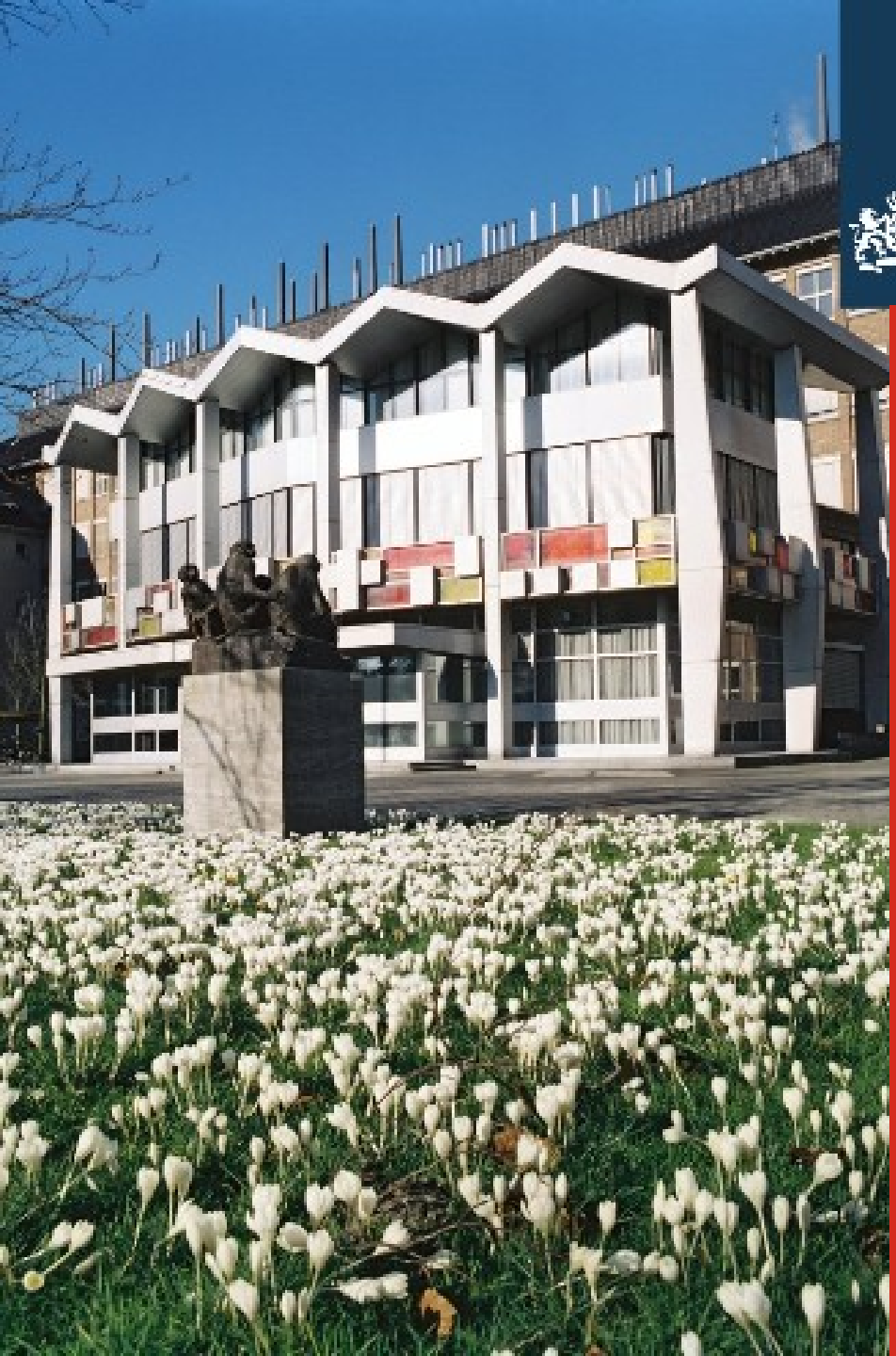

Rijksinstituut voor Volksgezondheid
en Milieu
*Ministerie van Volksgezondheid,
Welzijn en Sport*

Surface-contaminated non-food goods in the Netherlands after distant nuclear accidents

