



French Non Governmental Organization for Radioactivity Control

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# Analysis Report

RAP110708-OCJ-01 v3

## ANALYSIS

**Object : Evaluation of the environmental consequences in Japan caused by the Fukushima nuclear power plant accident**

## REPORT ID

**RAP110708-OCJ-01 v3** FROM : **July-08, 2011** version : **01**  
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## SAMPLES TYPES

ENVIRONMENT MATRICES : SOILS, VEGETABLES, WATER

## QUANTITY

**14** Samples

received : June-23 2011

## ANALYSES PERFORMED

MEASUREMENT OF GAMMA EMITTERS RADIONUCLIDES BY GAMMA SPECTROMETRY

SEARCH FOR ARTIFICIAL NUCLIDES

## VISA

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## 1. SAMPLES IDENTIFICATION

Reception date: June-23, 2011

The samples were collected by Japanese citizens according to the regular instructions and methodology provided by ACRO. The samples characteristics are given in the table below.

N°	Nature	Collection Date (local)	Location	Origin or species	Mass/Volume collected	ACRO References
Y-1	soil	06/19/11	Gyufun hisahara Yae Wasetani Yamato-machi Kitakata-city Fukushima prf. 福島県喜多方市山都町早稲谷八重久原牛ふん	Rain proof house 雨よけハウス	796.6 g	110629-OCJ-01
Y-2	soil	06/19/11	Ochiba Hisahara Yae Wasetani Yamato-machi Kitakata-city Fukushima prf. 福島県喜多方市山都町早稲谷八重久原落葉	Rain proof house 雨よけハウス	730.3 g	110629-OCJ-02
Y-3	soil	06/19/11	Takano Aikawa Yamato-machi Kitakata-city Fukushima prf. 福島県喜多方市山都町相川高野	Farm 畑	320.8 g	110629-OCJ-03
Y-4	soil	06/19/11	Shinden Aikawa Yamato-machi Kitakata-city Fukushima prf. 福島県喜多方市山都町相川新田	Farm 畑	357.5 g	110629-OCJ-04
M-1	pasture	05/05/11	Southern part of Miyagi prf. A 宮城県南部A			110629-OCJ-05
M-5	water	06/19/11	Southern part of Miyagi prf.B 宮城県南部B	Tap water 水道水	0.5 l	110629-OCJ-06
F-1	cabbage	06/18/11	Iino-machi Fukushima-city Fukushima prf. 福島県福島市飯野町	Farm in Iino 飯野町の畑で収穫		110629-OCJ-07
F-2	cabbage	06/20/11	Purchased from a supermarket in Fukushima city. Harvested in Chiba prf. 福島市内のスーパーから購入、千葉県産			110629-OCJ-08
F-3	carrot	06/20/11	Purchased from a supermarket in Fukushima city. Harvested in Chiba prf. 福島市内のスーパーから購入、千葉県産			110629-OCJ-09
O-1	water	06/08/11	Miyanomae Kuimaru Syouwa-mura Oonuma-gun Fukushima prf. 福島県大沼郡昭和村大字喰丸宮ノ前	Tap water 水道水	0.5 l	110629-OCJ-10
O-2	soil	05/23/11	Akakura Ryouhara Syouwa-mura Oonuma-gun Fukushima prf. 福島県大沼郡昭和村大字両原字赤倉	Farm 畑	394.3 g	110629-OCJ-11
O-3	soil	05/27/11	Akakura Ryouhara Syouwa-mura Oonuma-gun Fukushima prf. 福島県大沼郡昭和村大字小中津川字下川原	Farm 畑	1 197.4 g	110629-OCJ-12
M-6	soil	05/23/11	Kouno Marumori-cho Igu-gun Miyagi prf. 宮城県伊具郡丸森耕野		148.6 g	110629-OCJ-13
M-7	soil	05/23/11	Koshigou Shiraishi-City Miyagi prf. 宮城県白石市越河		687.1 g	110629-OCJ-14

## 2. ANALYSIS METHOD

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### Soils :

After homogenization, samples are conditioned in a geometry adapted to the gamma measurement.

### Vegetables :

The vegetables are grated and homogenized and the whole part is taken to be conditioned in a geometry adapted to the gamma measurement.

### Waters :

The waters are homogenized and the whole part is taken to be conditioned in a geometry adapted to the gamma measurement.

The analyses are performed by gamma spectrometry on raw material for soils, and fresh material for vegetables (see annex 1). The results are displayed in the following table.

