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

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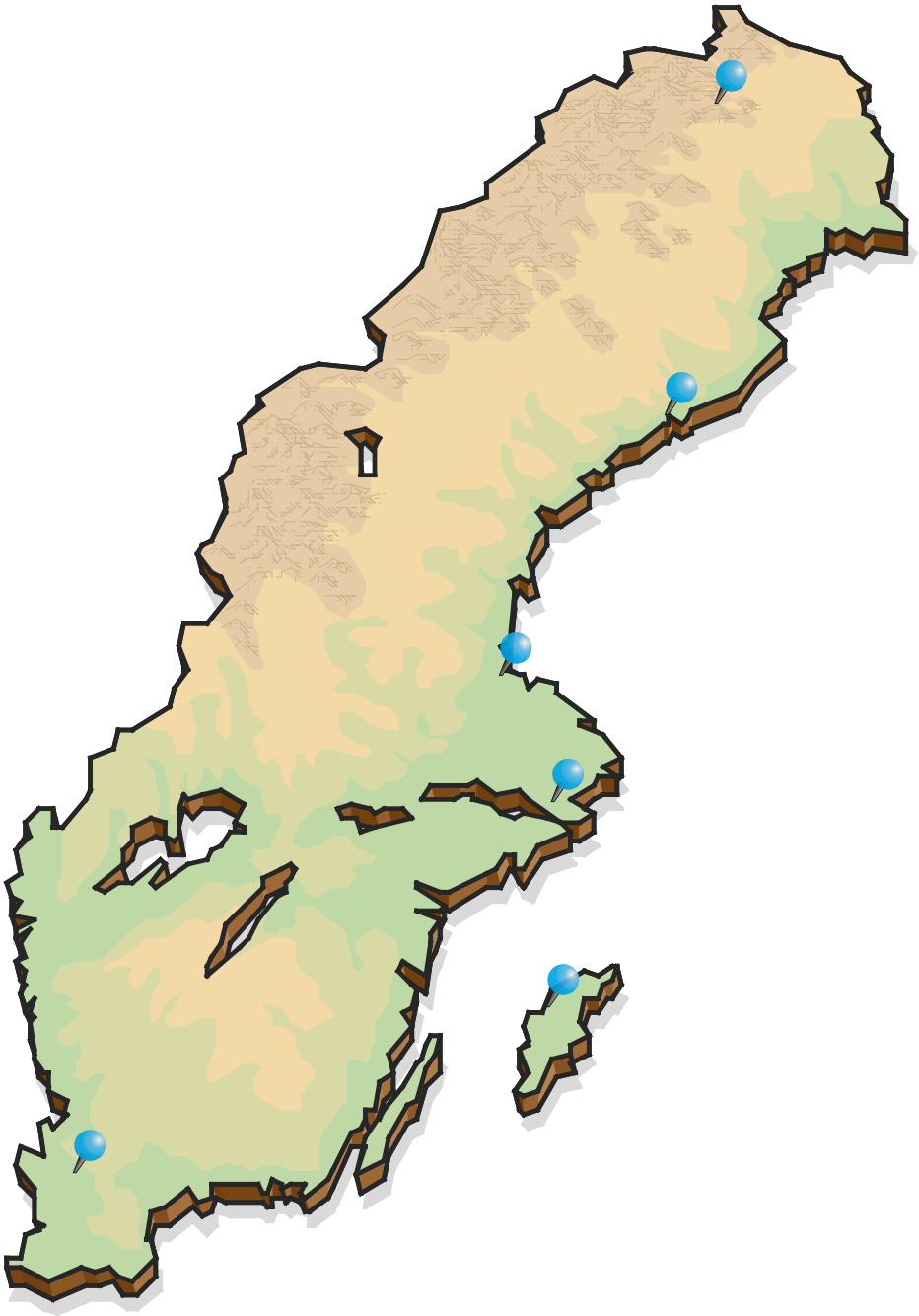
First quarter 2005



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Quarterly report on measurements of radionuclides in ground level air in Sweden. First quarter 2005.

