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Quarterly report on measurements of radionuclides in ground level air in Sweden

Fourth quarter 2001

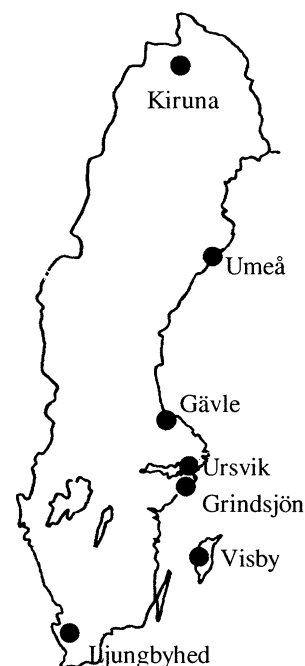
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Report title Quarterly report on measurements of radionuclides in ground level air in Sweden. Fourth quarter 2001.		
Abstract (not more than 200 words) Filtering of ground level air is performed weekly at seven different locations in Sweden: Kiruna, Umeå, Gävle, Ursvik, Grindsjön, Visby and Ljungbyhed. The filters are compressed and the contents of different radionuclides are measured by gamma spectroscopy. Precipitation is also collected at four of the stations: Kiruna, Gävle, Ursvik and Ljungbyhed, the samples are ashed and the contents of radionuclides measured. The levels of ^7Be and ^{137}Cs in air and deposition are presented for the different stations. Other anthropogenic radionuclides detected, if any, are also presented.		
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Rapportens titel (i översättning) Radionuklider i markluft i Sverige. Kvartalsrapport, fjärde kvartalet 2001.		
Sammanfattning (högst 200 ord) Stationer för filtrering av markluft finns på sju olika ställen i Sverige: Kiruna, Umeå, Gävle, Ursvik, Grindsjön, Visby och Ljungbyhed. Filtren analyseras veckovis genom gammadetektor med germaniumdetektor. Nederbörd samlas in på fyra av dessa stationer: Kiruna, Gävle, Ursvik och Ljungbyhed. Nederbördsproven askas in och mäts på samma sätt. Halterna i luft och deposition av ⁷ Be och ¹³⁷ Cs presenteras för de olika stationerna. I de fall andra antropogena radionuklider detekterats presenteras även dessa.		
Nyckelord Luftburen radioaktivitet, deposition, ⁷ Be, ¹³⁷ Cs		
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Sampling and analysis procedures

Sampling of ground level air is performed at seven different locations in Sweden, as follows:

Kiruna:	67,84° N	20,42° O
Umeå:	63,85° N	20,34° O
Gävle:	60,40° N	17,14° O
Ursvik:	59,39° N	17,96° O
Grindsjön:	59,07° N	17,82° O
Visby:	57,63° N	18,32° O
Ljungbyhed:	56,08° N	13,23° O



At all stations except at Grindsjön, 1000 m³/h of air is filtered through a glass fibre filter (Camfil type CS 5.0). At Grindsjön 5500 m³/h of air is filtered through 5 filters. At each station the filters are changed twice a week (Monday and Thursday or Friday) and sent by mail to our laboratory for measurement and analysis.

Weekly samples are made from each station by taking 3/4 of each filter (1/4 of the filter is left for the archive) and compress them together into a small disc (diameter 60 mm, thickness 13 mm). These samples are measured, 3-4 days after the collection, on well shielded High Purity Germanium (HPGe) detectors. From the Grindsjön station, the 10 filters produced per week are assembled in a Marinelli like geometry by pressing them into one circular disc, placed on top of the detector, and into five rectangular bricks (77 mm by 48 mm by 13 mm) placed around the detector.

At four of the stations (Kiruna, Umeå, Ursvik and Ljungbyhed) a small part of the air flow (12m³/h) that has passed the filter is taken through a charcoal cartridge in order to collect gaseous iodine. The cartridges are changed weekly but only analysed if particulate iodine in greater amount has been detected in the filter.

The stations in Kiruna, Gävle, Ursvik and Ljungbyhed are each equipped with a big stainless steel funnel (1m radius) to collect the precipitation that is passed through a cartridge consisting of a filter part, an anion part and a cation part. The cartridges are changed weekly and sent by mail to our laboratory. Four samples are combined to a monthly sample by ashing. The samples are measured on our HPGe detectors. From these measurements the total deposition is calculated.

