The seller for Site 1 is the former user of the site (Large industrial company), and for Site 2 a real estate investor. In both cases sales contracts were signed before site closure activities and included a property price and a definition of the required hand over condition of the property. The seller is trying to achieve: site closure, demolition activities, no obligation regarding soil pollution. A high property price and a site exit with no future liabilities. Meanwhile the buyer is trying to achieve: take over after site closure, and that necessary remediation activities depends on development plan (risk based). The buyer seeks a low property price and site takeover with optimal conditions for future redevelopment. Figure 8 shows the timeline for the site transfer and development process in both cases.

**Figure 8 Site timelines for the two case study sites**

A number of stakeholders are involved in this process: the seller and the buyer (each with a consultant and lawyer), a contractor performing the demolition works and the regulatory authorities. For both sites the complexity of the closure process and conflicting goals between these stakeholders led to many points of disagreement, for example relating to concerns about dispersal of soil contamination during demolition and how the site should be levelled. Both the seller and the buyer ended up with greatly increased costs for professional fees and the closure process for both sites was significantly delayed. This shows the need for clear and well defined site takeover procedures in contractual documents, or alternatively site hand over before closure and demolition.

The reuse of demolished building materials can be sustainable both economically and environmentally, but contamination may be an obstacle to re-use. Contamination levels in building materials can be an important factor when negotiating the takeover of a brown field. Contaminations levels should be investigated prior to demolition activities. In Denmark there are large differences in legislation regarding the reuse of contaminated building materials and contaminated soil.

**2.7. Use of innovative in-house quantitative risk assessment to determine the requirements for building fabric decontamination during site closure and site sale processes** Lindsay Pepperell and Alan Thomas, ERM, UK

Risk based management of contaminated land is a key policy tool that has been established in many countries. However, the issue of contamination of building fabric is not well established (if at all) and is often either not recognised, not assessed, discounted or approached in a generic manner only. Such approaches can lead to either an underestimate of human health risk (or perceived ‘risk’) or conversely, over-costly ‘remediation’. Either can present problems to site owners during site decommissioning, closure or building sale processes, if not anticipated

Some contaminants in buildings have well established guidance, e.g.

- Asbestos - Regulatory guidance for air and surface quality, established methods for monitoring and assessment
- Radiation – Regulation on exposure / dose gives rise to local guidance for surface quality and established methods for monitoring and assessment
Some other substances e.g. lead in paint, lead in dust, PCBs on surfaces, although these are often aimed at the public or residential buildings and may be difficult or over conservative to use for commercial building use.

Current approaches to assessing contamination of buildings are often based on workplace or occupational exposure limits (WELs / OELs). These are usually limits in air (with sometimes a “note” relating to exposure via dermal route). In the UK there are number of such limit values, but not many for non-volatile organics.

In some cases industry supplied in-house “clean-up criteria” may be available. These are useful to consultants, especially for their professional indemnity, but it is often unclear how they were derived and they can sometimes be overly conservative or unachievable. For example, the following is an extract taken from a client’s in-house procedure for surface “clean-up”:

The clean closure criterion for wipe samples collected using this method are: Non-detectable using the lowest published detection limit for analytical methods as published in US EPA SW-846 Test Methods for Evaluating Solid Wastes, Physical/ Chemical Methods, or Below background levels for all contaminants of concern.

Therefore there are gaps in current approaches for contaminants which are:

- Non-volatile, non-dusty or ‘fixed’
- ‘fixed’ includes trapped or contained within ‘normal’ dust and grease
- Typically organics, particularly from the pesticide and pharmaceutical sector.

i.e. contaminants which can be toxic / undesirable by dermal absorption and / or ingestion via dermal contact, as well as inhalation, and where the primary route of human exposure is likely to be dermal and dermal transfer to mouth.

The pesticide and pharmaceutical sectors are large industries undergoing large changes in manufacturing, packaging and storage locations of products – and it all happens in buildings. Many site transfers or exits may involve the handover of buildings which are re-used within organisations or by landlords / new owners.

It is common to find one of two typical approaches to assessing the risks from the re-use of buildings:

- Qualitative, typically one of the following
  - “ignore the issue or pretend it does not exist “;
  - adopt a ‘visually clean is clean’ standard – an approach sometimes taken by contractors;
  - or adopt generic cleaning methods with pre-assumed results/outcomes, often not linked to contaminant type or location, and irrespective of pre- and post-cleaning contaminant concentrations.

- Quantitative: there is some published research into quantitative approaches, but quantitative risk assessment for buildings is rarely undertaken. It tends to be complicated, if not simplified by ‘user guidance’ – i.e. to reflect real situations. It needs clear explanation for clients, contractors, vendors and buyers, but it can, if used sensibly, give a firm basis for the significance of risk and associated clean-up criteria.

The available technical literature for quantitative approaches indicates that for sampling from building surfaces the key variable is data collection - the method used to sample surfaces - and its reliability. There is often an assumption that using swabs or wipes is best, which is supported by the literature in principle, but with the proviso that swab sampling is not assumed to be 100% efficient at removing a residue from a surface (see Table 2).

However, an open question is how representative a wipe is of dermal contact with a surface. A reasonable and conservative assumption is that uncorrected wipes or swabs are ‘best’ i.e. 100% residue transfer efficiency is not representative of actual dermal exposures, and that using cotton or
similar swabs (as opposed to cotton buds, tapes or smears) over a reasonable surface area of 100cm² give a laboratory a reasonable amount of something to analyse.

**Table 2 – Comparison of surface sampling methods**

<table>
<thead>
<tr>
<th>Sample method</th>
<th>Wipe (cotton wool ball or medical gauze)</th>
<th>Surface press sampler with filter cassette</th>
<th>Swab (cotton bud type)</th>
<th>Lift tape, forensic tape</th>
<th>Smear tabs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sampling efficiency</td>
<td>84% – 97% (Bernard et al, 2007)</td>
<td>17% – 55% (Bernard et al, 2007)</td>
<td>81% (USDA ARS, 2003)</td>
<td>&lt;40% (Wheeler &amp; Standiff, 1998)</td>
<td>No data – assumed similar to lift tape</td>
</tr>
</tbody>
</table>

The available technical literature for risk assessment indicates that there are various risk assessment models published, mostly from the USA, with varying degrees of complexity. For example, some take account of surface fraction transfer, dermal absorption coefficient, fraction of gastro-intestinal absorption, differing exposure durations, exposure areas etc. In other words the available risk assessment methodology is not very standardised and is biased towards occupational exposure scenarios. However, most models refer back to published toxicity data i.e. reference doses or acceptable daily intakes (ADIs) or no observable adverse effect levels (NOA / NOAEL). Table 3 lists some of key technical publications.

**Table 3 Selected Building Decontamination References**

- Civil & Environmental Consultants, Inc. (CEC). (1997), Contaminated Dust Removal Plan, Metcoa Site, Pulaski, Lawrence County Pennsylvania

The other key aspect for surface contamination issues is – how do you clean-up / remediate? This question leads to further questions such as which methods to use, what is cost effective and practical, and how much sampling / risk assessment do you need to answer these questions?

Available methods for surface treatment or cleaning include:
• physical methods (e.g. abrasive blasting, scarifying, grinding, plaining, spalling, vibratory finishing / scrubbing, high pressure steam and water sprays),

• chemical methods (e.g. water washing and spraying, chemical oxidation / bleaching using hypochlorite, chemical reduction, liquid phase solvent extraction) and

• Immobilisation / sealing.

It is not always clear that of the options available, which ones will be cost effective and practical and how much sampling / risk assessment is needed to verify that “clean-up” has taken place.

ERM has derived in-house approaches to assist clients during the closure and sale of sites, where on-site buildings and building fabric has been potentially or actually contaminated with substances more normally associated with contaminated land risk assessment. The principal examples used are those associated with building internal contamination due to pesticides or pharmaceuticals.

