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*D.T.I. Dr. Trippe Ingenieurgesellschaft m.b.H.

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Abstract

The International Thermonuclear Experimental Reactor ITER is in its late engineering phase. One of the most important safety aspects - in particular for achieving public acceptance - is to assure that the releases of hazardous material are minimal during normal operation and for accidental events, even if very unlikely. To this purpose probabilistic dose assessments for accidental atmospheric releases of various ITER source terms which contain tritium and/or activation products were performed for the sites of Greifswald, Germany, and Cadarache, France. In addition, routine releases into the atmosphere and hydrosphere have been evaluated. No country specific rules were applied and the input parameters were adapted as far as possible to those used within former studies to achieve a better comparability with site independent dose assessments performed in the frame of ITER. The calculations were based on source terms which, at the first time, contain a combination of tritium and activation products. This allowed a better judgment of the contribution to the total dose of the individual fusion relevant materials. The results were compared to site independent dose limits defined in the frame of ITER. Annual doses from routine releases (CAT-I) are below 0.1 μSv for the aquatic scenarios and are close to 1 μSv for the atmospheric source terms. Source terms for two different categories of accidental releases, representing 'extremely unlikely events' (CAT-IV) and 'hypothetical sequences' (CAT-V), were investigated. In none of these cases, the release scenarios of category CAT-IV exceed the ITER limits. In addition, relevant characteristic quantities of the early dose distribution from the hypothetical scenarios of type CAT-V are still below 50 mSv or 100 mSv, values which are commonly used as lower reference values for evacuation in many potential home countries of ITER. These site specific assessments confirmed that the proposed release limits and thus the derived dose limits for a generic ITER site are unlikely to exceed the national criteria for evacuation. Other protective actions such as sheltering, relocation and food banning were investigated and only banning of agricultural products was found to be important.

Dosisabschätzungen für Greifswald und Cadarache mit neuen Quelltermen aus dem ITER NSSR-2 Bericht

Zusammenfassung

Der experimentelle Fusionsreaktor ITER befindet sich in einem fortgeschrittenen Planungsstadium. Eines der wichtigsten Ziele von Sicherheitsuntersuchungen, insbesondere um die Akzeptanz in breiten Bevölkerungsschichten zu sichern, ist nachzuweisen, daß sowohl Freisetzungen im Routinebetrieb als auch nach potentiellen Unfällen auf ein Minimum beschränkt bleiben. Deshalb wurden im Rahmen von Fusionsstudien Dosisabschätzungen für unfallbedingte Freisetzungen von Tritium und/oder Aktivierungsprodukten für die beiden Standorte Greifswald, Deutschland, und Cadarache, Frankreich, durchgeführt. Weiterhin wurden Routinefreisetzungen in die Atmosphäre und Hydrosphäre untersucht. Dabei wurden keine länderspezifischen Vorschriften angewendet. Die Eingabeparameter wurden soweit wie möglich an diejenigen früherer ITER Studien angepaßt. Die Ergebnisse wurden mit ITER internen Grenzwerten und Dosen, die im Rahmen von ITER für standortunabhängige Freisetzungen berechnet wurden, verglichen. Die jetzigen Quellterme sind die ersten, in denen Tritium und Aktivierungsprodukte zusammen vorkommen. Somit ist auch eine Zuordnung des Dosisbeitrags von Tritium oder von Aktivierungsprodukten zur Gesamtdosis möglich. Die Jahresdosen nach Routinefreisetzungen in die Hydrosphäre (CAT-I) lagen knapp unter 1μSv pro Jahr, die aus atmosphärischen Quellen lag deutlich darunter. Für Unfälle wurden Freisetzungsszenarien der Kategorie IV (sehr unwahrscheinlich) und V (hypothetisch) untersucht. In keinem Fall überschreiten die Ergebnisse der Szenarien der Kategorie IV die Kriterien zur Evakuierung, wie sie im ITER Umfeld definiert sind. Auch liegen die Dosen aus den Freisetzungen der Kategorie V im allgemeinen unterhalb 50 mSv bzw. 100 mSv, Werte, die in mehreren potentiellen ITER Gastländern als untere Eingreifrichtwerte für die Evakuierung gültig sind. Diese standortbezogenen Untersuchungen haben gezeigt, daß die vorgeschlagenen Freisetzungslimits und die davon abgeleiteten Dosisgrenzwerte nationale Eingreifrichtwerte für die Initiierung von Evakuierungsmaßnahmen wahrscheinlich nicht überschreiten werden. Als einzige nennenswerte Schutz- und Gegenmaßnahme wurde alleine das Verwerfen von Nahrungsmitteln identifiziert.

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1. Introduction

The results presented in this report complement the dose assessments documented first in 1996 /RAS96/ and later in 1997 /RAS97b/. For the first time /RAS97b/, source terms from potential accident sequences for the present design of ITER, as documented in /NSSR1/, have been used to perform site specific dose assessments. At the beginning of 1998, an update of the safety report describing the ongoing source term development for ITER /NSSR2/ has been circulated as a draft and has been used as basis for the new calculations described further down. To allow a comparison between the various dose assessment studies and also to look at the further development of the source terms, similar approaches, models and input parameters have been applied within all studies. To this purpose, the two potential sites Greifswald and Cadarache- despite not being candidates at present - have again been selected for the calculations.

Greifswald is located in North Germany at the coast of the Baltic Sea. The area around the site is mostly flat, thus, the prevailing meteorological conditions are influenced from the zonal western winds. Cadarache, in contrast, is located in southern France some 50 kilometres from the cost of the Mediterranean Sea. The weather at this site is quite different from Greifswald and more influenced from high pressure areas centred at the Azores or the Mediterranean Sea itself.

Probabilistic dose assessments, based on hourly meteorological data, have been performed. Mostly potential individual doses and, if appropriate, also the need to initiate protective measures have been investigated for three types of accidents, all of them placed in the event sequence categories IV ('extremely unlikely events') and V ('hypothetical sequences'). In addition, routine releases into the atmosphere and hydrosphere have been evaluated.

The present calculations for activation products have been performed with the updated foodchain data base and dose conversion factors /GSF94/, implemented into the computer system COSYMA /COS90/. Therefore, these new calculations cannot be simply compared with those performed in previous studies in the early nineties (see e.g. /RAS92/). However, as demonstrated in /RAS96/, the difference between the 'old' and the 'new' version of the foodchain calculations in general does not exceed a factor of two, however, strongly depends on the nuclide considered. As the extended foodchain information in the new COSYMA version 95/1 is now based on a more sophisticated model, the new results should be considered as more reliable as the ones achieved in earlier studies, which were based on rather simple assumptions from the German Regulatory Guidelines /STO94/.

2. Model description

2.1 Atmospheric releases

Calculations for tritium and activation products have been performed with separate computer programs, also in those cases in which the source term contained both materials. The results of both calculations were added before the evaluation of the consequences results. This was possible as both codes have been used in their probabilistic versions using the identical meteorological data base as well as the same probabilistic sampling scheme. A description of the probabilistic sampling scheme can be found in Appendix A.

2.1.1 Tritium

The computer program UFOTRI /RAS90/ and /RAS93/ for assessing the consequences of accidental tritium releases has been used for the dose assessments. Processes such as the conversion in soil of tritium gas (HT) into tritiated water (HTO), reemission after deposition and the conversion of HTO into organically bound tritium (OBT) are considered. For atmospheric dispersion and deposition calculations (dry and wet) the trajectory model MUSEMET /STR81/ implemented in UFOTRI was used. During the time period of the first few days, all the relevant transfer processes between the compartments of the biosphere (atmosphere, soil, plants, animals) are described dynamically. A first order compartment model calculates the longer term pathways of tritium in the foodchains. In its newest version all the exchange processes (atmosphere-soil; atmosphere-plant) are based on resistance approaches and will be re-evaluated dependent on the prevailing environmental conditions. A simple photosynthetic submodule, which calculates the actual transfer rate of HTO in plant water into organically bound tritium, improved the results for the ingestion pathways.

2.1.2 Activation products

Calculations for accidentally released activation products were performed with the version NL/95 of the program system COSYMA /COS90/ (subsystem NL), including extended data sets for activation products /GSF94/. For atmospheric dispersion and deposition calculations (dry and wet) the trajectory model MUSEMET implemented in COSYMA and UFOTRI was used. It was assumed, that the nuclides which appear in aerosol form have a mean diameter of 1 mμ AMAD, and the corresponding dry deposition velocity is set to be 1.0 E-3 m/s (see also Table 2). The doses by ingestion of contaminated foodstuffs are calculated assuming the local production and consumption method; that means, all foodstuffs are consumed in the grid element where they are harvested / produced. The foodchain information from the German model ECOSYS has been used in the calculations / GSF94/.

2.2 Aquatic releases

As described in /RAS96/, two models were used to assess the releases of tritium and activation products from the two sites of Cadarache and Greifswald. A simplified box model was chosen to calculate the concentration in water and fish as well as the dose to man assuming a release into the Greifswaldener Bodden - located close to the Baltic see. As the hydrological information on the river Serre Poncon close to Cadarache did not meet the requirements of the 2-D river model COASTOX, no specific dilution factor was calculated. Instead it was assumed, that the released activity was uniformly spread over the river, which seemed to be applicable in case of normal operation releases and average discharge regimes. The dose model H-DOSE uses then the activity concentrations in water to calculate the concentration in fish together with the doses by the ingestion pathways.

2.2.1 The simple box type model LAKE

The simplified 2-box model LAKE assumes equilibrium between the activity in lake water and the accumulated activity in fish flesh. This accumulation factor, often referred to as concentration factor is defined as the activity concentration in fish flesh compared to that in water assuming equilibrium conditions /TIL83/. In the model LAKE values from Table 1 are used for the calculations.

nuclide	fresh water	brackish water
HTO	1	1
Cr	200	400
Mn	400	550
Fe	200	1000
Co	300	300
Ni	100	300
Mo	10	10
Sr	2	4
Cs	800	50
Ta	100	100

Table 1: Concentration factor (Bq/kg / Bq/l) of tritium and activation products for fresh and brackish water

2.2.2 Dose model H-DOSE

Based on the concentration in water, in sediments and in fish, the computer code H-DOSE /RAS95/ calculates the dose from 4 different exposure pathways:

- Consumption of foodstuffs contaminated by irrigation (root vegetables, leafy vegetables, milk and milk products, meat and meat products)
- Consumption of contaminated drinking water
- Consumption of contaminated fish
- External irradiation from the borderline of the river or lake.

If the activity concentration in fish is not provided, H-DOSE has an integrated submodel to calculate this value by using the concentration factor approach. However, as this approach is only valid for equilibrium conditions, reduction factors were introduced, which take into account the non-equilibrium conditions /TIL83/. Rather simple approaches have been used mainly in accordance with the German Regulatory Guidelines [STO94]. Only the effective committed dose equivalent is assessed.

3. Release scenarios

3.1 Meteorological data for Greifswald and Cadarache

The Energiewerke Nord, maintaining the site of Greifswald, have provided meteorological data for one year covering the period from 20.03.1994 - 19.03.95 on an hourly basis. The 'Centre d'etudes de Cadarache', part of the CEA, provided meteorological data for Cadarache for the three years 1991, 1992 and 1993. The meteorological values were recorded every 3 hours for most of the

parameters, except the rain intensity (daily basis). In contrary to the request, the stability class was not included and the solar irradiation was provided for the year 1994 only. Furthermore, the irradiation measurements were performed on a daily basis only. As the year 1991 was most complete it was selected for the calculations.

The conversion into formats appropriate for the two computer codes has been described in /RAS96/. Again it has to be mentioned that interpolated meteorological data cannot be used for deterministic assessments, as the meteorological data set was not complete for both stations. However, the main sources for misinterpretations were removed and probabilistic assessments seemed to be possible (see also for more information / RAS96/).

3.2 Aquatic release characteristics

Greifswald is located at the border of the 'Bodden of Greifswald' opposite to the isle of Rügen at the coast of the Baltic Sea. The Bodden can be characterised as follows:

- area 514 km^2
- mean depth 5.6 m
- water volume 2.88 E+9 m^3
- water exchange rate 1700 m^3 /s
- salt content 10 per mill

Only one dilution factor will be calculated by the models as the water exchange rate with the Baltic Sea and the water volume does not change significantly over a year.

Cadarache is located close to the river Serre Poncon, which will be used for the liquid discharges from the projected power plant. There are three important discharge regimes, which can be characterised as :

- annual low 2.5 m^3/s
- annual high 2000 m^3/s
- annual mean 200 m^3/s

For normal operation conditions, the annual mean has been used for the calculations. As it was assumed that the activity is uniformly distributed over the whole river width, the following dilution factor was applied for the calculations:

- annual mean 2.0 E+5 l/s

3.3 Source terms and model input

Calculations were performed for various source terms of three categories out of 5 as defined in /NSSR1/. The first category includes operational events whereas the two categories CAT IV and CAT V represent the most unlikely and thus those events which might result in the highest consequences for the population (see Table 2).

EVENT SEQUENCE CATEGORY	I OPERATIONAL EVENTS	II LIKELY SEQUENCES	III UNLIKELY SEQUENCES	IV EXTREMELY UNLIKELY SEQUENCES	V HYPOTHE-TICAL SEQUENCES
Category Description	Events and plant conditions planned and required for ITER normal operation, including some faults and events which can occur as a result of the ITER experimental nature.	Event sequences not planned but likely to occur one or more times during the life of the plant but not including category I events.	Event sequences not likely to occur during the life of the plant.	Event sequences not likely to occur during the life of the plant with a very large margin; limiting events for "design basis"	Event sequences with extremely low frequency postulated with the goal of limiting the associated risk; outside the "design basis."
Typical Annual Expected Frequency	list of operational events to be defined explicitly	$f > \sim 10^{-2}/a$	$10^{-2}/a > f > 10^{-4}/a$	$10^{-4}/a > f > 10^{-6}/a$	$f < \sim 10^{-6}/a$
ITER Objectives	Meet appropriate national criteria for "design basis" events				No "edge" effects
	ALARA	Minimise releases to extent practical			
	Avoid any potential need for any public counter-measures			Avoid any potential need for public evacuation	
Type of dose	Annual chronic dose including ingestion	Chronic dose without ingestion		Early dose	

Table 2: Event categories and objectives (according to /PIE97/)

3.3.1 Model input

Probabilistic calculations for accidental release conditions were performed for two different release heights - 10 m with building wake effects and 100 m without any influence from the building - were considered. One year of hourly meteorological data from the sites of Greifswald and Cadarache was used as the basis of the dose assessments. However, calculations were performed only for the vegetation period, which is in fact the worst case for calculations with ingestion doses. This shortening of the potential range of weather sequences for the sampling scheme was also used for the calculations of the early dose without ingestion pathways as the early dose appears to differ not dramatically from summer to winter (see /RAS92/). The sampling scheme for obtaining the representative weather sequences of the desired period is shortly described in Appendix A. The same weather sequences have been used within UFOTRI and COSYMA. The main input parameters for the accidental release scenarios are shown in Table 2. The 'MOL' set of dispersion parameters was applied /BUL72/ for all calculations.

Two different sets of simulations were performed. The assessment of the potential dose of an individual located at the fence of the installation is based on the assumption that the person stays permanently outside the house on the meadow and the food is produced and consumed locally (if ingestion is considered). This results in the application of a shielding factor of 1 for all the exposure pathways. The second set investigated the potential need for protective measures. Here, the normal living habits of the population, as default included in COSYMA, were assumed. However, all the countermeasures considered were based on potential dose calculations, thus the shielding factors do not differ from 1 (see Table 3). Results of these calculations are the area and/or the number of people affected by an individual measure.

In case of normal operation releases, the meteorological data of the same year as for accidental assessments were used. Annual averages were calculated by COSYMA and NORMTRI applying the identical atmospheric dispersion model. The main input characteristics are also listed in Table 3. As for the accidental scenarios, the sigma parameter set MOL was applied. Potential doses were calculated with ingestion assuming local production and consumption.

parameter	value
source term	variable
individual dose for the	Most Exposed Individual
release height (accidental)	10 m or 100 m
release height (routine)	100 m, no building effects
building dimensions (h x w)	40m x 100m
release duration	1 hr, 1 y
washout coefficient (w)	w = A*I**B (1/s)
with rain intensity I	in mm/hr
coefficient A (nobel gas)	0.0 (hr s/mm)
coefficient B (nobel gas)	0.0
coefficient A (aerosol)	8.0 E-05 (hr s/mm)
coefficient B (aerosol)	0.8
coefficient A (HT)	0.0 (hr s/mm)
coefficient B (HT)	0.0
coefficient A (HTO)	9.0 E-05 (hr s/mm)
coefficient B (HTO)	0.6
deposition velocity (nobel gas)	0.0 m/s
deposition velocity (aerosol)	0.001 m/s
deposition velocity (HTO, routine)	0.005 m/s
deposition velocity (HTO, accidental)	variable
dose conversion factors act. prod.	nuclide dependent
dose conversion factor inhalation HT	6.8 E-16 Sv/Bq
dose conversion factor inhalation HTO	1.6 E-11 Sv/Bq
dose conversion factor ingestion HTO	1.6 E-11 Sv/Bq
dose conversion factor ingestion OBT	4.0 E-11 Sv/Bq
breathing rate	2.66 E-4 m**3/s
skin absorption rate (HTO)	1.60 E-4 m**3/s
ingestion rate veget. (root + grain)	180 kg/year
ingestion rate leafy vegetables	45 kg/year
ingestion rate meat	75 kg/year
ingestion rate milk	110 kg/year
shielding factor	1.0 (potential doses)
shielding factor	1.0 (protective measures)

Table 3: Input parameters for the accidental and routine release scenarios

The conditions for the aquatic discharges were adapted as far as possible to the ones for the atmospheric releases. Thus, the released quantities and main consumption rates remain unchanged. The differences and additional assumptions are summarised in the following:

- consumption rate of fish — 30 kg/y (meat reduced by 30 kg)
- consumption of drinking water — 1.5 l/d
- irrigation — 20 events of 5 mm / m^2
- distance from the release point — 1000 m

3.2.2 Source terms for atmospheric releases

Various source terms out of five ITER categories were selected for the calculations. As there is no final information available about the 'real' composition of the activated dust, it is assumed that the dust contains either 100% of tungsten, copper or steel. This allows to identify the worst case composition of the dust, even if the composition may change in real operation mode. The following source terms were investigated:

- **Type one**: 'normal operation releases', as proposed in /NSSR2/

scenario	composition dust	composition ACP	composition tritium	release height
CAT-I-W-el	W (5 g)	ACP (1.2 g)	HTO (112 TBq)	elevated
CAT-I-Cu-el	Cu (5 g)	ACP (1.2 g)	HTO (112 TBq)	elevated
CAT-I-St-el	Steel (5 g)	ACP (1.2 g)	HTO (112 TBq)	elevated

Table 4: Source terms for the 'CAT I, normal operation' (type one)

- **Type two**: 'New Release Limits for CAT IV', as proposed in /PIE97/

scenario	composition	amount	release height
CAT-IV-HTO-el	HTO	100 g	elevated
CAT-IV-HTO-gr	HTO	10 g	ground
CAT-IV-HT-el	HT	3000 g	elevated
CAT-IV-HT-gr	HT	300 g	ground
CAT-IV-W-el	Dust- W	2000 g	elevated
CAT-IV-W-gr	Dust- W	200 g	ground
CAT-IV-Cu-el	Dust- Cu	2000 g	elevated
CAT-IV-Cu-gr	Dust- Cu	200 g	ground
CAT-IV-St-el	Dust- Steel	2000 g	elevated
CAT-IV-St-gr	Dust- Steel	200 g	ground
CAT-IV-ACP-el	ACP	5000 g	elevated
CAT-IV-ACP-gr	ACP	500 g	ground

Table 5: Source terms for the 'New release limits for CAT IV' (type one)

- **Type three**: One CAT IV accident sequence from the NSSR-2 report /NSSR2/. 'Wet Bypass'

scenario	composition dust	composition ACP	composition tritium	release height
CAT-IV-bypass-W-el	W (110 g)	ACP (15 g)	HTO (23 g)	elevated
CAT-IV-bypass-Cu-el	Cu (110 g)	ACP (15 g)	HTO (23 g)	elevated
CAT-IV-bypass-St-el	Steel (110 g)	ACP (15 g)	HTO (23 g)	elevated

Table 6: Source terms for CAT IV 'Bypass and DV events' (type two)

- **Type four**: Highest source term from all CAT-V releases 'Wet bypass -1 hr isolation of GBR (ground)' /NSSR2/.

scenario	composition dust	composition ACP	composition tritium	release height
CAT-V-bypass-W-gr	W (4060 g)	ACP (18.2 g)	HTO (42 g)	ground
CAT-V-bypass-Cu-gr	Cu (4060 g)	ACP (18.2 g)	HTO (42 g)	ground
CAT-V-bypass-St-gr	Steel (4060 g)	ACP (18.2 g)	HTO (42 g)	ground

Table 7: Source terms for 'Wet bypass -1 hr isolation of GBR (ground)', CAT V

As mentioned above, information about the final composition of the dust is not yet available. Therefore, three individual materials (steel, copper and tungsten) have been selected for the investigation. For ACPs (Activated Corrosion Products) only the location (PFW/IBB loop) was considered. The nuclide specific composition of the three types of dust and of the ACP are listed in the following four Tables (Table 8 to Table 11).

