



SYSTEMATIC APPROACH TO BROWNFIELDS ASSESSMENT IN LITHUANIA *SISTEMĀTISKĀ PIEEJA DEGRADĒTO TERITORIJU IZVĒRTĒŠANĀ LIETUVĀ*

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Abstract. *This paper describes situation of brownfields in Lithuania. The brownfields analysis was made according to the main aspects influencing brownfields redevelopment process the most. This paper presents the existing legislation system relative to brownfields and economic possibilities; the cleaning methods and most popular technologies in Lithuania.*

Keywords: *brownfields, redevelopment, systematic approach.*

Introduction

The value of brownfields redevelopment as a potential for reduction of urban sprawl has become one of the priorities in many countries during the last decade. (“*Brownfields are abandoned, idled or underused industrial and commercial facilities where expansion or redevelopment is complicated by real or perceived environmental contaminations*”). (US EPA, 1996). “*Brownfields are sites that have been affected by the former uses of the site and surrounding land; are derelict and underused; may have real or perceived contamination problems; are mainly in developed urban areas; and require intervention to bring them back to beneficial use*”. (CABERNET*, 2005)). It is clear that restoration and redevelopment of brownfields can provide a range of economic, social and environmental benefits, including restoration of environmental quality and improvement of quality of life citizens, elimination of health threats, provision of land for housing or commercial purposes, creation of employment opportunities, expansion of the tax base for all levels of government, and reduction in the pressure on urban centres to expand into greenfields. Such strategies that reduce clean-up costs, decrease time frames and improve environment quality are mostly accepted of community that makes brownfields redevelopment process sustainable. [1]

The process of brownfields redevelopment is often long, difficult, and sometimes complicated. It is ongoing issue for governments, communities, and consultants around the world. There are four main spheres such as law, economy, environment, and engineering that influence brownfields redevelopment (1 fig.).

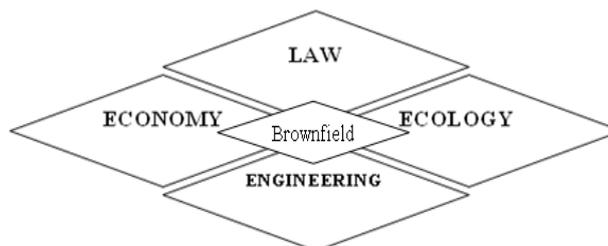


Fig. 1. L3E approach to brownfields assessment

So it is necessary to use a systematic approach in order to reach the most efficient of brownfields site redevelopment because this process routinely involves a lot of activities, and different methods, also all mentioned spheres are closely relative to each other.

Systematic approach in this paper is named L3E approach (L- law, 3E- economy, environment, and engineering). Therefore, aiming to reach the most efficient of brownfields redevelopment, all these spheres must be looked through carefully.

L3E approach

Legal approach. Brownfields redevelopment depends on the policy cycle, which includes identifying a problem, formulating and implementing a programme, examining the intended and unintended effects of implementation and continuing with/modifying or abandoning the programme. The state policy effects on formation of brownfields legal framework. Good working legal system is the key of successful brownfields redevelopment.

There is no special regulation on brownfields in Lithuania. Regulation is done through the environmental and spatial planning system legislations (2 fig.). The environmental legislation is divided into two groups- contaminated territories (soil and water) and construction and demolition waste. Demolition process and waste management are areas related to brownfields redevelopment, but some fields of construction regulation are very close to the regulation of buildings surveillance.

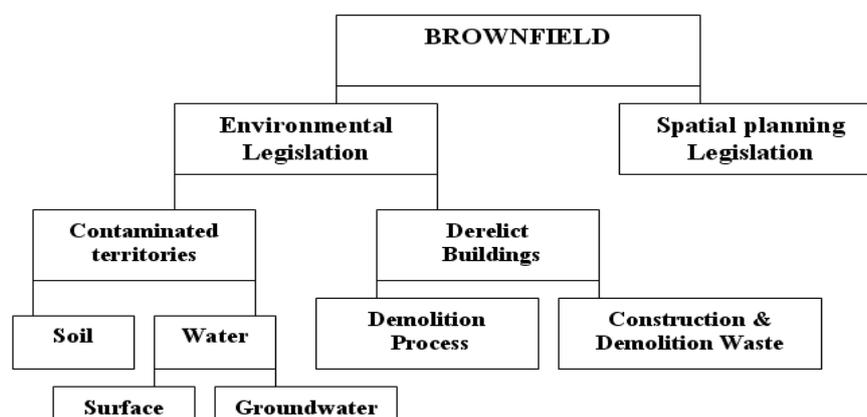


Fig. 2. The system of brownfields legislation in Lithuania

The economic damage to the environment and contaminated sites in Lithuania are provided for the Law on Environment Protection. Persons and users of natural resource in business activities, must take all necessary measures to avoid harm to the environment, human health and property interests, and the damage that was done in their activities, must be eliminated and the environment must be restored if it possible, prior to the initial state, the former damage to the environment, and to compensate all losses. [2]

