



Environmental radioactivity in the Faroes in 1971

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Danish Atomic Energy Commission
Research Establishment Risø

Environmental Radioactivity in the Faroes in 1971

by A. Aarkrog and J. Lippert

July 1972

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Danish Atomic Energy Commission

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Abstract

Measurements of fall-out radioactivity in the Faroes in 1971 are presented. Sr-90 (and Cs-137 in most instances) was determined in regularly collected samples of precipitation, grass, milk, lamb, fish, sea water, bread, and drinking water. In addition, analyses of spot samples of potatoes, sea plants, vegetables, eggs, and human bone were carried out. Estimates of the mean contents of Sr-90 and Cs-137 in the human diet in the Faroes in 1971 are given.

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ABBREVIATIONS AND UNITS

FP	fission products
pCi	picocurie, 10^{-12} Ci, $\mu\mu$ Ci
nCi	nanocurie, 10^{-9} Ci, $m\mu$ Ci
mCi	millicurie, 10^{-3} Ci
MPC	maximum permissible concentration
S. U.	pCi Sr-90/g Ca
O. R.	Observed ratio
M. U.	pCi Cs-137/g K
n Sr	natural (stable) Sr
S. D.	standard deviation, $\sqrt{\frac{\Sigma(x-x_i)^2}{(n-1)}}$
S. E.	standard error, $\sqrt{\frac{\Sigma(x-x_i)^2}{n(n-1)}}$
S. S. D.	sum of squares of deviations, $\Sigma(x-x_i)^2$
f	degrees of freedom
s^2	variance
v^2	ratio between the variance in question and the residual variance
P	probability of the distribution in question
\bar{x}	mean values
Σ	sum
η	coefficient of variation

1. INTRODUCTION

1.1.

The fall-out programme for the Faroes, which was initiated in 1962¹⁾ in close co-operation with the National Health Service and the chief physician of the Faroes, was continued in 1971. A few samples of human bone were obtained in 1971 from Dronning Alexandrines Hospital in Thorshavn.

1.2.

The present report will not repeat information concerning sample collection and analysis already given in Risø Reports Nos. 64, 86, 108, 131, 155, 181, 202, 221, and 246¹⁾.

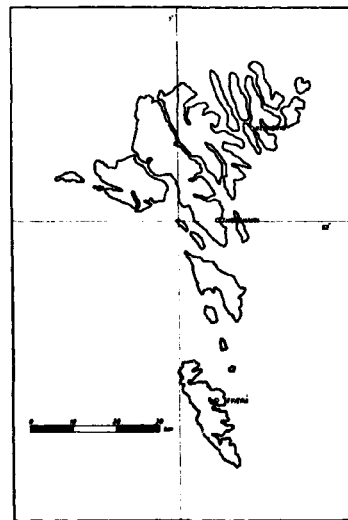


Fig. 2.1.1. The Faroes.

1.3.

The mean diet of the Faroese as used in this report is unchanged as compared with 1962, i. e., it is still based on the estimate given by Professor E. Hoff-Jørgensen, Ph. D., nutritional consultant to the Danish Atomic Energy Commission

1.4.

The present investigation was carried out along with corresponding examinations of fall-out levels in Denmark and Greenland, described in Risø Reports Nos. 265²⁾ and 267³⁾ respectively.

2. RESULTS AND DISCUSSION

2.1. Sr-90 in Precipitation

Table 2.1 shows the Sr-90 content in precipitation collected at Høyvig (near Thorshavn) and Klaksvig in 1971. The amount of precipitation at

Table 2.1

Sr-90 in precipitation from the Faroes in 1971

Month	Høyvig		Klaksvig	
	pCi Sr-90/l	mCi Sr-90/km ²	pCi Sr-90/l	mCi Sr-90/km ²
Jan.	0.98	0.16	0.89	0.17
Feb.	1.08	0.12	1.37	0.28
Mar.	1.30	0.20	1.74	0.50
Apr.	1.86	0.089	2.98	0.36
May	3.12	0.38	2.41	0.60
June	2.92	0.18	4.88	0.24
July	3.49	0.31	4.75	0.71
Aug.	3.12	0.15	2.34	0.18
Sep.	2.42	0.37	2.44	0.10
Oct.	2.68	0.23	1.72	0.25
Nov.	1.36	0.19	1.18	0.44
Dec.	1.43	0.36	1.44	0.40
1971	\bar{x} 1.95	\bar{x} E 2.74 Em 1408	\bar{x} 2.10	\bar{x} E 4.23 Em 2012