Copper (Cu outboard, BPP)					
isotope	half life [y]	activity [GBq/m3]	activity Bq/g	COSYMA	COSYMA Ing
Al-26	7.20E5	1.49E-01	1.73E+01	-	-
Co-60	5.27E0	4.23E+06	4.91E+08	31	25
Co-60m	1.99E-5	6.95E+07	8.06E+09	30	-
Ni-63	1.00E2	7.93E+05	9.20E+07	34	27
Cu-62	1.85E-5	1.47E+09	1.71E+11	36	-
Cu-64	1.45E-3	3.11E+09	3.61E+11	37	28
Cu-66	9.70E-6	9.67E+08	1.12E+11	38	-
Ta-182	3.15E-1	1.49E+06	1.73E+08	158	70
Bi-208	3.68E5	1.52E-01	1.76E+01	-	-

Table 8: Unit source term for copper (as dust), with the nuclide number of COSYMA

Steel, (SS316 outboard, EPP)					
isotope	half life [y]	activity [GBq/m3]	activity [Bq/g]	COSYMA	COSYMA Ing
Al-28	4.26E-06	1.57E+07	2.15E+09	-	-
V-52	7.13E-06	9.41E+07	1.29E+10	-	-
Cr-51	7.59E-02	1.42E+08	1.95E+10	16	14
Cr-55	6.66E-06	1.34E+07	1.84E+09	-	-
Mn-54	8.55E-01	2.72E+07	3.73E+09	20	17
Mn-56	2.94E-04	5.14E+08	7.04E+10	21	18
Fe-55	2.73E+00	1.67E+08	2.29E+10	23	19
Fe-59	1.22E-01	1.32E+06	1.81E+08	-	-
Co-57	7.44E-01	3.45E+07	4.73E+09	27	23
Co-58	1.94E-01	5.67E+07	7.77E+09	29	24
Co-58m	1.04E-03	9.40E+07	1.29E+10	28	-
Co-60	5.27E+00	5.71E+06	7.82E+08	31	25
Co-60m	1.99E-05	3.60E+07	4.93E+09	30	-
Ni-57	4.07E-03	5.03E+06	6.89E+08	-	-
Mo-99	7.52E-03	2.70E+07	3.70E+09	75	43
Tc-99m	6.86E-04	2.36E+07	3.23E+09	80	-

Table 9: Unit source term for steel (as dust), with the nuclide number of COSYMA

Tungsten (W inboard, EPP)					
isotope	half life [y]	activity [GBq/m3]	activity Bq/g	COSYMA	COSYMA Ing
Ag-110	7.79E-07	1.24E+06	6.46E+07		
Ta-179	1.82E+00	4.56E+06	2.38E+08		
Ta-180	9.30E-04	1.15E+06	5.99E+07		
Ta-182	3.15E-01	3.76E+06	1.96E+08	157	70
Ta-183	1.40E-02	3.27E+06	1.70E+08		
Ta-184	9.93E-04	9.08E+05	4.73E+07		
W-179	7.13E-05	3.51E+07	1.83E+09		
W-179m	1.27E-05	1.93E+06	1.01E+08		
W-181	3.32E-01	4.17E+08	2.17E+10	159	72
W-183m	1.65E-07	2.50E+09	1.30E+11	160	-
W-185	2.06E-01	8.81E+08	4.59E+10	161	73
W-185m	3.18E-06	4.90E+08	2.55E+10	-	-
W-187	2.73E-03	2.46E+09	1.28E+11	162	74
Re-186	1.03E-02	8.23E+07	4.29E+09	166	77
Re-188	1.94E-03	3.46E+07	1.80E+09	168	79
Re-188m		2.35E+06	1.22E+08		

Table 10: Unit source term for Tungsten (as dust), with the nuclide number of COSYMA

Activated Corrosion Products for a PFW/IBB loop					
isotope	half life [y]	activity [GBq/deposit]	activity [Bq/g]	COSYMA	COSYMA Ing
Cr-51	7.59E-02	2.55E+02	2.53E+08	16	14
Mn-54	8.55E-01	1.55E+02	1.54E+08	20	17
Mn-56	2.94E-04	4.34E+03	4.31E+09	21	-
Fe-55	2.73E+00	7.69E+02	7.64E+08	23	19
Co-57	7.44E-01	3.33E+02	3.31E+08	27	23
Co-58	1.94E-01	4.91E+02	4.88E+08	29	24
Co-60	5.27E+00	5.79E+01	5.75E+07	31	25
Ni-57	4.07E-03	1.40E+02	1.39E+08	-	-

Table 11: Unit source term for ACP (PFW/IBB), with the nuclide number of COSYMA

Based on the unit source terms as presented in the Table 8 to Table 11, the nuclide specific release rates for the individual source terms were derived. These values are presented in detail in the Appendices B and C for the four source term categories 1 - 4 and the two sites, respectively.

3.2.2 Source terms for aquatic releases

Only one aquatic source term is defined in the NSSR2 report. It contains activated corrosion products and tritium in form of HTO. The composition of the activated corrosion products was set identical to that used for the atmospheric scenarios (Table 10).

1. **Aquatic scenario**: 'normal operation releases', as proposed in /NSSR2/

scenario	composition dust	composition ACP	composition tritium
CAT-I-aq	-	ACP (1.9 g)	HTO (8 TBq)

Table 12: Source terms for 'CAT I, normal operation aquatic'

4. Results of the potential dose calculations

Probabilistic individual potential dose values (no shielding, no protective actions) for the most exposed individual (MEI) were calculated at 12 distances (ranging from 145 m up to 10 km). However, only the results for 1000 m are evaluated in detail as this distance may represent the proposed site boundaries for ITER. All further results are presented in the various Appendices.

For routine releases, the dose represents the average burden of the MEI at a certain distance band. The dose values from the accidental scenarios, however, are presented together with their probability of occurrence expressed in percentiles. The probability of occurrence for the highest dose obtained in one individual distance band is given by the probability of the corresponding weather sequence. To explain this further, the example is considered the calculations result in a 95% percentile of 1mSv. This means that in 5 % of all calculations 1 mSv may be exceeded and in 95 % of all cases the dose values remain below this value. As described in /RAS96/ and also later on, various percentiles can be compared with dose values obtained in the ITER study for a generic site /ESECS/ and /NSSR/. These percentiles are the maximum dose or the 95% percentile for worst case conditions (CAT-IV) and the mean or 50 % percentile for average conditions (CAT-V).

From previous investigations about accidental releases it was concluded, that the selection of the vegetation period only does not alter the results when compared with that of one complete year. Therefore, to reduce the computational effort, only weather sequences from the vegetation period (4800 hours of the year) were selected for the accidental scenarios.

Two different types of doses have been obtained. The individual early dose results from the first week exposure and a 70 years integration time (50 years for tritium). The exposure pathways are the external exposure from the passing cloud (CL), the first week external exposure from the ground (GR), the internal exposure from inhalation + skin absorption (IH) from the passing cloud and the internal exposure from inhalation + skin absorption from the reemitted tritium (IHR) during the first week; the ingestion pathways (IG) are not considered. The individual effective dose equivalent (EDE) results from chronic exposure and a 70 years integration time (50 years for tritium). The exposure pathways are the external exposure from the passing cloud and the ground, the internal exposure from inhalation + skin absorption from the passing cloud, the internal exposure from inhalation + skin absorption from reemitted tritium and the internal exposure from the ingestion of contaminated foodstuffs.

4.1 Greifswald

4.1.1 Potential doses of the MEI from routine releases

Doses from atmospheric releases range below 1 μSv/a at the distance of 1 km from the source. They are highest for steel as single dust composition. However, more than 50% of the total dose is related to the release of tritium in form of HTO (see Table 13). In case of tungsten, even more than 80% are attributed to the released HTO

Distance (km)	CAT-I-W-el dose (Sv/a)	CAT-I-C-el dose (Sv/a)	CAT-I-S-el dose (Sv/a)	HTO-alone dose (Sv/a)
0.5	6.1E-07	6.2E-07	7.3E-07	5.7E-07
1.0	5.9E-07	6.2E-07	7.8E-07	5.2E-07
2.0	3.6E-07	3.8E-07	4.8E-07	4.2E-07

Table 13: Dose from atmospheric routine releases, Greifswald, EDE of the MEI in Sv/a, near range

The doses from the discharge of activated corrosion products and tritium into the Greifswaldener Bodden are much lower than those obtained for atmospheric releases. They were lower than 10^{-3} μSv/a and dominated by the activated corrosion products. Tritium contributes by less than 20% only. This may be due to the fact that the accumulation factor is unity for tritium but can reach values of up to 1000 (Fe) for activated corrosion products.

Isotope	dose (Sv/a)	% of total
HTO	1.02E-10	17.8
Cr-51	6.36E-14	0.0
Mn-54	6.33E-11	11.0
Mn-56	0.00E+00	0.0
Fe-55	1.67E-10	29.2
Co-57	3.00E-11	5.2
Co-58	3.59E-11	6.2
Co-60	1.76E-10	30.6
Ni-57	1.40E-47	0.0
total	**5.74E-10**	

Table 14: Dose from aquatic routine releases into the Greifswaldener Bodden

4.1.2 Potential doses of the MEI at 1 km distance from accidental releases

Three different release scenarios, covering the proposed release limits of CAT IV and actual scenarios of the two release categories CAT IV and CAT V, have been investigated. Release heights of 10 m and 100m have been applied with and without building wake effects, respectively. The lower reference level for evacuation (50 mSv) as defined within the generic ITER safety study /GESECS/ is never reached by the early doses for any of the materials. Early doses from the release

limit scenarios of CAT IV exceed in no case the lower reference level of 50 mSv at 1 km distance. The 95% percentile which is often used in various countries in licensing guidelines is far below the lower reference level for evacuation (CAT IV). In case of the activation product source terms, 1 mSv is never exceeded. Releases of HTO shows slightly higher early doses with values up to 3 mSv.

release limits scenario (Greifswald)	characteristic quantities of the dose distribution (Sv)							
	max. value		95%-fractile		50%-fractile		mean value	
	early	EDE	early	EDE	early	EDE	early	EDE
CAT-IV-HTO-el	6.9E-03	1.1E-01	1.4E-03	1.9E-02	6.2E-04	5.0E-03	7.2E-04	7.6E-03
CAT-IV-HTO-gr	5.3E-03	2.0E-02	2.9E-03	1.3E-02	3.5E-04	3.6E-03	7.2E-04	5.0E-03
CAT-IV-HT-el	5.8E-04	8.5E-02	1.0E-04	1.4E-02	3.8E-05	6.2E-03	4.5E-05	6.6E-03
CAT-IV-HT-gr	4.2E-04	6.1E-02	1.7E-04	3.7E-02	3.0E-05	2.9E-03	5.1E-05	7.3E-03
CAT-IV-W-el	8.4E-03	1.4E-01	4.8E-04	3.8E-03	6.2E-05	5.8E-04	1.2E-04	1.4E-03
CAT-IV-W-gr	1.1E-03	1.8E-02	3.2E-04	3.2E-03	3.0E-05	3.0E-04	7.5E-05	8.0E-04
CAT-IV-Cu-el	5.9E-03	1.8E-01	4.7E-04	5.1E-03	1.2E-04	7.9E-04	1.7E-04	1.9E-03
CAT-IV-Cu-gr	8.4E-04	2.3E-02	4.5E-04	4.4E-03	5.4E-05	4.0E-04	1.2E-04	1.1E-03
CAT-IV-St-el	9.8E-03	6.8E-01	6.5E-04	1.9E-02	1.5E-04	2.8E-03	2.3E-04	7.0E-03
CAT-IV-St-gr	1.4E-03	9.0E-02	6.8E-04	1.6E-02	7.4E-05	1.4E-03	1.7E-04	3.9E-03
CAT-IV-ACP-el	1.2E-03	9.3E-02	7.4E-05	2.5E-03	1.7E-05	3.8E-04	2.6E-05	9.6E-04
CAT-IV-ACP-gr	1.6E-04	1.2E-02	8.3E-05	2.2E-03	8.9E-06	1.9E-04	2.1E-05	5.4E-04

Table 15: Characteristic quantities of the individual dose distribution (Sv) for the MEI at the distance of 1000 m for various source terms ('New Release Limits for CAT IV') under accidental release conditions, Greifswald, vegetation period

CAT IV scenario (Greifswald)	characteristic quantities of the dose distribution (Sv)							
	max. value		95%-fractile		50%-fractile		mean value	
	early	EDE	early	EDE	early	EDE	early	EDE
CAT-IV-bypass -W-el	1.6E-03	3.3E-02	3.3E-04	4.6E-03	1.5E-04	1.2E-03	1.7E-04	1.8E-03
CAT-IV-bypass-Cu-el	1.6E-03	3.5E-02	3.3E-04	4.6E-03	1.5E-04	1.2E-03	1.8E-04	1.9E-03
CAT-IV-bypass -St-el	1.7E-03	6.3E-02	3.4E-04	4.9E-03	1.5E-04	1.3E-03	1.8E-04	2.2E-03

Table 16: Characteristic quantities of the individual dose distribution (Sv) for the MEI at the distance of 1000 m for various source terms (CAT IV) under accidental release conditions, Greifswald, vegetation period

In addition to these limiting source terms, also source terms following certain accident sequences have been investigated. As the source terms of type three (CAT IV-bypass - Table 16) and four (CAT V-bypass - Table 17) are a combination of tritium and activation products, separate

calculations have been performed also for the composition steel, to investigate the contribution of the two materials to the total dose (see Table 18). These calculations show that the early dose and most of the percentiles of the EDE from the CAT IV release are dominated by the released tritium. The only exception is the maximum dose value of the EDE. This differs for the CAT V scenario which shows the activation products as the dominating material with respect to the EDE and a nearly equal contribution in case of the percentiles of the early dose. One interesting feature can be demonstrated when looking at the maximum values of the EDE. Here, the contribution of activated materials is highest for all cases as this weather sequence might be dominated by heavy rain which affects activation products much more than tritium (higher deposition causes higher doses from external radiation from ground surface and from ingestion).

CAT V scenario (Greifswald)	characteristic quantities of the dose distribution (Sv)							
	max. value		95%-fractile		50%-fractile		mean value	
	early	EDE	early	EDE	early	EDE	early	EDE
CAT-V-bypass-W-gr	3.4E-02	4.1E-01	1.8E-02	1.3E-01	2.1E-03	2.0E-02	4.6E-03	3.7E-02
CAT-V-bypass-Cu-gr	3.8E-02	5.1E-01	2.1E-02	1.5E-01	2.6E-03	2.3E-02	5.5E-03	4.3E-02
CAT-V-bypass-St-gr	4.8E-02	1.9E+00	2.6E-02	4.0E-01	3.0E-03	4.4E-02	6.6E-03	1.1E-01

Table 17: Characteristic quantities of the individual dose distribution (Sv) for the MEI at the distance of 1000 m for various source terms (CAT V) under accidental release conditions, Greifswald, vegetation period

scenario (Greifswald)	contribution of tritium and activation products to the dose in % of total							
	max. value		95%-fractile		50%-fractile		mean value	
	HTO	ACT	HTO	ACT	HTO	ACT	HTO	ACT
CAT-IV-St-el (early)	68.2	31.8	89.7	10.3	94.3	5.7	92.8	7.2
CAT-IV-St-el (EDE)	39.7	60.3	85.5	24.5	90.8	9.2	92.8	17.7
CAT-V-St-gr (early)	41.7	58.3	46.2	53.8	50.0	50.0	47.0	53.0
CAT-V-St-gr (EDE)	5.3	94.7	20.0	80.0	37.8	68.2	19.0	81.0

Table 18: Contribution of tritium and activated material (steel) to the individual dose distribution (%) for the MEI at the distance of 1000 m for various source terms (CAT IV and CAT V) under accidental release conditions, Greifswald, vegetation period

The early doses form the CAT IV scenarios (see Table 16) are far below the lower reference level for evacuation as it is the case for the predefined limiting source terms. However, as CAT-IV source terms may be used in case of licensing procedures, also the EDE with ingestion has to be evaluated. In certain countries, in particular in Germany, the dose from ingestion is considered when licensing a nuclear power plant. Looking at the percentiles, the EDE at 1 km distance is below 10 mSv for all compositions of the dust. As demonstrated in Table 18, HTO contributes mostly to final dose. Nevertheless it cannot be excluded, that there may exist weather conditions,

defined by deterministic calculating prescriptions, which result in doses higher than the 50 mSv target used in Germany.

According to the ITER guidelines, CAT-V releases, which are of hypothetical nature, should be evaluated by using average weather conditions. These average weather conditions fit best to the mean values and the 50% percentiles of the probabilistic calculations. Using these percentile criteria, the early doses never reach 10 mSv, a value which is definite below the lower reference level for evacuation. The EDE, however, is in general much higher than the early dose. In particular for the higher percentiles but also for the mean value, EDEs from CAT-V releases exceed 50 mSv. As CAT-V sequences are of 'hypothetical' nature, they never may be part of the licensing procedure, i.e. they may not play any role with respect to governmental decisions.

4.2 Cadarache

4.2.1 Potential doses to the MEI from routine releases

As for Greifswald, doses from atmospheric releases are highest for the steel as unit composition of the dust. The EDE for the MEI exceeds one μSv/a at 1 km distance for all release scenarios which means that the doses at Cadarache are slightly higher than those from Greifswald. The contribution of the two materials tritium and activation products to the total dose does not differ much from that observed at Greifswald. Again more than 50% of the total dose is related to the release of tritium in form of HTO (see Table19).

Distance (km)	CAT-I-W-el dose (Sv/a)	CAT-I-C-el dose (Sv/a)	CAT-I-S-el dose (Sv/a)	HTO-alone dose (Sv/a)
0.5	1.2E-06	1.2E-06	1.6E-06	1.2E-06
1.0	1.1E-06	1.2E-06	1.8E-06	8.9E-07
2.0	8.5E-07	9.3E-07	1.5E-06	6.3E-07

Table 19: Dose from atmospheric routine releases, Cadarache, EDE of the MEI in Sv/a, near range

The doses from the discharge of activated corrosion products and tritium into the river Serre Poncon results in a total dose of about 0.01 μSv/a at 1 km distance. The EDE is dominated by tritium with the highest contribution from the drinking water pathways. The corrosion products only contributes by less than 20%, which is different from the result obtained from the release in the Greifswaldener Bodden. One possible explanation can be found in different exposure pathways considered here. Irrigation and in particular drinking water was not included in the calculations for Greifswald, but shows here the highest contribution to the total dose. Without these two exposure pathways, the activation products would dominate the dose.

nuclide:	IGI.	IGD.	IGF.	dose (Sv/a)	% of tot
CR- 51	5.97	32.98	61.05	0.32E-11	0.03
MN- 54	1.32	6.47	92.20	0.19E-09	1.63
MN- 56	26.76	5.73	67.50	0.14E-11	0.01
FE- 55	2.85	6.26	90.89	0.21E-09	1.86
FE- 59	6.39	23.75	69.86	0.43E-28	0.00
CO- 57	1.92	6.76	91.33	0.17E-09	1.44
CO- 58	3.04	14.45	82.51	0.35E-09	2.99
CO- 60	1.71	4.82	93.47	0.92E-09	7.95
NI- 57	13.84	79.96	6.20	0.11E-10	0.09
HTO	12.24	81.26	6.50	0.97E-08	83.99
Total	10.63	69.47	19.90	0.12E-07	

Table 20: EDE in Sv/a from aquatic routine releases into the river Serre Poncon

4.2.2 Potential doses of the MEI at 1 km distance from accidental releases

The same release scenarios as for Greifswald have been investigated for Cadarache. Only the weather statistics were different. The most important difference between the two sites are the lower wind velocities at Cadarache, a site which is influenced by the Mediterranean climate. In agreement with these facts, the doses are in general slightly higher than for the site of Greifswald.

When evaluating the results from the release limit scenarios (CAT IV -Table 21) the lower reference level for evacuation of 50 mSv as defined within the generic ITER safety study /GESECS/ is not reached by any of the released materials. The 95% percentile, however, is slightly higher than that obtained for Greifswald and exceeds 1 mSv for dust and 5 mSv for tritium. However, doses from ACPs are still below 1 mSv.

Maximum and 95% percentiles of dose distribution of the early dose for the CAT-IV source terms based on accident scenarios are close to 1 mSv at 1 km distance (see Table 22). The EDE with ingestion exceeds 50 mSv for the maximum case but remains below 10 mSv for the 95% percentile. In case of the early dose the contribution of tritium and activation products is rather similar (see Table 24). But in case of the EDE, the contribution of tritium is dominating. Only in case of the maximum value, contribution of dust is higher which might be attributed to high deposition due to heavy rain events, as rain affects aerosols more than tritiated water vapor.

