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**The Icelandic Radiation Safety
Authority Environmental Monitoring
Measurements
2021 - 2022**

Environmental monitoring report



GEISLAVARNIR RÍKISINS
ICELANDIC RADIATION SAFETY AUTHORITY

The Icelandic Radiation Safety Authority Environmental Monitoring Measurements 2021-2022

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Summary

Systematic monitoring of environmental radioactivity in Iceland has been conducted since the late 1980s. The present report summarizes the measurements from the Icelandic Radiation Safety Authority's (IRSA) regular monitoring of radioactive cesium (Cs-137) in the environment and foodstuffs during the years 2021-2022.

The long-term monitoring program provides valuable data demonstrating the stability and gradual decrease of residual radioactive fallout in Iceland's environment and food chain. Cs-137 has been measured systematically in air (airborne particulates), precipitation, cow's milk (fresh milk and milk powder), lamb meat, seawater, seaweed, fish, and other food products.

Results indicate that Cs-137 concentrations are steadily decreasing across all monitored media. Yearly averages for milk powder and fresh milk are approximately 5 and 0.5 Bq/kg, respectively; lamb meat averages about 7.5 Bq/kg; cod, as a reference fish species, averages 0.1 Bq/kg. These values remain well below Icelandic regulatory limits [1]. The Cs-137 levels in Icelandic sea water averages around 1 Bq/m³ and are well below international reference values [2].

Real-time gamma radiation monitoring is conducted at four weather stations across the country, where ambient levels are typically low.

IRSA's 2020–2021 updates to its environmental monitoring program included new sample containers and a transition from the in-house Greina software to GammaVision for Cs-137 analysis. Comparisons across multiple sample types showed strong agreement between the two methods, with only minor systematic differences linked to efficiency calibration and container geometry. These differences were small relative to analytical and environmental variability, requiring only a modest correction for milk powder and a slight bias consideration for seawater, while Marinelli-container based measurements (milk, lamb meat, fish) remained unaffected. Overall, the updates maintain consistency across the long-term Cs-137 time series, with relevant method- and container-related adjustments incorporated in the present report.

1. Introduction

This report presents the results of monitoring measurements conducted by the Icelandic Radiation Safety Authority (IRSA) from 2021 to 2022, focusing on radioactive caesium (Cs-137) in the environment and in foodstuffs.

Cs-137 is a long-lived fission product released during nuclear weapons testing and nuclear reactor accidents, most notably the Chernobyl accident in 1986 and the Fukushima accident in 2011. Because it has a half-life of about 30 years and behaves chemically like potassium, Cs-137 can enter the food chain and accumulate in living organisms. Regular monitoring of Cs-137 in air, water, soil, and food is therefore essential to assess environmental contamination, verify compliance with safety standards, and ensure that public radiation exposure remains well below internationally accepted limits.

Systematic monitoring of environmental radioactivity in Iceland has been carried out since the late 1980s, following increased global awareness after the Chernobyl accident. However, measurable Cs-137 in Icelandic samples originates primarily from atmospheric nuclear weapons testing conducted in the 1950s and 1960s. Fallout from these tests was distributed globally and deposited trace amounts of Cs-137 across the Northern Hemisphere, including Iceland. The impact of later events such as Chernobyl (1986) and Fukushima (2011) on Iceland's environment has been negligible, and no significant increases in Cs-137 levels have been detected in subsequent years. The long-term monitoring program has therefore provided valuable data confirming the stability and gradual decline of residual fallout in Iceland's environment and food chain.

Cs-137 has continuously been measured in the following sample categories:

- Air (airborne particulates)
- Precipitation
- Cow's milk (fresh milk and milk powder)
- Lamb meat
- Seawater
- Seaweed
- Fish

Real-time gamma radiation monitoring instruments are located at four weather stations spread across the country.

Results from the environmental monitoring conducted by IRSA between 1989 and 2020 have been published almost annually and are available on the authority's website.

2. Regulatory limits and reference levels

Icelandic regulations stipulate maximum levels for radioactive substances in food. The levels are specified in the regulation "*Regulation on Various Contaminants in Foodstuffs*"

(Icelandic: Reglugerð um ýmis aðskotaefni í matvællum) [1]. The regulation sets distinct limits for milk and infant food, as well as for all other foodstuffs. The maximum permitted activity of cesium (Cs-134 and Cs-137) is 370 Bq/kg in milk and infant food, and 600 Bq/kg in other food products. Limits for other radionuclides, including strontium-90, iodine-131, plutonium-239, and americium-241, are also defined. These values apply to foods as consumed, with adjustments made for processed or dried products to account for concentration changes.

Limits for radioactive substances in marine environment are not specified in Icelandic regulations. However, Iceland, as a contracting party to the OSPAR Convention for the Protection of the Marine Environment of the North-East Atlantic, participates in regional efforts to monitor and control radioactive substances in the marine environment. Under OSPAR, Iceland is responsible for reporting data on radioactive discharges and concentrations in seawater, sediments, and marine biota within its waters.

For assessment purposes, OSPAR has established screening reference levels for radionuclides in seawater [2]. For Cs-137, the reference concentration in filtered seawater is set at 4.50 Bq/L. Concentrations exceeding this level trigger further evaluation and potential management actions. These reference values are not legally binding limits but serve as assessment criteria to guide monitoring and risk management.