Table 2.2

Sr-90 and Cs-137 in grass from Thorshavn 1971

Month	pCi Sr-90/g ash	pCi Sr-90/kg	pCi Sr-90/g Ca	pCi Cs-137/kg	pCi Cs-137/g K	Cs-137/Sr-90
June	17	217	447	441	117	2.6
Aug.	19	314	364	405	114	1.3

Klaksvig was a factor of 1.4 greater than that found at Høyvig, and the amount of fall-out at Klaksvig was 1.5 times that measured at Høyvig.

The mean specific activity of Sr-90 in precipitation in 1971 was approx. 10% higher than the 1970 level in the Faroes and the mean fall-out was approx. 30% higher. The amount of precipitation was 20% higher in 1971 than in 1970.

2.2. Sr-90 and Cs-137 in Grass

Grass samples were collected near Thorshavn in 1971 as in the previous years. Table 2.2 shows the results. The mean S. U. content of the grass during the summer months was estimated at 405 S. U., and the mean S. U. in milk during June-September was 37.5 S. U. at Thorshavn (cf. 2.3), i. e., the observed ratio between S. U. in milk and in grass was 0.09 (Mean 1965-71 0.093 ± 0.009 (SE)). The 1971 S. U. levels in grass were 25% lower than the 1970 levels. As compared with Danish grass in 1971²⁾, we found the S. U. levels in the Faroese grass to be higher by a factor of approx. 8 in the summer months. The mean content of Cs-137 during the summer months was 0.42 nCi Cs-137/kg or 115 M. U., i. e. one third of the 1970 levels, which were surprisingly high.

The mean ratio between Cs-137 and Sr-90 in the grass (pCi/kg) was 1.7 in 1971. (Mean 1965-71: 2.0 ± 0.2).

2.3. Sr-90 and Cs-137 in Milk

As in the previous years¹⁾, fresh milk samples collected weekly were obtained from Thorshavn, Klaksvig, and Tværå. Sr-90 and Cs-137 were determined in bulked monthly samples.

Table 2.3.1 shows the results and tables 2.3.3 and 2.3.4 the analysis of variance of the S. U., M. U. and pCi Cs-137/l figures respectively. The variation between months was probably significant for Cs-137 and significant for Sr-90. As also observed in previous years, the variation between locations was significant for Cs-137, but not significant for Sr-90. The highest Cs-137 levels were found in the milk from Klaksvig and Tværå and the lowest in the Thorshavn milk.

Table 2.3.1

Sr-90 and Cs-137 in milk from the Faroes in 1971

Month	Thorshavn				Klaksvig			Tværå			Mean	
	S. U.	pCi Cs-137/l	M. U.		S. U.	pCi Cs-137/l	M. U.	S. U.	pCi Cs-137/l	M. U.	S. U.	pCi Cs-137/l
Jan.	29	163	105	35	479	299	35	339	217	33	327	207
Feb.	25	146	93	24	170	106	36	523	335	28	280	178
Mar.	31	152	98	34	289	185	45	427	281	37	289	188
Apr.	25	157	103	33	277	178	47	370	243	35	268	175
May	31	165	103	40	267	167	35	231	148	35	221	139
June	34	202	126	39	279	179	42	386	241	38	289	182
July	43	265	170	46	339	212	46	547	360	45	384	247
Aug.	38	308	197	32	255	163	51	658	411	40	407	257
Sept.	35	180	112	34	268	176	29	602	376	33	350	221
Oct.	27	180	118	33	404	252	30	668	407	30	417	259
Nov.	26	319	204	37	597	373	22	772	563	28	563	362
Dec.	30	426	266	31	546	341	25	325	206	29	432	271
Mean	31	222	141	35	348	219	37	487	311	34	352	224