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May 22, 2013 (NERIS, ConGoo workshop Madrid)

Project description

- *Aim:*

derive clearance levels for surface contamination after a nuclear accident

- Started in 2012
- Commissioned by the Dutch Ministry of Economic Affairs
- Aftermath of the Fukushima nuclear accident
- Conditions:

distant accidents: no unavoidable hazard by the discharges;

non-food items: packages, containers, conveyances
consumer goods

Work done, in progress and future plans

- Surface contamination limits in German Radiation Protection Ordinance (StrSchV, 2001, Column-4 values in Bq/cm^2)

  How were they derived? How should they be used?
  Can they be used within the framework of this project?

- Identify several categories of conveyances, (consumer) goods,…
- Draw up exposure scenarios for members of the public and workers
- Development of a dose quantification model for surface contamination (Sudoqu)
- Dose calculations (µSv/yr per Bq/cm^2)
- Options for Dutch policy
- Derive operational levels for ambient dose rate (SurfRad)

German Radiation Protection Ordinance, 2001

- StrahlenSchutz Verordnung (StrSchV-2001), Appendix III, Table 1

Radionukli	Freigrenze			Oberflächenkontamination	Freigabe										Halbwertszeit
					uneingeschränkte Freigabe von				Freigabe von						
	Aktivität in Bq	spezifische Aktivität in Bq/g	Aktivität HRQ/1/100 A_1 in Bq	in Bq/cm^2	festen und flüssigen Stoffen in Bq/g	Bauschutt, Bodenaushub von mehr als 1 000 t/a in Bq/g	Bodenflächen in Bq/g	Gebäuden zur Wieder-, Weiterver-wendung in Bq/cm^2	festen Stoffen bis zu 100 t/a zur Beseitigung auf Deponien in Bq/g	festen und flüssigen Stoffen bis zu 100 t/a zur Beseitigung in Verbrennungsanl. in Bq/g	festen Stoffen bis zu 1 000 t/a zur Beseitigung auf Deponien in Bq/g	festen und flüssigen Stoffen bis zu 1 000 t/a zur Beseitigung in Verbrennungsanl. in Bq/g	Gebäuden zum Abriss in Bq/cm^2	Metallschrot zur Rezyklierun in Bq/g	
1	2	3	3a	4	5	6	7	8	9a	9b	9c	9d	10	10a	11

Exemption

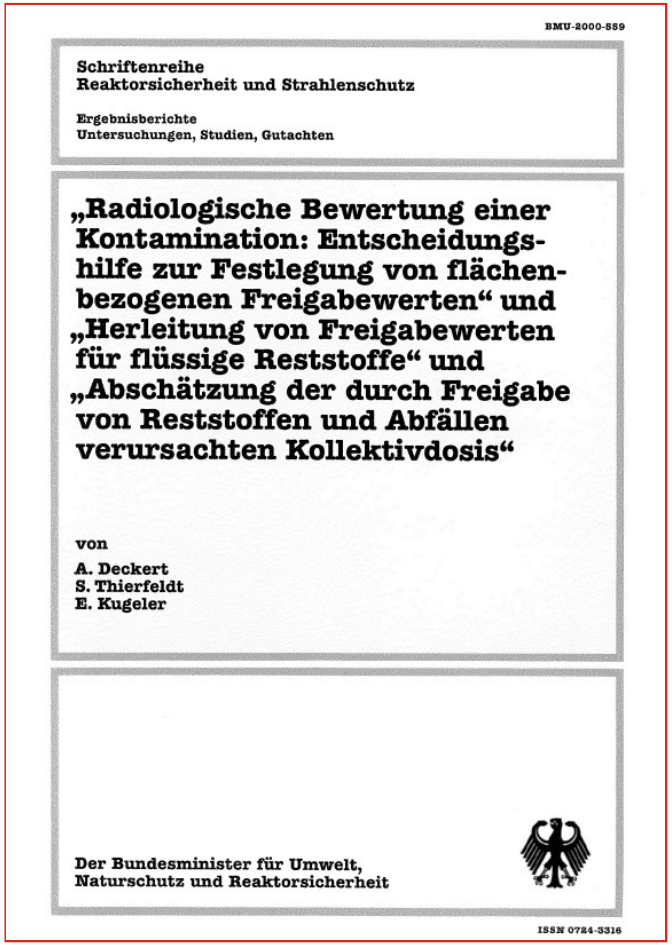
Column-4: Limiting values for surface contamination