3. Update of gamma spectroscopy measurements and analysis methods

In 2020, new measurement containers were introduced, and the software used for data processing was also replaced. Larger containers (350 ml) are now used instead of 200 ml containers, for example for milk powder, and Marinelli beakers were replaced with another type of the same volume but slightly different shape. As new efficiency calibrations had to be established for the new containers, it was decided at the same time to transfer gamma spectrometry and the determination of Cs-137 activity to new software, GammaVision [3], whereas an in-house developed software, Greina [4], had previously been used.

The effects of these changes on measurement results of Cs-137 activity in monitoring samples were systematically evaluated and published in a dedicated report [5].

The results from the analysis were as follows:

- **Comparison of methods:** Greina and GammaVision produce highly consistent Cs-137 results; remaining differences stem from employed efficiency calibration coefficients. With harmonized efficiencies, the methods are effectively equivalent, though GammaVision offers a more transparent long-term solution.
- **Container change (2021):** No measurable effect for liquid milk, but a systematic offset (~ 1.01 Bq/kg) was found for milk powder and small-volume samples. Corrections or explicit reporting of this offset are recommended in future reporting.
- **Seawater quantification:** Switching to GammaVision introduces a small systematic difference ($\sim 5\%$) linked to calibration. Interim use of legacy Cs-134 and interpolated Cs-137 coefficients maintains continuity until new calibrations are available.

- **Matrix effects:** Current water-based calibrations may bias results for dense or dry matrices due to self-attenuation. New calibration measurements are planned to evaluate matrix effects and improve accuracy.
- **Automated workflow:** A Python-assisted, CLI-based GammaVision workflow was developed, enabling faster, consistent, and fully reproducible data processing for the IRSA monitoring programme.

The impact of these observations is considered in chapter 5, Comparison with previous years, in the present report.

4. Results from measurements 2021-2022

4.1 Real-time monitoring of gamma radiation in Iceland 2021-2022

Monitoring of radiation levels is a part of Iceland's preparedness for radiological incidents. The results of the measurements show background radiation, which is generally low but varies by location and over time. For example, precipitation can wash radioactive substances from the atmosphere down to the ground. Figure 1 shows the location of the four real-time gamma radiation monitoring stations operated by the Icelandic Meteorological Office for IRSA.

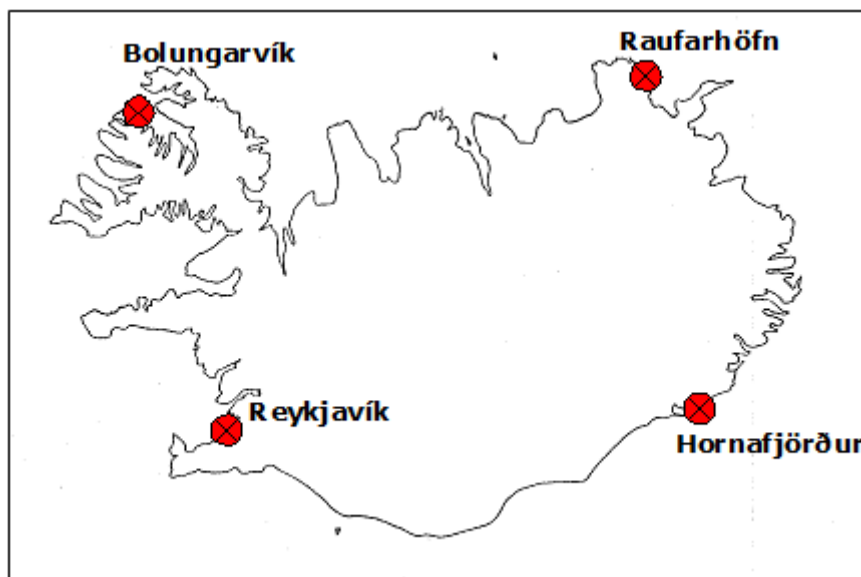


Figure 1: Locations of real-time gamma monitoring stations in Iceland.