Table 2.3.2

Analysis of variance of ln pCi Sr-90/g Ce in milk 1971
(from table 2.3.1)

Variation	SSD	f	s ²	v ²	P
Betw. locations	0.1570	2	0.0785	2.76	-
Betw. months	1.3736	11	0.1249	4.40	>99.9%
Remainder	0.5253	22	0.0284		

Table 2.3.3

Analysis of variance of ln pCi Cs-137/g K in Faroese milk in 1971
(from table 2.3.1)

Variation	SSD	f	s ²	v ²	P
Betw. locations	3.8438	2	1.9219	21.99	>99.9%
Betw. months	2.2782	11	0.2071	2.37	>95%
Remainder	1.9224	22	0.0874		

Table 2.3.4

Analysis of variance of ln pCi Cs-137/l milk in 1971
(from table 2.3.1)

Variation	SSD	f	s ²	v ²	P
Betw. locations	3.8229	2	1.9115	20.80	>99.9%
Betw. months	2.2671	11	0.2061	2.24	>95%
Remainder	2.0226	22	0.0919		

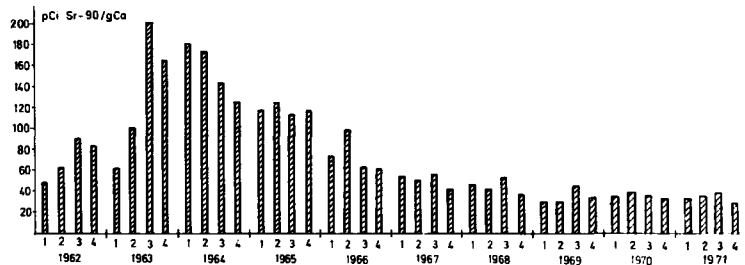


Fig. 2.3.1. Sr-90 in Faroese milk, 1962-71

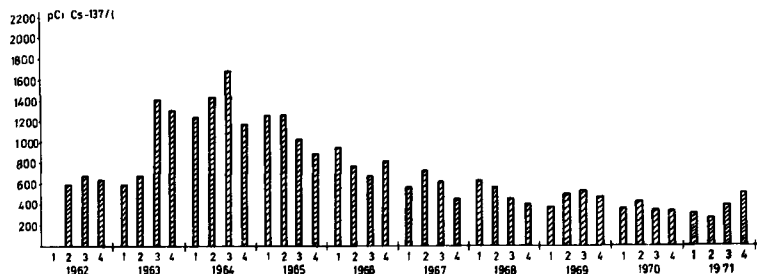


Fig. 2.3.2. Cs-137 in Faroese milk, 1962-71

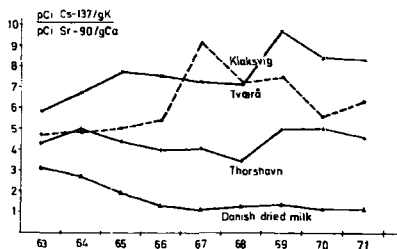


Fig. 2.3.3. $\frac{M.U.}{S.U.}$ ratios in Faroese and Danish milk, 1963-71

Fig. 2.3.1 shows the quarterly S. U. values and fig. 2.3.2 the quarterly pCi Cs-137/l levels since 1962. The annual mean values for 1971 were 34 S. U. (~41 pCi Sr-90/l) and 224 M. U. or 352 pCi Cs-137/l, i. e. the 1971 levels were equal to the 1970 mean levels. The predicted levels in Faroese milk from 1971 were 37 S. U. and 225 M. U. Prediction equations were calculated for the period 1962-70 and for an effective half life of Sr-90 (and Cs-137) in the soil of 4 years. (Cf. ref. 2, appendix C)

$$pCi \text{ Sr-90/g Ca} = 2.57 d_{(i)} + 1.67 d_{(i-1)} + 0.57 A_{by(i-1)}$$

$$pCi \text{ Cs-137/g K} = 10.8 d_{(i)} + 7.64 d_{(i-1)} + 4.93 A_{by(i-1)}$$

The annual mean values of the M. U. /S. U. ratio in Faroese milk are shown in fig. 2.3.3.