The hypothetical CAT-V releases, have been evaluated by calculating the mean and the 50% percentile of the dose distribution. None of the releases show doses higher than the 50 mSv lower reference level for evacuation for these lower percentiles. However, the higher percentiles (maximum and 95 %) nearly reach and, in the case of steel, exceed the 50 mSv at 1 km distance (see Table 23). Differing from the CAT IV releases, the contribution of tritium and activation products is similar for the early dose but dominated by the activation products in case of the EDE (see Table 24). This dominance may be explained either by the higher amount of dust released or by the contribution from external exposure from the ground and from ingestion. This differs in case of the early dose as the exposure from ground is only considered up to 7 days and the ingestion pathways are completely neglected. However, the release height also may have an influence on these observations.

release limits scenario (Cadarache)	characteristic quantities of the dose distribution (Sv)							
	max. value		95%-fractile		50%-fractile		mean value	
	early	EDE	early	EDE	early	EDE	early	EDE
CAT-IV-HTO-el	3.8E-03	9.6E-02	3.5E-03	6.5E-02	1.0E-03	1.2E-02	1.4E-03	2.1E-02
CAT-IV-HTO-gr	5.6E-03	2.9E-02	5.0E-03	2.2E-02	5.4E-04	5..2E-03	1.2E-03	9.2E-03
CAT-IV-HT-el	5.3E-06	5.7E-02	4.8E-06	5.1E-02	1.3E-06	1.1E-02	1.9E-06	1.7E-02
CAT-IV-HT-gr	7.9E-06	7.0E-02	6.9E-06	6.1E-02	6.8E-07	4.8E-03	1.8E-06	1.5E-02
CAT-IV-W-el	1.1E-02	1.8E-01	3.4E-04	3.2E-03	9.1E-05	8.3E-04	1.7E-04	1.9E-03
CAT-IV-W-gr	1.4E-03	2.2E-02	5.0E-04	5.1E-03	3.0E-05	2.8E-04	1.6E-04	1.7E-03
CAT-IV-Cu-el	7.8E-03	2.4E-01	5.5E-04	4.3E-03	1.8E-04	1.1E-03	2.5E-04	2.5E-03
CAT-IV-Cu-gr	9.6E-04	2.8E-02	8.1E-04	6.9E-03	5.2E-05	3.9E-04	2.5E-04	2.2E-03
CAT-IV-St-el	1.3E-02	9.1E-01	8.3E-04	1.5E-02	2.2E-04	4.1E-03	3.5E-04	9.3E-03
CAT-IV-St-gr	1.6E-03	1.1E-01	1.2E-03	2.5E-02	7.2E-05	1.4E-03	3.8E-04	8.2E-03
CAT-IV-ACP-el	1.5E-03	1.2E-01	9.5E-05	2.1E-03	2.5E-05	5.5E-04	3.8E-05	1.3E-03
CAT-IV-ACP-gr	1.9E-04	1.5E-02	1.5E-04	3.5E-03	8.5E-06	1.9E-04	4.7E-05	1.1E-03

Table 21: Characteristic quantities of the individual dose distribution (Sv) for the MEI at the distance of 1000 m for various source terms ('New release limits for CAT IV') under accidental release conditions, Cadarache, vegetation period

CAT IV scenario (Cadarache)	characteristic quantities of the dose distribution (Sv)							
	max. value		95%-fractile		50%-fractile		mean value	
	early	EDE	early	EDE	early	EDE	early	EDE
CAT-IV-bypass-W-el	1.4E-03	3.3E-02	6.3E-04	7.2E-03	2.4E-04	1.8E-03	2.8E-04	2.6E-03
CAT-IV-bypass-Cu-el	1.2E-03	3.6E-02	6.3E-04	7.4E-03	2.4E-04	1.9E-03	2.8E-04	2.7E-03
CAT-IV-bypass-St-el	1.5E-03	7.3E-02	6.5E-04	7.9E-03	2.5E-04	2.0E-03	2.9E-04	3.1E-03

Table 22: Characteristic quantities of the individual dose distribution (Sv) for the MEI at the distance of 1000 m for various source terms (CAT IV) under accidental release conditions, Cadarache, vegetation period

CAT V scenario (Cadarache)	characteristic quantities of the dose distribution (Sv)							
	max. value		95%-fractile		50%-fractile		mean value	
	early	EDE	early	EDE	early	EDE	early	EDE
CAT-V-bypass-W-gr	3.5E-02	5.2E-01	3.2E-02	1.9E-01	2.1E-03	2.0E-02	1.0E-02	6.7E-02
CAT-V-bypass-Cu-gr	4.2E-02	6.4E-01	3.9E-02	2.3E-01	2.6E-03	2.2E-02	1.2E-02	7.2E-02
CAT-V-bypass-St-gr	5.1E-02	2.3E+00	4.8E-02	6.0E-01	3.1E-03	4.4E-02	1.5E-02	2.0E-01

Table 23: Characteristic quantities of the individual dose distribution (Sv) for the MEI at the distance of 1000 m for various source terms (CAT V) under accidental release conditions, Cadarache, vegetation period

scenario (Cadarache)	contribution of tritium and activation products to the dose in % of total							
	max. value		95%-fractile		50%-fractile		mean value	
	HTO	ACT	HTO	ACT	HTO	ACT	HTO	ACT
CAT-IV-St-el (early)	52.0	48.0	29.2	70.8	48.0	52.0	31.6	68.4
CAT-IV-St-el (EDE)	30.0	70.0	89.2	10.8	88.5	11.5	83.2	16.8
CAT-V-St-gr (early)	35.3	64.7	47.9	52.1	45.2	54.8	48.0	52.0
CAT-V-St-gr (EDE)	4.4	95.6	15.0	85.0	27.3	72.7	15.0	85.0

Table 24: Contribution of tritium and activated material (steel) to the individual dose distribution (%) for the MEI at the distance of 1000 m for various source terms (CAT IV and CAT V) under accidental release conditions, Cadarache, vegetation period

5. Assessment of protective measures

To have an idea about the need and the extent of protective actions, calculations have been performed with one source term out of the three types of accidental scenarios. Different from previous investigations both sides were considered. The source terms considered are HTO from the new release limits of CAT-IV and steel as dominating material for the CAT-IV and CAT-V events.

The following countermeasures were considered (only areas outside the fence):

1) Short term
   - Evacuation: early dose (cloudshine, 7 days integration time for groundshine, 70 years committed dose from inhalation) > 50 mSv
   - Sheltering: early dose (cloudshine, 7 days integration time for groundshine, 70 years committed dose from inhalation) > 5 mSv and < 50 mSv
2) Long term
   - Relocation: effective dose equivalent (groundshine, 1 year integration time) > 50 mSv
   - Foodban: concentration levels in the foodstuff, exceeding EU criteria (total area where food bans are initiated)

scenario (Greifswald)	areas (km^2) and persons affected by evacuation and sheltering for various characteristic quantities of the dose distribution							
	max. value		95%-fractile		50%-fractile		mean value	
	evac	shelt	evac	shelt	evac	shelt	evac	shelt
CAT-IV-HTO-gr	-	-	-	-	-	-	-	-
CAT-IV-bypass -St-el	-	-	-	-	-	-	-	-
CAT-V-bypass -St-gr	-	0.7 (70)	-	0.2 (20)	-	-	-	0.03 (3)

Table 25: Off site areas (persons) affected by evacuation and sheltering for characteristic quantities of the dose distribution, accidental release conditions, vegetation period, ('evac' = evacuation, 'shelt' = sheltering, '-' means: areas < 0.01 km^2)

scenario (Cadarache)	areas (km^2) and persons affected by evacuation and sheltering for various characteristic quantities of the dose distribution							
	max. value		95%-fractile		50%-fractile		mean value	
	evac	shelt	evac	shelt	evac	shelt	evac	shelt
CAT-IV-HTO-gr	-	-	-	-	-	-	-	-
CAT-IV-bypass -St-el	-	-	-	-	-	-	-	-
CAT-V-bypass -St-gr	-	1.4 (140)	-	0.6 (60)	-	-	-	0.1 (10)

Table 26: Off site areas (persons) affected by evacuation and sheltering for characteristic quantities of the dose distribution, accidental release conditions, vegetation period, ('evac' = evacuation, 'shelt' = sheltering, '-' means: areas < 0.01 km^2)

The assessments for the short term countermeasures show that evacuation according to the 50 mSv criteria was not initiated for any of the investigated source terms (see Tables 25 and 26). Sheltering, however, occurred, but only areas of less than 2 km^2 were affected (see Tables 25 and 26). Relocation as a long-term countermeasure was only observed in a considerable quantity for worst case weather conditions and the CAT-V scenario (see Tables 27 and 28). Banning of food products however, was calculated for all scenarios and considerably large areas were found for all the percentiles (see Tables 27 and 28). Tritium is the main contributor to the area which has to be banned for at least one week. For the longer term, the harvest of winter wheat has to be interdicted for the first year on an area which covers about one third of total initial ban area. Looking at the elevated release of 2 kg of steel as the limiting source term, initial ban areas may be as large as 1000 km^2 for the 95% percentile.

scenario (Greifswald)	areas (km^2) affected by relocation and food bans for characteristic quantities of the dose/concentration distribution							
	max. value		95%-fractile		50%-fractile		mean value	
	reloc	food	reloc	food	reloc	food	reloc	food
CAT-IV-HTO-gr	-	9160	-	5670	-	2410	-	2889
CAT-IV-St-el	-	3470	-	678	-	208	-	274
CAT-IV-bypass-St-el (without HTO)	-	11900 (355)	-	7570 (129)	-	2680 (3)	-	3083 (23)
CAT-V-bypass -St-gr (without HTO)	2.04	19000 (3120)	-	12100 (585)	-	5920 (240)	0.03	6451 (279)

Table 27: Off site areas affected by relocation and food bans for characteristic quantities of the dose/concentration distribution, accidental release conditions, vegetation period, total area where food bans are initiated ('reloc' = relocation, 'food' = food ban, '-' means: areas < 0.01 km^2)

scenario (Cadarache)	areas (km^2) affected by relocation and food bans for characteristic quantities of the dose/concentration distribution							
	max. value		95%-fractile		50%-fractile		mean value	
	reloc	food	reloc	food	reloc	food	reloc	food
CAT-IV-HTO-gr	-	11200	-	7180	-	3560	-	3540
CAT-IV-St-el	-	4070	-	3670	-	202	-	669
CAT-IV-bypass -St-el (without HTO)	-	16700 (710)	-	11200 (435)	-	3960 (8)	-	4485 (70)
CAT-V-bypass -St-gr (without HTO)	3.8	22000 (3670)	-	17800 (1910)	-	7520 (324)	0.1	8387 (722)

Table 28: Off site areas affected by relocation and food bans for characteristic quantities of the dose/concentration distribution, accidental release conditions, vegetation period, total area where food bans are initiated ('reloc' = relocation, 'food' = food ban, '-' means: areas < 0.01 km^2)

6. Discussion of the site specific calculations

As the public safety is one of the important tasks in licensing ITER, derived dose limits have been published for a generic site recently /ESECS/. Dependent on the event sequence category, ranging from CAT-I ('routine emissions') to CAT-V ('hypothetical sequences'), different calculation criteria, dose limits and types of doses were applied:

- CAT-I: Routine releases: effective dose equivalent, annual dose based on annual averaged weather conditions,
- CAT-IV: Design basis accident: early dose, worst weather conditions and
- CAT-V: Beyond design basis accident: early dose, average weather conditions.

Doses from the routine emissions of the CAT-I scenarios should result in doses which are far below the natural background, e.g. far below 2 mSv/a. Accidental scenarios of the types CAT-IV should in no case exceed an early dose of 50 mSv at the fence of the installation. 50 mSv has been selected as this is in accordance with many lower reference levels for evacuation realised in ITER partner countries. CAT-V events are of hypothetical nature and therefore might never be considered in any licensing procedure. However, whenever it is possible to demonstrate that independent of the severity of the accident no major action has to be initiated, the public acceptance might be reached more easily. To this purpose also the initiation of protective measures based on national or international criteria were evaluated for selected scenarios.

Doses from routine releases into the atmosphere and the hydrosphere resulted in rather low doses of less than 0.1 percent of the natural background of several mSv. For both sites, the discharges into aquatic media showed lower doses than the release into the atmosphere. This seems to be partly due to the reduced number of exposure pathways (mostly ingestion) and in particular due to the lower source term.

The accidental site specific assessments showed that early doses from all CAT-IV release scenarios do not exceed the lower reference level of 50 mSv for evacuation at 1 km distance, when compared with the 95 % percentile of the probabilistic calculations. Independent from the selection of Cadarache or Greifswald as site, the new release limits fit with the proposed dose limits. However, the dose values for Cadarache are slightly higher than for Greifswald. As observed in earlier investigations /RAS96/ and /RAS97b/, this fact indicates that weather conditions in Southern France may contain more worst cases - with respect to radiation dose calculations - than weather in Northern Germany. Weather conditions which may appear only once a year can result in even higher early doses, however these conditions may not be considered in licensing procedures.

The evaluation of the CAT-IV source term which is based on potential accident sequences seems also to be important in terms of the total dose including ingestion. As such a CAT-IV scenario might be used as a design basis accident, none of the potential dose limits of any of the ITER partner countries should be exceeded. However, these dose calculations have to be performed with country specific input parameters, therefore one cannot decide at present whether this analysis is sufficient. As listed in Table 16 and Table 22, the total dose including ingestion sums up to about 10 mSv when looking at the 95% percentile which is often used within licensing procedures. However, the maximum values at both sites exceed 50 mSv. Important is to recognise the high contribution of tritium to the EDE when looking at the 95% percentile. This means that the chronic dose without ingestion is lower at least by a factor of four. For the maximum however, the activation products are dominating, thus the chronic dose without ingestion may be lower by only a factor of two to three.

CAT-V releases, which are stated to be hypothetical, showed early dose values of several mSv at 1 km distance when looking at the lower percentiles. Even if recommended to use average weather conditions, an look at the upper percentiles is also interesting. In particular the 50 mSv concept for evacuation is closely reached at the site of Cadarache and up to the half of this value is found for Greifswald when comparing with the 95% percentiles. This clearly indicates that none of the hypothetical accident sequences should be considered within licensing procedures.

At present, release limits to avoid evacuation are key criteria for ITER. However, other protective actions such as sheltering, relocation and food banning may become important in future. Therefore, source terms which showed highest doses in the potential calculations were evaluated with respect to these protective measures. Only banning of agricultural products was found to be important. Dependent on the scenario, banning affects initially areas of several hundreds of square kilometres and can be as large as 10000 km^2 and more for CAT-IV and CAT-V releases - when evaluating the 95 % percentile of the concentration distribution. Most of these large areas are attributed to tritium and the fact that there exists no special intervention level for food banning for tritium. Therefore, the value of 1250 Bq/kg fresh weight was selected as this value is appropriate for Cs and other long living radionuclides. However, the radiological significance of tritium is much lower than Cs, thus an overestimation of the ban areas cannot be precluded. Nevertheless, also when releasing the CAT-IV limits on dust (steel), initial ban areas of 1000 km^2 and more - for Cadarache - have been estimated.

When comparing the new calculations with those performed for similar source terms but at an earlier stage of the project /RAS97b/, it becomes obvious that the composition of the materials has changed. In particular the amount of longer living radionuclides seems to be reduced (see Figure 1). This reduction also affects the doses obtained with the present calculations. Comparing the dose release limits for the various dust compositions, the early doses are in general lower by

20%. In special cases, also dose reductions by 50% could be observed. This reduction increases for the EDE to about 40% in general and can amount a factor of up to 3 to 4 for tungsten as maximum. ACPs show even higher reductions than obtained for all dust compositions.

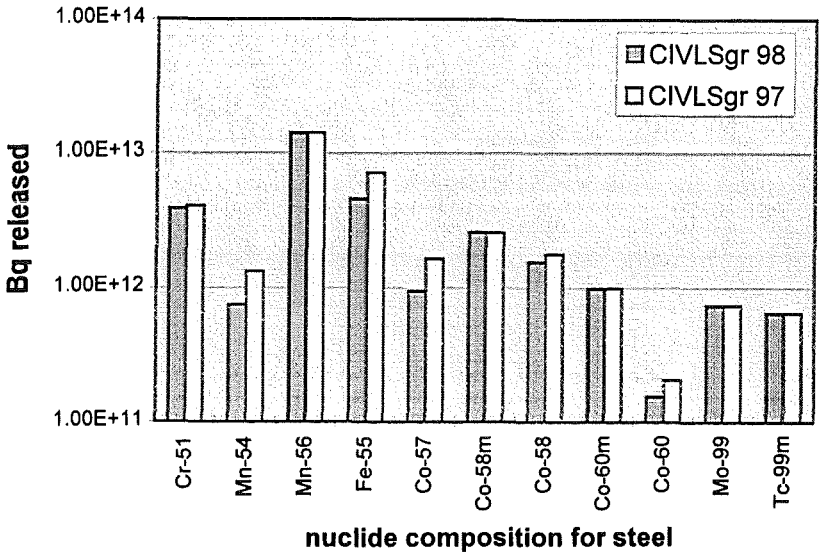

Figure 1: Comparison of the nuclide composition for the CAT-IV steel source term from the previous calculations (97) /RAS97b/ and the present ones

As was pointed out in an earlier report /RAS97a/, there are factors which may modify the results and which are still not yet finally defined at present. This includes :

- Material composition of the release
- Duration of the release
- Choice of dispersion parameters
- Variability in the weather over a longer period (about 10 years required for German licensing) and the adequacy of the sampling scheme for 144 weather sequences
- Choice of input parameters and targets (child or adult)
- Uncertainties of the mathematical models (parameters and approaches)

Many of the above mentioned influencing parameters are still open for discussion and, in particular, the final composition of the release material and the duration of the release have to be defined before 'final' dose assessments can be performed. And finally, one has also to include the uncertainties of the assessment models when decisions about the release limits have to be taken.

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APPENDIX A

Probabilistic sampling scheme

The consequences of a postulated release of radioactive material will vary considerably with the conditions pertaining at the time of the accidental release, in particular with the prevailing meteorological conditions, the season, the location and habits of population. For any given release, therefore, there will be a spectrum of possible consequences, each having different probabilities of occurrence determined by the environmental characteristics of the release location and its surroundings. To estimate the full spectrum of consequences of an accidental release a computer code should calculate all possible sequences of weather (a weather sequence is defined by its starting time in the weather record) which may occur during this period. Thus several thousands of different weather sequences had to be considered. In practice, time and computer effort prevent such an action. Therefore, a reduced number of weather sequences representing the full spectrum of atmospheric conditions at the site under consideration had to be selected.

The meteorological record includes (among others) wind speed, wind direction, rainfall and atmospheric stability category in hourly values for a given period (in our example for the whole vegetation period, 4800 hours). For each of the 4800 possible weather sequences the trajectory of the plume will be calculated and evaluated according to the following criteria:

- initial wind direction (12 classes)
  - 12 30° sectors
- travel time T up to the 20 km radius from the release point (3 classes)
  - $0 < T <= 2h$
  - $2\ h < T <= 5\ h$
  - $T > 5\ h$
- precipitation I, found during the travel time to reach 20 km (4 classes)
  - $I = 0$ mm
  - $0\ mm < I <=.\ 1$ mm
  - $1\ mm < I <=.\ 3$ mm
  - $I > 3$ mm

In this way 144 different classes of weather conditions are obtained together with their probability of occurrence which will be determined from the number of weather sequences sorted in each class divided by the total number of weather sequences. For the calculations one weather sequence of each class will be chosen randomly. Thus 144 weather sequences with their probability of occurrence may represent the vegetation period, however uncertain due to the chosen sampling scheme.

APPENDIX B - Greifswald

Doses from routine releases (CAT-I)

CAT-I-Cu-elevated, EDE with ingestion

NO.	NUCLIDE	SUM
	HTO	1.120E+14
8	AR- 41	2.000E+12
16	CR- 51	3.040E+08
20	MN- 54	1.850E+08
21	MN- 56	5.170E+09
23	FE- 55	9.160E+08
27	CO- 57	3.970E+08
29	CO- 58	5.850E+08
30	CO- 60M	4.030E+10
31	CO- 60	2.520E+09
34	NI- 63	4.600E+08
36	CU- 62	8.530E+11
37	CU- 64	1.800E+12
38	CU- 66	5.610E+11
157	TA-182	8.640E+08

RADIUS (KM)	.145	.210	.320	.500	.680	1.000
EDE	9.4E-07	7.3E-07	6.0E-07	6.2E-07	6.6E-07	6.2E-07

RADIUS (KM)	1.500	2.000	3.200	5.000	6.800	10.000
EDE	4.9E-07	3.8E-07	2.2E-07	1.3E-07	8.2E-08	4.8E-08

RADIUS (KM)	15.000	21.000	32.000	46.000	68.000	100.000
EDE	2.9E-08	2.0E-08	1.3E-08	9.3E-09	6.4E-09	4.3E-09

CAT-I-St-elevated, EDE with ingestion

NO.	NUCLIDE	SUM
	HTO	1.120E+14
8	AR- 41	2.000E+12
16	CR- 51	9.760E+10
20	MN- 54	1.880E+10
21	MN- 56	3.570E+11
23	FE- 55	1.150E+11
27	CO- 57	2.400E+10
28	CO- 58M	6.440E+10
29	CO- 58	3.940E+10
30	CO- 60M	2.470E+10
31	CO- 60	3.980E+09
75	MO- 99	1.850E+10
80	TC- 99M	1.620E+10

RESULTS ARE CALCULATED FOR THE WHOLE DISTANCE BAND

RADIUS (KM)	.145	.210	.320	.500	.680	1.000
EDE	9.4E-07	7.3E-07	6.2E-07	7.3E-07	8.1E-07	7.8E-07

RADIUS (KM)	1.500	2.000	3.200	5.000	6.800	10.000
EDE	6.2E-07	4.8E-07	2.7E-07	1.5E-07	9.8E-08	5.7E-08

RADIUS (KM)	15.000	21.000	32.000	46.000	68.000	100.000
EDE	3.3E-08	2.3E-08	1.5E-08	1.1E-08	7.2E-09	4.9E-09

CAT-I-W-elevated, EDE with ingestion

NO.	NUCLIDE	SUM
	HTO	1.120E+14
8	AR- 41	2.000E+12
16	CR- 51	3.040E+08
20	MN- 54	1.850E+08
21	MN- 56	5.170E+09
23	FE- 55	9.160E+08
27	CO- 57	3.970E+08
29	CO- 58	5.850E+08
31	CO- 60	6.900E+07
90	AG-110	3.230E+08
155	TA-179	1.190E+09
157	TA-182	9.790E+08
159	W -181	1.090E+11
160	W -183M	6.510E+11
161	W -185	2.290E+11
162	W -187	6.410E+11
166	RE-186	2.140E+10
167	RE-188M	6.120E+08
168	RE-188	9.010E+09

RESULTS ARE CALCULATED FOR THE WHOLE DISTANCE BAND

RADIUS (KM)	.145	.210	.320	.500	.680	1.000
MEAN DOSES	9.4E-07	7.3E-07	5.9E-07	6.1E-07	6.3E-07	5.9E-07

RADIUS (KM)	1.500	2.000	3.200	5.000	6.800	10.000
MEAN DOSES	4.7E-07	3.6E-07	2.2E-07	1.2E-07	8.0E-08	4.7E-08

RADIUS (KM)	15.000	21.000	32.000	46.000	68.000	100.000
MEAN DOSES	2.8E-08	1.9E-08	1.3E-08	9.1E-09	6.3E-09	4.2E-09

Probabilistic potential doses from source terms of case 2 (release limits)

CAT-IV-HTO-elevated, early dose (Greifswald)

NO.	NUCLIDE	SUM
1	HTO	3.70000E+16

RADIUS (KM)	0.145	0.210	0.320	0.500	0.680	1.000
MAX. DOSES	1.1E-02	1.1E-02	1.1E-02	7.7E-03	8.3E-03	6.9E-03
FRACTILE 99.0	9.8E-04	7.9E-04	2.1E-03	2.3E-03	2.1E-03	4.1E-03
FRACTILE 95.0	6.3E-05	1.0E-04	5.5E-04	1.0E-03	1.2E-03	1.4E-03
FRACTILE 90.0	2.0E-05	6.6E-05	4.2E-04	8.7E-04	1.0E-03	9.8E-04
FRACTILE 50.0	2.3E-07	4.6E-07	5.9E-05	3.0E-04	5.0E-04	6.2E-04
MEAN DOSES	3.2E-05	5.3E-05	1.7E-04	3.8E-04	5.5E-04	7.2E-04

