Paper 280

Assessment Methods for Secondary Environmental Impacts during Industrial Site Soil Remediation

With rapid industrialization, soil contamination at industrial sites has become a significant environmental challenge, involving pollutants such as heavy metals, organic compounds, and persistent chemicals, posing potential risks to the environment and public health. Soil remediation, as a key pollution control measure, aims to remove or stabilize contaminants and enable land reuse. However, during remediation processes, soil disturbance, contaminant migration, and the use of treatment media can generate secondary environmental impacts, including airborne dust, wastewater discharge, energy consumption, and greenhouse gas emissions. If uncontrolled, these secondary impacts can undermine the environmental benefits of remediation projects and introduce new environmental risks. Therefore, establishing systematic assessment methods for secondary environmental impacts is critical for the green design and sustainable management of industrial site soil remediation.

Secondary environmental impacts of soil remediation are influenced by multiple factors, including remediation technology (e.g., thermal desorption, chemical stabilization, bioremediation), construction procedures, choice of treatment media, energy consumption, and contaminant characteristics. Different technologies and processes may simultaneously remove pollutants and generate significant energy use, wastewater, greenhouse gas emissions, and noise or dust pollution. A comprehensive evaluation of environmental performance requires integrating direct pollutant removal benefits with potential secondary environmental burdens, establishing quantitative assessment indicators, and analyzing data from both engineering simulations and field monitoring.

This study proposes a methodology for assessing secondary environmental impacts during industrial site soil remediation. By developing a multi-source data coupled model, the effects of different remediation technologies and operational parameters on air, water, and greenhouse gas emissions are analyzed to evaluate secondary environmental loads and potential risks. In combination with life cycle assessment (LCA) methods, the overall environmental performance of remediation projects is quantified, providing guidance for design optimization, technology selection, and operational management. The approach offers a scientific tool for environmental

evaluation in industrial site soil remediation, supporting green construction, low-carbon operation, and sustainable land management.

The findings not only help identify potential environmental risks during remediation but also provide theoretical and engineering references for policy development, technological improvement, and industry standards, promoting efficient, green, and sustainable soil pollution control in industrial areas.