Summary of Gamma Spectrometry on Local Air Samples from 1985-1995

by

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MASTER

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From 1985 to 1995 (U)**

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FROM: W.G. WINN, 735-A

**Summary of Gamma Spectrometry on Local Air Samples
From 1985 to 1995 (U)**

INTRODUCTION

This report summarizes the 1985-1995 results of low-level HPGe gamma spectrometry analysis of high-volume air samples collected at the Aiken Airport, which is about 25 miles north of SRS as shown in Figure 1. The author began analyzing these samples with new calibrations using the newly developed GRABGAM code¹ in 1985. The air sample collections were terminated in 1995, as the facilities at the Aiken Airport were no longer available. Air sample measurements prior to 1985 were conducted with a different analysis system (and by others prior to 1984), and the data were not readily available.

The report serves to closeout this phase of local NTS air sample studies, while documenting the capabilities and accomplishments. Hopefully, the information will guide other applications for this technology, both locally and elsewhere.

MEASUREMENTS

The air sampler system is shown in Figure 2, and one of its 20"x20" cellulose collection filters is shown in Figure 3. Typically about 100,000 m³ of air was passed through such a filter during a 3-day period, after which the filter was removed and bagged into a triangular geometry (6"-sides, 8.5"-hypotenuse, 0.5"-thick). The sample was then counted overnight on either a 10% or 30% HPGe detector, which had been calibrated for this geometry using source mapping techniques. The detectors were well-shielded within the ULLCF; however, current NTS capabilities with the larger 90% and 160% HPGe detectors of the Underground Counting Facility offer much better sensitivity.

MEASUREMENTS DATA

Air sample isotopic data for gamma-emitting radionuclides are presented in Figures 4-16, where selected isotope intensities are plotted against time. The selected isotopes were either cosmogenic or man-made; however, not all of the Chernobyl isotopes are included as they have been reported in detail elsewhere^{2,3}.

The numerical values for time plots are given in Appendix B, which is saved as a LOTUS spreadsheet file. Except for Cs-137, only values that are above the detection limit are recorded. For Cs-137, "less-than" detection limits are denoted as negative values. Entries with only one significant digit are rough estimates for marginal detection. Other entries were detected with counting errors that were better than the determination limit of $\pm 33\%$.

The original GRABGAM analysis data are archived in ordered notebooks, should anyone wish to study other information associated with the measurements. A gap in the data occurred in September-October of 1988, where repairs to the sampler were apparently being conducted.

COMMENTS - General Phenomena and Events

Both naturally and artificially produced isotopes are reported and discussed in detail in the next section. Atmospheric and solar correlations are considered for the naturally produced isotopes of Be-7 and Na-22. The artificially produced isotopes are discussed in relation to events at SRS and other nuclear sites, although not all observations could be correlated.

Eleven notable events concerning the observed man-made radionuclides and their correlation status were tabulated to guide the reader. Some correlations were identified using

information from the annual SRS environmental reports⁴. Only two notable events occurred following 1987, after SRS nuclear production activities had been significantly reduced. The tabulation is given below:

Event-Date	Correlation	Description
A. 09/03-09/04/85	no	Maximum Nb-95, Zr-95
B. 01/31-02/03/86	yes	Releases from A and H areas
C. 05/10-05/11/86	yes	Chernobyl fallout maximum
D. 11/05-11/07/86	yes	H area Ce-144 and 6 other isotopes
E. 01/26-01/28/87	no	Cs-137 spike
F. 06/05-06/08/87	no	Maximum Co-60 with Cs-137 spike
G. 07/13-07/15/87	no	Ce-141 spike and Co-60; no Cs-137
H. 08/19-08/21/87	no	Cs-137 spike
I. 11/23-11/25/87	yes	H area release per leaky valve
J. 08/22-08/24/90	no	Ce-144 spike
K. 04/21-04/23/93	yes	Tomsok fallout observation per Ru-106

COMMENTS - Reported Isotopes

Be-7 (53d). Be-7 is plotted in Figure 4 (raw data) and Figure 5 (smoothed data). The overall geometric average for the Be-7 concentration was 131.5 fCi/m^3 , which is in good agreement with the EMS average 25 miles from SRS during this period⁴. The Be-7 levels appear anti-correlated with the 11-yr sunspot cycle, where a general dip in the data during 1990-1991 corresponds to the sunspot maximum. Jim Cadieux noted that this anti-correlation holds for C-14 also⁵. Jim also noted fine structure oscillations that appear to peak near the equinoxes, which Dave Hayes noted as probable meteorological effects. Al Boni commented that a pronounced upper atmospheric dumping to the troposphere in Spring may cause some Be-7 peaking, and Cliff Carlson noted a similar possibility for Fall.

Na-22 (2.6y). Na-22 is plotted in Figure 6. It is detected by its 1274 keV gamma-ray. Although Eu-154 also has a 1274 keV gamma, other Eu-154 gammas should have been detected; thus, the possibility of Eu-154 was discarded. Al Boni indicated that Na-22 does turn up in air samples from natural sources. He also noted that the data tend to show more Na-22 observations in Spring, consistent with upper atmosphere dumping to the troposphere. A possible cosmogenic origin is from the F-19 (α, n) Na-22 reaction. Na-22 was detected in only 15.1% of the air samples, yielding a geometric average of 0.0224 fCi/m^3 . Assuming the distribution of Na-22 concentrations to be log-normal implies that the 15.1% observed values all exceed a value of $\mu + 1.03\sigma$, where μ is the true log-mean log(v) of the distribution. Using a method developed in Appendix A yields $v = 0.0054 \text{ fCi/m}^3$, which is significantly lower than the mean of the observed values.

Co-60 (5.3y). Co-60 is plotted in Figure 7, where its detection appears to have been sporadic over the years. Co-60 was only observed in 1.43% of the measurements, which ranged from a barely detected 0.01 fCi/m³ to 0.14 fCi/m³. No particular events have been correlated with the observations; however, the detection of both Co-60 gammas for much of the data strongly confirms its presence. Maximum Co-60 occurred for the 6/5-8/87 event, which also had elevated Cs-137 at 0.78 fCi/m³.

Nb-95 (35d). Nb-95 is plotted in Figure 8; it normally occurs with Zr-95 as a fission product. Both were detected in the Chernobyl fallout; however, the largest detection was earlier in 1985, although no incident has been associated with the observation. For these larger Nb-95 concentrations, Al Boni suggested that there may be a correlation with earlier Cf-252 activities at the site. Maximum Nb-95 occurred in an early sample (9/3-4/85); other notable occurrences were with Chernobyl (5/10-11/86) and the high Ce-144 observation (11/5-7/86). For many of the smaller detections, Nb-95 was detected without Zr-95 (or vice versa); it is possible that these smaller occurrences were actually from high fluctuations in peaks of Bi-214 (or Ac-228 for Zr-95), as these were observed in only about 3% of the samples (1% for Zr-95), while Bi-214 (and Ac-228) were observed nearly 100% of the time.

Zr-95 (64d). Zr-95 is plotted in Figure 9; its features are described within the Nb-95 discussion above.

Ru-103 (39d). Ru-103 is plotted in Figure 10; it was mainly observed in the Chernobyl fallout (5/10-11/86). It was also among the 6 man-made isotopes accompanying the high Ce-144 event (11/5-7/86), although at levels too low to be observed in Figure 10. The Ru-103 from Chernobyl fallout continued to be observed beyond the time frame covered in the earlier Chernobyl reports²⁻³.

Ru-106 (362d). Ru-106 is plotted in Figure 11; it was observed in both the Chernobyl fallout (5/11-11/86) and Tomsk fallout (4/21-23/93). Ru-106 was also among the 6 man-made isotopes accompanying the high Ce-144 event (11/5-7/86). The Chernobyl peak activity was 29.2 fCi/m³ in May of 1986 and the Tomsk fallout was barely detected at 0.13 fCi/m³ in April of 1993.

Confirmation of the Tomsk observation resulted from recounting samples on the 90% HPGe of the Underground Counting Facility, whereby 12% counting statistics were observed for Ru-106. Independent observation of Ru-106 at EML in New York provided further confirmation. Unlike the Chernobyl reactor fallout, the Tomsk reprocessing facility fallout did not include the shorter-lived Ru-103. Dave Hayes speculates that the absence

of other longer-lived fission products in the TOMSK fallout is due to the nature of the accident, whereby favorable oxidation of Ru causes it to be more readily airborne.

