Report on the γ-ray measurement after the accident of Fukushima I Nuclear Power Plant

Part II

Radioactivity concentration in the air at RIKEN Wako Institute

RIKEN Nishina Center

Wako, Saitama 351-0198, Japan

June 15, 2011

Procedures

1. Collection of atmospheric suspended dust

Air sampler: M&F Enterprise SP-30 (30 L/min)

Period: March 15, 2011, 11:15 – June 10, 2011, 9:50

Location: Nishina building 2F (open air), RIKEN Wako Institute

2-1 Hirosawa, Wako, Saitama 351-0198, Japan

Latitude: 35° 46’ 32” north

Longitude: 139° 37’ 04” east

Altitude: 35 m

Filter: ADVANTEC HE-40T (without an activated carbon filter)

2. γ-ray spectrometry

High-pure Ge detector: ORTEC GEM type

Location: Nishina building BF2, RIKEN Wako Institute

Results

1. Nuclides identified in the γ-ray spectra

Table 1. List of nuclides identified in the γ-ray spectra.

Nuclide	Half-life	γ-ray energy (keV)	γ intensity
La-140	1.68 d	1596.2	0.954
Ba-140	12.8 d	537.3	0.2439
Cs-137	30.1 y	661.7	0.851
Cs-136g	13.2 d	818.5	1.00
Cs-134g	2.06 y	604.7	0.9762
I-133g	20.8 h	529.9	0.87
I-132g	2.30 h	667.7	0.987
Te-132	3.20 d	228.2	0.88
I-131	8.02 d	364.5	0.817
Te-131m	30 h	773.7&774.1	0.506
Te-131g	25.0 min	149.7	0.6875
Te-129m	33.6 d	695.8	0.0299
Te-129g	69.6 min	459.6	0.077
Ag-110m	249.8 d	884.7	72.2
Tc-99m	6.01 h	140.5	0.8906
Mo-99	65.9 h	739.5	0.1213
Nb-95	35.0 d	765.8	0.9981

2. γ-ray spectrum

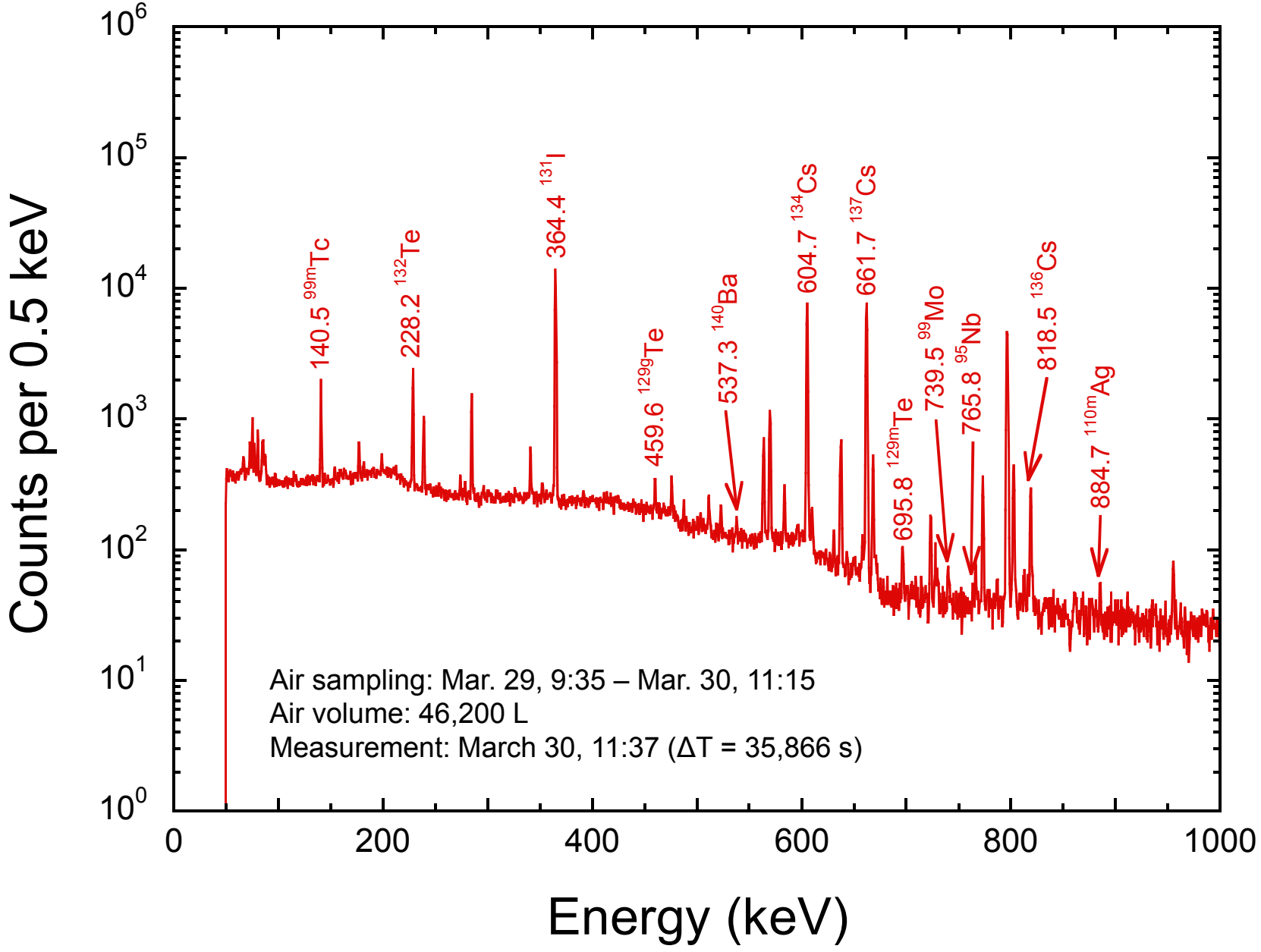

Fig. 1. Typical γ-ray spectrum at E_γ = 0 – 1000 keV.

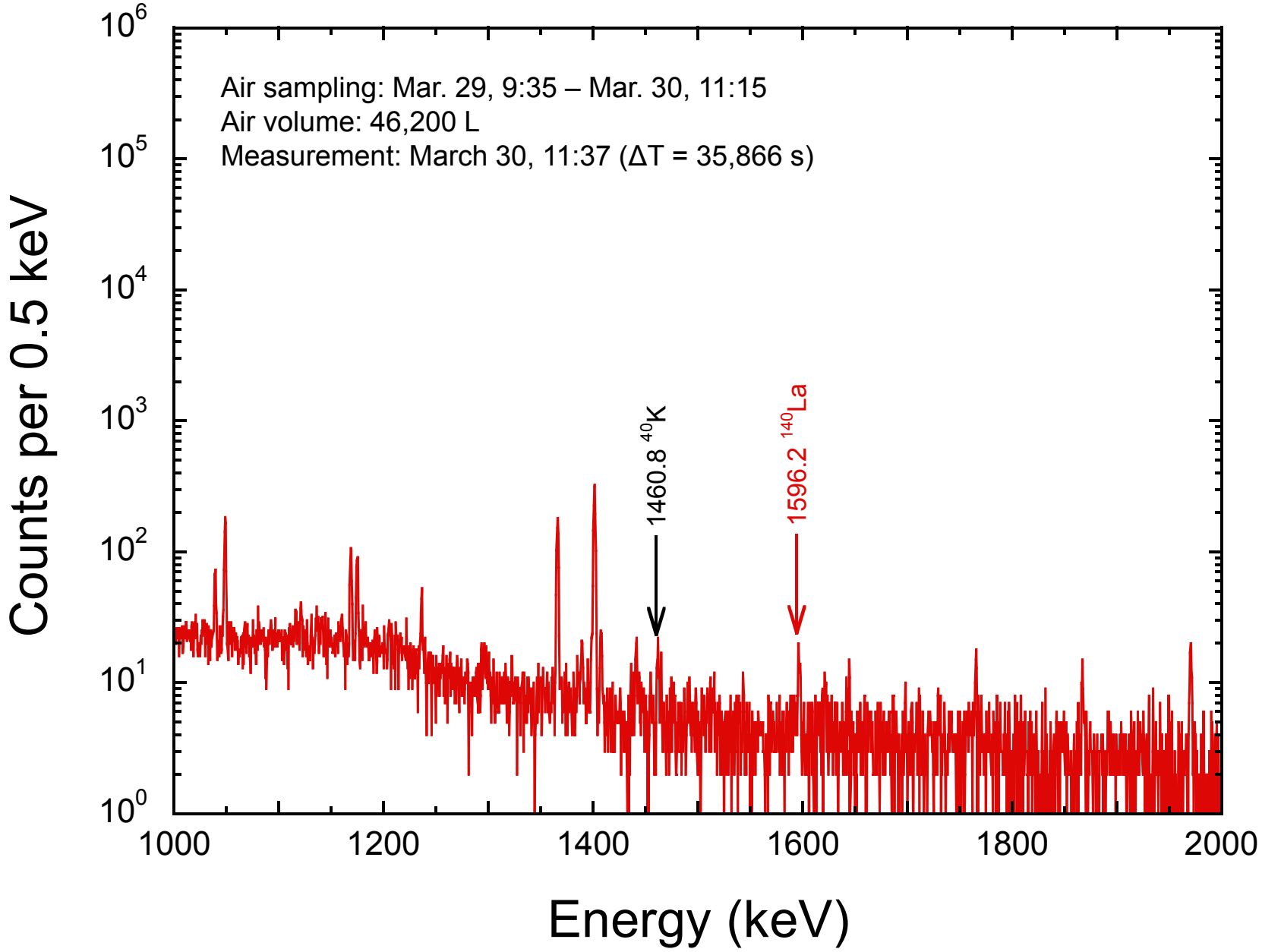

Fig. 1. (continued) Typical γ-ray spectrum at E_γ = 1000 – 2000 keV.

3. Radioactivity concentrations

(a) Evaluated nuclides

^{131}I, ^{132}Te, ^{137,136,134}Cs, ^{99}Mo, ^{140}Ba, ^{140}La, ^{95}Nb, and ^{110m}Ag

(b) Radioactivity

Radioactivities at the end time of sampling, corrected for decay loss during the measurement

Errors: 1 σ (counting statistics + detection efficiencies of 16–20%)

(c) Comparison with some literatures

i) High Energy Accelerator Research Organization (KEK)

Air collection: National Institute for Environmental Studies (NIES)
16-2 Onogawa, Tsukuba, Ibaraki, 305-8506 Japan

Data source: http://www.kek.jp/quake/radmonitor/

ii) Japan Chemical Analysis Center (JCAC)

Air collection: JCAC
295-3 Sannou, Inage, Chiba, 263-0002, Japan

Data source: http://www.jcac.or.jp/fukushima.html

Table 2a. Radioactivity concentrations of ^{131}I and ^{132}Te.