The context for these assessments is from the viewpoint of ERM, acting as a consultant or contractor to an industrial client who is in the process of decommissioning and selling a site to a third party. In most cases the third party intends to re-use the site buildings with minimal alteration, but often for a more sensitive ‘non-chemical’ future use. Therefore the purpose of such assessments are to reassure both vendor and potential buyer that relevant building contamination issues have been identified and addressed to the satisfaction of both, and that this is recognised and accepted by both.

One recent ERM case study includes sites where buildings were formally used to manufacture and store various pesticide products and where site decommissioning and closure was underway, and site sale for future non-pesticide / non-chemical use was planned. ERM derived in-house quantitative human health risk assessment tools to assess the significance of building fabric surface pesticide concentrations and the need (or otherwise) for remediation. In one example, remediation was required and ERM advised, specified and supervised remediation by environmental cleaning. This is contrasted with another similar site where the client/other consultant had proposed generic remediation by building wash-down, whereas the ERM risk assessment indicated that remediation was not required, and approximately £200,000 was saved by the client.

In another case study, pharmaceutical packaging buildings were to be decommissioned and sold for alternative uses. The contaminants of concern in the building were antibiotics and cytotoxic drugs. ERM used a simplified risk assessment that assumed that the new users of the building should not receive a dose greater than 20% of the acceptable daily intakes - ADIs (or with reference to NOAELs - no observable adverse effects level, if no ADI is published). This was used to back calculate allowable concentrations on surfaces. These calculations were compared with criteria set out in the clients own good laboratory practice (GLP) procedures, which indicated that the GLP levels should be lowered for antibiotics but could be increased for cytotoxic drugs. The recommended remediation was to carry out an internal cleaning where surface wipes indicated unacceptable levels of drug. Cytotoxics were treated by HEPA vacuum cleaning and applying a Decon 904 wipe. Thereafter, antibiotics were treated with a hypochlorite wash (which breaks the β-lactam ring). Verification was by a combination of HPLC coupled with a sensitive commercially available ELISA (enzyme linked immuno-sorbant assay) test system. Testing of treated surfaces was carried out as a verification step.

### 2.8. Site remediation closure from a remediation solution provider’s perspective Yvo Veenis, Groundwater Technology, The Netherlands

Most countries now have government policies in place that aim to prevent site becoming “derelict” and promote site re-use. However, with such “second hand” sites liabilities associated with existing impacts on soil and groundwater are often an issue of concern.

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(1) A commercially available surfactant used for analytical glassware cleaning
Four case studies from The Netherlands show several different approaches to dealing with such situations, from the service provider’s perspective. In all of the cases soil and groundwater problems were blocking desired property transfers and redevelopment. Solving the problem by complete removal of the source term was not possible for any of these sites (both technically and economically impossible). Therefore the greatest obstacle was managing liability associated with residual contamination. This was solved by reducing contaminant levels to concentrations that were (or will be) acceptable to regulators for the envisaged (changed) land use. The result is that the previous and new owners have certainty that they will not be required to undertake remediation on the residual contamination, given the planned land use. Liability over and beyond is transferred to the new owner.

**Case 1: Service station site.** The service station closed years ago, but land redevelopment (to residential use) was obstructed by existing contamination. Residual liability was solved by establishing a set of agreements: the oil company sold the site, with all liabilities, to an investor, who sold the site subject to completion of remediation to a property developer. The service provider contracted with the investor for lump-sum remediation to regulatory accepted levels for residential use. The site was a very desirable location with river views. Remediation was carried out by excavation and removal of the contaminated soil, and limited pump and treat for the groundwater plume.

**Case 2: Retail property,** The property is currently in use as women’s clothing shop with residential use on the higher floors. It is in a historic waterfront centre in the west of the Netherlands, but has soil and groundwater contamination with chlorinated solvents from a former dry-cleaner. The building (as well as adjacent properties) is a designated historic monument and highly prone to subsidence. The site is for sale, but environmental liability obstructs a deal. An earlier proposed remediation plan was based on MNA, and would have entailed perpetual monitoring, which was not acceptable to the buyer. The problem was solved by direct injection technologies to chemically and biologically degrade the contamination while also reducing the permeability (already low in clay) to virtually zero. The aim is to reduce migration risks such that once a stable situation is demonstrated; no further monitoring will be required.

**Case 3 Production Site** A global chemical company is selling production facilities to another (similar) company. Both the seller and buyer want a “clean deal” i.e. neither wants to be confronted with unexpected environmental liabilities from the soil and groundwater contamination. The problem was resolved by having consultants from both parties developing a jointly agreed remediation plan (with accepted costs), which was submitted to and approved by the regulators. This process provides both parties with sufficient certainty about the financial impact of possible liability. A mutually agreed sum is transferred from seller to buyer and the buyer undertakes the remediation.

**Case 4 Petrochemical Company.** The company wished to facilitate possible future sales or changes in production, and so is taking a strategic view to support possible future divestitures from their existing facilities, or investments to expand and upgrade them. Environmental impact on soil and groundwater is likely to be the largest liability, but had not yet been quantified. The concern is less about the presence of contamination as such but about the unquantified liability. Developing a Site Soil Management plan (which was submitted to and accepted by the regulators), set a strategy to handle contamination problems over the following decades. The approved Site Soil Management Plan is a negotiated, legally binding, agreement between the site owner and the regulators. Hence, it facilitates accurate budgeting of environmental expenditure over the next decades.

2.9. **100 years of industrial history: what’s next for the local economy? Gaelle Baldelli, BP France**

The former BP Courchelettes and Corbehem sites were operated from 1863 to 2004. The Courchelettes site is 15 ha with an additional 3 ha of woods. The Corbehem site is 7 ha. Together the sites cross two municipal and regional jurisdictions: (town of Courchelettes / Department of Nord and town of Corbehem / Department of Pas de Calais. Both sites are relatively small as BP facilities, but are of significant size for the towns concerned.
The Courchelettes site operated from 1885 to 2004 and was a storage facility for raw and refined hydrocarbon products, and also had a gas bottle filling activity. From 1951 to 1973 acid tars from an adjacent refinery were stored on site in lagoons covered with concrete/asphalt. All activities stopped in 2004. The Corbehem site operated from 1863 to 1999 for the manufacture of refined petroleum products and specialty chemicals for a business that was taken over by BP in 2002 / 2003. In 1944, the sites were severely bombed, causing a release of hydrocarbons.

The plant on both sites was decommissioned and demolished between 2001 and 2004. Several remediation activities also took place at this including: the removal or rendering safe of utilities; removal of underground storage tanks; and treatment of groundwater at former wharf location via a multi-phase extraction system and via skimming of floating product in the former depot area. Contaminated soils have been excavated and treated by bioremediation from a former pumping station area, former wharf and at several other locations based on risk assessment results. Management of the former acid tar lagoon is one last step remaining. Some longer term monitoring activities will still probably need to be conducted on the sites (see Table 4).

**Table 4 Remediation Activities at the Courchelettes and Corbehem Sites**

<table>
<thead>
<tr>
<th>COURCHELETTES</th>
<th>CORBEHEM</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001 - Former wharf: soil excavation and on-site biotreatment</td>
<td>2001-2009 – GW monitoring</td>
</tr>
<tr>
<td>2005-2009 - Acid tars investigations and feasibility study</td>
<td>2003-2005 : Soil excavation and on-site biotreatment</td>
</tr>
<tr>
<td>2006-2009 - GW monitoring and treatment at former gas depot</td>
<td></td>
</tr>
<tr>
<td>2006 : USTs (Underground Storage Tank) removal</td>
<td></td>
</tr>
<tr>
<td>2006-2007 - Former pumping station area: soil excavation and on-site biotreatment</td>
<td></td>
</tr>
<tr>
<td>2007 - Former bottling unit: removal of floor coating</td>
<td></td>
</tr>
</tbody>
</table>

Innovative solutions for future land use were needed because of the limited demand for industrial land in this part of France. One of the initial ideas considered was to use the sites for solar energy, but this was not found to economic. The most viable way forward for the site now seems as a component of a much larger regeneration initiative called Osartis which is a public-private partnership project. The Courchelettes and Corbehem sites border what has been an important canal, the Scarpe Canal. The Osartis Project seeks to establish a major transport hub linking canal and rail transport, with a range of additional mixed land use.