Cs-134 (2.1y). Cs-134 is plotted in Figure 12; it was mainly observed in the Chernobyl fallout (5/10-11/86). It was also among the 6 man-made isotopes accompanying the high Ce-144 event (11/5-7/86), although at levels too low to be distinguished in Figure 12. Following Chernobyl, the Cs-134/Cs-137 ratio gradually decreased from 0.5 to less than 0.1, as pre-existing long-lived Cs-137 on the ground was resuspended and mixed in with the airborne Chernobyl fallout³. However, the Cs-134/Cs-137 ratio was 0.23 for the high Ce-144 event, which occurred six months after the peak of the Chernobyl fallout.

Cs-137 (30y). Cs-137 is plotted in Figures 13 and 14, where Figure 13 has the larger scale to emphasize the Chernobyl fallout and Figure 14 uses a smaller scale to illustrate non-Chernobyl levels. Both figures plot MDA "less than" values as negative values. Some relatively high Cs-137 activity "spikes" were observed up to more than a year after Chernobyl (through 1987); however, these were generally less than 1% of the peak Chernobyl activity.

Other than Chernobyl, the largest Cs-137 spike was correlated with an H Area release due to a leaky valve (11/23-25/87). For this spike and two smaller preceding ones (1/26-28/87 and 8/19-21/87), Cs-137 was the only observed man-made isotope, suggesting the possibility of a common source, namely the leaky valve.

Additional Cs-137 spikes occurred with A and H area releases (1/31-2/3/86), the high Ce-144 event (11/5-7/86), and the maximum Co-60 observation (6/5-8/87). A small Cs-137 spike also occurred with the Nb-95/Zr-95 maximum (9/3-4/85).

Ce-141 (33d). Ce-141 is plotted in Figure 15. Like Cs-137, the major Ce-141 activity occurred with Chernobyl, with two smaller "spikes" being observed about a year later in 1987. One Ce-141 spike (7/13-15/87) was preceded and followed with a little Co-60, while the other Ce-141 spike was barely detected.

Ce-144 (284d). Ce-144 is plotted in Figure 16. Ce-144 was observed with Chernobyl, and the only other observations were a spike near the end of 1986 and one in 1990. The larger spike (11/5-7/86) exceeded the Ce-144 maximum for the Chernobyl fallout and was accompanied by six of the isotopes discussed above, namely Nb-95, Zr-95, Ru-103, Ru-106, Cs-134, and Cs-137. EMS also observed high Ce-144 (62 fCi/m³) at H area during November 1986, but a more precise source correlation was not investigated since the level was within legal limits⁴. The other spike (8/22-24/90) was relatively small, and its source has not been postulated.

COMMENTS - Unreported Isotopes

This report does not provide detailed data for all of the isotopes that were detected. In particular, previously reported isotopes^{2,3} that were observed only during the main Chernobyl fallout are excluded. Also natural isotopes associated with dust and radon are not given. Groupings of these isotopes are given below, should there be future interest in collating their data.

Isotopes only observed during main Chernobyl fallout:

Ag-110m (33d)
Sb-125 (2.7y)
Te-129m (33d)
Te-132 (3d)
I-131 (8d)
Cs-136 (13d)
Ba-140 (12d)
La-140 (12d)

Natural isotopes from dust and radon:

K-40 (1.3×10^9 y)
Tl-208 (3m+)
Pb-210 (22y)
Bi-212 (61m+)
Pb-212 (11h+)
Bi-214 (20m+)
Pb-214 (27m+)
Ra-226 (1600y)
Ac-228 (6.1h+)
Pa-234m (1.2m+)
Th-234 (24d+)
U-235 (7.0×10^8 y)

Dave Hayes commented that the natural isotopes may have interesting meteorological correlations; however, one must use the results of the natural isotopes with care. Evidence suggested that a sizeable K-40 background existed within the filter, so that K-40 levels are misrepresentative and should not be trusted. Many of the thorium and radium daughters have short half-lives but are denoted by a "+" to indicate that their chain equilibrium half-lives are much longer; probably the equilibrium half-lives exceed 1000 yr, as it is unlikely that much Rn-222 (3.9d) was collected by the filter as a precursor, although Rn-222 could be present in the room air background. The infrequently detected Pa-234m may be from room background fluctuations, and U-235 detections are most likely Ra-226, as both are denoted by detection of the 186 keV gamma and other less intense U-235 gammas were not observed.

One should also be cautioned that some of the gammas from these natural sources are similar to those of various man-made radioisotopes. Among these are Mn-54, Nb-95 and Zr-95. Finally, there were a few marginal detections that the GRABGAM code denoted as Cs-139; however, the associated 166 keV gamma peak was somewhat broad in these cases, possibly suggesting background fluctuations from backscatter.

ACKNOWLEDGEMENTS

Interpretation: Assistance in data interpretation from Jim Cadieux, Dave Hayes, Al Boni, and Cliff Carlson have already been acknowledged in the text. Bob Taylor and Cliff Carlson provided general information with data interpretations via their earlier oversight of these air collections.

Counting: Filter counting in the ULLCF was coordinated by Worth Dalton for a number of years; assisting him were John Thomas, Jim Rushton, Andy Cheek, and Sandy Stewart. Beginning in 1993 Jim Cadieux coordinated ULLCF counting with assistance from by Susie MacMurray and Jackie Medlin.

Collections: Various outside teams have conducted the field collections over the years. Participants included Richard Penix, Clovis Summer, Jerry Shuford, Raymond Roseberry, and Brian Antonicelli.

REFERENCES

1. W.G. Winn, W.W. Bowman, A.L. Boni, "Ultra-Clean Underground Counting Facility for Low-Level Environmental Samples", DP-1747 (1987).
2. M.V. Kantelo and W.G. Winn, "Summary of Chernobyl Fallout Monitoring by the Environmental Radiometrics Group", DPST-86-624 (1986).
3. W.G. Winn and M.V. Kantelo, "Time-Dependent Study of Chernobyl Fallout near Savannah River Site", Trans. Am. Nuc. Soc. 60, 75 (1989).

4. Savannah River Site Environmental Reports

<u>Year</u>	<u>Report Number</u>
1985	DPSPU 86-30-1
1986	DPSPU 87-30-1
1987	DPSPU 88-30-1
1988	WSRC-RP-89-59
1989	WSRC-IM-90-60
1990	WSRC-IM-91-28
1991	WSRC-TR-92-186
1992	WSRC-TR-93-075
1993	WSRC-TR-94-075
1994	WSRC-TR-95-075
1995	WSRC-TR-96-075

5. M. Stuiver and P.D. Quay, "Changes in Atmospheric Carbon-14 Attributed to a Variable Sun", Science 207, 11 (1980).

FIGURE 1. Location of Air Sampler

FIGURE 2. Air Sampler System

The air sampler system consists of the corrugated shed on left and associated equipment. Air passes through the filter, which is located in the elevated box to the right of the shed; then the air passes through the pump within the shed and is exhausted from the pipe on top of the shed.

FIGURE 3. Cellulose Filter

FIGURE 4

Be-7 in Air at Aiken Airport

FIGURE 5

Be-7 in Air at Aiken Airport

13-point smoothed

FIGURE 6

Na-22 in Air at Aiken Airport

FIGURE 7

Co-60 in Air at Aiken Airport

FIGURE 8

Nb-95 in Air at Aiken Airport

FIGURE 9

Zr-95 in Air at Aiken Airport

FIGURE 10

Ru-103 in Air at Aiken Airport

FIGURE 11

Ru-106 in Air at Aiken Airport

FIGURE 12

Cs-134 in Air at Aiken Airport

FIGURE 13

Cs-137 in Air at Aiken Airport

FIGURE 14

Cs-137 in Air at Aiken Airport

FIGURE 15

Ce-141 in Air at Aiken Airport

FIGURE 16

Ce-144 in Air at Aiken Airport

Appendix A. Data Distribution Analysis

The present work includes radioisotopic measurements that appear to be detected at random levels but only for a fraction of the observations. A normal probability distribution for such observations is shown below:

It is noted that the true mean μ of this distribution is below the detection threshold; it is obviously lower than the mean U of the observed measurements, per

$$U = \int_{\mu+p}^{\infty} xf(x)dx / F(p/\sigma)$$

$$U = \mu + \sigma/\sqrt{2\pi} \exp[-p^2/2\sigma^2]/F(p/\sigma)$$

If the sigma S of the observed measurements is calculated, we may write

$$U = \mu + S (\sigma/S) 1/\sqrt{2\pi} \exp[-p^2/2\sigma^2]/F(p/\sigma)$$

$$U = \mu + S G(\sigma/S, p/\sigma)$$

where we note that we may calculate $G(\sigma/S, p/\sigma)$ simply from the knowledge of the fraction of fluctuations $F(p/\sigma)$ above the detection limit. A BASIC program for this is given with example calculations on pages A-2 and A-3.