RADIUS (KM)	1.500	2.000	3.200	4.600	6.800	10.000
MAX. DOSES	7.5E-03	8.1E-03	5.2E-03	3.3E-03	2.2E-03	1.2E-03
FRACTILE 99	7.5E-03	7.6E-03	4.0E-03	1.9E-03	1.5E-03	8.7E-04
FRACTILE 95	1.6E-03	1.7E-03	1.4E-03	9.5E-04	6.0E-04	3.4E-04
FRACTILE 90	1.4E-03	1.5E-03	1.2E-03	7.2E-04	4.6E-04	2.6E-04
FRACTILE 50	5.4E-04	4.3E-04	2.5E-04	1.6E-04	9.5E-05	5.5E-05
MEAN DOSES	7.9E-04	6.9E-04	4.3E-04	2.7E-04	1.7E-04	1.0E-04

CAT-IV-HTO-elevated, EDE, with ingestion (Greifswald)

RADIUS (KM)	0.145	0.210	0.320	0.500	0.680	1.000
MAX. DOSES	5.9E-01	4.9E-01	3.2E-01	2.2E-01	1.7E-01	1.1E-01
FRACTILE 99	5.6E-02	4.9E-02	5.5E-02	4.1E-02	3.3E-02	2.8E-02
FRACTILE 95	1.3E-02	1.1E-02	1.4E-02	2.1E-02	2.3E-02	1.9E-02
FRACTILE 90	3.9E-03	5.4E-03	8.7E-03	1.5E-02	1.7E-02	1.6E-02
FRACTILE 50	2.3E-06	6.3E-06	4.8E-04	2.6E-03	4.3E-03	5.0E-03
MEAN DOSES	3.2E-03	3.0E-03	3.8E-03	5.9E-03	7.2E-03	7.6E-03

RADIUS (KM)	1.500	2.000	3.200	4.600	6.800	10.000
MAX. DOSES	6.5E-02	4.3E-02	3.6E-02	1.0E-02	7.0E-03	5.2E-03
FRACTILE 99	2.1E-02	1.6E-02	1.0E-02	6.6E-03	4.6E-03	3.6E-03
FRACTILE 95	1.5E-02	1.2E-02	8.5E-03	5.4E-03	3.1E-03	2.1E-03
FRACTILE 90	1.3E-02	1.1E-02	6.5E-03	4.4E-03	2.7E-03	1.7E-03
FRACTILE 50	6.3E-03	4.9E-03	3.0E-03	1.9E-03	1.1E-03	6.0E-04
MEAN DOSES	6.7E-03	5.5E-03	3.4E-03	2.2E-03	1.3E-03	7.8E-04

CAT-IV-HTO-ground, early dose (Greifswald)

NO.	NUCLIDE	SUM
1	HTO	3.70000E+15

RADIUS (KM)	0.145	0.210	0.320	0.500	0.680	1.000
MAX. DOSES	2.5E-02	2.4E-02	1.7E-02	1.2E-02	8.5E-03	5.3E-03
FRACTILE 99.0	2.5E-02	2.4E-02	1.7E-02	1.2E-02	8.5E-03	5.3E-03
FRACTILE 95.0	1.4E-02	1.3E-02	9.5E-03	6.5E-03	4.7E-03	2.9E-03
FRACTILE 90.0	1.3E-02	1.2E-02	8.5E-03	5.8E-03	4.2E-03	2.6E-03
FRACTILE 50.0	2.8E-03	2.5E-03	1.5E-03	8.9E-04	5.9E-04	3.5E-04
MEAN DOSES	4.5E-03	4.0E-03	2.6E-03	1.7E-03	1.2E-03	7.2E-04

RADIUS (KM)	1.500	2.000	3.200	4.600	6.800	10.000
MAX. DOSES	3.1E-03	2.0E-03	9.1E-04	5.2E-04	3.5E-04	2.1E-04
FRACTILE 99.0	3.1E-03	1.9E-03	6.9E-04	5.2E-04	2.6E-04	7.4E-05
FRACTILE 95.0	1.7E-03	1.1E-03	5.0E-04	2.4E-04	1.0E-04	4.7E-05
FRACTILE 90.0	1.5E-03	9.1E-04	4.0E-04	1.4E-04	6.5E-05	2.6E-05
FRACTILE 50.0	1.9E-04	1.2E-04	5.9E-05	3.2E-05	1.7E-05	9.3E-06
MEAN DOSES	4.1E-04	2.5E-04	1.2E-04	6.1E-05	3.1E-05	1.5E-05

CAT-IV-HTO-ground, EDE, with ingestion (Greifswald)

RADIUS (KM)	0.145	0.210	0.320	0.500	0.680	1.000
MAX. DOSES	1.3E-01	1.1E-01	6.8E-02	4.5E-02	3.2E-02	2.0E-02
FRACTILE 99.0	9.8E-02	8.3E-02	5.9E-02	4.1E-02	3.0E-02	1.8E-02
FRACTILE 95.0	7.4E-02	6.6E-02	4.6E-02	3.1E-02	2.2E-02	1.3E-02
FRACTILE 90.0	6.8E-02	6.2E-02	4.1E-02	2.8E-02	1.9E-02	1.2E-02
FRACTILE 50.0	3.5E-02	3.0E-02	1.7E-02	9.3E-03	6.3E-03	3.6E-03
MEAN DOSES	3.5E-02	3.1E-02	1.9E-02	1.2E-02	8.3E-03	5.0E-03

RADIUS (KM)	1.500	2.000	3.200	4.600	6.800	10.000
MAX. DOSES	1.5E-02	7.4E-03	4.3E-03	2.2E-03	2.1E-03	6.2E-04
FRACTILE 99.0	1.0E-02	6.8E-03	3.5E-03	2.2E-03	9.3E-04	4.1E-04
FRACTILE 95.0	7.6E-03	4.9E-03	2.3E-03	1.1E-03	5.6E-04	3.3E-04
FRACTILE 90.0	6.8E-03	4.2E-03	1.9E-03	9.5E-04	5.2E-04	2.9E-04
FRACTILE 50.0	2.0E-03	1.3E-03	6.5E-04	3.7E-04	1.9E-04	1.0E-04
MEAN DOSES	2.8E-03	1.8E-03	8.6E-04	4.7E-04	2.5E-04	1.3E-04

CAT-IV-HT-elevated, early dose (Greifswald)

NO.	NUCLIDE	SUM
1	HT	1.11000E+18

RADIUS (KM)	0.145	0.210	0.320	0.500	0.680	1.000
MAX. DOSES	8.0E-04	9.1E-04	9.6E-04	9.4E-04	7.2E-04	5.8E-04
FRACTILE 99.0	8.1E-05	8.7E-05	1.4E-04	2.1E-04	2.3E-04	2.2E-04
FRACTILE 95.0	1.2E-05	1.3E-05	2.6E-05	6.2E-05	1.0E-04	1.0E-04
FRACTILE 90.0	8.5E-06	9.8E-06	2.0E-05	5.8E-05	8.1E-05	7.8E-05
FRACTILE 50.0	5.0E-07	6.0E-07	2.0E-06	1.1E-05	2.5E-05	3.8E-05
MEAN DOSES	4.1E-06	4.8E-06	1.0E-05	2.4E-05	3.9E-05	4.5E-05

RADIUS (KM)	1.500	2.000	3.200	4.600	6.800	10.000
MAX. DOSES	5.2E-04	4.5E-04	3.7E-04	2.4E-04	2.4E-04	1.5E-04
FRACTILE 99.0	3.7E-04	3.9E-04	2.4E-04	1.4E-04	1.1E-04	6.8E-05
FRACTILE 95.0	1.3E-04	1.1E-04	7.6E-05	6.9E-05	3.9E-05	2.4E-05
FRACTILE 90.0	8.5E-05	8.7E-05	5.0E-05	4.3E-05	2.3E-05	1.4E-05
FRACTILE 50.0	4.5E-05	4.3E-05	2.6E-05	1.9E-05	1.1E-05	6.0E-06
MEAN DOSES	5.3E-05	5.3E-05	3.2E-05	2.4E-05	1.5E-05	8.6E-06

CAT-IV-HT-elevated, EDE, with ingestion (Greifswald)

RADIUS (KM)	0.145	0.210	0.320	0.500	0.680	1.000
MAX. DOSES	6.5E-02	8.7E-02	9.5E-02	9.4E-02	1.0E-01	8.5E-02
FRACTILE 99.0	2.7E-03	6.8E-03	2.0E-02	2.4E-02	1.9E-02	3.9E-02
FRACTILE 95.0	2.1E-04	4.2E-04	4.7E-03	9.5E-03	1.1E-02	1.4E-02
FRACTILE 90.0	1.6E-04	3.0E-04	3.7E-03	7.4E-03	7.9E-03	9.5E-03
FRACTILE 50.0	4.6E-06	6.3E-06	5.5E-04	2.5E-03	4.0E-03	6.2E-03
MEAN DOSES	2.2E-04	3.8E-04	1.5E-03	3.4E-03	5.0E-03	6.6E-03

RADIUS (KM)	1.500	2.000	3.200	4.600	6.800	10.000
MAX. DOSES	8.4E-02	7.7E-02	5.4E-02	3.0E-02	2.2E-02	1.2E-02
FRACTILE 99.0	7.1E-02	7.1E-02	4.0E-02	1.6E-02	1.8E-02	1.1E-02
FRACTILE 95.0	1.8E-02	2.0E-02	1.5E-02	9.3E-03	6.2E-03	3.7E-03
FRACTILE 90.0	1.3E-02	1.4E-02	1.1E-02	7.8E-03	4.9E-03	2.7E-03
FRACTILE 50.0	4.7E-03	3.5E-03	2,3E-03	1.5E-03	8.7E-04	5.0E-04
MEAN DOSES	7.4E-03	6.5E-03	4.1E-03	2.6E-03	1.6E-03	9.8E-04

CAT-IV-HT-ground, early dose (Greifswald)

1 HT 1.11000E+17

RADIUS (KM)	0.145	0.210	0.320	0.500	0.680	1.000
MAX. DOSES	1.5E-03	1.2E-03	9.7E-04	8.0E-04	6.6E-04	4.2E-04
FRACTILE 99.0	5.6E-04	1.0E-03	7.8E-04	6.3E-04	5.5E-04	3.4E-04
FRACTILE 95.0	2.5E-04	4.2E-04	3.8E-04	3.7E-04	2.8E-04	1.7E-04
FRACTILE 90.0	1.6E-04	2.5E-04	2.3E-04	2.1E-04	1.7E-04	1.1E-04
FRACTILE 50.0	4.8E-05	1.2E-04	8.5E-05	6.5E-05	5.0E-05	3.0E-05
MEAN DOSES	7.6E-05	1.4E-04	1.3E-04	1.0E-04	8.2E-05	5.1E-05

RADIUS (KM)	1.500	2.000	3.200	4.600	6.800	10.000
MAX. DOSES	2.7E-04	1.6E-04	8.8E-05	5.0E-05	3.5E-05	2.2E-05
FRACTILE 99.0	2.2E-04	1.4E-04	6.0E-05	3.6E-05	2.6E-05	1.1E-05
FRACTILE 95.0	1.3E-04	9.3E-05	3.7E-05	2.8E-05	1.4E-05	6.6E-06
FRACTILE 90.0	6.8E-05	4.9E-05	2.6E-05	1.3E-05	6.9E-06	3.6E-06
FRACTILE 50.0	1.9E-05	1.4E-05	7.1E-06	4.8E-06	2.8E-06	1.4E-06
MEAN DOSES	3.3E-05	2.3E-05	1.1E-05	6.9E-06	3.9E-06	2.0E-06

CAT-IV-HT-ground, EDE, with ingestion (Greifswald)

RADIUS (KM)	0.145	0.210	0.320	0.500	0.680	1.000
MAX. DOSES	2.8E-01	2.6E-01	1.9E-01	1.3E-01	9.8E-02	6.1E-02
FRACTILE 99.0	2.6E-01	2.4E-01	1.8E-01	1.2E-01	8.9E-02	5.6E-02
FRACTILE 95.0	1.7E-01	1.5E-01	1.1E-01	7.9E-02	5.9E-02	3.7E-02
FRACTILE 90.0	1.2E-01	1.1E-01	7.9E-02	5.5E-02	4.0E-02	2.6E-02
FRACTILE 50.0	2.6E-02	2.1E-02	1.2E-02	7.2E-03	4.9E-03	2.9E-03
MEAN DOSES	4.2E-02	3.8E-02	2.5E-02	1.7E-02	1.2E-02	7.3E-03

RADIUS (KM)	1.500	2.000	3.200	4.600	6.800	10.000
MAX. DOSES	3.6E-02	2.0E-02	1.0E-02	7.6E-03	4.2E-03	2.5E-03
FRACTILE 99.0	3.3E-02	1.7E-02	9.3E-03	7.6E-03	2.6E-03	1.0E-03
FRACTILE 95.0	2.2E-02	1.3E-02	5.8E-03	3.2E-03	1.3E-03	5.5E-04
FRACTILE 90.0	1.5E-02	1.0E-02	4.1E-03	1.5E-03	9.5E-04	4.9E-04
FRACTILE 50.0	1.7E-03	1.1E-03	5.5E-04	3.2E-04	1.8E-04	9.3E-05
MEAN DOSES	4.2E-03	2.6E-03	1.2E-03	6.7E-04	3.4E-04	1.7E-04

CAT-IV-Cu-elevated, early dose (Greifswald)

NO.	NUCLIDE	SUM
30	CO- 60M	1.610E+13
31	CO- 60	9.810E+11
34	NI- 63	1.840E+11
36	CU- 62	3.410E+14
37	CU- 64	7.220E+14
38	CU- 66	2.240E+14
157	TA-182	3.460E+11

RADIUS (KM)	.145	.180	.320	.460	.680	1.000
MAX. DOSES	4.1E-02	3.4E-02	2.0E-02	1.4E-02	9.4E-03	5.9E-03
FRACTILE 99.0	2.6E-03	2.2E-03	2.1E-03	1.7E-03	1.3E-03	9.5E-04
FRACTILE 95.0	4.8E-04	4.6E-04	5.2E-04	4.5E-04	3.8E-04	4.7E-04
FRACTILE 90.0	1.9E-04	1.7E-04	3.0E-04	2.7E-04	2.8E-04	2.2E-04
FRACTILE 50.0	3.5E-05	3.4E-05	5.6E-05	7.6E-05	1.1E-04	1.2E-04
MEAN DOSES	1.6E-04	1.5E-04	1.7E-04	1.6E-04	1.7E-04	1.7E-04

RADIUS (KM)	1.500	2.000	3.200	4.600	6.800	10.000
MAX. DOSES	3.2E-03	2.0E-03	1.6E-03	7.1E-04	9.2E-04	3.1E-04
FRACTILE 99.0	1.2E-03	1.1E-03	5.5E-04	2.9E-04	3.4E-04	1.9E-04
FRACTILE 95.0	4.9E-04	3.3E-04	2.3E-04	1.5E-04	1.2E-04	8.1E-05
FRACTILE 90.0	2.8E-04	2.8E-04	2.0E-04	1.4E-04	9.3E-05	5.2E-05
FRACTILE 50.0	9.8E-05	7.2E-05	4.3E-05	2.6E-05	1.4E-05	7.9E-06
MEAN DOSES	1.6E-04	1.3E-04	7.8E-05	4.9E-05	3.4E-05	1.9E-05

CAT-IV-Cu-elevated, EDE with ingestion (Greifswald)

RADIUS (KM)	.145	.180	.320	.460	.680	1.000
MAX. DOSES	1.2E+00	1.0E+00	6.1E-01	4.3E-01	2.8E-01	1.8E-01
FRACTILE 99.0	7.8E-02	6.5E-02	6.5E-02	4.9E-02	3.5E-02	2.6E-02
FRACTILE 95.0	1.3E-02	1.1E-02	1.1E-02	9.1E-03	6.8E-03	5.1E-03
FRACTILE 90.0	2.8E-03	3.7E-03	2.9E-03	2.7E-03	2.2E-03	3.1E-03
FRACTILE 50.0	3.5E-05	3.5E-05	1.2E-04	3.4E-04	6.5E-04	7.9E-04
MEAN DOSES	4.0E-03	3.4E-03	2.9E-03	2.4E-03	2.1E-03	1.9E-03

RADIUS (KM)	1.500	2.000	3.200	4.600	6.800	10.000
MAX. DOSES	9.8E-02	6.0E-02	4.9E-02	2.1E-02	1.7E-02	9.9E-03
FRACTILE 99.0	1.9E-02	1.5E-02	7.2E-03	5.1E-03	6.9E-03	2.3E-03
FRACTILE 95.0	7.2E-03	5.6E-03	3.7E-03	2.2E-03	1.9E-03	1.2E-03
FRACTILE 90.0	2.6E-03	2.1E-03	1.7E-03	1.2E-03	7.9E-04	5.4E-04
FRACTILE 50.0	6.6E-04	5.1E-04	3.0E-04	1.9E-04	1.1E-04	6.2E-05
MEAN DOSES	1.6E-03	1.3E-03	8.1E-04	5.3E-04	4.1E-04	2.3E-04

CAT-IV-Cu-ground, early dose (Greifswald)

NO.	NUCLIDE	SUM
30	CO- 60M	1.610E+12
31	CO- 60	9.810E+10
34	NI- 63	1.840E+10
36	CU- 62	3.410E+13
37	CU- 64	7.220E+13
38	CU- 66	2.240E+13
157	TA-182	3.460E+10

RADIUS (KM)	.145	.180	.320	.460	.680	1.000
MAX. DOSES	6.6E-03	5.5E-03	3.2E-03	2.1E-03	1.3E-03	8.4E-04
FRACTILE 99.0	3.7E-03	3.5E-03	2.5E-03	1.9E-03	1.2E-03	7.6E-04
FRACTILE 95.0	2.2E-03	2.0E-03	1.4E-03	1.1E-03	7.2E-04	4.5E-04
FRACTILE 90.0	1.9E-03	1.8E-03	1.3E-03	9.8E-04	6.6E-04	4.2E-04
FRACTILE 50.0	4.3E-04	3.6E-04	2.2E-04	1.4E-04	9.1E-05	5.4E-05
MEAN DOSES	7.0E-04	6.2E-04	4.1E-04	2.9E-04	1.9E-04	1.2E-04

RADIUS (KM)	1.500	2.000	3.200	4.600	6.800	10.000
MAX. DOSES	7.3E-04	3.5E-04	2.3E-04	8.7E-05	9.3E-05	6.2E-05
FRACTILE 99.0	4.5E-04	2.8E-04	1.7E-04	8.7E-05	3.8E-05	3.4E-05
FRACTILE 95.0	2.6E-04	1.7E-04	8.3E-05	5.1E-05	2.4E-05	1.1E-05
FRACTILE 90.0	2.4E-04	1.5E-04	6.3E-05	2.6E-05	1.4E-05	7.9E-06
FRACTILE 50.0	3.0E-05	2.0E-05	9.8E-06	5.5E-06	3.0E-06	1.7E-06
MEAN DOSES	6.8E-05	4.2E-05	2.1E-05	1.1E-05	5.6E-06	3.4E-06

CAT-IV-Cu-ground, EDE with ingestion (Greifswald)

RADIUS (KM)	.145	.180	.320	.460	.680	1.000
MAX. DOSES	1.6E-01	1.4E-01	8.5E-02	5.8E-02	3.5E-02	2.3E-02
FRACTILE 99.0	3.2E-02	2.9E-02	2.1E-02	1.5E-02	1.0E-02	6.5E-03
FRACTILE 95.0	1.9E-02	1.7E-02	1.3E-02	9.3E-03	6.8E-03	4.4E-03
FRACTILE 90.0	1.6E-02	1.5E-02	1.1E-02	8.1E-03	5.4E-03	3.6E-03
FRACTILE 50.0	3.4E-03	3.0E-03	1.7E-03	1.1E-03	6.8E-04	4.0E-04
MEAN DOSES	6.2E-03	5.5E-03	3.6E-03	2.6E-03	1.7E-03	1.1E-03

RADIUS (KM)	1.500	2.000	3.200	4.600	6.800	10.000
MAX. DOSES	2.0E-02	1.0E-02	5.0E-03	2.5E-03	2.8E-03	9.6E-04
FRACTILE 99.0	4.1E-03	2.8E-03	2.5E-03	1.0E-03	7.8E-04	6.6E-04
FRACTILE 95.0	2.5E-03	1.7E-03	8.9E-04	6.6E-04	2.8E-04	2.6E-04
FRACTILE 90.0	2.1E-03	1.4E-03	6.6E-04	3.6E-04	1.4E-04	1.0E-04
FRACTILE 50.0	2.2E-04	1.4E-04	7.2E-05	4.2E-05	2.3E-05	1.3E-05
MEAN DOSES	6.4E-04	4.0E-04	2.2E-04	1.3E-04	6.8E-05	4.8E-05

CAT-IV-St-elevated, early dose (Greifswald)

NO.	NUCLIDE	SUM
16	CR- 51	3.890E+13
20	MN- 54	7.450E+12
21	MN- 56	1.410E+14
23	FE- 55	4.580E+13
27	CO- 57	9.450E+12
28	CO- 58M	2.580E+13
29	CO- 58	1.550E+13
30	CO- 60M	9.860E+12
31	CO- 60	1.560E+12
75	MO- 99	7.400E+12
80	TC- 99M	6.470E+12

RADIUS (KM)	.145	.180	.320	.460	.680	1.000
MAX. DOSES	6.7E-02	5.5E-02	3.3E-02	2.3E-02	1.6E-02	9.8E-03
FRACTILE 99.0	4.2E-03	3.5E-03	3.5E-03	2.6E-03	2.0E-03	1.5E-03
FRACTILE 95.0	7.2E-04	6.9E-04	7.8E-04	6.3E-04	5.1E-04	6.5E-04
FRACTILE 90.0	3.0E-04	2.5E-04	3.6E-04	3.4E-04	3.9E-04	3.2E-04
FRACTILE 50.0	2.0E-05	2.0E-05	4.0E-05	7.4E-05	1.3E-04	1.5E-04
MEAN DOSES	2.4E-04	2.1E-04	2.1E-04	2.1E-04	2.2E-04	2.3E-04