Conditional and unconditional clearance

Column-8,-10: clearance levels surface contamination buildings

Origin of limiting values for surface contamination

- Brenk Systemplanung, BMU-2000-559;
- Covering scenarios (release + clearance);
- Pathways: external radiation, inhalation, ingestion and skin contamination
- Nuclidespecific;
- No radioactive decay;
- Includes scrap processing and clothing;


BMU-2000-559

Schriftenreihe
Reaktorsicherheit und Strahlenschutz

Ergebnisberichte
Untersuchungen, Studien, Gutachten

„Radiologische Bewertung einer Kontamination: Entscheidungshilfe zur Festlegung von flächenbezogenen Freigabewerten“ und „Herleitung von Freigabewerten für flüssige Reststoffe“ und „Abschätzung der durch Freigabe von Reststoffen und Abfällen verursachten Kollektivdosis“

von
A. Deckert
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E. Kugeler

Der Bundesminister für Umwelt, Naturschutz und Reaktorsicherheit

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Limiting values for surface contamination (Bq/cm^2)

Nuclide	StrSchV-2001 (24/2/2012)
	Column-4 value
I-131	10
Cs-134	1
Cs-136	1
Cs-137+	**1**
Te-132+	1
I-132	1
Ba-140+	1
La-140	1
Co-60	1
Sr-90+	**1**
Y-90	100
U-234	1
Pu-239	0,1
Am-241	0,1
Cm-242	1

Can these values be applied to:

Imported (consumer) goods with surface contamination?

<u>Aspects to consider:</u>

-Exposure scenarios;
-Dose criteria;
-Practicality;
-International harmonization;

SSK Recommendations , Fukushima accident

- Recommended level: **4 Bq/cm²**
  (only β/γ , no α-radiation)

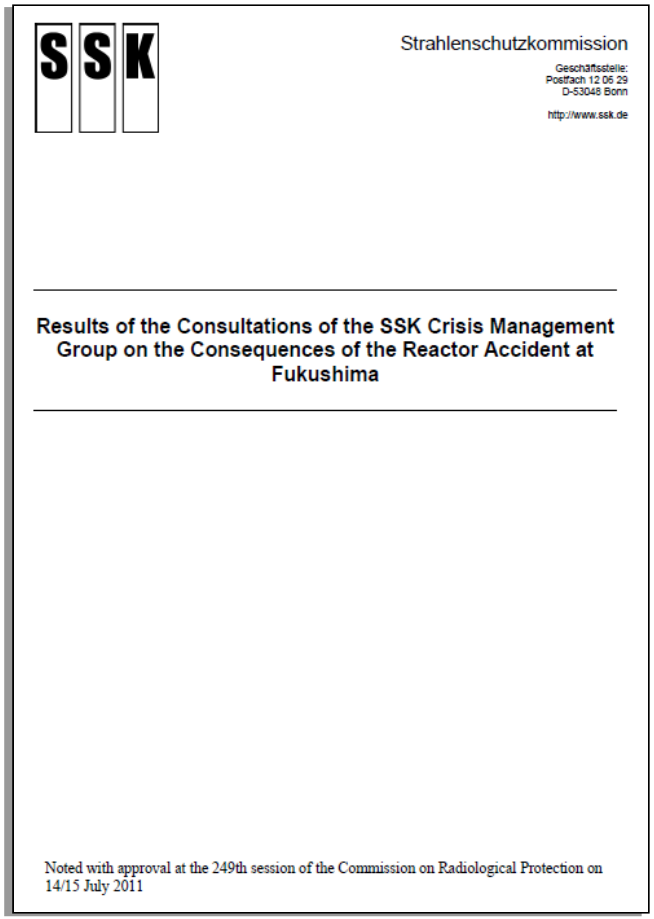
  ✓ passengers from Japan
  (freight, hand baggage, skin, garments)

  ✓ Freight arriving from Japan

- Transport regulations (IAEA, ADR, SCO-I)
  (no distinction between fixed/non-fixed)