As an example, we show the calculation for the Na-22 data, assuming that it is log-normally distributed:

Data from observed detection:

$$F(p/\sigma) = 0.151 \text{ or } 15.1\%$$

$$U = -1.65 = \log(.0224 \text{ fCi/m}^3)$$

$$S = 0.1785 = \text{Std of } \log(x \text{ fCi/m}^3) \text{ values}$$

Calculation using G vs F Calculations (page A-3)

$$G(\sigma/S, p/\sigma) = 3.50$$

Calculation of $\mu=\log(v)$ and v

$$\mu = U - S G(\sigma/S, p/\sigma) = -1.65 - 0.1785 \times 3.50 = -2.27$$

$$v = 10^{-2.27} = 0.0054 \text{ fCi/m}^3$$

```

5 REM gausslim.bas
10 CLS
100 REM - setup main loop
110 INPUT"First Limit PS (sigs)";PSF
120 INPUT"Last Limit PS (sigs)";PSL
130 INPUT"Step Limit PS (sigs)";PSS
135 PRINT:PRINT
140      PRINT"   Limit   F=%Total   AvgL   SigL   G"
150      PRINT"   PS       100*DI   AV     SD     AV/SD"
160 PRINT
170 FOR PS = PSF TO PSL STEP PSS
200 REM - calcs inner loop - probability
240 DI = 0
250 FOR X = PS+.01 TO PS+10 STEP .02
260 DI = DI + EXP(-.5*X^2)
265 REM PRINT X,DI
270 NEXT X
280 DI = .02*SQR(1/(2*3.14159))*DI
290 REM PRINT DI
300 REM - calcs inner loop - average and sigma
305 REM:IF PS = 0 THEN 240
310 NI = SQR(1/(2*3.14159))*EXP(-.5*PS^2)
320 AV = NI/DI:REM assumes sigma = 1
330 REM AV = 0:REM test
345 VR = 0
350 FOR X = PS+.01 TO PS+10 STEP .02
362 VR = VR + ((X-AV)^2)*EXP(-.5*X^2)
370 NEXT X
385 VR = .02*SQR(1/(2*3.14159))*VR/DI
386 SD = SQR(VR)
400 PRINT USING"   ##.##   ###.####   ##.####   ##.####   ##.####"; PS, 100*DI,AV
,SD,AV/SD
500 NEXT PS

```

First Limit PS (sigs)? -5
 Last Limit PS (sigs)? 5
 Step Limit PS (sigs)? 1

Limit PS	F=%Total 100*DI	AvgL AV	SigL SD	G AV/SD
-5.00	100.0000	0.0000	1.0000	0.0000
-4.00	99.9969	0.0001	0.9997	0.0001
-3.00	99.8651	0.0044	0.9933	0.0045
-2.00	97.7252	0.0552	0.9415	0.0587
-1.00	84.1349	0.2876	0.7935	0.3624
0.00	50.0000	0.7979	0.6028	1.3236
1.00	15.8651	1.5252	0.4462	3.4184
2.00	2.2748	2.3734	0.3380	7.0218
3.00	0.1350	3.2836	0.2656	12.3645
4.00	0.0032	4.2268	0.2160	19.5717
5.00	0.0000	5.1887	0.1807	28.7081

Ok

First Limit PS (sigs)? 1
 Last Limit PS (sigs)? 1.1
 Step Limit PS (sigs)? .01

Limit PS	F=%Total 100*DI	AvgL AV	SigL SD	G AV/SD
1.00	15.8651	1.5252	0.4462	3.4184
1.01	15.6244	1.5332	0.4449	3.4464
1.02	15.3860	1.5412	0.4436	3.4746
1.03	15.1501	1.5493	0.4423	3.5030
1.04	14.9166	1.5573	0.4410	3.5315
1.05	14.6855	1.5654	0.4397	3.5602
1.06	14.4569	1.5734	0.4384	3.5891
1.07	14.2306	1.5815	0.4371	3.6180
1.08	14.0067	1.5896	0.4358	3.6472
1.09	13.7853	1.5977	0.4346	3.6765
1.10	13.5662	1.6058	0.4333	3.7059

Ok

Appendix B. Air Filter Data

The air filter data are tabulated in this appendix. The data associated with the events tabulated on page 3 are underlined and identified by event letters (A, B, ... K).

Except for Cs-137, only values that are above the detection limit are recorded. For Cs-137, "less-than" detection limits are denoted as negative values. Positive entries with only one significant digit are rough estimates for marginal detection. Other positive entries have counting errors that are better than the determination limit of $\pm 33\%$. Conservative counting error guidelines for detected values V (fCi/m³) for each isotope are given below.

<u>Isotope</u>	<u>Estimated σ (fCi/m³)</u>
Be-7	$1 \times (V/100)^{1/2}$
Na-22	$0.004 \times (V/0.010)^{1/2}$
Co-60	$0.004 \times (V/0.010)^{1/2}$
Nb-95 *	$0.005 \times (V/0.010)^{1/2}$
Zr-95 *	$0.007 \times (V/0.010)^{1/2}$
Ru-103	$0.005 \times (V/0.010)^{1/2}$
Ru-106	$0.06 \times (V/0.10)^{1/2}$
Cs-137	$0.006 \times (V/0.010)^{1/2}$
Ce-141	$0.05 \times (V/0.10)^{1/2}$
Ce-144	$0.05 \times (V/0.10)^{1/2}$

* Estimated σ can vary due to natural background effects.

Date	Be-7 fCi/m3	Na-22 fCi/m3	Co-60 fCi/m3	Nb-95 fCi/m3	Zr-95 fCi/m3	Ru-103 fCi/m3	Ru-106 fCi/m3	Cs-134 fCi/m3	Cs-137 fCi/m3	Ce-141 fCi/m3	Ce-144 fCi/m3
5/20-5/22	157								0.129		
5/22-5/24	90								-0.054		
5/24-5/29	160								0.101		
5/29-5/31	94								-0.066		
5/31-6/3/85	222								0.104		
6/3-6/5	160								-0.062		
6/5-6/7	159								0.095		
6/7-6/10	52								-0.073		
6/10-6/14											
6/14-6/17	122								0.055		
6/17-6/19	101								0.045		
6/19-6/21	198	0.037							0.058		
6/21-6/24	164								0.102		
6/24-6/26	169								0.064		
6/26-6/28	139								0.135		
6/28-7/1/85	121								0.052		
7/1-7/3	182	0.029	0.02						0.037		
7/3-7/8	238								0.102		
7/8-7/10	285	0.034							0.161		
7/10-7/12	189	0.036							0.073		
7/12-7/15	164								0.061		
7/15-7/17	185								0.108		
7/17-7/19	178								0.262		
7/19-7/22	173								0.148		
7/22-7/24	107								0.124		
7/24-7/26	68								0.052		
7/26-7/29	87								0.033		
7/29-7/31	74								0.087		
7/31-8/2/85	146								-0.065		
8/2-8/5	143								0.044		
8/5-8/7	166								0.057		
8/7-8/9	74								-0.037		
8/9-8/12	123								-0.032		
8/12-8/14	162								-0.036		
8/14-8/16	253	0.026							0.120		
8/16-8/19	138								0.071		
8/19-8/21	81								0.094		
8/21-8/23											
8/23-8/26	176		0.04						0.079		
8/26-8/28	116								0.130		
8/28-8/30	91		0.04						0.101		
8/30-9/3/85	101								0.081		
9/3-9/4	151			2.17	1.38				0.333		
9/4-9/6	151			0.04					0.122		
9/6-9/9	171	0.037							0.051		
9/9-9/11	152		0.041						-0.038		
9/11-9/13	134			0.03					-0.038		
9/13-9/16	173								-0.030		
9/16-9/18	263	0.036							0.072		
9/18-9/20	267	0.029	0.02	0.04					0.060		
9/20-9/23	259								0.055		
9/23-9/25	145								0.090		
9/25-9/27	199		0.03						0.057		