RADIUS (KM)	1.500	2.000	3.200	4.600	6.800	10.000
MAX. DOSES	5.4E-03	3.3E-03	2.7E-03	1.2E-03	1.5E-03	5.3E-04
FRACTILE 99.0	1.9E-03	1.7E-03	8.5E-04	4.6E-04	5.5E-04	2.9E-04
FRACTILE 95.0	7.6E-04	4.9E-04	3.5E-04	2.4E-04	1.8E-04	1.3E-04
FRACTILE 90.0	3.7E-04	4.0E-04	3.0E-04	2.1E-04	1.4E-04	8.3E-05
FRACTILE 50.0	1.3E-04	9.8E-05	6.0E-05	3.8E-05	2.2E-05	1.2E-05
MEAN DOSES	2.2E-04	1.9E-04	1.1E-04	7.2E-05	5.2E-05	3.0E-05

CAT-IV-St-elevated, EDE with ingestion (Greifswald)

RESULTS ARE CALCULATED FOR THE WHOLE DISTANCE BAND

RADIUS (KM)	.145	.180	.320	.460	.680	1.000
MAX. DOSES	4.8E+00	4.0E+00	2.4E+00	1.7E+00	1.1E+00	6.8E-01
FRACTILE 99.0	1.0E-01	1.0E-01	1.0E-01	1.0E-01	1.0E-01	1.0E-01
FRACTILE 95.0	5.1E-02	4.3E-02	4.2E-02	3.3E-02	2.6E-02	1.9E-02
FRACTILE 90.0	9.5E-03	1.3E-02	1.1E-02	9.5E-03	7.8E-03	1.1E-02
FRACTILE 50.0	2.1E-05	2.1E-05	3.0E-04	1.1E-03	2.2E-03	2.8E-03
MEAN DOSES	1.6E-02	1.3E-02	1.1E-02	9.1E-03	7.8E-03	7.0E-03

RADIUS (KM)	1.500	2.000	3.200	4.600	6.800	10.000
MAX. DOSES	3.8E-01	2.3E-01	1.9E-01	8.3E-02	6.5E-02	3.8E-02
FRACTILE 99.0	7.2E-02	5.6E-02	2.8E-02	1.9E-02	2.6E-02	9.1E-03
FRACTILE 95.0	2.8E-02	2.2E-02	1.4E-02	8.3E-03	7.1E-03	4.8E-03
FRACTILE 90.0	1.0E-02	7.9E-03	6.2E-03	4.5E-03	2.9E-03	1.9E-03
FRACTILE 50.0	2.3E-03	1.9E-03	1.1E-03	6.8E-04	4.0E-04	2.2E-04
MEAN DOSES	6.1E-03	4.9E-03	3.0E-03	2.0E-03	1.6E-03	8.7E-04

CAT-IV-St-ground, early dose (Greifswald)

NO.	NUCLIDE	SUM
16	CR- 51	3.890E+12
20	MN- 54	7.450E+11
21	MN- 56	1.410E+13
23	FE- 55	4.580E+12
27	CO- 57	9.450E+11
28	CO- 58M	2.580E+12
29	CO- 58	1.550E+12
30	CO- 60M	9.860E+11
31	CO- 60	1.560E+11
75	MO- 99	7.400E+11
80	TC- 99M	6.470E+11

RADIUS (KM)	.145	.180	.320	.460	.680	1.000
MAX. DOSES	1.1E-02	8.9E-03	5.2E-03	3.4E-03	2.1E-03	1.4E-03
FRACTILE 99.0	5.5E-03	5.1E-03	3.7E-03	2.8E-03	1.9E-03	1.2E-03
FRACTILE 95.0	3.3E-03	3.0E-03	2.1E-03	1.6E-03	1.1E-03	6.8E-04
FRACTILE 90.0	2.8E-03	2.6E-03	1.9E-03	1.4E-03	9.8E-04	6.2E-04
FRACTILE 50.0	6.0E-04	5.2E-04	3.1E-04	2.0E-04	1.2E-04	7.4E-05
MEAN DOSES	1.0E-03	9.0E-04	5.9E-04	4.2E-04	2.8E-04	1.7E-04

RADIUS (KM)	1.500	2.000	3.200	4.600	6.800	10.000
MAX. DOSES	1.2E-03	5.8E-04	3.6E-04	1.4E-04	1.6E-04	1.0E-04
FRACTILE 99.0	6.9E-04	4.3E-04	2.8E-04	1.4E-04	6.0E-05	5.8E-05
FRACTILE 95.0	4.0E-04	2.7E-04	1.3E-04	7.9E-05	3.7E-05	1.9E-05
FRACTILE 90.0	3.6E-04	2.4E-04	1.0E-04	4.0E-05	2.2E-05	1.2E-05
FRACTILE 50.0	4.2E-05	2.8E-05	1.4E-05	8.3E-06	4.6E-06	2.6E-06
MEAN DOSES	1.0E-04	6.4E-05	3.3E-05	1.7E-05	8.9E-06	5.4E-06

CAT-IV-St-ground, EDE with ingestion (Greifswald)

RADIUS (KM)	.145	.180	.320	.460	.680	1.000
MAX. DOSES	6.3E-01	5.4E-01	3.3E-01	2.2E-01	1.4E-01	9.0E-02
FRACTILE 99.0	1.0E-01	1.0E-01	7.8E-02	5.8E-02	3.8E-02	2.4E-02
FRACTILE 95.0	7.2E-02	6.6E-02	4.7E-02	3.5E-02	2.5E-02	1.6E-02
FRACTILE 90.0	5.9E-02	5.5E-02	4.0E-02	3.0E-02	2.0E-02	1.3E-02
FRACTILE 50.0	1.3E-02	1.1E-02	6.2E-03	4.1E-03	2.5E-03	1.4E-03
MEAN DOSES	2.3E-02	2.0E-02	1.3E-02	9.5E-03	6.3E-03	3.9E-03

RADIUS (KM)	1.500	2.000	3.200	4.600	6.800	10.000
MAX. DOSES	7.9E-02	4.0E-02	1.9E-02	9.7E-03	1.1E-02	3.6E-03
FRACTILE 99.0	1.5E-02	1.1E-02	9.3E-03	3.9E-03	3.0E-03	2.6E-03
FRACTILE 95.0	9.1E-03	6.0E-03	3.3E-03	2.4E-03	1.1E-03	1.0E-03
FRACTILE 90.0	7.8E-03	5.1E-03	2.5E-03	1.3E-03	5.6E-04	4.0E-04
FRACTILE 50.0	7.9E-04	5.2E-04	2.6E-04	1.5E-04	8.5E-05	4.9E-05
MEAN DOSES	2.4E-03	1.5E-03	8.3E-04	4.7E-04	2.5E-04	1.8E-04

CAT-IV-W-elevated, early dose (Greifswald)

NO.	NUCLIDE	SUM
90	AG-110	1.290E+11
155	TA-179	4.750E+11
157	TA-182	3.920E+11
159	W -181	4.340E+13
160	W -183M	2.600E+14
161	W -185	9.180E+13
162	W -187	2.560E+14
166	RE-186	8.570E+12
167	RE-188M	2.450E+11
168	RE-188	3.600E+12

RADIUS (KM)	.145	.180	.320	.460	.680	1.000
MAX. DOSES	5.9E-02	4.9E-02	2.9E-02	2.0E-02	1.3E-02	8.4E-03
FRACTILE 99.0	3.7E-03	3.1E-03	3.1E-03	2.3E-03	1.7E-03	1.3E-03
FRACTILE 95.0	6.3E-04	5.4E-04	5.4E-04	4.7E-04	3.8E-04	4.8E-04
FRACTILE 90.0	2.3E-04	2.2E-04	2.0E-04	2.1E-04	1.9E-04	1.9E-04
FRACTILE 50.0	8.7E-06	8.7E-06	1.7E-05	3.0E-05	5.1E-05	6.2E-05
MEAN DOSES	2.0E-04	1.7E-04	1.6E-04	1.3E-04	1.3E-04	1.2E-04

RADIUS (KM)	1.500	2.000	3.200	4.600	6.800	10.000
MAX. DOSES	4.7E-03	2.8E-03	2.3E-03	1.0E-03	9.5E-04	4.6E-04
FRACTILE 99.0	8.9E-04	7.9E-04	4.6E-04	3.2E-04	3.7E-04	1.4E-04
FRACTILE 95.0	4.0E-04	3.2E-04	1.9E-04	1.3E-04	1.1E-04	6.3E-05
FRACTILE 90.0	1.6E-04	1.6E-04	1.3E-04	9.3E-05	6.5E-05	3.9E-05
FRACTILE 50.0	5.1E-05	4.1E-05	2.5E-05	1.5E-05	9.1E-06	5.2E-06
MEAN DOSES	1.1E-04	8.8E-05	5.5E-05	3.5E-05	2.7E-05	1.5E-05

CAT-IV-W-elevated, EDE with ingestion (Greifswald)

RESULTS ARE CALCULATED FOR THE WHOLE DISTANCE BAND

RADIUS (KM)	.145	.180	.320	.460	.680	1.000
MAX. DOSES	9.8E-01	8.1E-01	4.8E-01	3.3E-01	2.2E-01	1.4E-01
FRACTILE 99.0	6.0E-02	5.1E-02	5.1E-02	3.8E-02	2.8E-02	2.0E-02
FRACTILE 95.0	1.0E-02	8.7E-03	8.5E-03	6.8E-03	5.2E-03	3.8E-03
FRACTILE 90.0	1.9E-03	2.7E-03	2.2E-03	1.9E-03	1.6E-03	2.3E-03
FRACTILE 50.0	8.7E-06	8.7E-06	6.6E-05	2.3E-04	4.6E-04	5.8E-04
MEAN DOSES	3.1E-03	2.7E-03	2.3E-03	1.9E-03	1.6E-03	1.4E-03

RADIUS (KM)	1.500	2.000	3.200	4.600	6.800	10.000
MAX. DOSES	7.7E-02	4.7E-02	3.8E-02	1.7E-02	1.3E-02	7.8E-03
FRACTILE 99.0	1.5E-02	1.1E-02	5.8E-03	4.0E-03	5.4E-03	1.8E-03
FRACTILE 95.0	5.6E-03	4.4E-03	2.8E-03	1.7E-03	1.5E-03	9.5E-04
FRACTILE 90.0	2.0E-03	1.6E-03	1.3E-03	9.1E-04	5.9E-04	4.0E-04
FRACTILE 50.0	4.8E-04	3.8E-04	2.2E-04	1.4E-04	8.1E-05	4.7E-05
MEAN DOSES	1.2E-03	9.9E-04	6.1E-04	4.0E-04	3.2E-04	1.8E-04

CAT-IV-W-ground, early dose (Greifswald)

NO.	NUCLIDE	SUM
90	AG-110	1.290E+10
155	TA-179	4.750E+10
157	TA-182	3.920E+10
159	W -181	4.340E+12
160	W -183M	2.600E+13
161	W -185	9.180E+12
162	W -187	2.560E+13
166	RE-186	8.570E+11
167	RE-188M	2.450E+10
168	RE-188	3.600E+11

RADIUS (KM)	.145	.180	.320	.460	.680	1.000
MAX. DOSES	8.1E-03	6.9E-03	4.1E-03	2.8E-03	1.7E-03	1.1E-03
FRACTILE 99.0	2.2E-03	2.1E-03	1.5E-03	1.1E-03	7.6E-04	4.8E-04
FRACTILE 95.0	1.3E-03	1.2E-03	8.9E-04	6.8E-04	4.7E-04	3.2E-04
FRACTILE 90.0	1.1E-03	1.0E-03	7.8E-04	5.8E-04	3.9E-04	2.5E-04
FRACTILE 50.0	2.5E-04	2.1E-04	1.2E-04	8.1E-05	5.0E-05	3.0E-05
MEAN DOSES	4.2E-04	3.8E-04	2.5E-04	1.8E-04	1.2E-04	7.5E-05

RADIUS (KM)	1.500	2.000	3.200	4.600	6.800	10.000
MAX. DOSES	9.8E-04	4.9E-04	2.4E-04	1.2E-04	1.3E-04	5.7E-05
FRACTILE 99.0	2.8E-04	1.9E-04	1.5E-04	5.8E-05	3.6E-05	3.5E-05
FRACTILE 95.0	1.9E-04	1.2E-04	6.9E-05	4.3E-05	1.8E-05	1.3E-05
FRACTILE 90.0	1.5E-04	1.0E-04	4.7E-05	2.1E-05	1.0E-05	5.6E-06
FRACTILE 50.0	1.7E-05	1.1E-05	5.8E-06	3.4E-06	1.9E-06	1.1E-06
MEAN DOSES	4.5E-05	2.8E-05	1.5E-05	8.4E-06	4.5E-06	2.9E-06

CAT-IV-W-ground, EDE with ingestion (Greifswald)

RADIUS (KM)	.145	.180	.320	.460	.680	1.000
MAX. DOSES	1.3E-01	1.1E-01	6.6E-02	4.5E-02	2.8E-02	1.8E-02
FRACTILE 99.0	2.3E-02	2.2E-02	1.6E-02	1.2E-02	7.8E-03	4.9E-03
FRACTILE 95.0	1.5E-02	1.3E-02	9.3E-03	7.2E-03	5.0E-03	3.2E-03
FRACTILE 90.0	1.2E-02	1.1E-02	8.1E-03	6.0E-03	4.1E-03	2.7E-03
FRACTILE 50.0	2.5E-03	2.2E-03	1.3E-03	8.3E-04	5.0E-04	3.0E-04
MEAN DOSES	4.6E-03	4.1E-03	2.7E-03	1.9E-03	1.3E-03	8.0E-04

RADIUS (KM)	1.500	2.000	3.200	4.600	6.800	10.000
MAX. DOSES	1.6E-02	8.0E-03	3.9E-03	2.0E-03	2.2E-03	7.4E-04
FRACTILE 99.0	3.2E-03	2.1E-03	1.9E-03	7.8E-04	6.0E-04	5.1E-04
FRACTILE 95.0	1.9E-03	1.2E-03	6.8E-04	4.9E-04	2.2E-04	2.1E-04
FRACTILE 90.0	1.6E-03	1.0E-03	5.0E-04	2.8E-04	1.1E-04	8.1E-05
FRACTILE 50.0	1.6E-04	1.1E-04	5.4E-05	3.1E-05	1.7E-05	1.0E-05
MEAN DOSES	4.8E-04	3.0E-04	1.7E-04	9.6E-05	5.2E-05	3.7E-05

CAT-IV-ACP-elevated, early dose (Greifswald)

NO.	NUCLIDE	SUM
16	CR- 51	1.270E+12
20	MN- 54	7.700E+11
23	FE- 55	3.820E+12
27	CO- 57	1.650E+12
29	CO- 58	2.440E+12
31	CO- 60	2.870E+11

RADIUS (KM)	.145	.180	.320	.460	.680	1.000
MAX. DOSES	7.8E-03	6.5E-03	3.9E-03	2.8E-03	1.8E-03	1.2E-03
FRACTILE 99.0	4.9E-04	4.1E-04	4.1E-04	3.1E-04	2.3E-04	1.8E-04
FRACTILE 95.0	8.3E-05	7.8E-05	9.1E-05	7.2E-05	5.9E-05	7.4E-05
FRACTILE 90.0	3.3E-05	2.8E-05	4.1E-05	3.9E-05	3.8E-05	3.5E-05
FRACTILE 50.0	3.0E-07	3.0E-07	2.0E-06	7.1E-06	1.4E-05	1.7E-05
MEAN DOSES	2.6E-05	2.2E-05	2.2E-05	2.2E-05	2.4E-05	2.6E-05

RADIUS (KM)	1.500	2.000	3.200	4.600	6.800	10.000
MAX. DOSES	6.5E-04	4.0E-04	3.3E-04	1.4E-04	1.8E-04	6.4E-05
FRACTILE 99.0	2.1E-04	2.1E-04	1.1E-04	5.5E-05	6.9E-05	3.5E-05
FRACTILE 95.0	8.7E-05	5.8E-05	4.1E-05	2.8E-05	2.2E-05	1.4E-05
FRACTILE 90.0	4.2E-05	4.6E-05	3.5E-05	2.5E-05	1.6E-05	9.3E-06
FRACTILE 50.0	1.4E-05	1.1E-05	6.8E-06	4.3E-06	2.5E-06	1.4E-06
MEAN DOSES	2.5E-05	2.1E-05	1.3E-05	8.4E-06	6.0E-06	3.5E-06

CAT-IV-ACP-elevated, EDE with ingestion (Greifswald)

RADIUS (KM)	.145	.180	.320	.460	.680	1.000
MAX. DOSES	6.6E-01	5.5E-01	3.2E-01	2.3E-01	1.5E-01	9.3E-02
FRACTILE 99.0	4.1E-02	3.5E-02	3.5E-02	2.6E-02	1.9E-02	1.4E-02
FRACTILE 95.0	7.1E-03	5.9E-03	5.8E-03	4.6E-03	3.5E-03	2.5E-03
FRACTILE 90.0	1.3E-03	1.8E-03	1.5E-03	1.3E-03	1.0E-03	1.5E-03
FRACTILE 50.0	3.0E-07	4.1E-07	3.4E-05	1.5E-04	3.0E-04	3.8E-04
MEAN DOSES	2.1E-03	1.8E-03	1.5E-03	1.2E-03	1.1E-03	9.6E-04

RADIUS (KM)	1.500	2.000	3.200	4.600	6.800	10.000
MAX. DOSES	5.2E-02	3.2E-02	2.6E-02	1.1E-02	8.9E-03	5.3E-03
FRACTILE 99.0	1.0E-02	7.8E-03	3.9E-03	2.7E-03	3.6E-03	1.2E-03
FRACTILE 95.0	3.8E-03	3.0E-03	1.9E-03	1.1E-03	9.5E-04	6.5E-04
FRACTILE 90.0	1.4E-03	1.1E-03	8.5E-04	6.0E-04	3.9E-04	2.7E-04
FRACTILE 50.0	3.2E-04	2.5E-04	1.5E-04	9.3E-05	5.4E-05	3.1E-05
MEAN DOSES	8.3E-04	6.6E-04	4.1E-04	2.7E-04	2.1E-04	1.2E-04

CAT-IV-ACP-ground, early dose (Greifswald)

NO.	NUCLIDE	SUM
16	CR- 51	1.270E+11
20	MN- 54	7.700E+10
23	FE- 55	3.820E+11
27	CO- 57	1.650E+11
29	CO- 58	2.440E+11
31	CO- 60	2.870E+10

RADIUS (KM)	.145	.180	.320	.460	.680	1.000
MAX. DOSES	1.3E-03	1.1E-03	6.2E-04	4.1E-04	2.6E-04	1.6E-04
FRACTILE 99.0	7.1E-04	6.6E-04	4.8E-04	3.5E-04	2.3E-04	1.5E-04
FRACTILE 95.0	4.1E-04	3.7E-04	2.6E-04	2.0E-04	1.3E-04	8.3E-05
FRACTILE 90.0	3.6E-04	3.3E-04	2.4E-04	1.8E-04	1.2E-04	7.6E-05
FRACTILE 50.0	7.6E-05	6.5E-05	3.8E-05	2.5E-05	1.5E-05	8.9E-06
MEAN DOSES	1.3E-04	1.1E-04	7.4E-05	5.3E-05	3.4E-05	2.1E-05

RADIUS (KM)	1.500	2.000	3.200	4.600	6.800	10.000
MAX. DOSES	1.5E-04	6.9E-05	4.5E-05	1.7E-05	1.9E-05	1.3E-05
FRACTILE 99.0	8.5E-05	5.4E-05	3.3E-05	1.7E-05	7.9E-06	7.9E-06
FRACTILE 95.0	4.9E-05	3.2E-05	1.6E-05	9.8E-06	4.7E-06	2.5E-06
FRACTILE 90.0	4.5E-05	3.0E-05	1.2E-05	4.9E-06	2.6E-06	1.5E-06
FRACTILE 50.0	4.9E-06	3.2E-06	1.6E-06	9.3E-07	5.2E-07	3.0E-07
MEAN DOSES	1.2E-05	7.6E-06	3.9E-06	2.1E-06	1.1E-06	6.7E-07

CAT-IV-ACP-ground, EDE with ingestion (Greifswald)

RADIUS (KM)	.145	.180	.320	.460	.680	1.000
MAX. DOSES	8.6E-02	7.4E-02	4.5E-02	3.0E-02	1.9E-02	1.2E-02
FRACTILE 99.0	1.6E-02	1.4E-02	1.0E-02	7.8E-03	5.2E-03	3.2E-03
FRACTILE 95.0	1.0E-02	8.9E-03	6.3E-03	4.9E-03	3.4E-03	2.2E-03
FRACTILE 90.0	8.1E-03	7.4E-03	5.4E-03	4.0E-03	2.8E-03	1.8E-03
FRACTILE 50.0	1.7E-03	1.4E-03	8.5E-04	5.5E-04	3.3E-04	1.9E-04
MEAN DOSES	3.1E-03	2.8E-03	1.8E-03	1.3E-03	8.5E-04	5.4E-04

RADIUS (KM)	1.500	2.000	3.200	4.600	6.800	10.000
MAX. DOSES	1.1E-02	5.4E-03	2.7E-03	1.3E-03	1.5E-03	5.0E-04
FRACTILE 99.0	2.1E-03	1.4E-03	1.3E-03	5.4E-04	4.1E-04	3.5E-04
FRACTILE 95.0	1.3E-03	8.3E-04	4.6E-04	3.3E-04	1.5E-04	1.4E-04
FRACTILE 90.0	1.0E-03	7.1E-04	3.3E-04	1.9E-04	7.6E-05	5.5E-05
FRACTILE 50.0	1.1E-04	7.1E-05	3.5E-05	2.1E-05	1.1E-05	6.6E-06
MEAN DOSES	3.2E-04	2.0E-04	1.1E-04	6.4E-05	3.5E-05	2.5E-05

Probabilistic potential doses from source terms of case 3 (CAT-IV-bypass)

CAT-IV-bypass-Cu-elevated, early dose (Greifswald)

NO.	NUCLIDE	SUM
	HTO	0.85100E+16
16	CR- 51	0.38000E+10
20	MN- 54	0.23100E+10
21	MN- 56	0.64600E+11
23	FE- 55	0.11500E+11
27	CO- 57	0.49600E+10
29	CO- 58	0.73100E+10
31	CO- 60	0.86200E+09
90	AG-110	0.71000E+10
155	TA-179	0.26100E+11
157	TA-182	0.21500E+11
159	W -181	0.23900E+13
160	W -183M	0.14300E+14
161	W -185	0.50500E+13
162	W -187	0.14100E+14
166	RE-186	0.47200E+12
167	RE-188M	0.13500E+11
168	RE-188	0.19800E+12