- Reference level: 1 mSv/yr
  (ICRP-103: emergency exposure situation);

- For the relevant mix of nuclides
  Nuclide-specific measurements not practical


SSK

Strahlenschutzkommission

Geschäftsstelle:
Postfach 12 06 29
D-53048 Bonn

http://www.ssk.de

Results of the Consultations of the SSK Crisis Management Group on the Consequences of the Reactor Accident at Fukushima

Noted with approval at the 249th session of the Commission on Radiological Protection on 14/15 July 2011

QUESTION:
Can the Column-4-values be applied to imported (consumer) goods with surface contamination?

<u>Aspects to consider:</u>

-Exposure scenarios;	not based on consumer products
-Dose criteria;	different?
-Practicality;	not practical
-International harmonization;	no

ANSWER:

Probably not

Transport items and imported goods:

- **Category A: Transport items**

- Freight containers
- Packages and packing material
- Conveyances: vehicles, vessels and aircrafts

- **Category B: imported (consumer) goods and products**

- Conveyances
- Clothes and textile
- Toys
- Electronics
- Furniture
- Filters
- Raw/base materials
- …

To do: Draw up exposure scenarios for each item/product

- deterministic

- realistically conservative

- members of the public and (non-radiological) workers

Dose calculations with Sudoqu

- SUrface contamination-induced DOse: QUantification
- Includes: external radiation, inhalation, ingestion, skin contamination
- Nuclidespecific (start with most radiotoxic nuclides)
- Result: effective annual dose in µSv/yr per Bq/cm²

DOSISBEREKENINGEN OPPERVLAKTEBESMETTINGEN

STAP 1: Geef de verschillende nucliden op en hun onderlinge verhouding

NUCLIDE	AANDEEL	h(10)-bronconstante (Sv.m2.Bq-1.h-1)	T_1/2 (s)	T1/2 (h)	T1/2 (d)	T1/2 (yr)
		0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
		0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
		0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
		0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
		0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Cs-137	1	9,30E-14	9,51E+08	2,64E+05	1,10E+04	3,02E+01
I-131	1	6,60E-14	6,95E+05	1,93E+02	8,04E+00	2,20E-02
		0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
		0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
		0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
		0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
		0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
		0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
		0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
		0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00

LEGENDA:
- In te voeren waarde
- Opgezochte waarde
- Uitgerekende waarde
- Bijschrift

opmerking: deze sheet houdt geen rekening met ingroei van dochters. Deze nucliden dus zelf meenemen. Uitzondering is Cs-137 en Ba-137m. De DCC's voor Cs-137 bevatten de bijdrage van Ba-137m.

STAP 2: Geef de soort besmetting aan, en het besmettingsniveau

Soort besmetting: **Oppervlaktebesmetting**

Geef vervolgens het totale besmetting aan van alle nuclides samen *(pas op: vul slechts een van de gele velden hieronder in!)*

C_air		*Bq/m3*		*mBq/m3*		*microBq/m3*	luchtbesmetting
C_area		*Bq/m2*		*kBq/m2*	**4,00E+00**	*Bq/cm2*	oppervlaktebesmetting
C_line		*Bq/m*		*kBq/m*		*Bq/cm*	lijnbesmetting
C_point		*Bq*		*MBq*		*GBq*	puntbron

STAP 3: Specificeer de geometrie van oppervlaktebesmetting (dit is van belang voor de bepaling van de geometrische factor)

Alleen relevant voor oppervlaktebesmettingen!

Geometrie: **Cirkelvormig oppervlak**

Under development

Options for Dutch policy (1)

Distant accident treated as a *planned* exposure situation:

Option: derivation of new nuclide specific clearance values

-Exposure scenarios: ☺ based on consumer products
-Dose criteria: ☺ 10 µSv/yr
-Practicality: ⊘ measurements, amount products
-International harmonization: ⊘ NL-values only

Option: limiting values in Transport Regulations (4 Bq/cm^2 β/γ-nuclide)

-Exposure scenarios: ⊘ not based on consumer products
-Dose criteria: ⊘ > 10 µSv/yr is probable
-Practicality: ☺ measurements, amount products
-International harmonization: ☺ ADR (European agreement)