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Date	Be-7 fci/#3	Na-22 fci/#3	Co-60 fci/#3	Nb-95 fci/#3	Zr-95 fci/#3	Ru-103 fci/#3	Ru-106 fci/#3	Cs-134 fci/#3	Cs-137 fci/#3	Ce-141 fci/#3	Ce-144 fci/#3
9/27-10/2/85	151								0.042		
10/2-10/4	86								0.193		
10/4-10/7	122								-0.027		
10/7-10/9	169								0.084		
10/9-10/11	175								-0.039		
10/11-10/14	137								0.029		
10/14-10/16	122								-0.039		
10/16-10/18	114								-0.032		
10/18-10/21	91								0.040		
10/21-10/23	174								-0.021		
10/23-10/25	47								-0.036		
10/25-10/28	188		0.080						0.059		
10/28-10/30	207		0.02						0.033		
10/30-11/1/85	109								-0.026		
11/1-11/4	26								-0.040		
11/4-11/6	61								-0.038		
11/6-11/8	115								0.046		
11/8-11/11	185	0.035							0.047		
11/11-11/13	125								-0.035		
11/13-11/15	75								-0.039		
11/15-11/18	115								0.120		
11/18-11/20	105								0.044		
11/20-11/22	49								-0.055		
11/22-11/25	72								0.041		
11/25-11/27	168								0.056		
11/27-12/2/85	153								-0.030		
12/2-12/4	208	0.023							0.031		
12/4-12/6	226								-0.040		
12/6-12/9	92								0.079		
12/9-12/11	210								0.110		
12/11-12/13	94								0.066		
12/13-12/16	169								-0.027		
12/16-12/18	185								-0.030		
12/18-12/20	254								0.042		
12/20-12/26	173	0.031							0.072		
12/26-12/27	171								0.053		
12/27-12/30	208								0.064		
12/30-1/2/86	210								0.108		
1/2-1/3	178								-0.074		
1/3-1/6	134								0.058		
1/6-1/8	197								0.094		
1/8-1/10	154			0.02	0.060				0.176		
1/10-1/13	199								0.115		
1/13-1/15	131								0.076		
1/15-1/17	244		0.04						0.131		
1/17-1/20	198				0.050				0.135		
1/20-1/22	130			0.03					0.059		
1/22-1/24	109								0.043		
1/24-1/27	105								0.031		
1/27-1/29	156								0.077		
1/29-1/31	131								0.032		
1/31-2/3/86	263	0.040							0.495		
2/3-2/5	228								0.228		

B

Date	Be-7 fCi/m3	Na-22 fCi/m3	Co-60 fCi/m3	Nb-95 fCi/m3	Zr-95 fCi/m3	Ru-103 fCi/m3	Ru-106 fCi/m3	Cs-134 fCi/m3	Cs-137 fCi/m3	Ce-141 fCi/m3	Ce-144 fCi/m3
2/5-2/7	143								-0.039		
2/7-2/10	97								0.290		
2/10-2/12	59								0.043		
2/12-2/14	174								0.080		
2/14-2/18	225								0.187		
2/18-2/19	162								0.083		
2/19-2/21	90								0.116		
2/21-2/24	107	0.033							0.113		
2/24-2/26	235								0.088		
2/26-2/28	104								0.100		
2/28-3/3/86	158								-0.047		
3/3-3/5	106								0.082		
3/5-3/7	154								0.281		
3/7-3/10	256								0.246		
3/10-3/12	180								0.233		
3/12-3/14	101								0.076		
3/14-3/17	164								0.037		
3/17-3/19	141								0.136		
3/19-3/21	117		0.07						-0.048		
3/21-3/24	237								0.082		
3/24-3/26	240								0.104		
3/26-3/27	234								0.125		
3/27-3/31	193	0.023							0.160		
3/31-4/2/86	240								0.289		
4/2-4/4	285	0.023							0.237		
4/4-4/7	219								0.234		
4/7-4/9	237								0.167		
4/9-4/11	215								0.042		
4/11-4/14	219			0.02					0.154		
4/14-4/16	212								0.190		
4/16-4/18	31	0.059							0.126		
4/18-4/21	136								0.172		
4/21-4/23	211			0.05					-0.056		
4/23-4/25	361	0.051		0.02					0.103		
4/25-4/28	143								-0.082		
4/28-4/30	305								0.161		
4/30-5/2/86	227								0.176		
5/2-5/3	253								0.145		
5/3-5/4	225								0.185		
5/4-5/5	188								1.910		
5/5-5/6	386							0.243	17.000		
5/6-5/7	291								0.234		
5/7-5/8	234								-0.220		
5/8-5/9	146					0.54			0.201		
5/9-5/10	111					5.00		5.6	11.500		
5/10-5/11	219			1	1	51.4	18.9	144.0	281.000	2.27	1.94
5/11-5/12	193					28.6	10.1	57.0	127.000		
5/12-5/13	127					10.7	3.9	8.8	17.800		
5/13-5/14	120					13.8	3.4	16.6	37.400		
5/14-5/15	232					28.1	9.0	37.0	72.300		
5/15-5/16	329					87.6	27.4	75.8	152.000	1.27	1.86
5/16-5/17	164					40.4	13.1	34.0	65.300	1.04	
5/17-5/18	81					6.0	3.6	5.4	10.700		

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Date	Be-7 fCi/m3	Na-22 fCi/m3	Co-60 fCi/m3	Nb-95 fCi/m3	Zr-95 fCi/m3	Ru-103 fCi/m3	Ru-106 fCi/m3	Cs-134 fCi/m3	Cs-137 fCi/m3	Ce-141 fCi/m3	Ce-144 fCi/m3
9/22-9/24	121							0.090	0.221		
9/24-9/26	150			0.102	0.079				0.178		
9/26-9/29	147								0.061		
9/29-10/1/86	113							0.018	0.343		
10/1-10/3	150								0.103		
10/3-10/6	117								0.241		
10/6-10/8	165								0.059		
10/8-10/10	71								0.048		
10/10-10/13	144			0.02					0.037		
10/13-10/15	103								0.146		
10/15-10/17	228								0.041		
10/17-10/20	204	0.020							0.053		
10/20-10/22	200								0.055		
10/22-10/24	224								0.163		
10/24-10/27	160								-0.060		
10/27-10/29	74								-0.034		
10/29-10/31	114								0.061		
10/31-11/3/86	51								-0.029		
11/3-11/5	90							0.026	0.201		
11/5-11/7	73			0.216	0.390	0.083	0.779	0.226	0.998	17.0	D
11/7-11/10	141								0.558		
11/10-11/12	142								0.092		
11/12-11/17	110								-0.034		
11/17-11/19	55								0.172		
11/19-11/21	52								0.061		
11/21-11/24	86								0.084		
11/24-11/26	141								0.127		
11/26-12/1/86	90								0.057		
12/1-12/3	36			0.073					0.054		
12/3-12/5	112								-0.052		
12/5-12/8	140								-0.050		
12/8-12/10	133								0.173		
12/10-12/12	37								0.036		
12/12-12/16	167			0.03					0.039		
12/16-12/17	260								0.103		
12/17-12/19	227			0.03					0.072		
12/19-12/22	145								0.049		
12/22-12/26	61								0.051		
12/26-12/29	89								-0.045		
12/29-12/31	108								-0.053		
12/31-1/2/87	102								-0.059		
1/2-1/5	65								0.035		
1/5-1/7	226								0.081		
1/7-1/9	135								-0.050		
1/9-1/12	90			0.02					0.084		
1/12-1/14	155		0.06	0.096					0.101		
1/14-1/16	154								0.372		
1/16-1/19	52								-0.038		
1/19-1/21	92								-0.031		
1/21-1/23	71								-0.050		
1/23-1/26	99								-0.084		
1/26-1/28	149								0.984		E
1/28-1/30											

Date	Be-7 fCi/m3	Na-22 fCi/m3	Co-60 fCi/m3	Nb-95 fCi/m3	Zr-95 fCi/m3	Ru-103 fCi/m3	Ru-106 fCi/m3	Cs-134 fCi/m3	Cs-137 fCi/m3	Ce-141 fCi/m3	Ce-144 fCi/m3
1/30-2/2/87	99								-0.057		
2/2-2/4	103								0.089		
2/4-2/6	121								0.039		
2/6-2/9	181								0.061		
2/9-2/11	185								-0.053		
2/11-2/13	234								0.181		
2/13-2/17	178								0.687		
2/17-2/18	54								0.050		
2/18-2/22	146			0.063					0.044		
2/22-2/25	160								-0.053		
2/25-2/27	149								-0.053		
2/27-3/2/87	124								0.068		
3/2-3/4	149								0.041		
3/4-3/6	133								-0.019		
3/6-3/9	134								0.030		
3/9-3/11	123								-0.056		
3/11-3/13	217								-0.042		
3/13-3/16	231								0.044		
3/16-3/18	187								0.104		
3/18-3/20	179								0.054		
3/20-3/23	200	0.040							0.058		
3/23-3/25	114								-0.051		
3/25-3/27	85			0.03					-0.029		
3/27-3/30	109								0.062		
3/30-4/1/87	121								0.036		
4/1-4/3											
4/3-4/6	148	0.030							-0.028		
4/6-4/8	111								-0.051		
4/8-4/10	222								0.080		
4/10-4/13	253								0.158		
4/13-4/15	234								0.408		
4/15-4/16	115								-0.110		
4/16-4/20	33								-0.027		
4/20-4/22	157								0.200		
4/22-4/24	149								0.296		
4/24-4/27	186								0.067		
4/27-4/29	306								0.163		
4/29-5/1/87	301	0.040							0.071		
5/1-5/4	253	0.041							0.128		
5/4-5/6	237								0.124		
5/6-5/8	205								0.386		
5/8-5/11	236			0.077					0.426		
5/11-5/13	241								0.093		
5/13-5/15	108								-0.052		
5/15-5/18	543								0.468		
5/18-5/20											
5/20-5/22	14								-0.035		
5/22-5/26	104								0.105		
5/26-5/27	202								0.084		
5/27-5/29	160								0.120		
5/29-6/1/87	199								0.652		
6/1-6/3	136								0.130		
6/3-6/5	117								0.109		