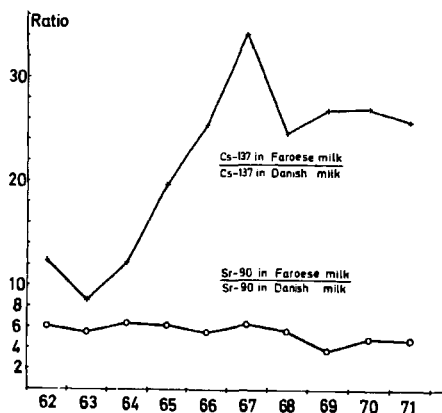


Fig. 2.3.4. A comparison between Faroese and Danish milk levels, 1962-71

The mean ratio in 1971 was 6.0 ± 0.7 during the grazing period (May-October), and in the winter time it was 7.5 ± 1.3 , i. e. unchanged. This is in agreement with previous observations¹⁾.

Fig. 2.3.4 shows a comparison between the Sr-90 and Cs-137 levels in Faroese- and Danish-produced milk. It is evident that the soil uptake plays an important role in the Faroes, especially for the Cs-137 levels.

2.4. Sr-90 and Cs-137 in Terrestrial Animals

Lambs' meat was collected in September and November 1971.

The mean levels were 26 pCi Sr-90/kg or 91 S. U. and 0.73 pCi Cs-137/kg or 356 M. U. The mean bone level was 173 pCi Sr-90/g Ca.

Table 2.4

Sr-90 and Cs-137 in sheep samples from the Faroes 1971

Sampling Month	Sample type	pCi Sr-90/kg	pCi Sr-90/g Ca	pCi Cs-137/kg	pCi Cs-137/g K
Sept.	Fresh Meat	51	153	618	271
Sept.	Bone	-	219	-	-
Nov.	Fresh Meat	1.4	29	848	441
Nov.	Bone	-	127	-	-

2.5. Sr-90 and Cs-137 in Fish

Table 2.5.1 shows the Sr-90 and Cs-137 levels in fish collected in 1971 in the Faroes. The mean levels in fish were 0.39 pCi Sr-90/kg (S. E.: 0.04) and 8.4 pCi Cs-137/kg (S. E.: 1.2).

2.6. Sr-90 in Drinking Water.

Drinking-water samples were collected as previously¹⁾. Table 2.6.1 shows the results and table 2.6.2 the analysis of variance. As in the previous years the drinking water from Thorshavn contained more Sr-90 than that from Tværd (cf. the explanation in Risø Report No. 181¹⁾).

Fig. 2.6.1 shows the two-monthly mean levels of Sr-90 in drinking water from the three locations since 1962.

The mean level in 1971 was 0.31 pCi Sr-90/l, i. e. a little less than the 1970 level.

Table 2.5.1

Sr-90 and Cs-137 in sea animals from the Faroes in 1970

Sampling Months	Species	Sample type	pCi Sr-90/kg	pCi Sr-90/g Ca	pCi Cs-137/kg	pCi Cs-137/g K	
Sep.	Fish	Gadus aegle finus	Meat	0.42	4.5	9.1	3.5
Sep.	"	Gadus callarias	Meat	0.35	3.5	5.5	2.0
Nov.	"	Gadus aegle finus	Meat	0.31	2.8	7.7	3.1
Nov.	"	Gadus callarias	Meat	0.49	4.9	11.2	3.7

Table 2.6.1

Sr-90 in drinking water from the Faroes in 1971
pCi Sr-90/l

Month	Thorshavn	Klaksvig	Tværå
Jan.	0.51	0.17	0.20
Mar.	0.30	0.18	0.24
May	0.39	0.13	0.21
July	0.37	0.21	0.24
Sep.	0.41	0.20	0.12
Nov.	0.58	0.72	0.35
1971	0.43	0.27	0.23