Air sampling			Air	^{131}I	er	^{132}Te	er
Start	Stop	[h]	[L]	[Bq/cm^3]		[Bq/cm^3]	
2011/3/15 11:15	2011/3/15 11:45	0.50	900	3.6E-05	7.5E-06	6.1E-05	1.2E-05
2011/3/16 13:15	2011/3/16 13:45	0.50	900	7.8E-07	1.6E-07	1.4E-07	5.6E-08
2011/3/16 18:32	2011/3/17 9:00	14.47	26040	5.7E-08	1.2E-08	6.6E-09	1.4E-09
2011/3/17 9:00	2011/3/18 10:15	25.25	45450	4.4E-08	8.9E-09	4.8E-09	1.0E-09
2011/3/18 10:30	2011/3/19 6:44	20.23	36420	7.7E-08	1.6E-08	1.5E-09	4.5E-10
2011/3/19 10:05	2011/3/20 10:00	23.92	43050	7.8E-08	1.6E-08	1.7E-09	4.4E-10
2011/3/20 10:00	2011/3/21 10:00	24.00	43200	5.4E-06	1.1E-06	2.4E-06	4.8E-07
2011/3/21 10:00	2011/3/22 10:00	24.00	43200	2.4E-06	4.9E-07	1.6E-06	3.2E-07
2011/3/22 10:00	2011/3/23 10:00	24.00	43200	7.8E-06	1.6E-06	7.4E-07	1.5E-07
2011/3/23 10:00	2011/3/24 10:10	24.17	43500	1.3E-06	2.7E-07	7.2E-09	1.6E-09
2011/3/24 10:10	2011/3/25 9:55	23.75	42750	1.6E-07	3.2E-08	1.3E-09	4.3E-10
2011/3/25 9:55	2011/3/26 10:00	24.08	43350	1.2E-07	2.6E-08	3.8E-09	7.9E-10
2011/3/26 10:00	2011/3/27 10:15	24.25	43650	2.0E-08	4.1E-09	2.5E-09	5.8E-10
2011/3/27 10:15	2011/3/28 11:00	24.75	44550	2.6E-08	5.4E-09	1.1E-09	3.4E-10
2011/3/28 11:00	2011/3/29 9:35	22.58	40650	1.0E-07	2.1E-08	4.4E-09	9.4E-10
2011/3/29 9:35	2011/3/30 11:15	25.67	46200	2.8E-07	5.7E-08	2.6E-08	5.3E-09
2011/3/30 11:15	2011/3/31 10:00	22.75	40950	1.7E-07	3.5E-08	1.5E-08	3.1E-09
2011/3/31 10:00	2011/4/1 10:00	24.00	43200	1.2E-08	2.4E-09	7.2E-12	2.2E-10
2011/4/1 10:00	2011/4/2 10:00	24.00	43200	2.3E-08	4.7E-09	2.5E-10	1.5E-10
2011/4/2 10:00	2011/4/3 9:30	23.50	42300	9.4E-09	2.0E-09	5.1E-10	2.7E-10
2011/4/3 9:30	2011/4/4 10:00	24.50	44100	3.6E-08	7.3E-09	7.4E-10	2.8E-10
2011/4/4 10:00	2011/4/5 9:15	23.25	41850	9.3E-09	1.9E-09	5.5E-10	2.3E-10
2011/4/5 9:15	2011/4/6 10:00	24.75	44550	9.8E-09	2.0E-09	0.0E+00	1.9E-10
2011/4/6 10:00	2011/4/7 10:00	24.00	43200	1.2E-08	2.5E-09	2.8E-10	2.1E-10
2011/4/7 10:00	2011/4/8 10:00	24.00	43200	8.9E-09	1.9E-09	1.5E-10	2.1E-10
2011/4/8 10:00	2011/4/9 9:20	23.33	42000	5.9E-09	1.2E-09	0.0E+00	1.4E-10
2011/4/9 9:20	2011/4/11 10:00	48.67	87600	1.7E-08	3.4E-09	1.2E-10	1.2E-10
2011/4/11 10:00	2011/4/13 10:00	48.00	86400	5.8E-09	1.2E-09	1.2E-10	7.9E-11
2011/4/13 10:00	2011/4/15 10:30	48.50	87300	2.7E-09	5.7E-10	0.0E+00	1.1E-10
2011/4/15 10:30	2011/4/17 10:00	47.50	85500	1.3E-09	3.0E-10	0.0E+00	1.2E-10
2011/4/17 10:00	2011/4/19 10:00	48.00	86400	2.5E-08	5.1E-09	3.2E-11	9.9E-11
2011/4/19 10:00	2011/4/21 10:00	48.00	86400	1.2E-08	2.5E-09	1.2E-10	1.4E-10

Table 2a. (continued) Radioactivity concentrations of ^{131}I and ^{132}Te.

Air sampling			Air	^{131}I	er	^{132}Te	er
Start	Stop	[h]	[L]	[Bq/cm^3]		[Bq/cm^3]	
2011/4/21 10:00	2011/4/23 10:00	48.00	86400	3.9E-09	8.0E-10	2.0E-11	7.9E-11
2011/4/23 11:00	2011/4/26 9:45	70.75	127350	7.9E-10	1.7E-10	6.5E-11	5.1E-11
2011/4/26 9:45	2011/4/29 10:45	73.00	131400	2.3E-10	6.5E-11	0.0E+00	4.2E-11
2011/4/29 10:50	2011/5/2 9:55	71.08	127950	6.0E-10	1.5E-10	2.9E-11	6.9E-11
2011/5/2 9:55	2011/5/5 11:15	73.33	132000	4.6E-09	9.5E-10	1.1E-11	5.6E-11
2011/5/5 12:00	2011/5/9 10:00	94.00	169200	3.0E-10	7.4E-11	3.8E-11	4.1E-11
2011/5/9 10:05	2011/5/13 10:00	95.92	172650	1.3E-10	3.8E-11	0.0E+00	2.7E-11
2011/5/13 11:05	2011/5/17 10:00	94.92	170850	9.9E-11	3.7E-11	0.0E+00	3.0E-11
2011/5/17 10:00	2011/5/21 10:10	96.17	173100	4.9E-11	3.2E-11	3.7E-11	3.2E-11
2011/5/21 10:35	2011/5/25 9:50	95.25	171450	1.3E-09	2.6E-10	0.0E+00	3.1E-11
2011/5/25 11:30	2011/5/29 17:25	101.92	183450	1.9E-10	5.6E-11	0.0E+00	3.3E-11
2011/5/29 17:25	2011/6/2 10:00	88.58	159450	1.8E-10	5.1E-11	5.3E-11	3.6E-11
2011/6/2 10:50	2011/6/6 10:00	95.17	171300	4.2E-11	2.9E-11	1.3E-11	2.8E-11
2011/6/6 10:37	2011/6/10 9:50	95.22	171390	0.0E+00	2.0E-11	3.7E-12	2.3E-11

Table 2b. Radioactivity concentrations of ^{137}Cs, ^{136}Cs, and ^{134}Cs.

Air sampling			Air	^{137}Cs	er	^{136}Cs	er	^{134}Cs	er
Start	Stop	[h]	[L]	[Bq/cm^3]		[Bq/cm^3]		[Bq/cm^3]	
2011/3/15 11:15	2011/3/15 11:45	0.50	900	9.5E-06	1.7E-06	1.3E-06	2.2E-07	7.0E-06	1.3E-06
2011/3/16 13:15	2011/3/16 13:45	0.50	900	2.2E-08	9.6E-09	0.0E+00	1.2E-08	7.2E-09	9.6E-09
2011/3/16 18:32	2011/3/17 9:00	14.47	26040	1.4E-09	4.5E-10	4.4E-10	3.1E-10	1.4E-09	4.7E-10
2011/3/17 9:00	2011/3/18 10:15	25.25	45450	1.5E-09	3.6E-10	5.8E-11	1.8E-10	8.3E-10	2.8E-10
2011/3/18 10:30	2011/3/19 6:44	20.23	36420	5.9E-10	2.7E-10	0.0E+00	2.4E-10	0.0E+00	2.6E-10
2011/3/19 10:05	2011/3/20 10:00	23.92	43050	8.6E-10	2.4E-10	0.0E+00	1.7E-10	3.7E-10	2.1E-10
2011/3/20 10:00	2011/3/21 10:00	24.00	43200	2.4E-06	4.3E-07	2.6E-07	4.4E-08	1.8E-06	3.3E-07
2011/3/21 10:00	2011/3/22 10:00	24.00	43200	6.4E-07	1.2E-07	6.9E-08	1.2E-08	4.7E-07	8.7E-08
2011/3/22 10:00	2011/3/23 10:00	24.00	43200	1.3E-07	2.3E-08	9.7E-09	2.0E-09	1.0E-07	1.9E-08
2011/3/23 10:00	2011/3/24 10:10	24.17	43500	1.5E-08	2.8E-09	1.3E-09	3.6E-10	1.2E-08	2.3E-09
2011/3/24 10:10	2011/3/25 9:55	23.75	42750	2.5E-09	5.5E-10	2.6E-10	2.4E-10	1.4E-09	4.1E-10
2011/3/25 9:55	2011/3/26 10:00	24.08	43350	4.5E-09	8.4E-10	8.8E-11	1.2E-10	3.2E-09	6.2E-10
2011/3/26 10:00	2011/3/27 10:15	24.25	43650	2.6E-09	5.2E-10	0.0E+00	1.9E-10	2.3E-09	4.8E-10
2011/3/27 10:15	2011/3/28 11:00	24.75	44550	2.3E-09	4.8E-10	1.2E-10	1.7E-10	1.5E-09	3.6E-10
2011/3/28 11:00	2011/3/29 9:35	22.58	40650	2.5E-08	4.6E-09	1.1E-09	2.8E-10	2.0E-08	3.8E-09
2011/3/29 9:35	2011/3/30 11:15	25.67	46200	2.9E-07	5.2E-08	1.1E-08	1.9E-09	2.3E-07	4.2E-08
2011/3/30 11:15	2011/3/31 10:00	22.75	40950	2.9E-07	5.2E-08	1.1E-08	1.9E-09	2.2E-07	4.1E-08
2011/3/31 10:00	2011/4/1 10:00	24.00	43200	2.0E-09	4.2E-10	1.1E-10	1.7E-10	1.4E-09	3.4E-10
2011/4/1 10:00	2011/4/2 10:00	24.00	43200	4.3E-09	8.0E-10	3.1E-10	1.2E-10	3.1E-09	5.9E-10
2011/4/2 10:00	2011/4/3 9:30	23.50	42300	3.0E-09	5.9E-10	1.9E-10	1.7E-10	1.6E-09	3.8E-10
2011/4/3 9:30	2011/4/4 10:00	24.50	44100	1.2E-08	2.2E-09	6.0E-10	2.1E-10	9.7E-09	1.8E-09
2011/4/4 10:00	2011/4/5 9:15	23.25	41850	2.9E-09	5.7E-10	1.7E-10	1.7E-10	2.0E-09	4.4E-10
2011/4/5 9:15	2011/4/6 10:00	24.75	44550	1.6E-09	3.6E-10	0.0E+00	1.6E-10	1.1E-09	2.9E-10
2011/4/6 10:00	2011/4/7 10:00	24.00	43200	4.4E-09	8.4E-10	1.6E-10	1.7E-10	4.1E-09	8.0E-10
2011/4/7 10:00	2011/4/8 10:00	24.00	43200	5.2E-09	9.9E-10	3.1E-10	1.7E-10	4.0E-09	7.9E-10
2011/4/8 10:00	2011/4/9 9:20	23.33	42000	2.9E-09	5.5E-10	0.0E+00	1.1E-10	2.3E-09	4.5E-10
2011/4/9 9:20	2011/4/11 10:00	48.67	87600	1.9E-08	3.4E-09	3.9E-10	1.3E-10	1.5E-08	2.8E-09
2011/4/11 10:00	2011/4/13 10:00	48.00	86400	4.3E-09	7.8E-10	7.7E-11	5.5E-11	3.4E-09	6.4E-10
2011/4/13 10:00	2011/4/15 10:30	48.50	87300	1.1E-09	2.3E-10	7.6E-11	8.1E-11	7.8E-10	1.8E-10
2011/4/15 10:30	2011/4/17 10:00	47.50	85500	2.7E-09	5.0E-10	1.1E-10	8.5E-11	1.7E-09	3.4E-10
2011/4/17 10:00	2011/4/19 10:00	48.00	86400	2.1E-08	3.8E-09	3.3E-10	1.0E-10	1.7E-08	3.1E-09
2011/4/19 10:00	2011/4/21 10:00	48.00	86400	1.2E-08	2.2E-09	2.8E-10	1.3E-10	9.7E-09	1.8E-09

Table 2b. (continued) Radioactivity concentrations of ^{137}Cs, ^{136}Cs, and ^{134}Cs.