Date	Be-7 fCi/m3	Na-22 fCi/m3	Co-60 fCi/m3	Nb-95 fCi/m3	Zr-95 fCi/m3	Ru-103 fCi/m3	Ru-106 fCi/m3	Cs-134 fCi/m3	Cs-137 fCi/m3	Ce-141 fCi/m3	Ce-144 fCi/m3	
6/5-6/8	195	0.034	0.139						0.775			F
6/8-6/10	267			0.06					0.120			
6/10-6/12	200								0.110			
6/12-6/15	103								0.214			
6/15-6/17	95								0.061			
6/17-6/19	100								0.047			
6/19-6/22	121	0.027							0.185			
6/22-6/26	104								0.066			
6/26-6/29	200								0.081			
6/29-7/1/87	226								0.142			
7/1-7/2	103								0.129			
7/2-7/7	35								-0.052			
7/7-7/9	181		0.094						0.086			
7/9-7/10	126								-0.092			
7/10-7/13	95								0.033			
7/13-7/15	172								-0.120	0.308		G
7/15-7/17	228		0.05						0.064			
7/17-7/20	225								0.046			
7/20-7/22	301	0.048							0.180			
7/22-7/24	309								0.078			
7/24-7/27	174								0.215			
7/27-7/29	219								-0.220			
7/29-7/31	159								0.368			
7/31-8/3/87	174								-0.052			
8/3-8/5	126			0.03					0.041			
8/5-8/7	140								0.066			
8/7-8/10	95								-0.060			
8/10-8/12	129								0.049			
8/12-8/14	164								0.049			
8/14-8/17	141								0.049			
8/17-8/19	153								0.091	0.074		
8/19-8/21	162								1.980			H
8/21-8/24	207								0.773			
8/24-8/26	159								0.130			
8/26-8/28	196								0.173			
8/28-8/31	165								0.136			
8/31-9/2/87	86								-0.033			
9/2-9/4	134								-0.038			
9/4-9/8	33								-0.040			
9/8-9/9	164								-0.070			
9/9-9/11	104								-0.037			
9/11-9/14	83								0.116			
9/14-9/16	134								-0.040			
9/16-9/18	178								0.110			
9/18-9/21	118								0.124			
9/21-9/23	179								0.260			
9/23-9/25	96								0.349			
9/25-9/28	169								0.092			
9/28-9/30	214								-0.053			
9/30-10/2/87	134								0.028			
10/2-10/5	104								0.146			
10/5-10/7	202								0.085			
10/7-10/9	108								0.072			

Date	Be-7 fCi/m3	Na-22 fCi/m3	Co-60 fCi/m3	Nb-95 fCi/m3	Zr-95 fCi/m3	Ru-103 fCi/m3	Ru-106 fCi/m3	Cs-134 fCi/m3	Cs-137 fCi/m3	Ce-141 fCi/m3	Ce-144 fCi/m3
10/9-10/12	155								0.185		
10/12-10/14	153								0.103		
10/14-10/16	209								0.153		
10/16-10/19	203								0.213		
10/19-10/21	210								0.258		
10/21-10/23	112			0.03					0.157		
10/23-10/26	236								0.291		
10/26-10/28	128								0.066		
10/28-10/30	121								0.065		
10/30-11/2/87	177								0.258		
11/2-11/4	179								0.107		
11/4-11/6	211								0.113		
11/6-11/9	114								0.093		
11/9-11/11	114								0.460		
11/11-11/13	178								0.041		
11/13-11/16	152								0.088		
11/16-11/18	152								0.165		
11/18-11/20	159	0.020							-0.019		
11/20-11/23	252								0.281		
11/23-11/25	195								3.400		
11/25-11/30	82								-0.027		
11/30-12/2/87	89								-0.033		
12/2-12/4	161								-0.048		
12/4-12/7	95								-0.046		
12/7-12/9	137								0.036		
12/9-12/11	179								0.058		
12/11-12/14	123								-0.036		
12/14-12/16	145								-0.033		
12/16-12/18	129								-0.059		
12/18-12/21	171								-0.023		
12/21-12/23	96								-0.046		
12/23-12/28	90								-0.022		
12/28-12/30	106								-0.049		
12/30-1/4/88	143								0.132		
1/4-1/6	230								0.262		
1/6-1/11	117		0.01						0.022		
1/11-1/13	184								0.042		
1/13-1/15	112								-0.035		
1/15-1/18	119								-0.041		
1/18-1/20	58								0.048		
1/20-1/22	95								-0.047		
1/22-1/25	97								0.057		
1/25-1/27	98								-0.030		
1/27-1/29	97								0.058		
1/29-2/1/88	72								0.052		
2/1-2/3	93								-0.056		
2/3-2/5	41								-0.024		
2/5-2/8	198								-0.030		
2/8-2/10	192								-0.039		
2/10-2/12	115								-0.053		
2/12-2/16	121			0.05					-0.029		
2/16-2/19	130	0.030							0.038		
2/19-2/22	157			0.06					-0.038		

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Date	Be-7 fCi/m3	Na-22 fCi/m3	Co-60 fCi/m3	Nb-95 fCi/m3	Zr-95 fCi/m3	Ru-103 fCi/m3	Ru-106 fCi/m3	Cs-134 fCi/m3	Cs-137 fCi/m3	Ce-141 fCi/m3	Ce-144 fCi/m3
7/5-5/8	218								0.168		
7/8-7/11	177				0.02				0.064		
7/11-7/13	72								0.122		
7/13-7/15	93								0.110		
7/15-7/18	101								0.120		
7/18-7/20	116								0.081		
7/20-7/22	82								0.054		
7/27-											
7/25-7/27	225								0.066		
7/27-7/29	141								0.067		
7/29-8/1/88	138				0.04				0.044		
8/1-8/3	134				0.06				0.065		
8/3-8/5	122								-0.046		
8/5-8/8	98								-0.033		
8/8-8/10	119								0.047		
8/10-8/12	95								0.091		
8/12-8/15	107								0.028		
8/15-8/17	63								-0.061		
8/17-8/19	88			0.033					0.055		
8/19-8/22	92								0.158		
8/22-8/24	94								-0.061		
8/24-8/26	186								-0.055		
8/26-8/29	129								-0.069		
8/29-											
9/2- /88											
9/4-											
9/6-											
9/8-											
9/10-											
9/12-											
9/14-											
9/16-											
9/18-											
9/20-											
9/22-											
9/24-											
9/26-											
9/28-											
9/30-											
10/1- /88											
10/2-											
10/4-											
10/6-											
10/8-											
10/10-											
10/12-10/14	109								0.030		
10/14-10/17	143								0.043		
10/17-10/19	155								0.149		
10/19-10/21	121								0.026		
10/21-10/24	148	0.011							0.015		
10/24-10/26	130								0.028		
10/26-10/28	118								-0.037		
10/28-10/31	158								0.020		

No samples collected from 8/29/88 to 10/12/88

Date	Re-7	Na-22	Co-60	Nb-95	Zr-95	Ru-103	Ru-106	Cs-134	Cs-137	Ce-141	Ce-144
	FCI/m3	FCI/m3	FCI/m3	FCI/m3	FCI/m3	FCI/m3	FCI/m3	FCI/m3	FCI/m3	FCI/m3	FCI/m3
10/31-11/2/88	117								-0.020		
11/2-11/4	156								0.046		
11/4-11/8	109								-0.016		
11/8-11/9	127								0.066		
11/9-11/11	135								-0.049		
11/11-11/14	139								0.042		
11/14-11/16	194								0.063		
11/16-11/18	166								-0.044		
11/18-11/21	172								0.023		
11/21-11/23	79								0.044		
11/23-11/28	96								0.037		
11/28-11/30	86								0.080		
11/30-12/2/88	91								-0.028		
12/2-12/5	149								0.019		
12/5-12/7	189								0.055		
12/7-12/9	211								0.060		
12/9-12/12	137								-0.053		
12/12-12/14	128								0.035		
12/14-12/16	127								-0.030		
12/16-12/19	138								-0.021		
12/19-12/21	196	0.032							0.059		
12/21-12/27	146	0.015			0.075				0.025		
12/27-12/28	151								-0.030		
12/28-1/3/89	92								0.028		
1/3-1/4	128								-0.043		
1/4-1/6	106								0.035		
1/6-1/9	186								-0.020		
1/9-1/11	151								-0.028		
1/11-1/13	61								-0.029		
1/13-1/16	84	0.011							-0.012		
1/16-1/18	182								-0.020		
1/18-1/20	204								-0.020		
1/20-1/23	268								-0.030		
1/23-1/25	126								-0.031		
1/25-1/27	117								0.055		
1/27-1/30	202	0.029							0.051		
1/30-2/1/89	139								-0.029		
2/1-2/3	119								0.034		
2/3-2/6	53								0.036		
2/6-2/8	68								0.032		
2/8-2/10	282								-0.029		
2/10-2/13	199	0.021							-0.023		
2/13-2/15	199								0.073		
2/15-2/17	161								0.067		
2/17-2/21	39								-0.021		
2/21-2/22	93								-0.065		
2/22-2/24	83								0.029		
2/24-2/27	186								-0.026		
2/27-3/1/89	58								-0.026		
3/1-3/3	123								-0.030		
3/3-3/6	44								-0.034		
3/6-3/8	64								-0.027		
3/8-3/10	205								-0.022		