Table 2.6.2

Analysis of variance of ln pCi Sr-90/l drinking water in 1971
(from table 2.6.1)

Variation	SSD	f	σ^2	$\sqrt{2}$	P
Betw. locations	1.7479	2	0.8739	8.79	>99%
Betw. months	1.6967	5	0.3393	3.41	>9%
Remainder	0.9937	10	0.0994		

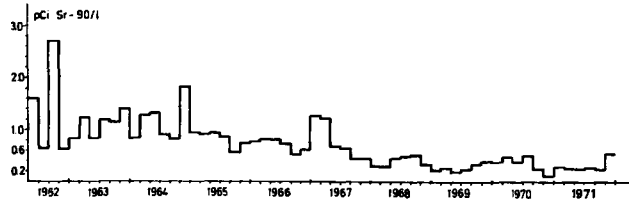


Fig. 2.6.1. Sr-90 in drinking water, 1952-71 (mean of Thorshavn, Klaksvig and Tværå)

2.7. Sr-90 and Cs-137 in Miscellaneous Samples

2.7.1. Soil

No soil samples were collected in 1971 from the Faroes. From earlier years' observations we estimate the accumulated fall-out at Thorshavn at 68 mCi Sr-90/km² and that at Klaksvig at 137 mCi Sr-90/km².

2.7.2. Sea Water

Surface sea water was collected near Thorshavn three times in 1971. The Sr-90 mean level was 0.074 pCi Sr-90/l.

Fig. 2.7.2 shows the Sr-90 levels since 1962.

Table 2.7.2

Strontium-90 in sea water collected at Thorshavn in 1971

Sampling month	pCi Sr-90/l	Salinity in ‰
Mar.	0.063	33.8
July	0.066	36.6
Aug.	0.092	33.8

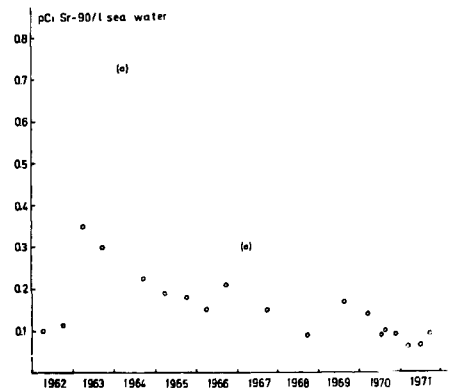


Fig. 2.7.2. Sr-90 in Faroese sea water, 1962-71

Table 2.7.4

Sr-90 and Cs-137 in potatoes and other vegetables from the Faroes in 1971

Sampling month	Species	pCi Sr-90/kg	pCi Sr-90/g Ca	pCi Cs-137/kg	pCi Cs-137/g K
Aug.	Carrots	13.6	32	B 6.3	B 1.9
-	Red currants	0.25	0.57	42	17
-	Spring cabbages	9.0	20	B 6.5	B 2.0
Dec.	Potatoes	8.1	467	72	18

B: counting error > 33%

2.7.3. Sea Plants

Sea plants (*Laminaria*) collected in March and August contained 67 and 7 S. U., respectively and the March sample showed a M. U. level of 44 pCi Cs-137/g K.

2.7.4. Potatoes and Other Vegetables

Table 2.7.4 shows the results of the Sr-90 and Cs-137 determinations. The Sr-90 level in potatoes was 8.1 pCi/kg, i. e. the same as in 1970. The Cs-137 mean level was 72 pCi Cs-137/kg, i. e. one fourth of the 1970 level.

The Sr-90 and Cs-137 levels in carrots collected in 1971 were higher and lower respectively than the levels found in Denmark²⁾.