Air sampling			Air	^{137}Cs	er	^{136}Cs	er	^{134}Cs	er
Start	Stop	[h]	[L]	[Bq/cm^3]		[Bq/cm^3]		[Bq/cm^3]	
2011/4/21 10:00	2011/4/23 10:00	48.00	86400	4.5E-09	8.1E-10	7.1E-11	5.3E-11	3.5E-09	6.6E-10
2011/4/23 11:00	2011/4/26 9:45	70.75	127350	1.1E-09	2.1E-10	3.3E-12	3.7E-11	7.7E-10	1.5E-10
2011/4/26 9:45	2011/4/29 10:45	73.00	131400	4.4E-10	9.0E-11	5.9E-11	3.2E-11	3.3E-10	7.3E-11
2011/4/29 10:50	2011/5/2 9:55	71.08	127950	2.1E-09	4.0E-10	9.9E-11	5.5E-11	1.6E-09	3.1E-10
2011/5/2 9:55	2011/5/5 11:15	73.33	132000	2.6E-08	4.7E-09	2.2E-10	5.4E-11	2.0E-08	3.7E-09
2011/5/5 12:00	2011/5/9 10:00	94.00	169200	8.5E-10	1.6E-10	3.0E-11	2.6E-11	6.3E-10	1.2E-10
2011/5/9 10:05	2011/5/13 10:00	95.92	172650	8.4E-10	1.6E-10	9.4E-12	1.9E-11	6.8E-10	1.3E-10
2011/5/13 11:05	2011/5/17 10:00	94.92	170850	1.1E-09	2.1E-10	0.0E+00	2.2E-11	8.8E-10	1.7E-10
2011/5/17 10:00	2011/5/21 10:10	96.17	173100	4.7E-10	9.0E-11	9.3E-13	2.2E-11	3.7E-10	7.5E-11
2011/5/21 10:35	2011/5/25 9:50	95.25	171450	5.7E-09	1.0E-09	3.0E-11	2.3E-11	4.0E-09	7.5E-10
2011/5/25 11:30	2011/5/29 17:25	101.92	183450	1.6E-08	2.9E-09	2.2E-11	2.8E-11	1.1E-08	2.1E-09
2011/5/29 17:25	2011/6/2 10:00	88.58	159450	1.0E-09	1.8E-10	2.5E-11	2.5E-11	7.1E-10	1.4E-10
2011/6/2 10:50	2011/6/6 10:00	95.17	171300	1.7E-10	3.9E-11	4.0E-11	2.1E-11	2.2E-10	4.8E-11
2011/6/6 10:37	2011/6/10 9:50	95.22	171390	1.9E-10	3.7E-11	9.8E-12	1.4E-11	1.4E-10	3.0E-11

Table 2c. Radioactivity concentrations of ^{99}Mo, ^{140}Ba, and ^{140}La.

Air sampling			Air	^{99}Mo	er	^{140}Ba	er	^{140}La	er
Start	Stop	[h]	[L]	[Bq/cm^3]		[Bq/cm^3]		[Bq/cm^3]	
2011/3/15 11:15	2011/3/15 11:45	0.50	900	1.1E-06	2.0E-06	5.4E-07	2.1E-07	1.1E-05	2.1E-06
2011/3/16 13:15	2011/3/16 13:45	0.50	900	1.6E-07	3.9E-07	0.0E+00	4.9E-08	2.8E-07	2.7E-07
2011/3/16 18:32	2011/3/17 9:00	14.47	26040	1.9E-09	2.4E-09	3.1E-10	1.3E-09	0.0E+00	4.3E-10
2011/3/17 9:00	2011/3/18 10:15	25.25	45450	2.2E-09	1.4E-09	8.4E-11	7.5E-10	3.2E-10	2.6E-10
2011/3/18 10:30	2011/3/19 6:44	20.23	36420	2.8E-11	1.8E-09	0.0E+00	9.0E-10	4.5E-11	3.6E-10
2011/3/19 10:05	2011/3/20 10:00	23.92	43050	4.2E-10	1.6E-09	1.1E-09	7.3E-10	0.0E+00	3.0E-10
2011/3/20 10:00	2011/3/21 10:00	24.00	43200	1.4E-07	3.4E-08	3.7E-08	1.6E-08	9.2E-09	2.7E-09
2011/3/21 10:00	2011/3/22 10:00	24.00	43200	1.8E-08	1.3E-08	1.1E-08	7.9E-09	5.8E-09	1.6E-09
2011/3/22 10:00	2011/3/23 10:00	24.00	43200	5.2E-08	1.2E-08	4.0E-09	4.9E-09	1.4E-09	9.0E-10
2011/3/23 10:00	2011/3/24 10:10	24.17	43500	5.3E-09	2.1E-09	0.0E+00	1.2E-09	7.2E-12	3.3E-10
2011/3/24 10:10	2011/3/25 9:55	23.75	42750	2.7E-09	1.8E-09	2.0E-10	9.1E-10	1.4E-10	3.7E-10
2011/3/25 9:55	2011/3/26 10:00	24.08	43350	1.1E-09	9.3E-10	3.0E-11	4.4E-10	2.3E-10	1.8E-10
2011/3/26 10:00	2011/3/27 10:15	24.25	43650	7.0E-10	1.6E-09	0.0E+00	6.7E-10	1.2E-10	3.8E-10
2011/3/27 10:15	2011/3/28 11:00	24.75	44550	8.6E-10	1.6E-09	0.0E+00	6.9E-10	6.9E-11	3.6E-10
2011/3/28 11:00	2011/3/29 9:35	22.58	40650	6.2E-10	1.6E-09	7.9E-10	8.6E-10	3.0E-10	3.1E-10
2011/3/29 9:35	2011/3/30 11:15	25.67	46200	1.3E-08	3.9E-09	4.6E-09	2.2E-09	1.6E-09	4.4E-10
2011/3/30 11:15	2011/3/31 10:00	22.75	40950	4.2E-09	3.0E-09	3.8E-09	2.0E-09	2.0E-09	4.6E-10
2011/3/31 10:00	2011/4/1 10:00	24.00	43200	6.7E-10	1.3E-09	0.0E+00	6.4E-10	1.7E-10	3.1E-10
2011/4/1 10:00	2011/4/2 10:00	24.00	43200	1.6E-09	9.3E-10	1.5E-10	4.3E-10	0.0E+00	1.9E-10
2011/4/2 10:00	2011/4/3 9:30	23.50	42300	6.7E-10	1.7E-09	2.1E-10	6.7E-10	0.0E+00	3.2E-10
2011/4/3 9:30	2011/4/4 10:00	24.50	44100	0.0E+00	1.3E-09	0.0E+00	7.2E-10	0.0E+00	2.8E-10
2011/4/4 10:00	2011/4/5 9:15	23.25	41850	1.9E-09	1.3E-09	4.4E-10	6.3E-10	0.0E+00	2.5E-10
2011/4/5 9:15	2011/4/6 10:00	24.75	44550	4.6E-10	1.1E-09	0.0E+00	6.1E-10	0.0E+00	2.6E-10
2011/4/6 10:00	2011/4/7 10:00	24.00	43200	0.0E+00	1.2E-09	4.0E-10	6.8E-10	0.0E+00	2.8E-10
2011/4/7 10:00	2011/4/8 10:00	24.00	43200	4.6E-10	1.2E-09	3.2E-10	6.6E-10	0.0E+00	2.5E-10
2011/4/8 10:00	2011/4/9 9:20	23.33	42000	8.7E-10	8.4E-10	0.0E+00	4.1E-10	2.1E-11	1.8E-10
2011/4/9 9:20	2011/4/11 10:00	48.67	87600	5.2E-10	7.4E-10	0.0E+00	4.3E-10	0.0E+00	1.4E-10
2011/4/11 10:00	2011/4/13 10:00	48.00	86400	0.0E+00	4.8E-10	0.0E+00	2.1E-10	2.1E-10	1.1E-10
2011/4/13 10:00	2011/4/15 10:30	48.50	87300	0.0E+00	7.1E-10	4.7E-11	3.3E-10	2.0E-10	1.6E-10
2011/4/15 10:30	2011/4/17 10:00	47.50	85500	0.0E+00	7.4E-10	0.0E+00	3.2E-10	1.6E-11	1.6E-10
2011/4/17 10:00	2011/4/19 10:00	48.00	86400	0.0E+00	6.1E-10	3.8E-10	3.4E-10	2.5E-10	1.2E-10
2011/4/19 10:00	2011/4/21 10:00	48.00	86400	0.0E+00	8.1E-10	0.0E+00	4.9E-10	1.2E-10	1.4E-10

Table 2c. (continued) Radioactivity concentrations of ^{99}Mo, ^{140}Ba, and ^{140}La.

