nks
Nordisk kernesikkerhedsforskning
Norrænar kjarnöryggisrannsóknir
Pohjoismainen ydinturvallisuustutkimus
Nordisk kjernesikkerhetsforskning
Nordisk kärnsäkerhetsforskning
Nordic nuclear safety research

NKS-78
ISBN 87-7893-134-7

Transfer Factors for Nuclear Emergency Preparedness

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December 2002

Abstract

This report by the NKS/BOK-1.4 project subgroup describes transfer factors for radiocaesium and radiostrontium for the fallout year and the years after the fall-out. The intention has been to collect information on tools to assess the order of magnitude of radioactive contamination of agricultural products in an emergency situation in Nordic environment. The report describes transfer paths from fallout to plant, from soil to plant and to animal products. The transfer factors of ra-dionuclides (Sr, Cs, I) given in the report are intended to be used for making rough estimates of the contamination of agricultural products soon after the heaviness and composition of the deposition (Bq m^{-2}) is known.

Key words

Transfer factor; Agriculture; Emergency Preparedness; Sr; Cs; I;

NKS-78
ISBN 87-7893-134-7

Pitney Bowes Management Services Denmark A/S, 2003

The report can be obtained from
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Transfer Factors for Nuclear Emergency Preparedness

Report from the NKS/BOK-1.4 project group Countermeasures in Agriculture and Forestry

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Preface

Within the NKS/BOK-1.4 project countermeasures in agriculture and forestry a survey of environmental transfer factors to be used in emergency preparedness planning was carried out. The survey covered the existing Nordic data on transfer factors in agricultural environment. This report is the result of the survey, participants of collecting the data were:

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The conclusions and recommendations issued in this report are solely the responsibility of the authors and not of NKS.

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Contents

Summary

The project was to find tools to assess the order of magnitude of radioactive contamination of agricultural products in an emergency situation. Making a literature survey of transfer factors did this. The review was mainly Nordic data, but to some extent also international data of environmental calculation models. The database of publications including transfer data was collected country-wise.

Transfer factors for radiocaesium and radiostrontium are given in this report, for the fallout year and for the years after the fallout. They are intended to be used for making rough estimates of the contamination of agricultural products soon after the heaviness and composition of the deposition (Bq m^{-2}) is known. They are aimed to give a basis for making decisions on the need of measurements for monitoring feedstuffs and for taking relevant countermeasures in agriculture to decrease radionuclide transfer to food items.

1 Background and introduction

In the connection of the late-phase nuclear emergency exercise Huginn (Lauritzen, 2001) the assessment of radionuclide concentrations was found difficult especially for the fallout year, because transfer data was not easily to be found for the fallout occurring during the growing season. The most reliable assessments of the radionuclide concentrations pertained to the year following the fallout year. There was a need for a survey of transfer factors especially for the fallout year (growing season).

The transfer factors for plant root uptake of ^{137}Cs and ^{90}Sr are generally available for the first year after the fallout year, and this data can be used also for assessments, if the fallout happens in spring before the growing season. This data concerns the root uptake of plants, but data concerning the transfer from the leaves to edible parts of the plant is scarce. For plants which are planted before deposition early in spring, only some contamination on the above ground parts would be expected, but little or no activity in the roots, because caesium is known to migrate very slowly in soil. Caesium is not expected to reach the depth of the roots before the fields have been ploughed and tilled and therefore considerable transfer from soil to plant through the roots cannot be expected before next year.

2 Methods

A review of literature was made by participating countries during the project work, concentrating in the data from Nordic countries published in literature and in-house reports. Both experimental data, and data related to real conditions (after Chernobyl) were looked through. The experimental data was the only data found for assessing the transfer of radionuclides when deposition takes place during the growing season. The transfer data after the Chernobyl accident for the next years was available for Nordic countries to be used for the years after the fallout year. The data included in environmental calculation models was gone over. Also the international literature was reviewed using databases of INIS, Springer-Verlag, Elsevier and Academic Press.

The database of publications including data of transfer factors was made as an Excel table with columns: Author/source, Publication name, Site, Deposition, Product(s), Soil, season, Transfer factor/foodchain transfer models. The data was compiled according to the author and publishing year (Appendix 2).

3 Transfer paths

In fallout situation the human population can be exposed to external and internal radiation by different pathways, Figure 1. We consider here the internal radiation from intake of food products, due to transfer of radionuclides to crops and animals in agriculture. As generally found, the transfer to a certain crop will be much less if fallout takes place between two growth seasons than during a growth season. The direct transfer from fallout to a crop exposed to the atmosphere during a growth season will always be much higher than the indirect transfer from a contaminated ground surface, which in turn will be higher than the transfer by root uptake from a contaminated soil or plough layer.

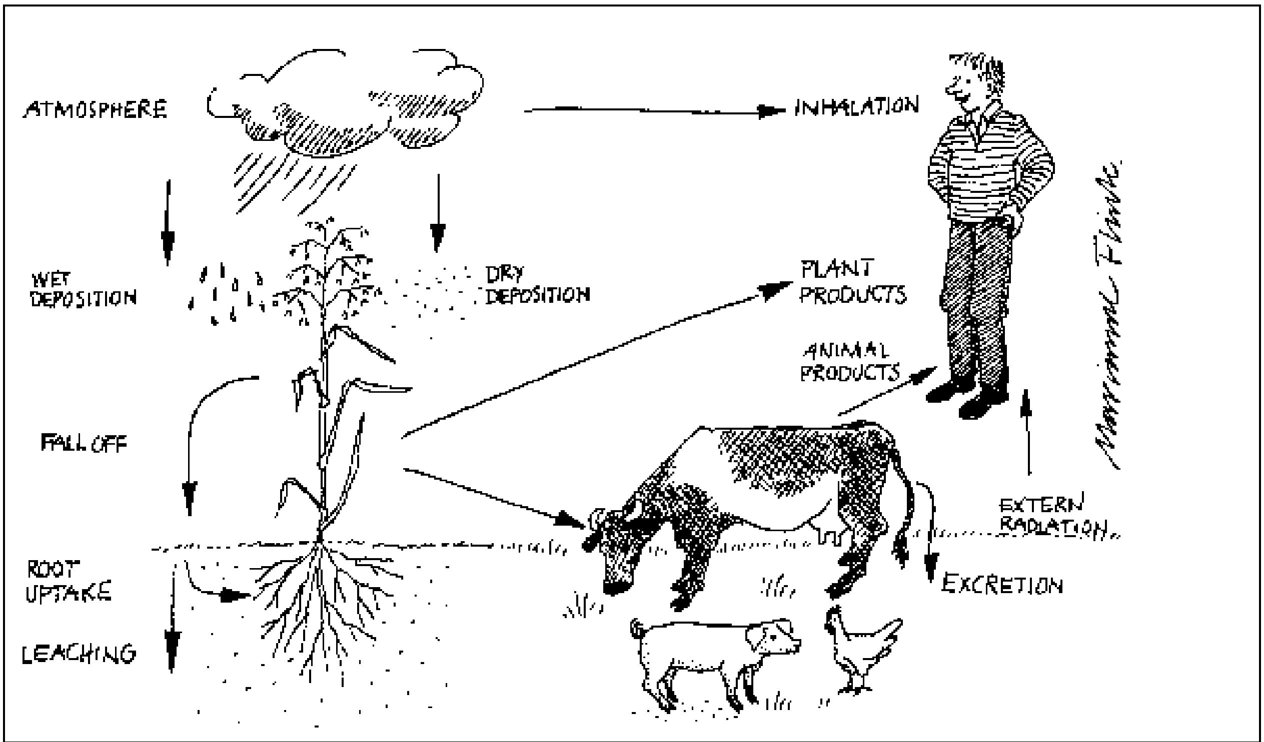

Figure 1. Main pathways for radionuclides to man (Rosén, 1996).

Different measures and units are used to evaluate and compare the transfer of radionuclides from one sector to another sector within the nutrient chains of ecosystems. Aspects on use of some of them will be treated below in the order: transfer from **fallout-to-plant**; transfer from **soil-to-plant;** transfer from **feedingstuff-to-animal products**. Some of the most used transfer factors/ ratios/coefficients are defined in Appendix 1.

3.1 Transfer fallout-to-plant

To describe the direct interception and retention of fallout radionuclides by agricultural crops, two types of measures, **TRd-value,** and **FRd-value,** can be used. The **TRd-value**, is obtained when the activity of a radionuclide transferred to 1 kg dry weight of the crop is weighted by the deposition, ***d***, per square meter at the time of fallout:

$$\mathbf{TRd} = \frac{\textbf{Concentration in plant (Bq (kg d.w.)}^{-1}\textbf{)}}{\textbf{Deposition on ground (Bq m}^{-2}\textbf{)}} \qquad (1)$$

where d = deposition.

The calculated value of **TRd** is proportional to the contamination level of the growing crop and independent of the fallout level at the moment of deposition. It is a **yield independent** measure, easy to compare fore different field situations.

If the yield per unit area is determined, the amount of a nuclide intercepted and retained by a crop per unit area can be weighted by the amount deposited through this unit area. The result of this operation is the **F**raction of the **d**eposition **R**etained by the crop. This fraction, denoted **FRd**, can be found by multiplying **TRd** by the crop weight per unit area:

$$\mathbf{FRd = Yield*TRd = m^2(kg\ d.w.)^{-1} * (kg\ d.w.)\ m^{-2}} \qquad (2)$$

The **FRd-value** is a **yield dependent** measure, which can be expressed as the fraction or percent of initial fallout. The fraction recovered by the growing crop, **FRd,** is dimensionless and influenced by the same factors as **TRd**.

The time of year and growth stage when radioactive fallout takes place greatly determine the nuclide transfer to an agricultural crop. After initial interception of the fallout and up to harvest, there is a period of time dependent **falloff**, which reduces the nuclide content in the crop. By repeated sampling during that part of the season the changes in the crop can be observed and half-times calculated, both with regard to the nuclide content per unit dry weight or **TRd,** and with regard to reduction in nuclide recovery or **FRd**.

3.1.1 Retention by grass crops

Grass fields, pastures or leys, are dynamic systems, used for feeding cattle. The magnitude of the fraction, retained on vegetation up to actual grazing or cutting time is dependent on season of fallout and precipitation. Notably, the loss of nuclides by **falloff** can partly be counteracted by other transfer modes. Nuclides, solubly bound to plant surfaces below cutting or grazing zone, can by growth penetrate to interior tissues and be transferred to above ground plant parts. Nuclides deposited on ground, before or after falloff, can be reabsorbed on leaves by resuspension of contaminated soil particles or reach above ground plant parts by root uptake from surface soil layers.

3.1.1.1 Pastures

Pastures used for grazing by cows are very sensitive for transfer of fallout nuclides during the summer period. The nuclides are deposited on grass leaves with rain as **wet fallout** or with air streams as **dry fallout**. Wet fallout was dominating in the Nordic countries after the Chernobyl accident.

Interception and retention of deposited radionuclides on pasture grass has been studied under Swedish field conditions (Eriksson, 1977). Table 1 shows examples in variation of TRd-values for initial interception of **wet fallout**, varying from 2.41-3.16 m^2 (kg d.w.)$^{-1}$. The values were somewhat higher for ^{85}Sr than for ^{134}Cs, and higher for lower than higher yield due to difference in growth dilution. Total retained fraction, FRd, was initially nearly half of that deposited for both nuclides.

Table 1. Initial retention of radionuclides by grass vegetation from wet depositions on pasture land

Grass, kg d.w. m^{-2}	Nuclide	TRd m^2 (kg d.w.)$^{-1}$	FRd
0.138	^{85}Sr	3.06	0.46
	^{134}Cs	3.16	0.43
0.193	^{85}Sr	2.50	0.48
	^{134}Cs	2.41	0.47

Table 2 shows examples of TRd-values for initial interception of simulated **dry depositions.** TRd varied from 0.15 to 1.03. As expected, TRd tended to be less the larger the particles were. TRd was higher for dry depositions on wetted grass than on dry grass, and highest for thoroughly wetted grass (rain). The absorptions were much lower than for wet deposition Table 1.

Table 2. Range and levels of absorption for dry deposited particles on pasture land, TRd, m^2 (kg d.w.)$^{-1}$

Particle fraction	Dep. on wetted grass		Dep. on dry grass
µm	Range, 3 exp.	1exp.	Range, 3 exp.
40-63	0.61-0.85	1.03	0.31-0.57
63-100	0.42-0.65	1.00	0.15-0.28
100-200	0.39-0.56	0.65	0.16-0.26

The above examples of wet and dry depositions indicate the problem of radioactive fallout and grazing by cattle, on natural pastures under seminatural conditions, on cultural pastures and on grass regrowth after hay harvest and silage production under natural agricultural conditions. Notably, the transfer fallout-to-animal products are triggered by the grazing performance of cattle.

3.1.1.2 Ley crops

During a limited time annually leys in rotation with arable crops grow relatively fast. It deals with 4-6 weeks per harvest, two or three harvests per year. The transfer to grass depends on many factors. Most important are growth stage and time up to harvest. Results from Swedish experiments, Table 3 for ^{134}Cs and Table 4 for ^{85}Sr (Eriksson et al., 1998, a; Haak et al., 2000) reflect conditions for interception and retention of the two nuclides. During early growth the interception was about the same as after Chernobyl. Fallout later, when the grass stand is dense, gives a higher interception. A maximum value is obtained at deposition just before harvest. After each harvest the interception capacity decreases due to less leaf surface of lower vegetation.

Table 3. Interception and retention of ^{134}Cs in experiments with leys, expressed as TRd and FRd. Data available for four sampling days (Sday). Julian day number 145 means 25th of May etc. Wd = Weighted.

	TRd, m^2 (kg d.w.)$^{-1}$				FRd			
Sday	1st cut	2nd cut	3rd cut	Wd mean	1st cut	2nd cut	3rd cut	Total fraction
	Deposition day 115							
148	0.114	0.019	0.011	0.03	0.019	0.022	0.009	0.030
158	0.063	0.022	0.011	0.03	0.019	0.003	0.004	0.026
169	0.034	0.021	0.010	0.02	0.013	0.001	0.003	0.017
184	0.021	-	0.010	0.02	0.014	-	0.003	0.017
	Deposition day 147							
148	1.217	0.040	0.014	0.26	0.187	0.117	0.004	0.198
158	0.846	0.097	0.032	0.32	0.217	0.020	0.009	0.246
169	0.269	0.087	0.022	0.15	0.101	0.080	0.006	0.115
184	0.165	-	0.033	0.12	0.114	-	0.010	0.124
	Deposition day 157							
158	1.594	0.056	0.005	0.58	0.394	0.008	0.002	0.404
169	0.625	0.092	0.030	0.34	0.247	0.089	0.008	0.264
184	0.261	-	0.028	0.18	0.175	-	0.010	0.185
	Deposition day 168							
169	0.691	0.101	0.008	0.33	0.259	0.009	0.003	0.271
184	0.398	-	0.030	0.26	0.242	-	0.009	0.251

Table 4. Interception and retention of ^{85}Sr in experiments with leys, expressed as TRd and FRd. Data available for 4 sampling days (Sday). Julian day 115 means 25th of May etc. Wd = Weighted.

	TRd, m^2 (kg d.w.)$^{-1}$				FRd			
Sday	1st cut	2nd cut	3rd cut	Wd mean	1st cut	2nd cut	3rd cut	Total fraction
	Deposition day 115							
148	0.095	0.043	0.018	0.05	0.016	0.018	0.011	0.045
158	0.062	0.060	0.037	0.05	0.020	0.009	0.014	0.043
169	0.031	0.053	0.029	0.03	0.012	0.003	0.009	0.024
184	0.029	-	0.024	0.02	0.020	-	0.006	0.026
	Deposition day 147							
148	0.958	0.026	0.017	0.20	0.141	0.008	0.005	0.153
158	0.474	0.023	0.015	0.17	0.122	0.005	0.004	0.131
169	0.461	0.033	0.014	0.12	0.080	0.003	0.004	0.087
184	0.168	-	0.009	0.05	0.044	-	0.003	0.047
	Deposition day 157							
158	1.140	0.012	0.000	0.41	0.282	0.002	0.000	0.284
169	0.461	0.005	0.000	0.23	0.181	0.001	0.000	0.182
184	0.168	-	0.000	0.11	0.113	-	0.010	0.113
	Deposition day 168							
169	0.476	0.025	0.000	0.21	0.176	0.002	0.000	0.178
184	0.293	-	0.014	0.19	0.180	-	0.010	0.184

3.1.2 Retention by grain crops

Cereals have large leaf surfaces, which at wet fallout during vegetative phase cause transfer to ears and grain, even if fallout during generative phase is more serious. **TRd** and **FRd** are in Tables 5 and 6 for different deposition and sampling days with spring wheat as experimental crop (Eriksson et al., 1998, b; Haak et al., 2000). They are given for vegetative parts, straw and leaves 5-20, 20-40 and > 40 cm above ground, and for generative part, ears.

For vegetative plant parts the reduction in TRd from deposition to sampling, depends partly on growth dilution and partly on falloff to the ground. Penetration to the interior and transfer to other plant parts, as outlined above, may contribute. Rapid early growth reduced the TRd-value considerably with time, from about 1.4 to 0.16 in three weeks. Later in season with less rapid growth, the reduction in TRd was also less.

The initial interception depends on the development of the surface/weight ratio of the particular crop during the season. After depositions on the maturing wheat, the initial interception, according to the TRd-values, seemed to reach ¼ of those early in the season. The top TRd-values in developing ears were recorded after deposition in July, (Deposition day, Dday 203). The retention was duly reduced with time in the same way for ears as for the vegetative parts. As shown by the FRd-values for ^{134}Cs in Table 3, the initial interception of caesium was low at the start of the growth but reached nearly 40% in July (Dday 203).

Table 5. Interception and retention of ^{134}Cs for spring wheat expressed as TRd and FRd. Data available for 4 sampling days (SDay).

	TRd, m^2 (kg d.w.)$^{-1}$					FRd				
Sday	Straw and leaves, cm >5-20	20-40	>40	Ears	Whole crop	Straw and leaves, cm >5-20	20-40	>40	Ears	Whole plant
	Deposition day 170									
184	0,131				0.131	0.012				
204	0.018	0.018		0.001	0.016	0.002	0.003		0.000	0.005
219	0.006	0.003	0.001	0.002	0.003	0.001	0.001	0.000	0.000	0.003
245	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Deposition day 183									
184	1.356				1.356	0.162				0.162
204	0.162	0.110		0.046	0.022	0.036			0.061	0.120
219	0.091	0.066	0.036	0.037	0.055	0.017	0.016	0.009	0.009	0.050
245	0.031	0.046	0.024	0.035	0.005	0.005	0.005	0.011	0.011	0.031
	Deposition day 203									
204	0.540	0.817		0.590	0.708	0.080	0.258		0.041	0.379
219	0,271	0.214	0.325	0.221	0.256	0.047	0.049	0.088	0.054	0.238
245	0.204	0.158	0.244	0.140	0.172	0.053	0.081	0.096	0.081	0.047
	Deposition day 218									
219	0.238	0.289	0.347	0.288	0.292	0.053	0.081	0.096	0.081	0.311
245	0.178	0.134	0.239	0.146	0.167	0.030	0.030	0.070	0.114	0.244
	Deposition day 234									
235	0.421	0.555	0.610	0.248	0.434	0.067	0.106	0.100	0.073	0.346
245	0.225	0.255	0.254	0.137	0.184	0.029	0.045	0.058	0.073	0.205

A comparison of data in Table 5 also shows a much lower ^{134}Cs reduction with time of FRd than of TRd. Considering the whole crop, the residence time in July seems to be about 3-4 weeks. Due to increased growth there is a tendency for increase of FRd in the ears with time after deposition even when there is a general reduction of TRd in straw and leaves.

The interception and retention of ^{85}Sr was about 20 % less than that of ^{134}Cs in the wheat after deposition. The falloff was comparatively larger for ^{85}Sr as shown by the FRd-values in Tables 5 and Table 6. Very little or no ^{85}Sr was detected in the ears from the two earliest depositions. The fractions or FRd, of both nuclides intercepted by the ears was about 10 % of that intercepted by the crop totally at Dday 203 but increased with plant growth up to 20-25 % in the latter part of the season at Dday 218 and Dday 234.

Table 6. Interception and retention of ^{85}Sr for spring wheat expressed as TRd and FRd. Data available for 4 sampling days (Sday).

	TRd, m^2 (kg d.w.)$^{-1}$					FRd				
Sday	Straw and leaves, cm >5-20	20-40	>40	Ears	Whole crop	Straw and leaves, cm >5-20	20-40	>40m	Ears	Whole crop
	Deposition day 170									
184	0,091				0.093	0.009				
204	0.001	0.002		0.000	0.001	0.000	0.000		0.000	0.009
219	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
245	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Deposition day 183									
184	1.114				1.114	0.133				0.133
204	0.137	0.047		0.000	0.063	0.018	0.015		0.000	0.033
219	0.093	0.040	0.000	0.000	0.029	0.017	0.009	0.000	0.000	0.026
245	0.043	0.016	0.009	0.000	0.012	0.005	0.002	0.000	0.000	0.009
	Deposition day 203									
204	0.356	0.563		0.590	0.367	0.054	0.178		0.025	0.257
219	0,204	0.145	0.286	0.221	0.045	0.035	0.033	0.075	0.011	0.155
245	0.167	0.127	0.231	0.140	0.026	0.024	0.025	0.064	0.017	0.130
	Deposition day 218									
219	0.178	0.233	0.230	0.288	0.184	0.040	0.065	0.064	0.052	0.221
245	0.185	0.105	0.203	0.146	0.063	0.031	0.024	0.059	0.049	0.163
	Deposition day 234									
235	0.293	0.413	0.379	0.248	0.163	0.047	0.079	0.062	0.048	0.235
245	0.129	0.341	0.118	0.137	0.123	0.019	0.062	0.032	0.068	0.180

Results from Tables 3-6 are graphically shown after statistical smoothing in Figures 2-4, where the time scale is days after plant emergence. As illustrated for ^{134}Cs, this transformation of data gives more clear trends of the change in retention of ^{137}Cs during the season. Notable, the change with time of TRd-values is influenced both by fall-off and growth dilution of the plant, while change of FRd-values is influenced by fall-off only. Both values, however, may be used for calculation of half-times of the nuclide intercepted, **reduction half-time** or **residence half-time,** respectively.

The development after different deposition times of the TRd-values and the FRd-values is shown for **vegetative parts** of wheat in Figures 2 and Figure 3. Figure 2 shows that the reduction half-time was about 2 weeks, and Figure 3 that the residence half-time was about 3-4 weeks. The growth of the crop during the season explains the difference between the two half times. TRd or the activity concentration of ^{134}Cs decreases faster than FRd or the fraction of deposition retained in the crop.

The development after depositions at different times of the FRd-values for **generative parts** is shown in Figures 4 (DD = DDay = deposition day). It shows that the fraction of ^{134}Cs retained in ears of the wheat crop increases with time of deposition or in the order DDay10 < DDay23 < DDay43. The later the fallout takes place the higher is the fraction of ^{134}Cs retained in the ears.

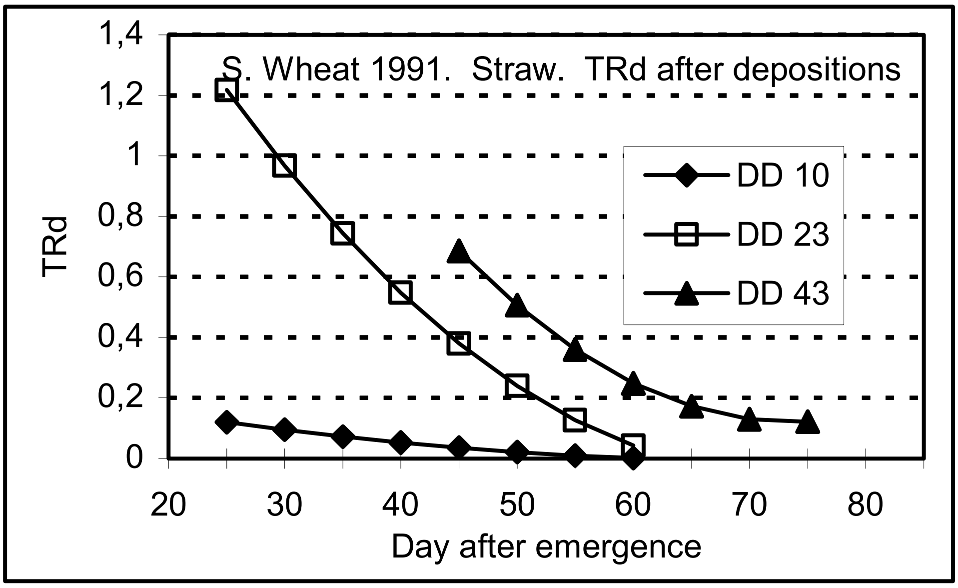

Figure 2. Reduction of the ^{134}Cs content in spring wheat straw after depositions during the season as indicated by TRd-values.

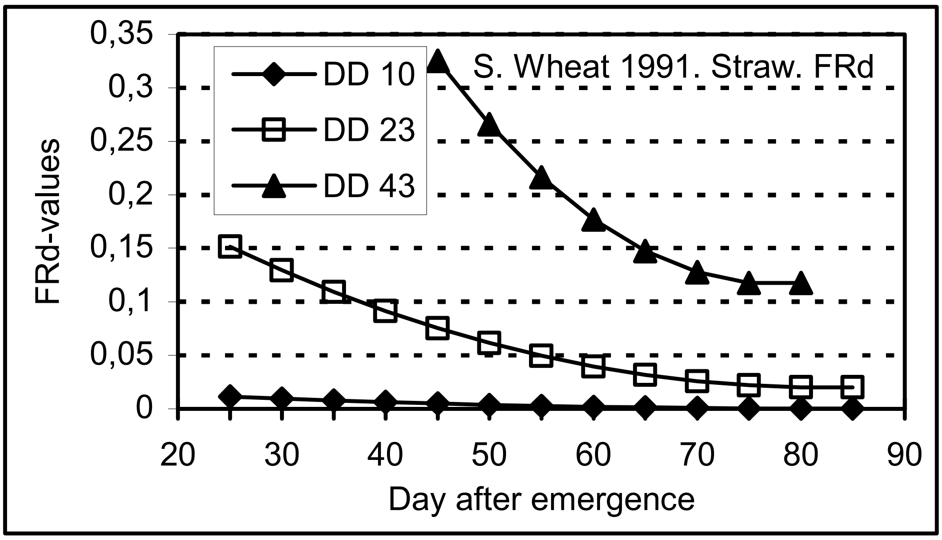

Figure 3. Reduction of the ^{134}Cs content in spring wheat straw after depositions during the season as indicated by FRd-values.

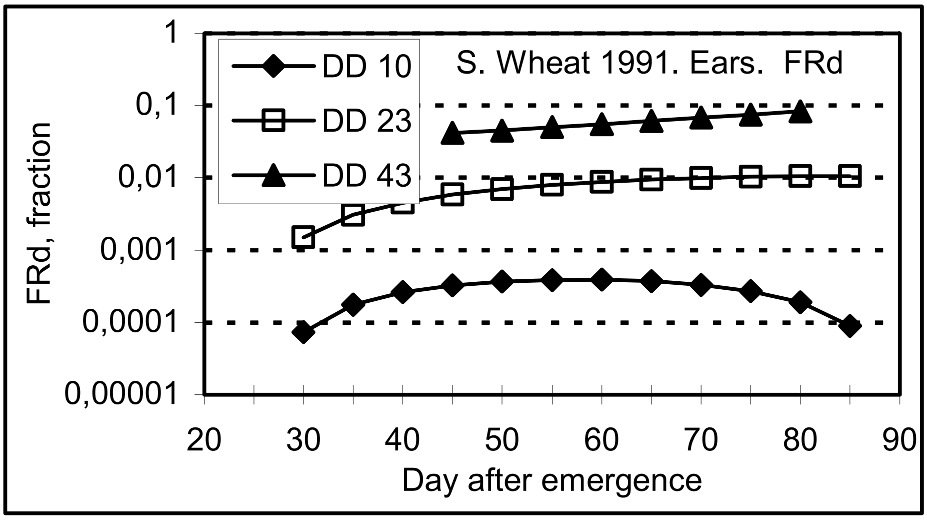

Figure 4. Change with time during the season of the ^{134}Cs content in ears of spring wheat after depositions as indicated by FRd-values.

In Table 7 changes with time in grain yield and **FRd-** and **TRd**-values are given. The transfer values were higher for ^{134}Cs than for ^{85}Sr, which show that caesium is more mobile in plant than strontium. The ratios are reduced in the two latter sections of the table, from vegetative parts to ears and from ears to grain due to relatively larger flow of caesium than of strontium within the plant. The double labelling of the crop with ^{85}Sr and ^{134}Cs, thus permits evaluation of the path-ways of the two nuclides, from interception on outer parts up to deposition in grains.

Table 7. Transfer of ^{134}Cs and ^{85}Sr to spring wheat from depositions on different Ddays during the growth period 1991. Yield level and nuclide transfer refer to harvest on Sday 245, 2nd Sept 1991.

Dday	Yield,	TRd, m^2 (kg d.w.)$^{-1}$		Fraction, FRd	
Nr	kg d.w. m^{-2}	^{134}Cs	^{85}Sr	^{134}Cs	^{85}Sr
170	0.10	0.001	0.000	0.000	0.000
183	0.35	0.018	0.000	0.005	0.000
203	0.51	0.112	0.018	0.057	0.009
218	0.59	0.104	0.032	0.061	0.019
234	0.42	0.073	0.032	0.029	0.013

3.2 Transfer soil-to-plant

Many factors influence the root uptake of radionuclides from contaminated soils as presented for Sr and Cs in figure 5. In the soil solution, they behave similar as potassium and calcium and act as carrier isotopes of these nutrients respectively. While ^{90}Sr stays with in the labile fraction, ^{137}Cs is largely fixed to clay minerals in the non-labile fraction. They are transferred to the root surface mainly by mass flow and diffusion respectively.

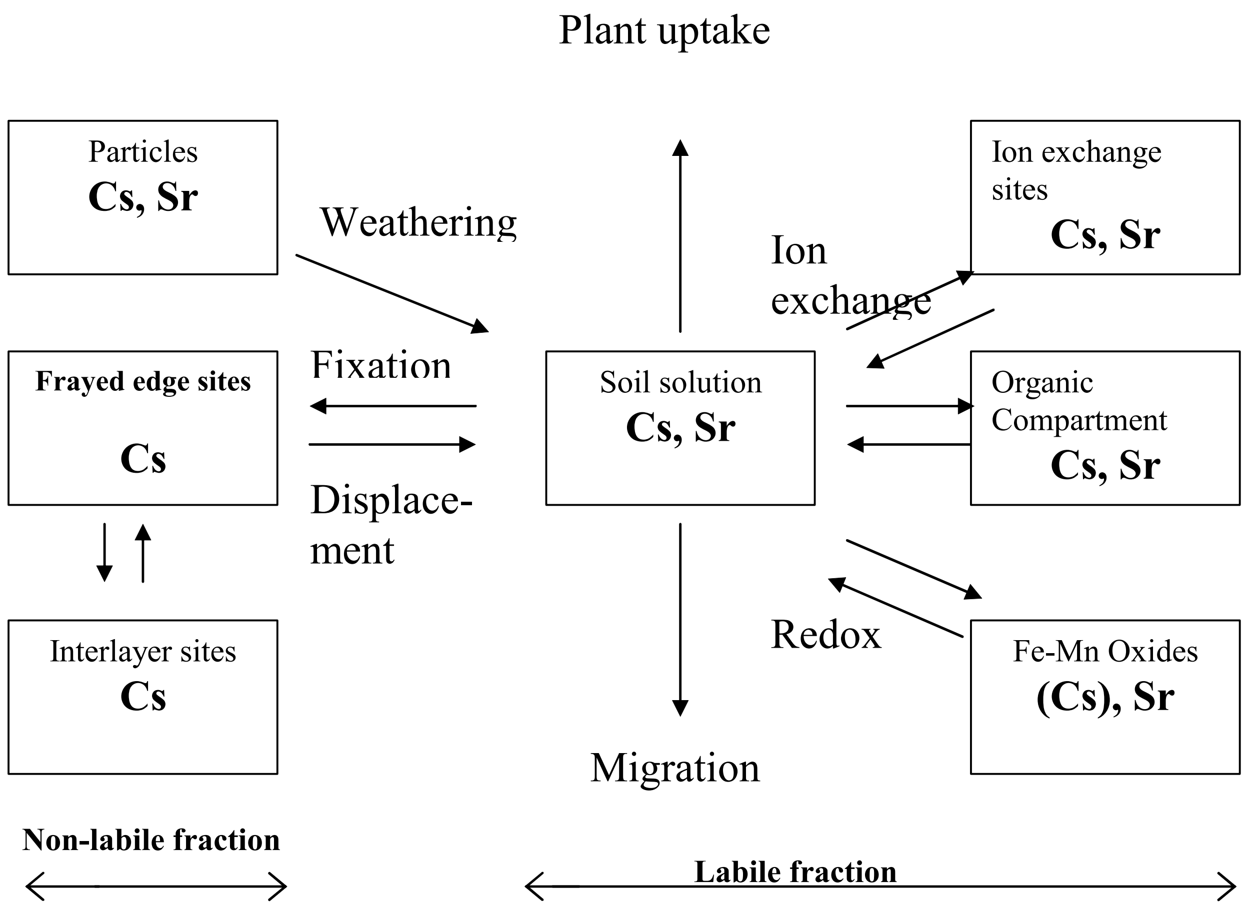

Figure 5. Schematic view of radionuclide pools and some of the processes involved.

Field crops absorb nutrients from different soil layers and the transfer factor, TRsp, is an integrated measure over root depth. We calculate TRsp as follows.

$$TRsp = TR = TF = \frac{\text{Concentration in plant (Bq (kg d.w.)}^{-1})}{\text{Nuclide deposition (Bq m}^{-2})} \qquad \text{Unit: m}^2 \text{ (kg d.w.)}^{-1} \qquad (4)$$

where s = soil and p = plant

This normalisation makes it easy to compare **soil-to-plant** transfer under different field conditions. If we know the nuclide deposition per unit surface, the transfer factor and the yield, we easily calculate the nuclide transfer to crop product per hectare.

Many factors influence the **soil-to-plant** transfer, soil-pH, crop type, rooting in the soil profile, clay and organic matter content. Mineral soils, especially clayey cause fixation of ^{137}Cs, which lower the root uptake. Transfer of both ^{137}Cs and ^{90}Sr is lower on clayey soils than on sandy soils. Organic soils usually have higher transfer of Cs than mineral soils. Mineral soils, with as low organic matter content as 5 percent, are quite effective to lower the root uptake of Cs considerably. TRsp found under Swedish field conditions are shown below.

Table 8. Soil-to-plant transfer factor, TF, of ^{137}Cs and ^{90}Sr for different soil types, calculated in the year after fallout, m^2 (kg d.w.)$^{-1}$ x 10^{-3} (Eriksson, 1994)

Crop	Radiocaesium (Cs)			Radiostrontium (Sr)		
	Clayey soils	Sandy soils	Organic soils	Clayey soils	Sandy soils	Organic soils
Cereals	0.05	0.2	2.0	0.5	1.0	0.5
Ley grass	5.0	10	100	10	20	10
Potatoes	0.3	1.2	12	1.0	2.0	1.0
Cultural pasture	5.0	10	100	10	20	10
Natural pasture	10	20	200	20	40	20

3.3 Transfer to animal products

Farming areas used for growing fodder crops are normally the base for animal husbandry. Grazing or feeding with contaminated crop products cause nuclide transfer to animal products. Most of the nuclide intake by animals goes back by secretion to the manure produced on the farm but a fraction that varies with the actual radionuclide and type of animal is retained in the animal product, later to be used as food items. The general formula or transfer coefficient, TC, for nuclide transfer from feeding stuff to animal products is defined as

$$\mathbf{TC = TC_{fm} = FM} = \frac{\text{Concentration in milk/meat (Bq/kg f.w.)}}{\text{Daily nuclide intake (Bq/animal and day)}} \qquad \text{Unit: [day/kg f.w.]} \qquad (5)$$

Transfer coefficients for ^{137}Cs, ^{90}Sr and ^{131}I are presented in Table 9 (Eriksson & Anderson, 1994). TC is the ratio between activity concentrations in the product divided by the daily intake of nuclide per animal. For transfer from feed to milk, equilibrium is relatively soon obtained between daily intake and secretion in milk. For cow meat, and to a less extent for pig meat, it takes a longer time to reach equilibrium. For transfer from feed to cow meat a dynamic model can be used. Applied to certain conditions and according to Whicker & Kirchner (1987) it can be described by

A_{mt} = TCk_bM, where
A_{mt} = Fraction of daily activity intake retained in the meat compartment, 0.5 for ^{137}Cs and 0.01 for ^{90}Sr
M = Meat compartment, i.e. part of eatable meat per animal, supposed to be 180 kg of total a slaughter weight of 270 kg
k_b = Daily release of activity from meat compartment, fraction
TC = Transfer coefficient, as above is the ratio between activity concentration in the actual product divided by the daily intake. Determination of TC is determined for "steady state conditions", Haak et al., 1998.

The dynamic model for cow meat is used for periods when the nuclide intake is changing with time. A_{mt}, M and K_b are then included to calculate the activity retained per kg cow meat at predetermined slaughtering occasions. The nuclide concentration in feed and cow meat varies during the year, being higher in summer at grazing than when feeding in winter with cereals. A similar dynamic model can be applied for pig meat, useful for predictive purposes to decrease nuclide content in meat by feeding with uncontaminated fodder before slaughtering.

Table 9. Transfer coefficients, TC, for some animal products

Nuclide	Milk Day/l	Cow meat A_{mt}	k_b (day)$^{-1}$	Pig meat day/kg
^{137}Cs	0.008	0.5	0.23	0.25
^{90}Sr	0.0013	0.01	0.093	0.02
^{131}I	0.012	0.05	0.039	-

4 UNSCEAR report data

The UNSCEAR 1988 Report lists assessed results of representative integrated concentrations of ^{131}I and ^{137}Cs in foods during the first year after the accident (Table 10). Also the first year diet intake of ^{137}Cs is given.

Table 10.

	Normalised integrated concentration for I-131 (Bq a/kg per kBq/m^2)		Normalised integrated concentration for Cs-137 in the first year (Bq a/kg per kBq/m^2)					First year diet intake of ^{137}Cs (Bq per kBq/m^2)
Country	milk products	leafy vegetables	Milk products	grain	leafy veg	veg/ fruit	meat	
Denmark	0.02	0.1	1.2	1.6	0,4	0.6	1	508
Finland	0,01	0.03	1.4	0.3	0.2	0.6	4.5	823
Norway	(0.01)	(0.04)	2.6	0.2	1.3	0,8	8.3	1326
Sweden	0.01	0.01	3.5	1.7	2,9	4.1	19.9	448

The transfer coefficients for the ingestion pathway from deposition to intake (Bq per Bq m^{-2}) for various radionuclides are listed in the UNSCEAR 2000 report (Table 11). These values are calculated for an even distribution of the deposition throughout the year, as was the case for global fallout from atmospheric nuclear testing. If the deposition occurs during the winter season, the transfer coefficients are lower, and for a summer deposition they are higher then the value for the even distribution.

Table 11. Transfer coefficients for radionuclides for the ingestion pathway (UNSCEAR 2000)

Radionuclide	Deposition to intake (Bq per Bq/m²)	First year (Bq per Bq/m²)
Cr-51	0.56	
Mn-54	2	
Fe-55	6	3
Fe-59	0.76	
Co-58	2.1	
Co-60	2.9	
Zn-65	3.6	
Sr-89	0.03	0.03
Sr-90	1.9	0.2
Zr-95	0.1	
Nb-95	0.07	
Sb-124	1	
I-131	0.07	0.07
Cs-134	2	
Cs-136	0.3	
Cs-137	4.2	1.9
Ba-140	0.005	0.005
Ce-141	0.07	
Ce-144	0.1	
Pu-238	0.05	
Pu-239	0.7	
Pu-240	0.7	
Pu-241	0.04	
Am-241	0.2	
Cm-244	0.04	

The transfer coefficients for radionuclides for the ingestion pathway according to Danish data are listed in Table 12 for different ingredients of the diet and for the whole diet.

Table 12. Transfer coefficients for radionuclides for the ingestion pathway (Danish data)

	Normalised transfer (mBq a/kg per Bq/m²)		First year transfer (mBq/kg per Bq/m²)	
	Sr-90	Cs-137	Sr-90	Cs-137
Rye	32	11	23	11
Barley	24	8	17	8
Wheat	23	8	15	8
Oats	37	7	14	7
Milk	3.5	3.4	1.6	3
Beef	1.4	28	0.5	25
Pork	1	35	0.2	18
	Normalised transfer (Bq per Bq/m²)		First year transfer (Bq per Bq/m²)	
Total diet	5	4.2	1.1	1.8

5 NRPB data

In the large transfer data compilation NRPB (1999) there are several tables of recommended values, for soil-to plant transfer of radiocaesium and radiostrontium, presented for different crops and soil types. The values of TFs are given as Bq kg^{-1} in plant per Bq kg^{-1} dry soil. This data does not give the connection between Bq kg^{-1} soil and deposition Bq m^{-2}. They are not readily usable since information of soil contamination level is usually available and most practically given in Bq m^{-2}. The TFs are given with 95 % confidence intervals in Tables 13 and 14 respectively. They are useful for planning monitoring of crops and countermeasures, in the years after fallout.

The crop types in the tables 13 and 14 are as follows:

- cereals, i.e. barley, wheat, oats, rye and maize grain
- tubers, i.e. potatoes
- leafy green vegetables, e.g. lettuce, endive, kale, parsley
- brassicas, e.g. cabbage, Brussels sprouts, cauliflower
- root vegetables, e.g. carrots, radish, swedes and turnips
- legumes, e.g. beans and peas
- onion family, i.e. onion, spring onion and leek

Definition of four broad soil types given in the tables 10 and 11 are as follows:

- sand, > 70% sand fraction by weight (particles with diameter greater than 0.2 mm)
- loam, any other combination of sand, silt and clay
- clay, > 35% clay fraction by weight (particles with diameter less than 0.002 mm)
- organic, > 20% organic matter

Table 13. Recommended values and 95% confidence intervals for TFs (Bq kg^{-1} dry mass plant per Bq kg^{-1} dry mass soil) for radiocaesium.