The field of contaminated territories is controlled by regulations of the Law on Land; the Law on the Underground; Law on Environmental Monitoring; Guideline of Eco-geological Research and some else. There are some more legislations and guidelines of soil pollution assessment and cleaning, also establishing a dangerous threshold values set up by Ministries of Environmental and Health. Some of them are LAND 9-2002 (Soil and groundwater contamination by oil pollution treatment and limitation requirements); HN 60:2004 (Lithuanian hygiene norm 'Dangerous chemicals maximum concentration in the soil'); HN 97:2000 (Lithuanian hygiene norm 'Pesticides and the concentration of the value of the environment'). The National Sustainable Development Strategy provides a comprehensive assessment of soil processes, defines important tasks and measures of implementation regulated by the Strategic Plan of the Environment Ministry in Lithuania.

The main legal act establishing the requirements for the quality of water intended for human consumption is the Lithuanian hygiene norm on the Quality of Drinking Water and on the Programmed Monitoring of the Quality of Drinking Water (transposes the requirements of Directive 98/83/EC). The requirements of the Directive on bathing waters (76/160/EEC) were transposed into the Lithuanian hygiene norm in 2000.

The practice of recording the use of water resources and monitoring the state of the environment is regulated by the State Monitoring Programme, Regulations for the State Environmental Laboratory Control, Procedure for Recording Pollutant Emissions into the Environment, Procedure for Initial Recording and Monitoring of the Use of Water Resources and Pollutants Emitted with Effluents.

There is one more a very important environment aspect according to assessment of brownfields redevelopment. It is construction and demolition waste. There are a lot of legislations and guidelines of construction and demolition waste: the law on Waste treatment; the Introduction of waste treatment; the law on Construction; Technical regulations of construction; Planning documents and some more. The main idea- waste treatment must be done accordance to the waste management hierarchy.

Spatial planning is regulated by the law on Territorial Planning, the law on Construction, the law on Environmental Impact Assessment. The law on Territorial Planning regulates territorial planning and the relation between the individuals, the legal entities and the public authorities involved in this process.

The regulations mentioned above and also a large number of policy plans, strategies and regulations directly or indirectly effect on brownfields redevelopment. On the one hand they may complicate decision making about brownfields redevelopment, but on the other hand they may provide opportunities for integrated problem solving. The existence of specific regulatory incentives would make brownfields redevelopment more efficient, but nowadays there are no specific regulatory incentives in Lithuania.

Economical approach. Looking at the financial issue in a broader perspective, collective benefits such as environmental benefits, improved neighbourhoods, preserved workspace, preservation of greenfields and lessening public health impacts are all important issues and one of the main reasons for developing brownfield areas from the public point of view. Redeveloping brownfield sites may also generate benefits for other private sector parties such as increased property values (commercial and residential) and/or increased value of neighbouring brownfields sites. At the same time brownfields redevelopment has a cost saving effect for third parties in terms of more efficient use of existing infrastructure, transportation, and other public services. Finances on brownfields areas thus should be considered in a broader prospective. Key issues on finance and marketing of brownfields redevelopment are the development of better ways of Public Private Partnership and new forms of financial engineering. A condition to meet thereby is a change towards a more positive image of brownfields. This requires a concentrated strategy and the support of public (European) funding. [1]

All the damage made to environment must be recovered according to “Polluter pay” principle in Lithuania. Therefore, the owners or polluters must remedy contaminated sites and developed derelict buildings using their funds. But there is a lot of historical contamination and ownerless abandoned buildings in Lithuania, so county and municipal administrations are responsible for the liquidation of construction and contamination cleaning. However, the government annually gives about 2 million Lt since 2006, because the municipalities and counties are not able to finance for the clean-up mechanism. Currently, the program of derelict buildings liquidation is framed using structural funds of EU and also public funds.

