# Development of a Clearance Measurement System for Concrete Waste − Development of Correction Method of BG Count Rate Due to Natural Radionuclides in Concrete −

## Background

Regarding the wastes generated from decommissioning of a nuclear power plant, they can be reused or recycled as resources when their activity levels are low enough; i.e. their activity levels are below the clearance levels *1. We therefore have developed a clearance level inspection system, named CLALIS (Clearance Automatic Laser Inspection System), which can measure very low-level activity using gamma-ray detector, laser shape measurement and Monte-Carlo calculation techniques. The activity detection ability of CLALIS for metal waste has been experimentally clarified using mock-metal waste and standard radioactive sources so far. To apply CLALIS into the clearance measurement of concrete waste, it is required to correct the BG (background) count rate *2 during gamma-ray measurement since it may be increased by natural radionuclides in concrete.

## Objectives

To develop a method which can correct the influence of BG count rate due to the natural radionuclides in concrete.

To evaluate the accuracy of the correction method using mock-concrete waste samples.

## Principal Results

### 1. Development of correction method of the effect due to natural radionuclides

A new correction method of BG count rate during gamma-ray measurement was developed using gamma-ray emission rate of natural radionuclides in concrete and Monte-Carlo calculation. The gamma-ray emission rate of natural radionuclide is pre-analyzed by representative sample and HPGe semiconductor detector (Fig.1).

### 2. Correction accuracy of BG count rate for concrete samples of different activity concentration and ratio of radionuclides

The natural activity concentration and ratio of natural radionuclides of concrete components, such as cement and aggregate vary according to the production site. Using six types of concrete samples from different production site, the accuracy of correction of BG count rate was evaluated. As a result, it was clarified that this method can correct the BG count rate during measurement within a good accuracy of +/- 1% (Fig.2).

### 3. Correction accuracy of BG count rate for concrete samples of various shapes and amounts

Considering the actual waste, such as segments, generated from nuclear power plant, the correction accuracy of BG count rate was evaluated using various shapes and amounts of mock-concrete wastes. Consequently, it was revealed that this method could estimate the BG count rate during gamma-ray measurement within a good accuracy of +/- 4% (Fig.3).

Since the detection limit *3 of CLALIS for concrete waste is evaluated as 110 Bq, it is indicated that CLALIS could be applied for clearance measurement of concrete waste above 1.1 kg when the key radionuclide is Co-60.

## Future Developments

We will study the application of CLALIS for concrete waste generated from nuclear power plant not only in decommissioning, but also in operation.

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***Reference***

M. Sasaki and T. Hattori, 2006, “Application of Clearance Automatic Laser Inspection System -Development of correction method of background count rate due to natural radionuclides ”, CRIEPI Report L05006 (in Japanese)

*1：Activity concentration level of material to judge whether it should be treated as radioactive or nonradioactive material.
*2：Count rate due to ambient radiation (radiation from radionuclides in atmosphere, or cosmic radioation etc.).
*3：The lowest limit of amount that a system can determine.

