

Remediation of contaminated soil and groundwater

Motoyuki Asada[1]

[1] Institute of Tech., Shimizu Corp.

<http://www.sit.shimz.co.jp/W3/html/>

The problem of the soil contamination in Japan stems from Ashio Copper Mine about one century ago. The Itai-itai disease by cadmium and Minamata disease by methyl-mercury was caused in the 1960s.

The event for the establishment of the legal system of the soil and groundwater contamination prevention in the city area happened in 1978 at Love Canal in Niagara Falls city, New York State, in the United States. 200 or more kinds of chemicals were dumped by the electrochemistry company from 1942 to 1952. The chemicals damaged the health of the residents who live on or near the dumping site. The Comprehensive Environmental Response and Compensation and Liability Act of 1980 (CERCLA or Superfund Act) in order to remediate the pollution area where the toxic substance dumped in the past was enacted.

In Japan, the illegal dumping of the hexavalent chromium happened in 1975 in Tokyo metropolitan area, and the soil pollution in the city area has been recognized.

In case the remediation of soil and groundwater contamination is performed, the goal must be set to the Environmental Quality Standards for Soil Pollution and Ground Water Pollution regulated in the Basic Environment Law. These laws also must be observed, such as Agricultural Land Soil Pollution Prevention Law, Wastes Disposal and Public Cleaning Law (Act of Waste Disposal), Water Pollution Control Law, Law Concerning Special Measures against Dioxins, and the regulations of each self-governing body. The soil pollution prevention act in imitation from the super fund act was enacted in May, 2002.

In 1975, the standard of waste landfills is defined as a stable type, a managed type, and an intercepted type, triggered by the illegal dumping of the hexavalent chromium happened in 1975 in Tokyo metropolitan area.

The soil contaminated by heavy metals has been filled at the managed landfill site; for example, the mercury contaminated sludge dredged from Minamata bay from 1977 to 1990 was contained in the 58ha of the reclaimed land. The total volume of the dredged sludge containing 25 ppm or more of methyl mercury reached up to 1,510,000m³.

In order to prevent the contamination of groundwater by the leaching from the landfill site, the barrier structure standard of the landfill sites was defined in 1998.

For heavy metals contamination, the solidification and immobilization technology are commonly used in many cases. According to the grade of contamination, new remediation technology, such as soil washing, thermal desorption, and vitrification method, are sometimes used together.

For volatile organic compounds contamination, remediation technology, such as the soil vapor extraction method developed in the U.S., is performed widely. Moreover, new remediation technologies, such as bioremediation and a reactive groundwater remediation wall, are on trail. Recently, monitored natural attenuation method, which uses the natural purification ability with detailed monitoring, is also performed, because the positive remediation of the contaminated groundwater is recently recognized to consume enormous time and money.

In this paper, the author presents the remediation technologies of contaminated soil and groundwater.

For heavy metals contamination, the solidification and immobilization technology, soil washing, thermal desorption, and vitrification method are commonly used in many cases.

To prevent the volatile organic compounds contamination, remediation technology, such as the soil vapor extraction method, bioremediation and a reactive barrier wall, monitored natural attenuation method are performed widely.

It is required for the remediation engineers to select suitable and economical technology from many of such new technologies according to the site conditions.