BP is working in partnership with Osartis, Etablissement Public Foncier (EPF) and the regulator, to bring forward this “Port Intérieur Corbehem Osartis” redevelopment project. If successful, this will significantly increase regional economic activity. The aspiration is to create a harbour and multi-modal logistical platform for European freight linked to the to Canal Seine-Nord, as an alternative to road transport. Harbour traffic is projected to be from 360 kT/y to 680 kT/y, and rail transport 100 kT/y.
The project is expected to maintain 300 jobs linked to the existing canal traffic and create 200 to 400 jobs created for the multi-logistical platform.

BP is now working towards transferring the sites to EPF in the framework of the French regulation and BP governance process. Before the transfer land use restrictions would have to be implemented on the sites to take into account their residual environmental states.

Sharing information and lessons learned is crucial to the BP project management process. Therefore the French BP team looked at other similar redevelopment projects in the company and is trying to apply effectively the relevant procedures learnt; in particular from recent Coed D’arcy project in Wales (UK). The project took a major step forward in 2009 when negotiations were initiated with EPF. Legal agreements will be signed with a vision to contribute actively to the new Port. Clearly there is still much to be done, but the project looks to enable not only an exemplary brownfield redevelopment project in complex French environmental legislation context, but also to provide technical solution for acid tar management.

2.10. Life after closure Euan Hall, Land Restoration Trust, UK

As the industrialised nations of the western world evolve to meet new market demands and the globalisation of trade many are left with the legacy of decades of industrial decay and dereliction. In many areas new industries require completely different property solutions, gone are the substantial plants making steel, mining coal or making cars – instead we have call centres occupying a fraction of the land previously needed. A financial services company with a thousand staff potentially needs only a few hectares for their offices as opposed to perhaps several hundred hectares previously used by a manufacturing plant employing the same number. This ultimately means a major shift in land use patterns. Even if the new business can be tempted to invest on or near the previous business due to the availability of the workforce what happens to the surplus land? Many companies closing plants, certainly in the UK initially, approach the open market seeking purchasers for their interests. Sometimes this works, sometimes particularly in the old industrial heartlands of the UK it does not. There is an estimated 70,000 – 200,000 hectares of derelict land in England. Much of it in the wrong place and is of the wrong sort to find built redevelopment. Some can be reused, but a substantial area of land remaining never re-useable for development.

Ultimately dereliction causes blight and vice versa. Derelict neglected and poorly maintained spaces:

- Encourage anti-social behaviour
- Adversely affect mental health
- Create barriers
- Encourage physical inactivity (reduce desire to go out of the house)
- Blight communities
- Undermine community pride & cohesion
- Reduce property value in the surroundings.

On the other hand green space provides many benefits to communities. It is a catalyst for economic regeneration and a tool for enhancing community cohesion. It helps deliver the health agenda be encouraging people to walk and take physical activity. It provides environmental improvement, and a multifunctional green infrastructure can provide a range of additional services, for example supporting conservation, providing renewable energy and water management.

One area of England that has been particularly hard hit by economic change is the former Yorkshire coalfield area of England where mines were closed in the 1980s and early 1990s. In the South Yorkshire coalfields towns were created solely to serve one industry, the coal industry, on previously rural locations. The collieries were the centre of these towns’ lives, providing recreation as well as jobs. Prosperous although not necessary attractive towns were created. For example the Bentley colliery
near Doncaster was sunk early in the 1900’s. The small village of Bentley expanded rapidly from a population of around 100 to over 19,000. Askern in the late 19th century was a small affluent Spa village in a rural location. Askern Colliery was sunk early 1900’s. The spa declined but was replaced by a thriving much larger self-contained pit town.

The South Yorkshire coalfields saw colliery closure by the early 1990’s leaving isolated towns and communities divided by vast derelict sites. Infrastructure in the region is poor. Coal was transported by rail not road. Very prosperous commuter villages, with better connections, have developed alongside deprived former industrial towns. Bentley is in the top 1% of deprived communities in UK. Askern is an isolated town with a huge derelict site at it centre. The site has no hope of commercial development. Local employment has gone and the recreation provided by the colliery has gone leaving a deprived community.

The Land Restoration Trust has worked to “green” these former colliery sites, creating seven community green spaces covering over 400ha, with 0.5 million trees. These spaces provide a focal point for the community. Over 10,000 school children have visited the site on educational activities and over 8,000 people have taken part on site in structured health activities. An innovative “Forest Schools” project is working with children with “behaviour problems”. The removal of blight has improved land value. Development land next to Bentley was recently sold for £millions. Previous solutions would have involved “greening” of former coalfield sites and leaving them to nature. This would eventually have resulted in greater blight to community and lack of community ownership and greater deprivation. The work of the Trust is to ensure that these sites are returned for active use by communities and are seen as assets to the community.

However, the “greening” work is only a part of the solution. Without maintenance the sites will ultimately fall into disrepair. For example, the Liverpool Garden Festival was created on the site of a former municipal landfill in 1983 at a cost £25m. The festival saw one million visitors and was a local and national success story. However, no funding allocated post restoration and the site is now derelict (see Figure 9), one of many such projects that failed the sustainability test. It has been estimated that to “re-restore” this site will cost £10million to restore. An investment of £2 million in 1984 would have created sufficient revenue year on year to have secured the site’s future.

![Figure 9 A recent view of the Liverpool Garden Festival site](image)

The Land Restoration Trust was set up because the Government wanted permanent responsible management of the public green space it created. The Trust aims to ensure the sustainable management, in perpetuity, of land for public benefit. It acts as a strategic land and fund holding body. It delivers individual projects through local partnerships. It uses permanent endowments to support cost effective secure delivery that maximises public benefits (within the available resources).
Stakeholders involved in this portfolio of sites included the departments of the UK Government, English Partnerships, now the Homes and Communities Agency, the Land Restoration Trust, Forestry Commission and the Coal Authority.

The Trust uses site specific costings to estimate a requirement for an upfront capital investment, or requirement for a permanent revenue stream. The interest earned then pays for maintenance in perpetuity. This is a best value approach: not the necessarily the lowest cost in the short-term but the most cost effective approach in the long-term.

The Trust’s 19 green space projects so far have delivered over 14,000 educational visits, over 15,000 visits from people on specific health activities (with a far greater number of casual users getting health benefits), over 4,600 training activities and over 2,200 days of volunteer activity. Re-use of brownfield sites is often viewed as a last resort, as a result of physical or financial constraints. Why not choose green space?

2.11. PPP: An efficient solution for a complex site closure in Belgium Jérôme Metz, DEC, Belgium

The Fabelta site is located along the Upper Scheldt River and the E17-E40 highways in Ghent (Belgium). In the 1970’s, Domo Services Gent NV (“Domo”), a textile manufacturing company, acquired the textile factory on this site from the carpet company Fabelta after its bankruptcy. In the 1990’s, Domo programmed the divestment 26 ha of the 42 ha site located.

The area includes five industrial lagoons containing 175,000 m³ of viscose sludge were located. These uncontrolled lagoons generated groundwater pollution by heavy metals and other organic compounds over an area of more than 7 ha. Domo, as site owner and current operator, was considered by the local authorities as liable for the pollution. The remediation costs were estimated to be €11 million.

As the waste material was brought in the lagoons by a previous operator on site, Domo contested the decision of the environmental authorities to lay the entire liability on the current owner. But despite the intricate legal debate about the issue, Domo has always indicated it is willing to take part of the responsibility providing that the authorities also accept part of the responsibility and help to facilitate the property transfer. In this context a number of questions were raised:

- Should the remediation be performed by Domo or by the purchaser of the property?
- How would the remediation costs be financed given difficult economic conditions?
- How would the risk of additional costs in the course of the remediation works be managed?
- How to ensure that the site was suitable for use in its envisaged redevelopment?
- How to manage liability transfer after a risk based remediation?