### 3. RESULTS : MASS ACTIVITY OF Soils in Bq/kg (raw weight)

Sample identification		110629-OCJ-01	110629-OCJ-02	110629-OCJ-03	110629-OCJ-04	110629-OCJ-11	110629-OCJ-12	110629-OCJ-13	110629-OCJ-14
Samples number registration		110629-OCJ-01	110629-OCJ-02	110629-OCJ-03	110629-OCJ-04	110629-OCJ-11	110629-OCJ-12	110629-OCJ-13	110629-OCJ-14
Kind - species		Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
		Y-1	Y-2	Y-3	Y-4	O-2	O-3	M-6	M-7
Sample									
Date		06.19.2011 12:00 AM	06.19.2011 12:00 AM	06.19.2011 12:00 AM	06.19.2011 12:00 AM	05.23.2011 11:00 AM	05.27.2011 2:00 PM	06.06.2011 6:30 PM	06.06.2011 5:30 PM
Place		Gyufun hisahara Yae Wasetani Yamato- machi Kitakata-city Fukushima prf. 福島県喜多方市山都 町早稲谷八重久原牛 心ん	Ochiba Hisahara Yae Wasetani Yamato- machi Kitakata-city Fukushima prf. 福島県喜多方市山都 町早稲谷八重久原落 葉	Takano Aikawa Yamato-machi Kitakata- city Fukushima prf. 福島県喜多方市山都 町相川高野	Shinden Aikawa Yamato-machi Kitakata- city Fukushima prf. 福島県喜多方市山都 町相川新田	Akakura Ryouhara Syowa-mura Oonuma- gun Fukushima prf. 福島県大沼郡昭和村 大字両原字赤倉	Akakura Ryouhara Syowa-mura Oonuma- gun Fukushima prf. 福島県大沼郡昭和村 大字小中津川字下川 原	Kouno Marumori-cho Igu-gun Miyagi prf. 宮城県伊具郡丸森耕 野	Koshigou Shiraiishi-City Miyagi prf. 宮城県白石市越河
surface area collected		100 cm2	100 cm2	100 cm2	100 cm2	100 cm2	100 cm2	100 cm2	100 cm2
total mass collected (g)		796.6 g	730.3 g	320.8 g	357.5 g	394.3 g	1197.4 g	148.6 g	687.1 g
Counting									
Geometry or volume (cm <sup>3</sup> )		61	61	61	61	61	61	61	61
analysed sample mass (g)		75.6	60.3	63.8	64.5	69.3	54.4	85.6	73.1
age of the sample (days)		12.5	13.5	15.2	15.5	42.3	41	31	29.2
state analysed		raw	raw	raw	raw	raw	raw	raw	raw
Result									
Reference date		06.19.2011 12:00 AM	06.19.2011 12:00 AM	06.19.2011 12:00 AM	06.19.2011 12:00 AM	05.23.2011 11:00 AM	05.27.2011 2:00 PM	06.06.2011 6:30 PM	06.06.2011 5:30 PM
Unit		Bq/kg	Bq/kg	Bq/kg	Bq/kg	Bq/kg	Bq/kg	Bq/kg	Bq/kg
ARTIFICIALS RADIONUCLIDES									
Ag-110m	249.8 days	< 4	< 3	< 13	< 8	< 5	< 5	< 9	< 10
Te-129m	33,6 days	< 80	< 84	< 48	< 280	< 240	< 110	300 ± 195	< 360
I-131	8 days	< 7	< 8	< 64	< 36	< 108	< 100	< 140	< 92
Cs-134	2,1 years	118 ± 14	142 ± 17	3,730 ± 440	1,030 ± 120	93 ± 11	198 ± 24	1,480 ± 170	600 ± 70
Cs-136	13,2 days	< 4	< 4	< 20	< 12	< 26	< 25	< 32	< 25
Cs-137	30 year	130 ± 16	160 ± 19	4,160 ± 490	1,190 ± 140	102 ± 13	225 ± 27	1,610 ± 190	650 ± 80

