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Performance Inspection and Climate Change Adaptation Measures for Final Waste Disposal Sites with Life Prolongation

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Promotion of the 3Rs (reduce, reuse and recycle) has brought about a recent decrease in amounts of landfill waste, prolonging the life of landfill sites past the planned period. How such landfill sites are operated and maintained is becoming more important in preventing environmental pollution problems from arising. The current state of these problems is not yet clear.

In addition, recent changes in precipitation have increased the risk of leachate generated in unanticipated heavy rain overflowing from landfill sites because of the small capacities of storage reservoirs and leachate treatment facilities. Proper leachate management strategies should be developed as a climate change adaptation measure, considering future changes in precipitation.

The objectives of this study on landfill sites for both municipal solid waste and industrial waste have been: 1) to clarify problems caused by landfill life prolongation and recent climate change in the operation and maintenance of landfill sites and the current state of performance inspection; 2) to compile one manual each on performance inspection and climate change adaptation measures based on the results of 1); and, particularly, 3) to propose a renovation strategy and cost reduction measures for leachate treatment facilities.

As to the results, 1) a questionnaire survey for landfill sites of municipal solid waste and industrial waste in Japan revealed prolonged lives of most landfill sites beyond their planned period, a variety of problems in the operation and maintenance of landfill structure and leachate treatment facilities, and low execution rates in performance inspections conducted by third-parties; 2) a performance inspection manual considering prolonged lives of landfill sites was successfully compiled, as was a climate change adaptation measure manual; and 3) in the climate change adaptation manual, a numerical model was developed to predict leachate generation, with vertical venting pipes considered. The model was applied to two actual landfill sites in Japan to confirm its effectiveness. Future leachate generation in each region was predicted using the model and maximum precipitation data for as far ahead as 2100. A case study of renewing a leachate treatment facility showed that bypass treatment, where some leachate treatment processes are bypassed, was effective at preventing leachate overflow during heavy rains. Finally, a feasible strategy for performance inspection and renovation of leachate treatment facilities at existing and new landfill sites was proposed.