Air sampling			Air	^{99}Mo	er	^{140}Ba	er	^{140}La	er
Start	Stop	[h]	[L]	[Bq/cm^3]		[Bq/cm^3]		[Bq/cm^3]	
2011/4/21 10:00	2011/4/23 10:00	48.00	86400	0.0E+00	5.0E-10	0.0E+00	2.1E-10	2.6E-10	1.2E-10
2011/4/23 11:00	2011/4/26 9:45	70.75	127350	4.7E-11	3.1E-10	0.0E+00	1.4E-10	6.5E-11	6.8E-11
2011/4/26 9:45	2011/4/29 10:45	73.00	131400	3.8E-10	2.6E-10	2.3E-10	1.4E-10	0.0E+00	5.5E-11
2011/4/29 10:50	2011/5/2 9:55	71.08	127950	5.8E-12	4.2E-10	0.0E+00	2.3E-10	0.0E+00	8.2E-11
2011/5/2 9:55	2011/5/5 11:15	73.33	132000	0.0E+00	3.7E-10	2.0E-10	1.8E-10	3.4E-10	9.6E-11
2011/5/5 12:00	2011/5/9 10:00	94.00	169200	4.4E-11	2.6E-10	0.0E+00	1.1E-10	0.0E+00	6.2E-11
2011/5/9 10:05	2011/5/13 10:00	95.92	172650	2.0E-10	1.8E-10	0.0E+00	7.7E-11	0.0E+00	3.6E-11
2011/5/13 11:05	2011/5/17 10:00	94.92	170850	1.5E-10	1.9E-10	0.0E+00	8.5E-11	6.9E-11	4.1E-11
2011/5/17 10:00	2011/5/21 10:10	96.17	173100	0.0E+00	2.0E-10	2.4E-11	8.6E-11	5.2E-11	4.3E-11
2011/5/21 10:35	2011/5/25 9:50	95.25	171450	0.0E+00	1.9E-10	1.1E-10	1.0E-10	0.0E+00	3.9E-11
2011/5/25 11:30	2011/5/29 17:25	101.92	183450	3.2E-10	2.3E-10	0.0E+00	1.2E-10	4.6E-11	3.6E-11
2011/5/29 17:25	2011/6/2 10:00	88.58	159450	6.9E-12	2.2E-10	0.0E+00	1.1E-10	4.2E-11	4.6E-11
2011/6/2 10:50	2011/6/6 10:00	95.17	171300	0.0E+00	1.8E-10	0.0E+00	8.0E-11	0.0E+00	3.6E-11
2011/6/6 10:37	2011/6/10 9:50	95.22	171390	0.0E+00	1.5E-10	7.4E-11	5.8E-11	1.0E-10	4.0E-11

Table 2d. Radioactivity concentrations of ^{95}Nb and ^{110m}Ag.

Air sampling			Air	^{95}Nb	er	^{110m}Ag	er
Start	Stop	[h]	[L]	[Bq/cm^3]		[Bq/cm^3]	
2011/3/15 11:15	2011/3/15 11:45	0.50	900	4.2E-08	2.7E-08	5.5E-08	3.0E-08
2011/3/16 13:15	2011/3/16 13:45	0.50	900	0.0E+00	8.4E-09	4.9E-09	9.3E-09
2011/3/16 18:32	2011/3/17 9:00	14.47	26040	4.4E-10	3.0E-10	0.0E+00	3.6E-10
2011/3/17 9:00	2011/3/18 10:15	25.25	45450	0.0E+00	1.6E-10	0.0E+00	2.3E-10
2011/3/18 10:30	2011/3/19 6:44	20.23	36420	2.4E-10	2.0E-10	0.0E+00	2.8E-10
2011/3/19 10:05	2011/3/20 10:00	23.92	43050	7.5E-11	1.6E-10	1.1E-10	2.1E-10
2011/3/20 10:00	2011/3/21 10:00	24.00	43200	0.0E+00	2.8E-09	1.2E-09	3.6E-09
2011/3/21 10:00	2011/3/22 10:00	24.00	43200	5.5E-10	1.5E-09	2.5E-09	2.1E-09
2011/3/22 10:00	2011/3/23 10:00	24.00	43200	0.0E+00	9.6E-10	1.9E-10	1.2E-09
2011/3/23 10:00	2011/3/24 10:10	24.17	43500	2.1E-10	2.3E-10	1.3E-10	2.7E-10
2011/3/24 10:10	2011/3/25 9:55	23.75	42750	4.1E-10	2.4E-10	2.8E-10	2.8E-10
2011/3/25 9:55	2011/3/26 10:00	24.08	43350	3.5E-10	1.2E-10	8.1E-11	1.3E-10
2011/3/26 10:00	2011/3/27 10:15	24.25	43650	6.6E-11	1.5E-10	0.0E+00	2.0E-10
2011/3/27 10:15	2011/3/28 11:00	24.75	44550	2.6E-10	1.5E-10	3.2E-10	2.1E-10
2011/3/28 11:00	2011/3/29 9:35	22.58	40650	6.8E-10	2.1E-10	2.6E-10	2.2E-10
2011/3/29 9:35	2011/3/30 11:15	25.67	46200	1.5E-09	4.6E-10	1.7E-09	5.6E-10
2011/3/30 11:15	2011/3/31 10:00	22.75	40950	1.5E-09	4.3E-10	1.4E-09	5.4E-10
2011/3/31 10:00	2011/4/1 10:00	24.00	43200	2.4E-11	1.4E-10	0.0E+00	1.8E-10
2011/4/1 10:00	2011/4/2 10:00	24.00	43200	3.4E-10	1.1E-10	1.7E-10	1.3E-10
2011/4/2 10:00	2011/4/3 9:30	23.50	42300	2.4E-10	1.5E-10	1.0E-10	1.9E-10
2011/4/3 9:30	2011/4/4 10:00	24.50	44100	4.8E-10	1.8E-10	9.1E-11	2.2E-10
2011/4/4 10:00	2011/4/5 9:15	23.25	41850	2.0E-10	1.4E-10	1.3E-11	1.8E-10
2011/4/5 9:15	2011/4/6 10:00	24.75	44550	9.5E-11	1.4E-10	1.7E-10	1.8E-10
2011/4/6 10:00	2011/4/7 10:00	24.00	43200	1.1E-10	1.5E-10	4.9E-10	2.2E-10
2011/4/7 10:00	2011/4/8 10:00	24.00	43200	9.4E-12	1.4E-10	1.0E-10	2.1E-10
2011/4/8 10:00	2011/4/9 9:20	23.33	42000	9.7E-11	9.2E-11	0.0E+00	1.2E-10
2011/4/9 9:20	2011/4/11 10:00	48.67	87600	4.4E-10	1.2E-10	5.5E-10	1.6E-10
2011/4/11 10:00	2011/4/13 10:00	48.00	86400	9.6E-11	4.7E-11	6.4E-11	6.3E-11
2011/4/13 10:00	2011/4/15 10:30	48.50	87300	0.0E+00	6.8E-11	0.0E+00	9.3E-11
2011/4/15 10:30	2011/4/17 10:00	47.50	85500	1.6E-10	7.8E-11	8.4E-14	9.5E-11
2011/4/17 10:00	2011/4/19 10:00	48.00	86400	2.7E-10	8.1E-11	1.1E-10	8.7E-11
2011/4/19 10:00	2011/4/21 10:00	48.00	86400	1.5E-10	1.0E-10	1.4E-10	1.4E-10

Table 2d. (continued) Radioactivity concentrations of ^{95}Nb and ^{110m}Ag.

Air sampling			Air	^{95}Nb	er	^{110m}Ag	er
Start	Stop	[h]	[L]	[Bq/cm^3]		[Bq/cm^3]	
2011/4/21 10:00	2011/4/23 10:00	48.00	86400	3.2E-11	4.1E-11	0.0E+00	5.8E-11
2011/4/23 11:00	2011/4/26 9:45	70.75	127350	2.4E-11	3.0E-11	6.6E-11	4.5E-11
2011/4/26 9:45	2011/4/29 10:45	73.00	131400	2.6E-11	2.8E-11	0.0E+00	3.7E-11
2011/4/29 10:50	2011/5/2 9:55	71.08	127950	8.3E-11	5.4E-11	9.9E-12	6.7E-11
2011/5/2 9:55	2011/5/5 11:15	73.33	132000	4.2E-10	8.0E-11	1.9E-10	5.2E-11
2011/5/5 12:00	2011/5/9 10:00	94.00	169200	1.3E-11	2.2E-11	3.5E-11	3.1E-11
2011/5/9 10:05	2011/5/13 10:00	95.92	172650	1.9E-11	1.7E-11	0.0E+00	2.2E-11
2011/5/13 11:05	2011/5/17 10:00	94.92	170850	4.3E-11	2.0E-11	1.9E-11	2.5E-11
2011/5/17 10:00	2011/5/21 10:10	96.17	173100	6.1E-12	1.8E-11	7.3E-12	2.6E-11
2011/5/21 10:35	2011/5/25 9:50	95.25	171450	1.6E-10	3.4E-11	3.7E-11	2.7E-11
2011/5/25 11:30	2011/5/29 17:25	101.92	183450	8.6E-11	2.7E-11	3.8E-11	3.0E-11
2011/5/29 17:25	2011/6/2 10:00	88.58	159450	1.8E-11	2.3E-11	9.2E-11	3.4E-11
2011/6/2 10:50	2011/6/6 10:00	95.17	171300	5.4E-12	1.7E-11	2.9E-11	2.4E-11
2011/6/6 10:37	2011/6/10 9:50	95.22	171390	1.6E-11	1.2E-11	0.0E+00	1.5E-11

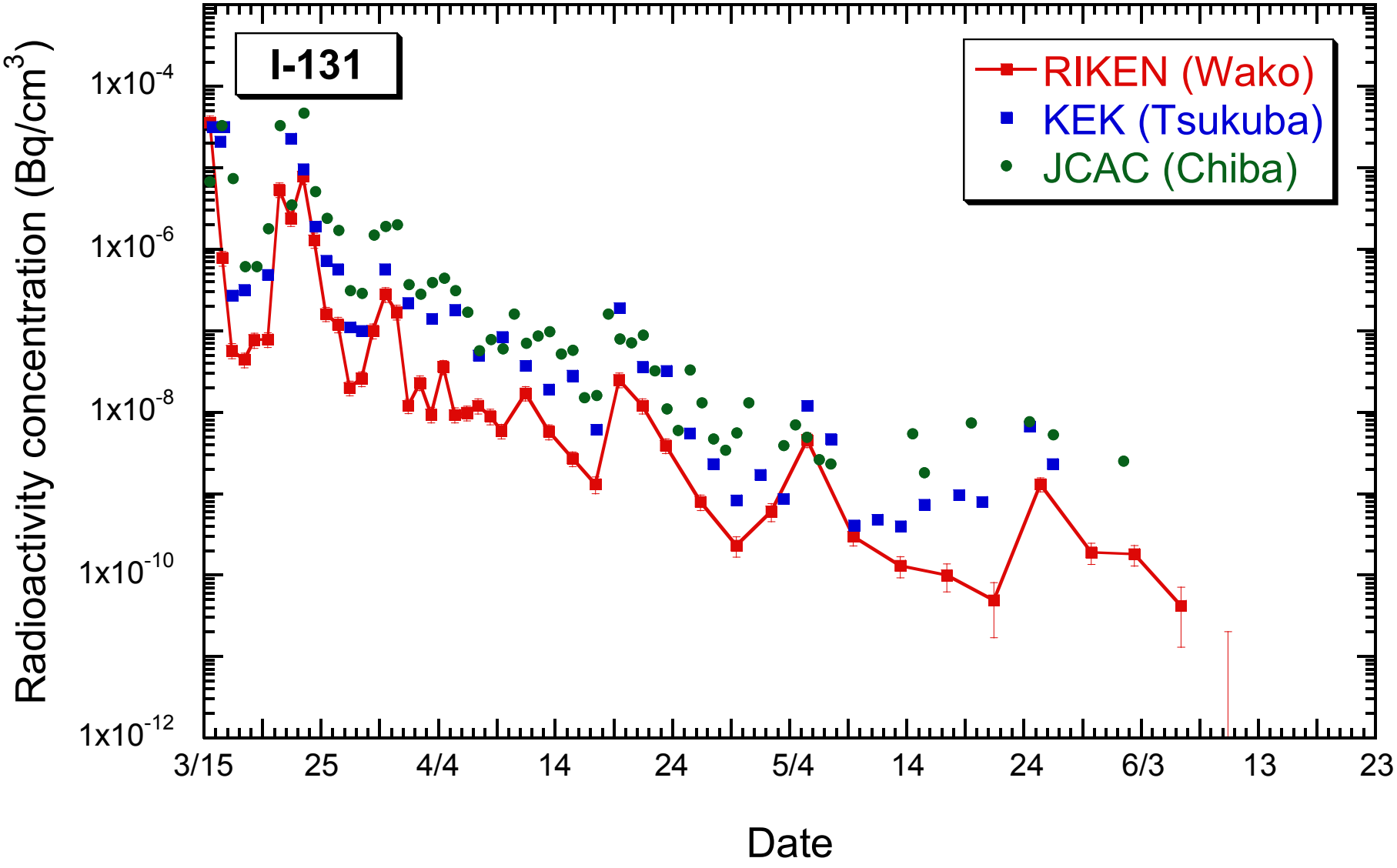

Fig. 2a. Time variation of the radioactivity concentration of ^{131}I.