Abstract (not more than 200 words)

Filtering of ground level air is performed weekly at six different locations in Sweden: Kiruna, Umeå, Gävle, Ursvik, Visby and Ljungbyhed. The filters are pressed 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 are measured. The levels of Be-7 and Cs-137 in air and precipitation are presented for the different stations.
Other antropogenic radionuclides detected, if any are also presented.

Keywords

Airborne radionuclides, deposition, ^{7}Be, ^{137}Cs, ^{131}I

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Radionuklider i markluft i Sverige. Kvartalsrapport, första kvartalet 2005.</td></tr>
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Stationer för filtrering av markluft finns på sex olika ställen i Sverige: Kiruna, Umeå, Gävle, Ursvik, Visby och Ljungbyhed. Filtren pressas och analyseras veckovis med hjälp av gammaspektroskopi med germaniumdetektor. Nederbörd samlas in på fyra av dessa stationer: Kiruna, Gävle, Ursvik och Ljungbyhed. Nederbördsproven askas in och mäts med hjälp av gammaspektroskopi.
Halterna av Be-7 och Cs-137 presenteras för luft och nederbörd för de olika stationerna. I de fall andra antopogena radionuklider detekteras presenteras även dessa.</td></tr>
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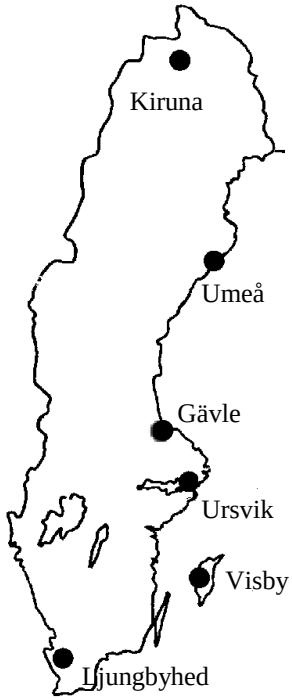
Sampling and analysis procedures

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



Kiruna:	67.84° N	20.42° E
Umeå:	63.85° N	20.34° E
Gävle:	60.40° N	17.14° E
Ursvik:	59.39° N	17.96° E
Visby:	57.63° N	18.32° E
Ljungbyhed:	56.08° N	13.23° E

At all stations except at Ursvik, 1000 m^3/h of air is filtered through a glass fibre filter (Camfil type CS 5.0). At each station the filters are changed twice weekly (Monday and Thursday or Friday) and sent by mail to our laboratory at Ursvik for measurement and analysis. At Ursvik 1800 m^3/h of air is filtered through 2 filters, the filters are changed with a time period of 28 hours.

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 station at Ursvik, the 12 filters produced per week are assembled in a Marinelli like geometry by pressing them into one circular disc (diameter 94 mm, thickness 16 mm), placed on top of the detector, and into six 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 (12m^3/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 at Kiruna, Gävle, Ursvik and Ljungbyhed are each equipped with a big stainless steel funnel (1m radius) to collect precipitation. Which 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 HPGe detectors. From these measurements the total deposition is calculated.

Radionuclides seen in the filters are normally only the naturally occurring radon daughters and ^{7}Be. Most of our stations also detect ^{137}Cs, which is due to resuspension of the Chernobyl fallout. In tables I and II the concentrations of ^{7}Be and ^{137}Cs 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