#### 4. RESULTS : SURFACE ACTIVITY OF Soils (Bq/m<sup>2</sup>)

Sample identification		110629-OCJ-01	110629-OCJ-02	110629-OCJ-03	110629-OCJ-04	110629-OCJ-11	110629-OCJ-12	110629-OCJ-13	110629-OCJ-14
Samples number registration		110629-OCJ-01	110629-OCJ-02	110629-OCJ-03	110629-OCJ-04	110629-OCJ-11	110629-OCJ-12	110629-OCJ-13	110629-OCJ-14
Kind - species		Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
		Y-1	Y-2	Y-3	Y-4	O-2	O-3	M-6	M-7
Sample									
Date		06.19.2011 12:00 AM	06.19.2011 12:00 AM	06.19.2011 12:00 AM	06.19.2011 12:00 AM	05.23.2011 11:00 AM	05.27.2011 2:00 PM	06.06.2011 6:30 PM	06.06.2011 5:30 PM
Place		Gyufun hisahara Yae Wasetani Yamato-machi Kitakata-city Fukushima prf. 福島県喜多方市山都町 早稲谷八重久原牛ふん	Ochiba Hisahara Yae Wasetani Yamato-machi Kitakata-city Fukushima prf. 福島県喜多方市山都町 早稲谷八重久原落葉	Takano Aikawa Yamato- machi Kitakata-city Fukushima prf. 福島県喜多方市山都町 相川高野	Shinden Aikawa Yamato-machi Kitakata- city Fukushima prf. 福島県喜多方市山都町 相川新田	Akakura Ryouhara Syouwa-mura Oonuma- gun Fukushima prf. 福島県大沼郡昭和村大 字両原字赤倉	Akakura Ryouhara Syouwa-mura Oonuma- gun Fukushima prf. 福島県大沼郡昭和村大 字小中津川字下川原	Kouno Marumori-cho Igu- gun Miyagi prf. 宮城県伊具郡丸森耕野	Koshigou Shiraishi-City Miyagi prf. 宮城県白石市越河
surface area collected		100 cm2	100 cm2	100 cm2	100 cm2	100 cm2	100 cm2	100 cm2	100 cm2
total mass collected (g)		796.6 g	730.3 g	320.8 g	357.5 g	394.3 g	1197.4 g	148.6 g	687.1 g
Counting									
Geometry or volume (cm <sup>3</sup> )		61	61	61	61	61	61	61	61
analysed sample mass (g)		75.6	60.3	63.8	64.5	69.3	54.4	85.6	73.1
age of the sample (days)		12.5	13.5	15.2	15.5	42.3	41	31	29.2
state analysed		raw	raw	raw	raw	raw	raw	raw	raw
Result									
Reference date		06.19.2011 12:00 AM	06.19.2011 12:00 AM	06.19.2011 12:00 AM	06.19.2011 12:00 AM	05.23.2011 11:00 AM	05.27.2011 2:00 PM	06.06.2011 6:30 PM	06.06.2011 5:30 PM
Unit		Bq/m2	Bq/m2	Bq/m2	Bq/m2	Bq/m2	Bq/m2	Bq/m2	Bq/m2
ARTIFICIALS RADIONUCLIDES									
Ag-110m	249.8 days	< 319	< 219	< 417	< 286	< 197	< 599	< 134	< 687
Te-129m	33,6 days	< 6,373	< 6,135	< 1,540	< 10,010	< 9,463	< 13,171	4,458 ± 2,898	< 24,736
I-131	8 days	< 558	< 584	< 2,053	< 1,287	< 4,258	< 11,974	< 2,080	< 6,321
Cs-134	2,1 years	9,400 ± 1,115	10,370 ± 1,242	119,658 ± 14,115	36,823 ± 4,290	3,667 ± 434	23,709 ± 2,874	21,993 ± 2,526	41,226 ± 4,810
Cs-136	13,2 days	< 319	< 292	< 642	< 429	< 1,025	< 2,994	< 476	< 1,718
Cs-137	30 year	10,356 ± 1,275	11,685 ± 1,388	133,453 ± 15,719	42,543 ± 5,005	4,022 ± 513	26,942 ± 3,233	23,925 ± 2,823	44,662 ± 5,497

5. RESULTS : MASS ACTIVITY OF PLANTS in Bq/kg

Sample identification					
Samples number registration		110629-OCJ-05	110629-OCJ-07	110629-OCJ-08	110629-OCJ-09
Kind - species		<b>pasture</b>	<b>cabbage</b>	<b>cabbage</b>	<b>carrot</b>
		M-1	F-1	F-2	F-3
Sample Date		05.05.2011	06.18.2011 9:00 AM	06.20.2011	06.20.2011
Place		A Southern part of Miyagi prf. 宮城県南部A	Iino-machi Fukushima-city Fukushima prf. 福島県福島市飯野町	Purchased from a supermarket in Fukushima city. Harvested in Chiba prf. 福島市内のスーパーから購入、千葉県産	Purchased from a supermarket in Fukushima city. Harvested in Chiba prf. 福島市内のスーパーから購入、千葉県産
Counting					
Geometry or volume (cm <sup>3</sup> )		500	500	500	500
analysed sample mass (g)		133.4	302.7	340.9	332.2
age of the sample (days)		62	12.7	11.7	12
state analysed		dry	fresh	fresh	fresh
Result					
Reference date		05.05.2011	06.18.2011 9:00 AM	06.20.2011	06.20.2011
Unit		<b>Bq/kg</b>	<b>Bq/kg</b>	<b>Bq/kg</b>	<b>Bq/kg</b>
ARTIFICIALS RADIONUCLIDES					
Ag-110m	249.8 days	< 4	< 1	< 2	< 0.8
Te-129m	33,6 days	< 260	< 26	< 34	< 24
I-131	8 days	-	< 1.5	< 2	< 2
Cs-134	2,1 years	<b>200 ± 24</b>	< 0.6	< 1	<b>1.36 ± 0.37</b>
Cs-136	13,2 days	< 54	< 1.2	< 1.5	< 1
Cs-137	30 year	<b>215 ± 26</b>	< 0.7	< 1	<b>1.21 ± 0.36</b>