RADIUS (KM)	0.145	0.180	0.320	0.500	0.680	1.000
MAX. DOSES	4.1E-03	4.0E-03	3.3E-03	2.3E-03	1.9E-03	1.6E-03
FRACTILE 99.0	4.1E-04	3.7E-04	6.3E-04	6.2E-04	5.0E-04	9.5E-04
FRACTILE 95.0	6.8E-05	8.3E-05	1.4E-04	2.6E-04	2.8E-04	3.3E-04
FRACTILE 90.0	1.6E-05	2.4E-05	1.2E-04	2.2E-04	2.4E-04	2.3E-04
FRACTILE 50.0	5.5E-07	5.9E-07	1.4E-05	7.1E-05	1.2E-04	1.5E-04
MEAN DOSES	1.7E-05	2.0E-05	4.8E-05	9.6E-05	1.3E-04	1.7E-04

RADIUS (KM)	1.500	2.000	3.200	5.000	6.800	10.000
MAX. DOSES	1.8E-03	1.9E-03	1.2E-03	7.8E-04	5.1E-04	2.8E-04
FRACTILE 99.0	1.8E-03	1.8E-03	9.3E-04	4.4E-04	3.6E-04	2.1E-04
FRACTILE 95.0	3.9E-04	4.0E-04	3.2E-04	2.2E-04	1.4E-04	7.9E-05
FRACTILE 90.0	3.3E-04	3.7E-04	2.9E-04	1.7E-04	1.1E-04	6.2E-05
FRACTILE 50.0	1.3E-04	1.0E-04	5.9E-05	3.8E-05	2.2E-05	1.3E-05
MEAN DOSES	1.9E-04	1.6E-04	1.0E-04	6.4E-05	4.0E-05	2.4E-05

CAT-IV-bypass-Cu-elevated, EDE, with ingestion (Greifswald)

RADIUS (KM)	0.145	0.180	0.320	0.500	0.680	1.000
MAX. DOSES	3.9E+00	3.3E+00	2.0E+00	1.2E+00	8.2E-01	5.1E-01
FRACTILE 99.0	9.3E-01	8.5E-01	6.2E-01	4.3E-01	3.1E-01	1.9E-01
FRACTILE 95.0	7.2E-01	6.8E-01	4.9E-01	3.4E-01	2.5E-01	1.5E-01
FRACTILE 90.0	5.9E-01	5.4E-01	3.8E-01	2.6E-01	1.9E-01	1.2E-01
FRACTILE 50.0	2.3E-01	1.9E-01	1.0E-01	6.0E-02	4.0E-02	2.3E-02
MEAN DOSES	2.8E-01	2.4E-01	1.6E-01	1.0E-01	7.0E-02	4.3E-02

RADIUS (KM)	1.500	2.000	3.200	5.000	6.800	10.000
MAX. DOSES	4.8E-01	2.2E-01	1.1E-01	4.7E-02	6.6E-02	2.8E-02
FRACTILE 99.0	1.2E-01	6.8E-02	4.0E-02	2.1E-02	1.8E-02	1.2E-02
FRACTILE 95.0	8.9E-02	5.2E-02	2.5E-02	1.4E-02	9.3E-03	5.0E-03
FRACTILE 90.0	6.8E-02	4.5E-02	2.2E-02	8.9E-03	5.2E-03	2.7E-03
FRACTILE 50.0	1.3E-02	8.7E-03	4.4E-03	2.3E-03	1.4E-03	6.8E-04
MEAN DOSES	2.5E-02	1.6E-02	7.9E-03	4.0E-03	2.5E-03	1.5E-03

CAT-IV-bypass-St-elevated, early dose (Greifswald)

NO.	NUCLIDE	SUM
	HTO	0.85100E+16
16	CR- 51	0.21400E+13
20	MN- 54	0.41200E+12
21	MN- 56	0.78100E+13
23	FE- 55	0.25300E+13
27	CO- 57	0.52500E+12
28	CO- 58M	0.14200E+13
29	CO- 58	0.86200E+12
30	CO- 60M	0.54200E+12
31	CO- 60	0.86900E+11
75	MO- 99	0.40700E+12
80	TC- 99M	0.35600E+12

RADIUS (KM)	0.145	0.180	0.320	0.500	0.680	1.000
MAX. DOSES	4.3E-03	4.3E-03	3.5E-03	2.4E-03	2.0E-03	1.7E-03
FRACTILE 99.0	4.4E-04	4.2E-04	6.8E-04	6.9E-04	5.1E-04	1.0E-03
FRACTILE 95.0	7.6E-05	9.1E-05	1.5E-04	2.7E-04	3.0E-04	3.4E-04
FRACTILE 90.0	1.8E-05	2.6E-05	1.2E-04	2.3E-04	2.5E-04	2.3E-04
FRACTILE 50.0	1.1E-06	1.3E-06	1.6E-05	7.4E-05	1.3E-04	1.5E-04
MEAN DOSES	2.0E-05	2.2E-05	5.1E-05	1.0E-04	1.4E-04	1.8E-04

RADIUS (KM)	1.500	2.000	3.200	5.000	6.800	10.000
MAX. DOSES	1.8E-03	2.0E-03	1.3E-03	8.0E-04	5.3E-04	2.9E-04
FRACTILE 99.0	1.8E-03	1.9E-03	9.5E-04	4.5E-04	3.8E-04	2.2E-04
FRACTILE 95.0	4.0E-04	4.1E-04	3.3E-04	2.3E-04	1.5E-04	8.3E-05
FRACTILE 90.0	3.5E-04	3.8E-04	3.0E-04	1.7E-04	1.1E-04	6.5E-05
FRACTILE 50.0	1.3E-04	1.0E-04	6.2E-05	3.9E-05	2.3E-05	1.3E-05
MEAN DOSES	1.9E-04	1.7E-04	1.1E-04	6.5E-05	4.1E-05	2.5E-05

CAT-IV-bypass-St-elevated, EDE with ingestion (Greifswald)

RADIUS (KM)	0.145	0.180	0.320	0.500	0.680	1.000
MAX. DOSES	4.0E-01	3.3E-01	2.0E-01	1.4E-01	9.9E-02	6.3E-02
FRACTILE 99.0	2.8E-02	2.3E-02	2.1E-02	1.5E-02	1.3E-02	1.0E-02
FRACTILE 95.0	6.2E-03	5.2E-03	7.1E-03	7.8E-03	6.6E-03	4.9E-03
FRACTILE 90.0	1.9E-03	1.7E-03	2.6E-03	4.0E-03	4.3E-03	3.9E-03
FRACTILE 50.0	1.5E-06	2.0E-06	1.4E-04	7.1E-04	1.1E-03	1.3E-03
MEAN DOSES	1.4E-03	1.3E-03	1.5E-03	1.9E-03	2.1E-03	2.2E-03

RADIUS (KM)	1.500	2.000	3.200	5.000	6.800	10.000
MAX. DOSES	3.6E-02	2.2E-02	1.9E-02	5.9E-03	3.7E-03	3.1E-03
FRACTILE 99.0	7.2E-03	6.0E-03	3.5E-03	2.4E-03	1.7E-03	1.0E-03
FRACTILE 95.0	4.7E-03	4.1E-03	2.3E-03	1.6E-03	1.1E-03	7.2E-04
FRACTILE 90.0	3.3E-03	2.8E-03	1.8E-03	1.2E-03	7.4E-04	5.4E-04
FRACTILE 50.0	1.7E-03	1.3E-03	8.1E-04	5.1E-04	3.0E-04	1.7E-04
MEAN DOSES	1.9E-03	1.5E-03	9.6E-04	6.1E-04	3.8E-04	2.3E-04

CAT-IV-bypass-W-elevated, early dose (Greifswald)

NO.	NUCLIDE	SUM
	HTO	0.85100E+16
16	CR- 51	0.38000E+10
20	MN- 54	0.23100E+10
21	MN- 56	0.64600E+11
23	FE- 55	0.11500E+11
27	CO- 57	0.49600E+10
29	CO- 58	0.73100E+10
31	CO- 60	0.86200E+09
90	AG-110	0.71000E+10
155	TA-179	0.26100E+11
157	TA-182	0.21500E+11
159	W -181	0.23900E+13
160	W -183M	0.14300E+14
161	W -185	0.50500E+13
162	W -187	0.14100E+14
166	RE-186	0.47200E+12
167	RE-188M	0.13500E+11
168	RE-188	0.19800E+12

RADIUS (KM)	0.145	0.180	0.320	0.500	0.680	1.000
MAX. DOSES	4.1E-03	4.0E-03	3.3E-03	2.3E-03	1.9E-03	1.6E-03
FRACTILE 99.0	4.1E-04	3.7E-04	6.3E-04	6.2E-04	5.0E-04	9.5E-04
FRACTILE 95.0	6.8E-05	8.3E-05	1.4E-04	2.6E-04	2.8E-04	3.3E-04
FRACTILE 90.0	1.6E-05	2.4E-05	1.2E-04	2.2E-04	2.4E-04	2.3E-04
FRACTILE 50.0	5.5E-07	5.9E-07	1.4E-05	7.1E-05	1.2E-04	1.5E-04
MEAN DOSES	1.7E-05	2.0E-05	4.8E-05	9.6E-05	1.3E-04	1.7E-04

RADIUS (KM)	1.500	2.000	3.200	5.000	6.800	10.000
MAX. DOSES	1.8E-03	1.9E-03	1.2E-03	7.8E-04	5.1E-04	2.8E-04
FRACTILE 99.0	1.8E-03	1.8E-03	9.3E-04	4.4E-04	3.6E-04	2.1E-04
FRACTILE 95.0	3.9E-04	4.0E-04	3.2E-04	2.2E-04	1.4E-04	7.9E-05
FRACTILE 90.0	3.3E-04	3.7E-04	2.9E-04	1.7E-04	1.1E-04	6.2E-05
FRACTILE 50.0	1.3E-04	1.0E-04	5.9E-05	3.8E-05	2.2E-05	1.3E-05
MEAN DOSES	1.9E-04	1.6E-04	1.0E-04	6.4E-05	4.0E-05	2.4E-05

CAT-IV-bypass-W-elevated, EDE with ingestion (Greifswald)

RADIUS (KM)	0.145	0.180	0.320	0.500	0.680	1.000
MAX. DOSES	1.9E-01	1.6E-01	1.0E-01	6.8E-02	5.1E-02	3.3E-02
FRACTILE 99.0	1.3E-02	1.1E-02	1.3E-02	9.5E-03	8.5E-03	6.8E-03
FRACTILE 95.0	3.6E-03	3.2E-03	4.3E-03	5.1E-03	5.6E-03	4.6E-03
FRACTILE 90.0	1.1E-03	8.9E-04	2.3E-03	3.6E-03	4.1E-03	3.6E-03
FRACTILE 50.0	7.1E-07	1.3E-06	1.3E-04	6.2E-04	1.0E-03	1.2E-03
MEAN DOSES	7.4E-04	7.0E-04	1.0E-03	1.5E-03	1.8E-03	1.8E-03

RADIUS (KM)	1.500	2.000	3.200	5.000	6.800	10.000
MAX. DOSES	1.9E-02	1.2E-02	1.0E-02	2.8E-03	2.0E-03	1.4E-03
FRACTILE 99.0	5.4E-03	4.2E-03	2.5E-03	1.7E-03	1.1E-03	8.7E-04
FRACTILE 95.0	3.7E-03	3.0E-03	2.0E-03	1.3E-03	8.1E-04	5.2E-04
FRACTILE 90.0	3.2E-03	2.5E-03	1.6E-03	1.0E-03	6.5E-04	4.4E-04
FRACTILE 50.0	1.5E-03	1.3E-03	7.8E-04	4.8E-04	2.8E-04	1.4E-04
MEAN DOSES	1.6E-03	1.3E-03	8.3E-04	5.3E-04	3.2E-04	1.9E-04

Probabilistic potential doses from source terms of case 4 (CAT-V-bypass)

CAT-V-Cu- bypass-ground, early dose (Greifswald)

NO.	NUCLIDE	SUM
	HTO	0.15540E+17
16	CR- 51	0.46100E+10
20	MN- 54	0.28000E+10
21	MN- 56	0.78400E+11
23	FE- 55	0.13900E+11
27	CO- 57	0.60200E+10
29	CO- 58	0.88700E+10
30	CO- 60M	0.32700E+14
31	CO- 60	0.19900E+13
34	NI- 63	0.37400E+12
36	CU- 62	0.69200E+15
37	CU- 64	0.14600E+16
38	CU- 66	0.45500E+15
157	TA-182	0.70200E+12

RADIUS (KM)	0.145	0.180	0.320	0.500	0.680	1.000
MAX. DOSES	3.1E-01	1.7E-01	1.2E-01	8.5E-02	6.1E-02	3.8E-02
FRACTILE 99.0	1.0E-01	1.0E-01	1.0E-01	8.5E-02	6.1E-02	3.8E-02
FRACTILE 95.0	1.0E-01	9.5E-02	6.9E-02	4.8E-02	3.4E-02	2.1E-02
FRACTILE 90.0	9.3E-02	8.7E-02	6.3E-02	4.3E-02	3.1E-02	1.9E-02
FRACTILE 50.0	2.0E-02	1.8E-02	1.1E-02	6.5E-03	4.5E-03	2.6E-03
MEAN DOSES	3.3E-02	3.0E-02	2.0E-02	1.3E-02	8.9E-03	5.5E-03

RADIUS (KM)	1.500	2.000	3.200	5.000	6.800	10.000
MAX. DOSES	2.2E-02	1.4E-02	7.4E-03	3.6E-03	2.3E-03	2.2E-03
FRACTILE 99.0	2.2E-02	1.4E-02	5.2E-03	3.5E-03	1.9E-03	1.1E-03
FRACTILE 95.0	1.2E-02	7.9E-03	3.8E-03	1.7E-03	7.9E-04	3.5E-04
FRACTILE 90.0	1.1E-02	7.2E-03	3.0E-03	9.3E-04	5.6E-04	3.0E-04
FRACTILE 50.0	1.5E-03	9.8E-04	4.8E-04	2.6E-04	1.5E-04	8.1E-05
MEAN DOSES	3.1E-03	1.9E-03	9.0E-04	4.3E-04	2.4E-04	1.2E-04

CAT-V-Cu- bypass-ground, early dose (Greifswald)

RADIUS (KM)	0.145	0.180	0.320	0.500	0.680	1.000
MAX. DOSES	3.9E+00	3.3E+00	2.0E+00	1.2E+00	8.2E-01	5.1E-01
FRACTILE 99.0	9.3E-01	8.5E-01	6.2E-01	4.3E-01	3.1E-01	1.9E-01
FRACTILE 95.0	7.2E-01	6.8E-01	4.9E-01	3.4E-01	2.5E-01	1.5E-01
FRACTILE 90.0	5.9E-01	5.4E-01	3.8E-01	2.6E-01	1.9E-01	1.2E-01
FRACTILE 50.0	2.3E-01	1.9E-01	1.0E-01	6.0E-02	4.0E-02	2.3E-02
MEAN DOSES	2.8E-01	2.4E-01	1.6E-01	1.0E-01	7.0E-02	4.3E-02

RADIUS (KM)	1.500	2.000	3.200	5.000	6.800	10.000
MAX. DOSES	4.8E-01	2.2E-01	1.1E-01	4.7E-02	6.6E-02	2.8E-02
FRACTILE 99.0	1.2E-01	6.8E-02	4.0E-02	2.1E-02	1.8E-02	1.2E-02
FRACTILE 95.0	8.9E-02	5.2E-02	2.5E-02	1.4E-02	9.3E-03	5.0E-03
FRACTILE 90.0	6.8E-02	4.5E-02	2.2E-02	8.9E-03	5.2E-03	2.7E-03
FRACTILE 50.0	1.3E-02	8.7E-03	4.4E-03	2.3E-03	1.4E-03	6.8E-04
MEAN DOSES	2.5E-02	1.6E-02	7.9E-03	4.0E-03	2.5E-03	1.5E-03

CAT-V-St- bypass-ground, early dose (Greifswald)

NO.	NUCLIDE	SUM
	HTO	0.15540E+17
16	CR- 51	0.79000E+14
20	MN- 54	0.15100E+14
21	MN- 56	0.28600E+15
23	FE- 55	0.92900E+14
27	CO- 57	0.19200E+14
28	CO- 58M	0.52300E+14
29	CO- 58	0.31500E+14
30	CO- 60M	0.20000E+14
31	CO- 60	0.31800E+13
75	MO- 99	0.15000E+14
80	TC- 99M	0.13100E+14

RADIUS (KM)	0.145	0.180	0.320	0.500	0.680	1.000
MAX. DOSES	3.4E-01	2.2E-01	1.5E-01	1.0E-01	7.6E-02	4.8E-02
FRACTILE 99.0	1.0E-01	1.0E-01	1.0E-01	1.0E-01	7.4E-02	4.7E-02
FRACTILE 95.0	1.0E-01	1.0E-01	8.3E-02	5.8E-02	4.2E-02	2.6E-02
FRACTILE 90.0	1.0E-01	1.0E-01	7.6E-02	5.2E-02	3.8E-02	2.4E-02
FRACTILE 50.0	2.4E-02	2.1E-02	1.3E-02	7.4E-03	5.1E-03	3.0E-03
MEAN DOSES	4.0E-02	3.5E-02	2.3E-02	1.5E-02	1.1E-02	6.6E-03

RADIUS (KM)	1.500	2.000	3.200	5.000	6.800	10.000
MAX. DOSES	2.8E-02	1.8E-02	9.8E-03	4.4E-03	3.4E-03	3.1E-03
FRACTILE 99.0	2.7E-02	1.7E-02	6.5E-03	4.2E-03	2.4E-03	1.4E-03
FRACTILE 95.0	1.5E-02	1.0E-02	4.7E-03	2.1E-03	1.3E-03	4.8E-04
FRACTILE 90.0	1.4E-02	8.9E-03	3.6E-03	1.1E-03	7.9E-04	4.3E-04
FRACTILE 50.0	1.7E-03	1.1E-03	5.6E-04	3.1E-04	1.8E-04	1.0E-04
MEAN DOSES	3.8E-03	2.4E-03	1.1E-03	5.4E-04	3.1E-04	1.6E-04

CAT-V-St- bypass-ground, EDE with ingestion (Greifswald)

RADIUS (KM)	0.145	0.180	0.320	0.500	0.680	1.000
MAX. DOSES	1.3E+01	1.1E+01	6.9E+00	4.3E+00	2.9E+00	1.9E+00
FRACTILE 99.0	2.6E+00	2.5E+00	1.8E+00	1.2E+00	8.7E-01	5.5E-01
FRACTILE 95.0	1.7E+00	1.6E+00	1.1E+00	7.9E-01	5.8E-01	4.0E-01
FRACTILE 90.0	1.5E+00	1.4E+00	1.0E+00	6.9E-01	5.0E-01	3.1E-01
FRACTILE 50.0	4.0E-01	3.2E-01	1.8E-01	1.1E-01	7.4E-02	4.4E-02
MEAN DOSES	6.1E-01	5.4E-01	3.6E-01	2.3E-01	1.6E-01	1.0E-01

RADIUS (KM)	1.500	2.000	3.200	5.000	6.800	10.000
MAX. DOSES	1.7E+00	8.2E-01	4.0E-01	1.7E-01	2.3E-01	1.1E-01
FRACTILE 99.0	3.5E-01	2.2E-01	1.4E-01	7.2E-02	6.3E-02	4.2E-02
FRACTILE 95.0	2.2E-01	1.4E-01	7.2E-02	4.4E-02	2.8E-02	1.7E-02
FRACTILE 90.0	1.8E-01	1.2E-01	6.0E-02	2.6E-02	1.4E-02	8.1E-03
FRACTILE 50.0	2.4E-02	1.6E-02	7.8E-03	4.4E-03	2.5E-03	1.4E-03
MEAN DOSES	6.0E-02	3.8E-02	2.0E-02	9.6E-03	6.8E-03	4.1E-03

CAT-V-W- bypass-ground, early dose (Greifswald)

NO.	NUCLIDE	SUM
	HTO	0.15540E+17
16	CR- 51	0.46100E+10
20	MN- 54	0.28000E+10
21	MN- 56	0.78400E+11
23	FE- 55	0.13900E+11
27	CO- 57	0.60200E+10
29	CO- 58	0.88700E+10
31	CO- 60	0.10500E+10
90	AG-110	0.26200E+12
155	TA-179	0.96400E+12
157	TA-182	0.79500E+12
159	W -181	0.88200E+14
160	W -183M	0.52900E+15
161	W -185	0.18600E+15
162	W -187	0.52000E+15
166	RE-186	0.17400E+14
167	RE-188M	0.49700E+12
168	RE-188	0.73200E+13

RADIUS (KM)	0.145	0.180	0.320	0.500	0.680	1.000
MAX. DOSES	3.1E-01	1.8E-01	1.1E-01	7.4E-02	5.4E-02	3.4E-02
FRACTILE 99.0	1.0E-01	1.0E-01	1.0E-01	7.1E-02	5.1E-02	3.2E-02
FRACTILE 95.0	8.5E-02	7.9E-02	5.8E-02	3.9E-02	2.8E-02	1.8E-02
FRACTILE 90.0	7.8E-02	7.2E-02	5.2E-02	3.6E-02	2.6E-02	1.7E-02
FRACTILE 50.0	1.7E-02	1.5E-02	8.7E-03	5.2E-03	3.6E-03	2.1E-03
MEAN DOSES	2.8E-02	2.5E-02	1.6E-02	1.1E-02	7.5E-03	4.6E-03

RADIUS (KM)	1.500	2.000	3.200	5.000	6.800	10.000
MAX. DOSES	2.3E-02	1.2E-02	7.4E-03	3.1E-03	2.9E-03	2.1E-03
FRACTILE 99.0	1.9E-02	1.2E-02	4.5E-03	3.1E-03	1.7E-03	9.1E-04
FRACTILE 95.0	1.0E-02	6.8E-03	3.2E-03	1.5E-03	8.3E-04	3.5E-04
FRACTILE 90.0	9.5E-03	6.0E-03	2.5E-03	8.1E-04	5.4E-04	2.9E-04
FRACTILE 50.0	1.2E-03	7.9E-04	3.9E-04	2.2E-04	1.3E-04	6.9E-05
MEAN DOSES	2.6E-03	1.6E-03	7.8E-04	3.9E-04	2.2E-04	1.2E-04

