THE CURRENT STATUS OF RADIOACTIVE WASTE MANAGEMENT AND PLANNING FOR NEAR SURFACE DISPOSAL IN INDONESIA

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Abstract

Near surface disposal has been practiced for some decades, with a wide variation in sites, types and amounts of wastes, and facility designs employed. Experience has shown that the effective and safe isolation of waste depends on the performance of the overall disposal system, which is formed by three major components or barriers: the site, the disposal facility and the waste form. Near surface disposal also rely on active institutional controls, such as monitoring and maintenance. The objective of radioactive waste disposal is to isolate waste so that it does not result in undue radiation exposure to humans and the environment. The required degree of isolation can be obtained by implementing various disposal methods, of which near surface disposal represents an option commonly used and demonstrated in several countries. In near surface disposal, the disposal facility is located on or below the ground surface, where the protective covering is generally a few meters thick. These facilities are intended to contain low and intermediate level waste without appreciable quantities of long-lived radionuclides.

Introduction

National Policy For Waste Management

Safety is the most important aspect in the applications of nuclear technology and the implementation of nuclear activities in Indonesia. This aspect is reflected by a statement in the Act Number 10 Year 1997, that " The Development and use of nuclear energy in Indonesia has to be carried out in such away to assure the safety and health of workers, the public and the protection of the environment". The management of low and intermediate level of radioactive waste are mainly consist of waste minimization, waste collection conforming the categories, volume reduction, solidification, and stabilization, reliable packaging, in-situ interim storage, safe transportation and final disposal.

Center of Radioactive Waste Management Technology (CRWMT)

CRWMT is an organization under the direction of the National Nuclear Energy Agency (BATAN), which has a responsibility to conduct research and development (R&D) on radioactive waste management technology in order to support the nuclear industry as well as application of nuclear science and technology in many national development sectors. Its vision to be a good and competent center for R&D and services of radioactive waste management through application of consistent quality and safety standards. One of our missions is to propose the radioactive waste disposal program for Low-Intermediate Level Waste in near surface disposal and for High Level Waste in deep geological formation.

Radioactive Waste Treatment

At the present time, the Radioactive Waste Management Development Center (CRWMT) has capabilities to treat radioactive waste on the form of liquid, spent resin, combustible waste, compactable waste, high active waste and sealed sources. The radioactive waste processing system in the CRWMT is illustrated in Figure 1. Those radioactive wastes are collected from BATAN facilities as well as from other institute such as; industry, hospital, research institutes etc. are represented in Table 1.

The above Low and Intermediate level waste emplaced on 100 l, 200 l drum and 350 l, 950 l concrete shell are stored in the interim storage. Radiation doses exposure on the surface of drum and shell should be limited less than 2 mSv. The interim storage designed was based on module system that could be expanded. During storage, the radioactivity of the waste in the drum and the shell will decrease by decay. Prediction of Waste quantity until 2011 years is illustrated in figure 2.

Site Selection

To carry the work activities in this stage, CRWMT developed a site selection procedure based on consideration of factors such as geologic properties, surface and subsurface hydrology, demographic issues, land use patterns and socioeconomic concerns.

Ideally, the disposal facility should be sited and constructed to minimize the chance that the waste could contaminate surface water or groundwater. The stability of the ground on which the facility structures are to be erected and the movement of water at the site were basically the conditions that must be met. Geologic features such as rock formation as well as the type of soil present in the studied regions are factors that will affect the way water flows on the surface and through the groundwater, which similarly affects the movement of contaminants. The stability of the ground depends largely on the type of rock and soil present therein. Similarly the likelihood of earthquakes, landslides, subsidence and liquefaction were also taken into account. On the other hand, the movement of water at the site depends on slope, soil and rock type, grain size and whether fractures, faults or karsts features are present.

The site selection process was conducted by descriptive, overlay and scoring methods, based on the criteria mentioned above. Detail and comprehensive description site characteristics of the Serpong Site in Table 2. Some figure and map can be showed as Figure 3.

Near Surface Disposal

The key to the successful performance of near surface disposal facility is the integration of the various phases of activity (i.e. site selection, site design and development, operation and closure) to ensure the most cost-effective achievement of the performance objectives. A systems approach should be used in predicting site performance, the approach should consider both the characteristics of the wastes to be disposed of at the site and the characteristics of the site itself. This performance assessment establishes the basis for design, development and operation, and serves as a guide for selecting specific features and procedures appropriate for that facility.

Multibarrier system

The purpose of the multibarrier is for retardation of radionuclide release to the human environment for as long as possible. Although it would not be relied on as a major barrier, the retardation of radionuclide migration by the surrounding media is an important factor to be considered during the sitting and design of a waste disposal facility. The safety barrier in our system are: 1st the engineered barrier: the wasteform, the container material, the vault, back fill material, 2nd The natural barrier: geology characteristic.

Conclusion

Looking at it from a geology characteristic and ground water table enable to place something shallow-land burial in unsaturated zone. The Serpong site is for planning of shallow-land burial in a place altitude 90-95 meters above sea level (flooding free) with slope 5-8 % (small erosion). Lithologies in depth 0-9 m are consist of lateritic clay layers with permeability $1.01x10^{-7}$ – $1.34x10^{-7}$ m/s (impermeable), radionuclide velocity are 0.0006 – 7.42. 10^{-6} m/day (very slowly). Depths of ground water surface are 8.50 m. Thus, the Serpong site is suitable for shallow-land burial in unsaturated zone on depths 0–4 m below ground surface. See table 2 and Figure 4, 5, 6.

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