In the late 1990s governmental organisations in the Ghent region were urgently seeking economic solutions for the disposal of contaminated dredged sediments. These sediments were created by the maintenance of navigable rivers, but there was no sediment treatment and disposal site in Ghent area. The locality also had a shortage of industrial area for the expansion of high technology businesses. A solution for the Fabelta was found between DEC, a remediation contractor, Domo, as the owner of the site, and the public authorities, taking advantage of these local economic demands. This has turned a liability into an opportunity. These organisations have created a public-private-partnership (PPP): CVBA— FASIVER (see Figure 10). The public partners are the Province of East Flanders and the city of Ghent. The private partners are DEC N.V. as a remediation contractor and Domo as owner of the contaminated land. FASIVER became the owner of the land and took over the liability for the contamination.

The FASIVER partners combined their know-how and expertise. The project has allowed DOMO to divest a large part of its 42 ha site. It has retained 11 ha, the rest was divested, including 15 ha sold land to
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FASIVER for a nominal sum and the remainder to private buyers (6 ha) and the “Water and Sea Administration” (10 ha).

![Diagram of CVBA FASIVER study period]

Figure 10 FASIVER public-private-partnership

The City of Ghent has an option to purchase land from FASIVER at its normal commercial value in the future. The remediation by DEC is financed by a bank loan. DEC also use the site for sediment treatment and disposal in return for a fee to FASIVER which meets the interest on the bank loan. The treated sediment is used to raise the site by five metres (which is a development requirement). The site will be redeveloped into an industrial park for small and medium sized enterprise and high technology industry, with a large green belt along the river Scheldt.

OVAM, the Flemish environmental authority, although not an official party to the PPP, has facilitated the development of the site by taking a pragmatic approach of the remediation in the sense that, to a certain extent, the remediation could be phased to coincide with income streams from a phased sell of the cleaned parts of the site.

Soil remediation was carried out in 2006, after which a groundwater treatment was started for a period of 5 years. In 2012, the sediment treatment activities will be terminated, after which FASIVER will sell the last part of the site to the City of Ghent and the province of East-Flanders that will ensure its further development.

At first sight, public and private partners had contradictory interests. The private partner wanted to reduce risks (insecurity of public policy and changing regulations) and increase financial return related to the investment, whereas the public partner wanted to diminish financial risks and the financing volume and increase efficiency in execution. Through a PPP these opposing interests could be shared in a common undertaking.

Risk sharing was distributed in the PPP. The private partner bears the technical risks (e.g. provides a lump sum decontamination price), the commercial risks (cost calculation, budget control) and pre-financed the project. The public partner took the final budget risk by guaranteeing to take over the decontaminated site at a price that would cover the total remediation costs based on an open bookkeeping and full disclosure of all costs and incomes of FASIVER. The public partner was also responsible for assisting the planning and permits and took part of the associated risks (e.g. delays in planning procedure, negative environmental impact assessment and failure to obtain construction permits).

FASIVER has acquired the 6 ha that were sold to private owners through expropriation. So ultimately FASIVER acquired some 21 ha. FASIVER was also allowed to use the 10 ha of the Water and Sea Administration and 5 ha of the residual Domo site for its sediment treatment activities.
2.12. Site closure management and future responsibility  Martin Peterson, Eindhoven University of Technology, Section for Philosophy and Ethics, The Netherlands

This presentation was from a philosophical perspective rather than from the perspective of a contaminated land management specialist. Site owners face a problem of “future responsibility”. The talk is predicated on the idea that “industry facing site closure (management) has a need to not only organise the sale or termination of lease notifications, permit notifications, social plans etc., but also to facilitate the complete exit from the property such that it no longer has rights or responsibilities towards its land use, i.e. such that there are no residual (potential) liabilities in respect of the site, both now and what will be seen as liabilities in the future”. The bad news is that from a philosophical perspective it is impossible for this need to be met. The analysis following explains why this is so.

The analysis begins with a problem statement. Suppose that everything has been done that was obliged to be done, i.e. that all our present responsibilities have been fulfilled: the site is “clean” and it is time to close it down. How does a site owner ensure that no new responsibilities arise in the future? For example the Hälleforsnäs Foundry (Sweden) started its activities in 1658. In the 1960s it was one of the largest foundries in Northern Europe. Hälleforsnäs went bankrupt in 1997, after several decades of decline. Pollution on the site is mainly concentrated to the old gasworks and the places where the coating has taken place, and where they dumped the coal tar from the gasworks. Contaminated soil in a coal tar dump was covered by a plastic layer and 1.5 metres of soils in 2004. Water from a nearby stream was re-directed and a site monitoring programme established. So in 2006 all present responsibilities were met for that area. What responsibilities may arise in the future?

Table 5 sets out a philosophical view of the types of responsibility that exist: whether it is forward or backward looking, and also whether it is directly causal, or about rule following or about decision making. Table 6 analyses the responsibilities of the stakeholders at the Hälleforsnäs using this framework, with the forward looking scenario being if remediation requirements get stricter in the future. The government (Society) in the widest sense generally picks up future responsibility but the future responsibility for the service provider is unknown, as society could require the service provider shares responsibility. Hence, no matter what precautionary measures might be taken now, there is a risk for a service provider and site owner that it could nevertheless become responsible for a new duty in the future, even if there is no causal link between the current actions and the future duty.

The speaker drew a distinction between legal responsibility and ethical responsibility, but pointed out that legal responsibility is often based on intuitions about moral or ethical responsibility, so ethical responsibility can be a good indicator of future legal responsibility. Another important debate is the extent to which corporations can be responsible. There are two dimensions to this debate:

- Can corporations be (morally) responsible for their actions?
- Can corporate responsibility be reduced to individual responsibility?

In everyday language we talk as if corporations take decisions, sign contracts, make deals with other companies, etcetera – does this entail that corporations actually are responsible for these actions?

There are two opposing views: “corporations/Groups are morally responsible for their actions” or “only individuals can be held morally responsible.” However, there are strong arguments against collective or corporate responsibility. Collective actions are not possible: groups, unlike individuals, cannot form intentions and hence cannot be understood to act or to cause harm qua groups. Groups, as distinct from their individual members, cannot be understood as morally blameworthy in the sense required by moral responsibility. It is very common that the decontamination of contaminated sites is paid for by the taxpayers because the firm that caused the problem no longer exists. If we accept that groups of individuals (e.g. corporations) can be morally responsible for their actions this is not very surprising. Once the group ceases to exist as a group it is no longer morally responsible – so the taxpayers have to take over the responsibility. On this view, group responsibility is simply not reducible to individual responsibility. However, a possible way of avoiding this seemingly implausible conclusion is to increase the responsibilities of individuals, i.e. the employees of the corporations, possibly by adjusting the relevant legal structures. By maintaining that responsibility is a property that applies to individuals only, at least some future problems may be possible to avoid.
3. Perspectives from NICOLE Working Groups


Waste was one of the first issues that EU environmental legislation tackled in the 1970s. The Waste Framework Directive was adopted in 1975. It aimed to protect human health and environment and set out waste definitions and a waste hierarchy (prevent, reuse, recycle, and dispose). However, the application of EU waste legislation to contaminated land and brownfield management has had unforeseen consequences. These have included: difficulties in applying the definition of waste to contaminated soil, finding a balance between environmental protection and recycling, “mission creep” leading to the possibility of contaminated soil in situ being considered a waste, dual regulation of sites under waste and contaminated land frameworks, and an inconsistent Member State interpretation of the Directive.

The Waste Framework Directive (WFD) has recently been revised in a way that has dealt with some of these concerns. In 2005 the European Commission published its Thematic Strategy on the Prevention of Waste and Recycling and in 2006 the first draft of revised WFD proposal. In 2007 political agree was

NICOLE’s interest in waste is related to the use of contaminated and uncontaminated soils, soil treatment and materials generated during brownfield regeneration. Certain interpretations of the WFD were undermining the contaminated land management principles of suitability for use, risk based land management, resulting in lost opportunities to reuse treated and untreated soils and increased use of landfill and primary quarried materials.