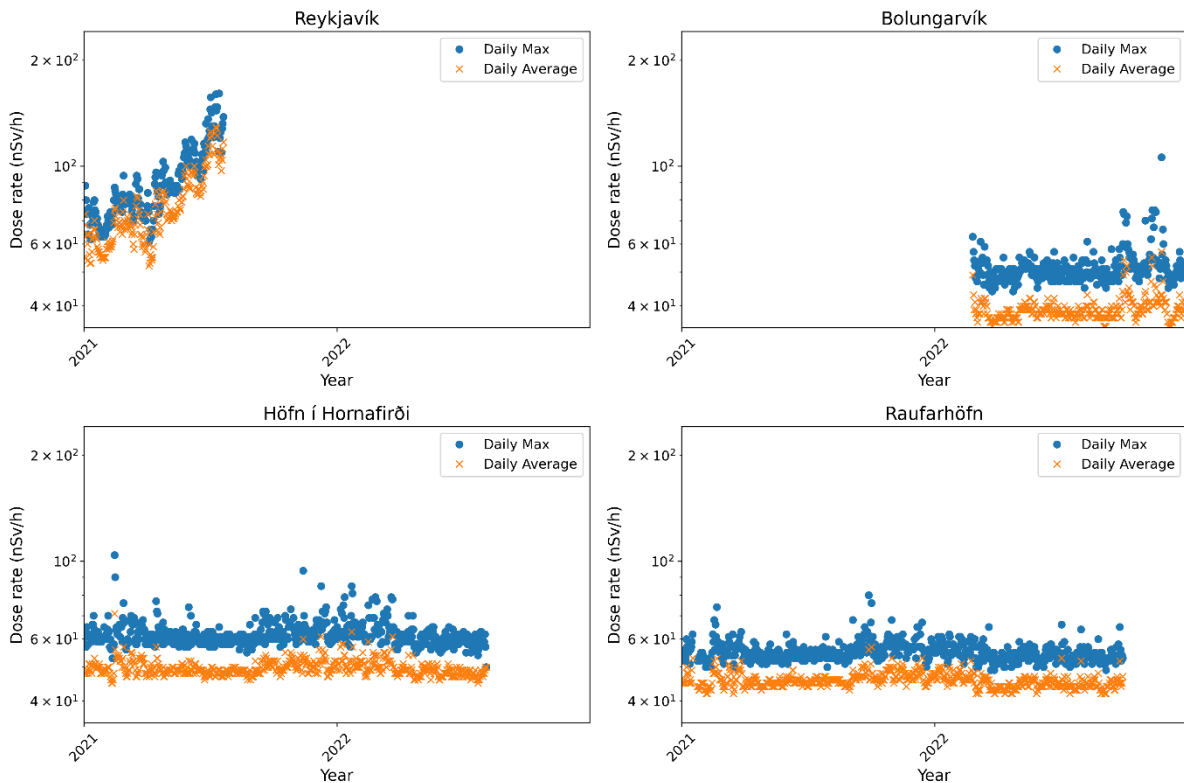


Figure 2: Results from the four measurement stations in Bolungarvík, Höfn í Hornafirði, Raufarhöfn and Reykjavík, respectively, during the period 2021-2022. Daily average dose rate is shown in orange, while daily maximum dose rate is shown in blue.

Figure 2 shows the daily measurements from the four stations in Iceland from January 1, 2021, to December 31, 2022. The daily averages (orange in the plots) in Bolungarvík, Höfn in Hornafirði and Raufarhöfn show steady dose rates well below 100 nSv/hour, comparable to previous years [6, 7]. The daily maxima (blue dots in the plots) display more variation. The station in Reykjavík was not functioning during a large part of the measurement period, which explains the lack of data from late 2021 and the entire 2022. In addition, the steady increase in dose rate during the beginning of 2021 is artificial and due to problems with the detector. The station in Bolungarvík experienced problems during 2021. The station was taken into operation again in early 2022, which is reflected by the onset of the data in the figure. Both the station in Höfn í Hornafirði and the one in Raufarhöfn stopped functioning the latter part of 2022.

4.2 Cs-137 in the environment and foodstuffs 2021-2022

4.2.1 Cs-137 in precipitation 2021-2022

Precipitation has for many years been collected by the Icelandic Meteorological Office at stations in Reykjavík and at Írafoss. As in measurements from previous years [6, 7], Cs-137 is not detectable in the samples from 2021 to 2022. Four samples in total were analyzed: two per station and year over the measurement period. Detection limits vary between samples but are usually around 1 $\mu\text{Bq/L}$.

4.2.2 Cs-137 in airborne particulates 2021-2022

IRSA operates a monitoring station for radioactive particulate matter in the atmosphere on the premises of the Icelandic Meteorological Office at Bústaðavegur in Reykjavík. Airborne particles are collected using automated equipment operating continuously, 24 hours a day throughout the year. The routine daily measurements consistently indicate Cs-137 concentrations below the detection limit, which is approximately 3 $\mu\text{Bq}/\text{m}^3$.

4.2.3 Cs-137 in milk and dairy products 2021-2022

The Icelandic Radiation Safety Authority has received samples of fresh milk (whole milk and low-fat milk) and milk powder from the main dairy producers in Iceland since the 1980s. The Authority receives monthly samples of fresh milk from MS Akureyri (whole milk) and from MS Selfoss (low-fat milk). The results from 2021 to 2022 are presented in Table 1.

Table 1: Concentration of Cs-137 in milk from MS Selfoss and MS Akureyri for the years 2021–2022. Absence of data for a given month indicates that no sample was available for that month.