Crop	Soil type	n[a]	N[b]	Recommended Value	95% confidence interval	
					Lower	Upper
Cereals	Sand	208	25	$2.1\ 10^{-2}$	$1.7\ 10^{-3}$	$2.5\ 10^{-1}$
	Loam	358	23	$1.4\ 10^{-2}$	$4.5\ 10^{-4}$	$4.2\ 10^{-1}$
	Clay	49	11	$1.1\ 10^{-2}$	$5.7\ 10^{-4}$	$2.1\ 10^{-1}$
	Mineral[c]	615	34	$1.5\ 10^{-2}$	$6.8\ 10^{-4}$	$3.5\ 10^{-1}$
	Organic	54	7	$4.3\ 10^{-2}$	$3.8\ 10^{-3}$	$4.9\ 10^{-1}$
Tubers	Sand	89	13	$1.1\ 10^{-1}$	$1.4\ 10^{-2}$	$8.9\ 10^{-1}$
	Loam	173	14	$2.9\ 10^{-2}$	$2.9\ 10^{-3}$	$2.8\ 10^{-1}$
	Clay	20	5	$2.9\ 10^{-2}$	$3.4\ 10^{-3}$	$2.5\ 10^{-1}$
	Mineral[c]	282	22	$4.4\ 10^{-2}$	$3.5\ 10^{-3}$	$5.6\ 10^{-1}$
	Organic	15	5	$5.5\ 10^{-2}$	$6.0\ 10^{-3}$	$5.1\ 10^{-1}$
Green	Sand	72	7	$2.1\ 10^{-1}$	$2.6\ 10^{-2}$	1.7
vegetables	Loam	100	12	$1.2\ 10^{-1}$	$1.2\ 10^{-2}$	1.2
	Clay	34	5	$6.6\ 10^{-2}$	$7.6\ 10^{-3}$	$5.8\ 10^{-1}$
	Mineral[c]	206	14	$1.3\ 10^{-1}$	$1.3\ 10^{-2}$	1.4
	Organic	7	2	$2.9\ 10^{-1}$	$1.6\ 10^{-2}$	5.5
Brassicas	Sand	36	7	$1.2\ 10^{-1}$	$1.3\ 10^{-2}$	1.2
	Loam	40	9	$2.8\ 10^{-2}$	$5.9\ 10^{-3}$	$1.3\ 10^{-1}$
	Clay	13	2	$4.4\ 10^{-2}$	$9.6\ 10^{-3}$	$2.0\ 10^{-1}$
	Mineral[c]	89	11	$5.5\ 10^{-2}$	$5.4\ 10^{-3}$	$5.6\ 10^{-1}$
	Organic	11	4	$2.1\ 10^{-1}$	$5.7\ 10^{-3}$	7.5
Root	Sand	38	9	$5.4\ 10^{-2}$	$8.7\ 10^{-3}$	$3.3\ 10^{-1}$
vegetables	Loam	52	11	$3.7\ 10^{-2}$	$1.5\ 10^{-3}$	$9.0\ 10^{-1}$
	Clay	13	3	$2.2\ 10^{-2}$	$3.5\ 10^{-3}$	$1.4\ 10^{-1}$
	Mineral[c]	103	14	$4.0\ 10^{-2}$	$2.8\ 10^{-3}$	$5.6\ 10^{-1}$
	Organic	12	4	$7.9\ 10^{-2}$	$3.3\ 10^{-3}$	1.9
Legumes	Sand	47	8	$7.4\ 10^{-2}$	$6.1\ 10^{-3}$	$9.0\ 10^{-1}$
	Loam	74	11	$1.1\ 10^{-2}$	$6.4\ 10^{-4}$	$1.8\ 10^{-1}$
	Clay	13	2	$3.8\ 10^{-3}$	$1.8\ 10^{-3}$	$8.0\ 10^{-3}$
	Mineral[c]	134	15	$1.9\ 10^{-2}$	$7.1\ 10^{-4}$	$5.2\ 10^{-1}$
	Organic	0	-	$3.5\ 10^{-2}$ [d]	-	-
Onions	Sand	20	3	$1.3\ 10^{-2}$	$3\text{-}6\ 10^{-3}$	$4.6\ 10^{-2}$
	Loam	11	2	$8.5\ 10^{-3}$	$1.3\ 10^{-3}$	$5.7\ 10^{-2}$
	Clay	7	1	$5.6\ 10^{-3}$	$9.5\ 10^{-4}$	$3.3\ 10^{-2}$
	Mineral[c]	38	4	$9.8\ 10^{-3}$	$1.9\ 10^{-3}$	$5.1\ 10^{-2}$
	Organic	5	1	$6.7\ 10^{-3}$	$2.8\ 10^{-4}$	$1.6\ 10^{-1}$

Notes

[a] Number of records.

[b] Number of studies.

[c] Data for sand, loam and clay combined.

[d] Value extrapolated using scaling factor for loam.

Table 14. Recommended values and 95% confidence intervals for TFs (Bq kg^{-1} dry mass plant per Bq kg^{-1} dry mass soil) for radiostrontium.

Crop	Soil type	n[a]	N[b]	Recommended Value	95% confidence interval Lower	Upper
Cereals	Sand	112	13	$2.3\ 10^{-1}$	$3.0\ 10^{-2}$	1.7
	Loam	88	13	$1.5\ 10^{-1}$	$2.2\ 10^{-2}$	$9.4\ 10^{-1}$
	Clay	21	5	$7.1\ 10^{-2}$	$2.2\ 10^{-2}$	$2.3\ 10^{-1}$
	Mineral[c]	221	16	$1.7\ 10^{-1}$	$2.3\ 10^{-2}$	1.3
	Organic	7	3	$3.0\ 10^{-2}$	$7.4\ 10^{-3}$	$1.2\ 10^{-2}$
Tubers	Sand	44	11	$2.3\ 10^{-1}$	$3.9\ 10^{-2}$	1.4
	Loam	33	10	$2.1\ 10^{-1}$	$5.3\ 10^{-2}$	$8.6\ 10^{-1}$
	Clay	9	3	$9.4\ 10^{-2}$	$2.8\ 10^{-2}$	$3.1\ 10^{-1}$
	Mineral[c]	86	14	$2.0\ 10^{-1}$	$3.9\ 10^{-2}$	1.1
	Organic	4	4	$1.7\ 10^{-2}$	$5.1\ 10^{-3}$	$5.5\ 10^{-2}$
Green vegetables	Sand	54	6	3.2	$4.5\ 10^{-1}$	$2.2\ 10^{-1}$
	Loam	75	7	2.4	$6.5\ 10^{-1}$	9.1
	Clay	27	4	1.8	$8.3\ 10^{-1}$	4.0
	Mineral[c]	156	8	2.5	$5.4\ 10^{-1}$	$1.2\ 10^{-1}$
	Organic	1	1	$3.3\ 10^{-1}$	-	-
Brassicas	Sand	24	8	3.0	$4.9\ 10^{-1}$	$1.8\ 10^{1}$
	Loam	28	7	2.2	$3.0\ 10^{-1}$	$1.6\ 10^{1}$
	Clay	8	2	1.7	$4.0\ 10^{-1}$	7.0
	Mineral[c]	60	9	2.4	$3.7\ 10^{-1}$	$1.5\ 10^{1}$
	Organic	5	4	$2.0\ 10^{-1}$	$8.1\ 10^{-2}$	$4.9\ 10^{-1}$
Root vegetables	Sand	32	9	1.5	$1.2\ 10^{-1}$	$2.0\ 10^{1}$
	Loam	29	7	1.6	$1.9\ 10^{-1}$	$1.3\ 10^{1}$
	Clay	6	2	1.4	$3.4\ 10^{-1}$	5.5
	Mineral[c]	67	12	1.6	$1.6\ 10^{-1}$	$1.5\ 10^{1}$
	Organic	3	2	$1.6\ 10^{-1}$	$9.4\ 10^{-2}$	2.6 10-[1]
Legumes	Sand	38	5	2.7	$7.4\ 10^{-1}$	9.6
	Loam	58	4	1.4	$3.0\ 10^{-1}$	6.5
	Clay	14	2	$8.2\ 10^{-1}$	$2.0\ 10^{-1}$	3.3
	Mineral[c]	110	7	1.6	$3.2\ 10^{-1}$	8.3
	Organic	0	-	$2.9\ 10^{-1}$ [d]	-	-
Onions	Sand	13	4	$9.0\ 10^{-1}$	$1.3\ 10^{-1}$	6.2
	Loam	8	2	$8.8\ 10^{-1}$	$1.8\ 10^{-1}$	4.2
	Clay	3	1	$5.4\ 10^{-1}$	$3.5\ 10^{-1}$	8.5 10-[1]
	Mineral[c]	24	5	$8.4\ 10^{-1}$	1-5 10^{-1}	4.5
	Organic	1	1	$4.2\ 10^{-1}$	-	-

Notes
[a] Number of records.
[b] Number of studies.
[c] Data for sand, loam and clay combined.
[d] Value extrapolated using scaling factor for loam.

6 Discussion

The default values given in this report are usable only for rough first estimations in an emergency situation in Nordic countries. For predicting the radionuclide concentrations in agricultural products more precisely specific information is needed on differences in agriculture, use of natural pasture, soil types, fertilisation status of the soils, growing conditions etc. All these factors cause variability and add the uncertainty of the estimations. The use of calculation models with transfer factors gives only robust assessments, which can be confirmed by measurements.

The literature review revealed that there is a lot of data collected after the Chernobyl fallout that can be used for soil-to-plant transfer for the years after the fallout year. Provided that the fallout levels of radiocaesium and radiostrontium are known, the values given, in Table 8 for soil-to-plant transfer and in Table 9 for transfer to animal products, can be used for decisions on agricultural use in the Nordic countries. They can also be used to decide whether extra countermeasures are needed for certain soils before use, in acute phase and in the long term.

Fallout during the growth period can be serious at relatively low fallout levels. The season of deposition is the factor that affects most the contamination of agricultural products. The start of the growing season and the harvest times vary, and the contamination of crops may differ a lot in different parts of the countries. Sample measurements are always needed in an emergency situation to confirm the assessments made by calculations. Calculation models, that take into account the time from fallout to harvest occasion, can be useful and improve the prediction of nuclide transfer to feed or food products.

Data on transfer of ^{131}I to agricultural products are few and seems to be inadequate for prediction of default values of transfer factors. According to the OECD/NEA Workshop 12-14 June 1995 it can be approximated that after ^{131}I deposition of 4-10 kBq m^{-2} the concentration of ^{131}I in milk exceeds 500 Bq l^{-1}. Documents of the NRPB (1994) give peak concentrations in milk, beef and lamb (and approximate times of occurrence) following deposition of 1 Bq m^{-2} on grass field on June and January (Table 15.).

Table 15. Comparison between concentrations of ^{131}I, ^{137}Cs and ^{90}Sr (Bq/kg) for milk, beef and lamb after deposition on the 1st of June and the 1st of January. It is assumed that cattle graze pasture in summertime.

	Peak concentration in Bq kg^{-1} (approximate time of occurrence in days)				
	Milk		Beef		Lamb
Radionuclide	Deposition on 1 June	Deposition on 1 January	Deposition on 1 June	Deposition on 1 January	Deposition on 1 June
^{131}I	7*10^{-2} (4)	7*10^{-7} (110)	2*10^{-2} (4)	2*10^{-7} (110)	2*10^{-2} (6)
^{137}Cs	7*10^{-2} (6)	6*10^{-3} (110)	1*10^{-1} (16)	1*10^{-2} (120)	3*10^{-1} (21)
^{90}Sr	1*10^{-2} (5)	1*10^{-3} (110)	2*10^{-3} (10)	2*10^{-4} (120)	2*10^{-3} (16)

7 References

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Appendix 1: Transfer factors

In radioecology different ratios/coefficient/factors are used to characterise the transfer of radionuclides from one sector to another within an ecosystem or a food chain. Below some of the most used ones are defined TRd, CR, TF, FM, CF and T_{ag}.

<u>Transfer from fallout to plant by direct deposition on growing crops</u>

$$\mathbf{TRd} = \frac{\textbf{Concentration in plant (Bq(kg d.w.)}^{-1}\textbf{)}}{\textbf{Deposition on ground (Bq m}^{-2}\textbf{)}} \qquad \textit{Unit: } m^2 \textit{/kg d.w.} \quad (1)$$

where d = deposition

$$\mathbf{FRd} = \text{TRd * Yield} \qquad (\mathbf{m^2(kg\ d.w.)^{-1} * (kg\ d.w.)\ m^{-2}}) \qquad \text{Dimensionless} \quad (2)$$

where d = deposition

<u>Transfer from soil to plant under field conditions</u>

$$\mathbf{TRsp = TR = TF} = \frac{\textbf{Concentration in plant (Bq/kg d.w.)}}{\textbf{Nuclide deposition (Bq/m}^{-2}\textbf{)}} \qquad \text{Unit: } m^2\text{/kg d.w.} \quad (3)$$

where s = soil and p = plant

<u>Transfer from plant to milk/meat</u>

$$\mathbf{TC = TC_{fm} = FM} = \frac{\textbf{Concentration in milk/meat (Bq/kg f.w.)}}{\textbf{Daily nuclide intake (Bq/animal and day)}} \qquad \text{Unit: day/kg f.w.} \quad (4)$$

where f = feed and m=meat

<u>Transfer from plant to animal muscle</u>

$$\mathbf{TF_{pm} = CF} = \frac{\textbf{Concentration in muscle (Bq/kg f.w.)}}{\textbf{Concentration in plant (Bq/kg d.w.)}} \qquad \text{Dimensionless} \quad (5)$$

where p = plant and m=muscle

<u>Transfer from soil to milk/meat</u>

$$\mathbf{T_{ag}} = \frac{\textbf{Concentration in milk/meat (Bq/kg f.w.)}}{\textbf{Nuclide deposition (Bq/m}^{-2}\textbf{)}} \qquad \text{Unit: } m^2\text{/ kg f.w.} \quad (6)$$

where ag = aggregated

Appendix 2: Bibliographic database

Author/Source	Publication name	Site	Deposition	Product(s)	Soil, season	Abstract
Andersson, I & Lönsjö, H. (1988). Swedish J. agric. Res. 18: 195-206.	Transfer of ^{137}Cs in two farm Ecosystems. Calculated effects of countermeasures following postulated fallout land contamination.	Case studies on two farms near Barsebäck and Ringhals, with different production conditions. Sweden.	Simulated deposition of Cs-137, 1MBq/hectare.	Crop and animal products on the two farms.	The situation some years after a nuclear accident.	Based on production data of the farms, estimates of the annual transfer of Cs-137 to crop and animal products and of internal radiation doses per person on the farms. Effects of countermeasures, fertilisation and soil managements, are discussed.
Absalom,J.P. Young,S.D. Crout,N.M.J. Sanchez,A. Wright,S.M. Smolders,E. Nisbet,A.F. Gillett,A.G. (2001). Journal of Environmental Radioactivity, Volume 52 Issue 1 (January 2001), Page 31-43.	Predicting the transfer of radiocaesium from organic soils to plants using soil characteristics	Europe. UK	Cs-137.			Activity concentrations of Cs-137 were measured in 325 samples of soil and potato which were taken from fields with various levels of Cs-137 deposition. The soil-potato transfer factor $TF=Cs_{potato}/Cs_{soil}$, where Cs_{potato} and Cs_{soil} are activity concentrations. (TF, Bq/kg plant/Bq/kg whole soil)
Agnedal, P.-O. & Eriksson, Å. (1990). Studsvik Report. Studsvik/NS-90/115.	In-situ studier av migrationsparametrar för strontium och cesium.	Lysimeter exps. in field and batch exps. in laboratory. Sweden.		Results related to nuclide uptake by barley.	3 mineral topsoils, in the lysimeter exp. placed on 2 subsoils, loamy sand and clay.	Calculation of the soil-plant transfer factors of Sr-90 and Cs-137 and study the parameters which mainly influence root uptake. Transfer factors were highest in poor, acid soils and uptake was influenced mostly by the soil organic matter, calcium and potassium contents.
Albers BP, Steindl H, Schimmack W and Bunzl K. (2000). Chemosphere 41, 717-723	Soil-to-plant and plant-to-cow's milk transfer of radiocesium in alpine pastures: significance of seasonal variability.	alpine pasture	Cs-137	cow's milk	alpine soil	Fallout radiocesium studied in natural sites. Very large scattering of soil-to-plant transfer factors because of the presence of a large number of species and soil adhesion on the vegetation from trampling cattle. Seasonal effects were therefore only observable as a result of the large number of data. The aggregated soil-to-plant transfer factor for a typical alpine pasture was, on average, 0.002 +/- 0.001 m(2) kg(-1). The plant-to-milk transfer coefficient was, on average, 0.02 day/l. The Cs -137 concentration in the milk varied within the grazing period only between 1.4 and 2.9 Bq/l., with a significant maximum at the beginning of August.
Albini E., Mascaro L. and Belletti S. JR: Health Physics, 1990, v. 59(4), p. 455-460.	Measurement of Radiocesium Transfer to Milk and Calculation of Resulting Dose in Brescia, Italy, Following the Chernobyl Accident..	Italy.	^{134}Cs, ^{137}Cs.	Cow's diet, milk.		Values were obtained for Cs transfer coefficients for cow's diet-to-milk and diet-to-faeces.

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Alexakhin R., Firsakova S., Rauret G, Arkhipov N., Vandecasteele M., Ivanov Yu., Fesenko S. and Sanzharova N. Conf.: 1. international conference on 'The radiological consequences of the Chernobyl accident' Minsk, Belarus, 18-22 Mar 1996. INIS-BY--020 Proceedings of the first international conference 'The radiological consequences of the Chernobyl accident', Luxembourg, 1996, 1192 p., p. 39-47.	Fluxes of Radionuclides in Agricultural Environments: Main Results and still unsolved Problems.	Belarus, Ukraine.	^{137}Cs.	Grain, potato, hay, milk, meat.		The influence of the factors on the Cs 137 fluxes in the main agricultural ecosystems of the Chernobyl accident zone are quantitatively determined.
Amaral ECS., Paretzke HG., Campos MJ., Pires do Rio MA. and Franklin M. JR: Journal of Environmental Radioactivity, 1995, v. ^{29}(3), p. 237-255.	Transfer of ^{137}Cs from Soil to Chicken Meat and Eggs.		Cs-137	Soil, eggs.		The distribution and biological half-lives of radiocaesium in poultry after prolonged ingestion of contaminated soil was studied. Based on these results, concentration ratios between egg components and chicken meat of different types from soil were determined. Concentration ratios ranged from 5·5 × 10-3 to 1·06 × 10-2 for whole consumable eggs, from 2·1 × 10-2 to 5·5 × 10-2 for meat and 1·1 × 10-2 to 3·1 × 10-2 for organs.
Andersson, I & Lönsjö, H. (1985). Institutionen för husdjurens utfodring och vård. Rapport 150. (1985). Swedish version.	Konsekvenser för enskilda lantbruksföretag i händelse av en kärnkraftolycka. Fallstudier av två enskilda gårdar i närheten av Barsebäcks och Ringhalsverken.	Case studies on two farms near Barsebäck and Ringhals, with different production conditions. Sweden.	Simulated deposition of Cs-137, 1MBq/hectare.	Crop and animal products on the two farms.	The situation some years after a nuclear accident.	Based on production data of the farms, estimates of the annual transfer of Cs-137 to crop and animal products and of internal radiation doses per person on the farms. Effects of countermeasures, fertilisation and soil managements, are discussed. Total transfer, MBq, internal radiation dose, mSv to crop and animal products.
Andersson, I. Lönsjö, H. Rosén, K. (2001) Journal of Environmental Radioactivity. Volume 52, Issue 1, January 2001, P. 45-66	Long-term studies on transfer of ^{137}Cs from soil to vegetation and to grazing lambs in a mountain area in Northern Sweden	Sweden.	Cs-137.			A model predicting plant uptake of radiocaesium based on soil characteristics is described. Three soil parameters required to determine radiocaesium bioavailability in soils are estimated in the model: the labile caesium distribution coefficient (kdl), K+
Angeletti; Livio Levi; Emilio Report: Jul 1977. 36 p CEA-R--4860.	A comparative study of transfer factors of water, iodine and strontium on rye-grass and clover. Development of a model of evaluation of the limits of foliar contamination by wet deposit. Etude comparative des fac-	France.	^{131}I, ^{85}Sr.	Clover, rye.		Transfer factors of water, iodine ^{131}I and strontium ^{85}Sr on above-ground parts of rye-grass and clover were determined as a function of aspersion intensities. An analysis of the results showed the effect of aspersion intensities, nature of the chemical element and plant species on the values of transfer factors of iodine and strontium. It also made it possible to propose a simple method of evaluation

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	teurs de transfert de l'eau, de l'iode et du strontium sur le ray-grass et le trefle. Proposition d'un modele d'evaluation des limites de la contamination foliaire par le depot humide. In French.					of contamination limits of the aerial parts of plants by wet deposit, based on transfer values of water on plants only
Artner, C. Gerzabek, M.H. Horak, O. Muech, K. Report: OEFZS--4581, May 1991, 9 p.	Investigations on ^{137}Cs and ^{90}Sr soil-to-plant transfer from soils contaminated by Chernobyl fallout. Ermittlung praxisbezogener Transferfaktoren fuer ^{137}Cs und 90Sr aus dem Fallout des Reaktorunfalles in Tschernobyl. In German.	Austria.	^{137}Cs, ^{90}Sr.	Plants.	Soils.	Radiological models use transfer factors to describe the movement of radionuclides in ecosystems. The soil-to-plant transfer value: TF = (Bq/kg plant-fresh weight)/(Bq/kg soil-dry weight). The highest mean ^{137}Cs-transfer values were obtained for straw of cereals. In most cases ^{90}Sr-transfer was one order of magnitude higher than the ^{137}Cs-transfer. ^{90}Sr showed a significantly lower mobility in the investigated plants as compared to ^{137}Cs.
Ashworth F.M., Prime D. and Clark J.S. In Book (Conf.): 4. International Symposium on Radiation Protection - Theori and Practice. Malvern (UK), 4-9 Jun 1989. Goldfinch, E.P., Proceedings…, 1989, 511p. p201-204.	The Concentration and Movement of Chernobyl Radionuclides in North Wales.	England. North Wales.	Cs-134, Cs-137.	Fungi, lichen, moss, grass, fern, tree leaves.	Soil. Weathering; organic matter; soil profile.	The movement both down the soil profile and into vegetation has been investigated. Findings indicate a lack of penetration below root depth and high levels of ^{137}Cs persisting in vegetation where soils contain a high percent of organic matter. Tables for ^{137}Cs and ^{134}Cs according to soil depth are presented. Weatherings through time are given in graphs.
Askbrant S. and Sandalls J. JR: Journal of Environmental Radioactivity, 1998, v. 38(1), p. 85-95.	Root Uptake of ^{137}Cs and ^{90}Sr by Rye-grass on Various Soils in the CIS.	Chernobyl zone.	Radio-isotopes of Cs, Sr and others.	Rye-grass		During 1992 caesium-137 and ^{90}Sr were measured in samples of rye-grass and on five soddy podsolic mineral soils. The concentration ratio (CR) (Bq kg-1 dw rye-grass/Bq kg^{-1} dry soil to 10 cm) for ^{90}Sr always exceeded that for ^{137}Cs but on one peaty soil, the CR for ^{137}Cs exceeded that for ^{90}Sr. On a second peaty soil, both CRs were small and probably very similar. The CRs for ^{137}Cs on the mineral soils ranged from 0.05 to 0.39 and from 0.65 to 0.90 for ^{90}Sr. On the peat soils, the ranges were 0.05 to 0.76 and 0.11 to 0.38, respectively. On the mineral soils, the lowest values of CR were found at a site still heavily contaminated with fuel particles at the time of sampling.
Assimakopoulos P.A., Ioannides K.G., Pakou A.A., Lolis D., Zikopoulos K. and Dusias B.	Radiocesium Levels Measured in Breast Milk One Year after Reactor Accident at	Greece.	^{134}Cs, ^{137}Cs.	Staple food (bread, milk, meat, apples),		With a mean contamination concentration of 16.4 Bq L^{-1} the corresponding transfer coefficient was calculated with a value of

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JR: Health Physics, 1989, v. 56(1), p. 103-106.	Chernobyl.			mother's milk.		$fm = 0.06 \pm 0.03$ d L^{-1}.
Assimakopoulos PA., Ioannides KG., Pakou AA. and Mantzios A. JR: Health Physics, 1987, v. 53(6), p. 685-689.	Measurement of the Transfer Coefficient for Radiocesium Transport from a Sheep's Diet to its Milk.	Greece.	^{134}Cs, ^{137}Cs.	Grass, milk.		A daily radiocesium intake was 832 Bq per day per animal. The transfer coefficient, describing the steady-state equilibrium in this model, was measured as $fm = 0.058 \pm 0.007$ d L^{-1}.
Assimakopoulos, P.A.; Ioannides, K.G.; Karamanis D.T., Pakou, A.A. Stamoulis K.C., Mantzios A.G. and Nikolaou E. JR: Journal of Environmental Radioactivity, 1994, V. 22, p. 63-75.	Variation of the Transfer Coefficient for Radiocaesium Transport to Sheep's Milk During a Complete Lactation Period.	Greece.	^{137}Cs, ^{134}Cs.	Grass, milk.		Values of transfer coefficients are given in tables and graphs.
Attwood, C.; Fayers, C.; Mayall, A.; Brown, J.; Simmonds, J.R. Report: IAEA-TECDOC--904 IAEA, Validation of models using Chernobyl fallout data from southern Finland. Scenario S, (VAMP). Sep 1996, 483 p., p. 199-236.	FARMLAND: Model description and evaluation of model performance. (Food Activity from Radionuclide Movement on Land).	Finland. Simulation.	^{131}I, ^{137}Cs, ^{90}Sr.	Crops, vegetables, milk, meat.	Simulated input.	The FARMLAND model can be used to predict activity concentrations in food as a function of time. The effect of deposition at different times of the year can be taken into account. FARMLAND contains a suite of models which simulate radionuclide transfer through different parts of the food chain. The main foods considered are green vegetables, grain products, root vegetables, milk, meat from cattle and meat from sheep. Isotopes of caesium, strontium and iodine are treated in greatest detail.
Auraldsson, H.-Å., Ekman, L., Eriksson, Å & Greiitz, U. (1971). Försvarets Forskningsanstalt, FOA 4 C-4473-A3.	Residual radioactivity on pasture available for cows after a previous short grazing period.	Experimental animal and pasture field station at Kungsängen, SLU, Uppsala. Sweden.	Spraying of I-131 and Sr-85 on pasture surface.	Grass and milk.	Residual transfer of I-131 and Sr-85 to grass and milk a 2nd time, 5 weeks after initial deposition.	Relative conc. of I-131 and Sr-85 in milk the second time compared to 1st time was 5.3% and 4.0 % respectively. Correspondingly the relative conc. in grass was 5.2% and 3.9%. All activity values were dated back to the date of deposition
Auraldsson, H.-Å., Ekman, L., Eriksson, Å. & Greiitz, U. (1970). Försvarets Forskningsanstalt, Rapport FOA 4 C4445-28.	Transfer of radiostrontium from pasture to milk.	Experimental animal and pasture field station at Kungsängen, SLU, and Uppsala. Sweden.	Sr-85 in water solutions were spread onto the surface of pasture.	Pasture grass.	Grazing period.	Initial deposition of Sr-85 on grass land, 1 uCi/m2, gave about 0.03 µCi/ l milk from grazing cows. About 40 % of deposited Sr-85 was retained on edible herbage consumed by the cows. µCi/m^2 pasture surface and µCi/l cow milk.
Auraldsson, H.-Å., Ekman, L., Eriksson, Å. & Greiitz, U. (1970). Försvarets Forskningsanstalt, Rapport FOA 4 C4478-A3.	A simultaneous study on the transfer of radioiodine from pasture to milk and from a single oral intake to milk.	Experimental animal and pasture field station at Kungsängen, SLU, Uppsala. Sweden.	I-125 and I-131 in water solutions spread onto the surface of pasture, which was grazed by cows.	Grass and milk.	Grazing period of early June 1970.	2 % of I-131 deposited was consumed by grazing cows. This transfer was lower than before or 6 %, which was attributed to later stage of grass shooting. About 60 % of iodine disappeared during 18 hours after deposition and 6 % more on three days.

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Auraldsson, H.Å., Ekman, L., Eriksson, Å. & Greiitz, U. (1970). Försvarets Forskninganstalt, Rapport FOA 4 C-4458-28.	Further Experimental Studies on the Transfer of Radioiodine from Pasture to Milk.	Experimental animal and pasture field station at Kungsängen, SLU, Uppsala. Sweden.	Deposition of I-131 on surface pasture and transfer to milk by oral dose of grass to cows.	Pasture grass and cow milk.	Grazing period.	The ratio of deposited I-131, $\mu Ci/m^2$, to peak concentration in milk, µCi/l, was about 50. Of deposited I-131 about 6 % was retained on edible herbage compared to 40 % for Sr-85. nCi Cs-137/kg d.w. and pCi/l milk
Auraldsson, H.Å., Ekman, L., Eriksson, Å. & Greitz, U. (1970). Försvarets Forskningsanstalt, FOA 4 C-4503-A3.	Transfer of Simulated Fall-out-Particles from Pasture to Grazing Dairy Cattle. 1. Introductory Experiments with Wet Deposited 100-20 mm Particles.	Experimental animal and pasture field station at Kungsängen, SLU, Uppsala. Sweden.	Sand particles labelled with La-140 were distributed on grass or given to cows.	Grass and milk.	Grazing period.	Fraction of deposition ingested by cows was assessed by assay of radioactivity in faeces. It was found to be about 20 %. Differently designed experiments gave similar results. Compare Greitz, U., Ekman, L.& Eriksson, Å. (1974).
Balonov M.I. Book (Conf.), 25. Annual meeting of Fachverband fuer Strahlenschutz e. V. (FS): Environmental radioactivity, radioecology, radiation effects. Bin auf Ruegen (Germany). 28-30 Sep. 1993, p. 554-560.	Consequences of the Chernobyl accident as the basis for development of ecological and dosimetric models.	Contaminated regions of Russia. Germany.	^{134}Cs, ^{137}Cs and ^{90}Sr.	Vegetation and food.	Different agrochemical characteristics and types of soil.	The transfer factor from soil to vegetation and to food ration of man for Cs-134 and Cs-137 decreases with the half-period of 1 to 1.5 years and depends on soil type and agrochemical characteristics.
Ban-nai, T., Muramutsu, Y,; Yanagisawa, K. JR: Journal of Radioanalytical and Nuclear Chemistry, Sep. 1999, v. 241 (3), p. 529-531.	Transfer of some selected radionuclides (Cs, Sr, Mn, Co, Zn, and Ce) from soil to root vegetables.	Japan. Radiotracer experiments.	^{137}Cs, ^{90}Sr, ^{60}Co, ^{54}Mn, ^{65}Zn and ^{141}Ce.	Root vegetables (radish, carrot and turnip).	Andosol - a typical soil type in Japan.	The averages of Tfs of ^{137}Cs and ^{90}Sr for edible parts of the three vegetables were 0.02 and 0.14 (Bq/g fr.w.plant / Bq/g dry w.soil). Noticed that Tfs for edible parts of root vegetables were markedly lower than those for leaf vegetables.
Ban-nai, Tadaaki; Muramutsu, Yasuyuki; Yanagisawa, Kei JR: Journal of Radiation Research, 1995	Transfer factors of some selected radionuclides (radioactive Cs, Sr, Mn, Co, and Zn) from soil to leaf vegetables.	Japan	Cs and Sr	Vegetables: cabbage, Chinese cabbage, komatsuma, spinach and lettuce.	Experiments on Andosol as a representative of Japanese soils	Transfer factors for Cs and Sr for edible parts of vegetables were 0.11 and 0.24. Tf of Sr was higher for older (outer) leaves than younger ones.
Ban-nai, Tadaaki; Muramutsu, Yasuyuki; Yoshida, Satoshi, Yanagisawa, Kei Conf: Nuclear cross-over research international workshop on improvement of environmental transfer models and parameters, Tokio, 5-6 Feb.1996 Available from Japan Atomic Industrial Forum, Inc	Studies on the transfer of Cs, Sr, Co, Mn and Zn from soil to plants and from medium to mushrooms by using radiotracer.	Japan	Cs and Sr	Vegetables: cabbage, Chinese cabbage, komatsuma, spinach and lettuce and different kinds of mushrooms.		Transfer factors for Cs and Sr for edible parts of vegetables were 0.11 and 0.24. TF of Sr was higher for older (outer) leaves than younger ones.
Becker, A.; Biesold, H.; Handge, P. Report: Schriftenreihe Reaktorsicherheit und Strahlenschutz.	Analysis of radioiodine transfer via the air-grass-cow-milk pathway.	Germany.	I-131.	Animal feeds, plants, milk.		The transfer factors air/pasture vegetation, pasture vegetation/milk and air/milk are calculated.

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Ergebnisberichte, Untersuchungen, Studien, Gutachten, 1988, 52 p. BMU--1988-181; GRS-A--1397	Analysen ueber den Transfer von Radiojod ueber den Luft-Wiede-Kuh-Milch-Pfad. In German.					
Beckmann, C.; Faas, C. Conf.: 27. Colloquium Spectroscopium Internationale (CSI) Presymposium on measurements of radionuclides after the Chernobyl accident. Bergen, Norway, 9-14 Jun 1991. JR: Analyst Mar 1992, v. 117(3), p. 525-527.	Radioactive contamination of soils in Lower Saxony, Germany, after the Chernobyl accident.	Germany, Saxony.	^{137}Cs.		Different soil parameters, seasonal and weather variations.	The vertical distribution patterns of caesium are dependent on the different physico-chemical soil properties. The maximum gamma-activity for ^{137}Cs of 33.3 kBq m^{-2} was found in a depth range of 0-20 cm (January 1, 1989). This was correlated with areas that had received heavy rainfall on May 4, 1986. On January 1, 1989 approximately 60% of the Chernobyl caesium was still in the top 0-2 cm of the topsoil.
Belli M., Blasi M., Borgia A., Poggi M., Sansone U., Menegon S. and Nazzi P. Book (Conf.): 4. Cadarache international Symposium on Radioecology. Cadarache (France). 14-18 Mar 1988. Vol. 2. Cadarache (France). Section Documentation - CEN/Cadarache. p. E144- E153.	First Results of a Radiological Research on the Agricultural Environment on the North-Eastern Region of Italy (Friuli-Venezia Giulia).	Italy.	Cs-137.	Maize.	Clay, loam, gravel, sand/clay, clay/loam.	The ^{137}Cs transfer factors relative to dry and wet maize weight are given according to soil, planting and harvesting date and plant parts in table. The values range between 0.028 and 0.17 with a mean of 0,075 and a standard deviation of 0,048.
Belli M., Sansone U., Piasentier E., Capra E., Drigo A. and Menegon S. JR: Journal of Environmental Radioactivity, 1993, V. 21, p. 1-8.	^{137}Cs Transfer Coefficients from Fodder to Cow Milk.	Italy.	^{137}Cs.	Grass, milk.		Mean values of transfer factors from feed-to-milk for ^{137}Cs are given in tables for different parts of country.
Beresford N. A., Gashchak S., Lasarev N, Arkhipov A., Chyorny Y., Astasheva N., Arkhipov N., Mayes R. W., Howard B. J., Baglay G., Loginova L. and Burov N. JR: Journal of Environmental Radioactivity, 2000, v. 47, p. 157-170.	The transfer of ^{137}Cs and ^{90}Sr to dairy cattle fed fresh herbage collected 3.5 km from the Chernobyl nuclear power plant.		^{137}Cs, ^{90}Sr	Pasture, milk, faeces, soil.		TF.
Beresford NA., Mayes RW., MacEachern PJ., Dodd BA. and Lamb CS. JR: Journal of Environmental Radioactivity, 1999, v. 44(1), p. 43-54.	The effectiveness of alginates to reduce the transfer of radiostrontium to the milk of dairy goats.	UK.	Cs-137.			In the event of a nuclear accident the radiation dose to human populations arising from radiostrontium ingested as contaminated milk is a major cause of concern. We report a study to determine if calcium alginate incorporated into the diet can be used as an

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						effective countermeasure to reduce radiostrontium transfer to the milk of dairy goats. When Ca-alginate was included into a pelleted ration at 5% dry weight the transfer of radiostrontium to the milk of the goats was reduced by approximately 50%.
Bergeijk, K.E., van; Noordjik, H.; Lembrechts, J.; Frissel, M.J. JR: Journal of Environmental Radioactivity, 1992, v. 15, p. 265-276.	Influence of pH, soil type and soil organic matter content on soil-to-plant transfer of radiocesium and strontium as analyzed by a nonparametric method.	Netherlands.	^{134}Cs, ^{137}Cs, ^{85}Sr, ^{89}Sr and ^{90}Sr.	Edible plant parts.	Sand, clay and loam with different organic matter contents.	Transfer of Cs in clay or loam was lower than in sand by five or three times. For Sr the transfer in clay or loam was about 1.4 times lower than in sand.
Bertilsson, J., Andersson, I. & Johanson, K.J. (1988). Health Physics, 55, 855-862.	Feeding green cut forage contaminated by radioactive fallout to dairy cows.	Sweden.	Cs-137.			Based on production data of the farms, estimates of the annual transfer of Cs-137 to crop and animal products and of internal radiation doses per person on the farms. Effects of countermeasures, fertilisation and soil managements, are discussed.
Berzero, A., Borroni, P.A., Oddone, M., Crespi, V.C., Genova, N., Meloni, S. Conf.: 27. Colloquium Spectroscopium Internationale (CSI) Presymposium on measurements of radionuclides after the Chernobyl accident. Bergen, Norway, 9-14 Jun 1991. JR: Analyst Mar 1992, v. 117(3), p. 533-537.	Distribution of radionuclides in the environment in Northern Italy after the Chernobyl accident.	Northern Italy.	^{137}Cs.	Grass, vegetables, milk.	Different soil parameters, time distributions.	An environmental radioactivity monitoring programme in which several matrices such as soil, grass, vegetables and cows' milk was carried out. The radioactivity distribution and its variation with time is presented, discussed and compared with other available data. Detection limits, precision and accuracy are also reported, and depth profiles in soils for ^{137}Cs are presented and correlated with soil quality parameters.
Biesold, H.; Handge, P. Report: GRS--75 Dec. 1989, 59 p.	Compilation of transfer factors and ecological parameters for calculation of radionuclide transport through food chains. Zusammenstellung von Transferfaktoren und oecologischen Parametern zur Berechung des Radionuklidtransports durch Nahrungshetten. In German.	Germany. Summary for Guidelines.	Different radionuclides.	Animal feeds, meat, milk, plants.		In connection with establishing administrative guidelines the transfer factors for soil-plant, feed-milk, and feed-meat are summarized. Individual results of national and international studies were taken into account. For ecological parameters such as yield, growth time, storage time, and the crops' water and carbon content, national statistics and handbooks of agricultural practice were used.
Boikat, U.; Koehler, W.; Khostravi, A. Conf: 12. Annual meeting on radioactivity and environment.	Studies of the soil -> plant transfer of cesium on permanent pastures. Untersuchungen zum Caesi-	Germany. Simulation on fallout measurements.	Cesium.	Plants.	Marshy soils.	Based on pot experiments (^{134}Cs) and fallout measurements for marshy soils. Transfer coefficient estimated is higher by a factor of 10-20 as compared to the calculations of the German Commis-

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Norderney, Germany F.R. 2-8 Oct. 1978. INIS-mf--5840.	um-Transfer Boden -> Pfllanze auf Daerweiden. In German.					sion on Radiological Protection. The authors demand exact determination and documentation of the types of plants, period of growth, and environmental parameters for future measurements.
Bonka H., Kreh R. Book (Conf.): 25. Annual meeting of Fachverband fuer Strahlenschutz e.V. (FS): Environmental radioactivity, radioecology, radiation effects. Binz auf Ruegen (Germany), 28-30 Sep 1993, p.750-755. FS--93-67-T	Changes of the Specific Cs-activity in Plants, Honey and Venison in Aachen after 1986. Veraänderung der Spezifischen Cs-aktivität in Pflanzen, Honig und Wildfleisch nach 1986 in Aachen. In German.	Germany.	^{137}Cs.	Plants, honey, meat.		This report deals with the long-term changes. Table of transfer factors of ^{134}Cs and ^{137}Cs are given in tables.
Bonka, H. Book (Conf.): 15. Regional congress of the International Radiation Protection Association (IRPA) on the radioecology of natural and artificial radionuclides. Visby, Sweden, 10-14 Sep 1989 FS--89-48-T; Feldt, W. (ed.), The radioecology of natural and artificial radionuclides. Proceedings. Koeln (Germany, F.R.); 1989, 609 p., p. 147-152.	Measured radioecological parameters after the Chernobyl accident.	Germany.	^{131}I and ^{137}Cs.	Plants, meat, milk.		After the Chernobyl accident the radioactivity in the environment in Aachen was measured in detail. The change of the different radionuclies in the ecosystem made it possible to obtain radioecological parameters especially for iodine and caesium. The most important data obtained like deposition velocity, washout coefficient, retention factor, removal rate constant, and transfer factor food-milk, food-beef, and soil-grass are reported.
Bonka, H.; Köster, G.; Kuppers, J. In Book (Conf.): 4. International Symposium on Radiation Protection - Theori and Practice. Malvern (UK), 4-9 Jun 1989. Goldfinch, E.P., Proceedings…, 1989, 511p. p341-346.	Transfer in milk, meat and grass obtained by the post Chernobyl measurements.	Germany. Field data.	I-131, Cs-137.	Grass, milk, meat.		The radioactivity measurements after the Chernobyl accident allowed in a unique way to study the transfer factor food-milk for I-131; food-meat and soil-grass for Cs-137. Values are given in Figures.
Borzilov V.A. and Klepikova N.V. In Book: Merwin, S.E.; Balonov, M.I. (eds.) The Chernobyl papers. Volume1. Doses to the Soviet population and early health effects studies. Richland, WA (USA). Research Enterprises.1993, p. 47-68.	Effects of Meteorological Conditions and Release Composition on Radionuclide Deposition after The Chernobyl Accident.	Russia.	^{137}Cs, ^{90}Sr, ^{131}I, ^{239,240}Pu.		Meteorological conditions.	Physico-mathematical modelling of the atmospheric transport and dispersion of radionuclides released during the Chernobyl accident. The results of computer simulations agree with actual measurements of radionuclide surface contamination both within 30-km zone around the Chernobyl reactor and at remote distances.
Bretthauer E.W., Mullen A.L. and Moghissi A.A. JR: Health Physics, Mar. 1972, v. 22, p. 257-260.	Milk Transfer Comparisons of Different Chemical Forms of Radioiodine.	USA.	Radio-iodine.			Ion-exchange analysis indicated that, regardless of the chemical form administered, 97% of the iodine in the milk was inorganic.

