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

First quarter 2002



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User report

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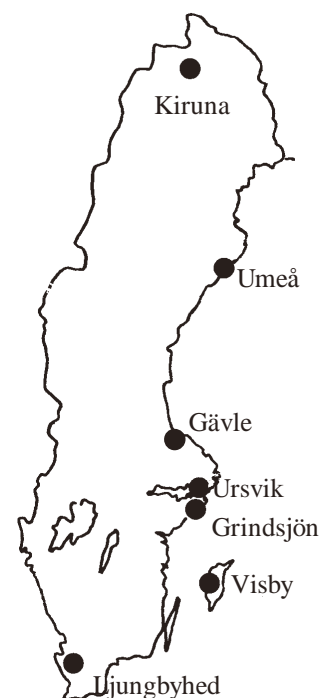
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Report title Quarterly report on measurements of radionuclides in ground level air in Sweden. First quarter 2002.		
Abstract (not more than 200 words) Filtering of ground level air is performed weekly at seven different locations in Sweden: Kiruna, 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, första kvartalet 2002.		
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 gammaspektroskopi 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, first quarter 2002

<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>
31-dec	1910 (0.3)	1410 ¹⁾ (0.3)	2820 (0.2)	3020 (0.2)	³⁾	2940 (0.2)	2220 (0.3)
7-jan	1250 (0.3)	1540 (0.3)	1840 (0.2)	1930 (0.3)	³⁾	1940 (0.2)	2390 (0.2)
14-jan	1850 (0.3)	1170 (0.4)	470 (0.5)	890 (0.3)	³⁾	1160 (0.3)	1100 (0.4)
21-jan	1620 (0.2)	1640 (0.3)	1470 ²⁾ (0.5)	1880 (0.2)	³⁾	1500 (0.3)	2000 (0.2)
28-jan	1380 (0.3)	1380 (0.3)	1830 (0.2)	2000 (0.2)	³⁾	1910 (0.3)	3030 (0.2)
4-feb	940 (0.3)	750 (0.4)	1480 (0.4)	1400 (0.3)	2010 (0.1)	1550 (0.3)	2110 (0.2)
11-feb	1450 (0.2)	1320 (0.3)	1430 (0.3)	1570 (0.3)	1870 (0.1)	1530 (0.3)	1830 (0.2)
18-feb	1360 (0.2)	1500 (0.2)	2030 (0.2)	1980 (0.3)	1950 (0.1)	1830 (0.3)	2060 (0.2)
25-feb	1470 (0.2)	1680 (0.2)	1830 (0.3)	1680 (0.3)	1880 (0.1)	1460 (0.3)	1810 (0.2)
4-mar	1670 (0.2)	1660 (0.2)	1930 (0.3)	1570 (0.3)	1790 (0.1)	1490 (0.3)	2230 (0.2)
11-mar	1920 (0.2)	1330 (0.3)	2840 (0.2)	2900 (0.1)	3100 (0.1)	2150 (0.3)	3470 (0.2)
18-mar	2670 (0.1)	2170 (0.2)	2020 (0.2)	1920 (0.1)	1840 (0.1)	1730 (0.2)	2130 ⁴⁾ (0.2)
25-mar	1300 (0.2)	1760 (0.1)	3240 (0.2)	4110 (0.2)	4560 (0.1)	3900 (0.2)	3490 (0.1)