NICOLE issued a 1st Waste Position Paper in May 2007, which reviewed drafts of the revised WFD and suggested revisions to texts. These revisions were received positively. A 2nd NICOLE Waste Position Paper has been drafted which considers the implications of the text of the revised WFD on soil management. An emerging concern for the Waste Working Group is the implications of REACH on the reuse of materials recycled from brownfield and contaminated land, including treated soils. This creates a problem as the 2nd Waste Position Paper cannot be issued until the implications of REACH are better understood, and yet the window to influence transposition is rapidly closing.

4. Interactive Session: Divestment of Industrial Sites

(Frank Westcott, RSK, UK; Hazel Burrows, BP International, UK and Laurent Bakker, Tauw, The Netherlands)

4.1. Syndicate exercises

Delegates undertook a syndicate exercise on each day. Day 1’s exercise was to brainstorm the issues that might arise in a site closure and divestment situation, considering: the pre-closure decision the announcement of closure, managing the closure process and completing the exit.

Day 2’s exercise was to apply this thinking to three case studies to:

- Prepare an outline of a site closure action plan including:
  - Aspects and Impacts to be considered in the site closure, e.g.:
    - Legal/regulatory context
    - Divestment/liability transfer context
    - Closure strategy
    - Closure management
    - Demolition, remediation, restoration
  - Issues and Priorities of the site closure
  - Business consequences of closure actions
  - Actions and tasks list for the site closure
- Based on this experience, draw up a “Road-map” for site closure?

The delegates were divided into three syndicate groups. At the end of Day 1 the issues from each group were combined in a plenary session. The same syndicate groups each tackled a different case study during Day 2. They were then shown the real world outcomes for each case study. Section 4.4 outlines the case studies and their outcomes. The three case studies were a former lead acid battery manufacturing plant; a minerals refining plant and a former ceramics factory.
4.2. Output from Day 1: Summary of Site Closure and Divestment Issues

The key issues identified could be mapped into four broad categories: site closure strategy; management and communication; legal and financial issues; and technical means. Risk management is essential in all of these categories. The individual issues identified are listed in Table 7. Overall site closure strategy and management needs transparent, realistic and flexible objectives; a competent and responsible project team and a realistic time frame. Adequate communication with all stakeholders (especially authorities and third parties) is essential. Risk management and risk communication are inextricably linked.

4.3. Output from Day 2 Closure Strategies and a General Closure Road-Map

Site closure is not just a question of sale or demolition of buildings and disposal of waste. In cases of economic distress environment, health and safety (EHS) issues may be overlooked, or dealt with by offering a discount of the site price. Price reduction is not always the solution. Long term soil and groundwater and other EHS liabilities may not be transferable, and their presence affects redevelopment and site re-use options. The aim of this exercise was, on the basis of case studies, to explore the possibility for a general framework or methodology (checklist/toolkit/road-map) for site closure and disengagement. The overall objective for such a scheme would be to determine how to divest a site with the highest overall efficiency and without residual liabilities. There is a range of possible strategies, with sale of the site as it is at one extreme, and redevelopment of the site for sale with an envisaged end-use at the other. The different scenarios carry different environmental risks and liabilities. These impact the means site rehabilitation and risk mitigation, and measures to control liability using indemnities and or warranties. The framework developed needs to encompass a range of operations: dismantling (equipment and installations); deconstruction, demolition and remediation.

This section focuses on the general conclusions relating to a road-map. Annex 2 summarises the findings specific to the case studies.

The case studies, and the meeting presentation, identified a number of problems encountered with different site closures. The sequence of considerations: sequence “aspects”, “issues”, “business consequences” and “action plans” (AIBA) was found to be a useful structure for discussions and has a good potential to facilitate decision making processes and budgeting. However, clear definitions of terminology are important. Checklists of relevant aspects, issues and business consequences were considered useful tools in providing a generic format for a road-map. Examples for common closure/divestment scenarios would be helpful: each type will generate its own checklist of relevant aspects, issues and business consequences. Circumstances vary by country and region. It would be useful to have central information about country legislations and regulatory climates with regard to closure and liability transfer.

An approach to closure guidance that could be employed might be a “project management handbook” with specific stages to work through with specialist information such as checklists and tools in each stage that assist managers doing a closure process, which may be for the first (maybe only) time. The guidance should highlight key decision points. Guidance should also support robust project reporting so that the closure strategy is clear and changes in strategy are well documented with consequences. (a specific document at the end of each stage).

BP have a general project management process identifying five key stages in project delivery, and one of the syndicate groups felt that this may be a good basis. It provides a structured approach and resonates with other project management tools. Table 8 shows the suggested approach.
Table 7  Site closure and divestment issues identified by the syndicate groups

<table>
<thead>
<tr>
<th>Site closure strategy</th>
<th>Remediation targets need to appropriate to envisaged end-use (e.g. Changing from industrial to residential use)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Tight time frames</td>
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<tr>
<td></td>
<td>Closure is driven by many issues, contaminated land specialists are not in the “driving seat:” and the problem belongs to the landowner with the authorities</td>
</tr>
<tr>
<td></td>
<td>Liability transfer; difficulties regarding aftercare, maintenance issues (technical, financial and organisational)</td>
</tr>
<tr>
<td></td>
<td>Different views of landscaping/architects and soil remediation technicians</td>
</tr>
<tr>
<td></td>
<td>Problems if there is no end-use plan</td>
</tr>
<tr>
<td></td>
<td>Circumstances may mean that there is lack of preparation and the late involvement of specialists comes too late</td>
</tr>
<tr>
<td></td>
<td>Sometimes involvement of a specialist comes only after failure or problems</td>
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<tr>
<td></td>
<td>Difficult to set flexible end-stop-criteria (a)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Management and communication</th>
<th>Risk perception causes big differences in expected end points</th>
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<tbody>
<tr>
<td></td>
<td>Management needs to take account of non-technical persons and influence of politics</td>
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<tr>
<td></td>
<td>Closure is driven by non environmental issues, contaminated land specialists are not in the “driving seat:” and the problem belongs to the landowner with the authorities</td>
</tr>
<tr>
<td></td>
<td>Work must be ethical</td>
</tr>
<tr>
<td></td>
<td>Liability transfer; difficulties regarding aftercare, maintenance issues (technical, financial and organisational)</td>
</tr>
<tr>
<td></td>
<td>Problems caused by the evolution of legislation during the project and the durability of agreements with the competent authorities</td>
</tr>
<tr>
<td></td>
<td>Problems can be caused by a lack of knowledge in the project team</td>
</tr>
<tr>
<td></td>
<td>Problems can be caused by a lack of knowledge in the competent authorities</td>
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<tr>
<td></td>
<td>Social and technical considerations may interfere with each other</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Legal and financial issues</th>
<th>Potential liabilities to third parties arising from the inheritance of industrial activities (voluntary take-over)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Legal and financial aspects (permits, re-use, contracting, cost and risk sharing, taxes, etc.) Can be significant obstacles even when the end use is defined and the buyer is willing</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Technical means</th>
<th>Remediation targets need to appropriate to envisaged end-use (e.g. Changing from industrial to residential use)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sustainable re-use of demolition materials/waste</td>
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<tr>
<td></td>
<td>Lack of transfer of knowledge from research institutes to practitioners</td>
</tr>
<tr>
<td></td>
<td>Unrealistic remediation targets, with overly positive prognoses of likely outcomes,</td>
</tr>
<tr>
<td></td>
<td>Underestimation of risks</td>
</tr>
</tbody>
</table>
Table 8 Possible Structure for a Site Closure Road-map