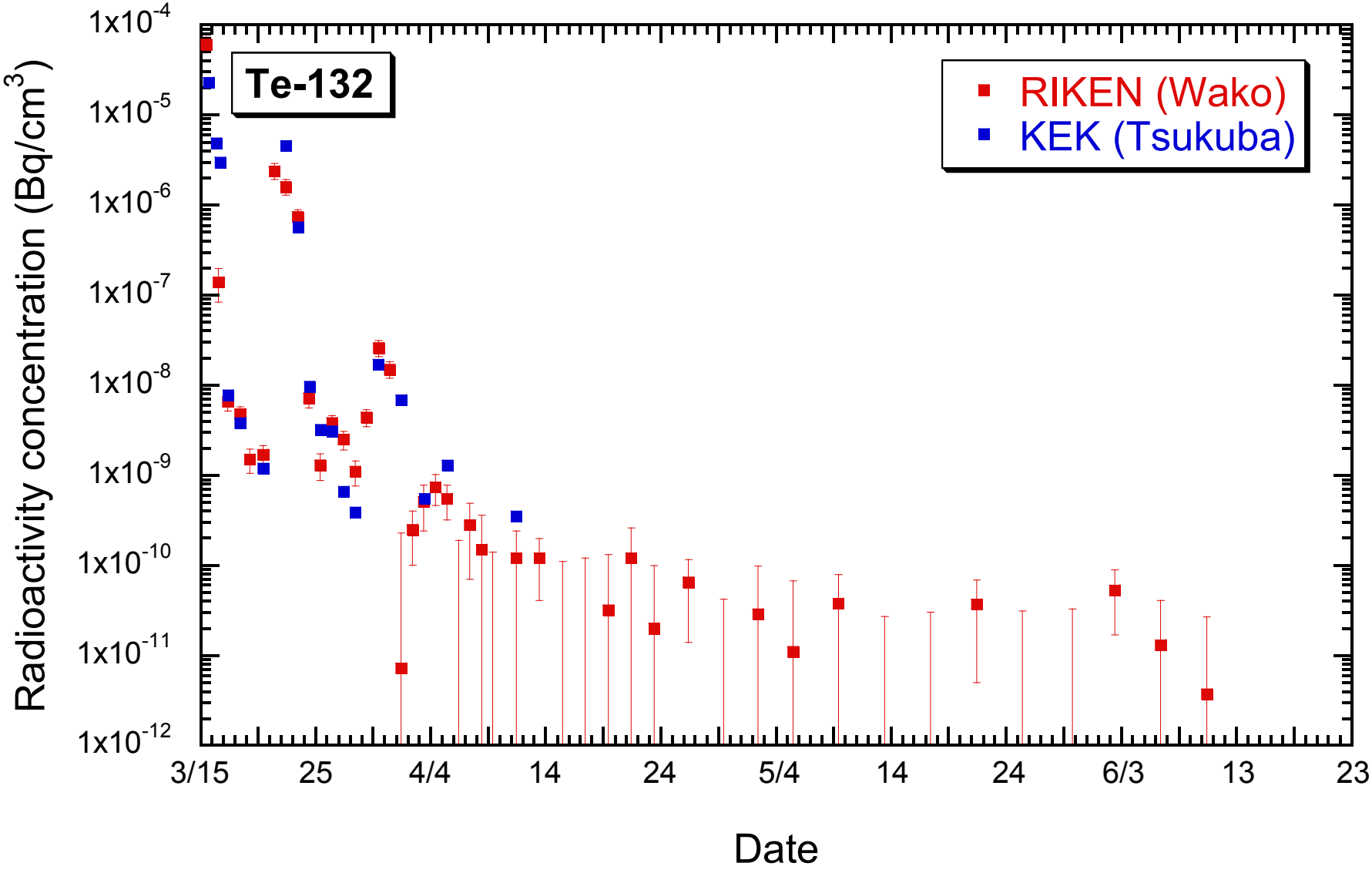

Fig. 2b. Time variation of the radioactivity concentration of ^{132}Te.

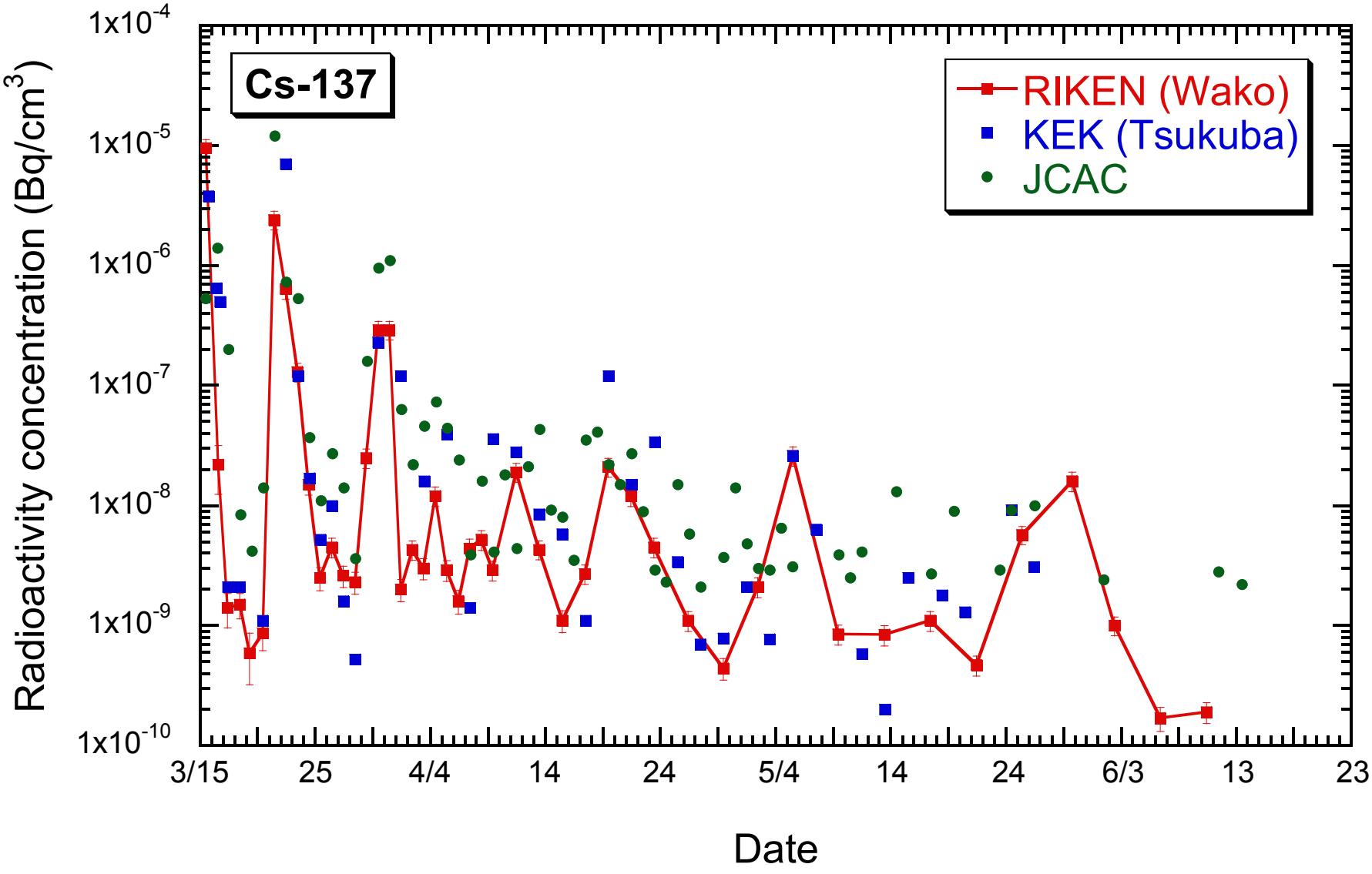

Fig. 2c. Time variation of the radioactivity concentration of ^{137}Cs.

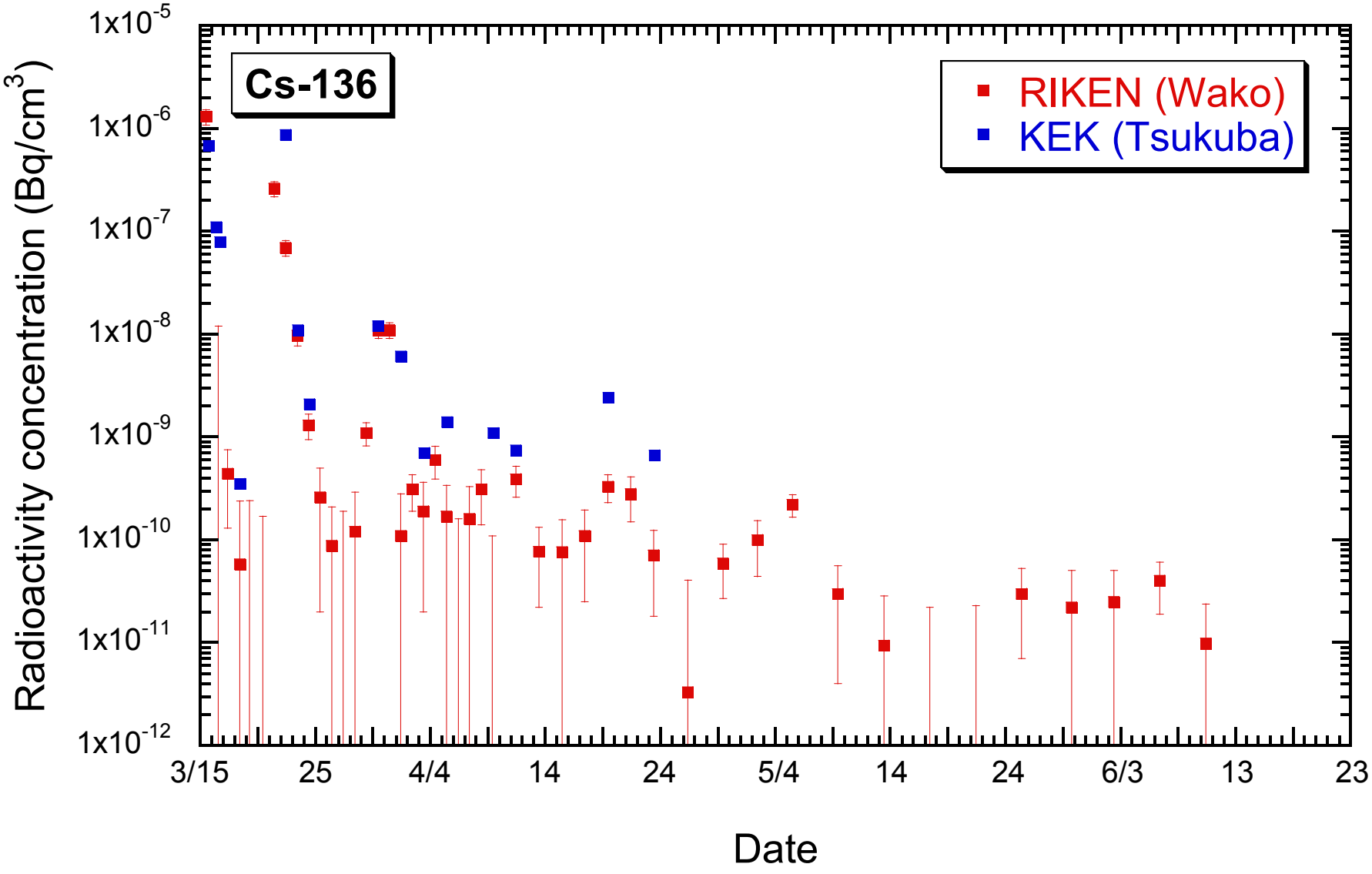

Fig. 2d. Time variation of the radioactivity concentration of ^{136}Cs.

