

SMALL-SCALE POTENTIAL BROWNFIELD REGENERATION IN TOKYO: SOIL CONTAMINATION EXPOSURE ASSESSMENT

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ABSTRACT

Brownfield (BF), where land is low in use and soil is contaminated, is described as an unfortunate but spontaneous consequence of maturing industrialized urban economies as the factories start to relocate in remote regions and developing countries. Previous studies demonstrate that the valid reuse and regeneration of urban BFs has become an important part of urban development policies in many countries, but Japan is still at the relatively primary stage of BF issue emphasizing on decontamination. Since the 1990s, the continuous hollowing out of manufacturing firms results in high possibility of BF closure, especially in eastern Tokyo. This area is predicted to be dominated by less popular typical mixed residential and industrial land use without good infrastructures in the near future.

BF regeneration in Japan has not been examined comprehensively despite its importance. Abundant studies have been conducted on soil contaminants through geochemical modeling, impact assessments, and risk assessments. Academic evidences also support the importance and significance of BFs in urban planning. However, a linkage bridges the soil contamination patterns and neighborhood planning is missing. Therefore a middle-ground approach minding the gap but unbiased on either is needed. To improve and to readdress the importance of understanding the soil contamination exposure before lands have been abandoned, the author invents an analysis to “pre-defreeze” the problematic potential BFs in the future context.

The purpose of the research is to integrate soil contamination distributions and

neighborhood conditions of small-scale potential BFs in mixed residential and industrial area to deliver regeneration restrictions and suggestions. Thus, an analytical scheme “Soil Contamination Exposure Assessment” to facilitate understanding of soil contamination exposure is generated. North Sumida, as a hotspot of local small-scale manufacturing industries with the majority covered by typical mixed residential and industrial zone, has already encountered BF problem and the issue tends to become more severe. Specific 32 chochomoku, the smallest planning and census unit in Japan, from mixed residential and industrial zoning are selected as specific study sites. The presently operating manufacturing firms, laundry stores, and gas stations are identified as potential BFs. The assessment results of potential BFs contribute to corresponding regeneration suggestions.

The analytical framework assesses soil contamination exposure by layering soil contamination and human exposure. First of all, the nature and properties of existing BFs and potential BFs are first reviewed for overall comprehension of the issues in the study area and for quantification of indicators. The area ratio of the most dangerous Category I, i.e. manufacturing III-A firms and gas stations, together with population density per km² are served as soil contamination indicator and exposure indicator joint to evaluate soil contamination exposure degree in chochomoku-level. On the other hand, four scenarios are created out of the assessment results. The most troublesome scenario with highest soil contamination is identified and emphasized by urgency and necessity of treatments. Move on from that, the second stage of more flexible utilization of various extents and ranges of land use controls on human activities and anthropogenic intervention on contamination regulation are assigned to each scenario. Finally, the developed analytical framework is applied and merged into existing urban planning scheme thus the practical implementation of study outcomes is addressed.

The nature and stock of current and potential BFs reflected by Specified Facility Sites (SFSs) and potential BF database respectively have been discovered. The main findings demonstrate that existing BFs in forms of SFSs are small and with hazardous substances, reducing with a stable ratio of 3.8% per year. Around 11% of closed SFSs are presently vacant lots. The consistency is observed from 1708 potential BFs in database, where 85% of sites are smaller than 200m² and annual closure rate is up to 3.7%. For spatial distribution, the potential BFs are found denser near the pure industrial zone. The currently limited uses of closed BFs should be improved. Also, because of the high vacancy and low-use of closed SFSs, utilization is predicted to be problematic and in needs of improvement after the shutting down of businesses.

Furthermore, scenarios imply differences in soil contamination exposure of the 32 chochomoku. To be more specific, Tachibana 5 and Yahiro 2 are classified as Scenario High Soil Contamination/ High Exposure (HH) and investigation and remediation obligation is suggested to the scenario. Sumida 5, Tachibana 6, Oshiage 1 and a few other chochomoku at the edge of the study site belong to Scenario Low Soil Contamination/ Low Exposure (LL) with the minimum soil contamination exposure. In addition, Tachibana 1 with a cluster of collective apartments and Bunka 2 with a large piece of industrial land use of individual company respectively represent Scenario LH and Scenario HL in this study. Among the four scenarios, the priority of monitoring and countermeasure should be allocated to Scenario HH.

According to differed levels of soil contamination exposure, varied recommendations and suggestions are given to each scenario which contribute to more effective and efficient uses of potential BFs. Scenario HH is recommended to have strict interventions on soil contamination and no more intense than low-density land uses, while Scenario LL accepts greater extents of control and loose restriction that even urban agriculture is possible to be

permitted to happen in the cleanest case there. For practical urban planning advice, the layering with needs of parks shows how different suggestions are distributed in various scenarios. For the future direction of the research, improvement of indicators and extension to site-level assessment are crucial.

Keywords: brownfield regeneration, soil contamination exposure, urban land use