THE STUDY ON METHOD OF APPROPRIATE SITE SELECTION CONSIDERING ENVIRONMENTAL RISK MANAGEMENT

K. NAKAISHI*, F. IGARI** ,K. HAYASHI°, M. SAITO°°, K. KUWAMOTO[#] AND M. HANASHIMA[##]

**LSA,NPO(Environmental Excellent Engineering Co., Ltd., 1-11 1-Chome Minami-ikebukuro Toshima-ku Tokyo 171-0022 Japan)*
***LSA,NPO(Oyo Corporation, 61-5 2-Chome Toro-cho kita-ku saitama- city Saitama Pref. 331-8688 Japan)*
°LSA,NPO(Maeda Corporation 10-26 2-Chome Fujimi Chiyoda-ku Tokyo 102-8151 Japan)
°°LSA,NPO(Yachiyo Engineering Co., Ltd., 18-12 2-Chome Nishi-ochiai Shinjuku-ku Tokyo 161-8575 Japan)
[#]LSA,NPO(Towakagaku Co., Ltd., 10-2 Nihonbashihakozakicho Chuo-ku Tokyo 103-0015 Japan)
[##]LSA,NPO(Landfill Systems & Technologies Research Association of Japan, NPO)

SUMMARY: Aiming at proper and smooth implementation of the landfill site construction accepted by inhabitants, we have been conducting a research to establish a method of appropriate site selection as one of activities covered by the Landfill Systems and Technologies Research Association of Japan, NPO.
In this study, method of appropriate site selection that minimizes environmental risk in the implementation of the landfill site construction is proposed. Minimizing environmental risk is performed by managing risks caused by leachate leaks from landfill sites. Especially manageable parameter of environmental risks caused by leakage was proposed.

1. INTRODUCTION

Local opposition arises against the landfill site construction in Japan. One of the causes results from the residents' concern of the landfill site, for example a fear of environmental pollution from these landfill sites. As a result, landfill capacity is tight condition. In this context, the method of appropriate site selection that minimizes environmental risk will be useful gaining inhabitant's trust for landfill.

The landfill is facility which manages the risk. It's consists of a variety of risk. In this study, risks caused by leachate leaks from landfill sites have been studied from the point of the

Proceedings Sardinia 2005, Tenth International Waste Management and Landfill Symposium
S. Margherita di Pula, Cagliari, Italy; 3 - 7 October 2005

influence of it on inhabitant's trust for landfill sites. Risks caused by leachate leaks are shown as equation (1).

Risks caused by leachate leaks = The incidence of leachate leaks × The extent of influence (1)

In this study, we selectively study the minimizing the factor of influence after the leachate leaks.

The point of the environmental risk management on appropriate site selection is evaluation for candidate's function that prevents leachate leaks from spreading through site boundary. The appropriate site requires one of the terms that are described to the following:

- The ground condition which prevents leachate leaks from spreading through site boundary
- The geological condition which takes measures to prevent leachate leaks from spreading through site boundary

If the site be unsatisfied the above terms, the candidate site requires that the measures to prevent leachate leaks spreading through site boundary have already been taken.

2. RESULTS AND DISCUSSION

The selection method on the Sanitary landfill site of having taken minimization of an environmental risk into consideration is shown by Figure 1. The improved point of the method is described to the following:

- Insert the process considering landfill system to minimize the environmental risks on each candidate sites between phase 2 screening adaptation and phase 3 screening adaptation (The shaded block in Figure 1).

The method of environmental risks management on the appropriate site selection

Minimizing environmental risk is performed by manage risks caused by leachate leaks from landfill sites. Especially the T_0 value was proposed as manageable parameter of environmental risks caused by leakage of leachate. The T_0 value was defined to the time when contaminant concentration of leachate leaks reaches the environmental standard at a monitoring well near the boundary line. It's means the buffer time of leakage runoff. Figure 2a shows the T_0 value as the buffer time of leakage runoff. Therefore the greater the T_0 value, the smaller the environmental risks by leakage of leachate. Those risks are shown quantitatively as equation (2).

$$\text{The environmental risks by leakage} = 1/T_0 \quad (2)$$

It is possible that the landfill system is made a plan which the environmental risks by leakage of leachate nearly equal to zero by means of equalizing to the T_0 with infinity. The process is shown in Figure 2 and the following in concrete terms.