2.7.5. Bread

As in the previous years¹⁾, rye bread and white bread were collected in Thorshavn in June and December. The mean levels in white bread were 3.7 pCi Sr-90/kg and 13.4 pCi Cs-137/kg, i. e. lower than the 1970 levels. The rye bread collected in 1971 contained on the average 15 pCi Sr-90/kg

Table 2.7.5

Sr-90 and Cs-137 in Faroese bread in 1971

Month	Sort	pCi Sr-90/kg	pCi Sr-90/g Ca	pCi Cs-137/kg	pCi Cs-137/g K
June	White bread	4.31	6.4	11.2	12.0
June	Rye bread	13.6	7.9	31.0	14.5
Dec.	White bread	5.08	1.9	15.5	14.3
Dec.	Rye bread	16.5	10.1	44.8	17.5

and 38 pCi Cs-137/kg, i. e. the Cs-137 contents were approx. 1.3 times the 1970 levels, while the Sr-90 level was nearly equal to that of 1970. The Faroese bread levels were 2/3 of the Danish²⁾.

2.7.6. Eggs

Eggs were collected from Thorshavn in June 1971. Table 2.7.6 shows the results.

Table 2.7.6

Sr-90 and Cs-137 in Faroese eggs in 1971

Month	pCi Sr-90/kg	pCi Sr-90/g Ca	pCi Cs-137/kg	pCi Cs-137/g K
June	5.2	9.2	18.3	14.0

2.8. Humans

In 1971 a number of human vertebrae samples were obtained from Dronning Alexandrines Hospital in Thorshavn. Table 2.8 shows the results.

The number of bone samples from the Faroes is sparse, and it is therefore difficult to make any comparisons. Let us, however, assume that the two first samples were representative of newborns' bone in 1971 in the Faroes. The mean level is 2.36 pCi Sr-90/g Ca, and from Danish measurements since 1963 we know that the observed ratio between newborns' bone and mothers' diet is 0.11. Hence the mothers' diet should have contained approx. 22 pCi Sr-90/g Ca. In 1970¹⁾ the Sr-90 level of the Faroese adult human diet was estimated at 20 pCi Sr-90/g Ca, and in 1971 we found (cf. 3) 15 pCi Sr-90/g Ca. As the bone samples were collected in April, it is reasonable that the estimated diet level is closest to that of 1970.

Table 2.8

Sr-90 in human vertebrae collected in the Faroes in 1971

Age	Month of death	Sex	pCi Sr-90/g Ca	Sample no.
1 day	4	F	2.97	MK 85
1 month	4	F	2.14	MK 66
2 months	10	M	2.76	MK 115
53 years	-	F	1.04	MK 156
66 years	5	M	7.11	MK 86

3. ESTIMATE OF THE MEAN CONTENTS OF Sr-90 AND Cs-137 IN THE HUMAN DIET

3.1. Annual Quantities

As in 1962¹⁾, the annual quantities are based on the estimate made by Professor E. Hoff-Jørgensen, Ph.D., on the assumption of a daily per capita intake of approx. 3000 calories.

3.2. Milk and Cream

75% of the milk consumed in the Faroes is assumed to be of local origin, and 25% comes from Denmark. Hence the Sr-90 content in milk consumed in the Faroes in 1971 was $1.2 \cdot (0.75 \cdot 34 + 0.25 \cdot 7.2) = 33$ pCi Sr-90/kg, and the Cs-137 content was $0.75 \cdot 352 + 0.25 \cdot 14.4 = 268$ pCi Cs-137/kg (cf. 2.3 and ref. 2). 1 kg milk contains 1.2 g Ca.

3.3. Cheese

Nearly all cheese consumed in the Faroes is of Danish origin, and the Danish figures from ref. 2 were used; 61 pCi Sr-90/kg and 10 pCi Cs-137/kg.

3.4. Grain Products

As most grain products are imported from Denmark, the Danish figures for 1970²⁾ were used in the calculation of the Faroese levels. The mean daily consumption of grain products in the Faroes is, as in Denmark, 80 g rye flour, 120 g wheat flour and 20 g grits. Hence the mean concentration of Sr-90 in grain products consumed in the Faroes in 1970 becomes 21 pCi Sr-90/kg and 55 pCi Cs-137/kg. We realize (cf. 2.7.5) that these activity figures probably overestimate the actual intake of Sr-90 from grain products in the Faroes.