<table>
<thead>
<tr>
<th>Project creation</th>
<th>Development</th>
<th>Delivery</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Appraise</strong></td>
<td><strong>Select</strong></td>
<td><strong>Define</strong></td>
</tr>
<tr>
<td>Consider closure options, e.g.:</td>
<td>Choose the option the business / team will pursue</td>
<td>Develop the detailed closure plan</td>
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<tr>
<td>- What is ‘end state vision’?</td>
<td>- set up project team</td>
<td>- communications plan</td>
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<tr>
<td>- Sell as a going concern?</td>
<td>- set up boundaries of project</td>
<td>- tender contracts for demolition, clean-up</td>
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<td>- Sell with liability?</td>
<td>- identify risks and mitigations for all options</td>
<td>- implement risk mitigations for the risks of the chosen project</td>
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<tr>
<td>Consider all the external factors</td>
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4.4. “Now the Yard’s just Scrap and Rubble”, Lessons Learned from Site Closure Implementation, Frank Westcott, Associate Director, Brownfield and Regeneration, RSK Group

Several cases are analysed, both from within RSK group and the author’s wider professional experience over 15 years, involving closure of UK manufacturing facilities. The paper identifies common problems encountered in implementing site closure, where these resulted in adverse consequences and where solutions were found, and will draw lessons from these cases. The cases considered include those from the syndicate exercise and are:

- A former railway rolling stock manufacturing facility in the English Midlands, involving plant decommissioning, demolition, site clearance and remediation and redevelopment integrated with site sale;

- A former lead smelting plant in northern England, involving plant closure and contamination assessment;

- A former lead acid battery manufacturing plant in the English Midlands, involving depollution, decommissioning and limited structural demolition, followed by sale of the site (Case Study 1);

- A minerals refining plant on the east coast of the UK, involving permit surrender, depollution, regulatory driven remediation and decision making on the future of the site (Case Study 2);

- A former ceramics factory in the English Midlands, with historical contamination issues, where the sale of the site funded the relocation of the facility to a new purpose built facility on another nearby site (Case Study 3).

**Locomotive Works, Derby, UK**


*Problems:*

- Split of responsibilities not clear enough
• Late/incomplete vacation by manufacturing company
• Late decision by manufacturing company to auction old machinery
• Third parties attempting to remove overhead cranes created dangerous conditions
• Last minute preservation order on part of site

Adverse Consequences
• Delay to start of redevelopment project
• Additional health and safety risks from third party works
• Renegotiation of demolition contract due to change in scrap values, extra soft strip
• Use for preserved buildings not considered in redevelopment plan

Solutions
• Clear End State Vision related to site redevelopment
• Single point responsibility defined in closing organisation
• Project management and safety management (CDM Regulations) roles combined for demolition work
• New use found for preserved buildings in new Derby College campus

Positive Outcomes
• Redevelopment of area includes hotel, leisure, office and new college campus
• Preserved historic buildings put to sympathetic new use

Lead Smelter, Leeds, UK

Description: 4 Ha site, closed 2003. Closing organisation intended to exit liabilities and cover closure costs by sale of site. Site investigation showed high lead contamination levels and remediation costs identified were greater than land value. Instead of being remediated the site was fenced securely and “mothballed” – remaining a continued blight on the local community.

Problems:
• Unrealistic expectations in closing organisation concerning land value vs closure costs and ability to realise a quick/clean exit
• Lack of budgetary provision for decontamination
• Unawareness/lack of consideration of blight effects on community

Adverse Consequences:
• Inability to sell site, or to exit liability.
• “Gates Shut” approach adopted to avoid crystallising remediation liability
• Ongoing costs (security, property taxes)
• No remediation completed, only new fencing
• Derelict site remains a blight on community after 6 years
• Attempts to lease the site for “open storage” so far unsuccessful

Solutions:
None
Positive Outcomes:
None

Lead Acid Battery Plant, Midlands, UK

Description: 5 Ha site closed in 2003. Sale of site negotiated by closing organisation to residential developer. Closing organisation was responsible for removal of equipment, materials and waste prior to sale completion. Closing organisation proposed to use existing (soon to be redundant) workforce to carry out this. However large scale machinery required significant structural dismantling and a specialist demolition company had to be brought in to do this. Specialist advice on HSE issues including CDM Regulations was also required. Wastes included large volumes of lead oxide paste and this was handled by site workforce trained in handling this material and under long term health screening.

Problems:
- Timescales dictated by land sale not required work scope
- Scope of pre closure works not appreciated: significant volumes of lead oxide paste and major machinery items needed removal before completion of sale.
- Third parties removing items of machinery sold by closing organisation created extra health and safety risks
- Skill set of site workforce engaged in closure works not sufficient to complete structural dismantling of large plant
- Site workforce demotivated as they were losing their jobs
- Challenges in co-ordinating site workforce and specialist dismantling contractor – different working cultures
- Interaction of lead at work laws and construction (CDM) laws

Adverse consequences:
- Complex works co-ordination task for closing organisation, significant management attention
- Several challenges for health and safety management
- As a result, high regulatory interest – full HSE unannounced inspection took place
- Increase in cost for closure, mitigated by increase in scrap reclaim value and by land sale receipts

Solutions:
- Clear End State Vision related to site sale for redevelopment
- Entire closure process under single client project manager
- Use of employees limited to their own skill sets
- External service providers used for structural dismantling and HSE advice

Positive Outcomes:
- No HSE incidents
- Decommissioning carried out to program
- Decommissioned buildings handed over to developer on time for demolition/remediation
- Liability transfer successful
- Residential development underway on site
Metal Refinery, E Midlands, UK

**Description:** 50 Ha site closed in 2009. Two legacy operations remain – CHP plant and by-product plant with long term contract to fulfil. Closure process ongoing – depollution of tanks/pipework and removal of wastes nearing completion. The site was operating under a PPC environmental permit and remediation will be required for deterioration in site condition (acidification) – investigation work just completed. Also historic pollution of undeveloped part of the site. A potential purchaser has been identified for the site and in parallel with regulatory closure, due diligence assessments and commercial negotiations are ongoing.

**Problems:**
- Differing objectives and poor communication between different parts of closing organisation
- End State Vision not communicated and complicated by legacy operations
- Regulatory closure and site sale not considered together; timescale objectives conflict
- Lack of communication between service providers
- Disengagement of legacy operations from remainder of site
- Logistics of regulatory closure, e.g. depollution vs. soil/groundwater investigations, demolition vs remediation
- Departure of staff with key knowledge from closing organisation
- Long term management of soil/groundwater impact reliant on effluent treatment operations planned for closure

**Adverse Consequences:**
- Decision making more complex and may not account for all factors and implications
- Increase in time and cost for closure
- Post closure property tax and utility costs
- Closure and liability transfer impeded by continuance of legacy operations
- Loss of key knowledge of the site
- Cost of necessary changes to long term management of soil/groundwater impact

**Solutions:**
- Solutions are being developed as the project progresses and the End State Vision becomes clearer.

**Positive Outcomes:**
- Positive outcome being sought involves establishing legacy operations as autonomous activities and disengagement from remainder of site with liability transfer to developer.

Ceramics Factory, Midlands, UK

**Description:** 3 Ha site. Closed in 2005 due to relocation of activities locally to modern facility. Closure and relocation costs to be paid for by sale of site for housing redevelopment. Historical contamination by chlorinated solvents and hydrocarbons required remediation as well as decommissioning and demolition; however timescales compressed due to site purchaser (housebuilder) requirement for early start to building.

**Problems:**
- Compressed timescale objectives (quick sale, early build start)
- Interface between demolition and remediation
• Scope/extent of remediation works needed
• Requirement for early service provider appointments (remediation, demolition)

Adverse Consequences:
Closure, remediation, demolition all happening concurrently
Space constraints on working areas on site

Solutions:
• Clear End State Vision related to relocation and sale of site
• Phased remedial solutions developed to meet timescale needs, integrated into sale agreement
• Closure process under single closing organisation project manager
• Agreed phased closure activity programme
• Joint appointment of turnkey remediation service provider; remediation started before closure
• Co-operation between demolition and remediation service providers

Positive Outcomes:
• Liability transfer and value realisation successful
• Relocation completed to programme
• First phase housebuilding started 2 months after closure
• First house occupancy before completion of last remediation phase
• Remediation finished 3 months early and below budget allowing building programme acceleration

Conclusions
Common problems encountered included: differing objectives within parts of the closing organisation; lack of a realistic end-state vision; unwillingness to invest in order to realise value; inability to agree liability transfer mechanisms; lack of single point responsibility for decision making and project management; unawareness of HSE implications; continuance of “legacy” operations; demotivation of employees involved in closure; degradation of site post-closure due to sabotage, vandalism, arson and theft, and failure to recognise blight effects on wider community.