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Date	Be-7 fCi/m3	Na-22 fCi/m3	Co-60 fCi/m3	Nb-95 fCi/m3	Zr-95 fCi/m3	Ru-103 fCi/m3	Ru-106 fCi/m3	Cs-134 fCi/m3	Cs-137 fCi/m3	Ce-141 fCi/m3	Ce-144 fCi/m3
11/20-11/22	175	0.021							-0.020		
11/22-11/27	124	0.012							0.019		
11/27-11/29	101								-0.022		
11/29-12/1/89	91								-0.013		
12/1-12/4	100								0.015		
12/4-12/6	188								-0.024		
12/6-12/8	84								-0.027		
12/8-12/11	53								-0.025		
12/11-12/13	63								-0.028		
12/13-12/15	136								-0.041		
12/15-12/18	156								-0.027		
12/18-12/20	86								-0.025		
12/20-12/22	137								-0.046		
12/22-12/27	97								-0.020		
12/27-12/29	80								-0.042		
12/29-1/2/90	110								0.025		
1/2-1/3	100								-0.031		
1/3-1/5	188								-0.027		
1/5-1/8	78								-0.018		
1/8-1/10	100								-0.017		
1/10-1/12	114								-0.024		
1/12-1/15	98								0.045		
1/15-1/17	199								0.064		
1/17-1/19	136								0.050		
1/19-1/22	91								0.030		
1/22-1/24	120								0.025		
1/24-1/26	109								-0.044		
1/26-1/29	147								-0.021		
1/29-1/31	49								-0.010		
1/31-2/2/90	188								0.030		
2/2-2/5	73								-0.025		
2/5-2/7	141								-0.042		
2/7-2/9	184	0.042							-0.031		
2/9-2/12	123	0.020							0.043		
2/12-2/14	160								0.060		
2/14-2/16	216								0.058		
2/16-2/20	85								-0.014		
2/20-2/21	144								-0.039		
2/21-2/23	178								-0.023		
2/23-2/26	51								-0.058		
2/26-3/1/90	187								0.037		
3/1-3/2	159								0.038		
3/2-3/5	98								0.031		
3/5-3/7	166								0.034		
3/7-3/9	157								0.047		
3/9-3/12	129								0.100		
3/12-3/14	128								0.192		
3/14-3/16	103			0.03					0.132		
3/16-3/19	90								0.060		
3/19-3/21	158								0.024		
3/21-3/23	244	0.022							0.044		
3/23-3/26	197			0.01					0.032		
3/26-3/28	133								0.024		

Date	Be-7 fCi/m3	Na-22 fCi/m3	Co-60 fCi/m3	Nb-95 fCi/m3	Zr-95 fCi/m3	Ru-103 fCi/m3	Ru-106 fCi/m3	Cs-134 fCi/m3	Cs-137 fCi/m3	Ce-141 fCi/m3	Ce-144 fCi/m3
3/28-3/30	106								-0.011		
3/30-4/2/90	57								0.014		
4/2-4/4	88			0.01					-0.016		
4/4-4/9	173	0.012							0.021		
4/9-4/11	174	0.039							0.026		
4/11-4/12	109								-0.028		
4/12-4/16	161	0.030							0.022		
4/16-4/18	156	0.034							0.025		
4/18-4/20	210								0.048		
4/20-4/23	144	0.019							0.032		
4/23-4/25	162	0.018							0.035		
4/25-4/27	182								0.158		
4/27-4/30	168								0.030		
4/30-5/2/90	114								-0.018		
5/2-5/4	129								0.086		
5/4-5/7	78								0.087		
5/7-5/8	172								-0.038		
5/8-5/9	144								-0.052		
5/9-5/11	141	0.042							-0.028		
5/11-5/14	194	0.028		0.01					0.025		
5/14-5/16	176	0.021							0.056		
5/16-5/18	133								0.029		
5/18-5/21	131								0.032		
5/21-5/23	62								-0.022		
5/23-5/25	89								0.026		
5/25-5/29	105	0.013							0.021		
5/29-5/31	116								-0.015		
5/31-6/1/90	76								-0.049		
6/1-6/4	115	0.016		0.020					0.019		
6/4-6/6	90	0.027							-0.019		
6/6-6/9	107								0.043		
6/9-6/12	96								-0.040		
6/12-6/13	99								-0.036		
6/13-6/15	110								0.057		
6/15-6/18	78								0.019		
6/18-6/20	107								0.022		
6/20-6/22	135								0.045		
6/22-6/25	116								-0.018		
6/25-6/27	107								0.024		
6/27-6/29	116								-0.043		
6/29-7/2/90	135								0.038		
7/2-7/3	102								0.045		
7/3-7/6	97								0.022		
7/6-7/11	127								-0.032		
7/11-7/13	103								-0.052		
7/13-7/16	96								0.025		
7/16-7/18	106			0.01					-0.018		
7/18-7/20	55			0.04					-0.031		
7/20-7/23	71								0.071		
7/23-7/25	71								-0.020		
7/25-7/27	99								-0.014		
7/27-7/30	94								0.030		
7/30-8/1/90	127								0.034		

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Date	Be-7 fCi/m3	Na-22 fCi/m3	Co-60 fCi/m3	Nb-95 fCi/m3	Zr-95 fCi/m3	Ru-103 fCi/m3	Ru-106 fCi/m3	Cs-134 fCi/m3	Cs-137 fCi/m3	Ce-141 fCi/m3	Ce-144 fCi/m3
4/12-4/15	150								0.017		
4/15-4/17	119								0.044		
4/17-4/19	126								0.058		
4/19-4/22	44								0.031		
4/22-4/24	143								0.033		
4/24-4/26	131	0.026							0.046		
4/26-4/29	103								-0.020		
4/29-5/1/91	91								-0.017		
5/1-5/3	172								-0.017		
5/3-5/6	177	0.017							-0.029		
5/6-5/8	143								-0.018		
5/8-5/10	151								-0.016		
5/10-5/13	156								-0.063		
5/13-5/15	98								-0.026		
5/15-5/17	77			0.04					-0.028		
5/17-5/20	71								-0.011		
5/20-5/22	131								-0.021		
5/22-5/24	135								-0.016		
5/24-5/28	83								-0.021		
5/28-5/29	69								-0.060		
5/29-5/31	69			0.02					-0.021		
5/31-6/3/91	125								-0.020		
6/3-6/5	159								0.026		
6/5-6/7	124								0.031		
6/7-6/10	90								0.026		
6/10-6/12	154								0.032		
6/12-6/14	116								0.015		
6/14-6/17	107	0.018							-0.013		
6/17-6/19	81								-0.019		
6/19-6/21	49								-0.015		
6/21-6/24	86								-0.018		
6/24-6/26	93								0.040		
6/26-6/28	117								0.032		
6/28-7/1/91	50								-0.011		
7/1-7/3	79								-0.027		
7/3-7/8	83	0.007							0.015		
7/8-7/10	80								0.039		
7/10-7/12	101								0.032		
7/12-7/15	131	0.019							-0.019		
7/15-7/17	81								-0.024		
7/17-7/19	96								-0.013		
7/19-7/22	105								-0.017		
7/22-7/24	158	0.036							0.030		
7/24-7/26	124								0.023		
7/26-7/29	64								-0.013		
7/29-7/31	36								-0.027		
7/31-8/2/91	40								-0.019		
8/2-8/5	91								-0.018		
8/5-8/7	131								0.033		
8/7-8/9	119								-0.024		
8/9-8/12	77								0.020		
8/12-8/14	90								-0.020		
8/14-8/16	106								-0.015		

