

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 Environmental Technos Co., Ltd. (Kanso Technos). The MRI system has reliably 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 $0.03 \text{ Bq m}^{-3} \text{ yr}^{-1}$ 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

1 Introduction	1-4
2 Instruments of cold charcoal trap - gas chromatography - gas counting system of ^{85}Kr	5-35
2.1 Sampling procedures	5-15
2.1.1 Outline	5-8
2.1.2 Start of sampling	8-9
2.1.3 Routine work during sampling	9
2.1.4 Exchange of the absorber	9-10
2.1.5 Transfer Kr to aluminum bottle (mini can)	11-13
2.1.6 Re-use of sampling instruments	13-14
2.1.7 Maintenance	14-15
2.2 Brief system description	15-16
2.3 Analytical procedures	17-19
2.4 Gas counting system	19-24
2.4.1 Sample proportional counter operation	20-22
2.4.2 Anti-coincidence counting	22-24
2.5 Determination of the stable Kr volume	24-26
2.6 Schedule of sample analysis	26-28
2.7 Calculation of atmospheric ^{85}Kr activity concentration	28-29
2.8 Uncertainty of atmospheric ^{85}Kr activity concentration	30-33
2.9 New ^{85}Kr measurement system	33-35
3 Standard gas for ^{85}Kr measurement	36-37
4 Atmospheric ^{85}Kr in Japan	38-63

4.1 ^{85}Kr activity concentrations at Tsukuba since 1995	38-57
4.2 Results in Tsukuba and Chiba during the technical transfer	57-60
4.3 Atmospheric ^{85}Kr activity concentrations in Aomori	60-61
4.4 ^{85}Kr activity concentration at several sites in Japan	61-63
Acknowledgements	64
References	65-67

Appendices:

Appendix 1 Chromatograms of the system	71-74
Appendix 2 Program of the system	75-90
Appendix 3 Hardware specifications of the system	91-96
Appendix 4 ^{85}Kr measurement system for continuous monitoring at the Meteorological Research Institute, Japan	97-107

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List of tables and Figures

Tables

Table 2.1	Schedule of sample analysis	27
Table 2.2	Uncertainties involved in ^{85}Kr measurement	33
Table 3.1	Gas composition of the sample in the aluminum bottle and the simulated gas	36
Table 4.1	Monthly averaged atmospheric ^{85}Kr activity concentrations in Tsukuba	38
Table 4.2	Weekly atmospheric ^{85}Kr activity concentration at Tsukuba during the period from May 1995 to March 2006	44-57
Table 4.3	Atmospheric ^{85}Kr activity concentration in Tsukuba and in Chiba	58
Table 4.4	Sampling locations and related information	62

Figures

Figure 2.1	Schematic diagram of ^{85}Kr measurement system	5
Figure 2.2	Diagram of sampling apparatus	6
Figure 2.3	Absorber for ^{85}Kr sampling	7
Figure 2.4	Removal of water from absorber	10
Figure 2.5	Water adsorbent tube	12
Figure 2.6	Transfer of sample gas	12
Figure 2.7	Schematic flow chart of pretreatment unit	16
Figure 2.8	Schematic flow chart of the GCs	16
Figure 2.9	Schematic flow chart of recirculating loop	20
Figure 2.10	Plateau curve of the center proportional counter	21

Figure 2.11	Activity counting unit	23
Figure 2.12	Diagram of signal cable connection	24
Figure 2.13	Chromatogram of stable Kr determination.....	25
Figure 4.1	Atmospheric ⁸⁵ Kr activity concentrations in Tsukuba observed from 1995 to 2006	39
Figure 4.2	Atmospheric background ⁸⁵ Kr activity concentrations in Tsukuba	41
Figure 4.3	Typical charts of backward trajectory in winter and in summer. The point for each category is indicated on the globe.....	42
Figure 4.4	Comparison between the observed ⁸⁵ Kr activity concentrations and the estimated ones from the “Trajectory Indexes” in Tsukuba in 1999.....	43
Figure 4.5	Temporal variation of atmospheric ⁸⁵ Kr in Tsukuba and in Chiba.....	59
Figure 4.6	Background ⁸⁵ Kr activity concentration observed at Tsukuba and Aomori from 2003 to 2005	61
Figure 4.7	Seasonal variation of the atmospheric ⁸⁵ Kr activity concentrations at all stations in Japan	63
Figure A.1	Chromatogram of coarse separation of Kr.....	73
Figure A.2	Expanded chromatogram of containing Kr fraction in coarse separation of Kr.....	73
Figure A.3	Chromatogram of purification of Kr	74