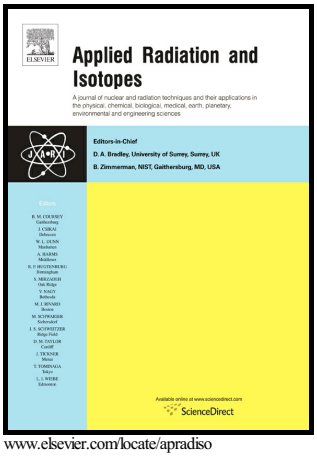

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PII: S0969-8043(16)30540-1
DOI: http://dx.doi.org/10.1016/j.apradiso.2016.12.002
Reference: ARI7665

To appear in: *Applied Radiation and Isotopes*

Received date: 15 August 2016
Revised date: 18 October 2016
Accepted date: 2 December 2016

Cite this article as: J. Kastlander and C. Söderström, Evaluation of an earl warning system for airborne radionuclides, *Applied Radiation and Isotopes* http://dx.doi.org/10.1016/j.apradiso.2016.12.002

Evaluation of an early warning system for airborne radionuclides

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Abstract

An early warning system for detection of increased levels of radioactivity in outdoor air was operative between 2004 and 2011 at the Swedish air sampling stations. The system consisted of a low resolution detector (NaI), positioned directly behind the filter and measurement of the accumulated radioactivity were performed continuously. An evaluation of the data collected during the period is presented with emphasis on natural occurring radionuclides and their influence on the detectability of anthropogenic radionuclides.

1. Introduction

Many countries have systems for surveillance of external radiation for protection of the public. Such a system is usually measuring the dose rate and sends data continuously so that appropriate countermeasures can be taken as soon as possible. In addition collection of radioactive particles in the air is often performed. Analysis of radionuclide concentrations in air have historically been used to estimate fallout and dispersion from nuclear weapons tests and the systems are typically designed to be able to detect very low atmospheric activity concentrations. Data from these systems are generally analyzed in the order of days after the sampling has been performed and can therefore not be used as an early warning system. Since the detection limits for the air sampling method are in the order of 10^3 times lower than for the dose rate system it is possible to mix the two to improve the detection limit (Korbech et al., 1992, Leppänen et al., 1997).

Sampling of aerosol particles on filter for determination of radioactivity in air has been done for more than half a century in Sweden. The sampling principle is simple with a suction pump pumping air through a filter. There are today six filter stations in Sweden where acquisition of radionuclides in air is performed continuously (Vintersved et al., 1982, Söderström et al., 2016). The filters are exchanged twice a week but combined and measured as weekly samples.

To facilitate the possibility of earlier alarms in the case of increased radioactivity in the athmosphere an early warning system were installed at the filter stations. In this study a rudimentary analysis of data from the stations are performed with regard to background levels and their variation. The detection limits from laboratory measurement are compared to collected data from the filter stations and different methods of data evaluation are compared.

2. Material and methods

2.1. Early warning system

The early warning system installed at the stations consisted of a 2”×2” NaI-detector positioned about 250 mm behind the glass fiber filter (60x60 cm^2) in an aluminum tube (inner diameter 72 mm, thickness 30 mm). To ensure temperature stability for the detector the aluminum tube was isolated with Styrofoam (40 mm thick) and has cooling flanges on the inside of the building (Figure 1). The detector was connected to a DigiBASE™ (ORTEC) and