Summary – Problems
• Differing objectives within parts of closing organisation/workforce
• Lack of End State Vision
• Lack of single point responsibility
• Budgeting, unwillingness to invest to realise value
• Continuance of legacy operations
• Liability transfer/remedy
• Post closure property tax and utility costs
• Failure to recognise blight effects on wider community
• HSE implications of closure actions/vacant buildings
• Involvement of third parties in closure process e.g. equipment removal
• Role of closing organisation employees in closure actions
• Pollution/liability caused by closure operations
• Demotivation of closing organisation employees
• Post closure dereliction (arson, theft, vandalism)
• Lack of understanding of demolition economics including “reclaim” value

Adverse consequences included: Incomplete closure due to “legacy” operations; incomplete closure where site is secured and abandoned but not redeveloped; inability to realise value expectations due to unquantified risks and liabilities; unbudgeted or increased site closure costs and timescale; unsafe conditions occurring during closure process or due to trespassers; reduction in value/increase in liabilities caused by closure process; inefficient implementation of closure actions.

Summary – Adverse Consequences
• Incomplete closure due to legacy operations
• Incomplete “gates shut” closure
• Value expectations not realised
• Unbudgeted/increased costs
• Excessive time taken for closure
• Inefficient “piecemeal” closure actions
• Complex decision making
• Increased liabilities
• Unsafe conditions during closure actions
• Unsafe conditions from dereliction of disused buildings (arson, theft, vandalism)
• Loss in value from dereliction of buildings
• Loss of key knowledge of the site
• Continuing blight on community

Solutions found included: early definition of end-state vision; single point decision and project management responsibility; integration of closure actions and budgets into a single project; rigorous activity planning; and integration of legal safety management requirements into overall closure project management.

Summary – Solutions
• Site closure objectives and end state vision should be carefully defined
• Site closure should be managed as any other project or organisational change
• Single point project management
• Realistic integrated budget
• Rigorous activity programming
• Integration of legal safety management requirements into overall closure project management.
• Recognise limitations of employee skill sets and support them with specialised service provider skills where needed
• Closing organisations moral responsibility to facilitate re-use of site and avoid blighting communities

Key lessons learned include that site closure should be managed as an integrated project with the same disciplines and management as any other organisational change, and that closing organisations
should recognise the limitations of their skill sets and ensure that site closure actions are in competent hands.

Positive outcomes
Positive outcomes are dependent on objectives but positive outcomes for site closure projects may include:

- HSE incidents avoided
- Clean exit with liabilities transferred or eradicated
- Realistic value expectations realised
- Budgets complied with and timescales achieved
- Redevelopment avoiding blight on communities

Closure of a site or sites is a uniquely painful form of organisational change. It is frequently a decision of last resort, precipitated by some form of organisational or economic crisis. In the circumstances the focus of the closing organisation is often on its own survival and restructuring, and in the immediate aftermath of the closure decision, meeting its direct obligations to those of its workforce who will have to be let go.

In the circumstances it is inevitable that the closure and divestment of physical assets can assume a lower priority and that key decisions may be subject to delay. The time lag between a site becoming disused, and its return to beneficial use, can extend to years or even decades. During this period the trauma and blight caused to a community by a disused, derelict site has significant adverse social, environmental and economic effects.

In these circumstances it is vital that those responsible for the closure of a site recognise that they have a social obligation to effect a rapid, efficient and effective disengagement from the site, so that it can be redeveloped by others and returned to a beneficial use in as short a time as possible.

5. Discussion

This discussion has been drawn from the discussions through the workshop including its closing plenary session, from the conclusions of the organising committee for the workshop and from comments kindly sent in by a number of delegates and NICOLE members after the workshop.

Closure of a site or sites is a uniquely painful form of organisational change. It is frequently a decision of last resort, precipitated by some form of organisational or economic crisis. In the circumstances the focus of the closing organisation is often on its own survival and restructuring, and in the immediate aftermath of the closure decision, meeting its direct obligations to those of its workforce who will have to be let go. For those within the closing organisation it can be a time of trauma and upheaval and it is a phase that all concerned will wish to move on from and forget as quickly as possible. In these circumstances it is perhaps inevitable that the closure and divestment of physical assets will assume a lower priority, that key decisions may be subject to delay, and that necessary investment in the closure process will be hard to justify. There is no doubt that it can take a very long time to turn these closed sites around: the time lag between a site becoming disused, and its return to beneficial use, can extend to years or even decades. During this period the trauma and blight caused to a community by a disused, derelict site has significant and long lasting adverse social, environmental and economic effects.

It is essential that those responsible for the closure of a site recognise that they have a social obligation, to the former workers in the closed facility and to their communities, to effect a rapid, efficient and effective disengagement from the site, so that it can be redeveloped by others and returned to a beneficial use in as short a time as possible. It is also vital that professionals engaged in facilitating the technical aspects of site closure recognise, and take responsibility, for this mission.
It is the issues that are not an organisation’s core business are most likely to be the ones that cause problems. This applies equally to industrial landowners closing a site and to those specialist advisors assisting them. All of us tend to view problems on the basis of our own perspectives. This was illustrated well by the syndicate exercise, where despite delegates being asked to take the widest possible view, the vast majority of suggestions were still technical or technically based ones.

Having a “clear end vision” for the closure process and a dedicated project team are essential to be able to plan and execute a closure of a site. In this context, it is perhaps better to perceive this as a process of transition rather than closure. Where neither a vision (goal) nor a clear plan is in place, the closure will not go smoothly. A number of the meeting presentations and syndicate case studies where there was a lot of confusion about who was in charge and what the aim of the closure project really was. This is not surprising in some circumstances, such as an unexpected closure. However, where internally within the company there is no synchronised action and no overarching decision-making, opportunities for creating value are reduced or lost. It is very important to have a common aim and plan, protocols and procedures for communications, and in particular clear boundaries on who does what. Early actions to motivate key staff who may be disengaged or disgruntled is a key component of this process. These actions may be in conflict with human resource objectives for setting rapid exists for staff, so a strong leadership is needed to find a dedicated site closure team in the face of such competing pressures. A related difficulty is the loss of experience, information, resources and documents that may facilitate the site closure management.

A number of closure options are usually available and time should be taken to assess the opportunities and risks associated with each one and to make a decision aligned with a desirable end-vision; rather than taking a rushed decision based on the most obvious and/or cheapest solution. Where the site closure is part of the restructuring of an ongoing company it may have a major impact on corporate reputation. It is therefore in the organisations best interest to manage the closure process in a way that as far as possible mitigates its external consequences.

Senior management buy-in and clear strategy was seen to be key to stop internal conflicts derailing the closure process. Having access to a team of specialists (e.g. legal, human resources, technical, financial, public relations etc) reduces the chance of an unexpected issue derailing the closure process.

Clear lines of communication are needed with all of stakeholders identified as having a legitimate interest. Partnering with them in the development and implementation of the project plan was seen as an effective way of smoothing a closure process, and there is merit in linking this engagement to an end vision based on “opportunities” that the transition of the site creates.

Not all site closure processes relate to large firms. Often site closures can be linked to smack businesses and family firms. This drastically changes the societal stakes in that the regulatory requirements may be near to impossible for the individuals concerned to bear.

Not all regulatory contexts are predictable. In some countries experience implies that regulatory agencies cannot agree with one another, hence no clear end-vision on for a site is possible, hence remediation and redevelopment may be delayed or even prevented.