Radionuclides seen in the filters are normally only the naturally occurring radon daughters and ⁷Be. Most of our stations also detect ¹³⁷Cs, which is due to the resuspension of the Chernobyl fallout. In tables I and II the concentrations of ⁷Be and ¹³⁷Cs are presented. The depositions at the stations where we collect precipitation are presented in table III. Sometimes we also detect other anthropogenic radionuclides and in that case these are presented in Table IV.

Table I

⁷Be concentrations in Sweden, fourth quarter 2001

<i>Week starting</i>	<i>Kiruna</i>	<i>Umeå</i>	<i>Gävle</i>	<i>Ursvik</i>	<i>Grindsjön</i>	<i>Visby</i>	<i>Ljungbyhed</i>
1-oct	380 (0.5)	530 (0.5)	1530 (0.3)	1830 (0.2)	1870 (0.1)	1710 (0.2)	2030 (0.3)
8-oct	440 (0.4)	1040 (0.6)	1760 (0.3)	1460 (0.2)	1540 (0.1)	1380 (0.3)	2340 (0.3)
15-oct	1350 (0.2)	1750 (0.2)	2410 (0.3)	2570 (0.2)	2610 (0.1)	2040 (0.3)	2560 (0.2)
22-oct	1080 (0.3)	1380 (0.3)	1980 (0.2)	1980 (0.2)	1990 (0.1)	1650 (0.2)	2750 (0.1)
29-oct	1060 (0.3)	1040 (0.3)	1250 (0.4)	1410 (0.3)	1520 (0.1)	1460 (0.2)	2190 (0.2)
5-nov	800 (0.3)	1220 (0.3)	1280 (0.3)	1390 (0.3)	1590 (0.1)	1370 (0.3)	1940 (0.3)
12-nov	980 (0.3)	850 (0.4)	1220 (0.5)	1170 (0.3)	1400 (0.2)	1160 (0.4)	1530 (0.3)
19-nov	560 (0.4)	1170 (0.3)	1470 (0.3)	1350 (0.2)	1560 (0.1)	1200 (0.3)	1540 (0.2)
26-nov	840 (0.3)	1020 (0.3)	1290 (0.4)	1560 (0.3)	1760 (0.1)	1210 (0.3)	1090 (0.2)
3-dec	2500 (0.2)	2850 (0.2)	1920 (0.2)	1640 (0.2)	1780 (0.1)	1570 (0.3)	1200 (0.2)
10-dec	2210 (0.1)	2140 (0.3)	3000 (0.2)	2230 (0.2)	2490 (0.1)	1740 (0.3)	2200 (0.1)
17-dec	1310 (0.3)	1290 (0.2)	1380 (0.5)	1210 (0.2)	1350 (0.1)	1230 (0.4)	1310 (0.1)
24-dec	1350 (0.2)	1410* (0.3)	1430 (0.3)	1240 (0.2)	1510 (0.1)	970 (0.3)	700 (0.5)

Values are given in $\mu\text{Bq}/\text{m}^3$.
Error estimates (1σ %) are given in brackets.

