STUDIES OF RADIOACTIVITY OF THE AIR IN CLUJ-NAPOCA, ROMANIA

Marta Bayer[1], T.Fiat[2], L.Dărăban[2], N.Matei[3], Manuela Rusu[1]

[1] Medical Center and Health Services and Management Cluj, Romania
[2] University "Babeş-Bolyai", Faculty of Physics, Cluj, Romania
[3] National Institute of Meteorology and Hydrology, Bucharest, Romania

SUMMARY

We present measurements of the radioactive contamination of the air in the laboratories of the some nuclear medicine centers and the follow-up of the effects of the nuclear activity.

The purpose of the measurements is to decrease to a minimum the occupational exposure and the monitoring of radioactivity in the atmosphere.

INTRODUCTION

The human nuclear activity contributes to the radioactive loading of the atmosphere, beside the initially natural radioactive loading. The radioactive substances in the aerosols or gases, may directly irradiate the human body by inhalation, ingestion or immersion, or indirectly through water and food (1, 5, 8).This paper presents the results of the verifications of air contamination in the laboratory rooms of the Nuclear Medicine Units in comparison with the atmosphere of Cluj-Napoca town (4).

MATERIALS AND METHODS

Radioiodine was selected as an indicator of contamination of the occupationally exposed workers because of its noxious effects (1). The air samples were collected in different workrooms e.g. laboratories for the first dilution, administrative and measuring offices.

The principle of the working methods is the pumping of known air quantity through special filters and measuring the filter radioactivity (2, 8, 9).

The filtering cartridge for ^{131}I is made of active coal impregnated with $AgNO_3$ solutions (2) and was measured with the well type NaI(Tl) crystal connected to an impulse-meter having an efficiency of 20% to 40%.

The beta radioactivity of the SYNPOR membrane situated in the front of he active coal was measured in anticoincidence counter connected to an impulse-meter. The efficiency is about 9,8% and the counting times were of about 2 hours.

In 1991 the filtering cartridge made of active coal impregnated $AgNO_3$ solution was replaced by the SLF 2I-50 special filter for radioiodine and the SYNPOR membrane filter was replaced by the FPP filter.

The results have been determined with the following formula:

$$A = \frac{R - F}{E \cdot e \cdot V}$$

where A=sample activity (Bq/m^3 or mBq/m^3); R=filter counting rate (imp/s); F=fund (imp/s); E=counting system efficiency; e=filtering efficiency; V=volume of filtered air (m^3).

In 1994 the used filters were searched for ^{131}I, ^{137}Cs and ^{60}Co by measuring them with a GeLi detector connected to a ICA-80 multichannel analyzer.

RESULTS AND DISCUSSION

Table 1 resumes the results obtained in 1979 of the average concentration of ^{131}I in the laboratory air where this isotope was used.

Table 1. Average values for ^{131}I in air in 3 medical laboratories in 1979.

Labor. No.	Dates	^{131}I (Bq/m^3)
1	May 21	1,34±0,15
1	May 21	3.78±0.44
1	May 28	3.03±0.33
1	May 28	under MDC
2	October 15	1.67±0.18
2	October 15	2.34±0.24
2	October 16	1.67±0.18
2	October 16	2.18±0.22
3	June 28	1.67±0.18
3	June 28	2.07±0.27
3	July 3	5.37±0.56
3	July 3	5.56±0.56
3	July 6	2.37±0.26
3	July 6	1.93±0.20

MDC=1.1 Bq/m^3

Analyzing the results we see that the values are under the occupationally maximum allowable concentration (1), but in the 3rd laboratory they are increased because of the high number of patients diagnosed and treated there.

The ^{131}I concentration in the atmosphere was determined simultaneously. For these determinations a larger air volume was collected, the sampling was up to 18 hours for diminishing the MDC value. The ^{131}I concentration is under the minimal detectable concentration and the results for beta radioactivity of aerosols varied between 4 mBq/m^3 and 48 mBq/m^3.

On May 1986 the maximum concentration of ^{131}I was of 170 Bq/m^3 and after 20 May all the values were under 3,3 Bq/m^3.

The values registered in 1995 for the studied workrooms of the ^{131}I concentration range between 1,11 Bq/m^3 and 29,63 Bq/m^3 and are situated on an average below the admissible levels of the occupational exposure norms.

CONCLUSION

In the nuclear medicine laboratory the radio protection norms have been respected, the studied workrooms do present safe work conditions.

Although the air quality in Cluj-Napoca town for overall beta radioactivity and ^{131}I, ^{137}Cs and ^{60}Co measurements is not harmful, the air radioactivity must be kept under control.

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