Environmental approach. Brownfields have an effect on environmental media as air, soil and water, and also waste as well as the consideration of natural assets. There is a challenging

need to generate multidisciplinary integrated approaches, in order to achieve well balanced regeneration schemes to improve quality of life in urban areas. To prevent negative impacts on the surrounding areas, even without regeneration, these sites require management and monitoring, leading into societal costs. Contamination of soil and groundwater is just one of the many environmental problems which have to be dealt with in brownfields redevelopment. Lithuanian Geological Survey under the Ministry of Environment (*lith.* LGT) has done the inventory of contaminated points in the 21 municipalities from the beginning of 2000 years till the end of 2007. About 40 percent of territory was inventoried during this time in the country. The 6071 potential pollution points are registered to the database of the information system of contamination from the total data of the questionnaires that are 6719, in which 1252 are the number of the declarations. About 570 of the declaration were received from municipal authorities and 680 ones from legal and natural persons. The number of given data represent only about 1 / 5 (could be) potential pollution sites in the territory of Lithuania. [3]

The eco-geological investigations were not done but the risk of contamination to the geological environment (surface water and groundwater also soil) was preliminary assessed in this inventory time. National inventories of contaminated lands are typically established for earlier sectorial databases of military facilities, municipal landfills and oil spills of petrol stations, mining sites, radioactive contaminations, chemical plants and storages (pesticide, fertilizer). Occasionally, inventories are based on the register of polluting sources (i.e. industrial facilities). Inventory databases are managed by the central agency, but in Lithuania, local governments are obliged to register contaminated sites on their administrative territory. The most contaminated sites are with petroleum hydrocarbons in Lithuania compeering with other polluted areas. There are more than 650 petrol stations in the country, and 250 of them are old ones. The total amount of contaminated area there exceeds 3-5 mln. m². Total area of oil business objects in Lithuania makes up 600-700 ha, but contaminated groundwater below it occupies 52-62 mln. m². Former Soviet Union objects make a single pollution source. The indirect data show that such objects occupy about 3 mln. m². [5]

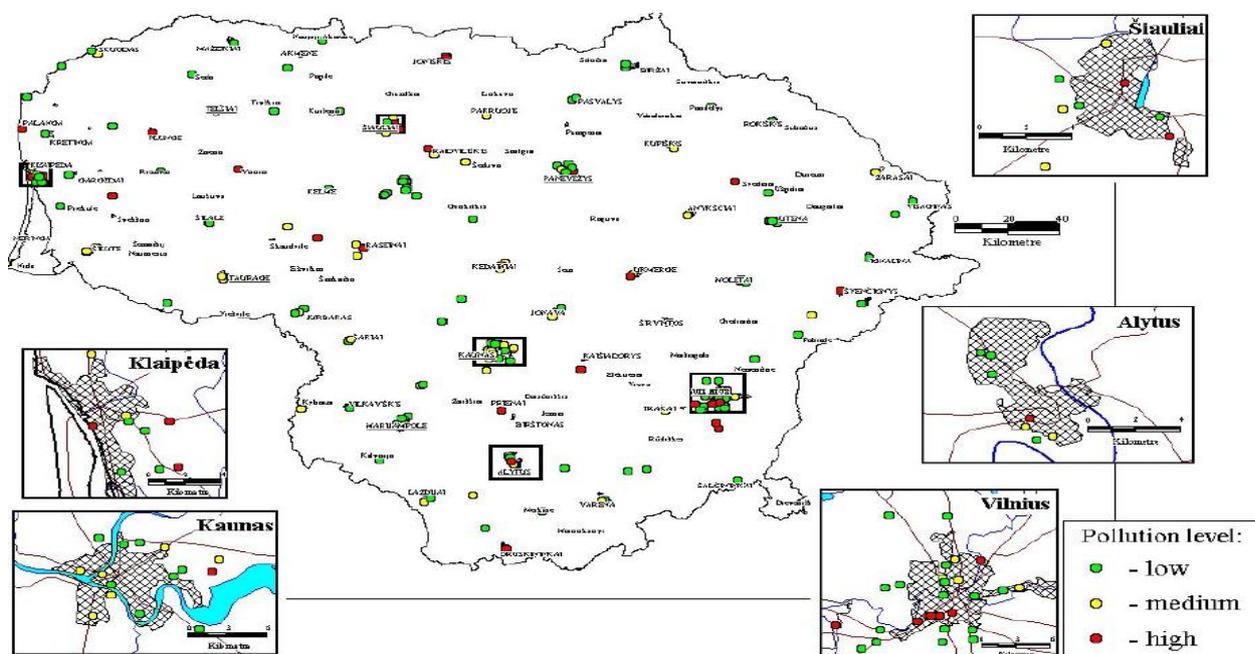


Fig. 3. Level of soil contamination with petroleum hydrocarbons in Lithuania [5]

According to Lithuanian specific conditions the main purpose of the limitation of subsurface contamination first of all is linked with groundwater protection especially because of Lithuania exclusively uses only groundwater for drinking water resources. Usually the

principal task is the stopping of spreading of contaminant in aquifers and the main condition for remediation of the territories with high and very high contamination levels is the removal of free phase petroleum products.