STEP 0(Figure 2a); T_0 is time until it oozes without full-scale measure and the hazardous substance concentration in the groundwater by the leakage of leachate or soil reaches an environmental criteria on a site boundary.

STEP 1(Figure 2b); T_0c_1 is a preparation period for performing the full-scale measure of Step 2, when water should leak leachate. For this reason, when T_0 is judged to be in transit ($T_0<T_0c_1$) by T_0c_1, in order to secure a required period, it is contingent [on performing full-scale measure for making $T_0>T_0c_1$] so that leakage-of- leachate influence may be less than outside a site boundary.

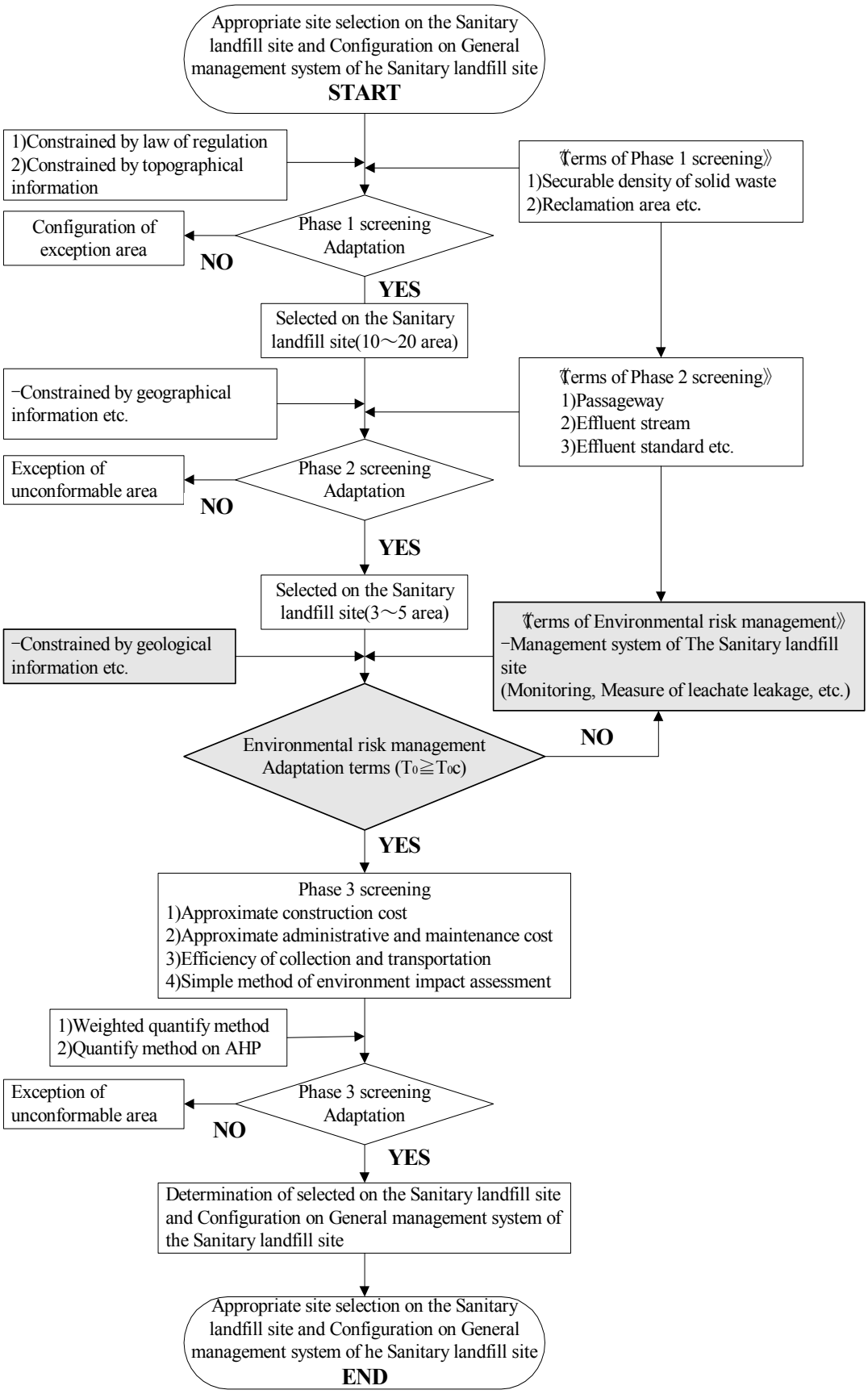

Figure 1. Flow of make a selection on the sanitary landfill site on minimization of an environmental risk

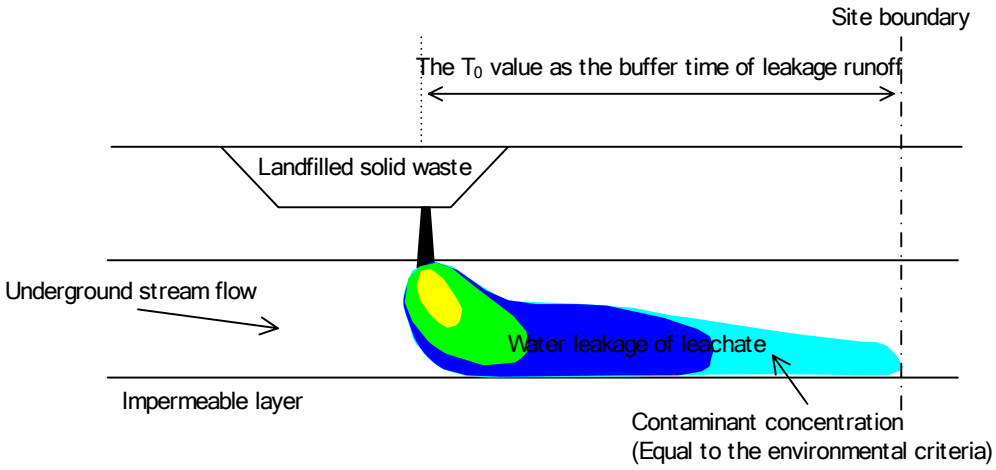

Figure 2a. The T_0 value as the buffer time of leakage runoff (The water leakage of leachate in Step 0)