3.5. Potatoes

All potatoes consumed in the Faroes are assumed to be of local origin. The values obtained from table 2.7.4 were used, i. e. 8.1 pCi Sr-90/kg and 72 pCi Cs-137/kg.

3.6. Other Vegetables and Fruit

As the amount of vegetables and fruit grown in the Faroes is limited, the Danish figures from 1971²⁾ were used. Thus the mean contents in

vegetables other than potatoes were 11 pCi Sr-90/kg and 2 pCi Cs-137/kg, and the mean contents in fruit were 5 pCi Sr-90/kg and 6 pCi Cs-137/kg.

3.7. Meat and Eggs

The meat and egg consumption in the Faroes is estimated to consist of 50% locally produced mutton (or lambs' meat), 25% local whale meat and 25% sea birds and eggs.

The mutton contained 26 pCi Sr-90/kg and 0.73 nCi Cs-137/kg (cf. 2.4). Whale meat from 1970¹⁾ contained 5.5 pCi Sr-90/kg and 850 pCi Cs-137/kg, sea birds from 1970¹⁾ and eggs (cf. 2.7.6): 1.5 and 5.2 pCi Sr-90/kg and 15 and 18 pCi Cs-137/kg respectively.

Hence we estimate the mean content of Sr-90 in meat and eggs consumed in 1971 to be

$$0.50 \cdot 26 + 0.25 \cdot 5.5 + 0.25 \cdot \left(\frac{1.5 + 5.2}{2} \right) = 15 \text{ pCi Sr-90/kg}$$

and the Cs-137 content to be

$$0.50 \cdot 730 + 0.25 \cdot 850 + 0.25 \cdot 16 = 582 \text{ pCi Cs-137/kg.}$$

3.8. Fish

All fish consumed in the Faroes is of local origin, and the mean contents in fish, obtained from subsection 2.5, were 0.39 pCi Sr-90/kg and 8 pCi Cs-137/kg.

3.9. Coffee and Tea

The Danish figures for 1971²⁾ were used, i. e. 27 pCi Sr-90/kg and 168 pCi Cs-137/kg.

3.10. Drinking Water

The mean value found in table 2.6 was used, i. e. 0.31 pCi Sr-90/l. The Cs-137 content was estimated to be approx. one fourth (the ratio found in New York tap water in 1964⁴⁾) of the Sr-90 content, i. e. 0.1 pCi Cs-137/l. Tables 3.1 and 3.2 show the estimates of Sr-90 and Cs-137 respectively.

Table 3.1

Estimate of the mean content of Sr-90 in the human diet
in the Faroes in 1971

Type of food	Annual quantity in kg	pCi Sr-90 per kg	Total pCi Sr-90	Percentage of total Sr-90 in food
Milk and cream	146	33	4818	53.9
Cheese	7.3	61	445	5.0
Grain products	80	21	1680	18.8
Potatoes	91	8	728	8.1
Vegetables	20	11	220	2.5
Fruit	18	5	90	1.0
Meat and eggs	37	15	555	6.2
Fish	91	0.39	35	0.4
Coffee and tea	7.3	27	197	2.2
Drinking water	548	0.31	170	1.9
Total			8998	

The mean annual calcium intake is estimated to be 600 g (approx. 200-250 g of creta praeparata). Hence the pCi Sr-90/g Ca ratio in the total Faroese diet was 15 S. U., and the mean daily intake was 24 pCi Sr-90.

Table 3.2

Estimate of the mean content of Cs-137 in the human diet
in the Faroes in 1971

Type of food	Annual quantity in kg	pCi Cs-137 per kg	Total pCi Cs-137	Percentage of total Cs-137 in food
Milk and cream	146	268	39128	53.0
Cheese	7.3	10	73	0.1
Grain products	80	55	4400	6.0
Potatoes	91	72	6552	8.9
Vegetables	20	2	40	0.0
Fruit	18	6	108	0.1
Meat and eggs	37	582	21534	29.2
Fish	91	8	728	1.0
Coffee and tea	7.3	168	1226	1.7
Drinking water	548	0.1	55	0.0
Total			73844	

The mean annual intake of potassium is estimated to be approx. 1200 g. Hence the pCi Cs-137/g K ratio becomes 62 and the daily intake of Cs-137 202 pCi.