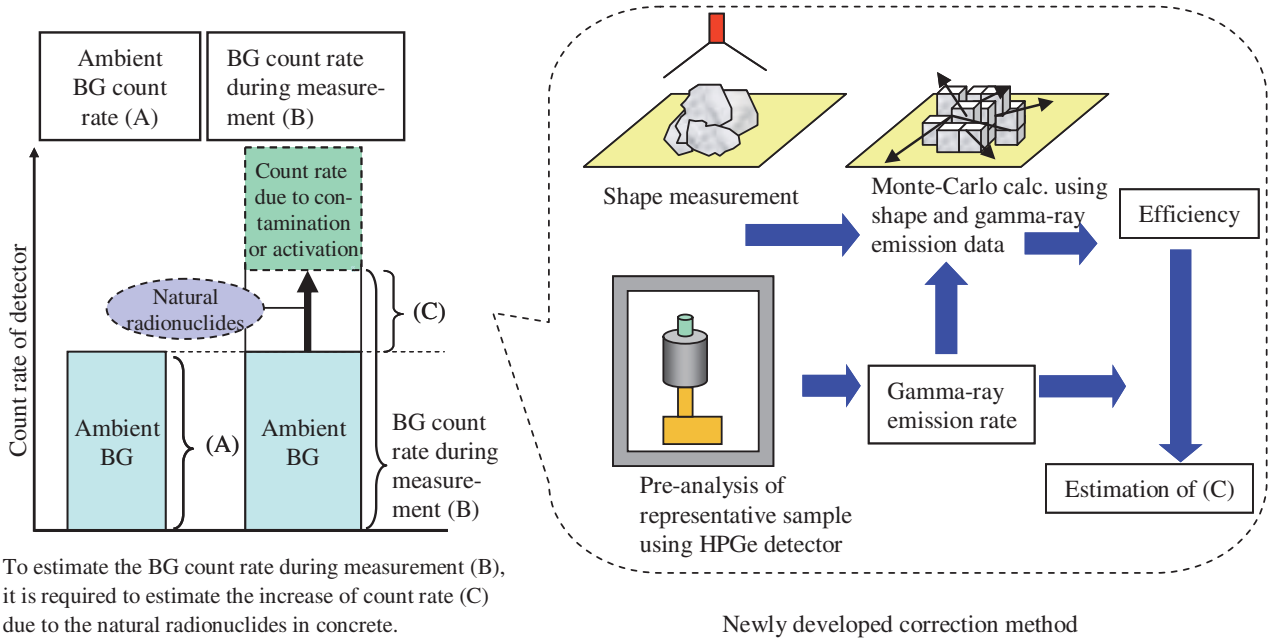


**Fig.1** Increase of BG count rate due to concrete waste measurement and newly developed correction method

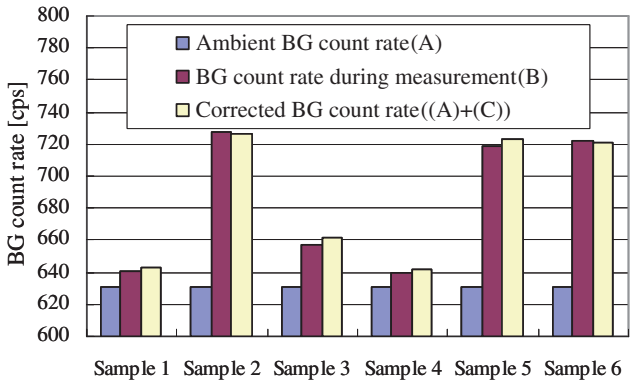


**Fig.2** Correction results of BG count rate for mock-concrete samples of different activity concentration

(A)···Ambient BG count rate without mock-concrete sample.
(B)···BG count rate with mock-concrete sample.
((A)+(C))···BG count rate corrected by the newly developed method. Since BG count rate during measurement (B) can be appropriately estimated, count rate due to contamination or activation can be estimated within a good accuracy.

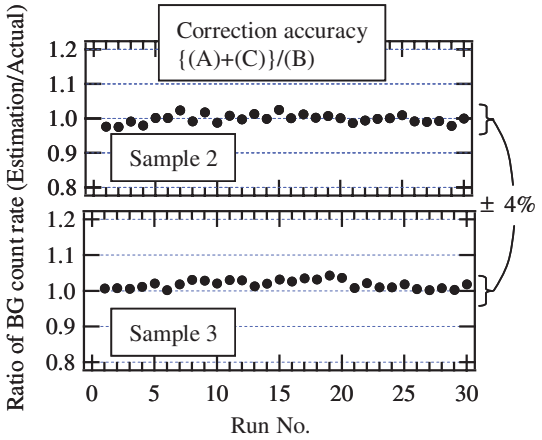


**Fig.3** Correction accuracy of BG count rate for various shapes and amounts