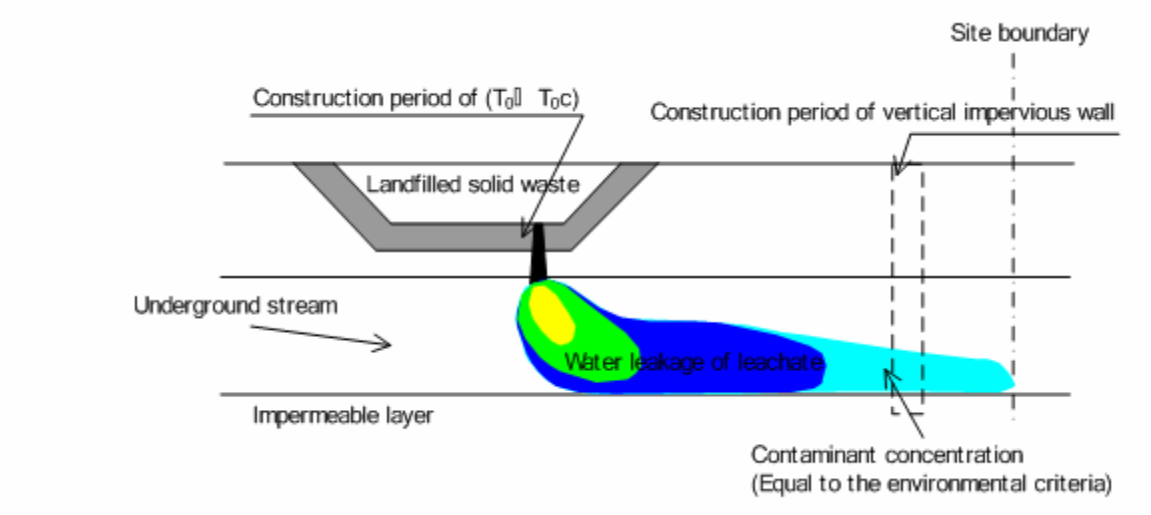

Figure 2b. The water leakage of leachate in Step 1

STEP 2(Figure 2c); T_0c_2 is time to perform restoration of surface impervious, and groundwater purification in a site, after confining the leakage of leachate in a site. For this reason, it is contingent [on adding up full-scale measure(vertical impervious) for attaining $T_0>T_0c_2$] so that it may exceed the period which needs the containment effect time for restoration and purification as risk measure expense at the time of emergency leakage of leachate.

STEP 3(Figure 2d); T_0c_3 is time taken for the hazardous substance concentration of the site boundary after the measure of Step 2 to transcend an environmental criteria. For this reason, the time becomes infinite ($T_0=T_0c_3$=infinity), and it is made for hazardous substance concentration not to exceed an environmental criteria on a site boundary.

In the above process, the cost of performing measure for making $T_0>T_0c_1$ is appropriated for the approximate construction cost. On the other hand, the cost of adding up measure for attaining $T_0>T_0c_2$ is appropriated as the risk measure expense at the time of emergency leakage of leachate in phase third screening adaptation.