*Two weeks filter

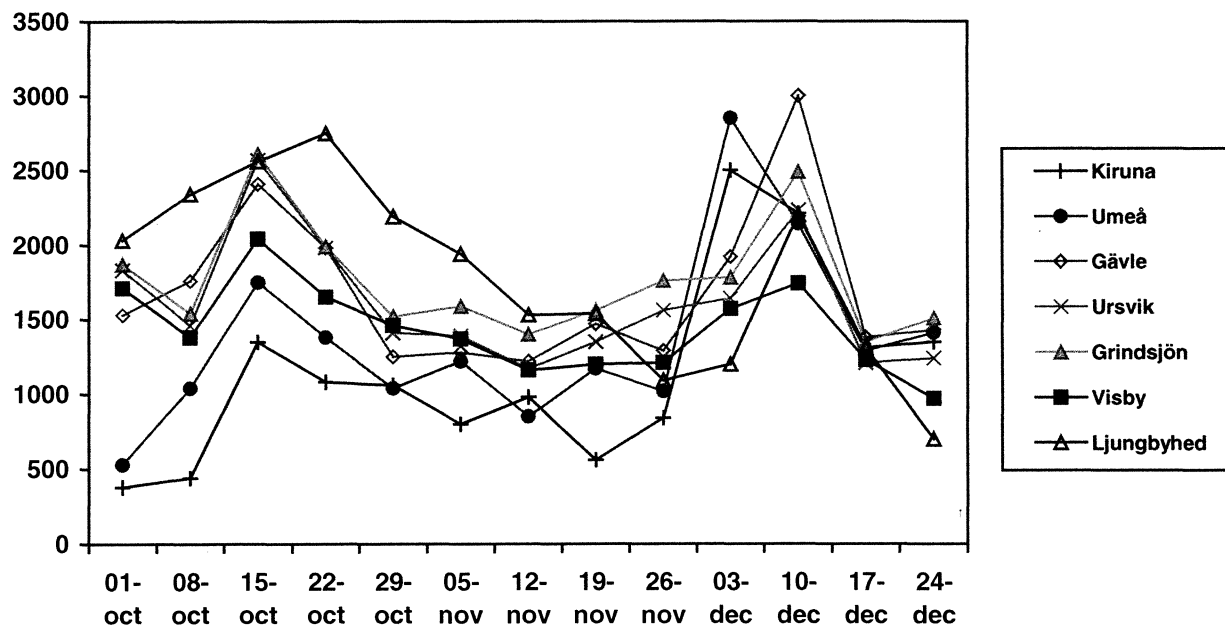


Table II

¹³⁷Cs concentrations in Sweden, fourth quarter 2001

<i>Week starting</i>	<i>Kiruna</i>	<i>Umeå</i>	<i>Gävle</i>	<i>Ursvik</i>	<i>Grindsjön</i>	<i>Visby</i>	<i>Ljungbyhed</i>
1-oct	0.2 (43)	5.6 (2)	23.6 (1)	0.5 (15)	0.5 (8)	0.5 (17)	0.5 (23)
8-oct	0.1 (10)	6.4 (5)	6.5 (3)	0.6 (12)	0.4 (7)	0.3 (25)	0.9 (15)
15-oct	<0.1	7.0 (2)	8.8 (3)	1.6 (7)	1.3 (4)	1.0 (12)	0.6 (16)
22-oct	<0.2	4.1 (3)	8.3 (2)	0.9 (9)	0.7 (5)	0.9 (11)	0.9 (6)
29-oct	<0.1	2.9 (4)	4.0 (5)	0.6 (14)	0.4 (9)	2.3 (5)	0.3 (31)
5-nov	<0.2	2.7 (4)	6.7 (2)	1.2 (8)	0.7 (5)	0.4 (22)	0.5 (25)
12-nov	<0.1	2.2 (5)	7.6 (4)	0.7 (13)	0.6 (7)	0.2 (61)	1.0 (16)
19-nov	0.1 (61)	2.6 (4)	4.1 (4)	1.0 (7)	0.9 (4)	0.2 (38)	0.8 (10)
26-nov	0.4 (22)	2.3 (5)	3.1 (5)	0.6 (16)	0.9 (4)	0.8 (10)	0.9 (7)
3-dec	0.5 (10)	2.7 (5)	6.1 (1)	0.9 (9)	1.0 (3)	1.1 (10)	1.2 (6)
10-dec	0.1 (42)	2.0 (9)	5.3 (3)	1.8 (6)	1.5 (2)	0.8 (15)	0.7 (6)
17-dec	<0.2	3.4 (2)	9.0 (3)	1.0 (9)	0.8 (3)	0.9 (23)	0.7 (6)
24-dec	0.2 (22)	2.0* (5)	7.4 (2)	1.8 (4)	1.1 (3)	0.8 (11)	1.3 (10)

Values are given in $\mu\text{Bq}/\text{m}^3$.

Error estimates (1σ %) are given in brackets.