^{7}Be concentrations in Sweden, first quarter 2005

Week starting	*Kiruna*		*Umeå*		*Gävle*		*Ursvik*		*Visby*		*Ljungbyhed*	
3-jan	420	(0.4)	770	(0.3)	1270	(0.2)	1440	(0.2)	1470	(0.2)	1990	(0.2)
10-jan	1300	(0.2)	1230	(0.2)	1350[1]	(0.4)	2230	(0.1)	1890	(0.3)	1680	(0.2)
17-jan	1160	(0.2)	1420	(0.2)	1650[2]	(0.3)	1770	(0.1)	1860	(0.3)	1520	(0.2)
24-jan	1610	(0.2)	1590	(0.2)	1870	(0.2)	2130	(0.1)	1780	(0.2)	1240	(0.2)
31-jan	1070	(0.2)	730	(0.2)	1170	(0.3)	1730	(0.1)	1790	(0.2)	1920	(0.2)
7-feb	2520	(0.1)	3010	(0.2)	3320	(0.1)	4120	(0.1)	3970	(0.1)	3270	(0.1)
14-feb	2480	(0.1)	2560	(0.2)	2430[3]	(0.2)	2240	(0.1)	2000	(0.2)	1780	(0.2)
21-feb	3170	(0.1)	4070	(0.1)	3000[4]	(0.2)	3090	(0.1)	2950	(0.1)	2340	(0.2)
28-feb	2310	(0.1)	2970	(0.1)	2620	(0.2)	3150	(0.1)	3310	(0.1)	2950[5]	(0.2)
7-mar	2380	(0.2)	1820	(0.1)	1880	(0.2)	1750	(0.2)	1860	(0.4)	1980[6]	(0.1)
14-mar	2430	(0.2)	2340	(0.2)	2520	(0.2)	2680	(0.1)	2240	(0.1)	2060	(0.2)
21-mar	2060	(0.1)	1970[7]	(0.1)	2660[7]	(0.1)	4160	(0.1)	3160[7]	(0.2)	3020[7]	(0.1)
28-mar	3260	(0.1)	2300[8]	(0.2)	3440[8]	(0.2)	4720	(0.1)	4480[8]	(0.1)	4580[8]	(0.1)

Values are given in µBq/m^3.
Error estimates (1σ %) are given in brackets.

[1] Four days filter, 10 – 14/1
[2] Ten days filter, 14 – 24/1
[3] Eight days filter, 14 - 22/2
[4] Six days filter, 22 - 28/2
[5] Eight days filter, 28/2 – 8/3
[6] Six days filter, 8-14/3
[7] Eight days filter, 21 - 29/3
[8] Six days filter, 29/3 – 4/4