Month	Low-fat milk, Selfoss	Uncertainty	Whole milk, Akureyri	Uncertainty
	Cs-137, Bq/kg	%	Cs-137, Bq/kg	%
January 2021	0.5	5.4	0.3	4.7
February 2021	0.5	3.8	0.3	5.9
March 2021	0.5	5.5	0.3	5.9
April 2021	0.6	5.3		
May 2021	0.5	3.7	0.4	8.3
June 2021	0.4	6.7	0.4	8.1
July 2021	0.4	6.8	0.3	7.1
August 2021	0.5	6.0	0.3	6.9
September 2021	0.6	5.4	0.3	11.5
October 2021	0.5	5.5	0.3	9.1
November 2021	0.5	6.2	0.3	10.7
December 2021	0.5	0.0	0.3	8.8
Average 2021	0.5	5.0	0.3	7.9
January 2022	0.6	5.1	0.3	7.0
February 2022	0.4	6.7	0.3	8.8
March 2022	0.5	5.5	0.3	10.7
April 2022	0.4	7.1	0.3	6.7
May 2022	0.5	6.3	0.2	12.8
June 2022	0.5	5.7	0.3	9.4
July 2022	0.5	5.1	0.2	12.5
August 2022	0.5	5.4	0.2	12.5
September 2022	0.4	7.1	0.3	7.4
October 2022	0.5	5.9	0.3	10.4
November 2022			0.2	12.0
December 2022	0.4	6.4	0.3	9.5
Average 2022	0.5	5.9	0.3	9.5

The Cs-137 activity in milk from MS Akureyri during the monitored period varies between approximately 0.2 and 0.4 Bq/L with an average activity level of 0.3 Bq/L. For milk samples from MS Selfoss, the concentration varies between approximately 0.4 and 0.6 Bq/L, with an average of 0.5 Bq/L.

Samples of milk powder are received monthly from MS Selfoss. The results from milk-powder samples collected during the years 2021 to 2022 are presented in Table 2.

Table 2: Concentration of Cs-137 in milk powder samples from MS Selfoss for the years 2021–2022. Absence of data for a given month indicates that no sample was available for that month.

Month	Concentration Cs-137, Bq/kg	Uncertainty %
January 2021	6.3	3.7
February 2021	4.5	5.8
March 2021	6.0	3.9
April 2021	5.6	2.6
May 2021	5.6	2.3
June 2021	5.7	2.6
July 2021	5.2	4.0
August 2021	5.6	4.4
September 2021	6.3	2.5
October 2021	6.0	3.3
November 2021		
December 2021	4.6	3.2
Average 2021	5.6	3.5
January 2022	5.2	4.3
February 2022	4.6	4.8
March 2022	5.6	4.9
April 2022	5.3	5.4
May 2022	4.7	3.5
June 2022	5.3	2.5
July 2022	4.4	6.9
August 2022	4.8	4.7
September 2022	3.7	3.4
October 2022	5.4	1.8
November 2022	4.9	2.3
December 2022	4.3	5.2
Average 2022	4.8	4.1

The Cs-137 activity in milk powder during the monitoring period is between approximately 4 and 6 Bq/kg, with an average of around 5 Bq/kg. Since milk powder is produced by removing the water from fresh milk, resulting in a more concentrated product, this result is expected.

4.2.4 Cs-137 in lamb meat 2021-2022

Lamb meat is collected annually during the slaughter season through the Icelandic Food and Veterinary Authority (Icelandic: Matvælastofnun). The results of Cs-137 measurements in lamb meat for the years 2021 to 2022 are presented in Table 3.

Table 3: Concentration of Cs-137 in lamb meat samples, 2021-2022

Year	Producer	Concentration	Uncertainty
		Cs-137 Bq/kg	%
2021	SAH Blönduós	7.3	1.1
2021	SAH Blönduós	3.9	1.6
2021	SAH Blönduós	19.5	0.6
2021	SAH Blönduós	11.4	0.9
2021	SAK Blönduós	5.8	1.3
2021	KVH Hvammstanga	5.4	1.1
2021	KVH Hvammstanga	4.0	1.1
2021	KVH Hvammstanga	11.8	1.5
2021	KVH Hvammstanga	5.9	2.5
2021	KVH Hvammstanga	6.4	1.0
2021	SS Selfossi	9.0	1.1
2021	SS Selfossi	3.8	1.6
2021	SS Selfossi	4.9	1.3
2021	SS Selfossi	2.3	2.5
2021	Average	7.2	1.4
2022	KVH Hvammstanga	16.8	0.7
2022	KVH Hvammstanga	13.4	0.7
2022	KVH Hvammstanga	2.9	1.9
2022	KVH Hvammstanga	5.6	1.2
2022	KVH Hvammstanga	18.4	0.7
2022	KVH Hvammstanga	5.3	2.9
2022	KVH Hvammstanga	4.8	3.1
2022	KVH Hvammstanga	1.4	3.5
2022	SAH Blönduós	1.7	5.5
2022	SAH Blönduós	5.1	1.3
2022	SAH Blönduós	19.6	1.2
2022	SAH Blönduós	9.7	2.0
2022	SAH Blönduós	1.1	3.4
2022	SS Selfossi	1.0	3.7
2022	SS Selfossi	12.4	0.8
2022	SS Selfossi	19.2	0.7
2022	SS Selfossi	7.2	20.5
2022	SS Selfossi	3.8	3.8
2022	Kaupfélag Skagfirðinga	4.7	3.1
2022	Kaupfélag Skagfirðinga	15.5	0.8
2022	Kaupfélag Skagfirðinga	1.1	3.5
2022	Average	8.1	3.1

The activity ranges from 1.0 to 19.6 Bq/kg over the given period, with an average activity concentration in 2021 of 7.2 Bq/kg, with a slight increase in 2022 to 8.1 Bq/kg.