*Two weeks filter

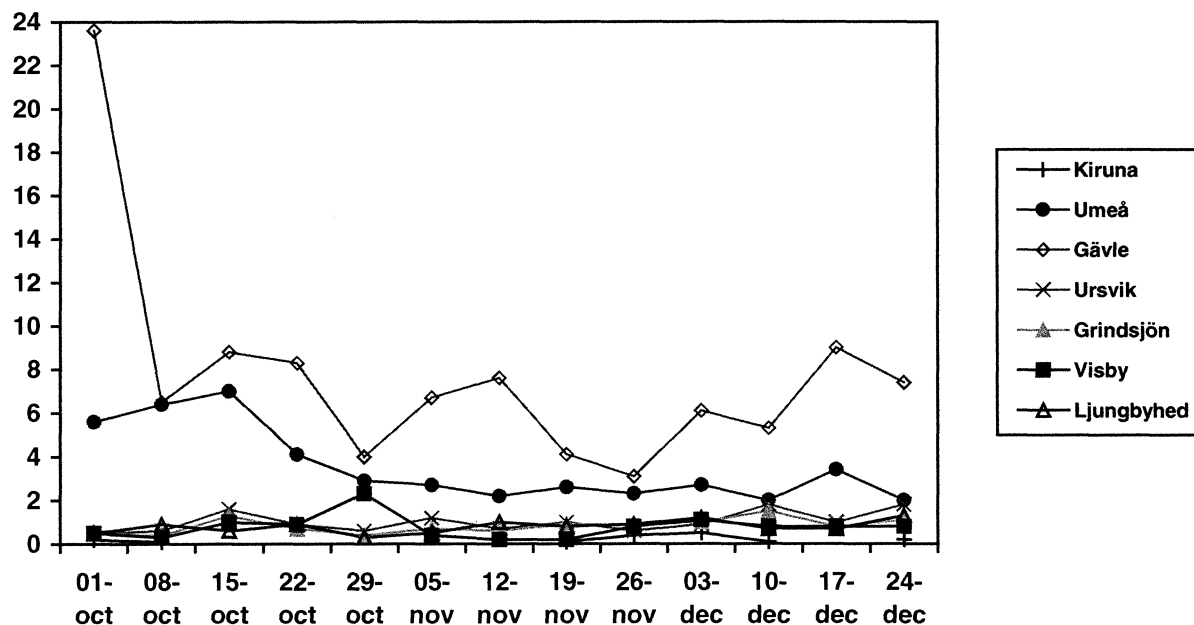


Table III

Deposition measurements, fourth quarter 2001***Kiruna***

<i>Weeks</i>	<i>Period</i>	<i>⁷Be</i>	<i>¹³⁷Cs</i>	<i>Precipitation (mm)</i>
40 - 43	1/10 - 29/10	15100 (1.2)	25 (39)	30.2
44 - 47	29/10 - 26/11	7100 (1.2)	13 (30)	20.7
48 - 52	26/11 - 2/1-02	15800 (1.3)	<25	6.0

Gävle

<i>Weeks</i>	<i>Period</i>	<i>⁷Be</i>	<i>¹³⁷Cs</i>	<i>Precipitation (mm)</i>
39 - 42	24/9 - 22/10	20100 (0.9)	71 (18)	40.7
43 - 46	22/10- 19/11	3400 (3.6)	24 (41)	9.0
47 - 50	19/11 - 17/12	8800 (1.5)	84 (11)	28.6

Ursvik

<i>Weeks</i>	<i>Period</i>	<i>⁷Be</i>	<i>¹³⁷Cs</i>	<i>Precipitation (mm)</i>
38 - 41	17/9 - 15/10	65800 (0.5)	44 (22)	57.7
42 - 45	15/10 - 12/11	48000 (0.6)	18 (56)	74.5
46 - 49	12/11 - 10/12	36300 (0.7)	<23	22.3

Ljungbyhed

<i>Weeks</i>	<i>Period</i>	<i>⁷Be</i>	<i>¹³⁷Cs</i>	<i>Precipitation (mm)</i>
37 - 40	10/9 - 8/10	90500 (0.4)	34 (29)	131.8
41 - 44	8/10 - 5/11	61500 (0.3)	30 (15)	46.2
45 - 48	5/11 - 3/12	50300 (0.6)	<24	58.6
49 - 52	3/12 - 31/12	26000 (1.0)	<25	27.4

Values are given in mBq/m².

Error estimates (1σ %) are given in brackets.

*Table IV****Other anthropogenic radionuclides detected,
fourth quarter 2001***

<i>Week starting</i>	<i>Station</i>	<i>Isotope</i>	<i>Concentration</i>
10-dec	Gävle	¹³¹ I	0.6 (42)

Values are given in $\mu\text{Bq}/\text{m}^3$.
Error estimates (1 σ %) are given in brackets.