

SITE INVESTIGATION AND SURVEING AS A KEY TO BROWNFIELDS REDEVELOPMENT

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Abstract

In Central and Eastern Europe countries degraded brownfields are very often located within big urban agglomerations, surrounded by areas inhabited by people. Due to their location they are usually attractive investment areas. However, redevelopment of a degraded area is much more expensive and difficult than analogical investment in the area not utilised yet. Based on the experience gained during realisation of European programme regarding revitalisation of brownfields, the paper presents selected technical and environmental problems that occur in the process of degraded areas revitalisation. Particular attention was drawn to the problems of environment contamination, types of required tests and analyses identifying pollutions as well as characteristic of revitalisation process stakeholders including recognition of their needs.

Streszczenie

W państwach Europy Centralnej i Wschodniej zdegradowane tereny przemysłowe bardzo często znajdują się w obrębie dużych aglomeracji miejskich, w otoczeniu terenów zamieszkałych przez ludzi. Ze względu na swoją lokalizację są one zazwyczaj atrakcyjnymi terenami inwestycyjnymi. Jednakże ponowne zagospodarowanie terenu zdegradowanego jest znacznie bardziej kosztowniejsze i trudniejsze, niż analogiczna inwestycja w terenie dotychczas nie użytkowanym. Bazując na doświadczeniach uzyskanych w trakcie realizacji europejskiego programu dotyczącego rewitalizacji terenów przemysłowych, w artykule przedstawiono wybrane zagadnienia techniczne i środowiskowe występujące w procesie rewitalizacji terenów zdegradowanych. Szczególną uwagę poświęcono problemom skażenia środowiska, rodzajom niezbędnych badań i analiz identyfikujących zanieczyszczenia, a także charakterystyce uczestników procesu rewitalizacji wraz z rozpoznaniem ich potrzeb.

Keywords: **Brownfields, Redevelopment, Environmental contamination.**

1. INTRODUCTION

Characteristic for Eastern and Central European cities non-accurate goods allocation and production, bad predictions about demand and supply led to the setting aside of large areas for the useless production and storage of raw materials. Companies buildups and their premises were often much larger than their counterparts in capitalist economies and sometimes over-equipped. After the bankruptcy of socialist economy and transition to a market economy large area of abandoned, brownfield land appeared. Comparing to the "old" UE, Central European cities have two to three times the amount of space devoted to current or past industrial

uses. They reduce the city and community economic performance and competitiveness. However many urban brownfields can be restored to the new uses. The portion of land devoted to industrial uses is even higher in industrial cities, additionally massive high-rise housing estates were developed beyond the industrial sites (for workers in these industries). All of these cause massive brownfield and restructuring problems.

In general brownfield reuse is more complex to deal with in terms of development than development on greenfield locations. There are many additional factors that require investigation, and there are many more development risks attached to this process. In the case of substantial demolition and environmental clearance

work, there may be a gap of several years before a viable site for redevelopment is available. Common practice by sellers is to remove structures to ground level, this can often lead to the developer's perception that all will be plain sailing, that is until such time that his engineers start the site investigation.

2. ENVIRONMENT CONTAMINATION INVESTIGATION

Contamination is usually a result of human industrial or agricultural activities. Contamination may refer the air, topsoil and the subsoil, surface- or groundwater, vegetation, structures, human health.

When promoting the reuse of the brownfield land, measures need to be taken to record the potential risks related to past land use. Theoretically, there should be records or documentation covering the whole period of site use or production, allowing identification of the type, range and possible effects of pollution. In practice, such documentation does not exist, it is not complete or is unreliable. Also, one needs to remember that society's perception of environmental and human risk acceptability is quickly changing and what is today considered a very risky process may have been, even only 20 years ago, considered a standard practice.