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Bruk G.Y., Shutov VN. Balonov MI., Basalayeva LN., Kislov MV. JR: Radiation Protection Dosimetry, 1998, v. 76(3), p. 169-178.	Dynamics of ^{137}Cs Contents in Agricultural Food Products Produced in Regions of Russia Contaminated After the Chernobyl Accident.	Chernobyl zone.	Cs-137.			TF from soil to milk and potatoes.
Bunzl K., Kracke W. JR: Science of the Total Environment May 1987, v. 63, p. 111-124.	Soil to plant transfer of $^{239+240}$Pu, ^{238}Pu, ^{241}Am, ^{137}Cs and ^{90}Sr from global fallout in flour and bran from wheat, rye, barley and oats, as obtained by field measurements.	Netherlands.	^{241}Am, ^{137}Cs, ^{239}Pu, ^{240}Pu, ^{90}Sr.	Wheat, rye, barley and oats, flour, bran, cereals.	Soils.	The soil-to-plant transfer factors of $^{239+240}$Pu for wheat, rye and barley flour were between 0.00026 and 0.00078 (oats 0.017) and for bran between 0.0048 and 0.02 (oats 0.014). For ^{241}Am the corresponding values were somewhat lower. For the wheat, rye and barley flour the transfer factors of ^{137}Cs were between 0.013 and 0.018 (oats 0.069) and, for the bran, between 0.08 and 0.10 (oats 0.16). The corresponding values for ^{90}Sr were significantly higher: for flour between 0.08 and 0.14 (oats 1.2) and for bran between 0.62 and 0.93 (oats 1.5).
Bunzl K., Albers BP., Schimmack W., Belli M., Ciuffo L. and Menegon S. JR: Journal of Environmental Radioactivity, 1998, v. 48(2), p. 145-158.	Examination of a relationship between ^{137}Cs concentrations in soils and plants from alpine pastures.	Germany, Italy.	Cs-137.			An essential prerequisite of the soil/plant transfer factor concept is the presence of a statistically significant relationship between the contents of a given radionuclide in the soil and plant. The resu^lts^ showed that increased plant ^{137}Cs concentrations were not significantly ^as^sociated with increased soil ^{137}Cs contents. The relation between potassium and radiocesium revealed a very strong b^ut^ negat^ive^ correlation between ^{40}K and ^{137}Cs in the plants.
Carini F. JR: Journal of Environmental Radioactivity, 1999, v. 46, p. 77-97.	Radionuclides in Plants bearing fruit: an overview.					TF.
Carini, F. (2001) Journal of Environmental Radioactivity Volume 52, Issue 2-3, January 2001, P. 237-279	Radionuclide transfer from soil to fruit	Europe.	caesium, strontium, plutonium and americium	in fruit plants		Studies were made during 1990-1997 on the transfer of Cs-137 from soil to vegetation (herbage) and to grazing lambs on a mountain farm with an uncultivated grazing area of about 10 km2. The farm is situated in an area in Northern Sweden.
Castren, O. Report, Studies on environmental radioactivity in Finland 1971-1975, Annual report, STL-A--21, Feb. 1977, p. 73-76.	UNSCEAR transfer coefficients P_{23} (milk and P_{234} for ^{90}Sr and ^{137}Cs in Finland.	Finland. Simulation.	Cs-137, Sr-90.	Milk.	Estimation made for northern temperature zone.	The transfer coefficients from deposition to milk (P_{23}) and from deposition to human body (P_{234}) were calculated on bases of results of the survey programs in Finland and compared with the UNSCEAR estimates for the northern temperature zone.
Castren, O.; Paakkola, O.; Rantavaara, A.	Radioactivity in Finnish milk. In Finnish.	Finland.	Cesium 137, strontium 90.	Milk.		Paper gives results of the country-wide survey of strontium-90 and cesium-137 levels in milk in

Author/Source	Publication name	Site	Deposition	Product(s)	Soil, season	Abstract
Report: Studies on environmental radioactivity in Finland 1971-1975, Annual report, Feb. 1977, p. 41-64. STL-A--21						Finland. The annual means weighted for production were calculated.
Cazzoli, S.; Lorenzelli, R.; Salvi, S.; Lamma, A.; Esposti, R.D.; Milani, U. Conf. (Book): Workshop on the transfer of radionuclides in natural and semi-natural environments, Desmet G. et al. (Ed.) Udine, Italy, 11-15 Sep. 1989. Elsevier Applied Science, 1990, p. 649-656.	Experimental measurements of the transfer factors of radioactive contaminations from soil to agricultural products following Chernobyl.	Italy. A hill-mountainous area.	Cs-137 and Cs-134.	Agricultural products, crops.		Study of transfer factors for Cs-137 and Cs-134 from soil to agricultural products.
Choi Y.H., Lee C.W., Kim S.R., Lee J.H., Jo J.S. (1998). Journal of Environmental Radioactivity Volume 39, Issue 2, 1 February 1998, P.183-198	Effect of application time of radionuclides on their root uptake by Chinese cabbage and radish - an interactive code for calculating concentrations of radionuclides in food products	Asia. Korea	Mn-54, Co-60, Sr-85, Cs-137	Chinese cabbage and radish,		Promising results were obtained using ammonium-ferric-hexacyano-ferrate (AFCF) as a countermeasure to reduce radiocaesium transfer rye-grass and clover grown on sandy soil and loamy soil was tested. As for rye-grass, ploughing was equally effective. TF Concentration in fresh plant at harvest (Bq /kg)// Applied activity decay-corrected to harvest (Bq/m^2)
Clooth G and Aumann D.C. JR: Journal of Environmental Radioactivity, 1990, v. 12, p. 97-119.	Environmental transfer Parameters and Radiological Impact of the Chernobyl Fallout In and Around Bonn (FRG).	Germany.	^{137}Cs, ^{134}Cs, ^{131}I.	Plants, milk.		Soil-to-plant concentration factors and transfer coefficients from feed to milk were determined. The F_m values (geometric means) were: for ^{134}Cs, 3.7*10-3 (d/l); for ^{137}Cs, 3.6*10-3 (d/l). For the1986 grazing season, an F_m value for ^{131}I was 4.2*10^{-3} (d/l).
Cojocariu T., Cutrubinis M., Turtureanu A. Report (Conf.): 28. annual meeting of the European Society for New Methods in Agricultural Research Annual meeting of the International Union of Radioecology (IUR) Working Group Soil-to-Plant Transfer Brno (Czech Republic), 26-29 Aug 1998, 202 p., p. 53. INIS-CZ—0022	^{137}Cs Soil- Wheat Plant Transfer in Greenhouse Conditions.	Romania.				TF.
Coughtrey, P.J. Report: EUR--12608	Radioactivity transfer to animal products.	UK.	^{241}Am, ^{134}Cs,^{137}Cs,	Animal feed, meat, milk, eggs.		Transfer factors derived after 100 d continuous intake and at equilibrium. Recommended transfer

Author/Source	Publication name	Site	Deposition	Product(s)	Soil, season	Abstract
1990, 151 p.			2^{39}Pu, ^{240}Pu, ^{103}Ru, ^{106}Ru, ^{89}Sr, ^{90}Sr.			factors for animal products in conditions of continuous discharge and models for application to field conditions after a nuclear accident are also presented. Transfer of caesium to animal products is more effective than that for the other elements. Transfer to meat of lamb, fattening pig, and chickens is generally more effective than that for other animals and other products.
Cristaldi, A., D'Arcangelo, E., Teradi, L.A., Mascanzoni, D., Mattei, T. & Van Axel Castelli, I. (1988). XIXth ESNA Conference (Ed. M. Gerzabek), 29 August - 2 September 1988, Vienna, Austria. Österreichisches Forschungszentrum Seibersorf, Report OEFZS-4489LA-210/89, pp. 274-282.	Chernobyl accident one year later: genetic damage and ^{137}Cs accumulation in wild rodents in Rome, Italy.	County of Gävle-borg, Sweden.				Micronucleus test showed based on the fact chromosome ruptures or mitosis anomalies in ertthro-blasters generate microonuclides in cells of rodents. There were differences in micronuclei frequences between animals from the fallout area and those from non-fallout districts.
Daburon F., Archimbaud Y., Cousi J., Fayart G., Hoffschir D., Chevallereau I., Le Creff H. and Gueguen L. JR: Journal of Environmental Radioactivity, 1991, v. 14, p. 73-84.	Radiocesium Transfer to Ewes Fed Contaminated Hay after Chernobyl Accident: Effects of Vermiculite and AFCF (Ammonium Ferricyanoferrate) as Countermeasures.	France.	^{137}Cs, ^{134}Cs.	Hay, milk.		The mean transfer coefficients to milk were 0.075 days litre^{-1}, and 0.11 days kg^{-1} to meat.
Delvaux B., Kruyts N., and Cremers A. (2000). Environ. Sci.Technol. 34. 1489-1493	Rhizospheric mobilization of radiocesium in soils.	Belgium, lab conditions	Cs-137.	Ryegrass	47 soil horizons from 17 pedons, forest and meadow ecosystems in various European countries. Contamination was either applied to the soil in solution, or the Cs was mixed in agar and formed a layer below the soil.	The soils varied in many properties (e.g clay 0.7 - 66%; organic carbon 0.1 -69%; CEC 1-112 cmolc /kg; pH 3.5 -7.8). The results showed that K depletion in the rhizosphere is a capital driving force in ^{137}Cs uptake, and that the soil radiocesium interception potential of the soil had a strong, negative correlation to the soil-plant uptake factor. Vermiculitic minerals and plant roots compete for radiocesium. Soil-plant transfer factors (g/g) using plant dry matter ranged linearly with radiocesium interception potential so that when RIP = 100, TF = ~0.2 g/g and when RIP = 1000, TF = ~1 g/g
Desmet, G.; Sinnaeve, J. Report: EUR--12550; 1992.	Evaluation of data on the transfer of radionuclides in the food chain post-Chernobyl action.	Europe. CEC.	Long-lived nuclides, ^{134}/^{137}Cs.	Plants, milk, meat, fish.	Soils, sediments, aquatic systems.	Impact of chemical speciation on the radionuclide transfer in soils and plants. Validation of soil-to-plant parameters.
Dreicer, M. and Klusek, C.S.	Transport of ^{131}I Trough the	USA,	I-131.	Grass, milk.		The time integrated activity was used to calculate a

Author/Source	Publication name	Site	Deposition	Product(s)	Soil, season	Abstract
JR: Journal of Environmental Radioactivity, 1988, v. 7, p. 201-207.	Grass-Cow-Milk Pathway at a Northeast US Dairy Following the Chernobyl Accident.	New Jersey.				milk transfer coefficient of 0.001d liter^{-1}.
Edvarson, K., Ekman, L., Eriksson, Å., Fredriksson, L. & Greitz, U. (1965). Försvarets Forskningsanstalt, FOA 4-4438-4623.	Studies on the Relationship Between ^{137}Cs Deposited on Pasture and Its Concentration in Milk.	Experimental animal and pasture field station at Kungsängen, SLU, Uppsala. Sweden.	Water solutions of 20 or 50 mCi I-131 were sprayed on pasture and grazed by cows.	Grass and milk.	Cultivated pasture on a clay soil.	About 10 % of I-131 deposited was consumed by the cows. The ratio between deposition of I-131 per unit area and the concentration in milk was about 10 %. pCi/m^2 of pasture and pCi/ l of milk.
Ehlken, S., Kirchner, G. Book (Conf.) 25. Annual meeting of Fachverband fuer Strahlenschutz e. V. (FS): Environmental radioactivity, radioecology, radiation effects. Binz auf Ruegen (Germany). 28-30 Sep. 1993, p.673-678.	Soil-to-grass transfer of ^{90}Sr, ^{134}Cs and ^{137}Cs in various soils in Northern Germany. Transfer von ^{90}Sr, ^{134}Cs und ^{137}Cs vom Boden in Gras auf Böden Norddeutschlands. In German.	Northern Germany.	^{90}Sr, ^{134}Cs and ^{137}Cs.	Grass plants.	Different soil matrix.	Differences in TFs between grass plants growing on different soils range up to a factor of about 100 for ^{137}Cs, but are less than one order of magnitude for ^{90}Sr. Nuclide concentrations in grass show marked seasonal trends. TFs soil-to-grass are presented in graphs.
Ehlken,S., Kirchner, G. JR: Journal of Environmental Radioactivity, 1996, v.33 (2), p.147-181.	Seasonal variations in soil-to-grass transfer of fallout strontium and cesium and of potassium in North German soils.	North German.	^{134}Cs, ^{137}Cs, ^{90}Sr and ^{40}K.	Grass plants.	Both mineral and organic soils. Seasonal fluctuations.	Tfs on different soils ranged up to a factor 100 for Cs, but were less than one order of magnitude for Sr. Tfs were higher if grass plants were cropped repeatedly.
Ekman, L., Eriksson, Å. & Greitz, U. (1973). Försvarets Forskningsanstalt, Rapport FOA 4 C 4573-A4	Transfer of simulated fallout particles from pasture to grazing dairy cattle. II. Experiments with wet deposited 43-60 and 100-200 um particles.	Experimental animal and pasture field station at Kungsängen, SLU, Uppsala. Sweden.	Silica sand particles labelled with La-140 and Ce-141.	Amounts of labelled particles consumed by cows as obtained by measurements of faeces.	Grazing period.	On average 18 (6-39) and 21 (6-27) % of the smaller and larger wet deposited particles was consumed by grazing cows. As investigated, it is very difficult to sample grass in a manner similar to the way cows graze.
Ekman, L., Eriksson, Å. & Greitz, U. (1973). Försvarets Forskningsanstalt, Rapport FOA 4 C 4573-A3.	Transfer of simulated fallout particles from pasture to grazing dairy cattle. III. Experiments with wet deposited 1 um and 100-200 um particles and dry deposited 100-200 um particles.	Experimental animal and pasture field station at Kungsängen, SLU, Uppsala. Sweden.	Silica sand particles labelled with La-140 and Ce-141.	Amounts of labelled particles consumed by cows as obtained by measurements of faeces.	Grazing period.	On average 15 (6-25) % of wet deposited particles was consumed by grazing cows. Retention of wet deposited 1 um particles (same as world wide fallout) was higher than of 100-200 um particles. Retention of dry deposited particles was 1-2 %.
Eriksson Å, Lönsjö H. and Karlström F. (1994). Inst. för radioekologi, Report SLU-REK-73.	Beräknade effekter av radioaktivt nedfall på jordbruksproduktionen i Sverige. II Jordbruksgrödornas förorening.	Estimates for Swedish conditions	Sr-90, Cs-137, Sr-89 and I-131, of 11.3, 14.7, 1920 and 14400 kBq per m^2 respectively.	Vegetative crops.	Soils in the different agricultural districts. Five depositions during the growth season were considered.	Caesium-contaminated soil was used as substrate for a pot experiment with cutting-derived plant of Salix viminalis. The total uptake of Cs-134 and Cs-137 was approximately 0.2 % of the caesium present in the soil. Almost 90 % of the assimilated caesium was found allocated in the roots. The total amount of the caesium in plants increased over time. From given depositions the nuclide contents and its changes with time in the products were calculated.

Author/Source	Publication name	Site	Deposition	Product(s)	Soil, season	Abstract
Eriksson Å. (1994). Inst. för radioekologi, Rapport SLU-REK-76.	A database model for calculations of the transfer of ^{90}Sr and ^{137}Cs in complex agricultural environments.	Estimates for Swedish conditions	Sr-90 and Cs-137.	All agricultural products were considered.		Summary in Eriksson & Andersson (1994) (Rapport SLU-REK-75.) Early fallout gave low contamination level of grass to be used as winter fodder. Pasturing in spring was delayed but no restrictions on the use of grain. Later fallouts caused increased restrictions especially in pasturing and preparations of winter fodder. Serious contamination of the grain crops could be expected from depositions in the early autumn and later. A new model.
Eriksson Å., Rosén K. & Haak E., (1998). Inst. för radioekologi. Rapport SLU-REK-80	Retention of simulated fallout nuclides in agricultural crops. I. Experiments on leys.	Field experimental station at Uppsala. Sweden.	Experimental depositions of the nuclides, Cs-134, Sr-85.	Grass crops.	Field plots with normal soils cultivated during the whole growth period.	In 1986 a large number of farms in Chernobyl-affected area in the county of Vasternorrland in northern Sweden were investigated for radiocaesium transfer to grass and cereal grain. The aim was to study the impact of soil and crop rotation on sensitivity Transfer factor and the seasonal influence of fallout time and development stage of the crops on the size of the nuclide transfer where studied.
Eriksson Å., Rosén K. and Haak E., (1998). Inst. för radioekologi, Rapport SLU-REK-81.	Retention of simulated fallout nuclides in agricultural crops. II. Deposition of Cs and Sr on grain crops.	Field experimental station at Uppsala. Sweden.	Experimental depositions of the nuclides, Cs-134, Sr-85.	The harvest products of seed crops, barley, summer wheat and peas.	Field plots with normal soils cultivated during the whole season.	Experiments with artificial wet depositions of Cs-134 and Sr-85 during the growth period were carried out. The studies are complementary to the experiences after the Chernobyl fallout. The aim was to get a description of the relative transfer to the harvest products of new clover-grass leys and old grass leys after initial depositions of tracer nuclides at different times during the growth period. The reduction in transfer with time, from deposition to sampling, depends partly on dilution by growth and partly on fall-off to the ground. The Reduction half-time for the nuclide content showed a range 10 - 14 days. The data obtained in the experiments can extend the basis for prediction of the consequences of fallout events at different times to new as well as to old leys in the field. Transfer factor and the seasonal influence of fallout time and development stage of the crops on the size of the nuclide transfer where studied.
Eriksson, Å. (1983). (Ed. Å. Eriksson). Inst. för Radioekologi, Rapport SLU-REK-55, pp. 111:1-	Resuspension och inandning av deponerat ^{137}Cs med jordbruksdamm. Långsiktiga	Estimates for Swedish conditions.	Cs-137.			The work aimed at an estimation of farmers' dose obtained by inhalation of Cs-137 resuspended after fallout on agricultural land. The deposition level

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26.	konsekvenser av radioaktiv beläggning i jordbruket i Malmöhus län					was assumed to be 1 MBq per square meter. Inhalation can occur of dust resuspended from contaminated soil, from harvest products drying and worked in the field or in the stables for feeding the animals. At an average farm 37 ha ploughed land with a staff of two people each person could obtain a dose by inhaled Cs-137 of about 2.5 microSv during the fallout year.
Eriksson, Å & Rosén, K. (2000). Kungl. Skogs- och Lantbruksakademiens Tidskrift. Årg. 139, Nr 5. pp 1-41. (In Swedish with English summary.)	Naturlig Radioaktivitet i Svenska odlade jordar och grödor.	Sweden.	K-40, Th-232, and Ra-226 (U-238, Pb-210)			Transfer factors of Cs-137 (Bq/g d.w.plant // Bq/g d.w. soil)
Eriksson, Å, & Rosén, K. (1992). Proceedings. Conference at Tromsö November 21-22, 1991. The radiological and radiation protection problems in Nordic regions. Ed. Baaril, J., Oslo, 1992. Tromsö, Norway, paper 4, pp 1-10.	Transfer of caesium on grassland after Chernobyl in the northern parts of Sweden and Implication for preparedness and counter actions.	Sweden.	Cs-137			The field experimental treatments were 0, 50, 100, and 200 kg K per ha. It was found that the highest annual transfer to grass, 4-10 % of the total deposition per unit area, occurred on permanent grasslands from one pasture on peat soil and from one pasture in the mountain district. The total transfer to arable crops from peat soil in control treatments was about 0.5 % of the total deposition. From the mineral soils the corresponding transfers were about 0.05 %. The potassium treatments were effective already on the 50 -100 kg level, although 200 kg K per ha gave the highest reduction in total caesium transfer with 60-80 % on grassland. The effect was observed already in the 1st cut. In the barley crops the potassium applications caused a relative reduction in caesium transfer to the same extent as on the grassland but on a lower absolute level. Among the vegetables, the order in caesium transfer to the crop took place in the order: Lettuce>Potatoes>Carrots>Leek. Transfer factors of Cs-137 (Bq/g d.w.plant // Bq/g d.w. soil)
Eriksson, Å. & Fredriksson, L. (1981). Inst. för Radiobiologi, Rapport SLU-IRB-52.	Naturlig radioaktivitet i mark och grödor.	50 provtagningsytor à ca 50 m2 i Västergötland, vissa med anknytning till Ranstad. Sweden.	Natural radiation from radionuclides of uranium, thorium radium, and potassium.	Plough layer and subsoil and cereal crops were sampled.	Mainly mineral soils.	Concentration ratios between nuclide contents in crops and soils and TF:s were established. Conc. ratios for thorium were not dependent on plant and soil characters, while those for uranium were. Ra/Ca-ratio in plant was dependent on Ra/Ca-ratio in upper soil.
Eriksson, Å. & Rosén, K. (1987). Proc. IUR Workshop Soil-Plant Transfer Factors, 13-16 April 1987,	Observations on the transfer of ^{137}Cs from soils to barley crops in Sweden after the	Sweden.				

Author/Source	Publication name	Site	Deposition	Product(s)	Soil, season	Abstract
Eggham, England, pp.	Chernobyl fallout in 1986.					
Eriksson, Å. & Rosén, K. (1987). Proc. Nordiska sällskapet för strålskydd, 26-28 August 1987, Mariehamn, Finland,	Överföring av nedfallscesium till fodergrödor och spannmål i Gävleborgs och Västernorrlands län 1986.	Sweden.	Cs-137.			Ett 70-tal olika gårdar i Tjernobyldrabbade områden har undersökts med avseende på deposition av cesium. Studien omfattar jord, spannmål och fodergrödor. Cesium överföring till fodergrödor har varit relativt liten och betydligt mindre till spannmålsgrödor Transferfaktorerna via upptag har varit höga för alla grödor, detta beroende på deposition och jordart. Transfer factors of Cs-137 (Bq/g d.w.plant // Bq/g d.w. soil)
Eriksson, Å. & Rosén, K. (1989). Nordisk Jordbruks-forsknings Förening (NJF) Proceedings. Seminar Nr 158. 21-23 augusti 1989. Beitostölen. NJF-utredning/RAPPORT Nr 59, Beitostölen, Norway, pp 40-45. (Oral presentations).	Chernobyl caesium in Swedish agricultural soils. In Deposition and Transfer of Radionuclides in Nordic Terrestric Environment.	Sweden.	Cs-137.			1987 startades 11 olika kaliumgödslingsförsök på olika jordtyper för att utröna effekten av olika gödselmedel.Försen har visat att mellan 0.8% till %% av deponerat cesium har tasgits upp av grödan. Ofta har cesium till 2:a skörd blivit något större än till 1:a skörd. Transfer factors of Cs-137 (Bq/g d.w.plant // Bq/g d.w. soil)
Eriksson, Å. & Rosén, K. (1989).The Radioecology of Natural and Artificial Radionuclides. Proceedings. Ed. W. Feldt, Verlag TÜV Rheinland GmbH, Köln. Visby, Sweden, pp 141-146.	Caesium transfer to agricultural crops for three years after Chernobyl.	Sweden.				In 1986 about 50 farms were selected for sampling at fixed sites of the soil surface layer and of the grassland and grain crops to come. It was found that the transfer level was much higher for the grassland than for the grain crops. On ploughed land the transfer by root uptake to grain crops was about one magnitude lower than the transfer to the grass crops. Transfer factors of Cs-137 (Bq/g d.w.plant // Bq/g d.w. soil)
Eriksson, Å. & Rosén, K. (1991). The Chernobyl fallout in Sweden. Results from a research programme on environmental radiology (Ed. L. Moberg). The Swedish Radiation Protection Institute, Stockholm, pp 291-304.	Transfer of caesium to hay grass and grain crops after Chernobyl.	Sweden.	Cs-137.			Cs-137-transfer was much higher to grass than to barley. Transfer to grass during the first year depends on interception capacity of plant cover and on dilution by growth, i.e. on soil fertility and fertilization. It decreased 2-10 times the following years. Transfer factors of Cs-137 (Bq/g d.w.plant // Bq/g d.w. soil)
Eriksson, Å. (1966). Unpublished?	Radioaktivt jod i atmosfäriskt nedfall och dess intag i livsmedelskedjan.		I-131			Review of literature, especially the entry of I-131 by milk to man after the bomb tests. Dose committed in 1962 was only 10 % of that for taking countermeasures.
Eriksson, Å. (1969). Inst. för Radiobiologi, Rapport RIRU-12.	Några markfaktorers inflytande på ^{137}Cs:s förhållande i jord och upptagning i växt.	Licentiat dissertation. Sweden.				Comprehensive literature review and discussion of how chemical and physical soil factors soil influence sorption, desorption, mobility and bioavailability of Cs-137 as exemplified by laboratory and pot experiments.
Eriksson, Å. (1970). Grundförbät-	Det radioaktiva nedfallet i	Sweden.		Crop and animal		The article gives the trend of the fallout after nu-

Author/Source	Publication name	Site	Deposition	Product(s)	Soil, season	Abstract
tring 23, 1970: Spec.nr. 5, 23-30.	marken.			products, and transfer to man.		clear weapon tests in 1961-62, and the resulting intake with food and accumulation of Sr-90 and Cs-137 in the body of man during the following years. curie and rad units.
Eriksson, Å. (1972). Försvarets Forskningsanstalt, Rapport FOA 4 C-4491-A4.	Plant Uptake of ^{137}Cs from Different Depths in a Homogeneous Subsoil Layer.	Microplot exp. at Uppsala-Näs field station. Sweden.	889 mCi/m^2 Cs-137 to different depths in the soil profile.	Grain of peas, white mustard, oats, barley and ley grass.	Normal vegetation period.	The relative uptake of Cs-137 decreased with depth, but varied with crop species. Root uptake of Cs-137 from the 7 cm depth decreased in the order: peas> white mustard>oats>ryegrass>barley. nCi/m^2/mCi/m^2.
Eriksson, Å. (1976). Inst. för Radiobiologi, Rapport SLU-IRB-33.	Studies on the Transport of the Fission Products Through the Food Chains. IV: On the Relationship Between ^{137}Cs in Fallout and ^{137}Cs in Grass and Milk.	Studies on ^{137}Cs fallout on 7 SLU-farms 1963-65 and on 3 private farms 1966-68 nearby Uppsala, Sweden.	Country wide bomb fallout in Sweden of Cs-137 in the early 60-ties	Grass and milk.	Survey on 7 SLU-farms and 3 other farms near Uppsala in 1963-67.	Mean TR, m^2/kg, for grass was 4 in 1963 and 3 in 1964 and 1965. Ratio, m^2/l, for milk varied with a factor of 4; range 0.05-0.1 kg/l. Highest value was on coarse and peaty soils, lowest on clayey soils. TRd, m^2/kg for grass and the ratio Bq/l/ Bq/m^2 = m^2/l for milk/grass
Eriksson, Å. (1977). Inst. för Radiobiologi, Rapport SLU-IRB-40.	Fissionsprodukter i svensk miljö.	Uppsala. Sweden.		Plant and animal products.		Fissionsprodukter i svensk miljö. Doctoral Dissertation. Comprehensive in depth treatment of agricultural radioecology on the base of lab, pot and microplot exp. and of extensive field surveys of bomb fallout.
Eriksson, Å. (1977). Inst. för Radiobiologi, Rapport SLU-IRB-42.	Direct Uptake by Vegetation of Deposited Materials. Retention of Nuclides and Simulated Fallout Particles in Pasture Grass. Inst. för Radiobiologi,	Experimental animal and pasture field station at Kungsängen, SLU, Uppsala. Sweden.	Wet material, ions and particles, was deposited with droplets of a simulated precipitation of 1 mm.	Pasture grass.	Clay soil/ vegetation period.	Interception and retention in grass of nuclides in ionic form and of labelled particles were studied. The interception on grass decreased in the order: wet-deposited nuclides > wet-deposited particles and smaller particle > larger particles. Bq/kg d.w./ Bq/m^2 = m^2/kg d.w.
Eriksson, Å. (1977). Inst. för Radiobiologi, Rapport SLU-IRB-46.	Transport av radioaktiva klyvningsprodukter från åker- och betesmark till husdjur och människa.	Uppsala. Sweden.				Transfer of Cs-137 and Sr-90 through food chains is investigated. On basis of field data, coefficients are calculated for transfer of Cs-137 to grain crops, pasture grass and milk. Transfer of both Cs-137 and Sr-90 through food chains is treated.
Eriksson, Å. (1978). Inst. för Radiobiologi, Rapport SLU-IRB-46.	Transport av radioaktiva klyvnings-produkter från åker- och betesmark till husdjur och människa.	Different sites in Sweden.		Plant and animal products		Summary of Dissertation, at SLU, Uppsala 1978. Compare SLU-IRB-40. Transfer factors derived in SLU-REK 40.
Eriksson, Å. (1979). Inst för Radiobiologi, Rapport SLU-IRB-47.	Jordbruksgrödors upptag av markdeponerad radiojod från olika jordtyper.	Exp. with 1 lysimeter, 4 micro plots and 2 field plots, all under field conditions. Sweden.		7 types of agricultural crops.	8 mineral soils during a vegetation period.	Accumulated, direct uptake from atmosphere and indirect uptake from soil of radioiodine were calculated for continuous deposition. Soil uptake contributed should not be neglected when estimating dose commitment for I-129 released to atmosphere.

Author/Source	Publication name	Site	Deposition	Product(s)	Soil, season	Abstract
Eriksson, Å. (1983). Commission of the European Communities, Vol. 1, Seminar on "The Transfer of Radioactive Materials in the Terrestrial Environment Subsequent to an Accidental Release to Atmosphere", 11-15 April 1983, Dublin, Ireland. Luxembourg, pp. 353-362.	Behaviour of ^{99}Tc in the environment as indicated by a five-year field lysimeter experiment.	Work based on Field experiments with artificial depositions of Tc-99 in soils from different parts of the country. Sweden.	Tc-99	Clover and wheat	Annual crops cultivated on 8 different soil types.	A seven year study on the plant uptake of Tc-99 from eight Swedish soils was carried out. The test crops were red clover for two years, then spring wheat for 3 years and red clover for another two year period. The high initial uptake was reduced rapidly during the first years. The availability half time was 0.1 years between the first and the second season and about 2.4 years at the end of the period calculated on the deposition at start. Extremely high root uptake. Transfer calculated as a ratio between Tc-content in plant dry matter and Tc-content in soil initially at deposition on dry weight basis. Cf. also Eriksson (1986).
Eriksson, Å. (1986). (Cf. Eriksson 1983). Inst. för Radioekologi, Rapport SLU-REK-61, pp 231-240.	Soil plant transfer of Tc-99 in a lysimeter experiment 1978-84. 1st International Contact Seminar in Radioecology 8-11 July 1985, Uppsala, Sweden.	Work based on Field experiments with artificial depositions of Cs-137 in soils from different parts of the country. Sweden.	Tc-99.	Clover and wheat.		A seven year study on the plant uptake of Tc-99 from eight Swedish soils was carried out. The test crops were red clover for two years, then spring wheat for 3 years and red clover for another two year period. The high initial uptake was reduced rapidly from the 1st year, when 39 % was found in the crop. Next year 8 % and in the 7th year about 1 % was found in the same type of crop. The transfer to the wheat crop was much lower than that to the clover. The environmental half-time seemed to range from 0.1 to about 2.4 years during the period of study. Accepting the figure 2.4 for the following years it can be estimated that within 10 years the uptake by fodder crops will be of the same size of order as that of Sr-90.
Eriksson, Å. (1986). (Eds. R. A. Bulman & J. R. Cooper). Elsevier Applied Science Publishers, London, pp. 121-127.	Speciation of fission and activation products in the environment	Work based on Field experiments with artificial depositions of Cs-137 in soils from different parts of the country. Sweden.	Pu-238.	Fodder crops. Clover for 1976-1979, wheat for 1980-1984.	Eight different soils from the main agricultural districts in Sweden.	A short description is given of the changes observed in the plant availability of Pu-238 in eight soils during a nine-year experimental period. With clover as test crop in the first period the plant uptake of Pu-238 was reduced with availability half-times ranging from 0.8 - to 2.= years. There were indications that the reduction in availability of Pu observed was reversible upon soil management that causes aeration and drying of the soil. Plant content, Bq Pu-238 and TFsp, based on the ratio Bq/kg dry w. of plant/Bq/kg dry soil, are given.
Eriksson, Å. (1986). Inst. för Radioek, Rapport SLU-REK-61, pp 101-113.	Lysimeter studies on the plant availability of transuranics in Swedish soils in 1976-84. Proc. 1st International Con-	Work based on Field experiments with artificial depositions of	Transuranic elements.	Clover and wheat.	Experiments over many years.	Experimental conditions are described for the three nuclides Pu-238, Np-237 and Am-241. It was found that with clover as test crop the uptake of Pu was reduced with time while the uptake of Np and

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	tact Seminar in Radioecology 8-11 July 1985, Uppsala, Sweden.	Cs-137 in soils from different parts of the country. Sweden.				Am was not reduced. Placing Pu at deeper horizon effectively reduced the uptake by plants. The relative uptake of Np was considerably higher than that of Pu and Am. Transfer expressed acc. to the equation TF=square meter of deposition found per kg dry matter of the crop.
Eriksson, Å. (1986). Proc. Int. Contact Seminar in Radioecology, Piazenca, Italia 9-11 Sept 1986.	Near the upper Limit for the Root Uptake of Cs-137.	Nine Chernobyl fallout sites in Sweden.	Variable with site.	Straw and grain of cereals.	8 organic and one mineral soil.	Uptake of Cs-137can be high in the short term situation. The uptake, however, largely depends on labile soil-K. The high availability of Cs-137 was due to placement in the sowing layer. Highest TC-value was close to limit for Swedish field conditions. kBq/kg d.w. and TC and TF as defined in the publication.
Eriksson, Å. (1986). Proc. Int. Contact Seminar in Radioecology, Piazenca, Talia, 9-11 Sept 1986.	Consequences in Sweden of the Chernobyl event: Agriculture.	Pasture microplots and survey of Chernobyl fallout sites in Sweden.	Variable with site.	Grass and cereal straw and grain.	Many soils.	Tables and figures showing distribution Cs-137 transfer grass and to cereal straw and grain are shown and discussed as effects of fertilisation on the transfer. kBq/kg d.w. and TC and TF as defined in the publication.
Eriksson, Å. (1987). Förraksledarmötet. Del 4, pp. 10.1 - 10.8. Uppsala.	Konsekvenserna av Tjernobyl för svenskt jordbruk: Följderna för åkermarkens och grödornas cesiuminnehåll.	Sweden	Chernobyl fallout			Chernobyl fallout caused for the society, and had impact on farming in C-, U-, X-, Y-, Z- and AC-counties. The fallout time, April, was favourable and caused low contamination of crops. Restriction of cow grazing existed on some places up to the end June.
Eriksson, Å. (1987). International Agrophysics, 3, 157-163.	A convenient method for determination of radium in environmental samples.	Analytical method developed in the laboratory for determination of small amounts of radium. Sweden.	Ra-226			A methodological study for determination of Ra-226 by Rn-222.
Eriksson, Å. (1987). Rapport Allmänt 108. SLU Konsulentavdelningen	Konsekvenserna av Tjernobyl för svensk jordbruk: Följderna för åkermarkens och grödornas cesiuminnehåll.	Uppsala. Sweden.	Cs-137.			Radiocesiums uptag i olika grödor på olika jordtyper i olika distrikt efter Tjernobyl nedfallet.
Eriksson, Å. and Andersson, I. (1994). Inst. för radioekologi, Report SLU-REK-75.	Beräknade effekter av radioaktivt nedfall på jordbruksproduktionen i Sverige. III. Djurprodukternas förorening.	Estimates for Swedish conditions	Sr-90, Cs-137, Sr-89 and I-131.	Animal products were considered to be produced on local feeds.	Five depositions during the growth season were considered.	The work has given a new model for calculation of the long term situation in agricultural environments. The aim has been to facilitate the calculation procedures necessary after fallouts and to increase the possibilities to analyse the importance of alternative pathways of the nuclides. This may broaden the basis for discussion of appropriate remedial

Author/Source	Publication name	Site	Deposition	Product(s)	Soil, season	Abstract
						measures to be taken in contaminated agricultural systems. From a given deposition the nuclide content and its changes with time in the products was calculated.
Eriksson, Å. Haak, E. & Karlström, F. (1976). Inst. för Radiobiologi, Rapport SLU-IRB-32.	Studies on the Transport of Fission Products Through the Food Chains. III: Analysis of the Relationship Between Cs in Cereal Grain and Cs Deposited in 1964.	Grain samples from 840 farms in Sweden were sampled and analysed for Cs137 content. Sweden.	Fallout from bomb tests in the early 1960-ties.	Winter and spring sown cereals sampled in June, July and August 1964.	Mainly mineral soils.	Regression of Cs-137 content in grain on monthly Cs-137 deposition showed that in southern region the influence of deposition in June was larger than that in July. For other regions the influence of depositions in June and July was about the same.
Eriksson, Å., Johanson, K.J. & Lönsjö, H. (1990). Inst. för radioekologi, Rapport SLU-REK-65.	Livsmedelsproduktion efter kärnvapenkrig. Rapport över fallstudie utförd på uppdrag av Statens jordbruksnämnd.	Middle Swedish conditions.	Deposition 350-600 km from weapon detonations. Fallouts of Cs-137, Sr-90, Sr-89 and I-131 are considered.	The transfer to grass, cereals, meat and milk and doses to plants, animals and people are estimated.	District with clay soils. Different parts of the season.	Uptake of nuclides by barley in lysimeters was positively and negatively correlated with exchangeability and Kd-values determined in batch experiments of soils respectively.
Eriksson, Å., Lönsjö, H. & Rosén, K. (1988).Proceedings. IVth International Symposium of Radioecology, 14-18 March 1988, Chadarache, France, pp.	Transfer of cesium to grassland crops in the Chernobyl fallout areas in Sweden in 1986 and 1987.	Sweden.				
Fabbri S., Piva G., Sogni R., Fusconi G., Lusardi E. and Borasi G. JR: Health Physics, Mar. 1994, v. 66(4), p. 375-379.	Transfer kinetics and Coefficients of ^{90}Sr, ^{134}Cs, and ^{137}Cs from Forage Contaminated by Chernobyl Fallout to Milk of Cows.	Italy.	Cs-134, Cs-137, I-131.	Forage, milk		TFs were 0.0008 d L^{-1} for ^{90}Sr, 0.0029 d L^{-1} for ^{134}Cs, and 0.0031 d L^{-1} for ^{137}Cs.
Fesenko S.V., Spiridonov S. I., Sanzharova N. I. and Alexakhin R. M. JR: Journal of Environmental Radioactivity, 1997, v. 34(3), p. 287-313.	Dynamics of ^{137}Cs Bioavailability in a Soil-Plant System in Areas of the Chernobyl Nuclear Power Plant Accident Zone with a Different Physico-chemical Composition of Radioactive Fallout .	Chernobyl zone.	Radio-isotopes of Cs and Sr.			Based on a 6-year (1987-1992) observation period and a dynamic model describing the behaviour of radiocaesium in meadow ecosystems are presented. It has been shown that the type of deposition and soil characteristics are main factors that significantly affect (up to five times) the changes in bioavailability of this radionuclide in the soil-plant system. The rates of decrease of ^{137}Cs uptake by plants can differ by factor of 3-5, being dependent on soil properties. The effect of these factors depends on the time lapsed after the deposition.
Fesenko S.V., Colgan P.A., Sanzharova N.I., Lissianski K.B., Vazquez C. and Guardans R. JR: Radiation Protection Dosimetry	The Dynamics of the Transfer of Caesium-137 to Animal Fodder in Areas of Russia Affected by the Chernobyl	Russia.	^{137}Cs.	Grasses, maize, beets, milk and milk products.	Different soil types (sand, clay, peat).	The aggregated transfer factor (Bq.kg^{-1} per Bq.m^{-2}) was found to increase in the order fodder beet$<$maize$<$perennial grasses$<$natural grasses and decreased with increasing clay content in the soil.