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

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

¹⁾Two weeks filter

²⁾Four days filter, 21 – 25/1

³⁾Fan out of order

⁴⁾Four days filter, 18 – 22/3

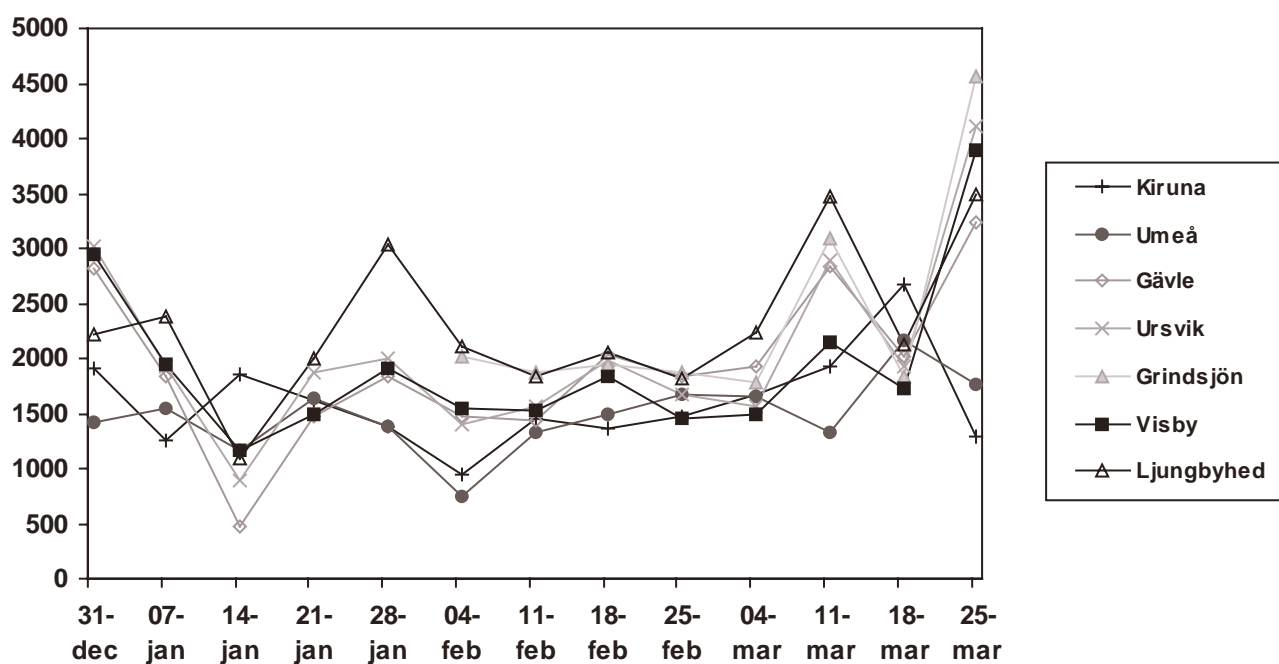


Table II

¹³⁷Cs concentrations in Sweden, first quarter 2002

<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>
31-dec	0.1 (70)	2.0 ¹⁾ (5)	52.8 ²⁾ (1)	1.6 (6)	⁴⁾	0.5 (18)	1.8 (9)
7-jan	0.3 (26)	2.1 (6)	4.6 (3)	0.7 (15)	⁴⁾	0.3 (31)	1.1 (12)
14-jan	<0.2	3.1 (4)	3.3 (5)	0.4 (18)	⁴⁾	0.4 (22)	1.3 (10)
21-jan	0.1 (33)	3.4 (4)	5.6 ³⁾ (6)	1.3 (5)	⁴⁾	0.7 (15)	0.7 (9)
28-jan	0.5 (21)	4.7 (3)	5.7 (2)	0.8 (7)	⁴⁾	1.1 (12)	0.7 (12)
4-feb	0.1 (42)	1.9 (6)	3.5 (4)	0.6 (18)	0.3 (8)	0.3 (29)	0.9 (8)
11-feb	<0.1	3.1 (4)	3.4 (4)	0.7 (16)	0.3 (10)	0.4 (28)	0.5 (21)
18-feb	0.3 (16)	3.8 (2)	10.3 (2)	0.8 (15)	0.5 (6)	0.5 (19)	0.4 (13)
25-feb	0.3 (13)	2.5 (3)	4.3 (5)	1.0 (11)	0.7 (4)	0.3 (23)	0.5 (10)
4-mar	0.1 (38)	2.9 (2)	3.7 (4)	0.5 (17)	0.3 (8)	0.3 (28)	0.2 (49)
11-mar	<0.1	3.2 (3)	7.4 (2)	1.1 (6)	0.9 (3)	0.6 (17)	1.9 (7)
18-mar	0.3 (17)	3.1 (4)	9.0 (1)	1.0 (5)	0.8 (4)	0.9 (7)	0.7 ⁵⁾ (13)
25-mar	0.1 (35)	2.2 (2)	7.7 (2)	1.1 (9)	0.8 (3)	0.9 (12)	1.4 (6)

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

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

¹⁾Two weeks filter

²⁾High value due to resuspension of Chernobyl fallout from ground preparation work in the neighbourhood of the sampler

