

Environmental Radioactivity Report 2019/2020

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1. SUMMARY

Samples were analysed for radioactivity from the following locations:

- Atmosphere – Kaitaia (RN47), Chatham Island (RN46), Rarotonga (RN23)
- Rainwater – Hokitika
- Milk powder – Waikato, Taranaki and Westland
- Seawater - Christchurch

Artificial radioactivity continued to be at levels that are below detection limits in most cases and significantly below levels that would give rise to health concerns. No significant change in the status of environmental radioactivity occurred during the period.

2. RESULTS

Radioactivity units used throughout this report are becquerels (Bq), millibecquerels (mBq = 10^{-3} Bq) and microbecquerels ($\mu\text{Bq} = 10^{-6}$ Bq). One becquerel is defined as one nuclear transformation per second.

We report standard deviations from annual means, including natural, daily and seasonal variations. The measurement uncertainties of individual results are significantly smaller.

2.1 ATMOSPHERE

Daily atmospheric samples were collected at Kaitaia, Chatham Islands and Rarotonga. The samples were analysed by high-resolution gamma spectrometry for I-131, Cs-134 and Cs-137, and the naturally occurring radionuclides Be-7 and Pb-212.

Detections of the artificial radionuclides are listed in Table 1. Aside of these detections, the concentrations of I-131, Cs-134 and Cs-137 were below Minimum Detectable Concentrations (MDCs), which were in the range of 1 to 4 $\mu\text{Bq}/\text{m}^3$.

The mean atmospheric activity concentrations of the naturally occurring radionuclides Be-7 and Pb-212 are given in Table 2.

TABLE 1: Detections of artificial radionuclides I-131 and Cs-137 in the atmosphere. Measurement uncertainties at a coverage factor of $k=1$.

Sampling site	Date (UTC)	I-131 ($\mu\text{Bq}/\text{m}^3$)	Cs-134 ($\mu\text{Bq}/\text{m}^3$)	Cs-137 ($\mu\text{Bq}/\text{m}^3$)
Chatham Islands	15/02/2020	0.91 ± 0.25	< MDC	< MDC
Chatham Islands	3/04/2020	0.64 ± 0.19	< MDC	< MDC
Chatham Islands	18/05/2020	< MDC	< MDC	0.87 ± 0.26
Kaitaia	5/02/2020	< MDC	< MDC	0.83 ± 0.91

TABLE 2: Annual means and standard deviations of daily activity concentrations in the atmosphere for naturally occurring Be-7 and Pb-212.

Sampling site	Be-7 (mBq/m^3)		Pb-212 (mBq/m^3)	
	Mean	Std. Dev.	Mean	Std. Dev.
Rarotonga	4.0	2.0	44	34
Chatham Islands	3.4	1.8	5.7	4.1
Kaitaia	3.9	1.9	12	13

2.2 RAINWATER

Weekly rainwater samples were collected at Hokitika. The samples were analysed for total beta-activity concentration using a liquid scintillation counter, and for artificial nuclides using gamma spectrometry. Be-7 measurements were used as a quality control for the performance of the sampling system.

No artificial radionuclides were detected. Based on the Minimum Detectable Concentrations for Cs-137, the upper limit for weekly deposition of Cs-137 was determined to be 0.3 Bq/m² which corresponds to 0.005 Bq/L.

The total annual deposition of beta emitters was 320 Bq/m² with 3170 mm of total collected rainfall. The mean weekly beta activity from deposition was 6.2 Bq/m² and the standard deviation from the mean 4.0 Bq/m². This activity is almost entirely due to naturally occurring radionuclides.

2.3 MILK POWDER

Monthly milk powder samples (in some cases liquid milk samples) were obtained from the Waikato, Taranaki and Westland regions¹. These were analysed for I-131, Cs-134 and Cs-137 by gamma spectrometry. Cs-137 was the only detectable artificial radionuclide. Milk powders from the Taranaki region remain the ones with the highest Cs-137 concentration. For Waikato and Westland regions, Cs-137 levels are commonly below Minimum Detectable Concentration of 0.2-0.6 Bq/kg.

TABLE 3: Annual means and standard deviations of Cs-137 detections in monthly milk powder samples.

Region	Cs-137 (Bq/kg)		Number of detections
	Mean	Std. Dev.	
Waikato	0.364	0.072	5
Taranaki	0.77	0.32	11
Westland	0.169	0.059	3

2.4 SEAWATER

Monthly seawater samples were obtained from Lyttelton Harbour and analysed by gamma spectrometry for the presence of artificial nuclides. None of the analysed samples showed detectable concentrations of I-131, Cs-134 or Cs-137. The Minimum Detectable Concentration for Cs-137 was 0.2 Bq/L. No other artificial gamma emitters have been detected.

¹ With exception of the May 2020 sample from Waikato and the July 2019 and June 2020 samples from Westland, which were not provided.



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