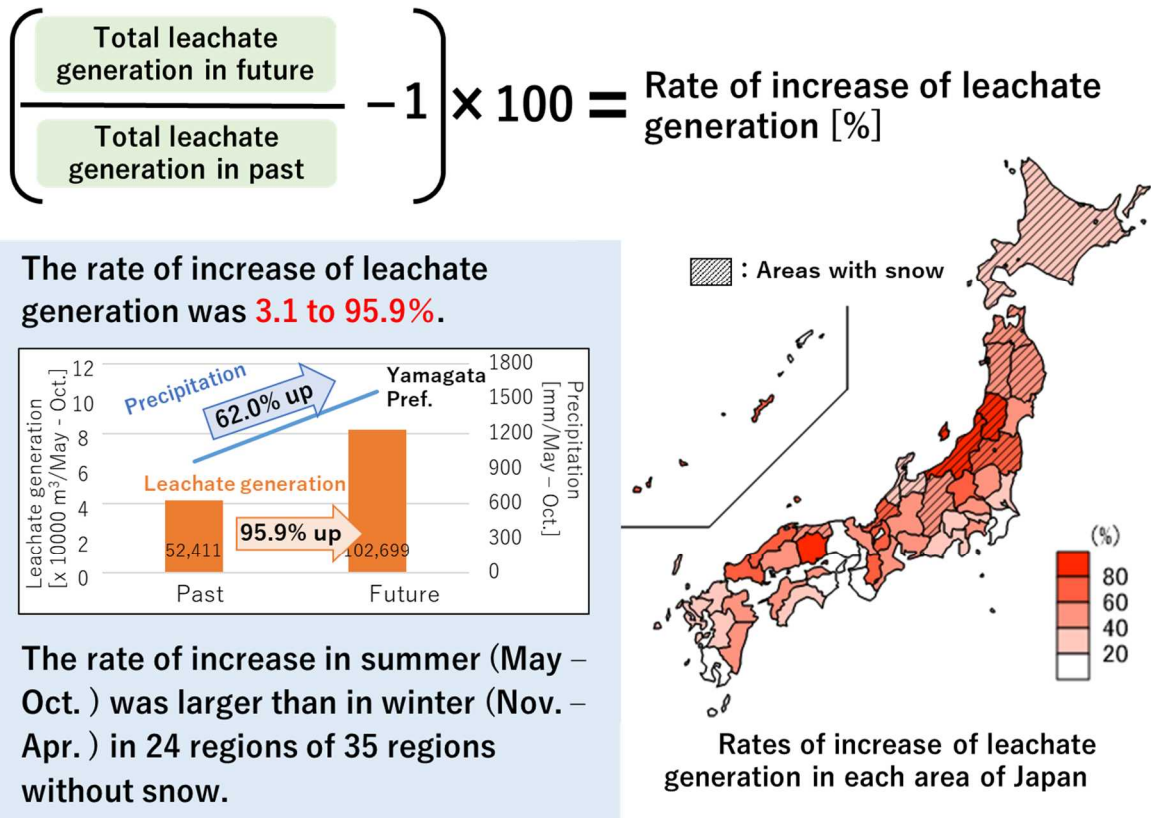


Fig. 1 Rate of increase of leachate generation by 2100 resulting from changes in precipitation, by area in Japan.

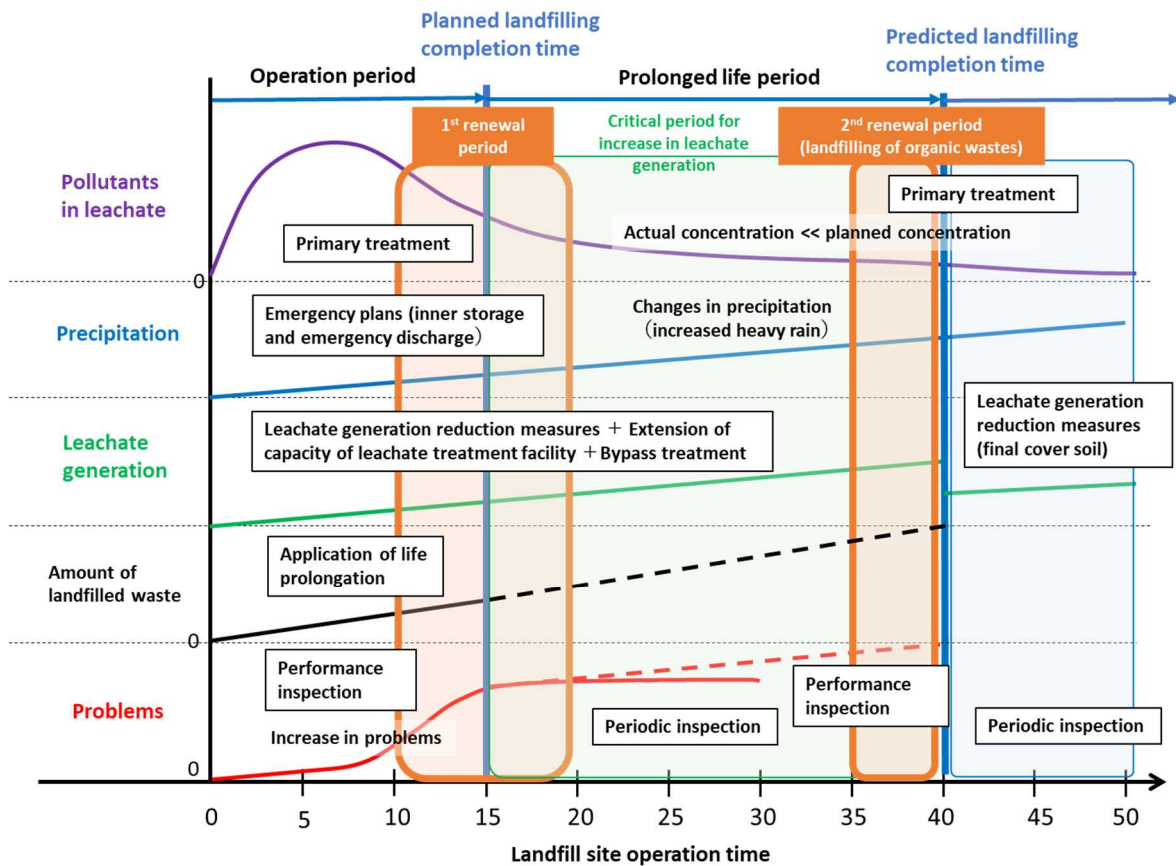


Fig. 2 Considerations for landfill site performance inspections and renovation of leachate treatment facilities (assuming the life of landfill site is prolonged from 15 to 40 years).