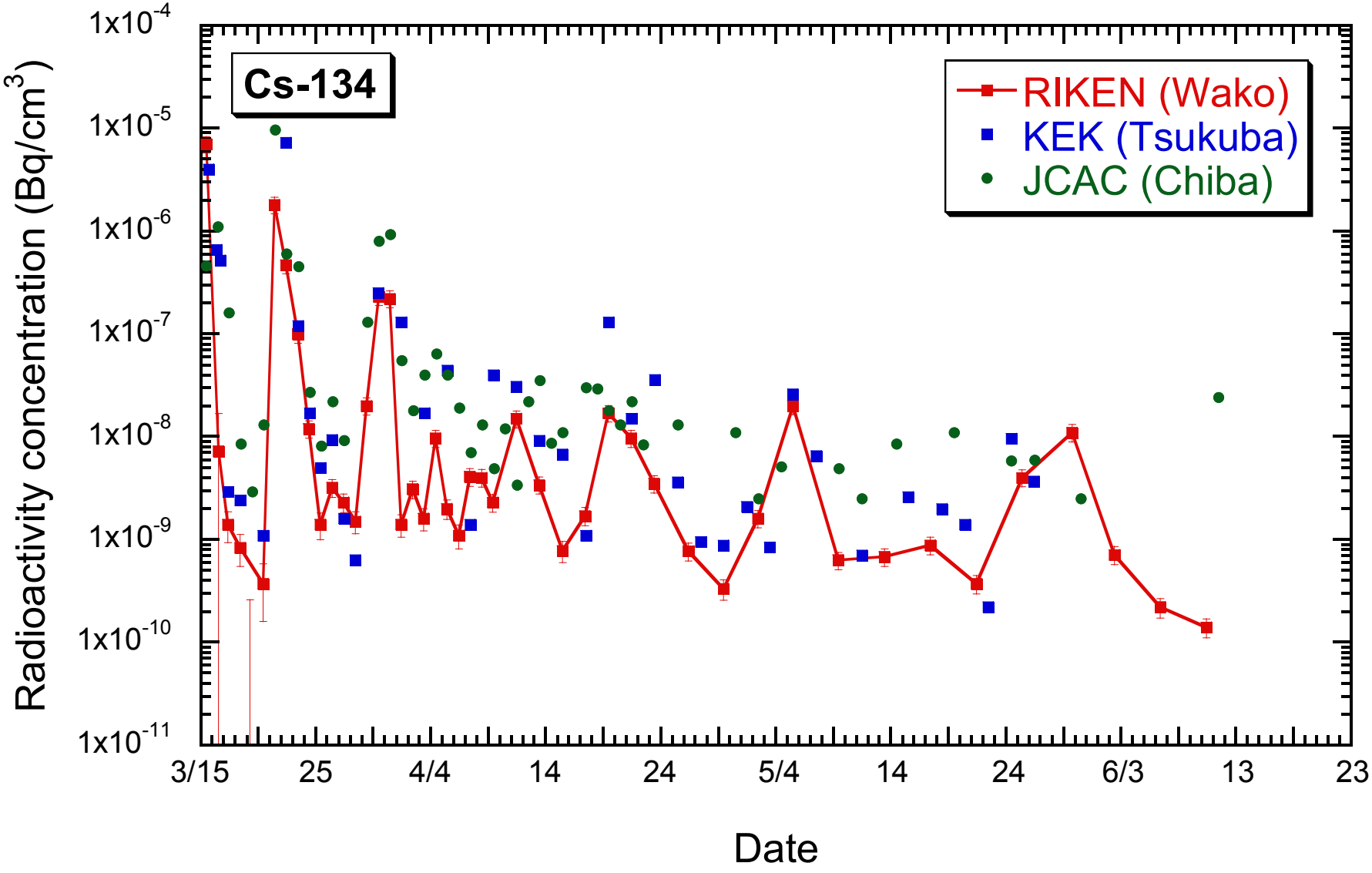

Fig. 2e. Time variation of the radioactivity concentration of ^{134}Cs.

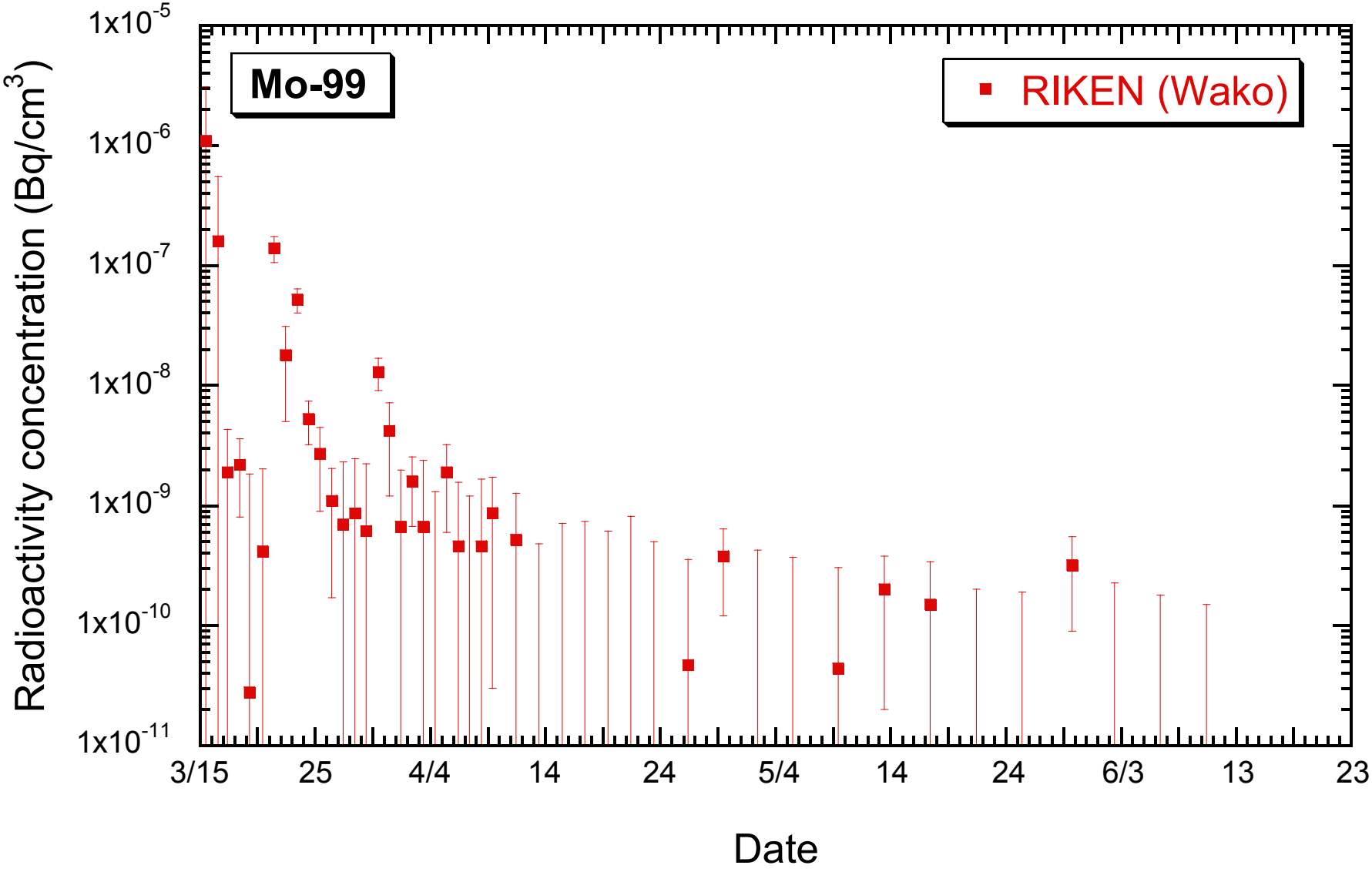

Fig. 2f. Time variation of the radioactivity concentration of ^{99}Mo.