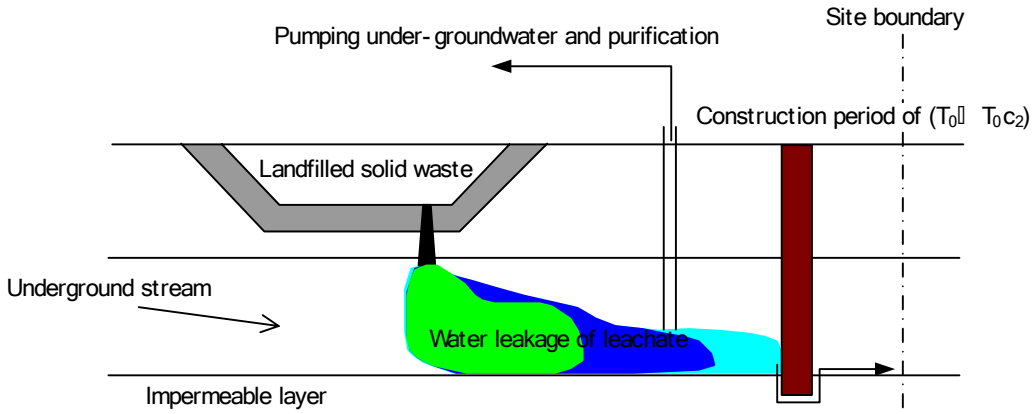

Figure 2c. The water leakage of leachate in Step 2

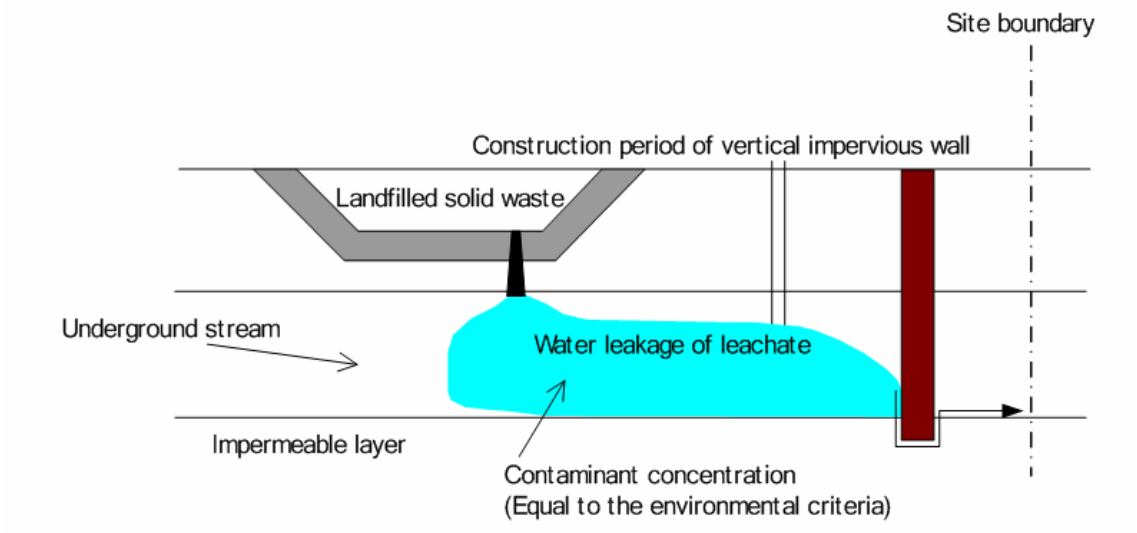

Figure 2d. The water leakage of leachate in Step 3

3. CONCLUSIONS

3.1 Parameter the T_0 value

We considered that simulation is one of useful methods so as to determine the T_0 value. The study tried to determine the T_0 value by applying numerical simulation. As a result, it was shown that the T_0 value will be a useful parameter in managing risks caused by leachate leaks from landfill sites.

3.2 Proposed site selection method

We examined whether a proposed site selection method is a useful measure to wipe the inhabitant's risks of the landfill site. Those risks can be broadly classified into four major categories. These are shown in the following:

Category1; Suspicion of appropriate disposal
Category2; Suspicion of enterpriser

Category3; Fear of miss the profits by landfill site construction
Category4; An image of landfill site as hateful facility

A proposed site selection method will be a useful measure for Category1 （Suspicion of appropriate disposal） because it minimizes the environmental risks on each candidate sites by landfill systems.

We recognized that a proposed site selection method needs to study the following item in order to make more practicable.

1) The simplified calculation method of the T_0 value
2) The quantitative study on some risk but on risk caused by leachate leaks from landfill sites.

REFERENCES

FUKUMOTO et al. (2000) Integration of the Process of Site Selection for Landfill Sites Through Considering Resident's Participation. Journal of the Japan Society Waste Management Experts, Vol.11, No.2, pp.101-110

FURUICHI (1998) Concept of Community Based Landfill. Journal of Japan Waste Management Association, Vol.51, No.225, pp.347-353

OHASHI (1997) Tasks to Solve "Industrial Waste Disputes" - A critique of the revised Waste Disposal Law and its Faults -. Journal of the Japan Society Waste Management Experts, Vol.8, No.5, pp.367-375

PAKU et al. (1996) Resident's Consensus for Landfill Sites Construction in Korea. Proceedings of the 7th Annual Conference of the Japan Society Waste Management Experts, pp.7-9

SEO et al. (1989) Analysis on the Cause of Waste Treatment Facilities Construction Disputes. Proceedings of the 10th Annual Conference of Japan Waste Management Association, pp.13-15

The brunch society for Study on Method of Appropriate Site Selection Considering Environmental Risk Management (2003) The Study on Method of Appropriate Site Selection Considering Environmental Risk Management. Proceedings of the 9th Annual Conference of the Landfill Systems and Technologies Research Association of Japan, pp.53-117