4.2.5 Cs-137 in fish 2021-2022

The Icelandic Radiation Safety Authority monitors Cs-137 in fish from Icelandic waters. Samples are obtained both from the Icelandic Food Research Institute (Icelandic: Matís), which collects specific samples annually, and from fish markets. Results from 2021 to 2022 are presented in Table 4.

Table 4: Concentration of Cs-137 in samples of fish from Icelandic waters (fresh weight). < before a value means that the minimum detectable activity (MDA) is displayed in the table and that the measured activity of the given sample is below the MDA.

Collection date	Species	Location	Concentration Cs-137 (Bq/kg)	Uncertainty (%)
27.12.2021	Ling (<i>Molva molva</i>)	Höfn	0.24	8.3
27.12.2021	Haddock (<i>Melanogrammus aeglefinus</i>)	Ólafsvík	0.030	54.9
27.12.2021	Haddock (<i>Melanogrammus aeglefinus</i>)	Ólafsvík	<0.032	
27.12.2021	Cod (<i>Gadus morhua</i>)	Siglufjörður	<0.029	
27.12.2021	Cod (<i>Gadus morhua</i>)	Siglufjörður	0.020	62.9
29.11.2022	Capelin roe (<i>Mallotus villosus</i>)	Unknown (sample from Matís)	<0.0030	
3.11.2022	Greenland halibut (<i>Reinhardtius hippoglossoides</i>)	Unknown (sample from Matís)	0.11	16.9
24.11.2022	Ling (<i>Molva molva</i>)	Unknown (sample from Matís)	0.13	19.6
29.12.2022	Ling (<i>Molva molva</i>)	Húsavík	0.17	9.6
30.11.2022	Carp (<i>Cyprinus carpio</i>)	Unknown (sample from Matís)	0.13	17.4
8.4.2022	Cod (<i>Gadus morhua</i>)	Unknown (sample from Matís)	0.04	45.5
25.5.2022	Cod (<i>Gadus morhua</i>)	Unknown (sample from Matís)	0.11	16.9
29.12.2022	Cod (<i>Gadus morhua</i>)	Hornafjörður	0.07	31.0
28.12.2022	Halibut (<i>Hippoglossus hippoglossus</i>)	Bolungarvík	0.17	9.9
2.5.2022	Pollock (<i>Pollachius pollachius</i>)	Unknown (sample from Matís)	0.11	20.2
3.11.2022	Atlantic redfish (<i>Sebastes mentella</i>)	Unknown (sample from Matís)	0.06	45.9
2.11.2022	Atlantic herring (<i>Clupea harengus</i>)	Unknown (sample from Matís)	0.10	27.3
22.8.2022	Cusk (<i>Brosme brosme</i>)	Grindavík	0.13	14.9
28.12.2022	Cusk (<i>Brosme brosme</i>)	Þórshöfn	0.10	17.1
2.11.2022	Atlantic mackerel (<i>Scomber scombrus</i>)	Unknown (sample from Matís)	<0.040	

The concentration of Cs-137 in fish from Icelandic waters is very small, sometimes below the minimal detectable activity. The highest activity concentration measured during 2021 and 22 was 0.24 Bq/kg in a sample of ling.

4.2.6 Cs-137 in seaweed 2021-2022

Seaweed samples during 2021-2022 have been provided by the algae factory Thorverk in Reykhólar. Table 5 presents the results for seaweed samples collected from 2021 to 2022.

Table 5: Concentration of Cs-137 in seaweed samples.

Collection date	Location	Concentration	Uncertainty
		Cs-137, Bq/kg	%
1.1.2021	Efri langey	0.12	21
1.1.2021	Skálanesgrunn	0.13	28
1.1.2021	Hvallátur	0.12	31
1.1.2022	Tjaldanes	0.081	28
1.10.2022	Skálanesgrunn	0.18	29
1.10.2022	Skáleyjar	0.066	75
1.10.2022	Skálanesgrunn	0.19	20

A total of 7 samples were collected and analyzed and the Cs-137 concentration was typically measured at activities between 0.1 and 0.2 Bq/kg.

4.2.7 Cs-137 in seawater 2021-2022

Seawater samples for radioactive substance analysis are collected annually during research cruises conducted by the Marine Research Institute (Icelandic: Hafrannsóknastofnun). The sampling locations for the period 2021–2022 are shown in Figure 3.