3.11. Discussion

Fig. 3 shows the Faroese diet levels since 1962.

The 1971 levels in total diet were lower than in any other year of the period. Especially the Cs-137 levels were low owing to low Cs-137 concentrations in meat and potatoes.

The main contributors of the Sr-90 content in the Faroese diet were milk products and cereals, which together accounted for 3/4 of the total Sr-90 content in the diet in 1971. As regards Cs-137, milk products, meat (lamb), and potatoes were the most important contributors. In 1971, approx. 90% of the total Cs-137 content in the diet came from these products.

The Faroese mean diet contained twice as much Sr-90 and approx. six times as much Cs-137 as the Danish 1971 diet⁽²⁾.

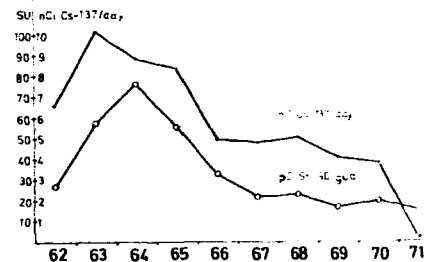


Fig. 3. Sr-90 and Cs-137 in Faroese diet, 1962-71

4. CONCLUSION

4.1.

The Sr-90 fall-out rate in the Faroes in 1971 was approx. 3.5 mCi Sr-90/km². The accumulated fall-out by the end of 1971 was estimated at approx. 102 mCi Sr-90/km² (the mean of Thorshavn and Klaksvig).

4.2.

The mean level of Sr-90 in Faroese milk was 34 S. U. or 41 pCi Sr-90/l. The Cs-137 concentration was 224 pCi Cs-137/g K₂O or 352 pCi Cs-137/l.

Potatoes contained 8.1 pCi Sr-90/kg and 72 pCi Cs-137/kg. Lamb contained 26 pCi Sr-90/kg and 0.7 nCi Cs-137/kg. Fish showed mean levels of 0.4 pCi Sr-90/kg and 8 pCi Cs-137/kg.

The mean content of Sr-90 in drinking water was 0.31 pCi/l.

The mean daily per capita intakes with the diet in the Faroes in 1971 were estimated at 24 pCi Sr-90 (15 S. U.) and 202 pCi Cs-137 (62 pCi Cs-137/g K), i. e. for Sr-90 approx. 3/4 and for Cs-137 1/2 of the 1970 levels.

4.3.

From the Faroese and Danish diet estimates and from measurements on deciduous teeth⁵⁾ and Faroese and Danish bones, the Faroese bone levels in 1971 were estimated as follows: in new-born children: approx. 2 S. U. ; in infants (1 month - 4 years): approx. 6 S. U. (depending upon the amount of locally produced milk in the diet of the infants); in children and teenagers (5 - 19 years): approx. 4 S. U. ; in adult vertebrae: approx. 2 S. U.

The mean content of Cs-137 in the Faroese adult was estimated at approx. 18 nCi or approx. 150 pCi Cs-137/g K. This estimate was based on the Faroese and Danish diet estimated in 1970-71 and on Danish whole-body measurements in 1971.

REFERENCES

- 1) Environmental Radioactivity in the Faroes 1962-1969. Risø Reports Nos. 64, 86, 108, 131, 155, 181, 202, 221, and 246 (1963-1971).
- 2) A. Aarkrog and J. Lippert, Environmental Radioactivity in Denmark in 1971. Risø Report No. 265 (1972).
- 3) A. Aarkrog and J. Lippert, Environmental Radioactivity in Greenland in 1971. Risø Report No. 267 (1972).
- 4) E. P Hardy, Jr., and Joseph Rivera, Fallout Program Quarterly Summary Report (March 1, 1965, through June 1, 1965). HASL-161 (1965).
- 5) A. Aarkrog, Prediction Models for Sr-90 in Shed Deciduous Teeth and Infant Bone. Health Physics 21 (1971) 803-809.