³⁾Four days filter, 21 – 25/1

⁴⁾Fan out of order

⁵⁾Four days filter, 18 – 22/3

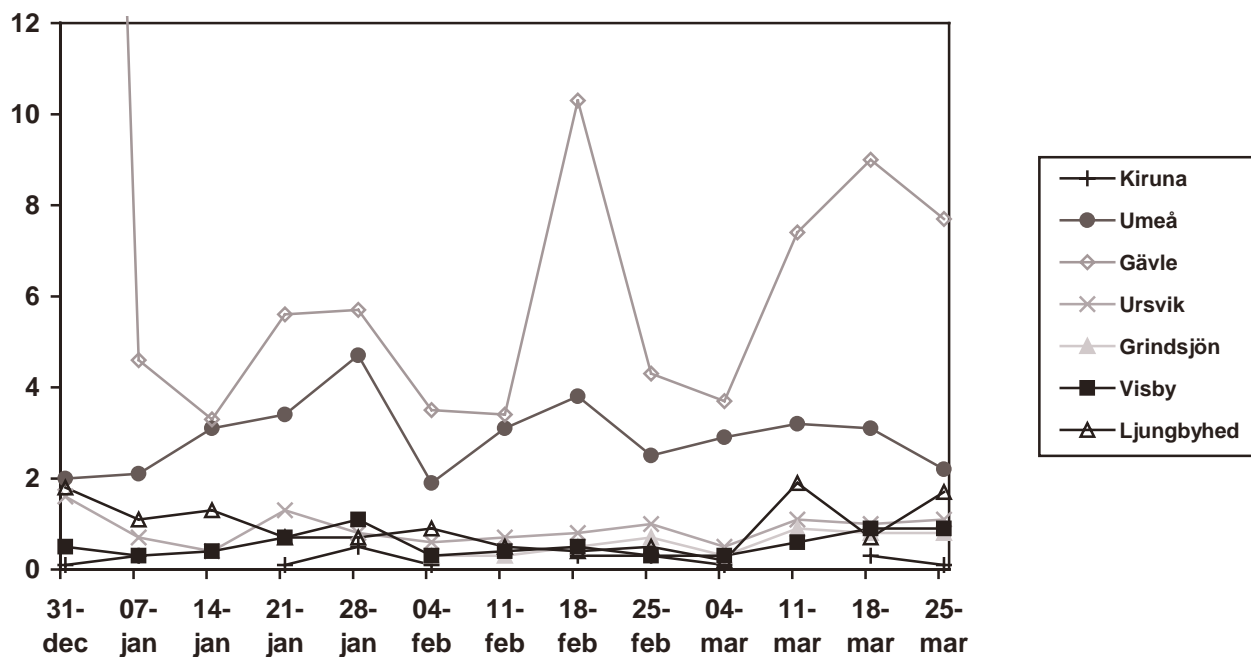


Table III

Deposition measurements, first quarter 2002**Kiruna**

<i>Weeks</i>	<i>Period</i>	<i>⁷Be</i>	<i>¹³⁷Cs</i>	<i>Precipitation (mm)</i>
01 - 03	2/1 - 21/1	3800 (1.2)	<6	50.0
04 - 07	21/1 - 18/2	9800 (1.7)	<24	17.5
08 - 11	18/2 - 18/3	2200 (1.8)	5 (64)	10.5

Gävle

<i>Weeks</i>	<i>Period</i>	<i>⁷Be</i>	<i>¹³⁷Cs</i>	<i>Precipitation (mm)</i>
51 - 02	17/12-01 - 15/1	7400 (2.5)	76 (17)	19.1
03 - 06	15/1 - 11/2	26800 (0.9)	109 (13)	54.1
07 - 10	11/2 - 11/3	8600 (1.9)	86 (16)	27.0

Ursvik

<i>Weeks</i>	<i>Period</i>	<i>⁷Be</i>	<i>¹³⁷Cs</i>	<i>Precipitation (mm)</i>
50 - 01	10/12-01 - 7/1	21700 (0.5)	15 (23)	43.0
02 - 05	7/1 - 4/2	34300 (0.8)	21 (54)	64.7
06 - 09	4/2 - 4/3	40100 (0.3)	12 (24)	56.8
10 - 13	4/3 - 1/4	19700 (0.4)	8 (26)	33.1

Ljungbyhed

<i>Weeks</i>	<i>Period</i>	<i>⁷Be</i>	<i>¹³⁷Cs</i>	<i>Precipitation (mm)</i>
01 - 04	31/12-01 - 28/1	76500 (0.5)	<25	84.0
05 - 08	28/1 - 25/2	116300 (0.4)	23 (40)	119.8
09 - 12	25/2 - 25/3	64300 (0.5)	16 (55)	70.0

Values are given in mBq/m².

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

*Table IV**Other anthropogenic radionuclides detected,
first quarter 2002*

<i>Week starting</i>	<i>Station</i>	<i>Isotope</i>	<i>Concentration</i>
31-dec -01	Gävle	¹³¹ I	0.6 (41)
7-jan	Gävle	¹³¹ I	1.7 (16)
11-mar	Gävle	¹³¹ I	0.8 (33)

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