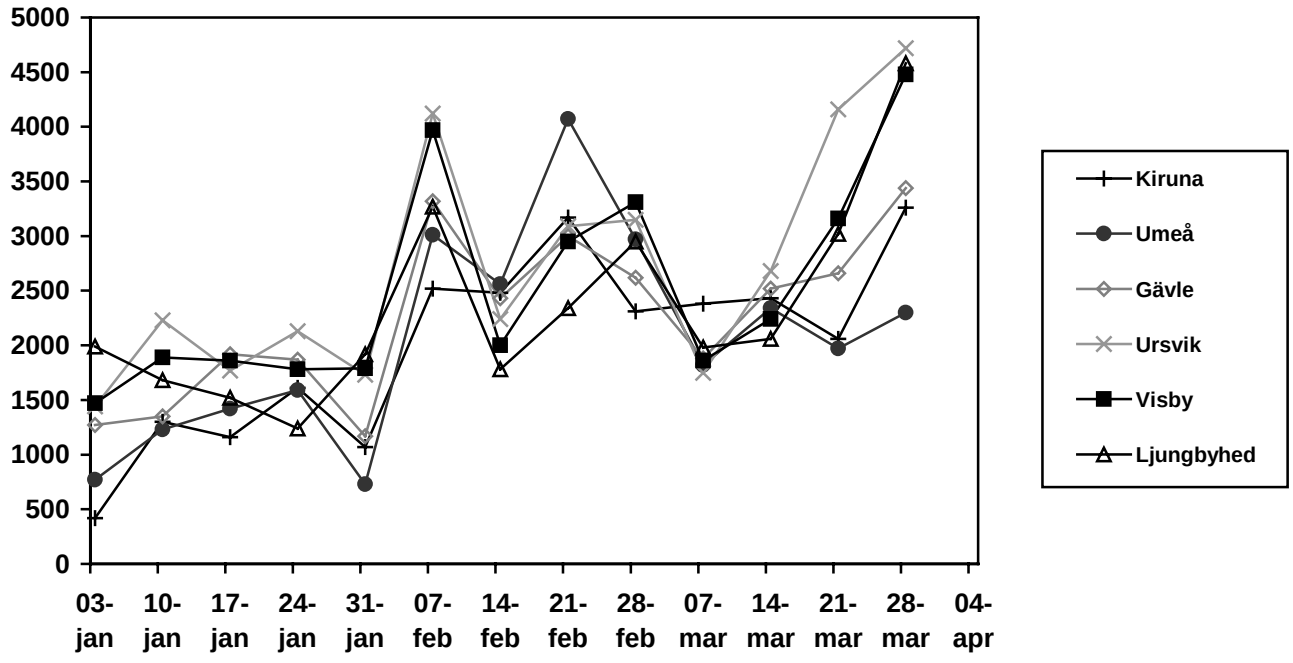


Table II

^{137}Cs concentrations in Sweden, first quarter 2005

Week starting	*Kiruna*	*Umeå*	*Gävle*	*Ursvik*	*Visby*	*Ljungbyhed*
3-jan	0.3 (18)	2.8 (2)	1.8 (5)	0.4 (15)	1.3 (6)	0.1 (36)
10-jan	0.2 (19)	1.6 (2)	1.6[1] (8)	0.5 (10)	0.5 (32)	0.8 (6)
17-jan	0.3 (18)	1.8 (3)	2.4[2] (4)	1.0 (6)	1.1 (15)	0.7 (8)
24-jan	0.4 (11)	2.4 (3)	5.7 (2)	1.6 (3)	0.9 (10)	2.6 (3)
31-jan	0.2 (29)	2.3 (3)	2.1 (5)	1.0 (6)	1.2 (5)	1.6 (4)
7-feb	0.5 (10)	2.8 (3)	5.0 (3)	1.8 (3)	1.6 (6)	1.8 (4)
14-feb	0.5 (10)	2.9 (3)	3.3[3] (4)	1.3 (4)	0.7 (13)	0.8 (7)
21-feb	<0.1	1.7 (3)	3.7[4] (3)	1.6 (4)	1.1 (6)	1.1 (5)
28-feb	0.3 (19)	4.0 (2)	6.6 (2)	1.8 (3)	1.2 (5)	1.6[5] (3)
7-mar	0.3 (17)	2.1 (2)	3.5 (3)	0.8 (10)	0.8 (7)	0.7[6] (9)
14-mar	0.4 (19)	3.3 (4)	6.0 (2)	1.6 (3)	0.8 (6	1.1 (6)
21-mar	0.1 (29)	3.1[7] (2)	5.0[7] (2)	1.7 (4)	1.4[7] (9)	1.7[7] (4)
28-mar	0.1 (56)	2.2[8] (3)	12.2[8] (1)	1.8 (4)	1.2[8] (6)	2.1[8] (4)

Values are given in µBq/m^3.
Error estimates (1σ %) are given in brackets.