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1997, v. 69(4), p. 289-298.	Accident and Doses Resulting from the Consumption of Milk and Milk Products.					Tables and graphs are presented.
Foerstel, H.; Goeres, W.; Steffens, W. Conf. (Book): 3. International symposium on radiological protection - advances in theory and practice. Inverness, Scotland, 6-11 June 1982.	Variation of the transfer factor soil-plant during the time of equilibrium after contamination with ^{90}Sr, ^{137}Cs, ^{60}Co and ^{54}Mn.	Germany	^{90}Sr, ^{137}Cs	Cereals	Two types of soil: parabraunerde and podsol.	Dependence of transfer factor soil/plant from type of soil and fertilization. The transfer factors in plants grown on podsol are much higher than in those grown on parabraunerde.
Forsberg, S. Rosén, K. Fernandez, V. Juhan, H. (2000). Journal of Environmental Radioactivity. Volume 50, Issue 3, September 2000, P. 235-252.	Migration of ^{137}Cs and ^{90}Sr in undisturbed soil profiles under controlled and close-to-real conditions	Europe.	Radiocaesium, Radiostrontium, Sr-90, Cs-137.		Soil types were loam, silt loam, sandy loam and loamy sand.	The study shows that there is a large variation depending on local conditions and crop type in the accumulation of natural radioactive elements by the plants. The result shows that the average contents of the nuclides ^{226}Ra and ^{232}Th, Bq per kg dry weight, is of the same size of order, 40, 50 and 80 Bq per kg in the southern, in the western and in the middle regions of Sweden, respectively. Considering also the daughters of the nuclide series it is found that the total nuclide activity will reach a sum of 300-600 kBq per square meter of the plough layer. Transfer factors of Cs-137 and Sr-90 (Bq/g d.w.plant // Bq/g d.w. soil)
Forsberg, S., Rosén, K. & Bréchignac, F. (2001). Journal of Environ. Radioactivity Vol. 54 No 2, pp 253-265.	Chemical availability of ^{137}Cs and ^{90}Sr in undisturbed lysimeter soils maintained under controlled and close-to-real conditions.	Europe.	Cs-137, Sr-90.		loam, silt loam, sandy loam and loamy sand, and were representatives of important European soil	The study was part of a larger project on radionuclide soil-plant interactions under well-defined conditions. Soil samples were taken from several depths in each soil in 1997 and 1998 and the samples were sequentially extracted with H2O, NH4Ac, NH2OH·HCl, H2O2 and HNO3. Extractability of Cs-137 decreased in the order: HNO3>Residual >NH4Ac>H2O2>NH2OH·HCl> H2O. More than 80% was found in the acid digestible or residual fractions, and 11¯17% in labile fractions. Soil type differences were small. Extractability of Sr-90 decreased in the order: NH4Ac>NH2OH·HCl>HNO3>H2O2 H2O. 31¯58% was found in easily available fractions. Differences between soil types were quite small. Transfer factors of Cs-137 and Sr-90 (Bq/g d.w.plant // Bq/g d.w. soil).
Franke, B. Ratka, R. Sand, H. van de. Report, Institut fuer Energie- und Umweltforschung e.V., Heidelberg	On the assessment of the radionuclide migration rate from the soil into plants. Contribution to partial study	Germany.	Cerium, cesium, cobalt, iodine, maganese, plutonium, ruthe-	Plants.	Soils.	The arithmetical values given in the recommendations of the Commission on Radiation Protection are subjected to a critical analysis as to their origin and comparability with experimental data from

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(Germany, F.R.), Oct 1978, 122 p.	26 of the model study 'Biblis, radiation and ecology'. rev. ed. Zur Abschaetzung des Transfers von Radionukliden aus dem Boden in Pflanzen. Beitrag zur Teilstudie 26 der Modellstudie Radiooekologie Biblis In German.		nium, strontium and other radioisotopes.			literature. The review of literature for the nuclides Co, Cs, Mn, Sr, and Zn revealed transfer factors varying over a range of several orders of magnitude. The major part of the studies indicates factors which are distinctly higher than the ones given by the Commission.
Fredriksson L. (1963) Försvarets Forskningsanstalt, Rapport FOA 4 A 4323-4623 (1963).	Plant Uptake of Fission Products Under Swedish Conditions. VI: A New Experimental Technique for Studies of Plant Absorption of Nutrients and Fission Products under Field Conditions.	Sweden.				A micro-plot experimental technique, suitable for tracer and fallout nuclide experimentation under field conditions was described. The micro-plots consisted of 0.25 m2 steel frames, which were filled with different plough layer soils and placed on in-situ clay subsoil and on constructed sandy subsoil down to 1 m depth. It is to be considered as a good approach to combine the high precision of pot experiments with field accuracy. Later it has been used to a large extent for soil-plant-transfer of Sr-90 and Cs-137.
Fredriksson, L, Eriksson, B. & Eriksson, Å. (1961). Försvarets Forskningsanstalt, Rapport A 4189-4623.	Studies on Plant Accumulation of Fission Products under Swedish Conditions. III. Accumulation of Sr-89 in the Aerial Parts of different Weed Species at varying Ca-level in soil.	Pot exp. in an open vegetation hall. 4.5 l Mischerlich pots. Sweden.	Not updated.	Vegetation of 8 weed species.	An acid podsolised sandy soil to which 4 lime treatments was employed.	Liming effectively decreased Sr-90 uptake. Sr-90 uptake varied with the species. µCi Sr-89/g Ca and pCi Sr-89 in soil accumulated in the plants.
Fredriksson, L. & Eriksson, Å. (1961). Försvarets forskningsanstalt, Rapport FOA 4 A 4187-4623	Studies on Plant Accumulation of Fission Products Under Swedish Conditions. I. Plant accumulation of Sr-90 in Pot Experiments in Relation to Uptake under Field conditions.	Pot exp. in an open vegetation hall. 4.5 l Mitscherlich pots. Sweden.	Not updated.	17 Plant species.		Based on the observed root uptake of Sr-90, Ci/g d.w., a forecast of the range of soil-to-plant transfer, pCi/kg d.w./mCi/km^2 under field conditions are discussed. µCi Sr-90/g d.w. in the pot exp. pCi/kg d.w./ mCi/km^2 under field conditions.
Fredriksson, L. & Eriksson, Å. (1961). Försvarets forskniningsanstalt Rapport FOA 4A-4188-4623	Studies on Plant Accumulation of Fission Products under Swedish Conditions. II. Influence of Lime and Phosphate Fertilizers on the Accumulation of Sr-89 in Red clover grown in 29 different Swedish Soils.	Pot experiments with 4 treatments. A. None; B: Superphosphate; C: lime; D: Superphosphate and lime. Sweden.	Not updated.	Clover	20 mineral soils and 1 organic soil.	Comprehensive data of influence of nutrient regime on plant uptake of Sr-89. Functional relationships between Ca and Sr in plant and soil are discussed. nCi/g d.w. and µCi/g Ca

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Fredriksson, L. & Eriksson, Å. (1965). Försvarets Forskningsanstalt, Rapport 4A 4457-4623	The Lysimeter Installation at Uppsala-Näs Field Station.	Sweden.				Technical data about are given about construction of a lysimeter installation built at Uppsal-Näs field exp. station, later to be used for studies of the behaviour of Sr-90 and Cs-137under field conditions.
Fredriksson, L. & Eriksson, Å. (1966). Försvarets forskningsanstalt, Rapport FOA 4 A 4485-4623	Studies on Plant Accumulation of Fission Products under Swedish Conditions. VII: Plant Absorption of ^{90}Sr and Cs from Soil as influenced by Soil Organic Matter.	Leaching and pot experiments with Sr-90 and Cs-137. Survey of Cs-137 uptake on 70 fields. Sweden.	4 µCi Sr-90 and 40 µCi Cs-137 in the pot experiment.	Terrestial vegetation, clover/hay	10 mineral and 11 organic soils in the pot experiment.	Range in pot exp.: 4.6-19.4 and 2.9-12.4 for Sr-90, 0.64-6.01and 0.46-90.11 for Cs-137 on mineral and organic soils respectively. Range in field survey 1.7-5.7, of which 3-25% was derived from soil and 75-97% from aerial deposition. nCi/g d.w. nCi/kg d.w.
Fredriksson, L. & Eriksson, Å. (1968).Försvarets Forskningsanstalt, Rapport 4 C-4354-28.	Expected Content of ^{90}Sr and ^{137}Cs in Swedish Crops and Milk at a Total Deposition in the Plowlayer of 1 Ci ^{90}Sr and 1 Ci ^{137}Cs per km2.	Analysis of Sr-90 and Cs-137 from micro plot exp. and the fallout from bomb tests over Sweden in the 60-ties. Sweden.	1 Ci/km^2 of Sr-90 and of Cs-137.	Many agricultural crops and milk.	Many mineral soils.	Based on analysis of Sr-90 and Cs-137 in crop products and milk, and deposition in the plow layer 1 Ci/km2, expected contents of Sr-90 and Cs-137 in crop products and milk, and range of them are evaluated. Sr-90: nCi/kg d.w., nCi/g Ca. Cs-137: nCi/kg d.w.
Fredriksson, L. & Eriksson, Å. (1970). Annals of the Agriculture College of Sweden, 36, 3-18	Plant Uptake of Fission Products Under Swedish Conditions. I. Uptake of ^{90} Sr in Pot Experiments in Relation to Uptake under Field conditions.	Pot exp. in an open vegetation hall. 4.5 l Mitscherlich pots. Sweden.	Not updated.	17 Plant species.		Based on the observed root uptake of Sr-90, Ci/g d.w., a forecast of the range of soil-to-plant transfer, pCi/kg d.w./mCi/km2 under field conditions are discussed. µCi Sr-90/g d.w. in the pot exp. pCi/kg d.w./ mCi/km^2 under field conditions.
Fredriksson, L. & Åberg, B. (1961).Försvarets forskningsanstalt, Rapport FOA 4A 4176-4623	Radioaktiv beläggning: mark, vegetation, husdjur och födoämnen.	Sweden.				Radioactive kontamination of ground/soil, vegetation, animals and food due to fallout is discussed as well as practical countermeasures in case of fallout.
Fredriksson, L. (1963). Försvarets forskningsanstalt, Rapport FOA 4 A 4322-4623.	Studies on Plant Accumulation of Fission Products Under Swedish Conditions. V: Uptake by Pasture and Ley Plants of ^{90}Sr and ^{137}Cs in Swedish Field Experiments.	Field microplot exp. on a natural pasture and a grazing ley, near Upppsala. Sweden.	Water solutions of 100 µCi Sr-90 and 225 µCi Cs-137 per m^2 was sprayed on field plots early in spring.	4 cuts of grass in the year of contamination.	A sandy soil and a clayey soil.	Transfer to grass of Sr-90 was much higher than of Cs-137. Both declined with cut number. The transfer to grass of both nuclides was affected by lime and fertilizer regime. pCi/g Ca of Sr-90: nCi/g d.w. and nCi/g K of Cs-137.
Fredriksson, L. (1963). Försvarets Forskningsanstalt, Rapport FOA 4 A-4321-4623	Studies on Plant Accumulation of Fission Products under Swedish Conditions. IV: Influence of Non-Exchangeable and Exchangeable Potassium and of Exchangeable Calcium in Soil	Pot exp. in an open vegetation hall. 4.5 l Mitsherlich pots. Sweden.	50.0 µCi/pot.	Clover vegetation, about 2 months at harvest.	178 Swedish mineral soils. 4.5 l Misherlich pots.	Influence of soil factors on uptake of Cs-137 was studied. Regression of pCi Cs-137/g K/mci/km2 on K-AL, Kres (K-HCl-K-AL) and Ca-AL (all with negative signs of the regr.coeff.) in the 178 soil explained about 43 % of the variation, i.e. R2 = 0.43.

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	on the adsorption of ^{137}Cs by Red Clover in Pot Experiments with 178 Swedish Soils.					
Fredriksson, L. (1970). Annals of the Agriculture College of Sweden, 36, 41-60.	Plant Uptake of Fission Products under Swedish Conditions. III: Uptake of ^{137}Cs Trifolium pratense as Influence by potassium and calcium level in the soil.	Pot exp. in an open vegetation hall. 4.5 l Mitsherlich pots. Sweden.	50.0 µCi/pot.	Clover vegetation, about 2 months at harvest.	178 Swedish mineral soils. 4.5 l Misherlich pots.	Influence of soil factors on uptake of Cs-137 was studied. Regression of pCi Cs-137/g K/mCi/km^2 on K-AL, Kres (K-HCl-K-AL) and Ca-AL (all with negative signs of the regr.coeff.) in the 178 soil explained about 43 % of the variation, i.e. R2 = 0.43.
Fredriksson, L. (1970). Annals of the Agriculture College of Sweden, 36, 61-89.	Plant Uptake of Fission Products under Swedish Conditions. IV: Uptake of 90Sr and ^{137}Cs from some Tropical and Sub-tropical Soils.	Pot exp. in a closed vegetation hall. Sweden.	Contamination not updated.	Green matter of Winter rape.	3 soils from Brazil and 3 from Equador.	Wide variation in nuclide uptake between soils. Uptake of both Sr-90 and Cs-137 much higher in these South American soils than in Swedish mineral soils. Liming and K-fertilization were effective to decrease uptake of Sr-90 and Cs-137 respectively.
Fredriksson, L., Eriksson, Å. & Haak, E. (1970). Annals of the Agriculture College of Sweden, 36, 19-39	Plant Uptake of Fission Products under Swedish Conditions. II. Uptake of ^{89}Sr by Trifolium as influenced by the calcium and phosphate status in the Soil.	Pot exp. in an open vegetation hall. 4.5 l Mitscherlich pots. Sweden.	Not updated.	Clover	20 mineral soils and 1 organic soil.	Comprehensive data of influence of nutrient regime on plant uptake of Sr-89. Functional relationships between Ca and Sr in plant and soil are discussed. nCi/g d.w. and uCi/g Ca
Fredriksson, L., Eriksson, Å. & Lönsjö, H. (1966). Försvarets Forskningsanstalt, Rapport 4A 4486-4623.	Studies on Plant Accumulation of Fission Products under Swedish Conditions. VIII: Uptake of ^{137}Cs in Agricultural Crops as Influenced by Soil Characteristics and Rate of Potassium Fertilization in a Three Year Micro-plot Experiment.	3 year micro plot exp. at Uppsala-Näs field station with K-fertilization and two N-fertilisers $Ca(N0_3)_2$ and H_4NO_3. Sweden.	241 µCi/0.25 m2.	Straw and grain of oats, peas and white mustard.	3 topsoils, a loam, a clay loam and silty clay, placed on sandy subsoil.	Cs-137-uptake decreased very substantially with increase of clay content and with in-creased K-fertilization and was usually lower for CaNO3 and for NH4NO3. For crops Cs-137-uptake increased in the order oats < white mustard < peas. pCi/g d.w. and nCi/g K
Fredriksson, L., Eriksson, Å., Haak, E., Söderman, 0. & Auraldsson, H.Å. (1970). Försvarets Forskninganstalt, FOA 4 A-4484-4623.	Studies on the Transport of Fission Products Through the Food Chains. II. ^{137}Cs in Swedish Grain Crops 1962-1967.	Study on Cs-137-transfer on 7 Swedish farms in 1963. Sweden.	Bomb fallout of Cs-137 accumulated up to 1963.	Pasture grass and forage crops.	Various soils.	During the vegetation period 1963 contents of Cs-137/kg d.w. and K in cattle feed and of Cs-137/l milk was determined. Results are discussed with special reference too prevailing fallout situation. nCi Cs-137/kg d.w. and pCi/l milk
Fredriksson, L., Eriksson, Å., Haak, E., Söderman, 0. & Auraldsson, H.Å. (1970). Försvarets Forskningsanstalt, FOA 4 C-4435-28.	Studies on the Transport of Fission Products Through the Food Chains. II. ^{137}Cs in Swedish Grain Crops 1962-1967.	Mainly arable mineral soils. Sweden.	Bomb fallout from the early 60-ties.	Cereal grain of barley, oats rye and wheat.	Country wide survey of Cs-137 content in cereal grain.	During 1962-67 the Cs-137-content in about 1700 samples of cereals was determined. The peak mean value in grain, 875 pCi, was obtained in 1963. Then it decrease roughly by one-half every year.
Fredriksson, L., Eriksson, Å., Lönsjö, H. & Haak, E. (1968).	Migration and Plant Availability of Fission Products in	The first 3 year results of the		Straw and grain of barley	4 NPK-levels on 3 topsoils placed	Plant uptake of Cs-137 was much more influenced by conditions in the topsoils than in the subsoils.

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Försvarets Forskningsanstalt, Rapport C-4357-28.	a Lysimeter Experiment. 1. Plant Uptake and Leaching of ^{137}Cs.	lysimeter exp. at Uppsala-Näs field station. Sweden.			on sandy and on clayey subsoils.	Increased applications of NH4NO3 increased Cs-137-uptake. pCi/g d.w. and nCi/g K
Fredriksson, L., Haak, E. & Eriksson, Å. (1968). Försvarets Forskningsanstalt Rapport FOA 4A 4378-28.	Studies on Plant Accumulation of Fission Products under Swedish Conditions. IX: Plant Uptake of ^{90}Sr and ^{45}Ca as Influenced by Soil Chemical Properties.	Pot exp. in an open vegetation hall. Sweden.	11.4 µCi Sr-90 and 30.6 µCi Ca-45 per 4.5 l Mitscherlich pot.	Clover vegetation, about 2 months at harvest.	169 mineral soils from south and middle Sweden.	Influence of soil factors on uptake of Sr-90 and Ca-45 was studied. Regression of pCi Sr-90/g Ca/mci/km2 on pH, Ca-AL, CEC and P-AL (all with negative signs of the regr.coeff.) in the 169 soil explained about 90 % of the variation, i.e. R2 = 0.91.
Fredriksson, L., Haak, E. & Eriksson, Å. (1969). Försvarets Forskningsanstalt, FOA 4 C4395-28.	Studies on Plant Accumulation of Fission Products under Swedish Conditions. XI: Uptake of ^{90}Sr by Different Crops as Influenced by Liming and Soil Tillage Operations	Four 7-year microplot exp. (1-4) with placement of Sr-90, 0-5, 0-10, 0-20 and 20-25 cm depth. Sweden.	703 µCi Sr-90/ 0.64 m2 in exp. 1-2, 985 µCi Sr-90/0.64 m^2 in exp. 3-4.	Mainly cereals and peas, but also other agricultural crops.	Three sandy soils and one clay, all with the subsoil in situ. The 4 exps. were located to different agr. distr. in Sweden.	Placement effects were evident but variable with site, crop and lime status and with year. The deeper the placement of Sr-90 was placed the lower was the uptake by the crops. nCi/g d.w.
Fredriksson, L., Lönsjö, H. & Eriksson, Å. (1969). Försvarets Forskningsanstalt, FOA 4 C4387-28.	Studies on Plant Accumulation of Fission Products under Swedish Conditions. X: Absorption of ^{90}Sr and ^{137}Cs from Soil by Vegetable Crops.	4-year micro-plot exp. at Uppsala-Näs field station. Sweden.	90.8 µCi Sr-90; 241 µCi Cs-137.	Vegetables	Two mineral soils, one loam and one clay loam.	Content in edible parts. Sr-90: Spinach, Lettuce> Radishes>Beans, Carrots> Beets, Parsnips> Cauliflower, Cabbage >potatoes. Cs-137: Lettuce, Spinach, Cauliflower> Radish, Cabbage, Carrots> Parsnips, Beans>Beets, Potatoes. Sr-90: pCi/d.w., nCi/g Ca. Cs-137: pCi/g d.w., nCi/g K.
Fredriksson, L., Lönsjö, H. & Eriksson, Å. (1969). Försvarets Forskningsanstalt, FOA 4 C-4405-28.	Studies on Plant Accumulation of Fission Products under Swedish Conditions. XII: Uptake of ^{137}Cs by Barley and Peas from 12 Different Top Soils Combined with 2 Subsoils in a Long-Term Microplot Experiment.	Microplot exp. at Uppsala-Näs field station. Sweden.	0.241 mCi Cs-137/0.25 m^2.	Straw and grain of barley and peas.	12 mineral topsoils on a sandy and a clayey subsoil.	Decreasing clay content and increasing organic matter content in soils enhanced Cs-137 uptake in crops. Cs-137 uptake was about 5 times higher in seed of peas than in grain of barley. pCi/g d.w. and nCi/g K. pCi/kg d.w./Ci/km2
Frissel MJ, Deb DL, Fathony M, Lin YM, Mollah AS, Ngo NT, Othman I, Robison WL, Skarlou-Alexiou V, Topcuoglu S, Twining JR, Uchida S, Wasserman MA. Journal of Environmental rRadioactivity 58 (2002) 113-128.	Generic values for soil-to-plant transfer factors of radiocesium.		Cs			The paper describes a generic system for ^{137}Cs, mainly based on a reference soil-to-plant transfer factor which depends solely on soil properties such as nutrient status, exchangeable K-content, pH and moisture content. Crops are divided into crop groups, cereals serving as reference group. The transfer of other crop groups can be calculated by multiplying data for cereals by a conversion factor.
Frissel M. J. Conf: Nuclear cross-over research international workshop on improve-	Behaviour of radionuclides in soils and their uptake by crops.	Netherlands.	Cs and Sr.	Crops.	Adsorptive properties of soils analysed.	Significance of transfer factor is discussed. Uptake Cs and Sr from soils by food crops and countermeasures which can be applied in case of an acci-

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ment of environmental transfer models and parameters, Tokio, 5-6 Feb.1996 Available from Japan Atomic Industrial Forum, Inc						dent.
Frissel M.J. Book (Conf.): 25. Annual meeting of Fachverband fuer Strahlenschutz e.V. (FS): Environmental radioactivity, radioecology, radiation effects. Binz auf Ruegen (Germany), 28-30 Sep 1993, p.567-573. FS--93-67-T	Parameters for Radiological assessment Models, Default Values, Reliability, Uncertainties and geographical Limitations.	IUR.	^{137}Cs, ^{90}Sr.	Cereals, clover, onion, bean, cucumber, potato.	Clay, sandy and peaty soils.	Transfer coefficients for milk and meat (in d/l, d/kg and for Cs in d/m2) are presented in tables and graph.
Frissel, M.J. Report (Conf.): 28. annual meeting of the European Society for New Methods in Agricultural Research Annual meeting of the International Union of Radioecology (IUR) Working Group Soil-to-Plant Transfer Brno (Czech Republic), 26-29 Aug 1998, 202 p., p. 56. INIS-CZ--0022	A preliminary classification of soil ecosystem as a means to estimate expected soil to plant transfer of radionuclides.	Netherlands.	^{137}Cs, ^{90}Sr.	Cereal, vegetables.	Different soil types and conditions.	The classification is based on reference soil to-plant transfer values (TF's). For Cs, cereals appeared to be a suitable reference crop for Cs, whereas green vegetables were used for Sr. The TF units are either (Bq/kg crop)/(Bq/m2) or (Bq/kg crop)/(Bq/kg soil). The availability of Cs and Sr decreases with time during 20 to 30 years (the longest time series available). Therefore it may be more appropriate to use transfer parameters for 'Steady state releases' and 'Accidental releases'.
Fuerh, F. Conf: Technical meeting on radiology. Bonn, Germany, F.R. 2-3 Oct. 1979. INKA-Conf--79-395-008.	Uptake of radionuclides from soil. Determination of transfer factors for practical use. Die Aufnahme von Radionukliden aus dem Boden. Ermittlung praxisgerechter Transferfaktoren. In German.	Germany, F.R. Simulation.	^{90}Sr, ^{137}Cs, ^{60}Co, ^{54}Mn.	Different plants.	Different types of soil. 0 to 1cm soil layer and 0 to 20 cm topsoil, AP horizon.	Dependence of transfer factor for radionuclides on certain soil properties, on the type of plant and its stage of growth at the time of harvesting, on the part of the plant.
Fulker M.J. JR: Journal of Environmental Radioactivity, 1987, v. 5, p. 235-244.	Aspects of environmental Monitoring by British Nuclear Fuels plc Following the Chernobyl Reactor Accident.	UK. West Cumbria.	^{137}Cs, ^{134}Cs, ^{131I}.	Grass, milk.		Transfer of radionuclides from deposition on grass to milk is shown in tables and compared with a model prediction.
Fulker M.J., McKeeverJ., Birch C.P. Book (Conf.): International symposium on environmental impact of radioactive releases, Vienna, Austria, 8-12 May 1995. IAEA, Oct 1995, 874 p., p. 734-737. IAEA-SM--339/198P; STI/PUB--	Validation of the Modelling of ^{129}I Transfer Through the Air-Grass-Milk Pathway.	UK.	129I.			Transfer coefficient from grass to milk 5 x 10^{-3} Bq/l per Bq/d for intake by cows.

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Gaare, E., and Staaland, H., (1994) In: H. Dahlgaard (Ed.): Nordic Radioecology. Elsevier Science Publishers, Amsterdam. ISBN 0-444-81617-8, pp. 303-335.	Pathways of fallout radioceasium via reindeer to man	Norway and some other Nordic countries	Cs-134 and Cs-137	Lichen - reindeer foodchain. Reindeer meat.	Strong seasonal variation	Like other animals reindeer are exposed to radioactive fallout through their food, and because they alone utilize lichens as forage, a high level of radiocaesium is found in their muscle. The lichen intake of reindeer varies from 70 - 80% of the diet in winter to 10 - 20% in summer. This factor, coupled with the short biological half-life of caesium in the reindeer body (10 - 20 days), leads to a strong seasonal variation: radiocaesium in the meat is five times higher in late winter compared to the late summer time. Predictions show that it will take about 20 years before radiocaesium burdens are the same as those prior to the Chernobyl accident. Estimates indicate that the effective half-life of radiocaesium in the meat of grazing reindeer is 3 - 4 years for the post Chernobyl period.
Gaare, E.; Jonsson, B.; Skogland, T. Report: NEI-NO--294 Apr 1991, 72 p.	Chernobyl. Final report on NINA's radioecological programme 1986 to 1990. Tsjernobyl. Sluttrapport fra NINA's radiooekologiprogram 1986-1990. In Norwegian.	Norway.	^{137}Cs.	Plants, fish.	Soils.	This report summerises the results from a post-Chernobyl research program on aquatic and terrestrial ecosystems in contaminated areas. Pathways, processes and factors determining the Cs-137 concentration in soil, plant, water, fish and wild animal were investigated.
Gastberger M., Steinhäusler F., Gerzabek MH. and Hubmer A. JR: Journal of Environmental Radioactivity, 2001, v. 54, p. 267-273.	Fallout strontium and caesium transfer from vegetation to cow milk at two lowland and two Alpine pastures.	Austria	^{137}Cs, ^{90}Sr, stable Sr	Pasture, milk.		^{90}Sr transfer coefficient ranged from 0.0005 to 0.0012 d/l and correlated with the stable strontium transfer coefficient (0.0006-0.0013 d/l with the lower values found on intensively managed pastures. The ^{137}Cs transfer coefficient ranged from 0.0009-0.0045 d/l.
Gastberger M., Steinhäusler F., Gerzabek MH., LettnerH. and Hubmer A. JR: Journal of Environmental Radioactivity, 2000, v. 49(2), p. 217-233.	Soil-to-plant transfer of fallout caesium and strontium in Austrian lowland and Alpine pastures.	Austria.	Cs-137 Sr-90.	Pastures.		The areal contamination, the depth distributions in the soil and the soil-to-plant transfer-factor^{s} were determined for ^{137}Cs and ^{90}Sr at four Austrian pastures. Two of these are intensively used lowland pastures at about 500 m above sea level, and the other two are Alpine pastures at 1600 and 1300 m. At the latter, the vertical migration velocity in the soil is slower and the soil-to-plant transfer is significantly higher than at the lowland pastures (for both nuclides). A strong positive correlation exists between the ^{137}Cs and ^{90}Sr soil-to-plant transfers, indicating that some of the parameters typical of Alpine environments have a similar effect on the

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						plant uptake of these fallout nuclides, e.g. low biological activity in the soil and short vegetation periods.
Gerald Kirchner. JR: Journal of Environmental Radio-activity, 1998, v. 38(3), p. 339-352.	Applicability of Compartmen-tal Models for Simulating the Transport of Radionuclides in Soil.	Germany.	Radionuclides.			The applicability of multi-compartmental models to describe the transport of radioactive trace sub-stances in soil is reconsidered. A compartmental approach provides a valid model of the transport processes only if the number of compartments is set to a specific value which is determined by the physical flow conditions in the soil studied. It is demonstrated that describing diffusional transport by the commonly used serial compartmental model results in apparently time-dependent residence times. Modifications of compartment models made in order to account for complex sorption behaviour of the radionuclides are discussed. Consequences for the design and interpretation of field studies are outlined.
Gerzabek, M.H. Report: OEFZS--4666, Jan 1993, 22 p.	The soil-to-plant transfer of radionuclides. Feasibilities and limits of the transfer concept. Der Boden-Pflanze Transfer von Radionukliden. Moe-glichkeiten und Grenzen des Transferfaktorenkonzeptes. In German.	Austria.	Sr-90, Cs-137.	Plants.	Soils.	^{90}Sr exhibited three to ten times higher transfer factors as compared to ^{137}Cs. The contamination source has a distinct impact on the plant availability of radionuclides. In semi-natural environments radiocaesium can be bound to the biomass to a great extent, which results in significantly higher biological half-lives as compared to agricultural ecosystems.
Gerzabek, M.H. Horak, O. Artner, C. Mueck, K. Report: OEFZS--4568, Jan. 1991, 60 p.	Radionuclide transfer in the soil - plant system. Untersuchung des Radionuk-lidtransfers im System Boden - Pflanze. In German.	Austria.	^{137}Cs, ^{90}Sr and ^{226}Ra.	Cereal grains, potatoes.	Four different soil types.	The chemical and physical characterization of the soil profiles proves the large differences in their properties. Transfer factors for cereal grains ranged from 0.036 (rye) to 0.22 (wheat) with a mean value of 0.1. The Sr-transfer into straw was 3.8 (rye) to 49 (maize) times higher than into grains. The mean concentration ratio between potato tubers and shoots was 1: 25. A significant correlation exists between exchangeable calcium and the Sr-transfer into grains of barley. The strontium uptake dimin-ishes with increasing exchangeable calcium con-centrations.
Gerzabek, M.H. Report: OEFZS--4560, 1990, 80 p., p. 1-31.	Report on research in Austria (Concerning the conse-quences of the Chernobyl	Austria.	Cs-137, I-131, Sr-90.	Vegetables, cereals, pastures.	Austrian soils, seasonal charac-teristics.	The Cs-137 activity deposition per km^2 due to the Chernobyl fallout varies between 0.08 Ci and 2.05 Ci, the Sr-90 app.20 to 40 times lower. The most

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	accident).					severe problems were due to the direct contamination of early vegetables, winter cereals and pastures with iodine and cesium. The cesium migration in the Austrian soils was greatest in the first hours and days after the fallout. At special sites cesium from Chernobyl fallout was detected down to 30 cm depth. Investigations of the radionuclide soil to plant transfer in the field resulted in quite low transfer factors into cereal grains (e.g.: Cs: maize: 0.0018, wheat: 0.0055. Sr: maize: 0.010, wheat: 0.10) and leaf vegetables as compared to the literature.
Gouthu S., Arie T., Ambe S. and Yamaguchi I. (1997). Journal of Radioanalytical and Nuclear Chemistry, Aug. 1997, v. 222 (1-2), p. 247-251.	Screening of plant species for comparative uptake abilities of radioactive Co, Rb, Sr and Cs from soil.	Laboratory conditions	Ru, Co, Sr and Cs	32 plant species	Horticultural soil, contaminated after seeding with dilute acid multi tracer solution.	Look at results in terms of possible phytoremediation, simply a screening
Green N., Wilkins, B.T., Hammond, D.J. JR: Journal of Radioanalytical and Nuclear Chemistry, Dec 1997, v. 226(1-2), p. 195-200.	Transfer of radionuclides to fruit.	N.W. England	^{137}Cs, Pu and Am	Fruit	Hamble loam, Adventurers peat and Fyfield sand. Soil contaminated winter 1983/1984 prior to planting	Transfer factors from this lysimeter experiment showed that the transfer factors used in NRPB's FARMLAND model are too high for fruit. TF (in (concentration/kg plant (fresh mass))/(concentration/kg of soil (dry mass)) Cs-137 (a) Apples: Field site = 8.6 x 10-4, Loam = 9.4 x 10-4, sand = 1.85 x 10-3, peat 3.7 x 10-2, model = 2.4 x 10-2 (b) Strawberries: Field site = 9.4 x 10-4, Loam = 9.0 x 10-4, sand = 4.2 x 10-3, peat 6.4 x 10-3: TF of Sr-90 (a) Apples: Field site = 1.2 x 10-2, Loam = 1.2 x 10-2, sand = 2.5 x 10-2, peat 1.2 x 10-3, model = 4 x 10-2 (b) Strawberries: Field site = 2.2 x 10-2, Loam = 1.0 x 10-1, sand = 2.1 x 10-1, peat 1.2 x 10-2.Root transfer factors were determined as follows (units = kg fresh product/kg of dry soil): Fruit vegetables Cs =1.0 x 10-2, Sr = 8.5 x 10-2; Root vegetables Cs 1.0 x 10-2, Sr 8.5 x 10-2; Leafy vegetables Cs = 2.5 x 10-2, Sr =1.2 x 10-1
Green, N.; Wilkins, B.T.; Hammond, D.J. JR: Journal of Environmental Radioactivity, 1994, v. 23(2), p. 151-170.	Transfer of ^{137}Cs and ^{90}Sr along the Soil-Pasture-Cows' Milk Pathway in an Area of Land Reclaimed from the Sea	UK. Lancashire coast.	^{137}Cs, ^{134}Cs,^{90}Sr.	Grass, milk.	Soil's types and profiles	Soil-plant transfer factors for ^{137}Cs of marine origin were at least five times less than the values currently recommended by the IUR for use in generic assessments. For ^{90}Sr, ingestion of soil was not an important contributor to uptake, ad soil-plant transfer factors were similar to the generic values recommended by the IUR.
Green, N.; Wilkins, B.T.;	Transfer of radionuclides to	Lancashire coast	^{137}Cs $^{239/240}$Pu	Cereals, green		This paper summarises the results of a study of the

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Hammond, D.J.; Davidson, M.F. JR: Journal of Environmental Radio-activity, 1996, v. 31(2), p. 171-187.	crops in an area of land re-claimed from the sea.	of UK.	and ^{241}Am, ^{99}Tc, ^{90}Sr.	vegetables, potatoes.		transfer of ^{137}Cs, ^{90}Sr, $^{239/240}$Pu, ^{241}Am and ^{99}Tc to several groups of crops, including green vegetables, potatoes and cereals. In many cases, the observed transfer factors were generally close to or slightly lower than values derived from the application of radionuclides to soil in a soluble form.
Green, N.; Wilkins, B.T.; Poult-ney, S. JR: Journal of Radioanalytical and Nuclear Chemistry, Dec. 1997, v. 226 (1-2), p. 75-78.	Distribution of radionuclides in potato tubers. Implication for dose assessments.	UK, model FARMLAND.	Cesium 137, strontium 90, americium 241, plutonium isoto-pes.	Potatoes.		A study of distribution of ^{137}Cs, ^{90}Sr, Pu and Am in potato tubers has been carried out. Cs-137 was uniformly distributed throughout the tuber, whereas up to about 50% of the Sr-90 activity was found in the peel. The values of soil-plant transfer factors currently assumed in the NRPB model FARMLAND are reasonable for general assessment purposes.
Greitz, U., Ekman, L. & Eriksson, Å. (1974). Försvarets Forskningsan-stalt, Rapport FOA 4 C-40005-4.3.	Transfer of Simulated Fallout Particles from Pasture to Grazing Dairy Cattle.	Experimental animal and pas-ture field station at Kungsängen, SLU, Uppsala. Sweden.				Fraction of deposition ingested by cows was as-sessed by assay of radioactivity in faeces. It was found to be about 20 %. Differently designed ex-periments gave similar results. Compare Ekman, L., Eriksson, Å. & Greitz, U. (1973).
Grzybowska, D. Wlodek, S. Report (Conf.): Radioecology ap-plied to the protection of man and his environment, Rome, Italy, 7-10 Sep 1971. Proceedings, May 1972, v. 2, p. 1069-1079. EUR--4800(vol.2)	Contribution to the study of soil-plant transfer factors of ^{90}Sr, ^{137}Cs and ^{226}Ra. Contribution a l'etude du transfert de Sr-90, Cs-137 et Ra-226 du sol vers les plan-tes. In French.	Poland.	^{90}Sr, ^{137}Cs and ^{226}Ra.	Plants.	Soils.	The study of soil-plant transfer factors of ^{90}Sr, ^{137}Cs and ^{226}Ra.
Haak, E. & Eriksson, E. (1973). Försvarets forskningsanstalt, Rap-port FOA4 C-4559-A3.	Studies on plant accumulation of fission products under Swedish condition. XV. Uptake of ^{137}Cs by wheat as influenced by type and rate of N-fertilization under field conditions.	3 soils x 3 N-types x 3 N-rates in split-plot designed mi-croplot exp. at Uppsala-Näs field station. Sweden.	Contamination of Cs-137 not updated.	Straw and grain of wheat.	3 topsoils - clay, a sandy clay loam and a loam - were placed on sandy subsoil.	Cs-137-transfer was much higher on the sandy soil than on the two clayey soils. On the sandy soil it increased with N-rate and was usually higher for ammonium nitrate and urea than for calcium ni-trate. pCi/kg d.w. and pCi/ g K
Haak, E. & Eriksson, Å. (1973). Försvarets Forskningsanstalt, Rap-port FOA 4 C-4557-A3.	Studies on Plant Accumula-tion of Fission Products under Swedish Conditions. XIV: Uptake of ^{137}Cs by Wheat and Timothy from six different soils as Influenced by Type and Rate of K-fertilization	Pot experiments in an open vege-tation hall. Swe-den.	Cs-137-transfer to plant is con-verted to a depo-sition of 1 µCi Cs-137 /m^2 soil.	Straw and grain of wheat. Herb-age of timothy.	3 mineral soils on sandy subsoil. 3 rates of 3 types of N-fertilizers. CaN = calcium nitrate, AN = ammonium ni-	Cs-137 uptake was highly negatively related to contents of clay and K-AL. N-type and N rate of fertilization influenced Cs-137-uptake, more on the sandy soil on which also the uptake increased with N-rate and usually more for AN and U than CaN. pCi/kg d.w.

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	and by type and rate of N-fertilization in pot experiment				trate, U = urea.	
Haak, E. & Lönsjö, H. (1975). Inst. för Radiobiologi, Rapport SLU-IRB-30.	Studies on Plant Accumulation of Fission Products under Swedish Conditions. XVI: Uptake of ^{90}Sr by Barley and Peas from 12 Different Top-soils Combined with 2 Sub-soils in a Long-Term Micro-plot Experiment.	8-year microplot exp. at Uppsala-Näs field station. Sweden.	90.8 µCi Sr-90/ 0.25 m^2.	Straw and grain of barley and peas.	12 topsoils placed on two subsoils, sand and clay.	Range of pCi/kg/mCi/ha for grain on sandy and clayey subsoil respectively. Topsoils: 18-61 and 13-35 for barley, 17-82 and 12-78 for peas. Years: 18-58 and 10-46 for barley, 25-67 and 20-46 for peas. Variation in Sr-90-transfer with year and topsoil. pCi/kg/ mCi/ha nCi/kg Ca /mCi/ha
Haak, E. (1983). (Ed. Å. Eriksson). Inst. för Radioekologi, Rapport SLU-REK-55, pp. V:2:1-15.	Variation i transportkoefficienter mark/växt för ^{137}Cs och ^{90}Sr. Långsiktiga konsekvenser av radioaktiv beläggning i jordbruket. L Malmöhus lõn	Work based on Field experiments with artificial depositions of Cs-137 and Sr-90 in soils from different parts of the country. Sweden.	Cs-137, Sr-90 and Sr-85.	Experimental experiences of the long term transfer of the nuclides to grass and grain crops in Swedish agriculture.	Different soil types from the large agricultural regions of Sweden.	Data are presented on the residence half-time of the nuclides on different pastures and on grain crops on ploughed land. For the pastures with initially high uptakes residense half-times of about 10-12 years was found, for crops on ploughed land considerably longer. The effective half-time could be estimated to 8-10 years on pastures and 22-23 years on ploughed land. Transfer expressed acc. to the equation TF=square meter of deposition found per kg dry matter of the crop.
Haak, E. (1983). (Ed. Å. Eriksson). Inst. för Radjoekologi, Rapport SLU-REK-55, pp. 1:1-30.	Transport och oralt intag av deponerat ^{137}Cs (^{90}Sr) med jordbruksprodukter. Långsiktiga konsekvenser av radioaktiv beläggning i jordbruket. 1. Malmöhus län	Work based on Field experiments with artificial depositions of Cs-137 in soils from different parts of Sweden.	Cs-137.	Estimated consequences of fallout for the Swedish agriculture	Conditions in Malmöhus län.	The study aimed at estimates of the consequences of Cs-137 fallout over the county, transfer to foods and internal and external doses to consumers and farmers. The effects of agricultural counter measures could be evaluated. Ploughing contaminated land and fertilization with potassium as well as suitable changes in farm management could be efficient for reduction of internal radiation doses from food intake. The effects were less on the external doses. Transfer expressed acc. to the equation TF=square meter of deposition found per kg dry matter of the crop and per kg fresh weight of animal products. Estimates of doses.
Haak, E. (1983). Commission of the European Communities, Vol. II, Seminar on "The Transfer of Radioactive Materials in the Terrestrial Environment Subsequent to an Accidental Release to Atmosphere", 11-15 April 1983, Dublin, Ireland. Luxembourg pp. 639-649.	Long term transfer of Cs-137 and Sr-90 within to Swedish agroecosystems as described by a stepwise model including corrective measures.	Kalkyler. Work based on Field experiments with artificial depositions of Cs-137 and Sr-90 in soils from different parts of the country. Sweden.	Cs-137, Sr-90.	Estimated consequences of fallout for the Swedish agriculture		The transfer of Cs-137 and Sr-90 to foods after fallouts in different counties of Sweden has been estimated with the aid of known factors in the agriculture, soil conditions, crop production and intensity in animal husbandry. The effects of corrective measures to reduce the transfer are discussed. Transfer expressed acc. to the equation TF=square meter of deposition found per kg dry matter of the crop and per kg fresh weight of animal products.

