Joint Research on Future Concepts of Efficient Sanitary Sewage Treatment Systems (Saitama City)

Year of research	2009～2010	Research of resource and energy in sustainability

(Goals)

Saitama City has established one wastewater treatment plant and 2 night soil treatment plants. The two night soil treatment plants began operation one year apart, and the investment required during their reconstruction or renewal periods might be concentrated in a short period. It is predicted that the future rise in the percentage of sewered population will reduce the night soil treatment population to about half of its present level, so it is necessary to work to construct efficient sanitary sewage treatment systems by linking night soil treatment plants to wastewater treatment plants, which are facilities similar to sanitary sewage treatment plants. The goal of this research is to predict the future quantities of night soil and septic tank sludge to study the quantity which can be accepted when accepted by wastewater treatment plants in the future, the impact on wastewater treatment plants, and effectiveness of their joint use.

(Results)

(1) Estimating sludge generation

Based on the planned total population, target percentage of sewered population, average rate of connection to the sewer system in the previous year, the night soil treatment population was estimated, then multiplied by the night soil/septic tank sludge unit load obtained based on measured values, estimating the sludge generation.

(2) Study of equipment reconstruction for acceptance

Night soil/septic tank sludge are accepted by digestion tanks of wastewater treatment plants. Under present circumstances, the moisture content of thickened sludge is high and the quantity of sludge is large, so there is no leeway in digestion tanks. It is, therefore, necessary to reconstruct thickening systems and to reconstruct the agitation equipment in digestion tanks.

(3) Comparison of project costs

The cases in Table 1 were set considering the positional relationship of various facilities, and the period when acceptance is possible and approximate project costs were calculated based on the estimated sludge generation (Fig. 1). The items calculated were, for wastewater treatment plants, cost of the facility reconstruction in (2) and the increase of the maintenance costs (rise of electric power consumed by water treatment equipment resulting from the increase of sludge disposal quantity and rise of the recycle flow load). For the night soil treatment plants, when used continuously, the items calculated were the renewal cost and maintenance cost of the overall facility, and when used to transmit

pre-treated sludge to a wastewater treatment plant, the items calculated were the renewal cost and maintenance cost of the pre-treatment and deodorization equipment and the construction cost and maintenance cost of sludge transportation equipment. And compared with the case where a night soil treatment plant is used continuously, in case 4, the cost is lowered by about 450 million yen per year.

Table 1. Test Cases

Case	Night soil treatment plant A (Collection area A)	Night soil treatment plant B (Collection area B)
1	Sludge from area A is pre-treated by night soil facility A, then supplied to the adjacent trunk sewer of the regional sewage system.	Continuous use
2	Sludge from area A is pre-treated by night soil facility A, then transported to the urban wastewater treatment plant by motor vehicle.	Continuous use
3	Continuous use	Sludge from area B is pre-treated by night soil facility B, then supplied to the adjacent wastewater treatment plant.
4	Halted	Sludge from areas A and B is combined and pre-treated by night soil facility B, then supplied to the adjacent wastewater treatment plant.

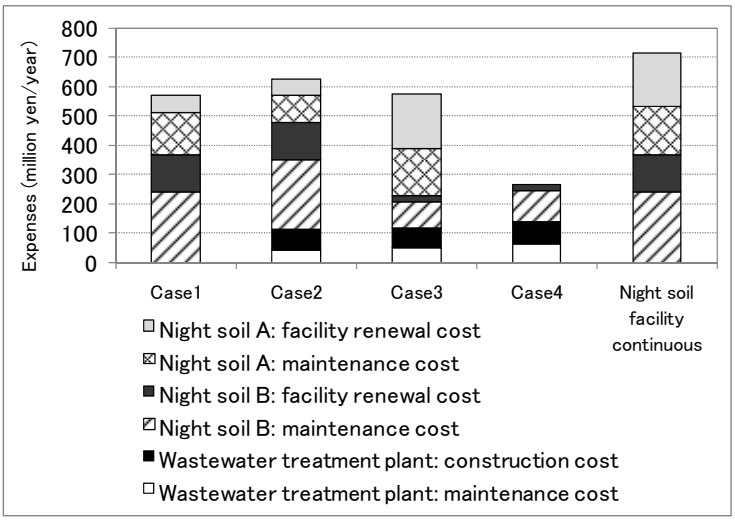

Figure 1. Comparison of Approximate Project Costs

(4) Impact on water treatment of accepting night soil

The acceptance of night soil increased the T-N load by 15% and the T-P load by 14% from those of the influent sewage. This confirmed that it is possible for wastewater treatment blowers to handle an increased load during normal times.

(5) Study of the effective use of biomass

In case 4, the acceptance of night soil/septic tank sludge increased the digestion gas about 1.7 times from its prior level. Trial calculations revealed that, in addition to the effects shown in Figure 1, using the digestion gas to generate electric power cut the purchase of electric power by about 30%, and using the waste heat from electric power generation to heat the digestion tank, cut the quantity of heavy oil used for heating, achieving effects of about 1.5 million yen per year.

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Key words	Biomass, receiving night soil, anaerobic sludge digestion