The fundamental principle of 'environment friendly' use and/or dismantling/demolition of derelict buildings and infrastructures are based on successful disposal of materials, water and energy. This is a similar hierarchy to the one applied to waste management, i.e. minimize, reuse, recover, recycle, dispose. Retention of buildings and infrastructure can include all elements of the hierarchy, but is predominantly focused on minimization of non-renewable resource consumption during the dismantling/demolition process and on the reuse of non-renewable resources that have already been consumed.

The priorities of management and inventory of derelict buildings in Lithuania are set in every year. According to country and municipal administrations reports, the 5421 buildings that do not have owners (or whose owners are unknown). For the construction of 2220 planned to take court action for the recognition mechanism, 363 objects in 2007 already recognized mechanism. Most of the buildings are abandoned; derelict or semi destroyed and the condition are very crash. Some of them are former of piggeries, cow-houses, droppings, mechanical workshops and various stores. Such buildings deface landscape, may pose a threat to the environment, human health or even life. Most of the derelict buildings are in rural areas.

Public administration made the lists of derelict buildings which has no owner (or whose owners are unknown) as well as organized the recognition mechanism procedures by initiative of the National Territorial (Spatial) Planning and Construction Inspectorate under the Ministry of the Environment. According to the lists (mentioned above) of 2007, 19 such objects (Pagėgiai municipality - 5, Skuodas district - 5, Šiauliai district -7 and Raseiniai district - 2) were demolished and cleaned their territory, using state budget funds.

Engineering approach. Brownfields redevelopment processes usually deal with buildings demolition (according to hierarchy of waste management: minimize - reuse - recover – recycle - dispose) and territories cleaning (if the territories are contaminated). There are some different ways of demolition, but mostly all of them leave a lot of waste. The main methods of demolition are manual (pneumatic hammer), machine (percussive breaker, hydraulic crusher, wrecking ball), mechanical (machinery), wire saw cutting, drilling, thermal lance, water jet, cutting and lifting machinery. The choice of demolition method depends on the project conditions, site constraints, sensitivity of the neighbourhood and availability of equipment. Some of demolition methods are applicable for most sites, particularly for those situated in busy urban areas. Other mechanical methods applied from the outside of the building may be suitable for projects that have sufficient clear spaces.

There are some buildings demolition companies in Lithuania, but almost all of them are in the biggest cities of country (Vilnius, Kaunas, Klaipėda, Šiauliai, Panevėžys) as well as the recycling companies of construction and demolition waste, i.e. in the regions where the biggest amount of them (more than 90 %) are produced. Sorting of waste and separate delivery to recycling companies is the main condition to recycle construction and demolition waste, to produce good quality secondary material. It is important to separate waste in demolition process, in selective demolition. According to the data of waste accounting 580 thousand tones of construction and demolition waste were produced in 2003, and it considered almost 12% of the total amount of waste. But this number has increased about 70% at last years. The reasons are very different. First of all, waste accounting system became more correct and modern, the requirements of landfills became stricter, also construction processes became more intensive and some else. The amount of recycling construction and demolition waste increased in the country as well. [4]

But almost always one of the main procedures in demolition process is cleaning of territories. Remediation of contaminated soil is normally a difficult and expensive operation. It is

however often of high priority and is thus undertaken in spite of costs. Soil contamination is very often responsible for groundwater contamination and can, therefore, create even more challenging problems to solve. Remediation technologies are very many and varied but can be categorized into these methods: *In situ* and *Ex situ*. *Ex situ* methods involve excavation of impacted soil and subsequent treatment at the surface, and *In situ* methods seek to treat the contamination without removing the soil. Well-chosen method and technique of contaminant elimination is the key of brownfields redevelopment efficiency.

The clean-up process of contaminated soil in Lithuania was begun fifteen years ago. The cleaning of contaminated soil surface began the company of microbiological technologies ‘Biocentras’ but the cleaning of deeper layers of soil began the hydrogeological company ‘Grotas’ that is probably the one in the country who has the biggest experience using the site remediation *in situ* methodology. The company has two main cleaning technologies (see below 4 and 5 fig.):

- *Ex situ* – bioremediation using bacteria and some plants;
- *In situ* – pump and treat; vacuum extraction; bioremediation using bacteria.