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Haak, E. (1983). Inst. för Radioeko-logi, Rapport SLU-REK-57.	Långsiktiga konsekvenser av radioaktiv beläggning i jord-bruket. II. Transport av ^{137}Cs och ^{90}Sr från mark till jord-bruksprodukter olika län (M, L, N, 0, Ps, H, F, B och C).	Work based on Field experiments with artificial depositions of Cs-137 and Sr-90 in soils from different parts of the country. Sweden.	Cs-137, Sr-90.	Estimated con-sequences of fallout for the Swedish agricul-ture		The transfer of Cs-137 and Sr-90 to foods after fallouts in different counties of Sweden has been estimated with the aid of known factors in the agriculture, soil conditions, crop production and intensity in animal husbandry. The effects of cor-rective measures to reduce the transfer are dis-cussed. Transfer expressed acc. to the equation TF=square meter of deposition found per kg dry matter of the crop and per kg fresh weight of ani-mal products.
Haak, E. (1986). Inst. för Radioek, Rapport SLU-REK-61, pp 247-254.	Effect of K-fertilization, liming and placement on crop uptake of cesium and stron-tium. Proc. 1st Int. Contact seminar in Radioecology 8-11 July 1985, Uppsala, Sweden.	Work based on Field experiments with artificial depositions of Cs-137 in soils from different parts of the coun-try. Sweden.	Cs-137 and Sr-90.	Field grain crops.	Different soil types from the large agricultural regions of Swe-den. Experiments over many years.	Remedial measures to reduce the crop uptake of Cs-137 and Sr-90 were carried out under different conditions and at several sites in Sweden. The influence of liming and placement by ploughing was tested on the plant uptake of Sr-90 and that of potassium fertilisation on the uptake of Cs-137. It was found that compared to even distribution of the nuclide in the plough-layer the shallower place-ments resulted in higher plant uptake. K-fertilisation reduced the caesium uptake considera-bly and more efficient than liming did with regard to Sr-90. Transfer expressed acc. to the equation TF=square meter of deposition found per kg dry matter of the crop.
Haak, E., Eriksson, Å. & Karlström, F. (1973). Försvarets Forskningsanstalt, Rapport C-4525-A3.	Studies on Plant Accumula-tion of Fission Products under Swedish Field Conditions. III: Entry of 90Sr and ^{137}Cs into the Herbage of Contrast-ing Types of Pasture.	Two pasture sites were contami-nated with Sr-90 and Cs-137 in early spring 1961, some plots also with Cs-137 in 1964. Swe-den.	150 µCi Sr-90 and 405 µCi Cs-137 in 1961, some plots with 485 µCi in 1964.	Several cuts of herbage/year, grass species mainly. Six years reported.	Natural pasture on Lövsta sandy soil and grasing ley on Risslinge clay soil. Both sites near Upp-sala.	Sr-90-transfer to herbage was larger than Cs-137-transfer at both sites already in 1st year. In the following years nuclide transfer decreased more slowly. Larger nuclide transfer on Lövsta than Risslinge. Effects of liming and fertilisation were observed. nCi/kg d.w. and nCi/g Ca for Sr-90; nCi/kg d.w. and pCi/g K for Cs-137.
Haak, E., Eriksson, Å. & Rosén, K. (2000). XXXth Annual Meeting of ESNA/ jointly organised with IUR working group soil-to-plant-transfer. Proc. Nov. 2000. Martin H. Gerza-beck (ed.) pages 8-14	Retention of simulated fallout nuclides in grass and grain crops.	Microplot exp. under field conditions. Sweden.	Experiments with wet deposi-tions of Cs-134 and Sr-85.	Grass of leys. Straw, leafs, ears and grain of cereals.	Vegetation peri-ods.	Migration of Cs-137 and Sr-90 in undisturbed soil was studied in large lysimeters three and four years after contamination, as part of a larger European project studying radionuclide soil-plant interac-tions. TRd and FRd as defined.
Haak, E., Eriksson, Å., Lönsjö, H. & Rosén, K. (1998). Inst. för ra-dioekologi, Rapport SLU-REK-82.	Överföring av Caesium-137 till jordbruksprodukter I Skåne och Blekinge efter en	Sweden.	Cs-137	Produkter från olika typer av jordbruk.	Olika marktyper och nedfallstid-punkter.	A mixed solution of the radionuclides was applied to the soil surfaces in culture boxes placed in a greenhouse at 4 different times during plant

Author/Source	Publication name	Site	Deposition	Product(s)	Soil, season	Abstract
	kärnenergiolycka. Uppsala. (Transfer of Cs137 to Agricultural Products in Southern Sweden after a Nuclear Accident)					growth. Soil-to-plant transfer factor (TF) was determined on the basis of radioactivity in unit area of soil.
Haas G., Schupfner R., Mueller A. JR: Journal of Radioanalytical and Nuclear Chemistry, 1995, v. 194 (2), p. 269-276.	Transfer of Natural and Man Made Radionuclides from Plants to Roe Deer and Farm Animals.	Germany.	^{137}Cs, ^{228}Ra, ^{228}Th, ^{232}Th, ^{40}K	Milk, eggs, meat, fish.		Feed-to-animal concentration ratios are given in table for bull, roe deer, cow and hen.
Halliwell C.M. and Rose C.L. (1995).J. Radiol Prot. 15. 3-36	Validation of two field models for radionuclide concentration in crops, using field data.	Scotland and N.W. England	Cs-137, Sr-90, Pu-239,240 and Am-241	Ryegrass	Scottish/ Northern English soils (non-calcerous gleys and peaty gley). "Natural" fallout deposition	Showed tendencies in the models for overpredicting/underpredicting certain radionuclide concentrations at the different sites. They state that it is unlikely that more successful model predictions cannot be made without taking into account the influence of soil characteristics on transfer factors. Used a set TF in the calculations, no TF data.
Handge, P. Meurin, G. Conf: 12. Annual meeting on radioactivity and environment, Norderney, Germany F.R., 2-8 Oct. 1978. INIS-mf--5888	Determination of potential radiation exposure via terrestrial food chains by the release of radioactive material from nuclear facilities. Ermittlung potentieller Strahlenexpositionen ueber terrestrische Nahrungsketten durch Ableitung radioaktiver Stoffe aus kerntechnischen Anlagen. In German.	Germany F.R. Compiled data.	Cs-134, Cs-137, Sr-90.	Milk, plants.	Soil properties.	The relevant transfer coefficients for the different plant species vary, depending on the soil properties, between 0.02 and 6.0 [pCi/kg fresh weight of vegetation: pCi/kg dry weight of soil] for Sr and between 1.10-3 and 0.2 [pCi/kg fresh weight of vegetation: pCi/kg dry weight of soil] for Cs. The sensitivity analysis shows that already a variation of the transfer coefficients for Sr from 0.5 up to 2.5 [pCi/kg fresh weight of vegetation: pCi/kg dry weight of soil] and for Cs from 3.10-2 up to 2.10-1 cause variations in the level of radiation exposure for individual exposure pathways by factors of 2 to 4. Correspondingly higher values are to be expected by still larger transfer of Sr and Cs from the ground to vegetation. For transfer coefficients >-2.5 [pCi/kg fresh weight of vegetation : pCi/kg dry weight of soil], however, removal of radioactive substances from the ground by the plants must not remain without consideration any longer
Handl J, Pfau A. and Huth F.W. JR: Health Physics, 1990, v. 48(5), p. 609-618.	Measurements of ^{129}I in Human and Bovine Thyroids in Europe - Transfer of ^{129}I into the Food Chain.	Germany.	I-129.	Grass, milk, meat.		The long-term transfer of radioiodine from soil to the plant and translocation within the soil were studied. During the 4 y. of the experiment, the transfer factor plant/soil decreased from 0.3 to $2.2*10^{-3}$. The mean value of the transfer factor milk/feed was $2.4*10^{-3}$ d kg^{-1}. The values of the transfer factor cow meat/feed obtained ranged between $3.0*10^{-4}$ (kidney) and $5.4*10^{-2}$ d kg^{-1} f.w.

Author/Source	Publication name	Site	Deposition	Product(s)	Soil, season	Abstract
Handl J. and Pfau A. Book (Conf.): 4. Cadarache international Symposium on Radioecology. Cadarache (France). 14-18 Mar 1988. Vol. 2. Cadarache (France). Section Documentation - CEN/Cadarache. p. E92 - E97.	Transfer of some Chernobyl Fallout Nuclides in the Animal-Product Food Chain.	Germany, Netherlands.	Cs-134, Cs-137.	Grass; hay and grass silage harvested between May and Sept. 1986. Milk, meat.		Mean value of transfer factors are presented from 5 feeding experiments and are for milk/feed in range from 3.0 to $8.6*10^{-3}$ day/kg. The mean transfer value for feed/meat is $1.4*10^{-2}$ d/kg which is about half the recommended value of $3.0*10^{-2}$ d/kg.
Hansen, H.S., and Andersson, I., (1994) In: H. Dahlgaard (Ed.): Nordic Radioecology. Elsevier Science Publishers, Amsterdam. ISBN 0-444-, 81617-8, pp. 197-211.	Transfer of Cs-137 to cows milk in the Nordic countries	Nordic countries	Cs-137	Milk from cows, diary milk and milk from individual farms.	Short after deposition	In 1986 and 1987 the levels of Cs-137 were highest in Finland and Norway, intermediate in Sweden, the Faroe Islands and Iceland (Cs-137 from global fallout only) and lowest in Denmark. The aggregated transfer coefficient (T_{agg}) to cows' milk was 2-10 times higher in the Faroe Islands, Iceland and Norway compared to that in Denmark, Finland and Sweden for all years after 1986.
Haunold, E. JR: Pflanzenarzt, Jul-Aug 1986, v. 39(7-8), p. 154-155.	Radionuclide uptake of plants from the soil. Die Aufnahme von Radionukliden aus dem Boden durch die Pflanze. In German.	Austria.	^{90}Sr, ^{137}Cs.	Different agricultural plants.	Different soil conditions.	Mean transfer factors for Cs and Sr and different agricultural plants are given. Activities in the plant mass are calculated for different soil conditions and advices for plant cultivation are given.
Haunold, E. Horak, O. Gerzabek, M. Report, Forschungszentrum Seibersdorf G.m.b.H. Inst. fuer Landwirtschaft, Aug 1986. 48 p. OEFZS--4369. LA--163/86.	Environmental radioactivity and its impact on agriculture. I. The behaviour of radionuclides in soils and plants. Umweltradioaktivitaet und ihre Auswirkung auf die Landwirtschaft. I. Das Verhalten von Radionukliden in Boden und Pflanze. In German.	Austria.	^{134}Cs, ^{131}I, ^{137}Cs, ^{106}Ru, ^{89}Sr, ^{90}Sr.	Different types of crop.	Soils.	The behaviour of radionuclides in soil and their uptake by plants. Soil-plant transfer factors are presented for the most important types of crops. With reference to fresh weight and vegetative plant matter, the range for Cs is between 0.01 and 0.03, for Sr between 0.1 and 1.2. The application of transfer calculations in practice is discussed.
Haunold, E.; Horak, O.; Gerzabek, M. Report, OEFZS--4369 Aug. 1986, 48 p. Available from INIS under the Report Number.	Environmental radioactivity and its impact on agriculture. I. The behaviour of radionuclides in soils and plants. Umweltradioaktivitaet und ihre Auswirkung auf die Landwirtschaft. I. Das Verhalten von Radionukliden in Boden and Pflanze. In German.	Austria.	Cs-137, Cs-134, Sr-89, Sr-90, I-131	Different types of crops with reference to fresh weight and vegetative plant matter.		Tf for Cs estimated between 0.01 and 0.03; for Sr between 0.1 and 1.2. The application of transfer calculations in practice is discussed.
Heeschen, W. JR: Deutsche Tieraerztliche Wochenschrift,	Radionuclide transfer from forage plants into milk. Transfer von Radionukliden	Germany.	^{131}I, ^{137}Cs, ^{90}Sr.	Forage, milk, butter, cheese.		There is a lot of information regarding the transfer of radionuclides (iodine, caesium, strontium) which allows the transfer factor being calculated with high

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9 Jun 1987, v. 94(6), p. 364-367.	aus Futterpflanzen in die Milch. In German.					certainty. The transfer coefficients (forage-) plant/milk laid down in Paragraph 45 of the Radiation Protection Ordinance (Strahlenschutzverordnung) amount to 1.0x10-2 for iodine-131, 1.2x10-2 for caesium-137 and 2.0x10-3 for strontium-90. More recent calculated factors are markedly lower at the average.
Heine, K., Wiechen, A. Conf: 5. International Congress of the International Radiation Protection Association. Jerusalem, Israel, 9-14 March 1980. Book of papers. 1980, v.3, p. 397-400.	Studies of the transfer factors of Sr-90 and Cs- 137 in the foodchain soil-plant-milk.	Gorleben, Germany.	^{137}Cs and ^{90}Sr.	Plants, milk.		Transfer factors of Sr-90 and Cs-137 were determined by low-level measurements of soil, plant and milk samples. The values of the Cs-137 TF (soil-plant) were higher in sandy than in loamy soils. The plant-milk transfer factors for Sr-90 agreed well for the different locations but for Cs-137 varied markedly. The highest values for TF plant-milk were found at farms with sandy soils.
Heine, K., Wiechen, A. JR: Kieler Milchwirtschaftliche Forschungsberichte, 1979, v. 31(4), p. 283-295.	Studies on the transfer factors of Sr-90 and further fallout-radionuclides in the food chain 'soil-plant-milk' in the surroundings of Gorleben. Untersuchungen zum Uebergang von Sr 90 und anderen Fallout-Radionukliden in der Nahrungskette Boden-Bewuchs-Milch in der Umgebung von Gorleben. In German.	Gorleben, Germany.	^{90}Sr and other radionuclides.	Milk. Plants.		To verify data for transfer factors arrived from the international literature for the ecological conditions of Germany, low-level measurements of soil, plant and milk were performed. TF of Sr 90 for the transition soil-plant range between 0.08 and 1.11 (pCi/kg plant wet weight: pCi/kg soil dry weight).TF of Sr-90 for the transition plant-milk range between 0.0013 and 0.0019. The mean value 0.0016 agrees well with the values 0.0014 and 0.002 evaluated by Ng et al. from literature respectively by Wiechen from radiological surveillance data. Therefore, the Sr-transfer factor 0.0008 enclosed in the Richtlinie should have to be doubled.
Heine, K.; Wiechen, A. JR: Milchwissenschaft, May 1979, v. 34(5), p. 275-280.	Studies on the Cs-137-transfer in the foodchain soil-plant-milk under the ecological conditions in a given environment. Untersuchungen zum Cs-137-Uebergang in der Nahrungskette Boden-Bewuchs-Milch an einem gegebenen Standort. In German.	Germany, F.R.	Cs-137.	Milk.	Different types of soil.	TFs for the Cs transition soil-plant range between 0.018 and 0.015 (pCi/kg plant wet weight: pCi/kg soil dry weight). Higher value was generally found for sandy soils than for the loamy soils of Elbe. Cs-137 TFs of the transition plant-milk range between 0.0023 and 0.057 (pCi/l : pCi/daily intake). The highest TFs are determined for the pastures which have sandy soils. More than 2/3 of all TFs for plant-milk are lower than the value 0.012 published by Strahlenschutzkommission in 1977.
Helton J.A., Jonson J.D., Rollstin J.A., Shiver A.W., Sprung J.L. Report, NUREG/CR--6134;	Uncertainty and sensitivity analysis of chronic exposure results with the MACCS	Simulation model. USA.	Cs-134, Cs-137, Sr-90, I-131.	Milk, meat, crops, legumes, plants and drink-	Number of environmental and seasonal influ-	MACCS model with 75 variables for evaluation of reactor accident consequences. Domination of dry deposition velocity, transfer of cesium from animal

Author/Source	Publication name	Site	Deposition	Product(s)	Soil, season	Abstract
SAND--93-2370 Jan. 1995, 90 p.	reactor accident consequence model.			ing water.	encing factors.	feed to milk and meat; transfer ^{90}Sr from soil to legumes and crops; contribution of ground concentration of I-131if accidents occur during the growing season.
Henrich, E. ; Schoener, W. Report: RP BALUF-STS--87-03, CA Bundesanstalt fuer Lebensmitteluntersuchung und -forschung, Vienna (Austria), 1987, 42 p.	Determination of transfer factors and effective half-times in several domestic animals for cesium-137 from the Chernobyl reactor accident. Part 1: several problems. Ermittlung von Transferfaktoren und effektiven Halbwertszeiten bei diversen Nutztieren fuer Caesium-137 aus dem Reaktorunfall Tschernobyl. Teil 1: Allgemeine Probleme. In German.	Austria.	Radio-nuclides.	Animal feed, meat.		The Chernobyl accident contaminated fodder-hey and grass has been fed to cows, bulls, calves, lambs and swine (fed with whey). Transfer factors fodder-to-meat and fodder-to-milk as well as the efficiency of radioactivity reducing additives had to be determined. Correlation of live-animals measurements with the meat contamination was investigated. The correlation was satisfactory except with swine.
Hinton T. G., Stoll J. M. and Tobler L. JR: Journal of Environmental Radioactivity, 1995, v. 29(1), p. 11-26.	Soil Contamination of Plant Surfaces from Grazing and Rainfall Interactions.					Contaminants often attach to soil particles, and their subsequent environmental transport is largely determined by processes that govern soil movement. We examined the influence of grazing intensity on soil contamination of pastures. Soil loadings (g soil kg-1 dry plant) increased 60% when grazing intensity was increased by a factor of four (p = 0·003). Rain and wind removed soil from vegetation in the ungrazed control plots, but when grazing sheep were present, an increase in rain from 0·3 to 9·7 mm caused a 130% increase in soil contamination. Multiple regression was used to develop an equation that predicts soil loadings as a function of grazing density, rainfall and wind speed (p = 0·0001, r2 = 0·78).
Hoffman FO. Amaral E. Report (Conf.): Workshop in radioecology. Neuherberg (Germany; F.R.), 5-7Nov. 1986. ISH--128	The use of Chernobyl fallout to test model predictions of the transfer radioiodine from air to vegetation to milk.	USA.	I-131.	Pastoral vegetation, milk.		Comparison of observed values with model prediction indicates a tendency for the models to overpredict the air-vegetation-milk transfer of Chernobyl I-131 by one to two orders of magnitude. It's mainly due to the transfer from air to pasture vegetation. Differences between model predictions and observations can be explained by : 1) overestimation of the fraction of the total amount of I-131in air that was presented as molecular vapour; 2) overestimation of wet and dry depositions; 3) Overesti-

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						mation of initial vegetation interception of material deposited during sever thunderstorms; 4) underestimation of the rates of weathering and growth dilution of material deposited on vegetation during periods of spring growth; 5) underestimation of the amount of uncontaminated feed consumed by diary cows, and 6) overestimation of the diet-to-milk transfer coefficient for I-131.
Hoffman, F.O. Gardner, R.H. Eckerman, K.F. Report: NUREG/CR--2612; ORNL/TM--8099. Jun 1982, 75 p.	Variability in dose estimates associated with the food-chain transport and ingestion of selected radionuclides.	USA. Simulations.	^{90}Sr, ^{137}Cs.	Different input.		For 90Sr, the parameters for soil retention, soil-to-plant transfer, and internal dosimetry contribute most significantly to the variability in the predicted dose for the combined exposure to all terrestrial pathways. For ^{137}Cs, the meat transfer coefficient, the mass interception factor for pasture forage, and the ingestion dose factor are the most important parameters.
Hoffman, F.O., Miller, C.W., Shaeffer D.L., and Garten Jr. C.T. JR: Nuclear Safety, Jul 1977, v. 18(3), p. 343-354.	Computer Codes for the Assessment of Radionucldes Released to the Environment.	USA. Computer simulation.	Radio-nuclides. Computer data input.	Computer data input.	Computer data input.	The capabilities of 83 computer codes in the areas of environmental transport and radiation dosimetry are summarized in tabular form. The incorporation of terrestrial and aquatic food-chain pathways has been a more recent development and reflects the need for satisfying the current requirements. The characteristics of the conceptual models employed by these codes are reviewed. The article includes 100 references.
Hoffman, F.O., Shaeffer, D.L.; Baes, C.F.; III Little, C.A.; Miller, C.W.; Dunning, D.E.; Jr. Rupp, E.M.; Shor, R.W. Conf: Direct use of geothermal energy. San Diego, CA, USA. 31 Jan - 2 Feb 1978 Report: CONF-780133--2	Evaluation of uncertainties in radioecological models.	USA.	Iodine-131.	Animal feeds, milk.		This paper presents results of statistical analyses for seven selected parameters commonly used in environmental radiological assessment models. The uncertainty is also estimated for the annual dose rate predicted by a multiplicative chain model for the transport of molecular iodine-131 via the air-pasture-cow-milk-child's thyroid pathway.
Hoffmann, F.O. JR: Health Physics, Mar. 1978, v. 35, p. 413-416.	A Review of Measured Values of the Milk Transfer Coefficient (fm) for Iodine.	USA.	I-131.	Milk		TF for milk.
Horak O., Mück K., Gerzabek M.H. Book (Conf.): International symposium on environmental contamination following a major nuclear accident, Vienna, Austria, 16-20 Oct 1989.	^{137}Cs Soil to Plant Transfer Factors Derived from Pot Experiments and Field Studies.	Austria.	Cs-137	Crop plants, leaf vegetables, fruits, potato tubers		TF.

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IAEA, 1990, 451 p., v. 2, p. 29-36. IAEA-SM--306/4.						
Horak, O. JR: Agro Zucker, 1986 v. 4, p. 11-12.	Radioactive uptake by plants. Die Aufnahme radioaktiver Stoffe durch Pflanzen In German.	Austria.	^{134}Cs, ^{131}I, ^{137}Cs, ^{106}Ru, ^{90}Sr.	Several agricultural plants.	Soils.	Fundamentals of radionuclide uptake by plants both by leafs and by roots. Iodine, cesium, strontium and ruthenium are considered and a table of the measured concentrations in several agricultural plants shortly after the Chernobyl accident is presented. Another table gives the Cs and Sr transfer factors soil plants for some plants. Using those estimates of future burden can be obtained.
Howard BJ., Beresford NA., Mayes RW. and Lamb CS. JR: Journal of Environmental Radioactivity, 1993, v. 19, p. 155-161.	Transfer of ^{131}I to Sheep Milk from Vegetation Contaminated by Chernobyl Fallout.	UK. Feeding experiment.	I-131.	Herbage.		The transfer coefficient (F_m) of ^{131}I from Chernobyl contaminated herbage was 0.29 ± 0.017 day litre^{-1}.
Howard BJ., Hove K., Strand P., Pronevich V. Book (Conf.): International symposium on environmental impact of radioactive releases, Vienna, Austria, 8-12 May 1995. IAEA, Oct 1995, 874 p., p. 247-258. IAEA-SM--339/198P; STI/PUB--971	Aggregated Transfer Coefficients. A simple approach to modelling transfer of radionuclides to food products from semi-natural ecosystems.	Nordic countries.	^{137}Cs.	Sheep meat, Goat milk, cow milk, beef, reindeer, fungi, berries, game animals	Organic soils, clay/sand soils.	Tag values with information on soil groups give potentially a robust, rapid method of predicting areas where there might be high, long term radiocaesium contamination of food products from semi-natural ecosystems.
Howard, B.J., Beresford, N.A., and Hove, K., (1991) Health Physics, Vol 61, No. 6, 715 - 725.	Transfer of radiocaesium to ruminants in natural and semi-natural ecosystems and appropriate countermeasures.	Norway, Sweden and Finland and some other countries	Cs-134 and Cs-137	Reindeer and lamb, meat, milk and milk-products	Short and long time after deposition	The duration and extent of radiocaesium contamination of ruminants will be more severe in unimproved ecosystems compared with agricultural areas. Countermeasures have been developed and used successfully to reduce radiocaesium levels in ruminants grazing in unimproved ecosystems. A part from decontamination by altering farming practices and providing uncontaminated feeds, sustained reductions of 50 to 80% in the radiocaesium concentrations of both milk and meat have been achieved in many ruminants species when AFCF is given via a sodium chloride lick or as a substined-release bolus.
Howard, J., Hove, K., Prister, B., Sobolev, A., Ratnikov, A., Travnikova, I,; Averin, V., Tronevitch, V.,; Strand, P. , Bogdanov, G. Conf.: 1. international conference on 'The radiological consequences of the Chernobyl accident' Minsk,	Fluxes of radiocesium to milk and appropriate countermeasures.	Belarus, Russia, Ukraine.	^{137}Cs.	Animal fodder, milk.	Soils, fertilizers.	Combining information about soil type, transfer rates for each major soil type, deposition, pasture size and grazing strategies can be a useful method of quantifying transfer of radiocesium to milk. Effective Countermeasures are available to reduce radiocesium transfer.

Author/Source	Publication name	Site	Deposition	Product(s)	Soil, season	Abstract
Belarus, 18-22 Mar 1996. INIS-BY--020 Proceedings of the first international conference 'The radiological consequences of the Chernobyl accident', Luxembourg, 1996, 1192 p., p. 349-362.						
Hove, K., and Strand, P. (1990) In: Environmental contamination following a major nuclear accident, Proceedings of an international symposium. IAEA, Vol 1, Vienna, IAEA-SM-306/40, 215 - 223.	Predictions for the duration of the Chernobyl radiocaesium problem in non-cultivated areas based on a reassessment of the behaviour of fallout from nuclear weapons tests.	Norway, non-cultivated areas	Cs-134 and Cs-137	Lamb	Grazing season	Levels in lamb meat of 13 - 100 Bq/kg of weapon tests Cs-137 were observed per kBq/m^2 in both the 1966 - 1972 and 1986 - 1988 periods. Transfer factors from Chernobyl radiocaesium were of similar magnitude (24 - 136 Bq/kg per kBq/m^2) in 1986 - 1988 shortly after the Chernobyl accident.
Hove K., Lönsjö H., Andersson I., SormunenCristian R., Hansen, H.S., Indridason K., Joensen H.P., Kossila V., Liken A., Magnusson S., Nielsen S.P., Paasikallio A., Pálsson S.E., Rosén K., Selnæs T., Strand P. and Vestergaard T. (1994) In: H. Dahlgaard (Ed.): Nordic Radioecology. Elsevier Science Publishers, Amsterdam. ISBN 0-444-81617-8, pp. 211-228.	Radiocaesium transfer to grazing sheep in Nordic environments.	Nordic countries	Cs-134 and Cs-137	Soil - herbage - lamb food chain	Spring	Soil to herbage radiocaesium transfer factors were high on the organic and acidic soils of the Faroe Islands, Iceland, Norway and Sweden averaging 18-82 Bq/kg Cs-137 herbage on a soil deposition of 1 kBq/m2 Cs-137, and much lower on the sandy soils of Denmark and clay soils in Finland (0.4-0.8). Herbage to lamb concentration factors were generally more homogenous, with values ranging from 0.25 - 0.70 indicating that absorption of radiocaesium from herbage was similar in each of the counties. A Cs-137 deposition of 1 kBq/m2 soil gave rise to much lower meat radiocaesium concentrations at the sites in Denmark, the Faroe Islands and Finland (0-5-3.0 Bq/kg) than Iceland, Norway and Sweden (20-47 Bq/kg).
Häkkinen U.L., Lakanen E. In Book: Comparative Studies of Food and Environmental Contamination. Proceedings of a Symposium, Otaniemi, 27-31 Aug. 1973, p.249-258.	The Adsorption and Extraction of ^{90}Sr and ^{137}Cs in Finnish Soils.	Finland	^{90}Sr, ^{137}Cs.			
Ivanov Y.A., Lewyckyj N., Levchuk S. E., Prister B. S., Firsakova S. K., Arkhipov N. P., Arkhipov A. N., Kruglov S. V., Alexakhin R. M., SandallsJ. and Askbran S. JR: Journal of Environmental Radioactivity, 1997, v. 35(1), p. 1-21.	Migration of ^{137}Cs and ^{90}Sr from Chernobyl Fallout in Ukrainian, Belarussian and Russian Soils.	Chernobyl zone.	Radio-isotopes of Cs and Sr.			The experimental results showed that the type of soil and its water content had a significant influence on the radionuclide distribution pattern in the soil profile. In undisturbed well-drained sandy and sandy loamy soils, the radionuclides were retained in the upper soil layers. However, in peaty boggy soils and flooded meadows, there was a greater downward migration. In tilled soils, the radionuclides were distributed more or less homogeneously

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						within the cultivated soil layer: the depth and homogeneity of the nuclide distribution depended on the soil texture and the way that the soil had been managed. The vertical migration rates of the ^{90}Sr were always higher than that of ^{137}Cs. In a comparison of migration rates between ^{137}Cs and ^{90}Sr in different types of soils, ^{90}Sr appeared to migrate fastest in sandy loam and sandy soils, and ^{137}Cs migrated fastest in peaty, boggy soils.
Joensen H.P. JR: Journal of Environmental Radioactivity, 1999, v. 46, p.345-360.	Long-Term Variation of Radiocaesium on the Food Chain of Lamb in the Faroe Islands.	Faroe Islands	^{137}Cs	Pasture, lamb meat.		TF.
Johanson, K.J. (1987). Försöksledarmötet. Del 4, pp. 9.1 - 9.3. Uppsala.	Konsekvenser av Tjernobyl för svenskt jordbruk. Det radioaktva nedfallet och dess biologiska verkningar.	Sweden.	Chernobyl fallout			Radioactive fallout was small in cities and important agricultural districts. The main fallout occurred in areas of high sensitivity for cesium, meagre soils areas. The most dangerous is that accidental can be transferred to distant areas from release power.
Jones DR., Paul L. and Mitchell NG. JR: Journal of Environmental Radioactivity, 1999, v. 44, p. 55-69.	Effects of ameliorative measures on the radiocaesium transfer to upland vegetation in the UK.	UK. Plot experiments.	Cesium-137, strontium-90.			The use of soil amendments to immobilize ^{137}Cs in the soil and/or reduce its uptake by plants was investigated. The ^{137}Cs concentration and transfer coefficient of vegetation from both treated and control plots exhibited a seasonal variation with peaks in early summer and were affected by plant species. Some treatments, particularly muriate of potash and clinoptilolite, produced marked reductions in the ^{137}Cs transfer coefficient of the bulk vegetation and individual species.
Karlén, G.& (Rosén, K.) (1994). Inst. för radioekologi, Report SLU-REK-74.	Intervjuundersökning av jordbrukare erfarenheter efter Tjernobyl-olyckan.	Field work. Sweden.	Cs-137.			
Karlen, G.; Johanson, K.J.; Bertilsson, J. (1995) Journal of Environmental Radioactivity 1995, v. 28(1), p. 1-15.	Transfer of ^{137}Cs to cow's milk: investigations on dairy farms in Sweden.	Sweden.	Cs-137.	Fodder, milk.	Seasonal variations.	Accumulated doses for the whole growth season, based on weekly labour time are estimated, mSv per farm unit: 24-39 for Gss, 21-38 for Ss, 4-8 for Nn. Collective dos for farmers, manSv per farm, are 64-172, 81-241, 12-37 respectively.
Katana H., Bunnenberg C. and Kühn W. Book (Conf.): 4. Cadarache international Symposium on Radioecology. Cadarache (France). 14-18 Mar 1988. Vol. 2. Cadarache (France). Section	Studies on the Translocation of Cs-134 from Leaves to Fruit of Apple Trees.	Germany.	Cs-134.	Apple trees.		The present study concern the translocation of cesium in apple trees from different plant parts into fruit in view of its possible contribution to fruit contaminatin. Translocation coefficients fT (Bq $kg^{-1}/Bq\ m^{-2}$) are given in table in relation to age and different application technique.

Author/Source	Publication name	Site	Deposition	Product(s)	Soil, season	Abstract
Documentation - CEN/Cadarache. p. E72 - E78.						
Keller, C. JR: Naturwissenschaftliche Rundschau, Jul 1980, v. 33(7), p. 282-284.	Uptake of radionuclides from soil. Aufnahme von Radionukliden aus dem Boden. In German.	Germany. Experiment.	^{90}Sr, ^{137}Cs, ^{60}Co, ^{54}Mn.	Potatoes, sugar beets, winter wheat, spring barley, clover, alfalfa ray grass.		The transfer factors for the radionuclides ^{90}Sr, ^{137}Cs, ^{60}Co and ^{54}Mn are reported about. Potatos, sugar beets, winter wheat, spring barley, clover, alfalfa and ray grass, and in some cases also field vegetables were used. The influence of soil properties on the transfer factors is investigated.
Kiefer, J. JR: Umwelt, Nov. 1986, no.7, p. 534-536.	Biological radiation effects. Extrapolating from high radiation loads to low values. Biologische Strahlenwirkung. Von hohen Strahlenbelastungen wird auf niedrige Werte extrapoliert. In German.	Germany.	^{131}I, ^{137}Cs, ^{90}Sr.			The Chernobyl reactor accident gave rise to the spreading of totally different versions and evaluations of short-term and long-term biological radiation effects. The topical discussion refers to the radionuclides iodine 131, cesium 137 and strontium 90 explaining the radionuclide migration (food chain, transfer factors).
Kirchmann, R. Fagniart. Report (Conf.): Meeting of the IUR workgroup on soil-to-plant transfer factors, Saint-Paul-lez-Durance (France), 16-18 Apr. 1984, 185 p., p.56-64. INIS-mf--10171	Workshop soil-plant transfer factors of radionuclides: results obtained at Mol.	Belgium.	^{60}Co, ^{137}Cs, ^{85}Sr, ^{99}Tc.	Plants.	Soils.	This report presents experiments performed at Mol during the year 1983 in the framework of the UIR working group. Materials and procedures used are briefly mentioned. Next, results on radionuclide transfer are presented especially of ^{60}Co, ^{134}Cs, ^{85}Sr and ^{99}Tc.
Kirchner G., Ehlken S. Report (Conf.): 28. annual meeting of the European Society for New Methods in Agricultural Research Annual meeting of the International Union of Radioecology (IUR) Working Group Soil-to-Plant Transfer Brno (Czech Republic), 26-29 Aug 1998, 202 p., p. 66. INIS-CZ--0022	Soil-to-Plant Transfer Factors: Limitations of a Simple Concept.	Germany.				TF.
Kirchner, G. Book (Conf.): 15. Regional congress of the International Radiation Protection Association (IRPA) on the radioecology of natural and artificial radionuclides. Visby, Sweden, 10-14 Sep 1989 FS--89-48-T; Feldt, W. (ed.), The radioecology of natural and artificial radionuclides.	Analysis of the transport of Chernobyl fallout nuclides through the pasture-cow-milk food chain using a time-dependent model.	Germany, Bremen.	^{131}I and ^{137}Cs.	Plants, milk.	Time dependence.	Following the Chernobyl accident, activity concentrations in grass and in milk from one particular cow grazing were analyzed continuously in order to monitor the time-dependent transfer via the grass-cow-milk food chain. From these data weathering half lives on grass are calculated. Using a three compartment model, transfer rates for the transport of I-131 and Cs-137 into milk are determined. Transfer coefficients from feed to milk for use with equilibrium food chain models are derived. Gener-

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Proceedings. Koeln (Germany, F.R.); 1989, 609 p., p. 196-201.						ally, results are in the range of transfer data reported in the literature.
Kirchner, G. and Baumgartner, D. Conf.: 27. Colloquium Spectroscopium Internationale (CSI) Pre-symposium on measurements of radionuclides after the Chernobyl accident. Bergen, Norway, 9-14 Jun 1991. JR: Analyst, Mar 1992, v. 117(3), p. 475-479.	Migration rates of radionuclides deposited after the Chernobyl accident in various North German soils.	Germany.	^{90}Sr, ^{134}Cs, ^{137}Cs and ^{239}Pu + ^{240}Pu.		Eutric Cambisol, Orthic Podsol and Eutric Histosol.	Distributions of ^{90}Sr, ^{134}Cs, ^{137}Cs and ^{239}Pu + ^{240}Pu in the soil profiles were determined. Sampling was performed more than 3 years after deposition of Chernobyl fallout nuclides. Migration rates calculated with a compartmental model showed no significant differences between Cs originating from either atomic weapons or Chernobyl fallout. This result indicates that Chernobyl Cs may have reached sorption equilibrium with the soil matrix 3 years after the accident.
Kirchner, G. JR: Health Physics, Mar. 1994, v. 66(6), p. 653-665.	Transport of Iodine and Cesium via the Grass-Cow-Milk Pathway after the Chernobyl Accident.	Germany.	Cs-137, I-131.	Feed and milk.		Mean values of equilibrium feed-to-milk transfer coefficients are 3,4± 0,4 10-3 d L^{-1} for ^{131}I and 5,4 ± 0,5 10-3 d L^{-1} for ^{137}Cs.
Knatko VA., Gurkov VV., Asimova VD., Shpakovskaya EB. and Shimanovich EA. JR: Journal of Environmental Radioactivity, 1994, v. 22, p. 269-278.	Soil-Milk Transfer of ^{137}Cs in an Area of Byelorussia after the Chernobyl Accident.	Belarus.	137Cs.	Grass, milk.	Different soil types.	An analysis of relationship between the TF and soil contamination shows a decreasing trend in the TF values with increasing soil contamination levels. TF values (Bq l^{-1} / kBq m^{-2}) were of about 0.5 and 0.4 for regions where soil contamination was 1000 kBqm^{-2} and 2000 kBq m^{-2} respectively.
Knatko, V.A.V.A. Ageets, V.U.V.U. Shmigelskaya, I.V.I.V. Ivashkevich, I.I.I.I. (2000). Journal of Environmental Radioactivity, Volume 48, Issue 2. April 2000. P, 171-181	Soil-to-potato transfer of ^{137}Cs in an area of Belarus: regression analysis of the transfer factor against ^{137}Cs deposition and soil characteristics - Evidence for non-linearity with reference to substrate concentration		Cs-137	potato which were taken from fields	325 samples of soil	TRd depends on surface/weight ratio of the plant part considered. Changes in TRd-values were rapid during early growth, slower in later growth stages. Top recovery was about 5-6 % of Cs-134 and 2 % of Sr-85. Results can be used for prediction purposes.
Koehler, H. Leising, C. Wirth, E. JR: Bundesgesundheitsblatt, Apr 1986, v. 29(4), p. 106-109.	Reliability of transfer factors used by mathematical models for radioecological assessment. Zuverlaessigkeit von Transferfaktoren in radiooekologischen Rechenmodellen. In German.	Germany.	^{137}Cs, ^{90}Sr.	Plants.	Soils.	The main causes of the large variability of transfer factors are analysed primarily using Cs-137 and Sr-90 as an example, and proposals are discussed for achieving a more reliable determination of transfer factors on the basis of available information.
Kopp P., Görlich W., Burkart W., Zehnder H.J. Book (Conf.): International symposium on environmental contamina-	Foliar Uptake of Radionuclides and Their Distribution in the Plant.	Switzerland.	Cs-134, Sr-85, Ca-45	Strawberries, berry bushes.		Radionuclides, especially cesium and to a lesser extent strontium are taken up by plants from the top surface of leaves and transported through the plants to the edible portion. This process is completed

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tion following a major nuclear accident, Vienna, Austria, 16-20 Oct 1989. IAEA, 1990, 451 p., v. 2, p. 37-46. IAEA-SM--306/50.						after about 6 hours. Iodine is also taken up, but not to the same extent. Shovering of the plants within a few hours of deposition removes most of the radionuclides from the leaves.
Kopp P., Oestling O. and Burkart W. In Book: Desmet G. (ed.) Reliability of Radioactive transfer models., Elsevier, London, 1988, p. 167-176.	Transfer of Radionuclides to Food Plants: Root Versus Foliar Uptake.	Switzerland.	^{137}Cs, ^{134}Cs.			TF.
Kopp, P.; Goerlich, W.; Burkart, W. Conf. (Book): Workshop on the transfer of radionuclides in natural and semi-natural environments. Udine, Italy, 11-15 Sep. 1989 Elsevier Applied Science, 1990, p. 583-590.	The transfer of cesium-134 and -137 from sewage sludge to plants.	Semi-natural environment; refused deposite site Switzerland.	Activities to May 1, 1986: 900 Bq/kg dry weight of ^{134}Cs; 1600 Bq/kg of ^{137}Cs and 20 Bq/kg of ^{90}Sr.	Vegetable edible parts: roots, sterm, leaves.	Sludge was deposited as a root deep layer (20cm) on a layer of clay.	Tf varied by a factor of 2.5 between similar kind of plants (leafy vegetables): 0.26 (kale) and 0.68 (chicory); and by a factor of three between different samples of the same plants (beans): 0.05 and 0.14.
Kostiainen E, Rantavaara A. In: Bréchignac F (ed.). Radioprotection. Proceedings Volume I of the International Congress: The Radioecology – Ecotoxicology of Continental and Estuarine Environments ECORAD 2001, Aix-en-Provence, France, 3-7 September, 2001. Radioprotection – colloques 2002; 37 (C1): CI-509-514.	Transfer of ^{137}Cs and ^{90}Sr from Finnish soils to cereal grains.	Finland.	^{137}Cs, ^{90}Sr	Wheat, rye, oats, barley	Different soil types.	The transfer of ^{137}Cs and ^{90}Sr from soil to cereal grains in various regions in Finland was studied. The aggregated transfer factors from the mean regional ^{137}Cs deposition (kBq m^{-2}) to cereal grains were calculated. The TFs (m^{2} kg^{-1} (d.w.)*10^{-3}) were highest in organic soils ranging from 0.013 to 0.12, lowest in clay soils, ranging from 0.015 to 0.061, and decreased in the order: oats > rye > barley and wheat.
Krouglov S.V., Filipas A. S., Alexakhin R. M. and Arkhipov N. P. JR: Journal of Environmental Radioactivity, 1997, v. 34(3), p. 267-286.	Long-Term Study on the Transfer of ^{137}Cs and ^{90}Sr from Chernobyl-Contaminated Soils to Grain Crops.	Chernobyl zone.	Radio-isotopes of Cs and Sr.	Grain crops		The level of ^{137}Cs and ^{90}Sr transfer to four grain crops and the change in transfer with time have been studied on two soils. Field experiments were carried out in 1987-1994. Shortly after the deposition, the rate of ^{90}Sr accumulation by crops was comparable with, or even slower, than that of ^{137}Cs, which is in disagreement with the usual findings. In the following years, ^{137}Cs uptake by plants was reduced by a factor in excess of than 50, whereas the soil-to-plant concentration ratio of ^{90}Sr increased within one order of magnitude, and has remained on approximately the same level since 1991. Changes of the ^{90}Sr and ^{137}Cs concentration ratios for grain crops with time have been used to

Author/Source	Publication name	Site	Deposition	Product(s)	Soil, season	Abstract
						evaluate the rate of radionuclide leaching from fuel particles and the ageing processes.
Lakanen E. and Paasikallio A. Report: Ann. Agr. Fenn., Ser. Agro-geol., Chim. Phys., 1970, 9(46), p. 133-138.	The Effects of Soil Factors on the Uptake of Radiostrontium by Plants. Part II.	Finland.	Sr-89.	Timothy.	Different soil types (sand, clay, peat), Ca, pH.	The soils were contaminated by 40 μCi of Sr-89 per pot. Timothy was sown, harvested after six weeks and analyzed. The mixing of Sphagnum peat in sand reduced the plant uptake of Sr-89 by factor of 7 and the Sr- 89/Ca ratio by factor of 3. The application of inactive strontium to previously contaminated soils reduced the Sr-89/Ca ratio of the plants in fine sand and heavy clay, but increased it in Sphagnum peat.
Lakanen, E. JR: Acta Agriculturae Scandinavica, 1967, 17, 2-3, p. 131-139.	The Effect of Liming on the Adsorption and Exchange Characteristics of the Trace Elements in Soils.	Finland.				
Lakanen E. and Paasikallio A. Report: Ann. Agr. Fenn., Ser. Agro-geol., Chim. Phys., 1968, 7, p. 89-94.	Effects of Soil Factors on the Uptake of Radiostrontium by Plants. Part I.	Finland. Pot experiment.	Sr-89.	Timothy.	Different soil types (sand, clay, peat), Ca, pH.	The effect of soil types and pH on the uptake of Sr 89 by timothy was studied. The increase of soil pH reduced the uptake of Sr. The effect of soil type was more pronounced and the Sr-89/Ca ratio of the plant clearly decreased in the order: fine sand, heavy clay, Sphagnum peat, and Carex peat.
Lassey K.R. JR: Health Physics, 1979, v. 37, p. 557-573.	The Transfer of Radiostrontium and Radiocesium from Soil to Diet: Models Consistent with Fallout Analyses.	New Zealand.	^{134}Cs, ^{137}Cs, ^{89}Sr, and ^{90}Sr.	Grass, grain, vegetables, milk.	Soil types.	Compartment models are used to predict contamination levels due to hypothetical fallout and comparing the resulting expressions with UNSCEAR's predictive formulae.
Lassey K.R. JR: Health Physics, 1980, v. 39(2), p. 321-325.	The Usage of Transfer Coefficients to Describe Radionuclide Transport fro a Cow's Diet to its Milk.	New Zealand.	Radio-nuclides.	Forage, milk.		The transport of radionuclides from cow's diet to its milk is frequently described in terms of "transfer function" or a "transfer coefficient". The usual definition of transfer coefficient is consistent with dimensions (time / volume), but in some cases the transfer coefficient is supplied with units which belie these dimensions. A further parameter (referred as the transfer rate) with dimensions (volume)$^{-1}$ is sometimes used in place of the transfer coefficient. The prolifiration of definitions and supplied units, and the fact that the symbol fm has been used to denote the transfer rate, can lead to a misinterpretation and misuse of published numerical values. Thus, a simple derivation of these parameters, their interpretations and interrelationships seems warranted.
Lengemann FW. and Wentworth R.A.	The Transfer Coefficient of ^{137}Cs into Cows Milk as	USA, NY.	Cs-137.	Milk		TF for milk.