CAT-V-W- bypass-ground, EDE with ingestion (Greifswald)

RADIUS (KM)	0.145	0.180	0.320	0.500	0.680	1.000
MAX. DOSES	3.1E+00	2.7E+00	1.6E+00	9.9E-01	6.7E-01	4.1E-01
FRACTILE 99.0	7.6E-01	7.1E-01	5.1E-01	3.5E-01	2.5E-01	1.6E-01
FRACTILE 95.0	6.3E-01	5.9E-01	4.3E-01	3.0E-01	2.1E-01	1.3E-01
FRACTILE 90.0	5.1E-01	4.7E-01	3.2E-01	2.2E-01	1.6E-01	9.8E-02
FRACTILE 50.0	2.1E-01	1.7E-01	9.1E-02	5.2E-02	3.5E-02	2.0E-02
MEAN DOSES	2.4E-01	2.2E-01	1.4E-01	8.7E-02	6.1E-02	3.7E-02

RADIUS (KM)	1.500	2.000	3.200	5.000	6.800	10.000
MAX. DOSES	3.9E-01	1.8E-01	8.9E-02	3.8E-02	5.4E-02	2.1E-02
FRACTILE 99.0	9.8E-02	5.8E-02	3.3E-02	1.7E-02	1.4E-02	9.8E-03
FRACTILE 95.0	7.6E-02	4.5E-02	2.1E-02	1.2E-02	7.6E-03	4.1E-03
FRACTILE 90.0	5.8E-02	3.8E-02	1.9E-02	7.4E-03	4.7E-03	2.3E-03
FRACTILE 50.0	1.1E-02	7.6E-03	3.8E-03	2.1E-03	1.2E-03	6.2E-04
MEAN DOSES	2.2E-02	1.4E-02	6.9E-03	3.5E-03	2.2E-03	1.2E-03

APPENDIX C -Cadarache

Doses from routine releases (CAT-I)

CAT-I-Cu-elevated, EDE with ingestion

NO.	NUCLIDE	SUM
	HTO	1.120E+14
8	AR- 41	2.000E+12
16	CR- 51	3.040E+08
20	MN- 54	1.850E+08
21	MN- 56	5.170E+09
23	FE- 55	9.160E+08
27	CO- 57	3.970E+08
29	CO- 58	5.850E+08
30	CO- 60M	4.030E+10
31	CO- 60	2.520E+09
34	NI- 63	4.600E+08
36	CU- 62	8.530E+11
37	CU- 64	1.800E+12
38	CU- 66	5.610E+11
157	TA-182	8.640E+08

RESULTS ARE CALCULATED FOR THE WHOLE DISTANCE BAND

RADIUS (KM)	.145	.210	.320	.500	.680	1.000
EDE	2.6E-06	2.0E-06	1.6E-06	1.2E-06	1.2E-06	1.2E-06

RADIUS (KM)	1.500	2.000	3.200	5.000	6.800	10.000
EDE	1.1E-06	9.3E-07	5.8E-07	3.2E-07	2.0E-07	1.1E-07

RADIUS (KM)	15.000	21.000	32.000	46.000	68.000	100.000
EDE	6.7E-08	4.7E-08	3.1E-08	2.1E-08	1.5E-08	1.0E-08

CAT-I-St-elevated, EDE with ingestion

NO.	NUCLIDE	SUM
	HTO	1.120E+14
8	AR- 41	2.000E+12
16	CR- 51	9.760E+10
20	MN- 54	1.880E+10
21	MN- 56	3.570E+11
23	FE- 55	1.150E+11
27	CO- 57	2.400E+10
28	CO- 58M	6.440E+10
29	CO- 58	3.940E+10
30	CO- 60M	2.470E+10
31	CO- 60	3.980E+09
75	MO- 99	1.850E+10
80	TC- 99M	1.620E+10

RESULTS ARE CALCULATED FOR THE WHOLE DISTANCE BAND

RADIUS (KM)	.145	.210	.320	.500	.680	1.000
EDE	2.6E-06	2.0E-06	1.6E-06	1.3E-06	1.5E-06	1.8E-06

RADIUS (KM)	1.500	2.000	3.200	5.000	6.800	10.000
EDE	1.8E-06	1.5E-06	9.5E-07	5.3E-07	3.3E-07	1.8E-07

RADIUS (KM)	15.000	21.000	32.000	46.000	68.000	100.000
EDE	1.1E-07	7.5E-08	4.9E-08	3.5E-08	2.4E-08	1.6E-08

CAT-I-W-elevated, EDE with ingestion

NO.	NUCLIDE	SUM
	HTO	1.120E+14
8	AR- 41	2.000E+12
16	CR- 51	3.040E+08
20	MN- 54	1.850E+08
21	MN- 56	5.170E+09
23	FE- 55	9.160E+08
27	CO- 57	3.970E+08
29	CO- 58	5.850E+08
31	CO- 60	6.900E+07
90	AG-110	3.230E+08
155	TA-179	1.190E+09
157	TA-182	9.790E+08
159	W -181	1.090E+11
160	W -183M	6.510E+11
161	W -185	2.290E+11
162	W -187	6.410E+11
166	RE-186	2.140E+10
167	RE-188M	6.120E+08
168	RE-188	9.010E+09

RESULTS ARE CALCULATED FOR THE WHOLE DISTANCE BAND

RADIUS (KM)	.145	.210	.320	.500	.680	1.000
EDE	2.6E-06	2.0E-06	1.6E-06	1.2E-06	1.2E-06	1.1E-06

RADIUS (KM)	1.500	2.000	3.200	5.000	6.800	10.000
EDE	1.0E-06	8.5E-07	5.3E-07	3.0E-07	1.9E-07	1.0E-07

RADIUS (KM)	15.000	21.000	32.000	46.000	68.000	100.000
EDE	6.2E-08	4.3E-08	2.8E-08	2.0E-08	1.4E-08	9.2E-09

Probabilistic potential doses from source terms of case 2 (release limits)

CAT-IV-HTO-elevated, early dose (Cadarache)

NO.	NUCLIDE	SUM
1	HTO	3.70000E+16

RADIUS (KM)	0.145	0.210	0.320	0.500	0.680	1.000
MAX. DOSES	3.2E-03	3.9E-03	5.8E-03	6.1E-03	5.8E-03	4.5E-03
FRACTILE 99.0	2.9E-03	3.8E-03	5.8E-03	6.0E-03	5.1E-03	3.6E-03
FRACTILE 95.0	1.9E-03	2.5E-03	3.4E-03	3.1E-03	2.6E-03	2.5E-03
FRACTILE 90.0	8.1E-04	2.0E-03	2.5E-03	2.2E-03	2.0E-03	1.8E-03
FRACTILE 50.0	4.2E-06	1.3E-05	1.7E-04	3.6E-04	6.5E-04	1.0E-03
MEAN DOSES	2.5E-04	4.1E-04	8.1E-04	9.2E-04	9.8E-04	1.2E-03

RADIUS (KM)	1.500	2.000	3.200	4.600	6.800	10.000
MAX. DOSES	3.3E-03	3.7E-03	3.1E-03	3.1E-03	1.6E-03	8.3E-04
FRACTILE 99.0	3.2E-03	3.7E-03	2.9E-03	2.7E-03	1.6E-03	8.3E-04
FRACTILE 95.0	3.1E-03	3.4E-03	2.5E-03	2.6E-03	9.3E-04	4.4E-04
FRACTILE 90.0	2.9E-03	3.0E-03	2.5E-03	1.9E-03	6.5E-04	3.0E-04
FRACTILE 50.0	7.1E-04	5.1E-04	2.9E-04	1.6E-04	9.1E-05	4.0E-05
MEAN DOSES	1.3E-03	1.2E-03	8.7E-04	6.5E-04	2.6E-04	1.2E-04

CAT-IV-HTO-elevated, EDE, with ingestion (Cadarache)

RADIUS (KM)	0.145	0.210	0.320	0.500	0.680	1.000
MAX. DOSES	4.6E-01	3.9E-01	2.4E-01	1.7E-01	1.3E-01	9.6E-02
FRACTILE 99.0	8.1E-02	8.3E-02	9.5E-02	7.1E-02	5.4E-02	4.6E-02
FRACTILE 95.0	2.5E-02	3.5E-02	4.5E-02	4.7E-02	4.4E-02	3.0E-02
FRACTILE 90.0	1.6E-02	1.9E-02	3.2E-02	3.2E-02	2.7E-02	1.9E-02
FRACTILE 50.0	4.9E-05	1.9E-04	2.6E-03	3.4E-03	5.5E-03	7.4E-03
MEAN DOSES	6.0E-03	7.6E-03	1.2E-02	1.3E-02	1.2E-02	1.1E-02

RADIUS (KM)	1.500	2.000	3.200	4.600	6.800	10.000
MAX. DOSES	6.1E-02	4.0E-02	2.2E-02	2.6E-02	1.2E-02	5.2E-03
FRACTILE 99.0	3.7E-02	2.8E-02	1.7E-02	1.1E-02	6.8E-03	5.2E-03
FRACTILE 95.0	2.0E-02	1.5E-02	1.1E-02	9.5E-03	4.9E-03	2.7E-03
FRACTILE 90.0	1.7E-02	1.3E-02	1.1E-02	8.3E-03	3.7E-03	2.1E-03
FRACTILE 50.0	9.1E-03	8.1E-03	4.3E-03	2.5E-03	1.4E-03	5.6E-04
MEAN DOSES	9.5E-03	7.9E-03	5.1E-03	3.6E-03	1.8E-03	8.7E-04

CAT-IV-HTO-ground, early dose (Cadarache)

NO.	NUCLIDE	SUM
1	HTO	3.70000E+15

RADIUS (KM)	0.145	0.210	0.320	0.500	0.680	1.000
MAX. DOSES	2.6E-02	2.4E-02	1.7E-02	1.2E-02	8.7E-03	5.7E-03
FRACTILE 99.0	2.6E-02	2.4E-02	1.7E-02	1.2E-02	8.7E-03	5.4E-03
FRACTILE 95.0	2.6E-02	2.3E-02	1.7E-02	1.2E-02	8.5E-03	5.4E-03
FRACTILE 90.0	2.5E-02	2.3E-02	1.7E-02	1.1E-02	8.3E-03	5.1E-03
FRACTILE 50.0	3.2E-03	2.6E-03	1.5E-03	8.3E-04	5.2E-04	2.9E-04
MEAN DOSES	9.3E-03	8.3E-03	5.6E-03	3.7E-03	2.6E-03	1.6E-03

RADIUS (KM)	1.500	2.000	3.200	4.600	6.800	10.000
MAX. DOSES	4.4E-03	2.7E-03	9.9E-04	3.7E-04	2.0E-04	7.7E-05
FRACTILE 99.0	3.4E-03	1.9E-03	6.6E-04	3.7E-04	1.8E-04	5.1E-05
FRACTILE 95.0	3.4E-03	1.8E-03	4.7E-04	3.0E-04	1.2E-04	4.1E-05
FRACTILE 90.0	3.0E-03	1.0E-03	4.3E-04	2.1E-04	7.6E-05	3.2E-05
FRACTILE 50.0	1.5E-04	1.0E-04	3.4E-05	1.7E-05	9.1E-06	4.6E-06
MEAN DOSES	9.3E-04	3.8E-04	1.3E-04	6.7E-05	2.7E-05	8.7E-06

CAT-IV-HTO-ground, EDE, with ingestion (Cadarache)

RADIUS (KM)	0.145	0.210	0.320	0.500	0.680	1.000
MAX. DOSES	1.7E-01	1.5E-01	9.2E-02	6.3E-02	4.6E-02	2.9E-02
FRACTILE 99.0	1.3E-01	1.2E-01	7.9E-02	5.1E-02	3.7E-02	2.2E-02
FRACTILE 95.0	1.1E-01	1.0E-01	7.1E-02	4.7E-02	3.3E-02	2.1E-02
FRACTILE 90.0	9.8E-02	8.9E-02	6.5E-02	4.3E-02	3.1E-02	1.9E-02
FRACTILE 50.0	4.4E-02	3.5E-02	1.7E-02	9.1E-03	5.9E-03	3.3E-03
MEAN DOSES	5.3E-02	4.7E-02	3.0E-02	1.9E-02	1.3E-02	7.8E-03

RADIUS (KM)	1.500	2.000	3.200	4.600	6.800	10.000
MAX. DOSES	2.6E-02	1.1E-02	4.5E-03	2.4E-03	1.4E-03	1.7E-03
FRACTILE 99.0	1.3E-02	9.8E-03	3.7E-03	1.8E-03	1.3E-03	3.9E-04
FRACTILE 95.0	1.3E-02	6.9E-03	3.0E-03	1.3E-03	6.8E-04	2.6E-04
FRACTILE 90.0	1.1E-02	5.9E-03	2.2E-03	1.2E-03	5.6E-04	1.8E-04
FRACTILE 50.0	1.8E-03	1.2E-03	5.8E-04	3.2E-04	1.7E-04	7.2E-05
MEAN DOSES	4.6E-03	2.4E-03	9.4E-04	4.8E-04	2.4E-04	9.5E-05

CAT-IV-HT-elevated, early dose (Cadarache)

NO.	NUCLIDE	SUM
1	HT	1.11000E+18

RADIUS (KM)	0.145	0.210	0.320	0.500	0.680	1.000
MAX. DOSES	2.3E-04	2.6E-04	4.8E-04	6.7E-04	7.4E-04	5.2E-04
FRACTILE 99.0	2.3E-04	2.5E-04	4.6E-04	6.7E-04	6.9E-04	5.0E-04
FRACTILE 95.0	1.3E-04	2.3E-04	2.8E-04	3.2E-04	3.3E-04	2.9E-04
FRACTILE 90.0	9.3E-05	1.7E-04	2.1E-04	2.4E-04	2.3E-04	1.7E-04
FRACTILE 50.0	7.9E-06	8.3E-06	1.3E-05	2.5E-05	4.4E-05	7.4E-05
MEAN DOSES	2.5E-05	3.6E-05	6.0E-05	9.0E-05	1.0E-04	9.4E-05

RADIUS (KM)	1.500	2.000	3.200	4.600	6.800	10.000
MAX. DOSES	4.6E-04	3.7E-04	2.4E-04	2.4E-04	1.2E-04	5.0E-05
FRACTILE 99.0	3.7E-04	3.5E-04	2.4E-04	2.1E-04	1.1E-04	4.9E-05
FRACTILE 95.0	3.4E-04	2.8E-04	2.0E-04	2.0E-04	1.1E-04	4.8E-05
FRACTILE 90.0	3.0E-04	2.5E-04	1.4E-04	1.3E-04	8.3E-05	4.0E-05
FRACTILE 50.0	7.6E-05	6.2E-05	3.6E-05	2.5E-05	1.4E-05	7.2E-06
MEAN DOSES	1.0E-04	9.4E-05	5.7E-05	4.8E-05	2.7E-05	1.3E-05

CAT-IV-HT-elevated, EDE, with ingestion (Cadarache)

RADIUS (KM)	0.145	0.210	0.320	0.500	0.680	1.000
MAX. DOSES	3.9E-02	5.3E-02	6.1E-02	6.7E-02	6.1E-02	5.7E-02
FRACTILE 99.0	2.7E-02	3.6E-02	6.0E-02	6.3E-02	5.2E-02	3.7E-02
FRACTILE 95.0	1.7E-02	2.3E-02	3.2E-02	3.2E-02	2.9E-02	2.7E-02
FRACTILE 90.0	7.8E-03	1.8E-02	2.0E-02	2.0E-02	1.9E-02	2.0E-02
FRACTILE 50.0	7.8E-05	1.4E-04	1.4E-03	3.7E-03	6.0E-03	9.5E-03
MEAN DOSES	2.4E-03	3.8E-03	7.7E-03	9.0E-03	9.7E-03	1.1E-02

RADIUS (KM)	1.500	2.000	3.200	4.600	6.800	10.000
MAX. DOSES	4.9E-02	3.9E-02	3.7E-02	3.3E-02	1.5E-02	9.7E-03
FRACTILE 99.0	3.4E-02	3.9E-02	2.8E-02	2.8E-02	1.5E-02	9.7E-03
FRACTILE 95.0	3.0E-02	3.4E-02	2.8E-02	2.6E-02	1.1E-02	4.0E-03
FRACTILE 90.0	3.0E-02	3.3E-02	2.7E-02	2.0E-02	7.4E-03	3.5E-03
FRACTILE 50.0	6.9E-03	4.7E-03	2.8E-03	1.7E-03	9.3E-04	4.4E-04
MEAN DOSES	1.3E-02	1.2E-02	8.6E-03	6.5E-03	2.7E-03	1.2E-03

CAT-IV-HT-ground, early dose (Cadarache)

NO.	NUCLIDE	SUM
1	HT	1.11000E+17

RADIUS (KM)	0.145	0.210	0.320	0.500	0.680	1.000
MAX. DOSES	1.1E-03	1.1E-03	9.4E-04	7.9E-04	6.8E-04	4.7E-04
FRACTILE 99.0	6.5E-04	1.1E-03	7.9E-04	7.1E-04	6.2E-04	4.2E-04
FRACTILE 95.0	6.2E-04	9.1E-04	7.8E-04	6.8E-04	5.8E-04	3.5E-04
FRACTILE 90.0	5.2E-04	8.9E-04	6.6E-04	6.2E-04	5.4E-04	3.3E-04
FRACTILE 50.0	8.3E-05	1.4E-04	8.9E-05	6.5E-05	4.9E-05	3.1E-05
MEAN DOSES	1.9E-04	2.8E-04	2.3E-04	1.8E-04	1.5E-04	9.5E-05

RADIUS (KM)	1.500	2.000	3.200	4.600	6.800	10.000
MAX. DOSES	3.8E-04	2.8E-04	9.8E-05	5.4E-05	3.0E-05	1.9E-05
FRACTILE 99.0	3.8E-04	2.2E-04	6.9E-05	3.2E-05	2.6E-05	8.9E-06
FRACTILE 95.0	3.1E-04	1.8E-04	6.9E-05	3.0E-05	1.3E-05	7.6E-06
FRACTILE 90.0	2.2E-04	1.7E-04	4.4E-05	2.8E-05	1.2E-05	7.6E-06
FRACTILE 50.0	1.9E-05	1.4E-05	6.9E-06	4.5E-06	2.5E-06	1.3E-06
MEAN DOSES	7.0E-05	4.6E-05	1.7E-05	9.6E-06	4.8E-06	2.3E-06

CAT-IV-HT-ground, EDE, with ingestion (Cadarache)

RADIUS (KM)	0.145	0.210	0.320	0.500	0.680	1.000
MAX. DOSES	3.0E-01	2.8E-01	2.1E-01	1.4E-01	1.1E-01	7.0E-02
FRACTILE 99.0	2.8E-01	2.6E-01	1.9E-01	1.3E-01	9.8E-02	6.2E-02
FRACTILE 95.0	2.8E-01	2.6E-01	1.9E-01	1.3E-01	9.5E-02	6.0E-02
FRACTILE 90.0	2.5E-01	2.3E-01	1.7E-01	1.2E-01	9.3E-02	5.9E-02
FRACTILE 50.0	3.0E-02	2.5E-02	1.4E-02	8.3E-03	5.6E-03	3.3E-03
MEAN DOSES	9.0E-02	8.2E-02	5.6E-02	3.8E-02	2.7E-02	1.7E-02

RADIUS (KM)	1.500	2.000	3.200	4.600	6.800	10.000
MAX. DOSES	4.9E-02	3.1E-02	1.2E-02	4.3E-03	3.2E-03	1.5E-03
FRACTILE 99.0	3.8E-02	2.4E-02	9.1E-03	4.3E-03	2.1E-03	6.2E-04
FRACTILE 95.0	3.7E-02	1.8E-02	5.6E-03	4.1E-03	1.6E-03	4.4E-04
FRACTILE 90.0	3.6E-02	1.3E-02	4.9E-03	3.1E-03	1.2E-03	3.4E-04
FRACTILE 50.0	1.9E-03	1.2E-03	4.6E-04	2.5E-04	1.2E-04	5.5E-05
MEAN DOSES	1.0E-02	4.3E-03	1.6E-03	8.4E-04	3.6E-04	1.1E-04

CAT-IV-Cu-elevated, early dose (Cadarache)

NO.	NUCLIDE	SUM
30	CO- 60M	1.610E+13
31	CO- 60	9.810E+11
34	NI- 63	1.840E+11
36	CU- 62	3.410E+14
37	CU- 64	7.220E+14
38	CU- 66	2.240E+14
157	TA-182	3.460E+11

RADIUS (KM)	.145	.180	.320	.460	.680	1.000
MAX. DOSES	5.3E-02	4.4E-02	2.6E-02	1.8E-02	1.2E-02	7.8E-03
FRACTILE 99.0	4.6E-03	3.9E-03	2.6E-03	2.0E-03	1.7E-03	1.4E-03
FRACTILE 95.0	4.8E-04	5.9E-04	1.1E-03	1.0E-03	8.1E-04	5.5E-04
FRACTILE 90.0	4.5E-04	5.6E-04	5.9E-04	4.7E-04	3.6E-04	3.8E-04
FRACTILE 50.0	3.7E-05	3.9E-05	1.8E-04	1.4E-04	2.0E-04	1.8E-04
MEAN DOSES	2.9E-04	2.8E-04	3.2E-04	2.8E-04	2.6E-04	2.5E-04

RADIUS (KM)	1.500	2.000	3.200	4.600	6.800	10.000
MAX. DOSES	4.4E-03	2.8E-03	1.2E-03	8.7E-04	4.2E-04	2.6E-04
FRACTILE 99.0	1.0E-03	7.9E-04	4.8E-04	4.1E-04	2.5E-04	1.3E-04
FRACTILE 95.0	5.4E-04	5.8E-04	4.4E-04	4.0E-04	1.7E-04	1.0E-04
FRACTILE 90.0	5.0E-04	4.9E-04	3.8E-04	2.9E-04	1.1E-04	5.8E-05
FRACTILE 50.0	1.2E-04	9.3E-05	4.5E-05	2.3E-05	1.2E-05	5.6E-06
MEAN DOSES	2.4E-04	2.2E-04	1.4E-04	1.0E-04	4.5E-05	2.2E-05