Options for Dutch policy (2)

Distant accident treated as an *existing* exposure situation:

ICRP-103: reference level < 20 mSv

Suppose we use of a reference level of 1 mSv/yr

Assume multiple exposures (10 sources): 100 μSv/yr per product-type

Assume 4 Bq/cm^2 contamination (for β/γ-nuclides) ;

Make use of scenarios for transport and consumer products

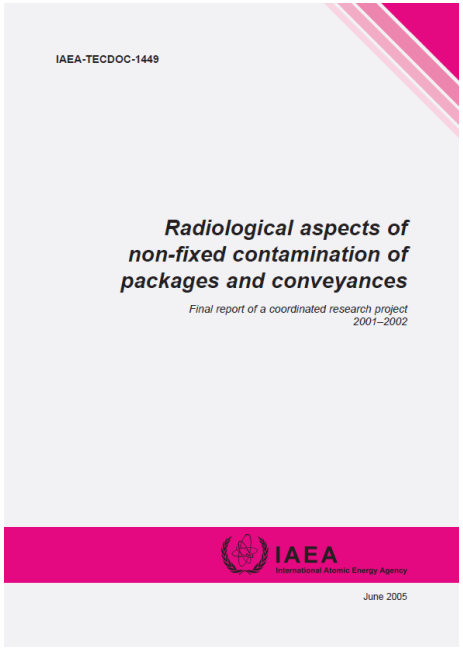
Is effective dose < 100 μSv/yr under these conditions?

Options for Dutch policy (3)

Would this work?

IAEA TECDOC1449

Nuclide	maximum dose to worker mSv/yr per Bq/cm2	Limiting value surface contamination (Bq/cm2) at dose constraint (mSv) 0.01	0.1	1
I-131	8.99E-03	1.1	11.1	111.2
Cs-134	2.00E-02	0.5	5.0	50.0
Cs-136	2.20E-02	0.5	4.5	45.5
Cs-137	8.90E-03	1.1	11.2	112.4
I-132	2.28E-02	0.4	4.4	43.9
Te-132	2.58E-02	0.4	3.9	38.8
Ba-140	2.39E-02	0.4	4.2	41.8
La-140	2.19E-02	0.5	4.6	45.7
Sr-90	9.51E-03	1.1	10.5	105.2