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JR: Health Physics, Mar. 1978, v. 34, p. 720-722.	Related to the Level of Milk Production.					
Lengemann F.W. JR: Health Physics, Mar. 1967, v. 13, p. 521-522.	Predicting the Total Projected Intake from Milk by Man: Modification of the Original Equation.	USA.	^{137}Cs, ^{90}Sr, ^{131}I.	Grass, milk.		Simplified formula of the transfer of radionuclides into milk as a function of time is given.
Lengemann, F.W., Wentworth R.A. and Hiltz F.L. JR: Health Physics, Mar. 1968, v. 14, p. 101-109.	Predicting the Cesium-137 Intake from Milk of a Human Population after a Single, Short-Term Deposition of the Radionuclide.	USA.	^{137}Cs.	Milk.		A rapid means of assessing the human dose-commitment of radiocesium following a nuclear incident is presented. The important advantage is that calculations rest upon knowledge of milk levels rather than upon values of surface contamination of pasture which are most difficult to obtain and interpret. The effects of practical countermeasures are also determined.
Lrhr, J. Report: EUR--4901; Nov. 1972.	Indirect radioactive contamination of the food chain determination of the factors of transfer soil/agricultural produce and soil/milk in the European Community.	CEC.	Cesium 137.	Forage, milk.	Mineral and organic compounds; pH values; humidity; seasonal variations.	TFs were evaluated in soil/agricultural and soil/milk transfer of radioactive contamination.
Lönsjö, H. & Haak, E. (1975). Inst. för Radiobiologi, Rapport SLU-IRB-31.	Studies on Plant Accumulation of Fission Products under Swedish Conditions. VII: Uptake of ^{90}Sr by Agricultural Crops as Influenced by Soil Type, Liming Rate and PK-Fertilization in a Long-Term Micro Plot Experiment.	6 year field experiment with 3 mineral topsoils on sandy subsoil. Sweden.	90.8 µCi/0.25 m2.	Straw and grain of oats, barley and peas in two 3-year crop rotations	3 mineral soils	Liming clearly decreased Cs-137-uptake by all 3 crops, more for peas in than oats and barley. K-fertilization slightly decreased the uptake: No consistent effect of P-fertilization. pCi/kg d.w. /mCi/ha
Lönsjö, H. & Haak, E. (1986). Inst. för Radioekologi, Rapport SLU-REK-60.	Effekter av djupplacering och kaliumgödsling på jordbruksgrödors upptag av cesium och strontium.	Work based on Field experiments with artificial depositions of Cs-137 in soils at two different sites, one in the Southern and one in the middle part of the country. Sweden.	Cs-134, Sr-89.	Ley crops, cereals, oil crops and sugar beets.	The soils were representative of the land near Barsebäck in the south and of middle Swedish heavy clays. 3 years in 1982-84	The crop uptake of strontium and caesium nuclides was studied under field conditions with the aid of the micro plot technique. Ley crops, cereals, oil seed crops and sugarbeets were tested in experiments with different placement of nuclides and of potassium amendments in four treatments. Fertilizer treatments as well as deeper placement of the nuclides reduced the uptake by the crops considerably.
Lönsjö, H. (1973). Inst. för Radiobiologi, Rapport SLU-IRB-20.	Radiostrontiums sorption och utbytbarhet i ett antal svenska jordar.	Licentiat dissertation. Sweden.				Comprehensive literature review and discussion of how chemical and physical soil factors soil influence sorption, desorption, mobility and bioavailability of Sr-90 as exemplified by laboratory ex-

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						periments.
Lönsjö, H. (1983). (Ed. Å. Eriksson). Inst. för Radioekologi, Rapport SLU-REK-55, pp. 11:1-68.	Extern strålning från deponerat radiocesium vid jordbruksdrift. Långsiktiga konsekvenser av radjoaktiv beläggning i jordbruket. J. Malmöhus län	Estimates for Swedish conditions	Cs-137, Sr-90.	Estimated consequences of fallout for the Swedish agriculture		On the basis of comprehensive studies by many workers a survey is given of the agricultural conditions that influence the farmer's radiation protection after heavy fallout on the land.
Lönsjö, H. (1986). Inst. för Radioek, Rapport SLU-REK-61, pp 255-265.	Effects of remedial measures on the external radiation exposure from Cs-137 after a farmland contamination. 1st Int. Contact sem. in Radio ecology 8-11 July 1985, Uppsala, Sweden.	Estimates for Swedish conditions	Cs-137	Estimated consequences of fallout for the Swedish agriculture		Effects of different remedial measures, restricted sojourn, deep-ploughing and ground surface decontamination on the external radiation of Cs-137 to family farmers, following a contamination of agricultural land were calculated. In the reference situation, i.e. where no measures were undertaken, the external dose to the farmer five years after deposition would amount to 1.1 mSv/year on a farm with brick buildings and to about 2.5 on a farm with wooden houses calc. for a dep. of 1 MBq/m^2. A reduction to 25-30 percent of these values might be achieved by deep ploughing and decontamination of the ground surfaces outside buildings.
Lönsjö, H. (1986). Inst. för Radioekologi, Rapport SLU-REK-59.	Externstråldoser från radiocesium deponerat på jordbruksmark.	Estimates for two Swedish farms in the southern and western parts of the country.	Cs-137.			Two case studies were made on farms near nuclear power stations. The aim was to assess the long-term effects on agricultural enterprises following accidental releases of radioactive elements. The external doses from Cs-137 and Cs-134 were estimated considering specified conditions with regard to the fallout and the distribution of caesium in the soil profile.
Lönsjö, H. (1987). Inst. för Radioekologi, Rapport SLU-REK-63.	Konsekvenser för lantbruket efter ett utsläpp av ^{137}Cs från Barsebäcksverket med respektive utan inkopplad filtra-anläggning.	Kalkyler utförda med olika hjälpmedel för att utreda nuklidtransporten med jordbruksprodukter efter nedfall i södra Sverige. Sweden.	Cs-137.	Estimated consequences of Cs-137 released.		The estimates show that after the FILTRA - CONSTRUCTION was in operation a release of Cs-137 from the Barsebäck works would cause very limited environmental consequences.
Lönsjö, H., Haak, E. & Rosén, K. (1990). Proceedings. FAO/IAEA/UNEP/WHO Interna-	Effects of Remedial Measures on Long Term Transfer of Radiocaesium from Soil to	Sweden.		Grain of cereals, peas and oil crops. Grass	Various mineral soils.	The situation for a real village of 14 farms after detonation of nuclear weapons in Europe is estimated. The fallout corresponding to a weekly dose

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tional Symposium on Environmental Contamination Following a Major Nuclear Accident, 16-20 October 1989, Vienna, Austria, pp 151-162.	Agricultural Products as calculated from Swedish Field Experiments.			herbage of pastures and leys.		in free air of 1 Gy is assumed to appear at different alternative parts of the season. The consequences with regard to the transfer to animal feed, human diet and doses to animals and the farmers are discussed. Relative effects and TFd = m^2/kg d.w.
Lönsjö, H., Nilsson, E. & Tuvesson, M. (1986). Proc Int. Contact Seminar in Radioecology, Piazenca, Italia 9-11 Sept 1986. Piacenza, Italy. Università Cattolica del Sacro Cuore, Instituto di Chimica, pp. 161-172.	Consequences in Sweden of the Chernobyl event. III: Distribution of ^{137}Cs in ley crops and measures taken to obtain hay and silage with acceptable nuclide concentrations.	Sweden.	Variable with the site.	Grass forage.	Highly contaminated Chernobyl fallout sites.	Investigation of countermeasure to enable harvest forage with acceptable Cs-137 concentrations and guidelines for advising farmers to decrease levels of Cs-137 enough for to be used for feeding animals with contaminated forage. kBq/kg d.w.
MacNeill G., Duffy JT., Cunningham JD., Coulter B., Diamond S., McAulay IR., Moran D. Conf.: 27. Colloquium Spectroscopium Internationale (CSI) Presymposium on measurements of radionuclides after the Chernobyl accident. Bergen, Norway, 9-14 Jun 1991. JR: Analyst Mar 1992, v. 117(3), p. 521-524.	Transfer characteristics of radiocaesium from soils to permanent pasture.	Ireland	^{134}Cs and ^{137}Cs.	Pasture.	Different types of soils. Seasonal variations.	The influence of soil parameters on transfer was investigated. Sampling of soil and pasture grass was undertaken during a period from the Spring of 1987 to the Autumn of 1988. In October 1988 more than 88% of the ^{137}Cs attributable to Chernobyl was mainly confined to the top 10 cm of undisturbed soil, with 79% on average in the top 5 cm. A negative correlation with pH was observed in 1987. In April 1987 concentration ratios for 137Cs in grass ranged from 0.03 to 0.49. In general, comparison of the concentration ratio values showed a decreasing trend over the 18 months.
Madelmont, C.; Bouville, A.; Beckhols, R.; Coulon, R. Book (Conf.) 4. International congress of the International Radiation Protection Association: radiation protection as an example of action against modern hazards. Paris, France. Apr. 24 - 30, 1977.	Levels of fallout ^{90}Sr and ^{137}Cs in milk regional variations of transfer factors. Contamination du lait en ^{90}Sr et en ^{137}Cs resultant des retombees atmospheriques: variations regionales des coefficients de transfert. In French.	France.	^{137}Cs, ^{90}Sr.	Milk.		On the basis of ten-year results of radioactive monitoring of the levels of ^{90}Sr and ^{137}Cs in milk at the production stage, a contamination model was developed taking account of regional parameters. Considering the fundamental differences between contamination conditions from the two radionuclides, an interpretation of the variations of the parameters obtained was attempted as a function of climatic, agronomic and zootechnic factors. General contamination models should be fitted to the specific environmental conditions, which is most interesting as it allows more accurate estimates as to consequences and predictions of ^{137}Cs and ^{90}Sr deposits in a specific area.
Malm, J., Uusi-Rauva, A., Paakkola, O., Rantavaara, A. JR: Journal of Environmental Radioactivity,	Uptake of caesium-137 from peat and compost mould by vegetables in a greenhouse experiment.	Finland. Experiment.	Cs-137.	Cucumber, tomatoes, parsley, radish, lettuce.		The transfer factors (activity in plant dry weight/activity in soil dry weight) varied from 0.66 to 1.8 for peat and from 0.060 to 0.19 for compost mould. Addition of potassium did not have any

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1991, v.14 (2), p. 123-133.						clear effect on the transfer factors.
Mascanzoni, D. (1983). (Ed. Å. Eriksson). Inst. för Radioekologi, Rapport SLU-REK-55, pp. V: 3:1-14.	En traktors skärmningsförmåga med avseende på strålningen från en med ^{137}Cs belagd markyta. Långsiktiga konsekvenser av radioaktiv beläggning i jordbruket. I Malmöhus län	Estimates for Swedish conditions	Cs-137.			Measurements indicate that a tractor can reduce the gonad dose of the driver, which is delivered by Cs-137 deposited on the ground. From a nearby area the protection factor may be ~2.5 but less from larger distance, >5 m. Tractors are open in some directions and higher protection factors require special constructions.
Mascanzoni, D. (1986). Inst. för Radioek, Rapport SLU-REK-61, pp 145-150.	Experimental work on transport of Co57, Mn54 and Ni63 to fodder crops from eight Swedish soils. 1st Int. Contact sem. in Radio ecology 8-11 July 1985, Uppsala, Sweden.	Work based on Field experiments with artificial depositions of nuclides in soils from different parts of the country. Sweden.	Co, Mn and Ni.	Fodder crops. Clover for 1976-1979, timothy for 1980-1984.	Eight different soils from the main agricultural districts in Sweden.	The root uptake of three activation products, Co-57, Mn54 and Ni-63 were studied in a long term field experiment. The data obtained were used for calculation of transfer factors. Transfer factors of the dimension (Bq/kg dry plant)/(Bq/kg dry soil) were calculated for Mn, Co and Ni for clover and Ni for timothy period.
Mascanzoni, D. (1986). Inst. för Radioekologi, Rapport SLU-REK-62.	The aftermath of Chernobyl in Sweden. Levels of Cs-137 in foodstuffs.	Sweden.	Cs-137 and Cs-134.	Estimated consequences of fallout for the Swedish agriculture after Chernobyl		Summary of laboratory data on the caesium content in foodstuffs analysed at the laboratory after Chernobyl.
Mascanzoni, D. (1986). Proc. Int. Contact Seminar in Radioecology, Piazenca, Talia, 9-11 Sept 1986.	Consequences in Sweden of the Chernobyl event: Caesium levels in Food stuffs.	Fallout area of Sweden.	Variable with site.	Cs-137 activity concentrations in various food stuffs.	Many sites all over Sweden.	Countrywide charts of observed Cs-137 fallout levels kBq/m^2 and Cs-137 concentration levels in edible products of Fish. Hare, Roe deer, Moose, Reindeer, Honey, Sheep & Goat and tables of vegetables, berries and dairy products. Bq/kg (nCi/kg)
Mascanzoni, D. (1988). Inst. för radioekologi, Rapport SLU-REK-64.	Radioactive Fission and Corrosion Products: Transport from Soil to Plant under Swedish Field Conditions.	Doctor dissertation. Field experiments with artificial depositions of Cs-137 in soils from different parts of the country. Sweden.	Four activation products, Mn-54, Ni-63, Zn-65, Co-57 and Sr-90, Cs-137.			Four activation products and two fission products were deposited in eight different soils placed in micro plots. The transfer of the nuclides from these soils to clover, timothy and wheat over the period 1976-1984 was studied. Changes with time of the transfer factors for crops and soils were recorded as well as the differences between the soil types and between the crop products.
Mascanzoni, D. (1989). Journal of Environmental Radioactivity, 1989, v. 10(3), p. 233-249.	Plant uptake of activation and fission products in a long-term field study.	Sweden.	Cs-137, Sr-90, Ni-63, Mn-54, Zn-65.	Wheat, timothy.	Agricultural soils which occur most frequently in Sweden.	A summary version of the Doctor dissertation, SLU-REK-64 (1988). Transfer factors were highest in poor, acid soils and uptake was influenced by soil organic matter, and Ca and K status of the soils. New information on uptake of Ni-63 was provided. The uptake was correlated with Ca status

Author/Source	Publication name	Site	Deposition	Product(s)	Soil, season	Abstract
						of the soil. Distribution of the nuclides in different soil fractions confirmed competition between Ni-63/Sr-90 and calcium soil status.
Matthies M., Eisfeld K., Paretzke H. and Wirth E. JR: Health Physics, 1981, v. 40(5), p. 764-769.	Stochastic Calculations for Radiation Risk Assessment: a Monte-Carlo Approach to the Simulation of Radiocesium Transport in the Pasture-Cow-Milk Food Chain.	Germany.	Cs-137.	Grass, milk.		Results from a Monte-Carlo simulation have been presented for the transport of ^{137}Cs via the pasture-cow-milk pathway, taking into account the uncertainties and naturally occurring fluctuations in rate constants. This approach permits an estimate of the variation of the physico-chemical behaviour of radionuclides in the environment in a more realistic way than using only the highest transfer coefficients in deterministic approaches, which can lead to non-realistic overestimates.
Mirna, A. JR: Fleischwirtschaft, 1979, v. 59 (12), p. 1836-1839.	Calculation of the transfer factors for the transfer of caesium-137 from feedingstuffs to the meat of farm animals. Berechnung von Transferfaktoren fuer den Uebergang von Caesium-137 aus Futtermitteln in das Fleisch landwirtsschaftslicher Nutztiere. In German.	Germany, F.R.	^{137}Cs.	Different kind of meat.		The value presented in the article for the transfer of fallout Cs-137 from the food (animal) into the meat is, on an average, six times higher than had been assumed up to day. In pork meat, there was even an increase by 2 tenth powers.
Nalezinski S, Ruhm W and Wirth E. (1996) Health Physics 70, 717-721	Development of a general equation to determine the transfer factor feed-to-meat for radiocesium on the basis of the body mass of domestic animals	?	Cs-137	monogastric animals and ruminants	N/A	Study carried out so transfer factors can be assessed for animals where poor or no t.f information is available. Overall, the relationship between body mass and transfer factor is T.F = 8.0 x animal body mass (-0.91), with r = -0.97. For monogastric animals (including poultry) the relationship is TF = 5.8 x animal body mass (-0.70) with r = -0.97, and for ruminants it is TF = 1.9 x animal body mass (-0.72) with r = -0.72.
Nedveckaite, T.; Filistovic, V.; Maceika, E.; Tamulenaite, O. Book (Conf.): International symposium on ionizing radiation. Stockholm, Sweden, 20-24 May 1996. Amiro, B. (ed.) et al. Protection of the natural environment. International symposium on ionising radiation. Proceedings, V.1. Stockholm, SSI. 1996, 745 p., p . . . 634-639.	Experimental determination of site-specific transfer parameter of ^{131}I, $^{134,137}Cs$ and ^{210}Pb from fodder into milk and meat.	Lithuania.	^{131}I, $^{134,137}Cs$ and ^{210}Pb.	Animal fodder, milk, meat.		Measurements of ^{131}I, $^{134,137}Cs$ in feed and foodstuff during 1978-1994 (approximately 5000 measurements) provided opportunity to determine site-specific feed-to-milk (Fm) and feed-to-meat (Ff) parameter values. Plausible explanation of pre- and post-Chernobyl differences includes peculiarity of Chernobyl fallout, differences of physical-chemical forms with different bio-activity and bio-availability. Food-chain modelling and site-specific Fm and Ff values obtained in this study may be

Author/Source	Publication name	Site	Deposition	Product(s)	Soil, season	Abstract
						used to predict radioiodine, radiocesium activity in food.
Ng Y.C. JR: Nuclear Safety, Jan-Feb. 1982, v. 23(1), p. 57-71.	A Review of Transfer Factors for Assessing the Dose from Radionuclides in Agricultural Products.	USA.	Radio-nuclides.	Variety of plants.	Different soil properties.	A table of transfer factors from U.S Nuclear Regulatory Commission Regulatory Guide 1.109 is presented. Updated transfer factors suggest changes, both increases and decreases, in the current estimates.
Ng Y.C., Colsher C.S., Thompson S.E. Report (Conf.): UCRL--82545(Rev.1) CONF-790325--8 13 Jun. 1979, 28 p. Book (Conf): International symposium on biological implications of radionuclides released from nuclear industries. Vol. 2, Vienna, Austria, 26-30 Mar. 1979, p. 295-318.	Transfer factors for assessing the dose from radionuclides in agricultural products.	Simulated behaviour. California, Livermore, USA	Radioisotopes.	Milk, meat, different types of crop and plants.	Different soil conditions.	The updated TFs to predict the environmental transport of radionuclides through terrestrial food-chains to man are given. The variation of the TFs with physical and chemical form of the radionuclide, type of soil and crop leads to recommendation of adopting multiple soil-to-plant concentration factors (CF).
Nilsson, J. (1983). Inst. för Radioekologi, Rapport SLU-REK-56.	Nedplöjning av simulerad radioaktiv beläggning på jordbruksmark.	Experiments on a field scale at a site in middle Sweden.	Kieserite (MgSO4 H2O), a mineral containing 16 % of magnesium.			Experimentally different equipments for ploughing contaminated land has been compared with regard to placing a surface soil layer below the ordinary plough depth and thereby reduce plant uptake of contaminants.
Nisbet A.F., Woodman R. F.M. JR: Health Physics, Mar. 2000, v. 78, p. 279-288.	Soil-to-plant transfer factors for radiocesium and radiostrontium in agricultural systems.	UK. Data base references.	Radio-cesium, radio-strontium.	Cereals, tubers, legumes, green and root vegetables.	Different types of soil, organic substances, pH, climatic regions.	A data base of soil-to-plant transfer factors for Cs and Sr has been compiled for arable crops from published and unpublished sources. 28 soil-crop combinations, covering 4 soil types and 7 crop groups.
Nisbet A.F., Woodman R.F.M., Haylock, R.G.E. Report: NRPB-R304 London: TSO, 1999.	Recommended soil-to-plant transfer factors for radiocesium and radiostrontium for use in arable systems.	UK. Data base references.	Radio-cesium, radio-strontium.	Cereals, tubers, legumes, green and root vegetables.	Different types of soil, organic substances, pH, climatic regions.	A data base of soil-to-plant transfer factors for Cs and Sr has been compiled for arable crops from published, in-house reports and unpublished data. Best estimate values of TFs were calculated for 28 soil-crop combinations, covering 4 soil types and 7 crop groups.
Nisbet, A.F. and Shaw, S. JR: Journal of Environmental Radioactivity, 1994, v. 23, p. 171-187.	Summary of a Five-Year Lysimeter Study on the Time Dependent Transfer of ^{137}Cs, ^{90}Sr, ^{239,240}Pu and ^{241}Am to Crops from Three Contrasting Soil Types. 2 Distributions Between Different Plant Parts.	UK.	Summary ^{137}Cs, ^{90}Sr, ^{239,240}Pu and ^{241}Am.	Carrot, cabbage, barley crops.	Loam, peat, sand soils.	Soil contamination made an important contribution to the ^{137}Cs content of non-edible parts of crops growing in sand and loam due to the low soil-to plant concentration ratios in these soils. For peat soils root uptake and translocation were responsible for most of the ^{137}Cs in unpalatable crop parts. For ^{90}Sr differences in distribution between crop parts were entirely attributed to differences in mobility and translocation due to plant physiological factors. In general, partitioning of ^{137}Cs and ^{90}Sr was simi-

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						lar to K and Ca.
Noordjik H., van Bergeijk KE., Lembrechts J., Frissel MJ. JR: Journal of Environmental Radioactivity, 1992, v. 15, p. 277-286.	Impact of Ageing and Weather Conditions on Soil-to-Plant Transfer of Radiocesium and Radiostrontium.	Netherlands.	^{134}Cs, ^{137}Cs, ^{85}Sr, and ^{90}Sr.	Edible plant parts.	Climatic factors.	Transfer of Cs to edible parts of plant species gradually decreased as a result of ageing. This decrease is estimated to be a factor 1.5 after 1-2 years, up to a factor 4 after 7 years. For Sr the transfer did not change. After correction for ageing effects, annual fluctuations of up to a factor of 10 were found, depending on the plant species due to climatic conditions. The transfer of Sr increased with rainfall or with decreasing intensity of light or temperature. Values of TF are given.
Norges Offentlige Utredninger NOU, (1987) Rapport fra Helsedirektoratets raådgivende faggruppe. NOU 1987: 1, Universitetsforlagene, ISSN 0333-2306, ISBN 82-00-71051	Tsjernobyl-ulykken	Norway	Cs-134 and Cs-137, I-131 and Sr-90	Soil, vegetation, sheep, reindeer, cattle, milk and milk products	Short time after deposition	Rapporten gir en oversikt over nedfallet etter Chernobyl og konsekvensene i Norge.
Ocker, H.D. JR: Deutsche Tieraerztliche Wochenschift. 9 Jun. 1987, v. 94(6), p. 360-361.	Transfer of radiation into grain. Uebergang von Radionukliden in Getreide (Transfer factors). In German.	Germany, F.R.	Cesium 137, Strontium 90.	Cereal grains, potatoes.		Radiocesium Tfs were found to be between 0.001 and 0.04 for cereals and potato plants. Radiostrontium is much more absorbed by plants and TFs observed 0.1 and 0.35. Deposition of radionuclides on plant parts above ground leads to high contamination rates. Especially radiocesium, but also other radionuclides are movable within the plants and transported to the cereal grains and potato tubers.
Ohmomo; Yoichiro Nakamura; Yuji Honma; Yoshifumi Sumiya; Misako. Report: First report on estimation of dose from exposure to natural and manmade radiation in the environment. Sep 1976. p. 41-47. NIRS-R--5.	Studies on the estimation of radiation dose to thyroid gland through foods contaminated by gaseous radioactive iodine. In Japanese.	Japan.	I-131.	Vegetables, leaves, grass, milk.		Specially designed closed system, gaseous radioactive iodine exposure chamber, was made in order to investigate the deposition velocity of the nuclide onto leaf vegetables and grass under the different environmental conditions. Deposition velocity of the nuclide onto plant leaves relating to its chemical forms in the air, transfer rate from grass to milk and the consumption rate of those critical foods were discussed in this paper.
Olsen, R.A., (1994) In: H. Dahlgaard (Ed.): Nordic Radioecology. Elsevier Science Publishers, Amsterdam. ISBN 0-444-81617-8, pp. 265-287.	The transfer of radiocaesium from soil to plant and fungi in seminatural ecosystem	Seminatural ecosystem, Norway	Cs-134 and Cs-137	Soil - plant uptake, soil - fungi uptake	No specific	The uptake of radiocaesium in plants varied in different species and in different ecosystems. The transfer factor of pooled plant samples from natural pastures varied in 1990 from 0.005 to 0.05 m^2/kg d.w., while the variation in different acid forest soil ecosytems was between 0.08 and 0.3 m^2/kg. The radiocaesium in fungal fruit bodies of different species varied considerably, but was for many species, all of them mycorrhizal basidiomycetes,

Author/Source	Publication name	Site	Deposition	Product(s)	Soil, season	Abstract
						more than 50 times higher than in plants sampled at the same site.
Oughton, D. H. & Salbu, B. (1992) Journal of Radiation Protection Dosimetry, Vol 41, 217-222	Stable caesium, rubidium and potassium distribution with reference to radiocaesium metabolism studies	Norway.	Cs-134, Cs-137 and stable analogues	Ewes, lambs and reindeer calves	Spring	Stable alkali metals, K, Rb and Cs, have been determined in tissues of ewes and 9 week old lambs. Stable Cs and Rb, as well as Cs-134 have also been determined in blood samples from reindeer calves. Results support the assumption of specific binding of Cs ions to intracellular components. The concentrations of Cs in tissues followed the pattern: muscle>kidney>liver, varying from 0.09 to 0.23 mg/kg.
Oughton, D. H.; Salbu, B. and Day, J. P., (1991) In: B. Momcilovic (Ed): Trace elements in man and animals (TEMA-7), Institute for Medical Research and Occupational Health University of Zagreb, pp 27/15-17.	Stable Cs and Cs-137 transfer and distribution in soil, grass and sheep	Norway	Cs-137	Soil - grass - sheep	No specific	Radiocaesium showed a higher transfer from soil to vegetation than stable Cs, reflecting a larger mobile fraction of Cs-137 than stable Cs. Nevertheless, >80% of Cs-137 was found to be strongly bound to soil components, and radioactive and stable Cs were on equilibrium within the mobile fractions. The Cs-137 transferred from vegetation to tissue was in equilibrium with stable Cs, and the two isotopes were distributed similarly within body tissues.
Oughton, D. H.; Salbu, B.; Riise, G.; Østby, G. & Nøren, A. (1992) Analyst, Vol 117, 481 - 486.	Radionuclide mobility and bioavailability in Norwegian and Soviet soils	Norway and Soviet soils	Cs-137 and Sr-90	Soil - plant uptake	No specific	Although the levels of Sr-90 are generally much lower than Cs-137 activities, Sr-90 is more easily extractable, and hence more mobile than Cs-137 in the soil. In areas closer to the Chernobyl reactor, a significant proportion of the deposited activity is associated with particles. This is reflected in the higher activities of Sr-90 and the lower extractability of the Sr-90 in soil samples collected from within the 30 km exclusion zone.
Oughton, D., and Salbu, B., (1994) In: H. Dahlgaard (Ed.): Nordic Radioecology. Elsevier Science Publishers, Amsterdam. ISBN 0-444-81617-8, pp. 165-185.	Influence of Physico-chemical forms on transfer	Nordic countries	Cs-134, Cs-137 and Sr-90	Soil - plant uptake	Seasonal variations.	Mobility factors have been measured on ca. 200 soil samples collected in Norway, and were observed to range from between < 0.5 to 22% for Cs-137, and from 43 to 95% for Sr-90. Corresponding aggregated transfer factors for Cs-137 ranged from 0.008 to 0.33 m^2/kg and for Sr-90 from 0.02 to 0.35. The Cs-137 mobility factors and transfer factors for soil samples in the other Nordic countries were of the same order of magnitude as those seen in Norway.
Oughton, D.H., (1990) IUR Working group on soil-plant transfer: Workshop on The Contamination of Crops because of "Soil Adhesion",	Radiocaesium association with soil components: The application of a sequential extraction technique.	Norway and Byelorussia	Cs-134 and Cs-137	Soil - plant uptake	No specific	After soil correction, the transfer coefficients for Cs-137 (Bq/kg grass per Bq/m^2 soil) were calculated for the Norwegian and Byelorussian sites. Compared to the Norwegian samples, 2.4 - 8.0 x10-

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Uppsala, Sweden, pp 182-189.						2 m^2/kg, the samples collected from Byelorussia showed very high levels of soil associated with vegetation, 7.7 - 47 x10-2 m^2/kg. This probably reflects the low bulk density of vegetation growing in the Byelorussian soil
Oughton, D.H., and Salbu, B., (1990) In: Forskningsprogram om radioaktivt nedfall, Norges land-bruksvitenskapelige forskningsråd, pp77-83	Estimering av radionukliders mobilitet i jord v.h.a. mobili-tetsfaktorer	Norway	Cs-137 and Sr-90	Soil - plant - uptake	variation	Transfer coefficients calculated on the basis of total activity of Cs-isotopes and Sr-90 in vegetation and in soil samples show poor reproducibility, and are subject to seasonal and species variations. Based on sequential extractions, information on radionu-clides in mobile and inert forms can be obtained. Based on these fractions the mobility factors are calculated, which reflect the potentially bioavail-able fraction. These factors show good reproduci-bility, and are not influenced by seasonal variation, and should be most useful for modelling purposes.
Oughton, D.H., Salbu, B., and Strand, P., (1990) On the validity of environmental transfer models, Biomovs, Symposium Stockholm, Sweden, 235-238.	Mobility factors for estimat-ing the bioavailability of radionuclides in soil.	Norway	Cs-134, Cs-137 and Sr-90	Soil - grass	No specific	Both deposition and activities in vegetation varied by a factor of 100. In additional, the observed transfer factors varied by a factor of 100, 0.002-0.362 m^2/kg, and large variations were also ob-served within the individual sites. For samples collected from Lierne, analysis of Cs-isotopes and Sr-90 were performed. The calculated transfer factors for Cs-137 and Sr-90 varied by a factor of 4 within 1m^2, and the deposition varied by a factor of 20.
Oughton, D.H., Tronstad, E., and Skipperud, L., (1995) In: Technical Report EKO-2.1, The sheep project 1994 and 1995, Nordisk Kjernesik-kerhetsforkning, TR-EKO-2(1995)1.	Mobility of Cs in Soil	Nordic Countries	Cs-134 and Cs-137	Soil - vegetati-on/fungi - Lamb	grazing season	Soil to plant concentration ratios were higher for Cs-137 than for stable Cs both for Blomhöjden, Sweden, and Tjøtta, Norway, soil-plant systems. Data on Bq/kg soil for Hestúr soils is not available, but the few measurements of samples carried out indicate that stable Cs and Cs-137 transfer factors are of similar order of magnitude. We conclude that the decrease of Cs-137 in vegetation (and sheep) in Hestúr is more likely to be driven by the physical removal of Cs-137 from the rooting zone, than by chemical fixation in soils. In Blomhöjden and Tjøtta, removal of Cs-137 to irreversibly fixed sites could lead to reduction in transfer factors.
Oughton, D.H., Tronstad, E., and Skipperud, L., (1995) In: Technical Report EKO-2.1, The sheep project 1996, Nordisk Kjernesikkerhets-	Soil mobility: Laboratory studies	Nordic countries	Cs-134, Cs-137 and Sr-90	Soil-vegetation	Short time after deposition	Tracer studies show clearly that radionuclide mo-bility in soils varies at the different sites and within different soil types at the same site. Both Cs and Sr are rapidly sorbed to soil components, but whereas

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forkning, TR-EKO-2(1997)1.						Sr remains in ion-echangable, easy extractable forms, Cs is strongly bound to soil components. Organic content and pH seems to have the greatest influence on Sr mobility. Mineral type and content is probably the most important factor for Cs mobility.
Paakkola O. Book: Sood, D.D.; Reddy, A.V.R.; Pujari, P.K. (eds.). Radiochemistry Div. Frontiers in nuclear chemistry. Mumbai (India). Indian Association of Nuclear Chemists and Allied Scientists, 1996, 266 p., p. 229-255.	Environmental radioactivity and safety.	Finland.	^{137}Cs, ^{131}I.	Milk.		Natural radionuclides and their genesis are described. Contributions of radionuclides from the weapon testing and nuclear power production are discussed with a special attention to the aftermath of Chernobyl accident. Various pathways of radionuclides into the environment are described. Role of two important radioisotopes ^{137}Cs and ^{131}I vis-a-vis environment is highlighted.
Paasikallio A. JR: Annales Agriculturae Fenniae, 1984, v. 23, p. 109-120.	The Effect of Time on the Availability of ^{90}Sr and ^{137}Cs to Plants from Finnish Soils.	Finland.	^{90}Sr, ^{137}Cs	Ryegrass, soil.	Different types of peat soils.	Over a period of four years ryegrass removed approximately 7% of the ^{90}Sr and 4% of the ^{137}Cs applied to the soils. The mean annual uptake of ^{90}Sr by ryegrass ranged from 0.5% (compost) to 2.9% (sphagnum peat) and that of ^{137}Cs from 0.07% (compost) to 3.6% (Sphagnum peat) according to soil type. ^{137}Cs/^{90}Sr ratios in plant samples varied markedly with years and soil types.
Paasikallio A. and SormunenCristian R. (1996). The transfer of Cs-137 through the soil-plant-sheep food chain in different pasture ecosystems.	Agricultural and food science in Finland 5: 577-591.	Southern Finland	Cs-137	Sheep	Natural forest pasture, semi-natural pasture (set-aside pasture) and cultivated pasture, all with clay soil. Seasonal variation studied	Soil was moderately contaminated with Cs-137 from Chernobyl fallout. Study carried out between 1990-3. Seasonal and annual variation assessed. Transfer to sheep was highest from forest pasture and lowest from cultivated pasture. Transfer factors were higher to muscle and kidney than liver and heart. A seasonal variation was observed with highest transfer to the pasture plants occurring in June. 1993 was considered a typical year for Cs transfer to plants, and in this year the mean soil-meat aggregated transfer factors were 11.0, 0.28 and 0.03 for forest, semi natural and cultivated pastures, respectively.
Paasikallio A., Häkkinen U. and Lakanen E. Ann. Agr. Fenn., Ser. Agrogeol., Chim. Phys., 1971, 10, p. 125-130.	The Effects of Soil Factors on the Uptake of Radiostrontium by Plants. Part III.	Finland.	Sr-89.	Oats.	Different types of peat soils.	Uptake of Sr-89 by plants growing in different types of peat soils in relation to Ca was found to decrease with increasing C/N ratio. Increasing amounts of organic matter (humin) mixed with organic fine sand decreased the uptake of radiostrontium and calcium by plants. However, the Sr-89/Ca ratio of the plants increased when the organic matter content of the soil was low.

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Paasikallio A.; Rantavaara, A.; Sippola, J. JR: Science of the total Environment, 24 Aug. 1994, v.155 (2), p.109-124.	The transfer of Cs-137 and strontium-90 from soil to food crops after the Chernobyl accident.	Finland, 7 locations. 2-4 years.	Cs-137, Sr-90.	Vegetables, fruits, berries.	Coarse mineral soil, clay, silt, organic soil.	The plant/soil concentration ratio of ^{137}Cs for field crops ranged from 0.001 to 0.26 (in the south) and 0.01 to 2.29 (in the north). The mean concentration ratio of ^{90}Sr was about 9 times higher than value of ^{137}Cs in the south part. Concentration ratio of ^{137}Cs for vegetables decreased gradually after the first year. Soil retaining properties are also discussed.
Papastefanou C., Manolopoulou M., Loannidou A., Zahariadou K., Stoulos S and Charalambous S. In Book (Conf.): 4. International Symposium on Radiation Protection - Theori and Practice. Malvern (UK), 4-9 Jun 1989. Goldfinch, E.P., Proceedings…, 1989, 511p. p201-204.	Post-Chernobyl Environmental Radioactivity Monitoring at Thessaloniki, Greece.	Greece, Thessaloniki Field data for two years after the accident.	Cs-134, Cs-137 and other fission products.	Grass, milk.	Soil, dry and wet depositions, weather conditions.	Sampling and measuring techniques are presented. Radioactivity concentrations versus time are given for soil, grass and milk. Results are discussed.
Papastefanou, C.; Manolopoulou, M.; Charalambous, S. JR: Journal of Environmental Radioactivity, 1988, v. 7, p. 49-64.	Radiation Measurements and Radioecological Aspects of Fallout from the Chernobyl Reactor Accident.	Greece, Thessaloniki Field data for a year after the accident.	Radioisotopes of I, Cs and many other fission products.	Grass, milk, leafy vegetables.	Soil, dry and wet depositions, rainfalls, storms.	Air sampling commenced on May 3 and continued until June 15 when most of the short-lived radionuclides were detectable. Results of cesium activity in soil and grass are also given in tables. The intensity of precipitation was 72*1 mm, typical for the May period. Iodine -131 was very important for milk and leafy vegetables, the nuclide transport time being only 4 days. Transfer ratios in air-grass-cow-milk-man pathway for ^{131}I are given and have an excellent agreement with literature values. These ratios help quantify the transfer of fallout contamination from air through to the food chain.
Papastefanou,C. Manolopoulou,M. Stoulos,S. Ioannidou,A.&Gerasopoulos,E. (1999). Journal of Environmental Radioactivity, Volume 45, Issue 1, October 1999, p. 59-65	Soil-to-plant transfer of ^{137}Cs, ^{40}K and ^{7}Be	Europe.Thessaloniki area of northern Greece, in the temperate zone	Caesium-137, Potassium-40, Beryllium-7	Grass (graminae or poacheae) samples area of 3 m2 (0.125 kg of grass per m2)		Experiments with artificial wet depositions of Cs-134 and Sr-85 at different times during the growth period were carried out. The studies are complementary to the experiences after the Chernobyl fallout and the results are compared with similar earlier Swedish works on nuclide retention in experiments and on fallout in agriculture. The aim was to cover the nuclide transfer to grain crops after depositions at different times during the growing period. The initial interception capacity per kg d.w., TRd, seemed to depend on the surface/weight ratio of the plant parts considered. Changes in TRd-values were rapid during the early growth but slower in later stages. The reduction half-time was then often 2 weeks for vegetative parts. Consider-

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						ing the fraction of a deposition retained, FRd, the residence half-time had an average length of 3-4 weeks. During that time there were possibilities for caesium penetration into the plant and further transfer to ears and grain. Strontium did not seem to be transferred that way. There was no increase of caesium in the ears per unit d.w. after the initial interception. Soil-to-plant transfer factors, TF, i.e., the ratio; TF" [Ri*Bq/kg d.w.] plant // [Ri*Bq/kg d.w.] soil where Ri is the uptake of the i th radionuclide by plants from the soil through the soil-root-trunk pathway.
Popplewell, D.S. Ham, G.J. JR: Journal of Radiological Protection, Sep 1989, v. 9(3), p. 189-193.	Transfer factors for ^{137}Cs and ^{90}Sr from grass to bovine milk under field conditions.	UK.	^{137}Cs, ^{85}Sr.	Pasture grass, milk.		Transfer factors for ^{137}Cs and 90Sr from herbage to cow's milk have been calculated from data acquired from a routine monitoring programme in west Cumbria during 1977 to 1985. The values for ^{137}Cs and ^{90}Sr, 0.004 d 1-1 and 0.001 d 1-1, respectively, agree reasonably well with values reported in the literature from controlled experiments.
Popplewell, D.S. Ham, G.J. Stather, J.W. Report (Conf.): Workshop on the measurement of soils to plant transfer factors for radionuclides. Wageningen (Netherlands), 1982, In two parts. 307 p. pt. 2, p. 164-171. INIS-mf--10413	The uptake of ^{239}Pu + ^{240}Pu, ^{241}Am, ^{90}Sr and ^{137}Cs into potatoes.	UK.	^{241}Am, ^{137}Cs, ^{239}Pu, ^{240}Pu, ^{90}Sr.	Potatoes.		The objectives of this work are to measure season-by-season the uptake of plutonium, americium, ^{90}Sr and ^{137}Cs into potatoes and to provide the soil-to-plant transfer factors for modelling studies whose aim is to predict the dose to man through the food chain.
Puhakainen M. and Yläranta T. JR: Agric. Sci. Finl., 1992, 1, p. 27-35.	Uptake of radionuclides by spring wheat and barley from cultivated soils supplemented by contaminated sewage sludge.	Finland.	^{137}Cs	Sprig wheat, barley.		Experiments were conducted on clay, clay loam and sandy loam soils with spreading digested sludge on fields. TFs were defined for treated and untreated soils.
Rantavaara A, Kostiainen E, Sihvonen H. In Report: Ylätalo S, Pöllänen R (eds). Properties of Nuclear Fuel Particles and Release of Radionuclides from Carrier Matrix. Finnish Association for Aerosol Research, University of Helsinki, Report Series in Aerosol Science 39. Helsinki 1998: 91-95.	The transfer of ^{137}Cs from nuclear fallout to milk in Finland.	Finland.	^{137}Cs	Milk, deposition		Comparison of the transfer of ^{137}Cs from fallout to milk was compared in two different areas in Finland 1986-1996. The transfer of ^{137}Cs to milk in the northern area was 2.3 times higher than in the southern area. The data confirmed that human exposure to environmental radiocaesium depends significantly on the type of soils used for agricultural production.