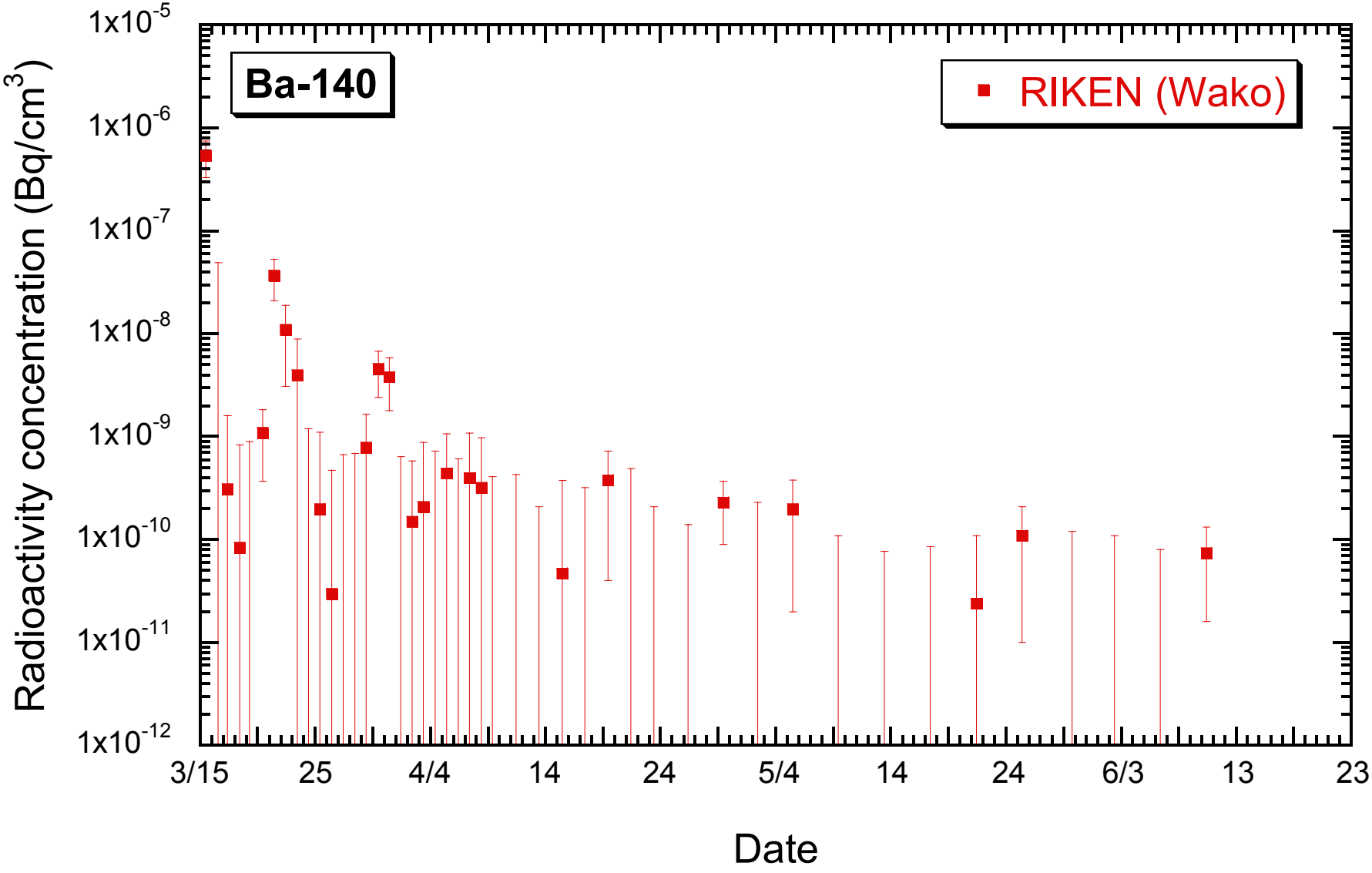

Fig. 2g. Time variation of the radioactivity concentration of ^{140}Ba.

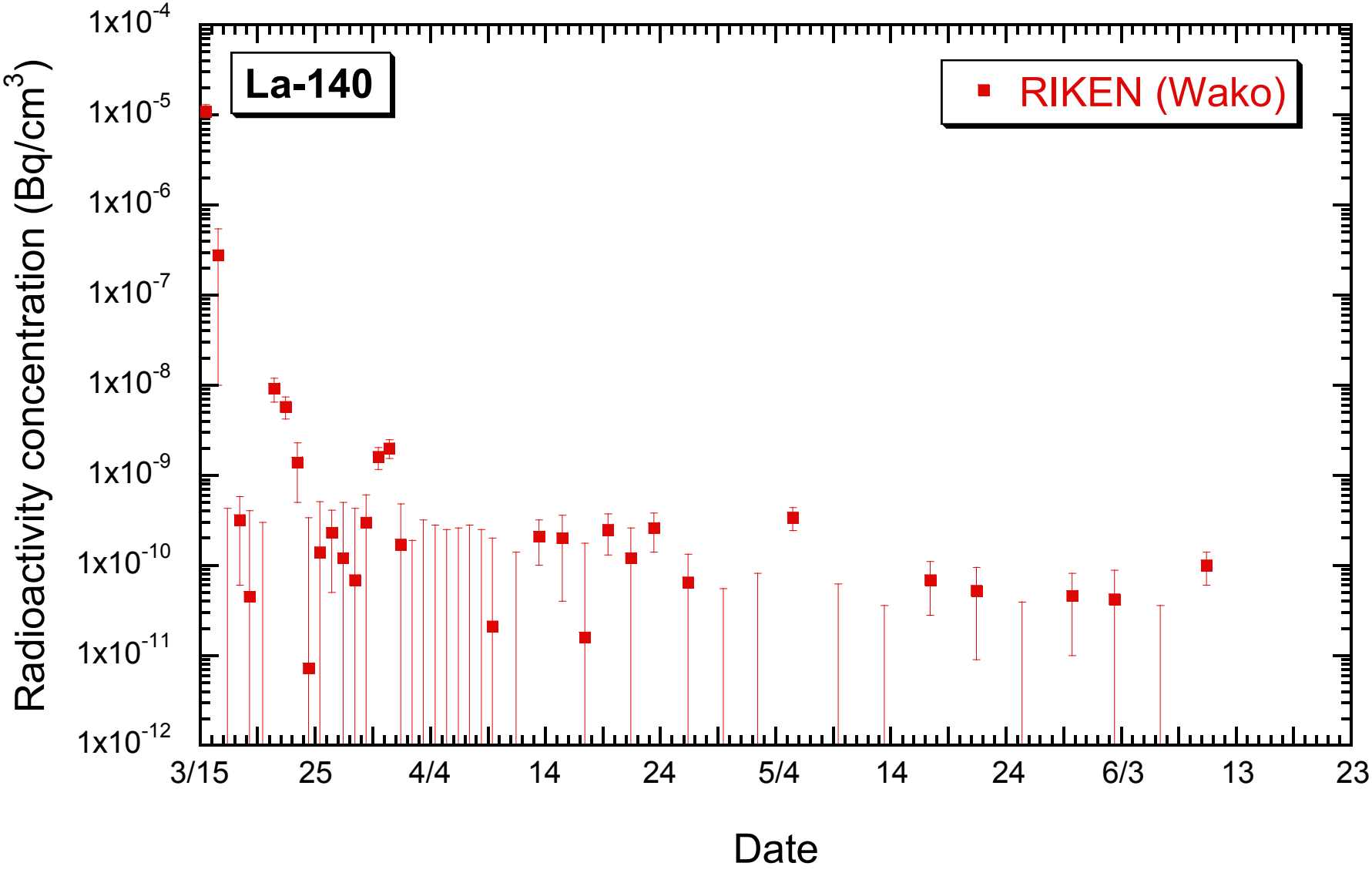

Fig. 2h. Time variation of the radioactivity concentration of ^{140}La.

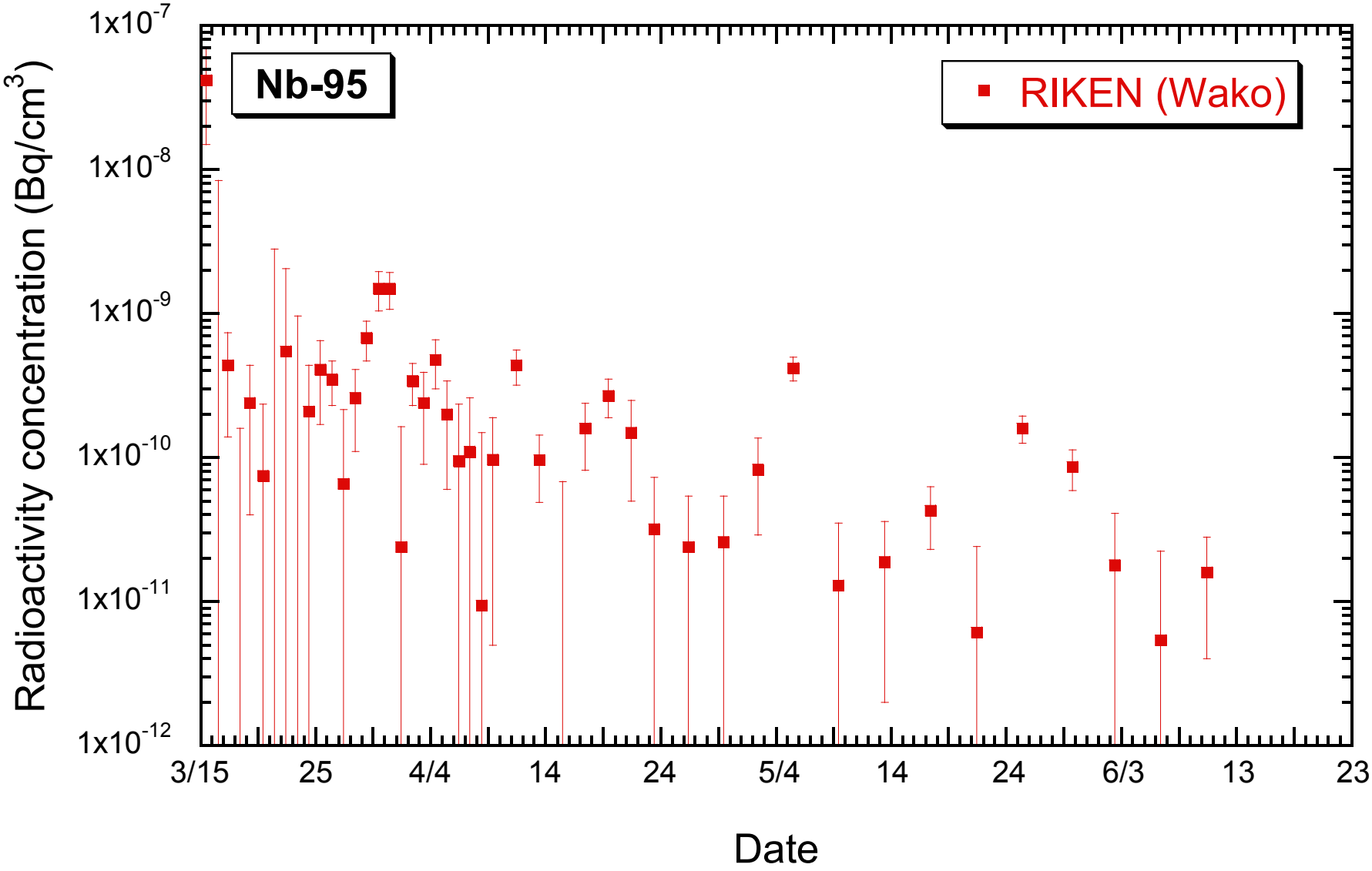

Fig. 2i. Time variation of the radioactivity concentration of ^{95}Nb.