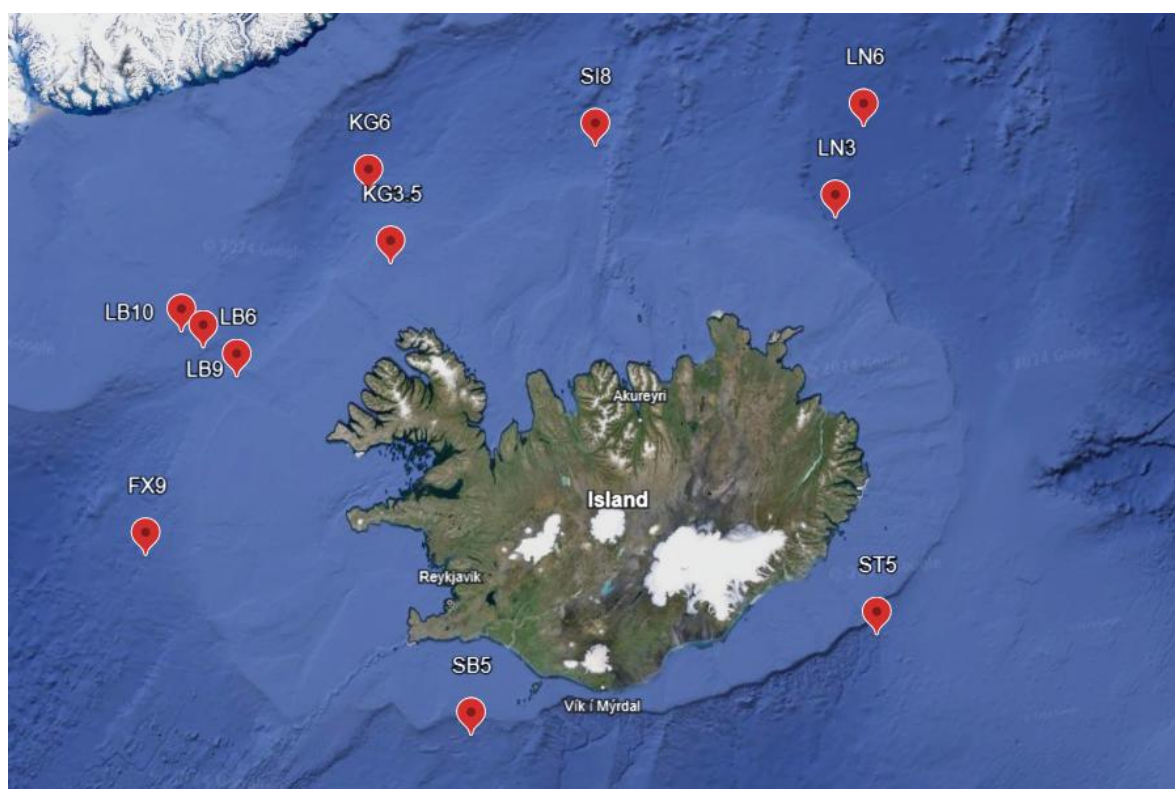


Figure 3: Map of Iceland with seawater sample locations (red indicators).

Table 6 lists the sampling location with coordinates, organized by sampling date, along with details of each sample and the measured Cs-137 activity.

Table 6: Concentration of Cs-137 in Icelandic seawater during the period 2021-2022. The table shows the latitude (N) and longitude (W) coordinates for the sample location, the sample depth (m), water temperature (°C), salinity in ppt, and Cs-137 concentration (Bq/m³) ± uncertainty. The sample locations are displayed in Figure 3.

Sample date	Sample location	Coordinates		Depth (m)	Temperature (°C)	Salinity 0/00	Concentration Cs-137 (Bq/m ³)
		N	W				
16.02.2021	LB9	66°09'	27°15'	5m	1.09	33.98	1.33 ± 0.13
16.02.2021	LB7	66°09'	27°15'	5m	-1.54	33.26	1.45 ± 0.14
18.02.2021	KG6	67°35'	23°56'	5m	1.21	34.55	1.56 ± 0.18
18.05.2021	FX9	64°20'	27°58'	5m	7.18	35.10	0.95 ± 0.12
18.05.2021	LB9	66°09'	27°15'	5m	0.46	33.96	1.14 ± 0.12
19.05.2021	LB6	65°56'	26°29'	5m	5.91	35.03	0.69 ± 0.11
20.05.2021	KG6	67°35'	23°56'	5m	-0.16	33.73	1.14 ± 0.11
21.05.2021	SI8	68°00'	18°50'	5m	1.56	34.32	1.04 ± 0.11
22.05.2021	LN3	67°15'	13°34'	5m	1.89	34.78	0.97 ± 0.08
23.05.2021	LN6	68°00'	12°40'	5m	1.26	34.75	1.21 ± 0.10
25.05.2021	KR5	65°00'	10°07'	5m	2.69	34.75	1.50 ± 0.12
26.05.2021	ST5	63°40'	13°40'	5m	8.00	35.19	1.18 ± 0.11
27.05.2021	SB5	62°59'	21°29'	5m	8.46	35.17	1.03 ± 0.11
12.02.2022	LB10	66°15'	27°45'	5m	0.11	33.86	1.28 ± 0.11
13.02.2022	KG6	67°35'	23°56'	5m	0.19	34.18	1.43 ± 0.12
13.02.2022	HB6	67°30'	21°35'	5m	0.54	34.41	1.21 ± 0.11
19.05.2022	KG5	67°20'	23°40'	5m	5.34	34.96	1.32 ± 0.13
21.05.2022	SI8	68°00'	18°50'	5m	4.94	34.95	1.03 ± 0.12
22.05.2022	LN3	67°15'	13°34'	5m	1.65	34.69	1.48 ± 0.11

Cs-137 activity in Icelandic seawater is generally very low. Between 2021 and 2022, the highest measured activity was 1.56 Bq/m³ at location KG6 in February 2021, while typical values are around 1 Bq/m³. The residual Cs-137 in Icelandic seawater primarily originates from nuclear weapons tests conducted during the 1950s and 1960s.

4.2.8 Cs-137 in miscellaneous samples 2021-2022

Three samples of different foodstuffs, acquired from markets in the capital area, were measured during the period 2021-2022, see Table 7.