Author/Source	Publication name	Site	Deposition	Product(s)	Soil, season	Abstract
Rantavaara, A. Report: STUK-A--78, Jun. 1991, 89 p.	Radioactivity of foodstuffs in Finland in 1987-1988. Supplement 4 to the Annual Reports STUK-A74 and STUK-A89.	Finland.	I-131, Cs-134, Cs-137, Sr-89, and Sr-90.	Food of agricultural origin.		Nationwide survey was extended both areally and by types of foodstuffs after Chernobyl accident in 1986.The purpose was to give information for dose assessment.
Rantavaara A, Arvela H, Suomela M. Second report of the VAMP Multiple Pathways Assessment Working Group. Report IAEA-TECDOC-904. Vienna: International Atomic Energy Agency, 1996, 86-196.	Documentation and evaluation of model validation data used in scenario S. Appendix I in: Validation of models using Chernobyl fallout data from southern Finland. Scenario S.	Finland.	Cs-134, Cs-137			
Rantavaara, A.; Haukka, S. Report: STUK-A--58, Jun. 1987, 110 p.	Radioactivity of milk, cereals and other agricultural products in Finland after the Chernobyl accident in 1986. Supplement 3 to annual report STUK-A55.	Finland.	I-131, Cs-134, Cs-137, Sr-89, and Sr-90.	Cereals, meat, milk, eggs.		The main objectives were to assess the dietary intake of fallout radionuclides via milk, meat, cereals and eggs in Finland during period May-December 1986.
Rantavaara, A. Report: Studies on environmental radioactivity in Finland 1976-1977, Annual report, Apr. 1979, p. 35-64. STL-A--26.	Radioactivity in milk and other foodstuffs.	Finland.	Sr-90, Cs-137.	Milk, other food samples.		The country-wide survey of fallout radioactivity in milk and the regional foodstuff programme made near Finland's nuclear power plants. Measurable quantity of ^{131}I was found in milk and in some other samples following the Chinese nuclear tests in 1976 and 1977.
Rantavaara, A. Report: Studies on environmental radioactivity in Finland 1978, Annual report, Jan. 1980, p. 29-45. STL-A--32.	Radioactivity in milk and other foodstuffs.	Finland.	Sr-90, Cs-137.	Milk, meat, cereals, fruits, vegetable$^{s.}$		The country-wide survey of ^{90}Sr and ^{137}Cs in milk continued in 1978. The regional foodstuff programme made for environmental studies near Finland's nuclear power plants. No fresh fallout from nuclear tests was detected.
Rantavaara, A.. Report: Studies on environmental radioactivity in Finland 1979, Annual report, Dec. 1980, p. 27-42. STL-A--34.	Radioactivity in milk and other foodstuffs.	Finland.	Sr-90, Cs-137.	Milk, meat, cereals, fruits, vegetable$^{s.}$		The country-wide survey of ^{90}Sr and ^{137}Cs in milk continued in 1979. The regional foodstuff programme made for environmental studies near Finland's nuclear power plants.
Rantavaara, A. Report: STUK-A--59, Jun. 1987, 88 p.	Radioactivity of vegetables and mushrooms in Finland after the Chernobyl accident in 1986. Supplement 4 to	Different areas of Finland.	^{134}Cs, ^{137Cs}, ^{89}Sr, ^{90}Sr, 131I and other short-lived	Vegetables, fruits, berries, mushrooms.780 samples of the	Early May - six month period of the first fallout year.	In May 1986 ^{131}I and other short-lived isotopes were dominated. Later in season concentration of ^{137}Cs in leafy and root vegetables, fruits and potatoes was 0.3-8 Bq kg^{-1} on an average depending on

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	annual report STUK-A55.		radio-nuclides.	most common species.		species. In garden berries - from 10 to 30 Bq kg^{-1}, and in wild berries from 80 to 120 Bq kg^{-1}. The average concentration of ^{137}Cs in mushrooms varied from 220 to 1100 Bq kg^{-1}. ^{89}Sr and ^{90}Sr were determined in a limited number of vegetables and berries, and content of ^{90}Sr were about slightly higher than in the previous years. Fruit and vegetables of season 1986 contributed 3.4 Bq d^{-1} to the dietary intake, and mushrooms - 1 Bq d^{-1}.
Rauret G., Vallejo VR., Cancio D., Real J. JR: Journal of Environmental Radioactivity, 1995, v. 29(2), p. 163-184.	Transfer of Radionuclides in Soil-Plant Systems Following Aerosol Simulation of Accidental Release: Design and First Results.	France, Spain.	^{134}Cs, ^{110m}Ag, ^{85}Sr	Lettuce.		The behaviour of ^{134}Cs, ^{110m}Ag and ^{85}Sr was studied in different soil-plant systems, using two types of Mediterranean soil with contrasting properties (sandy and sandy-loam soils). The plant species used was lettuce (Lactuca sativa). Contamination was induced at different stages of plant growth, using a synthetic aerosol which simulated a distant contamination source.
Rauret, G., Alexakhin, R.M,; Kruglov, S.V., Cremers, A., Wauters, J., Valcke, E., Ivanov, Y., Vidal, M. Report (Conf.): 1. international conference on 'The radiological consequences of the Chernobyl accident', Minsk (Belarus), 18-22 Mar 1996, p.81-96. INIS-BY--020	Physical and chemical factors influencing radionuclide behaviour in arable soils.	Belarus, Ukraine, Russia. Plant growth experiments.	^{137}Cs, ^{90}Sr.	Spinach.	Podsolic and peat soils, different chemical conditions.	Study of the factors affecting the equilibrium of the radionuclides between solid and soil solution phases. Considering these factors, the calculation of the in situ KD values helps to predict the relative transfer of radionuclides. The calculation of the KD of the materials that could be used as countermeasures could permit the prediction of its suitability to decrease transfer of radionuclides.
Renaud P., Réal J., Maubert H. and Roussel-Debet S. (1999) Health Physics 76 (5). 495-501	Dynamic modelling of the cesium, strontium and Ruthenium transfer to grass and vegetables.		Cs, Sr and Ru	Grass and vegetables (tomatoes, salads, beans and radishes)	compost, single aerosol contamination to pre-planted crops, only deals with year 1	Transfer factors monitored over time since single deposition, including transfer factors for successive harvests. This was then modelled as part of the ASTRAL post-accident radioecology model. Cs and Sr global transfer (m2/kg) to grass starts at ~0.7 in the first 20 days (the similarity of the transfer factors indicate that mainly physical processes govern direct contamination). After 1 year the transfer factor is ~0.001 for Sr and 0.0004 for Cs. The transfer factors are constant from 100 days after the contamination event. For radishes beans and tomatoes, the global transfer factor of Cs starts at ~0.062 and decreases over time to 0.0003 by 178 days, giving a first year integrated transfer factor of approximately 0.006 m2 a /kg. If a second crop is

Author/Source	Publication name	Site	Deposition	Product(s)	Soil, season	Abstract
						grown, the transfer factor is constant over time 1.8 x 10(-5) from day 77 - day 178. Sr shows similar patterns, with the first crop global transfer factor decreasing from ~0.062 - 0.0003 by day ~80, and then the first crop has a constant transfer factor, equal to that of the second crop grown, of ~0.0003. This means that the first year integrated transfer factor is approximately 0.005 m2 a /kg. Leaf vegetable TF are ~0.21 on day 1, and decrease steadily (Cs and Sr) to 0.021 on day ~45, this gives a first year integrated transfer factor of approximately 0.2 m2 a/kg . The second crop TF were lower, at 0.0001 for Cs and 0.00004 for Sr.
Repin, V., Novak, N., Perevoznikov, O., Tsygankov, N. JR: Radiation Protection Dosimetry, 2000, v. 88(3), p. 207-221.	Retrospective estimation of strontium-90 intake dynamics and doses for the population living in the territories affected by the Chernobyl accident.	Reconstruction based on data from Zhytomir region of Ukraine.	Cesium 137, strontium 90.	Milk, potatoes.		Using the proposed model the total annual intake of ^{90}Sr in 1986-1994 were found, the values of transfer factors from soil to milk and potato have been calculated.
Riedel, H.; Bretschneider, J.; Gesewsky, P. Report: STH--21/77, May 1977, 66p.	Measurements of the Institut fuer Strahlenhygiene of radioiodine in air, precipitation and fresh milk after the Chinese nuclear bomb test of Sept. 17, 1977. Messungen des Institut fuer Strahlenhygiene von Radiojod in Luft, niederschlag und Frischmich nach dem chinesischen Kernwaffenversuch vom 17.9.1977. In German.	Germany.	^{131}I.	Pasture grass, milk.	11days period in air; 40 days on pastureland and milk.	About 35% of milk contamination was caused by wet deposition. The ^{131}I concentration in milk when deposition had ended shows an effective half-life of 6 days. Over the whole period of detectable ^{131}I concentrations in milk a total air to milk transfer factor 325 Ci/l:Ci/m^3.
Riedel, H.; Gadow, A. Von ; Gesewsky, P. Report, STH--3/77 May 1977, 66p.	Studies on radioiodine concentrations in air, precipitation, grass, cow's and goat's milk after the Chinese nuclear bomb test on September 26th, 1976. Untersuchungen ueber das Auftreten von Radiojod in Luft, Niederschlag, Gras, Kuh- und Ziegenmilch nach dem chinesischen Atombom-	Ge'many.	^{131}I. Air: max 191 fCi/m^2, ave. 42.5; Precipita-tion: max 6.3 pCi/m^2 ave. 3.0;	Grass, cow's and goat's milk.	Six weeks period.	Concentrations of ^{131}I were estimated in grass: max. 164 pCi/m^2, ave. 105 pCi/m^2; in cow's milk: max. 18.5pCi/l, ave. 9.0 pCi/l; in goat's milk: max. 26.9pCi/l, ave. 14.9 pCi/l. With the additional assumption on a retention factor on grass for washout (20%) and an effective half-life of ^{131}I on grass (3,9 and 5 d) from these data the deposition velocity of ^{131}I on pasture and the transfer coefficients air-grass and grass-milk as well as air-milk have been calculated.

Author/Source	Publication name	Site	Deposition	Product(s)	Soil, season	Abstract
	benversuch vom 26.9.1976. In German.					
Riise, G., Bjørnstad, H.E., Lien, H.N., Oughton, D.H., and Salbu, B., (1990) Journal of Radioanalytical and Nuclear Chemistry, Vol 142, No 2, pp 531-538.	A study on radionuclide association with soil components using a sequential extraction procedure.	Central Norway	Cs-134, Cs-137 and Sr-90	Mobility in soil		Radioactive Cs-isotopes, deposited after the Chernobyl accident, are predominantly associated with components in the upper layer (0-2 cm). Based on sequential extraction the Cs-isotopes are strongly bound, especially to mineral matter, and less than 10% can be considered mobile. To a large extent, isotope exchange with naturally occurring stable caesium appears to have taken place during the 3 years after deposition. In the upper layers, Sr-90 is predominantly present in a leachable form. Compared to the Cs-isotopes a much higher relative fraction of Sr-90 should be considered mobile and available for plant uptake.
Robb, Paul Owen, L.M.W. Crews, H.M. JR: Journal of Analytical Atomic Spectrometry, Sep. 1995, v. 10(9), p. 625-630.	Stable isotope approach to fission product element studies of soil-to-plant transfer and in vitro modelling of ruminant digestion using inductively coupled plasma mass spectrometry.	UK.	Sr, Cs, Ce isotopes.	Fruits, berries.		Limits of detection (dry mass LODs) of 0.053 mg kg^{-1} for Sr, 0.011 mg kg^{-1} for Cs and 0.084 mg kg^{-1} for Ce were low enough to allow the determination of soil-to-plant transfer factors for soft fruit and the application of the approach to an in vitro model of ruminant digestion.
Roca M.C., Vallejo V.R., Roig M., Tent J., Vidal M. and Rauret G. (1997) J. Environ. Qual. 26. 1354-1362	Prediction of cesium-134 and strontium-85 crop uptake based on soil properties.	Lysimeters	^{134}Cs and ^{85}Sr	Lettuce and peas	Medditerranean soil types: a Calcic Luvisol and a Fluvisol; the contamination was via an aerosol directly to the bare soil. Plants were grown subsequently	Soil properties evaluated were CEC and radionuclide available fraction for radiostrontium and soil solution composition, solid-liquid distribution coefficient and radionuclide available fraction for Cs. This helped improve predictions with respect to results, but factors depending on plant physiology need to be better evaluated. Results (given in weighted concentration ratios of kg soil (dry weight)/kg plant (dry weight): 1) Sr: a) Lettuce: Loamy soil, seedling = 7.5+/-1.8, Commercial = 5.8 +/- 1.5; Loam Sandy, seedling =40.6 +/- 30.2, commercial = 22.9 +/- 17.8. b) Pea plant: Loamy soil, seedling = 8.6 +/-3.5, mature = 43.2 +/- 12.3, fruit = 8.2 +/- 2.9; Loam Sandy, seedling =131.1 +/- 36.5, mature = 457.1 +/- 57.2, fruit = 13.2 +/- 2.7. 2) Cs: a) Lettuce: Loamy soil, seedling = 0.7 +/- 0.3, Commercial = 0.2 +/- 0.1; Loam Sandy, seedling = 3.6 +/- 2.9, commercial = 1.1 +/- 1.0. b) Pea plant: Loamy soil, seedling = 1.0 +/- 0.4, mature = 50.1 +/- 19.2, fruit = 8.3 +/- 1.2; Loam Sandy, seedling = 8.8 +/- 2.9, mature = 32.8 +/-

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						24.3, fruit = 9.1 +/- 6.2.
Roca MC., Vallejo VR., Rauret G., Vidal M., Real J., Cancio D. Book (Conf.): International symposium on environmental impact of radioactive releases, Vienna, Austria, 8-12 May 1995. IAEA, Oct 1995, 874 p., p. 669-672. IAEA-SM--339/198P; STI/PUB--97[1]	T[r]ansfer of ^{134}Cs, ^{85}Sr and 110Agm in Different Soil-Plant Systems (Tarras Project).	Spain. Experiments.	134Cs, 85Sr, 110Agm.	Lettuce, pea.		Experiments based on the deposition on bare soils (sandy loam and sandy soils), which had been sown with lettuce and pea plant seeds. TFs (kg soil/kg plant and m^2 soil/kg plant d.w.) are given for seedlings and mature plants, leaves, stems and fruit.
Roca, M.C. Vallejo, V.R. JR: Journal of Environmental Radioactivity, 1995, v. 28(2), p. 141-159.	Effect of soil potassium and calcium on caesium and strontium uptake by plant roots.	Spain.	^{134}Cs, ^{85}Sr.	Lettuce plants.	Sandy-loam soils.	The transfer factors were higher in the sandy soil. Greater K selectivity than ^{134}Cs was always observed, although the selectivity of K was higher in the sandy soil which had a lower K concentration. In the sandy-loam soil which had a higher Ca concentration, selectivity of ^{85}Sr was higher than that of Ca. These results suggest that radionuclide uptake by roots depended on the availability in the soil of the radionuclides and root uptake selectivity, which were both related to the nutrient concentration in the soil solution.
Rosén, K, Andersson I, Lönsjö, H. (1994)... Meeting September 12-16, 1994, Varna Bulgaria. Soil-Plant Relationships. Proceedings of the XXIVth Annual ESNA/IUR, Ed. Martin Gerzabek. Varna, Bulgaria, pp 204-210.	Transfer of Radiocaesium from Soil to Vegetation and to Grazing Lambs in a Mountain Area in Northern Sweden	Sweden.	Cs-137.			A field survey investigation was carried out in the Chernobyl fallout area in Sweden to find out the experiences of the farmers during the fallout period 1986-87 with regard to the activities of the authorities and to their own counter actions. Also the private situation of the farmers during the period and their attitudes to similar situations in the future were discussed. Transfer factors of Cs-137 (Bq/g d.w.plant // Bq/g d.w. soil)
Rosén, K. & Öborn, I. (1990). Proceedings. International Union of Radioecologists. VIIth report of the working group soil-to-plant transfer factors. Report of the working group meeting in Uppsala, Sweden September 27-29, 1990. Netherlands. Uppsala, Sweden, pp 206-210.	Effects of potassium on caesium to crops.	Sweden.	Cs-137.			Review of some Swedish field studies on the Cs-137-soil-to-plant transfer, with special reference to effective chemical and soil management countermeasures to decrease the transfer in case of fallout. Transfer factors of Cs-137 (Bq/g d.w.plant // Bq/g d.w. soil)
Rosén, K. (1988). Proc. Det femte nordiska radioekologiseminariet, 22-25 August 1988, Rättvik, Sweden, pp 1-8.	Kaliumgödslingens betydelse för kontroll av cesiumtransporten från Tjernobyldrabbade Norrlandsjordar.	Sweden.	Cs-137.	vall, spannmål	Different soil types from large agricultural regions of Swe-	Four activation products and two fission products were deposited in eight different soils placed in micro plots. The transfer of the nuclides from these soils to clover, timothy and wheat over the period

Author/Source	Publication name	Site	Deposition	Product(s)	Soil, season	Abstract
					den.	1976-1984 was studied. Changes with time of the transfer factors for crops and soils were recorded as well as the differences between the soil types and between the crop products. Transfer factors of Cs-137 (Bq/g d.w.plant // Bq/g d.w. soil)
Rosén, K. (1991). The Chernobyl fallout in Sweden. Results from a research programme on environmental radiology (Ed. L. Moberg). The Swedish Radiation Protection Institute, Stockholm, pp 305-322.	Effects of potassium fertilization on caesium transfer to grass, barley and vegetables after Chernobyl.	Sweden.	Cs-137.	grass, cereals, vegetables (Lettuce, Potatoes, Carrots and Leek)	different soil types in Sweden	Influence of K-fertilization (00, 50, 100 and 200 kg K/ha) on Chernobyl-Cs-137 was studied. The K-fertilization was effective already on the 50-100 kg level, although 200 kg gave the highest reduction; decrease with 60-89 % on grassland. The Cs-137 transfer to barley was an about one order of magnitude lower. It decreased relatively to the same extent as for grassland. Among the vegetables, the order in caesium transfer to the crops was Lettuce<Potatoes<Carrots<Leek. Transfer factors of Cs-137 (Bq/g d.w.plant // Bq/g d.w. soil)
Rosén, K. (1994). The Transfer of Radionuclides through Nordic Ecosystems to Man. (Ed. Henning Dahlgaard). Elsevier Science Publishers, Amsterdam, pp 239-259.	Studies on countermeasures after radioactive deposition in Nordic Agriculture. In: Nordic Radioecology.	Sweden.	Cs-137, Sr-90, I-131.			This study demonstrates the relationship between radiocaesium deposition in soil and the activity transfer to pasture in a natural or semi-natural ecosystem. Factors that may influence the transfer are described. The study also demonstrates which level of radiocaesium that can be expected in lambs grazing in the mountain area when no countermeasures are taken. The results indicate that agriculture, especially animal production, based on the utilization of the natural and semi-natural environment, is very sensitive in a fallout situation. Problems may persist for many years and countermeasures have to be taken for a long time in order to provide acceptable levels of radiocaesium in animal products for human consumption. Otherwise diet recommendations should be given. Ch - Rosén, K., Andersson, I. & Lönsjö, H. (1995). J. Environ. Radioactivity, Vol. 26, pp 237-257.
Rosén, K. (1996). Marginal and semi-natural areas in the county of Jämtland. Sci. Total Environ, Vol. 182. Nos. 1-3, pp 135-145.	Transfer of Radiocaesium in Sensitive Agricultural Environments after the Chernobyl fallout in Sweden. II.	Sweden.	Cs-137.	pasture and grass		This thesis deals with appearance of Chernobyl ^{137}Cs and ^{134}Cs in some of the agricultural areas of the U-, C-, X-, Y- and Z-counties. The investigations were carried out on real field conditions from 1986 up to 1995 on farms where transfer to grass and milk the first years were high. The results show that agriculture, and especially livestock holding, based on feeding by animals is sensitive for transfer of radiocaesium to diet. At some farms there were

Author/Source	Publication name	Site	Deposition	Product(s)	Soil, season	Abstract
						need of countermeasures to reduce the transfer to milk and meat and it may exist for long time. After the Chernobyl fallout 1986, the grass crops were heavily contaminated in some areas, and the first cut had to be discarded on some farms in the most contaminated areas. Transfer factors of Cs-137 (Bq/g d.w.plant // Bq/g d.w. soil)
Rosén, K. (1996). PhD. Thesis. Report SLU-REK-78. .	Field studies on the behaviour of radiocaesium in agricultural environments after the Chernobyl accident	Sweden.	Cs-137.			Concentrations of Cs-137 were measured from sheep, goats and reindeer in the period 1987-1989. Reindeer and goats had the most diverse food selection whereas sheep fed mainly on grasses, forbs and to some extent, on leaves of willow. Depending on the type
Rosén, K. (1997). Inst. för radioekologi, Rapport SLU-REK-79	Underlag för utarbetande av myndigheternas rekommendationer till lantbrukare i händelse av en kärnenergiolycka (efter ett larm, men före nedfallet av radioaktiva ämnen).	Swedish conditions.	Expected fallout within the near future.	Crop and animal products.	Different parts of the season.	The report contains calculation of expected Cs-137 transfer and development of the transfer from contaminated agricultural land (1 MBq/m2) to crop and animal products in the southern parts of Sweden. Different soil types and different management of the enterprises were compared as well as different types of counter actions to reduce the nuclide transfer to the food produced. The two most important countermeasures which can be made by farmers are extra potassium fertilisation and ploughing before reuse of contaminated land.
Rosén, K. Haak, E. Eriksson, A. (1998).The Science of the Total Environment. Volume 209, Issue 2-3,19 January, 1998, P. 91-105	Transfer of radiocaesium in sensitive agricultural environments after the Chernobyl fallout in Sweden: III. County of Vasternorrland	Sweden.	Cs-137, I-131.	grass and cereals		Countermeasures are discussed for a situation of impending disaster, when maybe heavy fallouts are expected.
Rosén, K. von Fircks, Y & Sennerby-Forsse, L. (1999). . Eds: Jens Søgaard-Hansen & Anders Damkjær. Nordic Society for Radiation Protection 12th ordinary meeting, 23-27 August 1999. Roskilde. Skagen, Denmark, pp 277-281. (Poster presentation.)	Uptake and activity concentration of ^{137}Cs and ^{90}Sr in Salix viminalis. Proceedings	Sweden.	Cs-137, Sr-90.	energy forest, salix	Soil: loam and clay loam soils and the subsoil was loamy sand	Long-term measurements over an 11-year period. Cs-137 transfer coefficients, TF, from soil to plants (grass) ranged from 0.002 to 7.42. Potassium-40TF values from soil to plants (grass) ranged from 0.25 to 2.42 (average 0.73). Transfer factors of Cs-137 and Sr-90 (Bq/g d.w.plant // Bq/g d.w. soil)
Rosén, K. Öborn, I. Lönsjö, H. (1999). Journal of Environmental Radioactivity, Volume 46, Issue 1, October 1999, P. 45-66	Migration of radiocaesium in Swedish soil profiles after the Chernobyl accident, 1987-1995	Sweden.	Cs-137.	grass		Little is known about the behaviour of caesium and strontium in energy forest systems. Plants were grown in micro plots with an area of 0.25 m2 under field conditions. The soils in experimental site had been contaminated in 1961 with 35.7 and 13.4 MBq per m2 of ^{137}Cs and ^{90}Sr, respectively. The

Author/Source	Publication name	Site	Deposition	Product(s)	Soil, season	Abstract
						experiment was carried out for three years. The plots were fertilised with 60 kg N/ha and different amounts of K per ha, 0 kg, 80 kg and 240 kg during the two first years. The concentration of ^{137}Cs in the different plant parts varied between 20 000 to 140 Bq kg^{-1} and ranked in the following order: roots > leafs > cuttings > stems. The ^{137}Cs concentration was higher in the 0 kg K treatment than in the 80 kg K or 240 kg K treatment. Leafs contained more ^{90}Sr than stems and cuttings.
Rosén, K., Andersson, I. & Lönsjö, H. (1995). J. Environ. Radioactivity, Vol. 26, pp 237-257.	Transfer of Radiocaesium from Soil to Vegetation and to Grazing Lambs in a Mountain Area in Northern Sweden	Sweden.	Cs-137.	soil, herbs, grasses, woody plants, trees and shrubs and lambs		Transfer coefficients, Fm, of Cs-137 from pasture and fodder to cow's milk were determined for one month on winter-fodder, and for the first month in 1987 and 1988 on pasture. The average Fm for all investigations was estimated to be 0.0055. Transfer factors of Cs-137 (Bq/g d.w.plant // Bq/g d.w. soil)
Rosén, K., Eriksson, Å. & Haak, E. (1996). Sci. Total Environ. Vol. 182, pp 117-135.	Transfer of Radiocaesium in Sensitive Agricultural Environments after the Chernobyl fallout in Sweden. I. County of Gävleborg.	Sweden.	Cs-137, I-131.	grass and cereals		In 1986-1994 two Chernobyl-affected areas in county of Jämtland, a Mountain area and a River valley area were investigated as to radiocaesium behaviour and transfer to grass. Grass samples were analysed on 9 temporary grassland sites and 8 permanent pasture sites. The aim of this investigation was to study the sensitivity of different soil types and influence of normal farming practises, ploughing and K-fertilization on the caesium transfer, in short- and long-term perspectives after the Chernobyl fallout. As expected, the transfer of Cs-137 to grass was usually higher on permanent pasture than on temporary grassland. The transfer was reduced considerably, showing a range of 0.1-177.3 m^2/kg d.w. * 10^{-3}.As shown, both countermeasures, ploughing and K-fertilization, are of potential value to decrease grass contamination. Where both measures were employed a reduction in the range of 78-95 % was recorded in the year after ploughing. Transfer factors of Cs-137 (Bq/g d.w.plant // Bq/g d.w. so
Rosén, K., Eriksson, Å. & Haak, E. (1996). In Ten years terrestrial radioecological research following the Chernobyl accident. Proceedings. Ed. Martin Gerzabek. International Symposium on Radioecology	Transfer of Radiocaesium in sensitive agricultural environments 1986-1994 after the Chernobyl fallout in Swede	Sweden.	Cs-137.	grass and cereals	different soil types in Sweden	In 1986 to 1994, 15 farms in the Chernobyl-affected area of the county of Gävleborg were investigated for radiocaesium transfer to grass and cereal grain. The aim was to study the impact of site and soil characteristics on sensitivity of Cs-137 transfer in a long-term perspective. The transfer

Author/Source	Publication name	Site	Deposition	Product(s)	Soil, season	Abstract
1996. Vienna, Austria, pp 101-110.						was much higher to grass than to cereal grain. For both crop products, however, there was a considerable annual reduction. The annual reduction in transfer to grass was reduced by a factor of 2 to 100, one order less. It was less on organic than on mineral soils. Both ploughing through the surface layer and the mixing of radiocaesium with soil, contributed to a decreased transfer of radiocaesium to crops. Thick stubble and grass sward on the grassland sites was the main reason for a lag period of high persistent transfer. Transfer factors of Cs-137 (Bq/g d.w.plant // Bq/g d.w. soil)
Sauras Yera T., Vallejo, R., Waegeneers N., Madoz-Escande CH. Report (Conf.): 28. annual meeting of the European Society for New Methods in Agricultural Research Annual meeting of the International Union of Radioecology (IUR) Working Group Soil-to-Plant Transfer Brno (Czech Republic), 26-29 Aug 1998, 202 p., p. 82. INIS-CZ--0022	^{137}Cs and ^{90}Sr root uptake by beans in soils with contrasting properties.	Czech Republic.	^{137}Cs, ^{90}Sr.	Bean plants.	Different soil types and conditions.	Radionuclide soil to crop transfer was analysed under controlled climatic conditions. The ^{137}Cs concentration in soil solution varied from 400 Bq/l to 9 Bq/l in the various types of soil. The ^{137}Cs root uptake crop reflected the specific scenario of each soil. K, Ca and Mg in the soil solution play an important role in the ^{137}Cs and ^{90}Sr root uptake and, in addition to the soil type and specific growing conditions, are important factors governing the transfer.
Sauras Yera T.,. Vallejo V. R, Valcke E., Colle C.,Förstel H. , Millán R. and Jouglet H. JR: Journal of Environmental Radioactivity, 1999, v. 45(3), p. 191-217.	^{137}Cs and ^{90}Sr root uptake prediction under close-to-real controlled conditions.	Belgium, France, Spain, Germany, and UK.	Cs-137 Sr-90.	Winter barley		Radionuclide soil-to-crop transfer was analysed in large undisturbed soil monoliths installed in lysimeters under controlled climatic conditions. The activity concentration of radionuclides in the plants was negatively correlated with crop yield, indicating that high crop productivity produced a general dilution effect in radionuclide concentration activity in plants. The relative radionuclide crop accumulation expressed in Bq m^{-2} was predicted from the soil availability parameters, available ^{137}Cs fraction divided by the distribution coefficient (KD) and by the K concentration in soil solution, and the available ^{90}Sr divided by the cationic exchange capacity (CEC). These predictions could not be obtained when using the CR, as this does not fully account for the crop growing conditions which influence radionuclide uptake by the crop.
Saxen, R., Rantavaara, A., Arvela, H., Aaltonen, H.	Environmental radioactivity in Finland after the Chernobyl	Finland.	^{137}Cs and ^{134}Cs.	Agricultural products, fish,		Results of environmental monitoring programmes years 1986-1988. Milk and beef made the dominant

Author/Source	Publication name	Site	Deposition	Product(s)	Soil, season	Abstract
Report (Conf.) International symposium on environmental contamination following a major nuclear accident., Vienna (Austria), 16-20 Oct. 1989. Proceedings, IAEA, 1990, 497 p., v.1, p.23-39. IAEA-SM--306/84	accident.			berries, mushrooms.		contribution to dietary intakes of radionuclides in the first fallout year. In the second year the contribution of natural products to intakes almost equalled, and in the third year exceeded that of agricultural products.
Schelenz, R. Report: Bundesministerium des Innern, Bonn (Germany, F.R.). Status report on radionuclide transfer. Statusbericht ueber den Transfer von Radionukliden. Jan 1980. 166 p. p. 146-149. INIS-mf--6902	Transfer from vegetation to meat. Transfer Futter/Fleisch. In German	Germany. Compiled data.	^{90}Sr, ^{137}Cs.	Animal feeds, meat.		A list of the transfer factors food/meat for Sr and Cs which have been referred to in several articles. The author proposes to deal intensively with the literature in order to achieve more knowledge on the transfer factors food/meat for Sr and Cs and for other relevant radionuclides.
Scotti, I. A. JR: Journal of Environmental Radioactivity, 1997, v. 33(2), p. 181-191.	Effect of Treatment Time on the ^{134}Cs and ^{85}Sr Concentrations in Green Bean Plants.	Italy. Experiments.	Radio-isotopes of Cs and Sr.	Green bean plants.		Green bean plants were sprayed with ^{85}Sr and ^{134}Cs at three different growth stages; 4 h after each treatment, half of all treated plants were sprinkled; at harvest, pod and leaf activity were detected. Results indicate that treatment time has an important role in the concentration of radionuclides in both sprinkled and non-sprinkled plants. Furthermore sprinkling reduces ^{134}Cs and ^{85}Sr concentrations, since the three growth stage reductions were 65, 60 and 52% for ^{134}Cs, and 24, 39 and 58% for ^{85}Sr.
Sennerby-Forsse, L., Melin, J., Rosén, K. & Sirén, G. (1993) Journal of substainable forestry, Vol. 1(3), pp 93-103.	Uptake of radiocaesium in fast-growing Salix Viminalis L.	Sweden.	Cs-137 and Cs-134.	salix	organic soil	The influence of soil parameters, contact time and various concentrations of Cs, K and ammonium ions in the solution on the sorption ratio for radiocaesium were determined by using Cs-134 as a tracer. Important parameters influencing the sorption were clay content, pH, and the concentration of cations in particular that of potassium and ammonium ions, which compete with caesium for the sorption sites. Transfer factors of Cs-137 (Bq/g d.w.plant // Bq/g d.w. soil).
Shenber, M.A. (1992). Thesis, Inst. för radioekologi, Report SLU-REK-68.	Sorption behaviour of radiocaesium in soils from various regions of Libya and Sweden.	Experimental work in the laboratory. Sweden.	Cs-137.		Libyan and Swedish soils	Sorption and desoprtion behaviour of radiocaesium on 7 Libyen and 13 Swedish soils as well as influence of Zeolite amendments on the Cs-134 uptake by wheat. Adding zeolite to soil caused a considerable reduction in Cs-134 uptake. A reduction of transfer by a factor of 3-8 was observed with increasing equilibration time for Cs-134 before sow-

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						ing.
Sheppard, S.C. Report: AECL--11474, Dec 1995, 63 p.	Application of the International Union of Radioecologists soil-to-plant database to Canadian settings.	Canada.	Large selection of radionuclides and isotopes.	Different plants.	Different soil types, different conditions.	The International Union of Radioecologists (IUR) has compiled a very large database of soil-to-plant transfer factors for Cs, Sr, Co, Pu and Np, and contains records for Am, Ce, Cm, I, La, Mn, Ni, Pb, Po, Ra, Ru, Sb, Tc, Th, U and Zn. The tables presented here summarize the data in a way that should be immediately useful to modellers. Values are averaged for a number of crop types and species. Correction factors are developed to facilitate interpolation among soil conditions.
Sheppard, S.C. and Evenden W.G. JR: Health Physics, May 1997, v. 72(5), p. 727-733.	Variation in Transfer Factors for Stochastic Models: Soil-to-Plant Transfer.	Canada.	Radio-nuclides.			CR.
Shinonaga T, Gerzabek MH, Strebl F, Muramatsu Y. (2001). The Science of the Total Environment 267, 33-40	Transfer of iodine from soil to cereal grains in agricultural areas of Austria	38 Austrian agricultural areas	Iodine (stable)	Cereal grains (winter wheat, spring wheat, winter rye, and wheat).	?	Transfer factors (concentration in dry mass of plant/ concentration in dry mass of soil in the upper 20 cm) for iodine from topsoil to grain were in the range 0.0005 to 0.017, with an arithmetic mean of 0.0029 and a standard deviation of 0.0034. The median TF was 0.0016 and the geometric mean was 0.0019.
Shutov V.N., Bruk G.Y., Balonov M.I., Parkhomenko V.I., Pavlov I.Y. In Book: Merwin, S.E.; Balonov, M.I. (eds.) The Chernobyl papers. Volume1. Doses to the Soviet population and early health effects studies. Richland, WA (USA). Research Enterprises.1993, p. 167-218.	Cesium and strontium radionuclide migration in the agricultural ecosystem and estimation of internal doses to the population.	Bryansk and Tula regions. Central part of Russia.	^{137}Cs and ^{90}Sr.	Grassy vegetations.	Torf-podsol sandy soil and black earth soil.	A quantitative relationship between Cs and Sr for radionuclide transfer factors to grassy vegetation and its dependence on the chemical properties of soil are investigated.
Shutov, V. Conf: 24.annual meeting of the European Society for New Methods in Agricultural research (ESNA). Varna (Bulgaria) 12-16 Sep. 1994. ESNA - XXIV annual meeting. Book of abstracts. Stara Zagora (Bulgaria). Nauka i Tekhnika OOD, 1994, 124 p., p. 74.	Influence of soil properties and time elapsed after the accident on caesium and strontium intake to vegetation.	St. Petersburg, Russia.	Cs, Sr	Grasses, potato, maize, grain and straw of barley, rye, wheat and oats.	Different soil characteristics.	Depending on soil properties Tfs of Cs and Sr for different plants varied by order 1-3 of magnitude. The Cs soil-to plant Tf over the first 5 years decreased exponentially with a half-time of 0.8 to 2 years. The Sr Tf over the first 7 years decreased with a half-time of 6 to 10 years.
Silva, S. Report: EUR--14927; 1993, p.565-578.	Chemical treatment to reduce the transfer of caesium radioisotopes to the human food-chain after a serious nuclear	Experimental. CEC.	Cesium isotopes.	Crops, milk, meat.		The possibility of reduction of the TF in plants, milk and meat following a severe nuclear accident.