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Date	Re-7 fCi/m3	Mn-22 fCi/m3	Co-60 fCi/m3	Nb-95 fCi/m3	Zr-95 fCi/m3	Ru-103 fCi/m3	Ru-106 fCi/m3	Cs-134 fCi/m3	Cs-137 fCi/m3	Ce-141 fCi/m3	Ce-144 fCi/m3
4/29-5/1/92	60								0.018		
5/1-5/4	165	0.033							0.023		
5/4-5/6	121								0.027		
5/6-5/8	36								-0.040		
5/8-5/11	169								-0.019		
5/11-5/13	186								-0.029		
5/13-5/15	135								0.033		
5/15-5/18	143	0.020							0.009		
5/18-5/20	137								0.026		
5/20-5/22	244								0.059		
5/22-5/26	223	0.039							0.027		
5/26-5/27	120								-0.029		
5/27-5/29	151								-0.029		
5/29-6/1/92	76	0.018							-0.018		
6/1-6/3	81								-0.034		
6/3-6/5	82								-0.040		
6/5-6/8	98			0.03					-0.029		
6/8-6/10	44								0.018		
6/10-6/12	78								-0.027		
6/12-6/15	90								-0.017		
6/15-6/17	85								-0.041		
6/17-6/19	237	0.048							0.033		
6/19-6/22	131								-0.031		
6/22-6/24	125								0.034		
6/24-6/26	186			0.03					0.035		
6/26-6/29	91								0.013		
6/29-7/1/92	79			0.03					-0.023		
7/1-7/6	93	0.010							0.011		
7/6-7/8	86								-0.046		
7/8-7/10	153								-0.043		
7/10-7/13	165								0.061		
7/13-7/15	160								-0.026		
7/15-7/17	79								-0.023		
7/17-7/20	84								-0.018		
7/20-7/22	93								-0.026		
7/22-7/24	63								-0.039		
7/24-7/27	85	0.019							-0.018		
7/27-7/29	86								-0.023		
7/29-7/31	146	0.017							0.029		
7/31-8/3/92	133	0.021							-0.016		
8/3-8/5	154								-0.041		
8/5-8/7	149				0.03				-0.025		
8/7-8/10	115								-0.018		
8/10-8/12	197	0.022							0.025		
8/12-8/14	53								-0.022		
8/14-8/17	41								-0.010		
8/17-8/19	72								-0.039		
8/19-8/21	63								-0.027		
8/21-8/24	131								-0.019		
8/24-8/26	194								0.020		
8/26-8/28	151								-0.045		
8/28-8/31	171	0.027							-0.016		
8/31-9/2/92	210								-0.024		

Date	Be-7 fCi/m3	Na-22 fCi/m3	Co-60 fCi/m3	Nb-95 fCi/m3	Zr-95 fCi/m3	Ru-103 fCi/m3	Ru-106 fCi/m3	Cs-134 fCi/m3	Cs-137 fCi/m3	Ce-141 fCi/m3	Ce-144 fCi/m3
9/2-9/4	149	0.029							-0.026		
9/4-9/8	63								-0.018		
9/8-9/9	65								-0.055		
9/9-9/11	94								-0.016		
9/11-9/14	142								-0.015		
9/14-9/16	252								-0.026		
9/16-9/18	140								-0.037		
9/18-9/21	120	0.010							0.018		
9/21-9/23	95								-0.024		
9/23-9/25	123								-0.047		
9/25-9/28	52								-0.017		
9/28-9/30	147								-0.022		
9/30-10/2/92	193								0.025		
10/2-10/5	102								-0.016		
10/5-10/7	133	0.017							-0.016		
10/7-10/9	101								-0.020		
10/9-10/12	172								-0.018		
10/12-10/14	158								-0.024		
10/14-10/16	168								-0.027		
10/16-10/19	176	0.021							-0.018		
10/19-10/21	178								0.041		
10/21-10/23	167								0.023		
10/23-10/26	148	0.016							0.019		
10/26-10/28	193								0.033		
10/28-10/30	124								0.028		
10/30-11/2/92	70								0.019		
11/2-11/4	116		0.044						-0.019		
11/4-11/6	51								-0.023		
11/6-11/9	62								-0.018		
11/9-11/11	135								-0.026		
11/11-11/13	110								0.019		
11/13-11/16	195								-0.013		
11/16-11/18	148								-0.025		
11/18-11/20	108								0.030		
11/20-11/23	71								-0.017		
11/23-11/25	87	0.015							-0.017		
11/25-11/30	70								0.012		
11/30-12/2/92	142								-0.017		
12/2-12/4	124	0.030							-0.025		
12/4-12/7	142	0.019							0.019		
12/7-12/9	49								-0.015		
12/9-12/11	84								-0.020		
12/11-12/14	45								-0.015		
12/14-12/16	86								-0.024		
12/16-12/18	116								-0.027		
12/18-12/21	109								-0.018		
12/21-12/23	85								-0.028		
12/23-12/28	176								0.014		
12/28-12/30	182								-0.014		
12/30-12/31	3								-0.048		
12/31-1/4/93	118								-0.013		
1/4-1/6	78								-0.026		
1/6-1/8	89								-0.026		

Date	Be-7 fCi/m3	Na-22 fCi/m3	Co-60 fCi/m3	Nb-95 fCi/m3	Zr-95 fCi/m3	Ru-103 fCi/m3	Ru-106 fCi/m3	Cs-134 fCi/m3	Cs-137 fCi/m3	Ce-141 fCi/m3	Ce-144 fCi/m3
1/8-1/11	84								-0.010		
1/11-1/13	2								-0.022		
1/13-1/15	120								-0.023		
1/15-1/18	123								-0.012		
1/18-1/20	28								-0.013		
1/20-1/22	379								-0.066		
1/22-1/25	92								-0.026		
1/25-1/27	138	0.026							-0.020		
1/27-1/29	124								-0.042		
1/29-2/1/93	202	0.030							-0.018		
2/1-2/3	192			0.02					-0.022		
2/3-2/5	245	0.038							0.031		
2/5-2/8	117								0.029		
2/8-2/10	74								-0.022		
2/10-2/12	90								-0.040		
2/12-2/16	75								-0.014		
2/16-2/17	26								-0.087		
2/17-2/19	158	0.035							-0.024		
2/19-2/22	258								0.042		
2/22-2/24	157								-0.021		
2/24-2/26	165								-0.040		
2/26-3/1/93	92								-0.018		
3/1-3/3	261	0.033							0.037		
3/3-3/5	49								-0.024		
3/5-3/8	169	0.015							-0.008		
3/8-3/10	132								-0.018		
3/10-3/12	155	0.018							0.015		
3/12-3/15	118								0.015		
3/15-3/17	182	0.013							-0.012		
3/17-3/19	163								-0.023		
3/19-3/22	240								-0.020		
3/22-3/24	96								-0.023		
3/24-3/26	103								-0.034		
3/26-3/29	39								-0.017		
3/29-3/31	166								0.041		
3/31-4/2/93	72								0.036		
4/2-4/5	98								-0.028		
4/5-4/7	52								-0.016		
4/7-4/8	213								-0.083		
4/8-4/12	191	0.019							0.060		
4/12-4/14	181								0.052		
4/14-4/16	169	0.016							0.070		
4/16-4/19	198	0.019							0.027		
4/19-4/21	235	0.031							0.030		
4/21-4/23	183	0.019					0.129		0.030		K
4/23-4/26	291	0.034							0.037		
4/26-4/28	229	0.023							-0.019		
4/28-4/30	248	0.039							0.051		
4/30-5/3/93	206	0.024							-0.021		
5/3-5/5	118								0.031		
5/5-5/7	156	0.017							-0.016		
5/7-5/10	185	0.025							0.018		
5/10-5/12	205	0.031							0.032		