Table 7: Concentrations of Cs-137 in miscellaneous samples. < before a value means that the minimum detectable activity (MDA) is displayed in the table and that the measured activity is below the MDA.

Date	Sample type	Producer	Cs-137 (Bq/kg)	Uncertainty (%)
26.12.2021	Beef	Íslandsnaut	2.1	2
15.12.2021	Potatoes	Hornafjarðar	0.1	11
15.12.2021	Barley	Móðir jörð	<0.03	

5. Comparison with previous years

Figures 4 and 5 present an overview of Cs-137 concentrations in the primary sample categories: foodstuffs (Figure 4) and seawater (Figure 5). The figures illustrate the temporal evolution from the onset of monitoring for each respective sample type, thereby providing insight into long-term variations in Cs-137 levels.

It should be noted that the data for milk powder post-2020 has been corrected due to the method change in 2021, when sample containers and analysis methods were updated within the IRSA monitoring program. The uncorrected data points are also shown (orange dots).

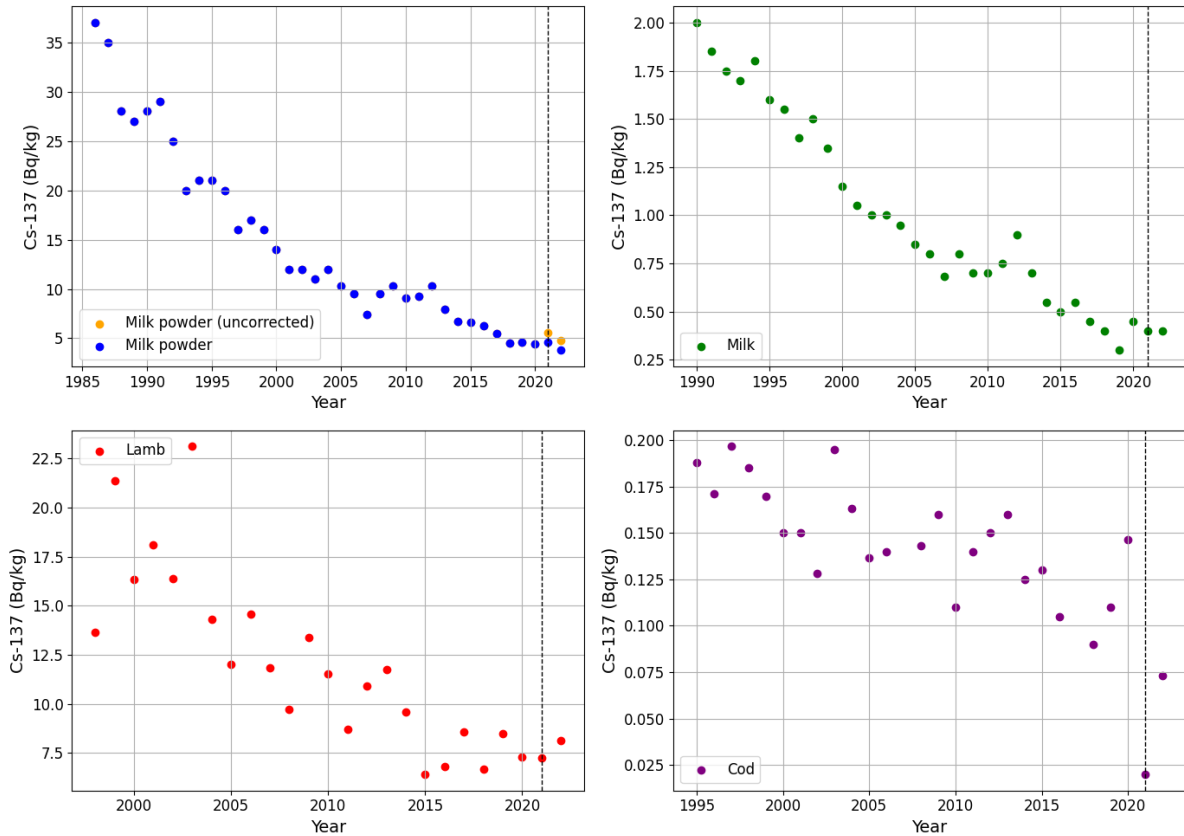


Figure 4: Cs-137 concentrations in milk powder (blue and orange), milk (green), lamb meat (red), and cod (purple), showing the annual sample averages for each year from 1986 to 2022. The dashed vertical lines indicate the method changes introduced in 2021, i.e. change of container and analysis method. For the milk powder data, the blue data points post-2021 are corrected by subtraction of 1.012 Bq/kg, to maintain continuous comparison with the method employed pre-2021 [5].

As can be seen in Figure 4, the Cs-137 levels are steadily decreasing in all environmental media monitored in Iceland. Yearly average concentrations of milk powder and milk have decreased to around 5 and 0.5 Bq/kg, respectively. The average activity levels of lamb meat have decreased to about 7.5 Bq/kg and cod, as a reference fish sample, displays average concentrations of about 0.1 Bq/kg.