6. RESULTS : VOLUME ACTIVITY OF Waters in Bq/L

Sample identification			
Samples number registration		110629-OCJ-06	110629-OCJ-10
Kind - species		tap water	tap water
		M-5	O-1
Sample			
Date		06.19.2011 4:30 PM	06.08.2011 9:00 AM
Place		B Southern part of Miyagi prf. 宮城県南部B	Miyanomae Kuimaru Syowa-mura Oonuma- gun Fukushima prf. 福島県大沼郡昭和村大 字喰丸宮ノ前
Counting			
Geometry or volume (cm <sup>3</sup> )		500	500
analysed sample mass (g)		500.2	507.1
age of the sample (days)		15	25
state analysed		raw	raw
Result			
Reference date		06.19.2011 4:30 PM	06.08.2011 9:00 AM
Unit		Bq/l	Bq/l
ARTIFICIALS RADIONUCLIDES			
Ag-110m	249.8 days	< 1	< 0.5
Te-129m	33,6 days	< 19	< 16
I-131	8 days	< 2	< 3
Cs-134	2,1 years	< 0.5	< 0.3
Cs-136	13,2 days	< 1	< 1
Cs-137	30 year	< 0.5	< 0.3

## APPENDIX 1

ANALYSIS	GAMMA
TITLE	<b>Measurement of gamma emitters nuclides by gamma spectrometry</b>
TREATMENT	The raw sample is homogenised. A representative part is taken to be conditioned in a geometry adapted to the gamma measurement.
MATERIAL	High-Purity Germanium (HPGe), type N coaxial , 32% efficiency, mounted in a vertical cryostate. The samples are placed in a 10-cm thick lead shielding. Data are readout by a digital acquisition system (DSPEC-ORTECH). The energy range is taken as 27-2000 keV. The containers are plastic round boxes with a fiducial volume of 61ml (ref. 7215) and standard geometries of 500ml.
UNITS	The measured quantity is the activity in becquerel (Bq) per kilogram of raw or fresh material (kg), in becquerel (Bq) per liter (L) and becquerel (Bq) per square meter (m <sup>2</sup> )

RESULTS	
IN GENERAL	<p>Measurements are performed with identical geometries as thoses of the standard (calibrated) sources. They concern gamma-emitters radionuclides displaying one or several emission peaks within the reference energy range. Among all the radionuclides detected in the samples, only the most abundant are displayed in the tables, without any specific demand from the client. In all cases, the tables display at least all detected artificial radionuclides.</p> <p>Only elements with activity larger than the decision threshold are given. On the contrary, for the specified radionuclides, the detection limit –LD- (detection limit) is indicated, with the inferior “&lt;” sign. When it is not possible to deduce a satisfying detection limit LD, the data are replaced by the sign “-“. When an element has been detected but cannot be quantified properly, the mention “Identified but Not Quantified” (INQ) is reported. The measured activity of each radioelement is given with its absolute uncertainty calculated within a 95% interval of confidence (2 times the standard deviation). Each expressed activity, including the detection limit, is calculated at the reference date indicated in the table (collection date and time).</p>

## APPENDIX 2

INFORMATION ABOUT THE LABORATORY ACRO	
Measurements capacities	The ACRO laboratory can measure radon concentration in the air, tritium (HTO) in liquids and gamma radionuclides in all kind of matrices. Other measurements are under development. The measurement protocols are in accordance to the actual French and International standards (ISO/CEI 17025).
QUALIFICATION	
The laboratory is qualified for radioactivity measurements in the environment by the French nuclear safety authority (ASN)	
Decision n°DEP-DEU-0704-2009 du 8/12/09 Of French nuclear safety authority (ASN)	<ul style="list-style-type: none"> <li>- Measurement of gamma-emitters radionuclides in biological matrices</li> <li>- Tritium measurement in waters</li> </ul>
Decision n°DEP-DIS-346-2008	<ul style="list-style-type: none"> <li>- Radon concentration (volume activity) in public places</li> </ul>
Decision n°CODEP-DEU-2010-031543 du 15/06/10	<ul style="list-style-type: none"> <li>- Measurement of gamma-emitters radionuclides in waters and soils</li> <li>- Uranium isotopes in soils</li> <li>- Thorium isotopes in soils</li> </ul>
Decision CODEP-DEU-2011-031763 du 15/06/11	<ul style="list-style-type: none"> <li>- Radium-226/228 and decaying partners in soils.</li> <li>- Measurement of gamma-emitters radionuclides in soils</li> </ul>