Date	Be-7 fCi/m3	Na-22 fCi/m3	Co-60 fCi/m3	Nb-95 fCi/m3	Zr-95 fCi/m3	Ru-103 fCi/m3	Ru-106 fCi/m3	Cs-134 fCi/m3	Cs-137 fCi/m3	Ce-141 fCi/m3	Ce-144 fCi/m3
5/12-5/14	170	0.040							0.038		
5/14-5/17	187								-0.031		
5/17-5/19	232	0.028							0.027		
5/19-5/21	121								0.016		
5/21-5/24	162	0.024							-0.020		
5/24-5/26	242	0.027							0.016		
5/26-5/28	142	0.019							0.023		
5/28-6/1/93	48	0.005							0.061		
6/1-6/2	76								-0.042		
6/2-6/4	158								-0.029		
6/4-6/6	171	0.024							0.037		
6/7-6/9	153								0.056		
6/9-6/11	175								0.038		
6/11-6/14	154								0.033		
6/14-6/16	127								0.028		
6/16-6/18	162								0.032		
6/18-6/21	166			0.024					-0.018		
6/21-6/23	144								-0.026		
6/23-6/25	172	0.021							0.050		
6/25-6/28	85								-0.019		
6/28-6/30	164								-0.030		
6/30-7/1/93	154								-0.041		
7/1-7/6	132								-0.027		
7/6-7/7	154								0.048		
7/7-7/9	171								0.024		
7/9-7/12	182								0.038		
7/12-7/14	168								0.047		
7/14-7/16	154								0.031		
7/16-7/19	112								-0.021		
7/19-7/21	122								0.026		
7/21-7/23	161								0.032		
7/23-7/26	122								0.015		
7/26-7/28	154								-0.019		
7/28-7/30	161								-0.025		
7/30-8/2/93	224	0.024							-0.018		
8/2-8/4	147	0.018							0.036		
8/4-8/6	135								-0.027		
8/6-8/9	107								-0.020		
8/9-8/11	132								-0.027		
8/11-8/13	149								0.037		
8/13-8/16	167								0.039		
8/16-8/18	195								0.025		
8/18-8/20	147								0.023		
8/20-8/23	140	0.014							0.040		
8/23-8/25	238								-0.014		
8/25-8/27	205								0.106		
8/27-8/30	103								-0.018		
8/30-9/1	176								0.040		
9/1-9/7/93	100	0.008							0.019		
9/7-9/8	446	0.039							0.089		
9/8-9/10	122								-0.014		
9/10-9/13	158								-0.015		
9/13-9/15	202								-0.030		

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Date	Be-7 fCi/m3	Na-22 fCi/m3	Co-60 fCi/m3	Nb-95 fCi/m3	Zr-95 fCi/m3	Ru-103 fCi/m3	Ru-106 fCi/m3	Cs-134 fCi/m3	Cs-137 fCi/m3	Ce-141 fCi/m3	Ce-144 fCi/m3
5/6-5/9	171								-0.015		
5/9-5/11	208	0.026							0.029		
5/11-5/13	239	0.031							0.033		
5/13-5/16	137	0.018							0.019		
5/16-5/18	176	0.020							-0.016		
5/18-5/20	136	0.021							-0.021		
5/20-5/23	147	0.022							0.011		
5/23-5/25	239	0.026							0.023		
5/25-5/27	237	0.038							-0.020		
5/27-5/31	248	0.028							0.020		
5/31-6/1/94	135								-0.048		
6/1-6/3	164								-0.026		
6/3-6/6	176								-0.014		
6/6-6/8	62								-0.019		
6/8-6/10	117								-0.015		
6/10-6/13	103								0.019		
6/13-6/15	111								0.018		
6/15-6/17	107								-0.018		
6/17-6/20	155								-0.017		
6/20-6/22	176								-0.022		
6/22-6/24	120								-0.022		
6/24-6/27	142								0.019		
6/27-6/29	158								-0.027		
6/29-6/30	168								-0.051		
6/30-7/5/94	126	0.015							0.015		
7/5-7/6	145								0.032		
7/6-7/8	135								0.021		
7/8-7/11	142	0.009							0.016		
7/11-7/13	148								-0.019		
7/13-7/15	127								-0.020		
7/15-7/18	151								0.016		
7/18-7/20	168								-0.029		
7/20-7/22	82								-0.018		
7/22-7/25	136								0.016		
7/25-7/27	162								-0.021		
7/27-7/29	93								-0.021		
7/29-8/1/94	134	0.019							-0.017		
8/1-8/3	108								-0.023		
8/3-8/5	136								0.025		
8/5-8/8	158	0.020							0.023		
8/8-8/10	277	0.028							0.053		
8/10-8/12	222	0.020							0.024		
8/12-8/15	104								0.028		
8/15-8/17	95								0.028		
8/17-8/19	88								-0.021		
8/19-8/22	148								-0.018		
8/22-8/24	173								-0.020		
8/24-8/26	216								0.033		
8/26-8/29	248	0.016							0.046		
8/29-8/31	203	0.015							0.037		
8/31-9/2/94	159								-0.022		
9/2-9/7	165	0.010							0.017		
9/7-9/9	146								0.084		

Date	Be-7 fCi/m3	Na-22 fCi/m3	Co-60 fCi/m3	Nb-95 fCi/m3	Zr-95 fCi/m3	Ru-103 fCi/m3	Ru-106 fCi/m3	Cs-134 fCi/m3	Cs-137 fCi/m3	Ce-141 fCi/m3	Ce-144 fCi/m3
9/9-9/12	201	0.024							0.037		
9/12-9/14	250	0.014							0.047		
9/14-9/16	269								0.053		
9/16-9/19	130								0.037		
9/19-9/21	108	0.023							-0.020		
9/21-9/23	209		0.02						0.043		
9/23-9/26	171								0.028		
9/26-9/28	180								-0.022		
9/28-9/30	237								0.028		
9/30-10/3/94	208								0.019		
10/3-10/5	149		0.02						-0.020		
10/5-10/7	145								-0.019		
10/7-10/10	162	0.012							0.012		
10/10-10/12	187								-0.025		
10/12-10/14	143								-0.025		
10/14-10/17	209								-0.020		
10/17-10/19	277	0.017							0.016		
10/19-10/24	145								-0.013		
10/24-10/26	230	0.016							0.018		
10/26-											
10/28-10/31	140	0.014							0.017		
10/31-11/2/94	125								-0.024		
11/2-11/7	186								0.020		
11/7-											
11/9-11/11	128								0.021		
11/11-11/14	311	0.016							-0.012		
11/14-11/16	266	0.017							-0.016		
11/16-11/18	116								-0.022		
11/18-11/21	162								-0.017		
11/21-11/23	207	0.021							-0.018		
11/23-11/28	183								0.013		
11/28-11/30	264								-0.026		
11/30-											
12/2-12/5/94	140								-0.017		
12/5-12/7	215								-0.042		
12/7-12/9	105								-0.016		
12/9-12/12	232								-0.064		
12/12-12/14	241								-0.027		
12/14-12/16	163								-0.023		
12/16-12/19	96								-0.016		
12/19-12/21	74								0.034		
12/21-12/22	96								-0.028		
12/22-12/27	173								-0.010		
12/27-12/28	232								-0.049		
12/28-12/30	165								-0.028		
12/30-1/3/95	185	0.015							-0.010		
1/3-1/4	247								-0.029		
1/4-1/6	229								-0.028		
1/6-1/9	582								0.094		
1/9-1/11	157								0.028		
1/11-1/13	134								0.036		
1/13-1/16	124								-0.018		
1/16-1/18	101								-0.025		

Date	Be-7 fCi/m3	Na-22 fCi/m3	Co-60 fCi/m3	Nb-95 fCi/m3	Zr-95 fCi/m3	Ru-103 fCi/m3	Ru-106 fCi/m3	Cs-134 fCi/m3	Cs-137 fCi/m3	Ce-141 fCi/m3	Ce-144 fCi/m3
1/18-1/20	71								0.030		
1/20-1/23	112								-0.014		
1/23-1/25	191								-0.020		
1/25-1/27	208								-0.026		
1/27-1/30	152								-0.017		
1/30-2/1/95	109								-0.022		
2/1-2/3	148								-0.025		
2/3-2/6	215								0.015		
2/6-2/8	146	0.029							-0.023		
2/8-2/10	212								-0.026		
2/10-2/13	183								-0.015		
2/13-2/15	188	0.018							-0.015		
2/15-2/17	65								-0.023		
2/17-2/21	109								-0.009		
2/21-2/22	68								-0.043		
2/22-2/24	173								-0.026		
2/24-2/27	249	0.017							0.021		
2/27-3/1/95	189	0.030	0.040						0.040		
3/1-3/3	112								-0.030		
3/3-3/6	166		0.030						0.024		
3/6-3/8	116								0.042		
3/8-3/10	178								0.030		
3/10-3/13	326								0.032		
3/13-3/15	282								0.044		
3/15-3/17	275	0.021							0.037		
3/17-3/20	164	0.017							0.030		
3/20-3/22	229	0.016							0.076		
3/22-3/24	248								0.111		
3/24-3/27	192	0.026							0.121		
3/27-3/29	212	0.037							0.196		
3/29-3/31	157								0.054		
3/31-4/3/95	146								0.051		
4/3-4/5	290								0.085		
4/5-4/7	229	0.027							0.024		
4/7-4/10	187	0.020							0.025		
4/10-4/12	137								0.044		
4/12-4/13	69								-0.023		
4/13-4/17	235	0.030							0.021		
4/17-4/19	283	0.028							0.025		
4/19-4/21	223	0.026							0.035		
4/21-											
4/24-4/26	145								0.022		