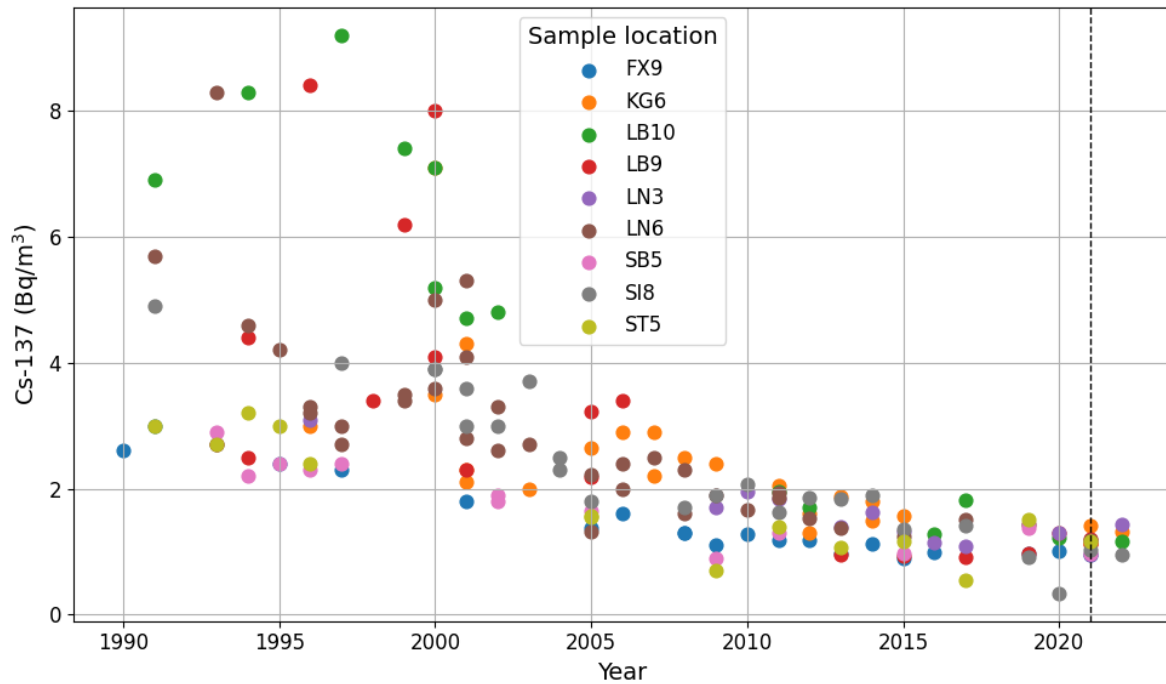


Figure 5: Cs-137 concentrations in seawater at various sampling locations. The sampling locations are shown in Figure 3. The dashed vertical line indicates the introduction of the updated analysis method used to estimate Cs-137 activity concentration in seawater.

The concentration of Cs-137 in seawater has decreased to about 1 Bq/m³ on average. It should be noted that the data for 2021-2022 which is obtained with the new analysis method is expected to be 5% higher than if it would have been analyzed with the older method used prior to 2021. The data in Figure 5 is not corrected for this effect and the average concentration over the measurement period 2021-2022 is comparable to previous years.

6. Conclusion

The environmental monitoring program of the Icelandic Radiation Safety Authority indicates that Cs-137 activity in Icelandic environmental media and foodstuffs remains very low, consistently well below the prescribed regulatory limits. The authority notes that the observed activity levels continue to decline over time, in accordance with the radioactive decay of Cs-137, with no indications of new releases. The ongoing environmental monitoring program is essential to confirm that activities remain low, to establish baseline data for potential new radionuclides, and to provide a reference framework for assessing any future radiological events or accidents.

In 2020–2021, IRSA updated its environmental monitoring program, including changes to sample containers and Cs-137 analysis methods. GammaVision replaced the in-house Greina software for radionuclide quantification. Comparisons of GammaVision and Greina across a wide range of environmental samples (milk, milk powder, lamb meat, and seawater) showed a strong linear correlation, with minor systematic differences attributable to efficiency calibration and container geometry. These differences were generally small relative to

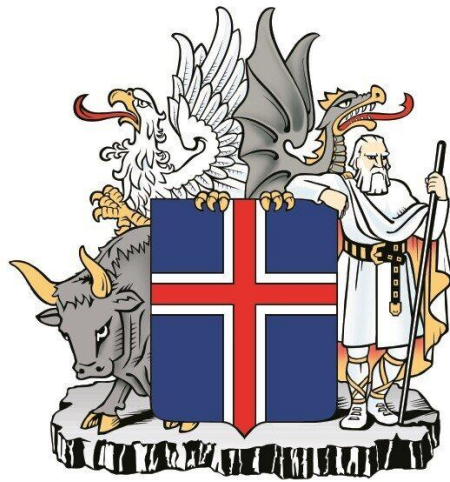
analytical and environmental variability, with a slight positive bias (~5%) for seawater and a minor correction required for milk powder due to the larger containers adapted post-2020; no correction was needed for media employing Marinelli containers (milk, lamb meat and fish). Overall, the updates maintain consistency in reported Cs-137 concentrations over the entire time-series, i.e. from the start of measurements within the IRSA monitoring program, and the small method- and container-related adjustments was considered in the present report.

7. Acknowledgement

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