6. Concluding Remarks

There are some very wide extremes in outcome from a site closure process. In some circumstances the site closure is part of a smooth transition in the use of a site that brings widely recognised benefits. In other circumstances the site closure may be unplanned and unanticipated and lead to a chaotic situation where a site remains unused and a blight for a long period of time. While economic circumstances are clearly a determining factor for where a site closure will fall across this spectrum, it also appears that poor anticipation and planning play a major role in poor outcomes.

The ideal approach is that the objectives and an end state vision for a site closure process should be carefully defined, with realistic targets. The closure process needs a single point of project
management and rigorous programming of activities. The management of the closure process needs access both to the skills and experiences of site employees and or specialised service providers. Organisations undertaking site closure should recognise their social responsibility to facilitate re-use of site and avoid blighting communities. There was a clear mood in the meeting to move away from a perception that site closure was a negative process where site owners were trying to wash their hands of a site and disengage with it as expediently as possible, to a position of trying to find a shared vision for a positive outcome and a process of transition and re-use for a site.

The workshop set out to develop some kind of ‘road-map’ which can be used in site closure situations. Many of the delegates felt that this was a useful idea, and that a generic “project management” framework could be used (a stepwise process) with specifics relating to closure (checklists / tools in each stage). The overall consensus was that NICOLE should take a stepwise approach. As a first step NICOLE could produce a short leaflet on site closure providing some initial guidance. Given the wide range of regulatory jurisdictions and economic circumstances across Europe, providing a detailed piece of guidance for site closure does not seem very feasible. However, as a second step NICOLE could identify a set of common principles to guide decision making in site closure processes, which users could then fit to their local circumstances. Across its membership NICOLE has a large body of experience and expertise which could be applied to supporting these principles with checklists to support particular technical issues, in particular the “4-D’s”: Dismantling, Deconstruction, Demolition and “Depollution”. This activity was felt to fall into the remit of the NICOLE Brownfields Working Group, with linkages to other Working Groups (such as those for waste and sustainable remediation).
### Annex 1 List of Participants

<table>
<thead>
<tr>
<th>Organisation</th>
<th>First name</th>
<th>Family name</th>
<th>Country</th>
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<td>Adamas Lawyers</td>
<td>Yvan</td>
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<td>Administration de l’Environnement</td>
<td>Sophie</td>
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<td>Adventus Europe</td>
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Annex 2  Case Study Specific Findings

Former Lead Acid Battery Manufacturing Plant Case Study

The syndicate group used the aspects-issues-consequences framework to plot topics identified to pertain to their case, as set out in Table 9.

<table>
<thead>
<tr>
<th>Aspect</th>
<th>Issues</th>
<th>Consequences</th>
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<tbody>
<tr>
<td>Community relations</td>
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<td>Comm Plan + Programme incl nuisance</td>
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<tr>
<td>Contract</td>
<td>Dismantling, demolition, performance / time</td>
<td>Performance requirements (property), fees/ fines; monitoring, [ESCROW]</td>
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<tr>
<td>Storage in tanks</td>
<td>Waste streams, risk of spill, logistics w/ demolition</td>
<td>Conditions for equipment (delivery+ end-use)</td>
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<tr>
<td>WWTP / sludge</td>
<td>May be needed; sludge disposal</td>
<td>Compliance w/regs [licences, records, etc]</td>
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<tr>
<td>Lead oxide paste / waste</td>
<td>Waste disposal</td>
<td>Plan for WWTP+sludge operation in coordination</td>
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<tr>
<td>Work force</td>
<td>Some exit; demotivation; competence of key staff needed</td>
<td>As for (3)</td>
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<tr>
<td>Dismantling</td>
<td>Decontaminate, safety, waste, theft, nuisance</td>
<td>Select key staff; incentivize; social plan for rest</td>
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<tr>
<td>Health and Safety / CLAW</td>
<td>Exposure to lead / acid, ACM, S&amp;GW</td>
<td>Manual+procedures; record-keeping; sign-off; for nuisance see (1)</td>
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<tr>
<td>Internal Comm / strategy</td>
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<td>H&amp;S plan and mngr; training; monitor; records</td>
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<tr>
<td>Security</td>
<td>Theft</td>
<td>Clea missions; internal plan+comm; see (1)</td>
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</table>

The following conclusions were drawn:

• The aspects - issues- business consequence structure offers a useful structure to facilitate discussion

• Structures and frameworks offered may not be easily applicable to all situations however as a minimum checklists are useful and may offer a generic format for a ‘road map’

• Topics, aspects or issues are likely to usually arise in the following categories: people, contracts / requirements, EHS

Metal Refinery Case Study

Aspects & Impacts

- PPC permit – restoration requirements
  - Additional requirements outside permit
  - Relatively clear obligations
- Feasible to get to end point but needs negotiation with regulators to finalise
- Future use – fixed? Likely to be industrial or commercial. But not agreed
- HSE laws, demolition
- Responsible persons
- Timescale, not fixed? ; linked to demolition, & remediation – conflict with ideal timescale for sale process.
- Ability to sell existing legacy operations (sale & lease backs may prevent boundary issues developing / Protect boundaries)
- Shared liabilities? New liabilities?
- Is developer willing to take liabilities?
- Link remediation to permit surrender to liability transfer.
- Zoning unclear – no view from public authority on future use of land and planning
- Interaction between regulators – Environment agency vs. local authority – who have 2 hats, one for planning and one for environmental health.
- Off site contamination? From offsite sources?
- Continuing use of effluent treatment plant for remediation (but to be closed?)
- Financial? No budget fixed
- No central project management
- NO CLEAR END VISION
- No board decisions
- No clear project plan

Issues and priorities

- Get a clear vision
- Get a Project manager (with authority) and a supporting team with clear responsibilities
- Get senior management buy in
- Get the ‘right people’ ‘in the know’ so that all parts of the interacting projects know what other parts are doing
  - Builds consensus and trust
  - Feed regulator (and other stakeholders) a consistent message
  - Communicate a plan (once developed) with measurements of progress, and completion of actions
- Develop scenarios (costs and implications)
- Set budget / provision
- Develop evolving project plan
- Communicate? Who needs to be involved?
- Understand level of control / risk tolerance of the organisation.
- Where do we wish to be on the ‘sell all’ – ‘keep all’ continuum?
- Identify redevelopment opportunities as part of the scenarios.
- Key skills
  - Engage specialists where needed (internal or external)
  - Eg demolition / remediation / also real estate, legal, HR etc
  - Use local workforce if appropriate
- Need a vision that says “at the end of the project we want to be clear…..
  - Who owns the land – us or someone else?
  - Demolished or not?
  - Remediated or not? “

Business consequences

- Counterproductive if we don’t get a clear vision
- Means revisiting works
- Increases costs and timescales
- Influence on Health & safety
  o Fatalities impact reputation and sale process
  o Ad-hoc / unplanned work increases risks
  o Simultaneous works / multi projects increase risks
- Risk to brand & reputation
- Could impact ability of legacy operations to continue & associated contracts
- Land sale ultimately at risk.

Actions and tasks lists

- Identify internal & external resources required and where to source them from
- Including budget
- Clear project (“closure process”) manager with authority
- Clear vision which this manager can aim to deliver
- Clear boundaries of time and budget
- Plan (‘Front End Loading’ or appraise / select plan) – set strategy
  o Identify stakeholders
  o Identify options (matrix?) how to weight them?
  o Identify vision
  o Plan with gates for decisions and delivery
  o Tools and indicators for communication
- HSE review. Stand down?
  o HSE plan and system
- Continuous improvement loops? Iterative process? Lessons learnt?

Ceramics Factory Case Study

Key issues identified were:

- Time constraints
- Economical risks
- Liability transfer
- How to manage/share the risks?
- Time scale of remediation
- Achieving the remediation targets – warranty and costs
- Traffic concerns
- Permitting – regulatory risks
- Quality control of the process
- Risk perceived as “too high”
- Building houses in different phases
- Demands of the building company and the factory owner
- Momentum of signing the contract
- Insurances – continuity of the project
- Dedicated project team (seller, buyer and authorities) looking at the mutual benefits
- Selling of the houses