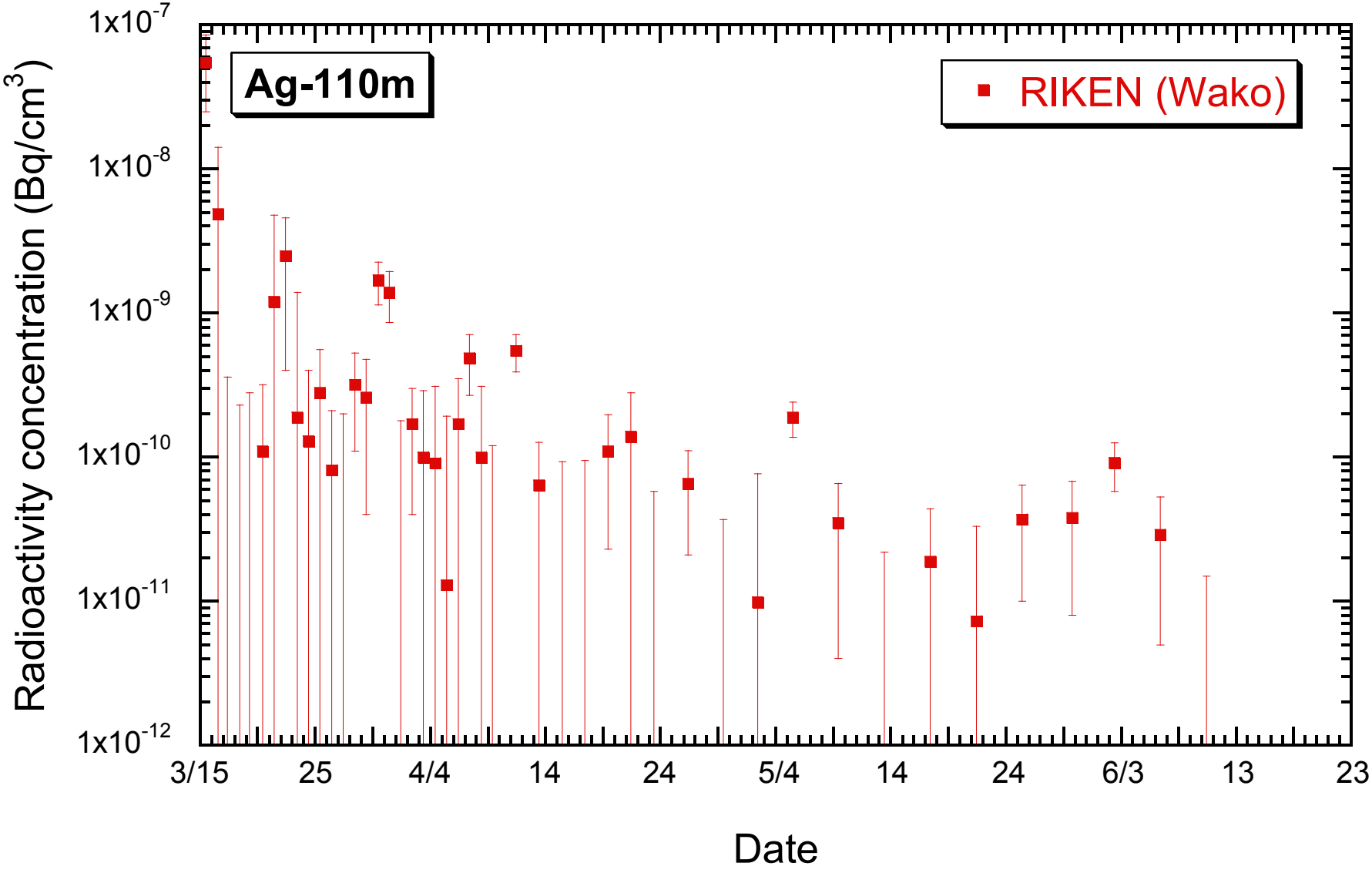

Fig. 2j. Time variation of the radioactivity concentration of ^{110m}Ag.

Appendix

Distance between Fukushima I Nuclear Power Plant and RIKEN

Fig. A1. Map between Fukushima I Nuclear Power Plant and RIKEN Wako Institute.

Effective dose rate at RIKEN Wako Institute

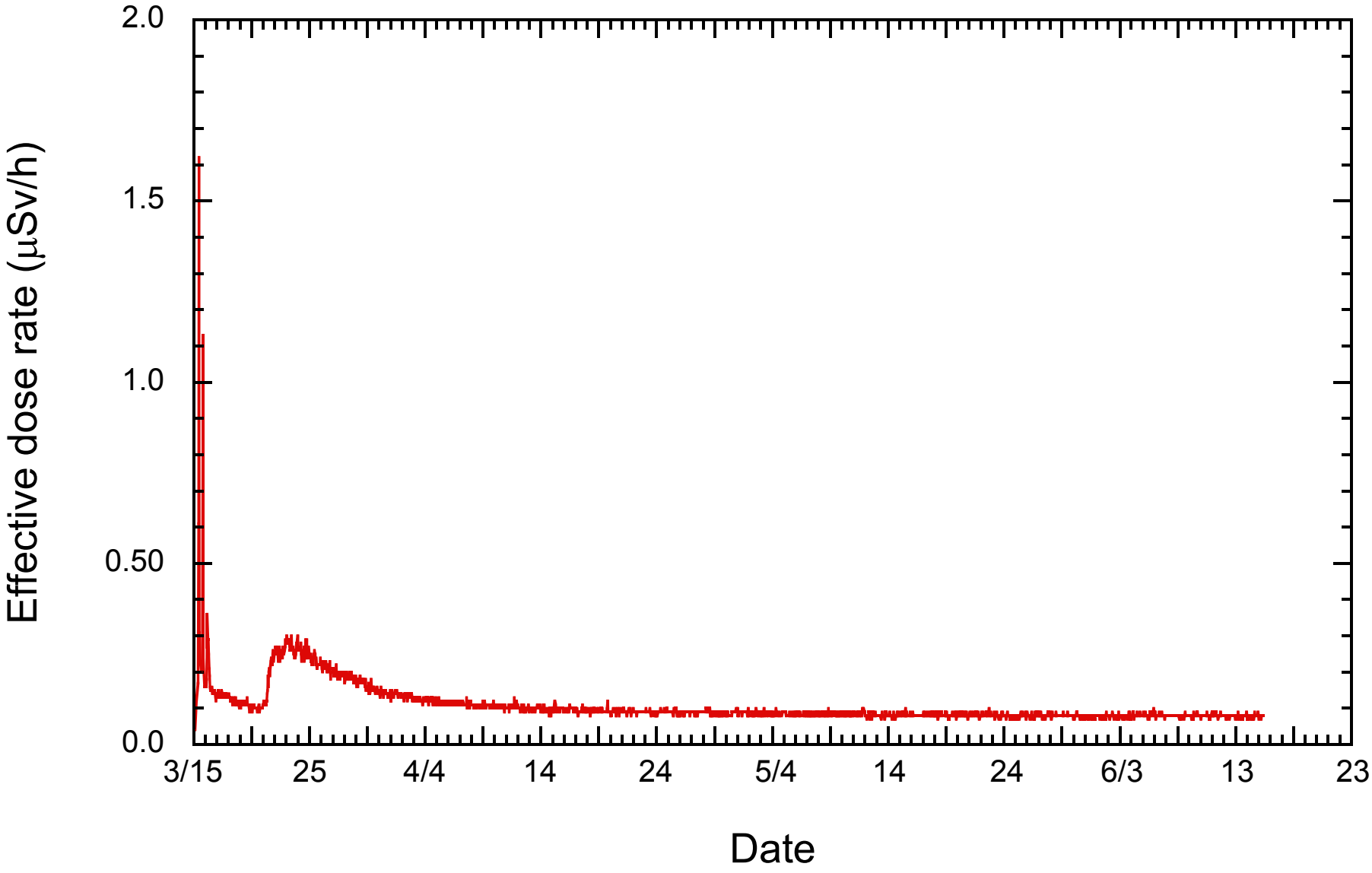

Fig. A2. Effective dose rate measured at the radiation monitoring post at RIKEN Wako Institute.

Rainfall at RIKEN Wako Institute

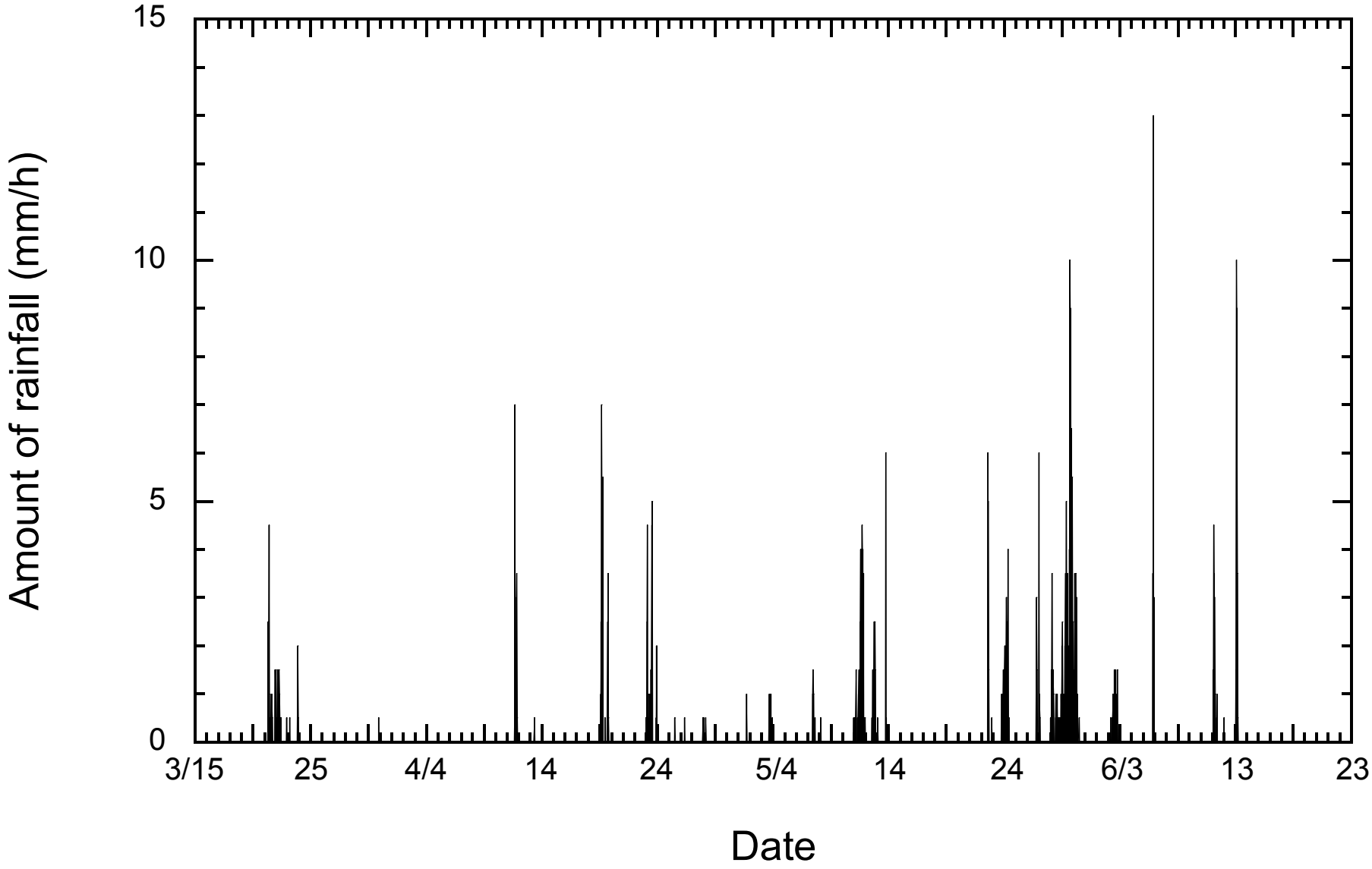

Fig. A3. Amount of rainfall at RIKEN Wako Institute.

Note

Results on the samples collected in March 15, 11:15 – April 21, 10:00, have been already presented in our 1st report on April 25, 2011. (http://www.radiochem.org/kinkyu/49.pdf)

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