In most buildings and processes their users (customers, workers, managers, etc.) are those who possess the most valuable knowledge on what processes or substances were used and where they were used. Plants however close down, people move away or die and the memory of what went on dies with them. It then becomes necessary to employ specialists to establish the likelihood and type of risk related to past use of the site and its structures. This is especially important when land use will be changing to higher value uses, as in most national legislation the referential or allowable level of contamination is related to the land use. Even on national or regional databases inventories of potential sources of environmental contamination are limited to a few survey points and coherent inventories are lacking.

There are several levels of environmental pollution investigation, each suitable for different purposes and different stages of the project. Table 1 describes the main categories of investigation [1]. National environmental legislation may prescribe or recommend the exact formats under which certain categories of investigation are carried out and national regulating bodies usually certify or verify that the Risk Analysis Report recommendations are acceptable. In some cases

national legislation regulators may also need to certify, on completion of remediation, that the agreed remediation limits were adhered too. Special qualifications and certification is usually needed for anything above an outline investigation. In order to reduce the contamination EU recommend permanent monitoring of air [2], water [3], noise [4], pollutions [5] and mining wastes [6]. Those documents are defining the main directions of brownfields investigations.

The most important component of an environmental pollution hazard is the hazard to health. It can be defined as the quality and quantity indicators of negative and positive health results appearing in people who were exposed to it and as the effects of a harmful factor influences. On individual brownfield sites the exposure and related risks may be influenced by the following elements:

- characteristics of the area,
- identification and choice of chemical compound indicators (evaluation of relationship-dose response),
- assessment of the exposure of people to danger during specific scenarios of exposure (frequency, durability of exposure),
- estimation of chemical substances toxicity (carcinogenic and non-carcinogenic).

3. OUTLINE INVESTIGATION

In the short term the goal is to collect the maximum amount of relevant information. The most significant advantage of such a procedure is the high-end value of information obtainable for minimal financial investment.

Preliminary site investigation aims to assess the site and estimate if, and eventually how, the site is contaminated. Unless there are any boreholes recorded, environmental audits (compulsory for certain industries) or any documents assessing the site available to hand we have to make do with the preliminary investigation. Information about production, processes and substances used shows if there were any possible sources of contamination, which combined with the knowledge about the site use and data from maps, surveys, discussions, geo-environmental maps, geological archives, the local department of environmental affairs and other available sources, should be sufficient for an assessment. This should be in terms of, contamination (sure, probable, unlikely) and hazard (acute, medium, safe), migration of contaminants (far reaching, blocked by natural barriers) and also in

Table 1.
Types of environmental investigations [1]

Outline investigation (desk search from publicly available information)	
when needed	for considering land-use changes for first consideration of site acquisition
what for	to establish whether there is a likelihood of a contamination problem
who does it	experienced professional access to public records and those who may remember what went on site
output	short report indicating site use history and the likelihood of contamination
how much	relatively cheap, 1-2000 Euro, according to complexity
Environmental audit	
when needed	when there is a need or a reason to know more
what for	to record in detail what risk processes and substances were involved, where they are located and to identify grounds for no action, monitoring, further action
who does it	specially certified engineer, minimal, generally non-destructive equipment
output	report identifying and recording the individual risk activities and substances
how much	moderate cost
Site environmental pollution investigation	
when needed	when it is necessary to prove the type and scale of contamination
what for	to establish the amount and type of pollution, structures, soil and water investigation based on extracted and laboratory tested samples
who does it	specialised and certified company, required drilling and specialist analytical equipment and an independent laboratory services
output	large report, presenting the site investigation information
how much	expensive
Risk analyses	
when needed	when the site investigation identifies substantial pollution
what for	evaluates all available information arising from site investigation, intended site use and sets the major parameters for the remediation work
who does it	specially certified engineer or company
output	report containing a set of measures and limits for site remediation project
how much	moderate to expensive

terms of the potential future use (residential, commercial, recreational, industrial), threads (known, expected), interested parties, financing and next steps towards the redevelopment.

