Contribution ID: **1076** Type: **Poster**

Development of an integrated on-line monitoring system for Tritium and radioactive carbon using robotics technology

Tuesday, 17 May 2022 18:30 (5 minutes)

Tritium and radioactive carbon generated by the operation of nuclear facilities are radionuclides with half-life of 12.3 and 5730 years, respectively, so if leaked, it will have a significant long-term impact on the environment and humans, so continuous monitoring is required.
In the case of radioactive carbon dioxide, it is fixed in living organisms through respiration of animal and plant or carbon assimilation when it is emitted to the environment. In addition, since it can affect the human body through the path of the food chain, continuous monitoring in terms of the source of occurrence is necessary.
Tritium can also be released into the environment from nuclear facilities in gaseous or liquid form, affecting nearby residents. In Korea, tritium in urine samples of residents around heavy water reactors was detected higher than those of other regions, making it a social issue.
Radionuclides discharged into the environment must be analyzed and monitored periodically and continuously, so it is most effective to apply automated monitoring devices. However, it has not yet been automated because pre-treatment such as distillation, heat treatment, and fluorescent liquid mixing are essential to analyze beta nuclides such as tritium and radioactive carbon.
In this study, an integrated 3H-14C on-line monitoring system that automates all processes of analysis, including collection of gas samples, pre-treatment, sample injection, mixing of scintillation liquid, and measurement, to automatically monitor tritium and radioactive carbon in gases released into the environment without analyst was developed.
The 3H-14C online monitoring system largely consists of a collection part, a mixing part, and a measuring part.
The collection part consists of six collection bottles, a cooling device with a peltier thermoelectric module, a catalytic reactor, a peristaltic pump and a solenoid valve, enabling separation and collection of tritium, organic and inorganic radioactive carbon.
The mixing part consists of a combination of robot arm, peristaltic pump, and solenoid valve to sequentially perform opening and closing of the vial cap, position and operation control, and injection of a certain amount of collection liquid into the measurement vial.
A TDCR type low-level liquid scintillation counter(HIDEX 300SL) was used in the measurement unit, and measurement was configured to automatically start when a robot arm put a vial into the liquid scintillation counter.
The tritium and radioactive carbon on-line monitoring system developed in this study is configured to automatically operate all processes necessary for analysis, such as gas sample collection, pre-treatment, injection of collection liquid, mixing of scintillation liquid, and measurement, for at least four months. If the storage and liquid tank are expanded, long-term monitoring is also possible.
Through this study, procedures and methods for automatic analysis of tritium and radioactive carbon were established, and the applicability and usefulness of robotics technology could be confirmed when manufacturing automatic radiation monitoring system.

Primary authors: SONG, Youngju (Elim-Global Inc.); JOO, Myeonghoon (Elim-Global Inc.); KIM, Damhyang (Elim-Global Inc.); LEE, Joon-seok (Elim-Global Inc.); KIM, Seung-il (Elim-Global Inc.)

Presenter: SONG, Youngju (Elim-Global Inc.)

Session Classification: Nuclear Analytical Methods

Track Classification: Nuclear Analytical Methods