Preface

Krypton-85 is a major radionuclide released from the nuclear fuel reprocessing plants into the atmosphere. Radiological concern is still present on the level and variation of atmospheric ^{85}Kr. Especially, a large-scale nuclear fuel reprocessing plant will be operated in Rokkasho, Aomori, Japan. Therefore, the measurement of the atmospheric ^{85}Kr is one of the most significant requirements in Japanese environmental radioactivity monitoring. However, there was no continuous measuring system for atmospheric background ^{85}Kr in Japan until 2000. In 1995, the Meteorological Research Institute (MRI) decided to establish a monitoring system for atmospheric ^{85}Kr and to set-up a system based on the one developed by the Bundesamt für Strahlenschutz BfS in Germany. In 2000, the MRI established the atmospheric ^{85}Kr monitoring system based on the BfS system by collaboration with the BfS, Shimazu, Rinei and General Enviornmental Technos Co., Ltd. (Kanso Technos). The MRI system has reliable been operated to measure the atmospheric ^{85}Kr activity concentration from 2000 to 2005. The atmospheric ^{85}Kr activity concentration determined by the MRI is traceable to the BfS. In 2005, an atmospheric ^{85}Kr monitoring system as the same as the MRI system was constructed by the Japan Chemical Analysis Center (JCAC) in order to establish a Japanese monitoring network for atmospheric ^{85}Kr. The technical report, which is a joint project of the MRI and JCAC, includes procedural and technical details of the atmospheric ^{85}Kr measuring MRI system, although the principle concepts of the MRI system and its development were published in a research journal. This technical report is a useful tool for monitoring background ^{85}Kr in the atmosphere.

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Abstract

At the Meteorological Research Institute (MRI) in Tsukuba, Japan, atmospheric ^{85}Kr activity concentrations in ground level air have been observed since 1995 in collaboration with the Bundesamt für Strahlenschutz (BfS), Germany. In 2001, MRI implemented an atmospheric ^{85}Kr measurement system for continuous monitoring based principally on the BfS method (Cold charcoal trap - Gas chromatography - Gas counting system) for the first time in Japan. Thereafter, this system had been used to monitor the atmospheric ^{85}Kr activity concentrations in ground level air at MRI in Tsukuba and several other locations in Japan up to March 2006. In parallel samples were collected and sent to the noble gas laboratory of the BfS for analysis and quality assurance. In 2006, MRI and the Japan Chemical Analysis Center (JCAC) had started a cooperative effort to develop a new practical ^{85}Kr measuring system based on the existing MRI system. Their objectives were to establish a ^{85}Kr monitoring system in Japan and publish a technical document on ^{85}Kr measurements.

This report gives a detailed description of the new ^{85}Kr measurement systems as established at the MRI and JCAC and the technical procedures needed for the operation. It includes also the results of ^{85}Kr measurement in Tsukuba during the period from May 1995 to March 2006.

The record distinctively indicates the background level of the ^{85}Kr activity concentration in ground level air at mid-latitudes in the Northern Hemisphere and the elevated concentrations affected by the operation of a nuclear-fuel reprocessing plant in Tokai-mura, Ibaraki, Japan.

Atmospheric ^{85}Kr activity concentrations have been continuously monitored since

1995 at the MRI in Tsukuba, Japan. In January 1996, the background atmospheric ^{85}Kr activity concentration was 1.21 Bq m^{-3}. It increased to 1.51 Bq m^{-3} in January 2006. The annual growth rate of the background atmospheric ^{85}Kr activity concentrations in Tsukuba was calculated to be 0.03 Bq m^{-3} yr^{-1} during the period from 1995 to 2006. The global atmospheric inventory of ^{85}Kr in December 2001 was also estimated to be 5 EBq m^{-3} using the ^{85}Kr activity concentrations observed in Tsukuba.

Contents

Appendices:

Yasuhito Igarashi, Michio Aoyama, Kazuhiro Nemoto, Katsumi Hirose, Takashi Miyao, Katsuhiko Fushimi, Mikihiko Suzuki, Shigeo Yasui,Yasuhiro Asai, Iwao Aoki, Kenji Fujii, Shigeo Yamamoto, Hartmut Sartorius, Wolfgang Weiss, ^{85}Kr measurement system for continuous monitoring at Meteorological Research Institute, Japan, *Journal of Environmental Monitoring,* 3, 688-696, 2001

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