Relevant information for preliminary investigation can be divided into following groups shown in table 2:

Table 2.
Sources of outline investigation [1]

General maps:	town plan, local map, plan of distribution networks and grids, land-use limits scheme, GIS resources, orthophoto maps, cadastral map.
Specific maps:	geo-environmental maps (geological, geology, hydro-geological, natural resources, geochemical reactivity of rocks, soil geochemical composition of surface waters, geophysical indicators and interpretation, geo-factors, protected areas), map of rainfall, flood plans, culmination flow rates of nearby streams, nearby boreholes and their interpretation, environmental audits.
General information:	general information about the construction of the object, (disposition, dimensions, spans – gaps, materials used) detailed project, building services, distribution networks.
Use data:	way of use, processes, modes of productions, technologies used (volumes, frequencies), used substances, changes in use, end of use (dates), cultural and historical technical heritage, accidents, emergencies, sudden deaths, fires, leaks.
Information in archives and historical documents:	annals, commentaries, old city plans (prior use of the locality), assessment, any related projects, old photographs.
Information from the site:	walk over, site visit – assessment of the situation, vegetation, animals, colours, smells, quality of water conversation with (former) employees, employers, neighbours, witnesses.
Comparison of legislation:	changes in allowed concentrations.

Unfortunately all necessary data cannot be found under one roof. Queries to different offices and departments are necessary, some sources are by order only. Therefore, it is highly recommended to work with more than one site at the same time.

Also some extraordinary places can be used to collect useful data. Information can be found among the records kept by the army, approval authorities, units specialised in measurement and estimation of environment conditions.

Data obtained during the survey conducted among local residents and former workers should be treated very carefully as there may be some subjective factors.

4. SITE INVESTIGATION

Preparing any site and especially brownfield site investigation, it is important to know what level of investigation is being commissioned and why it is being done. One must remember that surveying the site can be carried out for various purposes and that various level of detail will be required at various stages of site investigation. Table 3 explains various types and levels of investigation.

5. RISK ANALYSES

Risks related to brownfield sites reuse for investors, regulators, consultants and public exceed the risks of greenfield development. But the risks for the individ-

ual stakeholders may not be the same as the risks of the others.

Risks can be effectively managed when objectives for their mitigation are clear and are correctly set at the outset. Table 4 illustrates the principal ways in which risks to brownfield sites can be mitigated.

6. DUE DILIGENCE AUDIT

The evaluation phase is the most important step in the investigation process. Strongly urbanised regions are usually packed with degraded areas. Due diligence analysis should minimise risks and protect investors from liability in real-estate and other business transactions with an all-in-one information service that puts him on a secure legal footing. The auditor should:

- handle with confidence brownfield redevelopment projects and multi-interest, commercial, and industrial real-estate transactions,
- review of historical land records,
- get ongoing coverage of the news. Know the latest requirements and be fully prepared to act on changes and trends in the law,

Table 3.
Levels of site investigation [1]

Desk top investigation (information is obtained from available public sources: internet, press, sellers or agents brochures, public records)	
what for	– initial perception, – orientation information for facilitating further investigation
for whom	– client to consider purchase, – developer to consider the development, – consultants to advice clients first brief, – for sellers to understand the site
involved into the preparation	– individual who needs to know, – individual who is commission to find out.
range of the product	1-3 page outline statements
approximate cost	free service or next to nothing
Outline investigation (can cover various aspect such as ownership, land-use, value of site, cost and potential value of possible development)	
what for	– to establish main fact about the site, – to identify the main risks.
for whom	– client to assist with the purchase decision, – developer to assist with the initial development proposal, – consultants to advice on first development proposals, – regulating authorities to formulate their initial opinion on reuse of the site, – for sellers to understand the risks related to the site
involved into the preparation	specialist project management or surveying practitioner, who may invite other parties
range of the product	10-20 page report
approximate cost	max. 3000 €