[1] Four days filter, 10 – 14/1
[2] Ten days filter, 14 – 24/1
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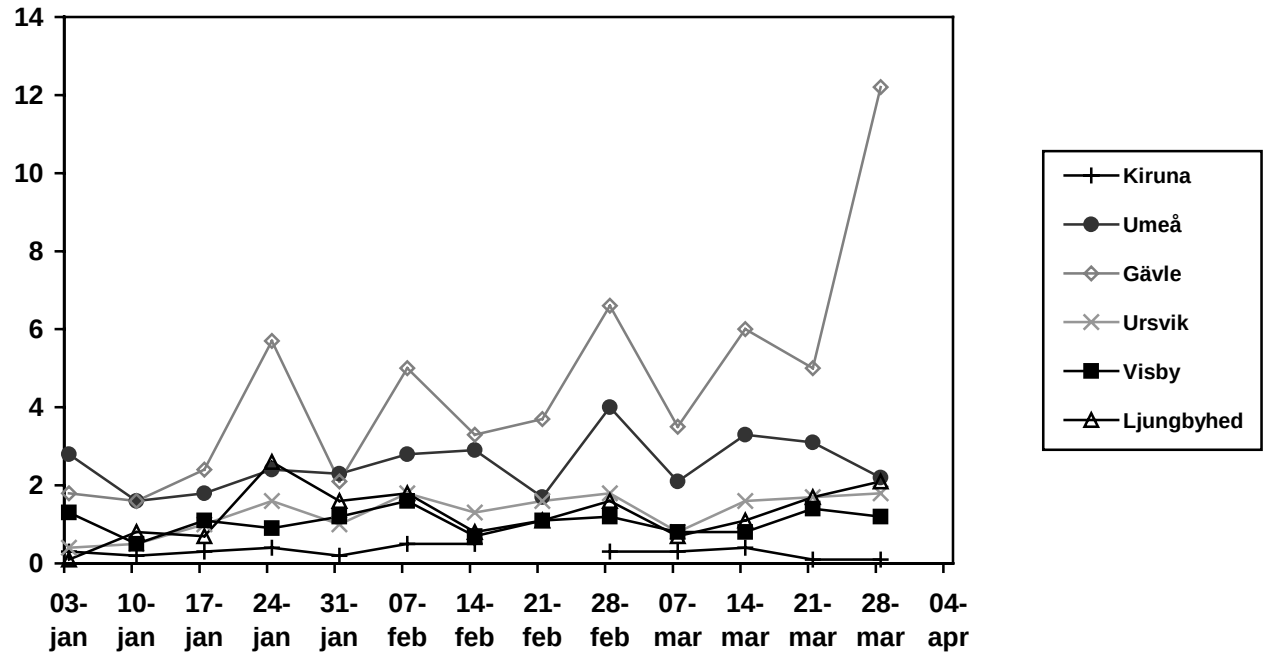

Table III

Deposition measurements, first quarter 2005

Kiruna

Weeks	*Period*	*^{7}Be*	*^{137}Cs*	*Precipitation (mm)*
52 – 02	20/12 -04 – 17/1-05	18300 (0.5)	10 (24)	62.7
03– 06	17/1 – 14/2	12300 (1.1)	22 (29)	14.3
07– 10	14/2 – 14/3	2200 (4.2)	16 (34)	3.5

Gävle

Weeks	*Period*	*^{7}Be*	*^{137}Cs*	*Precipitation (mm)*
51 – 01	13/12-04 – 10/1-05	18200 (0.7)	73 (10)	29.9
02 – 05	10/1 – 7/2	10000 (1.1)	65 (13)	8.0
06 – 09	7/2 – 7/3	70200 (0.3)	164 (5.4)	35.9
10 -13	7/3 – 4/4	12200 (1.0)	42 (19)	12.1

Ursvik

Weeks	*Period*	*^{7}Be*	*^{137}Cs*	*Precipitation (mm)*
01 – 04	3/1 – 24/1	16800 (0.9)	21 (32)	29.3
05 – 08	24/1 –28/2	35300 (0.4)	27 (23)	43.0
09 – 12	28/2 – 28/3	8100 (1.4)	20 (29)	15.3

Ljungbyhed

Weeks	*Period*	*^{7}Be*	*^{137}Cs*	*Precipitation (mm)*
53 – 03	27/12 -04 – 24/1-05	101000 (0.2)	18 (31)	86.6
04 – 07	24/1 – 21/2	37200 (0.4)	18 (30)	12.7
08 – 11	21/2– 21/3	39800 (0.4)	21 (24)	26.3

Values are given in mBq/m^2.

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

Table IV

Other anthropogenic radionuclides detected, first quarter 2005

Week starting	*Station*	*Isotope*	*Concentration*	*Note*
31-jan	Ljungbyhed	^{131}I	0.4 (40)	
22-feb	Gävle	^{131}I	1.3 (15)	(1)
28-feb	Gävle	^{131}I	2.1 (12)	(1)

Values are given in µBq/m^3.
Error estimates (1σ %) are given in brackets.

(1) The activities of ^{131}I found in Gävle have been shown to correspond to administration of cancer treatment doses for thyroidea cancer at the Gävle-Sandviken County Hospital (ref. Erlandsson et al., "I-131 in air filters at Gävle", presented at NSRP 13th meeting in Åbo, 25-29 August 2002).