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	accident.					
Simmonds J.R. and Linsley C.T. JR: Nuclear Safety, Nov-Dec. 1981, v. 22(6), p. 766-777.	A Dynamic Modelling System for the Transfer of Radioactivity in Terrestrial Food Chains.	UK.	Radio-nuclides of iodine, cesium, strontium and other.	Leafy vegetables, grain, milk.	Soil types and profiles	The main application of dynamic food-chain models is the prediction of the consequences of accidental releases to the environment. A number of parameters, such as interception and retention values, translocation mechanism and soil concentration factors are discussed. Transfer coefficients for ^{90}Sr in the pasture-cow-milk model are presented in table.
Skarlou V. Nobeli, C. Anoussis, J. Haidouti, C. Papanicolaou, E. (1999). Journal of Environmental Radioactivity, Volume 45 Issue 2, October 1999, P. 139-147	Transfer factors of ^{134}Cs for olive and orange trees grown on different soils	Europe. northern Greece	Cs-134	Olive and citrus trees in greenhouse experiment.		The study site comprises temporary and permanent grassland in areas in central and northern Sweden which were strongly affected by the Chernobyl fallout in 1986. The aim of the study was to investigate the vertical migration of radiocaesium from 1987. Transfer factors of Cs-134 (Bq/kg D.W.plant // Bq/kg D.W. soil)
Skarlou, V. Papanicolaou, E. Nobeli, C. Conf.: 24. Annual meeting of the European Society for New Methods in Agricultural research (ESNA). Varna (Bulgaria). 12-16 Sep., 1994. ESNA - XXIV annual meeting. Book of abstracts. Stara Zagora (Bulgaria). Nauka i Tekhnika OOD, 1994, 124 p., p. 74.	Comparison of transfer factors of 85Sr and ^{134}Cs for some Greek soils and crops.	Greece.	^{134}Cs, ^{85}Sr.	Wheat, alfalfa, radish, string bean, cucumber, lettuce.	Soil conditions.	The TFs for the tested crops and soils ranged between 0.3 and 36.5 for ^{85}Sr and between 0.01 and 1.72 - for ^{134}Cs. For 85Sr the TFs of the edible parts were much lower than those of the rest plant material, while this difference was not so high for 134Cs. The correlation between TFs and pH was for ^{85}Sr r=-0.89, for ^{134}Cs r=-0.82. The values of TRs indicated a trend towards negative correlation with other soil properties (cation exchange capacity - CEC, clay %). The exchangeable (Ca+Mg) cations gave a significant or highly significant correlation with TFs of both radionuclides.
Smajda, B. Hanusik, V. Szabova, T. Musatovova, O. JR: Radioaktivita a Zivotne Prostredie, 1983, v. 6(1), p. 49-64.	Migration of selected radionuclides in the food chain. I. ^{90}Sr and ^{137}Cs migration in the soil-plant system. Sirenie vybranych radionuklidov v potravinovom retazci. I. Sirenie ^{90}Sr a ^{137}Cs v systeme poda-rastlina. In Slovak.	Czechoslovakia.	^{90}Sr, ^{137}Cs.	Important agricultural plants.	Different types of soil, organic additives.	The behaviour of radionuclides in soils and their transfer into plants is affected mainly by the soil type, the content of organic matter, the share of the loam fraction, the biological properties of plants and the method of soil tillage. Attention is devoted mainly to the transfer factors in the soil-plant system for important agricultural plants.
Smolders E., Sweeck L., Merckx R. and Cremers A. JR: Journal of Environmental Radioactivity, 1997, v. 34(2), p. 161-170.	Cationic Interactions in Radiocaesium Uptake from Solution by Spinach.	Belgium.	Cs.	Spinach.		Interionic effects on radiocaesium uptake in spinach were measured in 15 different nutrient solutions, spiked with ^{137}Cs, in which K, NH_4, Ca and Mg concentrations were varied at four different total salt concentrations between 5·3 meql^{-1} and 21˙2 meql^{-1}. The plant/solution ^{137}Cs transfer factor

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						(TF) varied between 41 lkg^{-1} and 117 lkg^{-1}. However, radiocaesium levels were significantly reduced by increasing Ca + Mg concentrations in solution. A quantitative relationship is presented between the ^{137}Cs TF and the fractional loading of ^{137}Cs in the apoplast, which is calculated by ion exchange laws. This relationship is linear (R2 = 0·81) for the 15 different solutions studied.
Smolders, E. Sweeck, L. Merckx, R. Cremers, A. (1997). Journal of Environmental Radioactivity, Volume 34, Issue 2, 1997, P. 161-170	Cationic Interactions in Radiocaesium Uptake from Solution by Spinach,	Europe.	Cs-137	spinach (Spinacia oleracea L. cv. Subito)	5 different nutrient solutions	From 1986 to 1994, 25 sites in the county of Gävleborg and 17 sites in the county of Jämtland in Sweden were investigated regarding Cs-137 transfer to grass on different types of pasture and to cereal grain. The transfer of Cs-137 was higher to grass on permanent pasture land than on temporary grassland. It was much higher to grass than to cereal grain. For both crop products, however, there was a considerable annual reduction. In the following years, the transfer to grass was reduced by a factor of 2 to 100. Ploughing down and mixing of the contaminated surface soil layer with a larger soil volume was effective in reducing the transfer to crops.
Spezzano, P. and Giacomelli, R. JR: Journal of Environmental Radioactivity, 1991, v. 13, p. 235-250.	Transport of ^{131}I and ^{137}Cs from Air to Cows' Milk Produced in North-Western Italian Farms following the Chernobyl Accident.	Italy.	Cs-137, I-131.	Pasture grass, milk.		The observed values of the vegetation-to-air, milk-to-vegetation and milk-to-air concentration ratios were compared with the values predicted by an assessment model for the transfer of radionuclides through terrestrial food chains. Predicted values were higher than the observed results by factors of 2.6, 2.1 and 5.6 for I-131 and 4.3, 3.7 and 16 for Cs-137, for the vegetation-to-air, milk-to-vegetation and milk-to-air ratios, respectively.
Staaland, H.; Garmo, T.H.; Hove, K.; Pedersen, O. (1995). Journal of Environmental Radioactivity, 1995, v. 29(1), p. 39-56.	Feed selection and radiocaesium intake by reindeer, sheep and goats grazing alpine summer habitats in southern Norway.	Norway.	Cs-137, Cs-134, I-131 and K-40.	Plants, animals.	Different subalpine areas.	Radioecological studies on a mountain farm in the Chernobyl fallout area in the county of Jämtland, Sweden, have shown a fairly high transfer of radiocaesium from soil to vegetation and further to grazing lambs in 1990-1993. Activity analyses of soil samples, taken to 10 cm depth at nine sampling sites within a grazing area of about 10 km2 showed a mean deposition of Cs-137 of 15.7 (range 14.1-17.6) kBq/m^2. The average transfer factor soil-plan[t] of 0.067 (range 0.074-0.057) m^2/kg. The Cs-137 concentration in single plant species decreased in the order: herbs > grasses > woody plants > trees

Author/Source	Publication name	Site	Deposition	Product(s)	Soil, season	Abstract
						and shrubs. Transfer factors (plant to muscle) decreased from 0.93 kg d.w./kg w.w. in 1990 to 0.61, 0.56 and 0.71 in the following years.
Steffens W. , Fuhr F., Mittelstaedt W. Conf. 2. International symposium on radiology, Cadarache, France, 19-22Jun.1979. CEA. 1980. 774 p. p. 705-709.	The evaluation of laboratory experiments to determine transfer factors of radionuclides from soil to plant.	Germany. Experiment.	^{90}Sr, ^{137}Cs.	Plants.	Different soil types.	Published transfer data are based on small scale laboratory experiments using a few hundred grams of soil only. However, it is known that in such experiments the uptake are greatly influenced by: 1) soil type, 2) distribution of the radionuclide in the soil, 3) density of plants and root mass in the soil, respectively, 4) daily water fluctuations and water supply, 5) growth conditions and transpiration rates, 6) fertilizer application rates. Therefore, in comparison to outdoor lysimeter studies 'Neubauer' experiments were conducted to determine the transfer factors for ^{90}Sr and ^{137}Cs.
Steffens W., Fuhr F., Mittelstaedt W. Conf. 5. International Congress of the International Radiation Protection Association, Jerusalem, Israel, 9 - 14 March 1980. International Radiation Protection Association, Washington, DC (USA). Book of papers. 1980. v. 3 p.343-346. INIS-mf--5876.	Evaluation of small scale laboratory and pot experiments to determine realistic transfer factors for radionuclides ^{90}Sr, ^{137}Cs, ^{60}Co and ^{54}Mn.	Germany. Field, greenhouse and pot experiment.	^{90}Sr, ^{137}Cs, ^{60}Co, ^{54}Mn.	Barley, potatoes, sugar beet, salad vegetables.	Podsolic and loess soils.	The transfer factors of the small scale Neubauer cup experiments differed greatly from those obtained from the outdoor lysimeter. In the pot experiments, the transfer factors for ^{90}Sr, ^{137}Cs and ^{54}Mn showed less deviation from the lysimeter results especially in crops grown on podsolic soil. Transfer factors obtained in pot experiments can only be applicable to a limited extent to field conditions.
Steffens W., Fuehr F., Mittelstaedt W., Klaes J., Foerstel H. Report: Juel--2250, Dec 1988, 123 p.	Investigation of the transfer of ^{90}Sr, ^{137}Cs, ^{60}Co, and ^{54}Mn from soil to plant, and of the main soil parameters that have influence on the transfer process. Final report. Untersuchung des Transfers von ^{90}Sr, ^{137}Cs, ^{60}Co und ^{54}Mn vom Boden in die Pflanze und der wichtigsten, den Transfer beeinflussenden Bodenparameter. Abschlussbericht. In German.	Germany.	Cesium, strontium, cobalt, manganese isotopes.	Plants.	2 soil types.	In lysimetric field experiments with 2 soil types and small pot experiments under reproducible climatic chamber conditions were to examine whether or not transfer data from laboratory and pot experiments can be applied to field conditions. In large-scale comparative pot experiments the relative transfer factors were determined.
Steffens W., Förstel H., Mittelstaedt W. Book (Conf.): 25. Annual meeting of Fachverband fuer Strahlenschutz	Lysimeter experiments on root uptake of Co-60, Sr-90 and Cs-137 from soil into vine and apple trees and on	Germany.	^{137}Cs, ^{90}Sr, ^{60}Co.	Apple trees, wine.	Parabraunerde and podzol soils.	The transfer of ^{60}Co, ^{90}Sr and ^{137}Cs from soil into vine and apple trees was investigated over a time period of 5 years (1988-1992). The soil was contaminated in 1978, so that at the beginning of the

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e.V. (FS): Environmental radioactivity, radioecology, radiation effects. Binz auf Ruegen (Germany), 28-30 Sep 1993, p. 679-686. FS--93-67-T	the transfer into grapes and apples. Lysimeterversuche zur Wurzelaufnahme von Co-60, Sr-90 und Cs-137 aus dem Boden bei Weinreben und Apfelbaeumen sowie zum Transfer in Weintrauben und Aepfel. In German.					experiment the radionuclides were already aged. The transfer factors varying between 0.001 and 0.029 for ^{60}Co, 0.01 and 0.036 for ^{90}Sr and 0.001 and 0.109 for ^{137}Cs, respectively. The influence of the soil type is shown by the higher incorporation of ^{60}Co, ^{90}Sr and ^{137}Cs into the single plant organs and by the higher transfer factors in must and apples grown on the podzolic soil.
Steffens W., Mittelstaedt W., Fuhr F. Conf. 5. International Congress of the International Radiation Protection Association, Jerusalem, Israel, 9 - 14 March 1980. International Radiation Protection Association, Washington, DC (USA). Book of papers. 1980. v. 3 p.347-350. INIS-mf--5876.	The transfer of Sr-90, Cs-137, Co-60 and Mn-54 from soils to plants - results from lysimeter experiments.	Germany.	^{90}Sr, ^{137}Cs, ^{60}Co, ^{54}Mn.	Pastures grass mixture, potatoes, sugar beets, winter wheat, summer barley and red clover.		While the transfer factors measured on the sandy podzol in the simulated accident situation are 3-10 times lower than after permanent contamination, on average they are 2-4 times lower in the parabrown earth, rich in clay and silt. The influence of the soil type differences between the plants on the transfer factors is discussed.
Stoutjesdijk, J.F. Desmet, G.M. Pennders, R.M.J. Sibbel, R. Report (Conf.): Meeting of the IUR workgroup on soil-to-plant transfer factors, Saint-Paul-lez-Durance (France), 16-18 Apr. 1984, 185 p., p. 132-139. INIS-mf--10171	Determinations of soil-plant transfer factors for Dutch soils (1981-1983).	Netherlands. Experimental.	^{137}Cs, ^{85}Sr, ^{60}Co, ^{54}Mn, ^{65}Zn.	Grass.	Dutch soil: loess, sandy soil and river clay.	Long term experiments and consists of 32 containers filled with three different types of Dutch soil: loess, sandy soil and river clay. The soils have been labelled with ^{54}Mn, ^{60}Co, ^{65}Zn, ^{90}Sr and ^{137}Cs, i.e. three activated corrosion products and two fission products. Soil-grass transfer factors for different soil types are given per kg dry soil.
Suolanen, V. Report: IAEA, Vienna (Austria). Validation of models using Chernobyl fallout data from southern Finland. Scenario S. Second report of the VAMP multiple pathways assessment working group, Sep 1996, 483 p., and p 373-411. RP IAEA-TECDOC--904	DETRA: Model description and evaluation of model performance (Doses via Environmental Transfer of Radionuclides).	Simulation modelling on Chernobyl fallout in Finland.	Radionuclides.	Crops, vegetables, milk, meat.		The computer code DETRA is a generic tool for environmental transfer analyses of radioactive or stable substances. The code has been applied for the biospheric transfer of radionuclides in consideration of foodchain exposure pathways in the analyses of off-site consequences of reactor accidents. For each specific application an individually tailored conceptual model can be developed. The biospheric transfer analyses performed by the code are typically carried out for terrestrial, aquatic and food chain applications.
Suolanen, V. Report: STUK-YTO-TR--115, Dec. 1996, 43 p.	Model description and evaluation of model performance, scenario S. Multiple pathways assessment of the	Southern and central Finland. Simulation.	Assumed Cs-137 deposition profile and quantity similar to those	Various foodstuffs.		A modelling approach was used to predict doses via terrestrial and aquatic environments. Intermediate results of the study, such as concentrations in various foodstuffs and the resulting body burdens

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	IAEA/CEC co-ordinated research programme on validation of environmental model predictions (VAMP).		resulting from the Chernobyl accident.			were presented.
Suolanen, V. Report: STUK-YTO-TR--65, Feb. 1994, 30 p.	Model of transfer of cesium and strontium to domestic animal products as a consequence of accidental deposition on ground. In Finnish.	Finland.	^{137}Cs, ^{134}Cs and ^{90}Sr.	Plants, milk products, meat (beef and pork), grain.	Deposition timepoints: 1st May; 1st July; 1st September.	Simulation model of dynamic behaviour of radionuclides after an accident was applied and studied. The contamination of domestic animal products and grain are predicted in relation to the season of deposition case.
Suolanen, V.; Ilvonen, M. Report, STUK-YTO-TR--149, Oct. 1998, 20 p.	Generic uncertainty model for DETRA for environmental consequence analyses. Application and sample outputs.	Finland. Simulation.	Cs-137, 10 kBq/m^2.	Milk.	Pasture and season modelling.	Estimation of contamination of milk caused by radioactive deposition was carried out with the computer simulation model DETRA . The multisequence calculation consisted of a pasture modelling and season modelling parts. DETRA provides an easily applicable tool for uncertainty analyses.
Tompkins J.A., Wadey P., Bell J.N.B., Butler A.P., Shaw G., Wheather H.S. Report (Conf.): 28. annual meeting of the European Society for New Methods in Agricultural Research Annual meeting of the International Union of Radioecology (IUR) Working Group Soil-to-Plant Transfer Brno (Czech Republic), 26-29 Aug 1998, 202 p., p. 87. INIS-CZ--0022	New Scalable Transfer Factors: A Study of the Key Processes Affecting Soil-to-Plant Transfer Factors and the Development of a New Scalable Approach.	UK.				TF.
Tracy, B.L., Walker, W.B. and McGregor, R.G. JR: Health Physics, Mar. 1989, v. 56(2), p. 239-243.	Transfer to Milk of ^{131}I and ^{137}Cs Released During the Chernobyl Reactor Accident.	Canada.	Cs-137, I-131.	Pasture grass, milk.		For the transfer of radionuclides from air to pasture grass and milk observed, it appears that dry deposition was more significant for I and wet deposition for Cs. Concentrations of I-131 in milk measured in Bq/l were 1,000 to 2,000 times the concentrations of particulate I-131 in air measured in Bq/m^3. About 10% of deposited Cs was intercepted by the edible portion of the grass.
Ulvsand, T. and Lönsjö, H. (1994). Försvarets Forskningsanstalt Rapport, FOA 4 C-40325-4.3.	Beräknade effekter av radioaktivt nedfall på jordbrukprosduktionen i Sverige. Dosbesparing vid senareläggning och effekter på utfallet i växtodling.	Dose calculations for three regions: Gss/ south, Ss/middle and Nn/north Sweden.	Accumulated external dose was 100 mSv during the first week after fallout event.		Calculations for a whole production season in Swedish agriculture with start after fallout event.	A literature revue of Nordic study of countermeasure was investigated. A description of the short- as well as the long-term agricultural situation after a deposition of radioactive nuclides provides the background for a review of experimental work to develop efficient countermeasures, carried out since the sixties. Experiments have mainly concerned two

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						strategies: 1. Ploughing in a contaminated surface soil layer to place it at a considerable depth in the soil profile. External radiation is reduced, as too root accessibility and plant availability of the nuclides. 2. Fertilization and liming to dilute plant-available caesium and strontium in the soil, thereby reducing root uptake of the nuclides.
United Nations Scientific Committee on the Effects of Atomic Radiation 1988 Report for the General Assembly, with annexes	Sources, Effects and Risks of Ionizing Radiation	Europe	I-131, Cs-137	Milk, Leafy Vegetables, Grain, Meat	European soils, non-specified	Actual measurements, correlation curves fitted showing integrated transfer factors according to latitude. First year data. Transfer factors quoted as Bq a/kg per kBq/m^2 : I-131 Milk: ~4 (32 N) - 0.1 (~56 N); Leafy vegetables: ~6 (3 N) - 0.09 (60 N); Cs-137 in Milk: ~6 (41 N) - ~3 (60 N), Grain ~5 (37 N)- ~0.8 (60 N); Leafy vegetables ~6 (35 N) - ~0.8 (60 N); Vegetables/fruit ~5.5 (40 N) - ~1 (58 N); Meat ~8 (40 N) - ~5 (60 N); Total diet ~7.5 (23 N) - 3 (60 N). See attached worksheet for full data.
UNSCEAR 2000: Sources and effects of ionizing radiation	United Nations		Sr-90, I-131, Cs-137	Deposition to diet data (total diet)		See attached worksheet for the deposition to diet data and the annual effective does per unit deposition density data
Wagner, A. Hellmuth, K.H. Fischer, E. Report: BFE-R--88-01, Dec. 1988, 116 p.	Radioecological investigations in the food-chain air-soil-vine-wine. Pt. 1. Transfer of fallout from nuclear weapon tests from soil to wine. Radiooekologische Untersuchungen in der Nahrungskette Luft-Boden-Rebe-Wein. T. 1. Transfer von Kernwaffenfallout vom Boden in den Wein. In German.	Germany.	H-3, C-14, Sr-90, and Cs-137.	Beverages, grapes.	Soil parameters, climatic conditions.	The contents of H-3, C-14, Sr-90, and Cs-137 in air, soils, leaves of the vine, grapes and wine were measured and site-specific transfer factors were calculated. Data concerning soil parameters, climatic conditions, cultivation and vinification were collected. Transfer factors soil-grapes were 0.027 for Sr-90 and 0.0057 for Cs-137.
Wagner, A. Report: BFE-R--89-03, Oct 1989, 205 p.	Radioecological investigations in the food-chain air-soil-vine-wine. Pt. 2. Final report. Radiooekologische Untersuchungen in der Nahrungskette Luft-Boden-Rebe-Wein. T. 2. Abschlussbericht . In German.	Germany.	Sr-90, Cs-137, Cs-134, K-40, H-3, C-14 and Ra-226.	Vine leaves, grape.	Soil parameters, climatic conditions.	This Part 2 presents all of the results, including the harvest of 1986 and 1987 and thus describes the consequences of the Chernobyl accident. H-3, C-14, Sr-90 and Cs-137 were determined in soil, vine leaves, grapes and wine at different locations.Site-specific transfer factors were calculated for Sr-90 and for the Cs radionuclides. Site-specific influences such als soil parameters, climate, cultivation, vinification and differences between years had no pronounced effects on transfer factors.

Author/Source	Publication name	Site	Deposition	Product(s)	Soil, season	Abstract
Wagner, H. Mirna, A. Conf: Radioecology symposium. Stuttgart (Germany, F.R.). 15-16 Oct., 1981.	Transfer factors feed/meat in bovine and pigs. Transferfaktoren Futtermittel/Fleisch bei Rind und Schwein. In German.	Various parts of the FR of Germany.	^{90}Sr, ^{137}Cs, ^{210}Pb.	Animal feeds, consumer products.		Meat samples examined for their content of Cs-137, Sr-90, and Pb-210. The data determined by measurement for each of the location-specific samples revealed a transfer factor for Cs-137 ranging between 3 x 10-2 and 7.5 x 10-2. For Sr-90, agreement between measured data and the theoretical value given in the General Instructions and Standard Values for Calculation is found.
Valcke, E. Elsen, A. Cremers, A. (1997). Zeolites, Volume 18, Issue 2-3, 3 February 1997, P. 225-231	The use of zeolites as amendments in radiocaesium- and radiostrontium- contaminated soils: A soil-chemical approach. Part IV: A potted soil experiment to verify laboratory-based predictions.	Europe. Belgium	Sr-85, Cs-137	spinach	sandy podzol soil	Interionic effects on radiocaesium uptake in spinach (Spinacia oleracea L. cv. Subito) were measured in a solution culture experiment. Radiocaesium levels in the plants were poorly, but positively, correlated with the K concentration in solution.
Valcke, E. Vidal, M. Cremers, A. Ivanov, J. Perepelyatnikov, G. (1997). Zeolites, Volume 18, Issue 2-3, 3 February 1997. P. 218-224	The use of zeolites as amendments in radiocaesium- and radiostrontium- contaminated soils: A soil-chemical approach. Part III: A soil-chemical test to predict the potential effectiveness of zeolite amendments	Europe. Belgium	Sr-85, Cs-138	spinach	sandy podzol soil	A potted soil experiment was performed to test the effect of the addition of different types of zeolites on the Cs-137 or Sr-85 uptake by spinach grown on a sandy podzol soil. In all cases, a significant reduction of the Cs-137 or Sr- 85 soil-to-plant transfer
Van den Hoek J., Kirchmann R.J., Colard J. and Sprietsma J.E. JR: Health Physics, 1969, v. 17, p. 691-700.	Importance of some Methods of Pasture Feeding, of Pasture Type and of Seasonal Factors on ^{85}Sr and ^{134}Cs Transfer from Grass to Milk.	Belgium.	^{85}Sr, ^{134}Cs.	Grass, milk.		The transfer coefficient from grass to milk ranged from 0.31 - 0.45% for ^{134}Cs and from 0.05 - 0.07% for ^{85}Sr, the lowest transfer of ^{134}Cs and the highest of ^{85}Sr being recorded at the beginning of the grazing season.
Vandenhove, H. Van Hees, M. Bacquoy, C. Vandecasteele, C.M. (1997). Journal of Environmental Radioactivity Volume 37, Issue 2, 1997, 193-200.	Usefulness of AFCF as a Countermeasure for Radiocaesium Transfer from Loamy Soil to Rye-grass and Clover	Europe.	radiocaesium	rye-grass grown and clover,	on sandy soil and loamy soil	A laboratory method is presented to estimate the effectiveness of zeolite amendments on soils contaminated with radiocaesium and radiostrontium. The method is tested for various soil types from Belgium, Belarus, Russia, and Ukraine. Transfer factors of Cs-137 (Bq/g d.w.plant // Bq/g d.w. soil)
Vankerkom, J., Van Hees M., Vandecasteele CM., Colard J., Culot JP. and Kirchmann R. Book (Conf.): 4. Cadarache international Symposium on Radioecology. Cadarache (France). 14-18 Mar 1988. Vol. 2. Cadarache (France). Section Documentation - CEN/Cadarache.	Transfer to Farm Animals (Ruminants) and Their Products of Cs-134, Cs-137 and I-131 after the Chernobyl Accident.	Belgium.	Cs-134, Cs-137, I-131.			The evolution of the transfer of radioisotopes from grass to milk was followed in open field conditions during first months after deposition. The ecological half-lives in grass and milk for iodine were 4.6; 5.3 and 5.8 d respectively; for radiocesium values were 33, 80 and 87 d. The calculated transfer coefficients provided values increasing during the period of 4 months after deposition from 0.03 to 0.08 d/l for sheep and from 0.003 to 0.01 d/l for cows.

Author/Source	Publication name	Site	Deposition	Product(s)	Soil, season	Abstract
p. E111 - E119.						
Ward G.M. and Johnson J.E. JR: Health Physics, Mar. 1965, v. 11, p. 95-100.	The cesium-137 Content of Beef from Dairy and Feed-Lot Cattle.	USA.	^{137}Cs.	Hay, grain, milk, meat		The ^{137}Cs levels per kg of edible meat leveled off at less than 1per cent of the daily intake in mature dairy cattle, at 3 per cent in feed-lot cattle and 15 per cent in calves. The ratio of activity meat/milk per kg ranged from 1.2 to 4.9.
Ward G.M., Johnson J.E. and Stewart H.F. In Book: Radioactive Fallout from Nuclear Weapons Tests. Proceedings of the Second Conference, Germantown, Maryland, Nov. 3-6, 1964. p.703-710.	Cesium-137 Passage from Precipitation to Milk.	USA.	^{137}Cs.			TF.
Watabe, Teruhisa JR: Hoken Butsuri, 1993	Transfer factor of ^{137}Cs from deposition to total-diet: P_{23} for assessing effective dose equivalent commitment of the general public through ingestion pathways by UNSCEAR's method, (1). Application for the radioactivity survey data to preparation of the P_{23} Tokio and Hokkaido.	Japan Tokio and Hokkaido.	Deposition density 1kBq/km^2 (^{137}Cs).	Total-diet that includes milk and meat.		
Vetrov V.A., Andrianova G.A. Book (Conf.): International symposium on environmental contamination following a major nuclear accident, Vienna, Austria, 16-20 Oct 1989. IAEA, 1990, 451 p., v. 2, p. 17-27. IAEA-SM--306/116.	Accumulation of Chernobyl Radionuclides in Agricultural Plants During 1986-1988 in Relation to Contamination Conditions and Soil Characteristics.	Russia, Ukraine.				Interception factors from soil to plants are given.
Vidal, M. Rauret, G. JR: Journal of Radioanalytical and Nuclear Chemistry, Jun 1994, v. 181(1), p. 85-95.	Prediction capacity of a sequential extraction scheme.	Spain.	^{85}Sr, ^{134}Cs, ^{110}Ag.	Plants.	Sandy, sandy-loam soils.	Total soil-to-plant transfer of ^{134}Cs and ^{85}Sr is higher in sandy oils than in sandy-loam soil, as expected and predicted by the scheme.
Wiechen, A. Report: Status report on radionuclide transfer. Statusbericht ueber den Transfer von Radionukliden. Jan. 1980, p. 140-145. INIS-mf--6902	Transfer from vegetation to milk. Transfer Futter - Milch. In German.	Germany.	Sr, Cs, I and other radio-isotopes.	Animal feeds, plants, milk.	Different soils.	The transfer of 3H, 14C, Sr-, I- and Cs isotopes from food into milk is reported. The transfer factors found in several experiments and in different soils are listed.
Wiechen, A.; Heine, K.	Conclusions from the results	Germany.	^{131}I.	Milk.		The observed contaminations were a consequence

Author/Source	Publication name	Site	Deposition	Product(s)	Soil, season	Abstract
JR: Kieler Milchwirtschaftliche Forschungsberichte, 1978, v. 30(2), p. 205-217.	of I-131 surveillance in milk and grass in 1976 and 1977. Folgerungen aus den Ergebnissen der J-131-Ueberwachung von Milch und Bewuchs in den Jahren 1976 und 1977. In German.			Grass samples.		of two nuclear weapon tests on 26/9/1976 and 17/9/1977 in China. On the basis of the numerical values of these measurements a transfer factor grass-milk 1.1.10-3 pCi/l : pCi/daily intake has been estimated. This mean value is about one power of tenths lower than the value assumed by the German Radiation Protection Commission. Direct measurements of ^{131}I in air and milk lead only to transfer factors of 200 to 800 m3 air/l milk, that correspond far better with the experience in ^{131}I surveillance measurements.
Wilkins BT., Green N. and Bradley EJ. Book (Conf.): 4. Cadarache international Symposium on Radioecology. Cadarache (France). 14-18 Mar 1988. Vol. 2. Cadarache (France). Section Documentation - CEN/Cadarache. p. E129 - E135.	A Comparison of the Transfer from Feed to Milk for Radiocesium of Different Origins.	UK.	Cs-137.		Dry and wet depositions. Seasonal variations.	This paper compares results from several field investigations to illustrate the influence of the form of the radiocesium upon availability for uptake. Milk transfer coefficients derived from artificial conditions are not sufficient to describe transfer in natural system adequately. Several factors can affect the intake of activity by grazing cattle, and their relative importance changes with time and circumstance. Values of Fm (d L-1) are given in table for a season and dry / wet depositions.
Wilkins, B.T.; Green, N.; Cooke, A.I.; Weekes, T.E.C.; Rimmer, D.L. JR: Radiation Protection Dosimetry, 1997, v. 69(2), p.111-116.	The availability of soil-associated radionuclides for uptake by ruminants: implications for radiological assessment models.	U.K.	^{137}Cs, $^{239/240}$Pu and ^{241}Am; limited studies on ^{90}Sr.	Grass	A range of soil types.	Foodchain model, validation using published data and dedicated in vitro experiments.
Wilmott, S.; Nair, S.; Ponting, A.C. Report (Conf.): Seminair on Methods and Codes for Assessing the off-side Consequences of Nuclear Accidents. Athens (Greece), 7-11 May 1990. EUR--1301/2	An uncertainty analysis of the digetion dose following a discrete deposition from atmosphere.	Simulation. CEC.	^{131}I, ^{137}Cs, short- and long-lived isotopes.	Vegetables, milk.		Probability distributions for the committed dose equivalent per unit intake of ^{131}I and ^{137}Cs have been derived. The expectation values of the dose conversion factors were found to be in good agreement with ICRP recommended values.
Wirth, E. Book, Berlin, Germany, F.R. Reimer, 1980, 112 p. STH--1/80.	Literature on the problem of the transfer of long-lived radionuclides from soil to plants. Literaturstudie zur Problematik des Transfers langlebiger Radionuklide aus dem Boden in die Pflanzen. In German.	Germany. Literature survey.	Long-lived radionuclides.	Plants.		Test principle and test conditions are briefly described. When judging the measured transfer factors for Ce, Co, J, Mn, Tc, Pu, Sr, Cs, and Zr as to their relevance for the agricultural practice, obvious failures in testing and mistakes in the evaluation are pointed out. As for the transfer of the elements Ce, Co, J, Mn, and Tc from the ground into the plants, only 1 to 3 points in literature are quoted in the expertises.

Author/Source	Publication name	Site	Deposition	Product(s)	Soil, season	Abstract
Voigt G., Howard B.J., Vandecasteele C., Mayes R.W., Belli M., Sansone U., Stakelum G., Colgan P.A., Assimakopoulos, P., Crout N.M.J., Jones B.E.V, Hove, K. Book (Conf.): 25. Annual meeting of Fachverband fuer Strahlenschutz e.V. (FS): Environmental radioactivity, radioecology, radiation effects. Binz auf Ruegen (Germany), 28-30 Sep 1993, p.599-604. FS--93-67-T	Factors Affecting Radiocaesium Transfer to Ruminants. Results of a Multi-National Research Group.	International team. Six countries, Nine laboratories.	^{137}Cs, ^{134}Cs.			A two year CEC-DG XII Radiation Protection Programmewere aimed to identify and quantify some of the most important factors influencing the radiocaesium levels in animal food products. Programme has adopted a more mechanistic approach and conducted experiments to measure the true absorption coefficient (A_t) of radiocaesium. Coefficients are given in tables.
Voigt G., Müller H., Pröhl G. and Paretzke HG., Propstmeier G., Röhrmoser G. and Hofmann P. JR: Health Physics, Mar. 1989, v. 57(6), p. 967-973.	Experimental Determination of Transfer coefficients of ^{137}Cs and ^{131}I from Fodder into Milk of Cows and Sheep after the Chernobyl Accident.	Germany.	Cs-137, I-131.	Feed, milk		Transfer coefficients for cow's milk were calculated to be 0,003 d L^{-1} (range 0,0015 to 0,005) for ^{131}I and 0,003 d L^{-1} (range 0,0025 to 0,004) for ^{137}Cs.
Voigt, G.; Probstmeier, G.; Roehrmoser, G. Report: GSF--8/93, Mar 1993, 32 p.	Investigations into the effect of stable iodine administration to cows on the transfer of iodine-131 from the food to the cow's milk. Final report. Untersuchungen zum Einfluss der Versorgung von Milchkuehen mit stabilem Jod auf den Transfer von I-131 vom Futter in die Milch. Abschlussbericht. In German.	Germany.	Iodine-131.	Animal feeds, milk.		The investigations were carried out with the aim to quantify the effects of stable iodine taken up in various concentrations with the food on the rates of radioactive iodine-131 eliminated in the milk. Milk transfer factors remained in the range of 0.015+-0.002 d/L and bore no relation to the added concentrations of stable iodine (10 and 100 mg/d). The only exceptions are cows kept in low supply areas. Here, it appears likely that the addition of stable iodine to the food would have a detectable effect on the elimination rates.
Voigt, G.; Henrichs, K.; Proehl, G.; Paretzke, H.G JR: Radiation and environmental Biophysics, May 1988, v.27 (2), p. 143-152.	Measurements of transfer coefficients for ^{137}Cs, ^{60}Co, ^{54}Mn, ^{22}Na, ^{131}I and ^{95m}Tc from feed into milk and beef.	Germany. Experimental.	^{131}I, ^{137}Cs.	Animal feed, meat, milk.		The equilibrium transfer coefficients for ^{137}Cs for milk 0.0022±0.0002 d/l; for meat 0.0062±0.0006d/kg. For ^{131}I for milk 0.009± 0.0014d/l.
Voors P.I. and van Weers A.W. JR: Journal of Environmental Radioactivity, 1991, v. 13, p. 125-140.	Transfer of Chernobyl Radiocesium (^{134}Cs and ^{137}Cs) from Grass Silage to Milk in Dairy Cows.	Netherlands.	^{137}Cs, ^{134}Cs.	Grass silage, milk.		An average transfer coefficient from feed to milk, F_m of 0.25% d liter^{-1} has been derived for radiocesium.
Yassine, T.; Al-Oudat, M.; Othman, I.; Sharaneq, A. Report, AECS-PR/FRSR--166. Jul. 1998, p. 66.	Transfer of ^{137}Cs and ^{90}Sr from contaminated soil to some crops in Syria. In Arabic.	Syria.	Isotopes of Cs and Sr.	Vegetables, crops, cereals.	Natural soil with added mineral and organic matter.	The Tfs (expressed as Bq/g of dried material to Bq/g of soil) highest values were 3.78 for ^{90}Sr and 0.067 for 137Cs in green vegetables, whereas cereal grains had the lowest values. The TFs for both

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						radionuclides were lower of those obtained in other areas, which was due to high pH, low organic matter and high exchangeable potassium and cal-cium in the soil. The TFs of ^{137}Cs were decreased from the first year for most crops by factor up to 4, while this approach was not found for ^{90}Sr.
Yassine, T; Al-Oudat, M.; Oth-man, I.; Sharanek, A. JR: Aalam Al-Zarra, Mar-Apr 1999, (60), p. 82-83.	Transfer of radio-cesium and radio-strontium from typical soil to some crops in Syria. In Arabic.	Syria.	^{137}Cs, ^{90}Sr.	Cereal crops, vegetables.	High pH, low organic matter and high ex-changeable po-tassium and calcium in the soil.	Tfs of Cs-137 and Sr-90 from contaminated soil to some common crops were investigated under field conditions for a period of three years. The results showed large variations in Tf values from one crop to another. The highest values for both radionu-clides were found in green vegetables, whereas cereal grains had the lowest values. The transfer factor values of Sr-90 were generally much higher than those of Cs-137 for the same crop by factors ranged up to 263.
Yasuda, Hiroshi Uchida, Shigeo. JR: Journal of Nuclear Science and Technology, Dec 1994, v. 31(12), p. 1308-1313.	Statistical analyses of soil-to-plant transfer factors. Stron-tium and cesium.	Japan.	^{137}Cs, ^{90}Sr.	Leafy plants: cabbage, spinach and grass.	Two soil types: loam and sand.	The soil-to-plant transfer factors (Tfs) of Sr and Cs summarized in the IUR report were statistically analyzed for three leafy plants: cabbage, spinach and grass. Tfs reported by IAEA were examined. The Tfs in the IUR report showed log-normal distributions for the three leafy plants. The geomet-ric mean was found to be significantly different between plant species and between two soil types: loam and sand. In comparison to the IUR values, the default Tfs of Sr were considered to be overes-timated for cabbage and underestimated for spin-ach, while the default Tfs of Cs were likely to be overestimated for cabbage and underestimated for spinach and grass.
Yu, C.; Gnanapragasam, E. Report: IAEA, Vienna (Austria). Validation of models using Cherno-byl fallout data from southern Finland. Scenario S. Second report of the VAMP multiple pathways assessment working group, Sep 1996, 483 p., and p 412-432. RP IAEA-TECDOC--904	RESRAD: Model description and evaluation of model performance.	Simulation mod-elling on Cher-nobyl fallout in Finland.	Radionuclides.	Crops, vegeta-bles, milk, meat.	Soils.	RESRAD uses the relation between radionuclide concentrations in soil and the dose expressed as a pathway sum, which is the sum of products of "pathway factors". Nine potential exposure path-ways are analyzed. Among others: internal radia-tion from ingestion of plant foods grown in the contaminated soil; of meat from livestock fed with fodder grown in the contaminated soil; of milk from livestock fed with fodder grown in the contaminated soil; and from ingestion of aquatic foods (fish) from drinking water from a well or pond.
Zach R.	Contribution of Inhalation by	Canada.	57 radio-			Soil/plant transfer coefficients, taken from various

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JR: Health Physics, 1985, v. 49(5), p. 737-745.	Food Animals to Man's Ingestion Dose.		nuclides.			sources are documented and presented in table.
Årkrog A. Danish Data from Chernobyl fallout	Risø	Denmark	Sr-90 and Cs-137	rye, barley, wheat, oats, dried and fresh milk, beef, pork and total diet		Post Chernobyl first year data - average of Jutland and islands data. The following first year results are given in mBq/kg per Bq/m^2 Sr-90: Rye: 14.8. Barley: 14.4. Wheat: 13.4. Oats: 23.4. Potatoes: 1.5. Cabbage: 8.1. Carrot: 9.2. Apples: 0.3. Milk: 2.7. Beef: 0.1. Pork: 0.9. Cs-137: Rye: 9.6. Barley: 0.8. Wheat: 0.6. Oats: 0.7. Potatoes: 0.2. Cabbage: 0.2. Carrot: 0.1. Apples: 1.4. Milk: 1.3. Beef: 1.7. Pork: 0.6. Total diet (Bq per Bq/m^2): Sr-90 = 2.1; Cs-137 = 0.4
Årkrog A. Danish Data from fallout (pre-Chernobyl)	Risø	Denmark	Sr-90, Cs-137	rye, barley, wheat, oats, dried and fresh milk, beef, pork and total diet		Pre-Chernobyl fallout data. Time integrated and first year data, based on measurements. The following results are given in mBq y kg^{-1}, with the integrated data given first, followed by the first year data for each foodstuff. Sr-90: Rye: 32; 23. Barley: 24; 17. Wheat 23; 15. Oats: 37; 14. Dried milk (Jutland) 4.6; 1.8. Dried milk (islands): 2.6; 1.5. Fresh milk (Jutland): 3.5; 1.8. Fresh milk (islands): 3.4, 1.3. Beef: 1.4; 0.5. Pork 1.0; 0.23. . Cs-137: Rye: 11; 11. Barley: 8; 8. Wheat 8; 8. Oats: 7; 7. Dried milk (Jutland) 4.4; 3.7. Dried milk (islands): 2.9; 2.6. Fresh milk (Jutland): 3.6; 3.4. Fresh milk (islands): 2.6, 2.4. Beef: 28; 25. Pork 35; 18. Total diet (Bq per Bq/m^2): Sr-90 = 5.0; 1.1; Cs-137= 4.2; 1.8.
Årkrog A. In Book: Dahlgaard, H. (ed.) Nordic radioecology. The transfer of radionuclides through Nordic ecosystems to man, Amsterdam (Netherlands), Elsevier, 1994, 496 p., p. 433-456.	Doses from the Chernobyl Accident to the Nordic Populations via Diet Intake.	Denmark.				
Årkrog, A. In Book: Dahlgaard, H. (ed.) Nordic radioecology. The transfer radionuclides through Nordic ecosystems to man, Amsterdam, 1994, p.149-163.	Direct contamination - seasonality.	Denmark.	^{131}I, ^{137}Cs and other radionuclides.	Terrestrial vegetation, crops.	Contamination depends on the season of the year. Thus, impact of fallout was higher in southern than in	Direct contamination and secondary depositions; seasonality and temperature dependence.

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					northern Europe for the same deposition density.	
Årkrog, A. JR: Journal of Environmental Radioactivity, 1988, v. 6(2) p. 151-162.	The radiological impact of the Chernobyl debris compared with that from nuclear weapons fallout.	Denmark.	^{131}I, ^{137}Cs, ^{90}Sr.	Barley, oats, rye, wheat, cereals, milk.		Special emphasis is paid to the contamination of milk and cereal products. Furthermore, it is shown how the composition of the Chernobyl debris changed with distance from Chernobyl, due to the differences in volatility of the various radionuclides involved. Finally, the paper compares the dose equivalents received from unit releases (1 PBq ^{137}Cs) of global fallout and of Chernobyl accident debris.
Årkrog, A. Conf.: 6. Nordic radio-ecological seminar, Torshavn, Foeroyar (Denmark), 14-18 Jun 1992, 398 p., p. 1-10.	Ecological half-lives in the Faeroe Islands' and in Danish agricultural ecosystems. Oekologiske halveringstider i faeroeske og danske landbrugsoekosystemer. In Danish.	Denmark.	Sr-90, Cs-137.	Cereals, milk.		It is important to be conversant with the ecological halving times when determining doses from radioactive pollution of the environment. This subject is elaborated and dose calculations and transfer factors are dealt with. It is stated that Sr-90 shows a longer ecological halving time then Cs-137. Cs-137 from global fallout has a longer halving time than that originating from the Chernobyl accident. Unexpectedly, global fallout in Danish food products has a longer ecological halving time than is found in products from the Faroe Islands.
Årkrog, A. Report (Thesis of Dissertation), RISO-R--437(pt.1) Jun 1979, 267p.	Environmental studies on radioecological sensitivity and variability with special emphasis on the fallout nuclides ^{90}Sr and ^{137}Cs. Pt.1. Main text.	Denmark.	^{90}Sr, ^{137}Cs.	Cereals, bread, milk, meat, vegetables.	Soils.	Radiological sensitivity and variability were applied to the ^{90}Sr and ^{137}Cs data obtained from the environmental studies on the human foodchain carried out during the last two decades in Denmark, the Faroe Island, and Greenland.
Årkrog. A. JR: Health Physics, May 1975, v. 28, p. 557-562.	Radionuclide Levels in Mature Grain Related to Radiostrontium Content and Time of Direct Contamination.	Denmark.	Cs-137 Sr-90 and others.		Crops, different stage of development.	The direct contamination of cereals depends greatly on the stage of development of the plants. Certain nuclides, e.g. ^{90}Sr, ^{144}Ce and ^{106}Ru will hardly show up in the grain, if contamination takes place at the early stages of development. Nuclides such as ^{65}Zn, ^{55}Fe, ^{137}Cs, ^{60}Co and ^{54}Mn are, on the other hand, easily translocated to the seeds.
Øhlenschlæger M., Gissel-Nielsen G. Report: RISØ-M--2831, Nov 1989, 20 p.	Transfer of radiocaesium to barley, rye grass and pea.	Denmark.	Cs-137, Cs-134.	Spring barley, rye grass and pea.	Clay-loam and organic soil.	The aim was to identify crops with relatively low or high root uptake of ^{137}Cs and ^{134}Cs. Although such differences may be small, a shift in varieties might be a cost-effective way to reduce collective doses. Each crop was grown in two types of soil, a clay-loam and an organic soil. ^{137}Cs was added to the

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						clay-loam. The organic soil, which was contaminated with ^{137}Cs from the Chernobyl accident, was supplied with ^{134}Cs. Barley and Italian rye-grass were identified among the species tested as plants with a relative high uptake of radio-caesium.

Bibliographic Data Sheet **NKS-78**

Title	Transfer Factors for Nuclear Emergency Preparedness
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ISBN	87-7893-134-7
Date	December 2002
Project	NKS/BOK-1.4
No. of pages	103
No. of tables	15
No. of illustrations	5
No. of references	12
Abstract	This report by the NKS/BOK-1.4 project subgroup describes transfer factors for radiocaesium and radiostrontium for the fallout year and the years after the fallout. The intention has been to collect information on tools to assess the order of magnitude of radioactive contamination of agricultural products in an emergency situation in Nordic environment. The report describes transfer paths from fallout to plant, from soil to plant and to animal products. The transfer factors of radionuclides (Sr, Cs, I) given in the report are intended to be used for making rough estimates of the contamination of agricultural products soon after the heaviness and composition of the deposition (Bq m^{-2}) is known.
Key words	Transfer factor; Agriculture; Emergency Preparedness; Sr; Cs; I;

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