Detailed investigation there may be several types of investigation going on proving various facts and risks identified in the outline investigation	
what for	to confirm record and analyse the main facts
for whom	– client to confirm the purchase decision, – developer to formulate the outline development proposal, – consultants to produce specific advice on issues identified, – regulating authorities to formulate their requirements.
involved into the preparation	specialist consultant or lawyers
range of the product	reports of various type, in accordance with commissioning documents
approximate cost	cost money (based on private agreement, but may be regulated by the professional levels of fees)
Specialised investigation for example legal title, ownership, environmental pollution, environmental assets and barriers, demolition and dilapidation schedules, infrastructure availability, condition and ownership, ground and foundation condition, structural reports of existing structures, financial feasibility, outline development proposal, real estate valuation, risk analysis.	
what for	to precisely analyse or confirm needed information
for whom	– client – to elaborate the purchase decision, – developer – to elaborate the outline development proposal, – consultants – to produce specific detailed advice on identified issues, – regulating authorities – to elaborate their requirements.
involved into the preparation	specialist consultant, experts or lawyers
range of the product	reports of various type, in accordance with commissioning documents
approximate cost	cost money (based on private agreement, but may be regulated by the professional levels of fees)
Due diligence detailed analysis reviewing and evaluating all the available information, on complex projects can be carried out at the intermediate level and at detail level	
what for	to confirm or denounce the investment decision
for whom	– client – to accept or refuse the purchase decision, – developer – to accept or refuse development proposal
involved into the preparation	specialist team lead by a senior project manager consultant or by client procurement director
range of the product	purchase/development decision
approximate cost	can cost a lot of money (involves a number of professionals, based on private agreement, but may be regulated by the professional levels of fees).

Table 4.
Environmental risk management

step	what for	product
Analysis	to select, specify and characterise of environmental hazards	a series of analytical maps showing the ecological conditions of the territory – geology, hydrology, climate, soil, biodiversity, positive and negative features of relevant complexes
Interpretation	to interpret focused characteristics of the land	indicators (e.g. sensitivity, ecological importance, carrying capacity) that represent the baseline for the evaluation of environmental problems as well as for the elimination proposals
Evaluation	to evaluate collected records and to determine of ecological problem areas	evaluation of the present land use, its adverse impact from the point of view of ecology and correspondence with the ecological principles
Proposition	to solve the environmental problems of given land and the to optimize of spatial and functional land use	series of measures and propositions for the minimisation of environmental risk associated with measures that focus on the removal of environmental stresses (e.g. decontamination of soil, new air cleaning technologies), propositions for the increase of ecological stability and biodiversity, for the environmental protection and conservation, for the natural resources protection

- read commentary and analysis by recognised experts and authorities,
- identify sources of environmental risk,
- hire and evaluate an environmental consultant,
- conduct a site review (sampling of soil and ground-water),
- purchase comprehensive general liability and property insurance,
- negotiate and interpret an environmental assessment,
- anticipate cleanup requirements and costs. Determine appropriate remediation techniques.

7. SUMMARY

Possibilities for some of the polluted brownfields reuse are, in a way, a function of their pollution. This means that the greater the pollution the higher are the likely costs of rehabilitation. This then directly reduces the chances of site future utilisation. Under such conditions of severe pollution effective remediation can happen only in locations where the market is able to bear such costs or in locations where there is a public subsidy available to cover them. What is actually in the ground can be made clear by site investigation, however it can be proved only by actual remediation. Sometimes it needs not to be the cost of the remediation which is the main problem but the time it takes to remove it (for example polluted groundwater may take several years of pumping to remove the pollution to the level agreed by the risk analysis) and time, as we all know, costs money. There are therefore serious cost risks related to site remediation. Experienced consultants and reliable site investigation of the environmental risks help to keep down unplanned costs of rehabilitation, thus increasing the project's chance of success.

Site investigation is a complex subject on which a team of various consultants usually cooperate. The investigation of brownfield sites is more complex as it needs not only to establish the existing structures and uses but also to concentrate on the sites past uses and processes. Generally, brownfield sites with less "site build up ratio" are easier to survey and to reuse than sites which are heavily built upon, additionally sites subjected to bankruptcy proceedings have specific difficulties.

REFERENCES

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