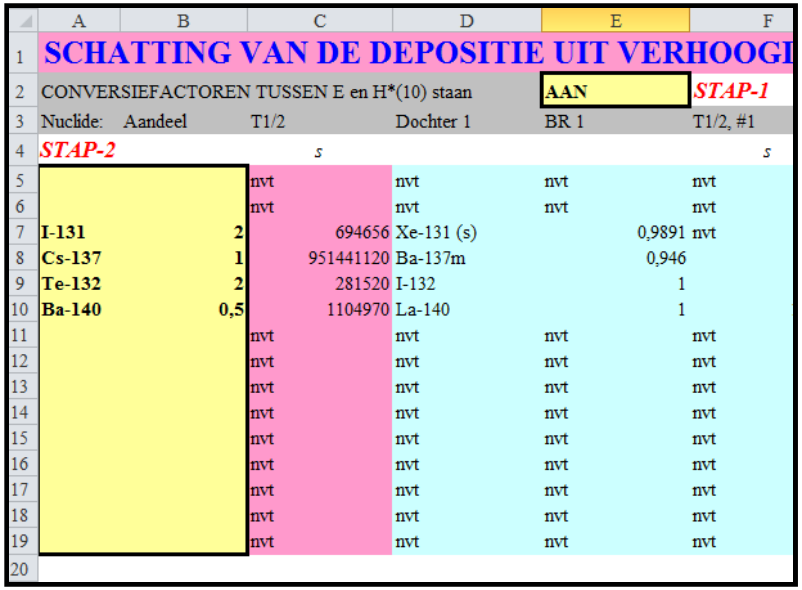


For transport scenarios: yes

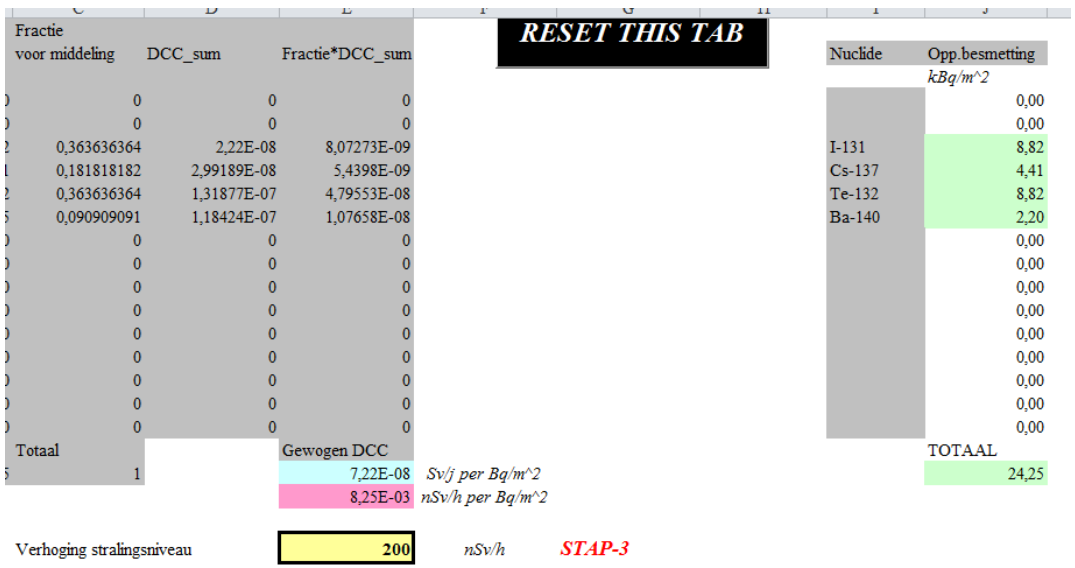
Operational levels for ambient dose rate

Screening levels for ambient dose rate

SurfRad: ambient dose rate from surface contamination levels for a given mix of radionuclides



	A	B	C	D	E	F
1	SCHATTING VAN DE DEPOSITIE UIT VERHOOGI					
2	CONVERSIEFACTOREN TUSSEN E en H*(10) staan				AAN	STAP-1
3	Nuclide:	Aandeel	T1/2	Dochter 1	BR 1	T1/2, #1
4	STAP-2		s			s
5			nvt	nvt	nvt	nvt
6			nvt	nvt	nvt	nvt
7	I-131	2	694656	Xe-131 (s)	0,9891	nvt
8	Cs-137	1	951441120	Ba-137m	0,946	
9	Te-132	2	281520	I-132	1	
10	Ba-140	0,5	1104970	La-140	1	
11			nvt	nvt	nvt	nvt
12			nvt	nvt	nvt	nvt
13			nvt	nvt	nvt	nvt
14			nvt	nvt	nvt	nvt
15			nvt	nvt	nvt	nvt
16			nvt	nvt	nvt	nvt
17			nvt	nvt	nvt	nvt
18			nvt	nvt	nvt	nvt
19			nvt	nvt	nvt	nvt
20						



Fractie voor middeling	DCC_sum	Fractie*DCC_sum		RESET THIS TAB
0	0	0		
0	0	0		
0,363636364	2,22E-08	8,07273E-09		
0,181818182	2,99189E-08	5,4398E-09		
0,363636364	1,31877E-07	4,79553E-08		
0,090909091	1,18424E-07	1,07658E-08		
0	0	0		
0	0	0		
0	0	0		
0	0	0		
0	0	0		
0	0	0		
0	0	0		
0	0	0		
0	0	0		
Totaal		Gewogen DCC		
1		7,22E-08	Sv/j per Bq/m^2	
		8,25E-03	nSv/h per Bq/m^2	
Verhoging stralingsniveau		200	nSv/h	STAP-3

Nuclide	Opp.besmetting kBq/m^2
	0,00
	0,00
I-131	8,82
Cs-137	4,41
Te-132	8,82
Ba-140	2,20
	0,00
	0,00
	0,00
	0,00
	0,00
	0,00
	0,00
	0,00
	0,00
TOTAAL	
	24,25

Under development