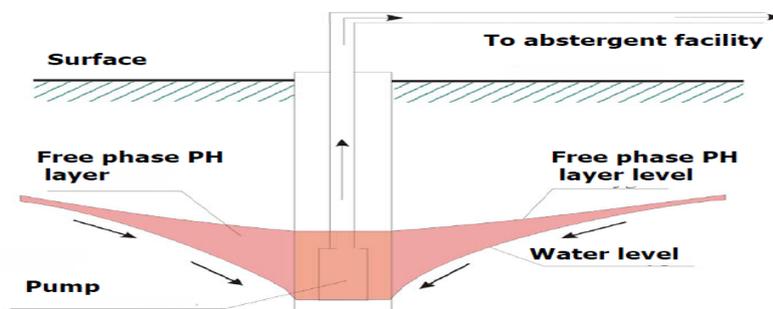


Fig. 4. ‘Pump and treat’ (in situ) method scheme [5]

The technology of ‘pump and treat’ is the traditional method of groundwater remediation. It is a costly method because it requires pumping water for years and sometimes decades to reach acceptable contaminant concentration levels, due to contaminant mass transfer limitations. Another technology is soil vacuum (vapor) extraction. It removes contaminants from the unsaturated soil zone by pulling a vacuum.

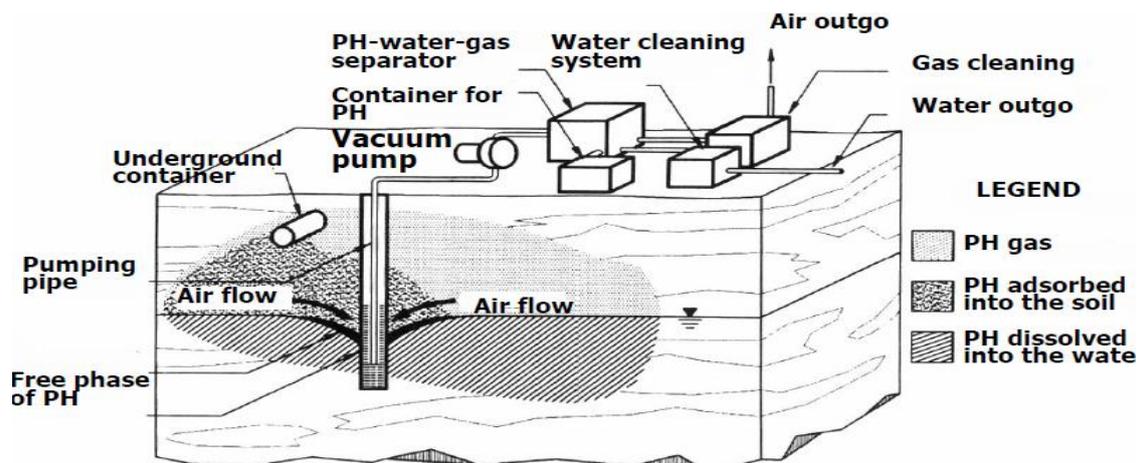


Fig. 5. Vacuum extraction (in situ) system [5]

Nowadays the biological methods of soil cleaning technology *in situ* are very popular. These methods have some advantages - excavating and transporting the soil is needless, that makes process complicate on the much built sites, especially problematic is the installation of specific platforms. In the process of technology choosing it is necessary to pay attention to

many factors such as soil structure of granules, type of contamination, distance till stationary bioremediation platforms, development peculiarity of contaminated territories, possibilities of techniques protection also economic and some other factories. The best decision of process choosing is based on the best available techniques. But first of all, it is necessary to improve prevention process and do the best in order to escape emergency petroleum and other pollutions spilling in to the soil.

Discussion

This paper has tried to develop a systematic approach to analyses of brownfields redevelopment process in Lithuania from legal, financial, environmental and engineering points of view. Brownfields has not a separate field in the policy of the country. The problems of brownfields are usually solved according to contaminated territories or derelict buildings points of view. But not always such method of solving problems is more efficiency.

There are necessary improvements in all spheres mentioned in the part of L3E approaches, aiming more efficiency of brownfields redevelopment. Some of them:

- to provide legal incentives/regulations to encourage brownfields development and discourage greenfields development;
- to reduce financial barriers and provide incentives.

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References

1. Regeneration of European Sites in Cities and Urban Environments (RESCUE), Best Practice Guidance for Sustainable Brownfield Regeneration, 2005.
2. The law on Environment protection.
3. Lithuanian Geological Survey under the Ministry of Environment, Annual report, 2007.
4. Miliūtė J., Staniškis J.K., Analysis and Possibilities for Improving the Lithuanian Construction and Demolition Waste Management System, 2006.
5. Šečkuvienė R. Hydrological company "Grota", Investigation and remediation of sites contaminated with petroleum hydrocarbons in Lithuania, 2006.