CAT-IV-Cu-elevated, EDE with ingestion (Cadarache)

RADIUS (KM)	.145	.180	.320	.460	.680	1.000
MAX. DOSES	1.6E+00	1.3E+00	7.9E-01	5.6E-01	3.7E-01	2.4E-01
FRACTILE 99.0	1.0E-01	1.0E-01	7.2E-02	5.5E-02	4.1E-02	3.0E-02
FRACTILE 95.0	2.8E-03	3.7E-03	7.2E-03	7.6E-03	6.2E-03	4.3E-03
FRACTILE 90.0	2.0E-03	2.7E-03	4.2E-03	3.2E-03	2.5E-03	2.3E-03
FRACTILE 50.0	4.0E-05	4.7E-05	2.3E-04	4.1E-04	8.5E-04	1.1E-03
MEAN DOSES	6.5E-03	5.7E-03	4.2E-03	3.4E-03	2.8E-03	2.5E-03

RADIUS (KM)	1.500	2.000	3.200	4.600	6.800	10.000
MAX. DOSES	1.3E-01	8.5E-02	3.9E-02	2.5E-02	1.3E-02	8.4E-03
FRACTILE 99.0	2.2E-02	1.7E-02	1.1E-02	7.6E-03	4.3E-03	2.7E-03
FRACTILE 95.0	3.9E-03	4.6E-03	3.5E-03	3.2E-03	2.0E-03	1.6E-03
FRACTILE 90.0	3.8E-03	4.2E-03	3.1E-03	2.9E-03	1.1E-03	1.0E-03
FRACTILE 50.0	8.1E-04	6.3E-04	3.2E-04	1.9E-04	1.0E-04	4.5E-05
MEAN DOSES	2.3E-03	2.0E-03	1.4E-03	9.9E-04	4.8E-04	3.0E-04

CAT-IV-Cu-ground, early dose (Cadarache)

NO.	NUCLIDE	SUM
30	CO- 60M	1.610E+12
31	CO- 60	9.810E+10
34	NI- 63	1.840E+10
36	CU- 62	3.410E+13
37	CU- 64	7.220E+13
38	CU- 66	2.240E+13
157	TA-182	3.460E+10

RADIUS (KM)	.145	.180	.320	.460	.680	1.000
MAX. DOSES	9.5E-03	8.2E-03	4.9E-03	3.2E-03	1.9E-03	9.6E-04
FRACTILE 99.0	3.8E-03	3.5E-03	2.6E-03	1.9E-03	1.3E-03	8.1E-04
FRACTILE 95.0	3.8E-03	3.5E-03	2.6E-03	1.9E-03	1.3E-03	8.1E-04
FRACTILE 90.0	3.7E-03	3.5E-03	2.5E-03	1.9E-03	1.2E-03	7.6E-04
FRACTILE 50.0	5.2E-04	4.1E-04	2.4E-04	1.5E-04	8.9E-05	5.2E-05
MEAN DOSES	1.4E-03	1.3E-03	8.7E-04	6.2E-04	4.1E-04	2.5E-04

RADIUS (KM)	1.500	2.000	3.200	4.600	6.800	10.000
MAX. DOSES	7.6E-04	4.2E-04	1.7E-04	1.1E-04	9.4E-05	1.1E-04
FRACTILE 99.0	5.2E-04	2.9E-04	1.0E-04	1.1E-04	4.0E-05	3.6E-05
FRACTILE 95.0	5.1E-04	2.8E-04	8.7E-05	5.6E-05	2.6E-05	1.4E-05
FRACTILE 90.0	4.4E-04	1.7E-04	6.9E-05	3.6E-05	1.4E-05	8.5E-06
FRACTILE 50.0	3.0E-05	1.7E-05	5.4E-06	2.6E-06	1.4E-06	7.2E-07
MEAN DOSES	1.5E-04	6.4E-05	2.4E-05	1.4E-05	6.0E-06	3.4E-06

CAT-IV-Cu-ground, EDE with ingestion (Cadarache)

RADIUS (KM)	.145	.180	.320	.460	.680	1.000
MAX. DOSES	2.4E-01	2.1E-01	1.3E-01	8.9E-02	5.3E-02	2.8E-02
FRACTILE 99.0	3.6E-02	3.2E-02	2.1E-02	1.6E-02	1.1E-02	7.4E-03
FRACTILE 95.0	3.2E-02	3.0E-02	2.1E-02	1.6E-02	1.1E-02	6.9E-03
FRACTILE 90.0	3.2E-02	3.0E-02	2.1E-02	1.5E-02	1.0E-02	6.6E-03
FRACTILE 50.0	4.1E-03	3.2E-03	1.9E-03	1.2E-03	6.6E-04	3.9E-04
MEAN DOSES	1.2E-02	1.1E-02	7.5E-03	5.4E-03	3.6E-03	2.2E-03

RADIUS (KM)	1.500	2.000	3.200	4.600	6.800	10.000
MAX. DOSES	1.5E-02	1.1E-02	4.9E-03	3.3E-03	2.9E-03	3.2E-03
FRACTILE 99.0	5.9E-03	3.3E-03	1.8E-03	1.7E-03	9.8E-04	7.8E-04
FRACTILE 95.0	4.4E-03	2.4E-03	1.3E-03	7.1E-04	5.0E-04	4.0E-04
FRACTILE 90.0	4.2E-03	1.8E-03	6.6E-04	5.0E-04	2.8E-04	2.1E-04
FRACTILE 50.0	2.3E-04	1.4E-04	4.3E-05	2.1E-05	1.0E-05	5.8E-06
MEAN DOSES	1.3E-03	6.1E-04	2.6E-04	1.7E-04	1.0E-04	7.1E-05

CAT-IV-St-elevated, early dose (Cadarache)

NO.	NUCLIDE	SUM
16	CR- 51	3.890E+13
20	MN- 54	7.450E+12
21	MN- 56	1.410E+14
23	FE- 55	4.580E+13
27	CO- 57	9.450E+12
28	CO- 58M	2.580E+13
29	CO- 58	1.550E+13
30	CO- 60M	9.860E+12
31	CO- 60	1.560E+12
75	MO- 99	7.400E+12
80	TC- 99M	6.470E+12

RADIUS (KM)	.145	.180	.320	.460	.680	1.000
MAX. DOSES	8.7E-02	7.2E-02	4.3E-02	3.0E-02	2.0E-02	1.3E-02
FRACTILE 99.0	7.4E-03	6.2E-03	4.1E-03	3.2E-03	2.7E-03	2.2E-03
FRACTILE 95.0	5.6E-04	7.1E-04	1.4E-03	1.4E-03	1.2E-03	8.3E-04
FRACTILE 90.0	4.1E-04	6.3E-04	7.8E-04	6.2E-04	4.8E-04	5.0E-04
FRACTILE 50.0	2.2E-05	2.5E-05	1.2E-04	1.1E-04	2.0E-04	2.2E-04
MEAN DOSES	4.2E-04	3.9E-04	4.0E-04	3.6E-04	3.4E-04	3.5E-04

RADIUS (KM)	1.500	2.000	3.200	4.600	6.800	10.000
MAX. DOSES	7.4E-03	4.6E-03	2.1E-03	1.4E-03	7.2E-04	4.5E-04
FRACTILE 99.0	1.7E-03	1.3E-03	7.8E-04	6.5E-04	3.9E-04	2.0E-04
FRACTILE 95.0	7.8E-04	8.9E-04	6.8E-04	6.2E-04	2.8E-04	1.5E-04
FRACTILE 90.0	7.2E-04	7.8E-04	5.9E-04	4.7E-04	1.9E-04	1.0E-04
FRACTILE 50.0	1.6E-04	1.2E-04	6.2E-05	3.6E-05	1.9E-05	8.7E-06
MEAN DOSES	3.5E-04	3.2E-04	2.2E-04	1.6E-04	7.0E-05	3.5E-05

CAT-IV-St-elevated, EDE with ingestion (Cadarache)

RESULTS ARE CALCULATED FOR THE WHOLE DISTANCE BAND

RADIUS (KM)	.145	.180	.320	.460	.680	1.000
MAX. DOSES	6.2E+00	5.2E+00	3.1E+00	2.2E+00	1.4E+00	9.1E-01
FRACTILE 99.0	1.0E-01	1.0E-01	1.0E-01	1.0E-01	1.0E-01	1.0E-01
FRACTILE 95.0	9.5E-03	1.3E-02	2.6E-02	2.7E-02	2.2E-02	1.5E-02
FRACTILE 90.0	6.9E-03	9.3E-03	1.5E-02	1.2E-02	8.7E-03	7.9E-03
FRACTILE 50.0	2.9E-05	6.3E-05	7.6E-04	1.4E-03	2.9E-03	4.1E-03
MEAN DOSES	2.5E-02	2.2E-02	1.6E-02	1.3E-02	1.0E-02	9.3E-03

RADIUS (KM)	1.500	2.000	3.200	4.600	6.800	10.000
MAX. DOSES	5.2E-01	3.3E-01	1.5E-01	9.5E-02	5.2E-02	3.3E-02
FRACTILE 99.0	8.3E-02	6.5E-02	4.5E-02	3.0E-02	1.7E-02	1.0E-02
FRACTILE 95.0	1.4E-02	1.7E-02	1.3E-02	1.2E-02	7.4E-03	6.2E-03
FRACTILE 90.0	1.4E-02	1.5E-02	1.1E-02	1.1E-02	4.3E-03	3.9E-03
FRACTILE 50.0	2.9E-03	2.2E-03	1.1E-03	7.1E-04	3.7E-04	1.6E-04
MEAN DOSES	8.5E-03	7.5E-03	5.2E-03	3.7E-03	1.8E-03	1.1E-03

CAT-IV-St-ground, early dose (Cadarache)

NO.	NUCLIDE	SUM
16	CR- 51	3.890E+12
20	MN- 54	7.450E+11
21	MN- 56	1.410E+13
23	FE- 55	4.580E+12
27	CO- 57	9.450E+11
28	CO- 58M	2.580E+12
29	CO- 58	1.550E+12
30	CO- 60M	9.860E+11
31	CO- 60	1.560E+11
75	MO- 99	7.400E+11
80	TC- 99M	6.470E+11

RADIUS (KM)	.145	.180	.320	.460	.680	1.000
MAX. DOSES	1.5E-02	1.3E-02	8.0E-03	5.3E-03	3.1E-03	1.6E-03
FRACTILE 99.0	5.6E-03	5.2E-03	3.8E-03	2.8E-03	2.0E-03	1.3E-03
FRACTILE 95.0	5.6E-03	5.2E-03	3.8E-03	2.8E-03	1.9E-03	1.2E-03
FRACTILE 90.0	5.5E-03	5.1E-03	3.7E-03	2.8E-03	1.9E-03	1.2E-03
FRACTILE 50.0	7.2E-04	5.8E-04	3.4E-04	2.2E-04	1.3E-04	7.2E-05
MEAN DOSES	2.1E-03	1.9E-03	1.3E-03	9.2E-04	6.1E-04	3.8E-04

RADIUS (KM)	1.500	2.000	3.200	4.600	6.800	10.000
MAX. DOSES	1.2E-03	6.5E-04	2.8E-04	1.8E-04	1.6E-04	1.9E-04
FRACTILE 99.0	8.1E-04	4.5E-04	1.7E-04	1.8E-04	6.5E-05	5.9E-05
FRACTILE 95.0	7.9E-04	4.4E-04	1.4E-04	8.7E-05	4.6E-05	2.6E-05
FRACTILE 90.0	6.9E-04	2.6E-04	1.1E-04	5.6E-05	2.3E-05	1.4E-05
FRACTILE 50.0	4.1E-05	2.7E-05	8.1E-06	3.8E-06	2.0E-06	1.1E-06
MEAN DOSES	2.3E-04	1.0E-04	3.7E-05	2.2E-05	9.8E-06	5.7E-06

CAT-IV-St-ground, EDE with ingestion (Cadarache)

RADIUS (KM)	.145	.180	.320	.460	.680	1.000
MAX. DOSES	9.3E-01	8.1E-01	5.1E-01	3.4E-01	2.1E-01	1.1E-01
FRACTILE 99.0	1.0E-01	1.0E-01	8.1E-02	6.2E-02	4.2E-02	2.8E-02
FRACTILE 95.0	1.0E-01	1.0E-01	7.8E-02	5.8E-02	4.0E-02	2.5E-02
FRACTILE 90.0	1.0E-01	1.0E-01	7.8E-02	5.8E-02	3.8E-02	2.4E-02
FRACTILE 50.0	1.5E-02	1.2E-02	6.8E-03	4.3E-03	2.4E-03	1.4E-03
MEAN DOSES	4.5E-02	4.1E-02	2.8E-02	2.0E-02	1.3E-02	8.2E-03

RADIUS (KM)	1.500	2.000	3.200	4.600	6.800	10.000
MAX. DOSES	5.8E-02	4.1E-02	1.9E-02	1.3E-02	1.1E-02	1.2E-02
FRACTILE 99.0	2.2E-02	1.3E-02	6.9E-03	6.6E-03	3.8E-03	3.0E-03
FRACTILE 95.0	1.6E-02	8.7E-03	5.1E-03	2.7E-03	1.9E-03	1.6E-03
FRACTILE 90.0	1.5E-02	6.6E-03	2.4E-03	1.8E-03	1.1E-03	8.3E-04
FRACTILE 50.0	8.7E-04	5.1E-04	1.5E-04	7.9E-05	3.8E-05	2.1E-05
MEAN DOSES	5.0E-03	2.3E-03	9.7E-04	6.5E-04	3.8E-04	2.7E-04

CAT-IV-W-elevated, early dose (Cadarache)

NO.	NUCLIDE	SUM
90	AG-110	1.290E+11
155	TA-179	4.750E+11
157	TA-182	3.920E+11
159	W -181	4.340E+13
160	W -183M	2.600E+14
161	W -185	9.180E+13
162	W -187	2.560E+14
166	RE-186	8.570E+12
167	RE-188M	2.450E+11
168	RE-188	3.600E+12

RADIUS (KM)	.145	.180	.320	.460	.680	1.000
MAX. DOSES	7.6E-02	6.3E-02	3.8E-02	2.6E-02	1.8E-02	1.1E-02
FRACTILE 99.0	6.5E-03	5.5E-03	3.5E-03	2.7E-03	2.1E-03	1.6E-03
FRACTILE 95.0	2.3E-04	2.9E-04	5.8E-04	5.9E-04	4.8E-04	3.4E-04
FRACTILE 90.0	1.7E-04	2.6E-04	3.2E-04	2.5E-04	1.9E-04	2.0E-04
FRACTILE 50.0	1.7E-05	1.7E-05	5.2E-05	4.7E-05	8.3E-05	9.1E-05
MEAN DOSES	3.3E-04	3.0E-04	2.5E-04	2.1E-04	1.8E-04	1.7E-04

RADIUS (KM)	1.500	2.000	3.200	4.600	6.800	10.000
MAX. DOSES	6.4E-03	4.0E-03	1.8E-03	1.2E-03	6.2E-04	3.9E-04
FRACTILE 99.0	1.1E-03	8.9E-04	5.9E-04	3.7E-04	2.2E-04	1.4E-04
FRACTILE 95.0	3.2E-04	3.7E-04	2.8E-04	2.6E-04	1.7E-04	8.7E-05
FRACTILE 90.0	3.1E-04	3.3E-04	2.5E-04	2.3E-04	8.7E-05	5.5E-05
FRACTILE 50.0	6.5E-05	5.0E-05	2.6E-05	1.5E-05	8.3E-06	3.7E-06
MEAN DOSES	1.6E-04	1.5E-04	1.0E-04	7.3E-05	3.4E-05	1.9E-05

CAT-IV-W-elevated, EDE with ingestion (Cadarache)

RESULTS ARE CALCULATED FOR THE WHOLE DISTANCE BAND

RADIUS (KM)	.145	.180	.320	.460	.680	1.000
MAX. DOSES	1.3E+00	1.0E+00	6.2E-01	4.4E-01	2.9E-01	1.8E-01
FRACTILE 99.0	1.0E-01	8.9E-02	5.6E-02	4.3E-02	3.2E-02	2.4E-02
FRACTILE 95.0	1.9E-03	2.7E-03	5.2E-03	5.6E-03	4.6E-03	3.2E-03
FRACTILE 90.0	1.4E-03	1.9E-03	3.0E-03	2.4E-03	1.8E-03	1.7E-03
FRACTILE 50.0	1.8E-05	2.6E-05	1.6E-04	2.8E-04	6.0E-04	8.3E-04
MEAN DOSES	5.1E-03	4.4E-03	3.2E-03	2.6E-03	2.1E-03	1.9E-03

RADIUS (KM)	1.500	2.000	3.200	4.600	6.800	10.000
MAX. DOSES	1.1E-01	6.6E-02	3.1E-02	1.9E-02	1.0E-02	6.6E-03
FRACTILE 99.0	1.7E-02	1.3E-02	9.1E-03	5.9E-03	3.4E-03	2.1E-03
FRACTILE 95.0	2.9E-03	3.4E-03	2.6E-03	2.4E-03	1.5E-03	1.3E-03
FRACTILE 90.0	2.8E-03	3.1E-03	2.3E-03	2.2E-03	8.7E-04	8.1E-04
FRACTILE 50.0	5.9E-04	4.6E-04	2.3E-04	1.4E-04	7.6E-05	3.3E-05
MEAN DOSES	1.7E-03	1.5E-03	1.1E-03	7.5E-04	3.6E-04	2.3E-04

CAT-IV-W-ground, early dose (Cadarache)

NO.	NUCLIDE	SUM
90	AG-110	1.290E+10
155	TA-179	4.750E+10
157	TA-182	3.920E+10
159	W -181	4.340E+12
160	W -183M	2.600E+13
161	W -185	9.180E+12
162	W -187	2.560E+13
166	RE-186	8.570E+11
167	RE-188M	2.450E+10
168	RE-188	3.600E+11

RESULTS ARE CALCULATED FOR THE WHOLE DISTANCE BAND

RADIUS (KM)	.145	.180	.320	.460	.680	1.000
MAX. DOSES	1.2E-02	1.0E-02	6.4E-03	4.3E-03	2.6E-03	1.4E-03
FRACTILE 99.0	2.3E-03	2.1E-03	1.5E-03	1.1E-03	8.1E-04	5.2E-04
FRACTILE 95.0	2.2E-03	2.1E-03	1.5E-03	1.1E-03	7.9E-04	5.0E-04
FRACTILE 90.0	2.2E-03	2.1E-03	1.5E-03	1.1E-03	7.6E-04	4.8E-04
FRACTILE 50.0	3.0E-04	2.3E-04	1.3E-04	8.9E-05	5.1E-05	3.0E-05
MEAN DOSES	8.6E-04	7.7E-04	5.3E-04	3.8E-04	2.6E-04	1.6E-04

RADIUS (KM)	1.500	2.000	3.200	4.600	6.800	10.000
MAX. DOSES	7.1E-04	5.1E-04	2.3E-04	1.6E-04	1.3E-04	1.5E-04
FRACTILE 99.0	3.6E-04	1.9E-04	1.1E-04	1.0E-04	4.6E-05	4.1E-05
FRACTILE 95.0	3.3E-04	1.8E-04	6.9E-05	3.8E-05	2.6E-05	1.8E-05
FRACTILE 90.0	3.0E-04	1.1E-04	5.0E-05	2.7E-05	1.4E-05	1.0E-05
FRACTILE 50.0	1.7E-05	1.1E-05	3.5E-06	1.7E-06	8.7E-07	4.8E-07
MEAN DOSES	9.8E-05	4.4E-05	1.8E-05	1.1E-05	5.7E-06	3.7E-06

CAT-IV-W-ground, EDE with ingestion (Cadarache)

RESULTS ARE CALCULATED FOR THE WHOLE DISTANCE BAND

RADIUS (KM)	.145	.180	.320	.460	.680	1.000
MAX. DOSES	1.9E-01	1.7E-01	1.0E-01	7.0E-02	4.2E-02	2.2E-02
FRACTILE 99.0	2.8E-02	2.5E-02	1.7E-02	1.3E-02	8.5E-03	5.8E-03
FRACTILE 95.0	2.3E-02	2.2E-02	1.6E-02	1.2E-02	7.9E-03	5.1E-03
FRACTILE 90.0	2.3E-02	2.2E-02	1.6E-02	1.2E-02	7.8E-03	4.9E-03
FRACTILE 50.0	3.0E-03	2.4E-03	1.4E-03	8.7E-04	4.9E-04	2.8E-04
MEAN DOSES	9.2E-03	8.3E-03	5.6E-03	4.1E-03	2.7E-03	1.7E-03

RADIUS (KM)	1.500	2.000	3.200	4.600	6.800	10.000
MAX. DOSES	1.2E-02	8.3E-03	3.9E-03	2.6E-03	2.3E-03	2.5E-03
FRACTILE 99.0	4.5E-03	2.6E-03	1.4E-03	1.3E-03	7.6E-04	6.0E-04
FRACTILE 95.0	3.2E-03	1.8E-03	1.0E-03	5.5E-04	3.9E-04	3.2E-04
FRACTILE 90.0	3.2E-03	1.3E-03	4.9E-04	3.7E-04	2.2E-04	1.7E-04
FRACTILE 50.0	1.8E-04	1.0E-04	3.2E-05	1.6E-05	7.8E-06	4.4E-06
MEAN DOSES	1.0E-03	4.6E-04	2.0E-04	1.3E-04	7.7E-05	5.5E-05

CAT-IV-ACP-elevated, early dose (Cadarache)

NO.	NUCLIDE	SUM
16	CR- 51	1.270E+12
20	MN- 54	7.700E+11
23	FE- 55	3.820E+12
27	CO- 57	1.650E+12
29	CO- 58	2.440E+12
31	CO- 60	2.870E+11

RADIUS (KM)	.145	.180	.320	.460	.680	1.000
MAX. DOSES	1.0E-02	8.4E-03	5.0E-03	3.5E-03	2.4E-03	1.5E-03
FRACTILE 99.0	8.5E-04	7.2E-04	4.6E-04	3.7E-04	3.2E-04	2.6E-04
FRACTILE 95.0	5.9E-05	8.1E-05	1.6E-04	1.7E-04	1.4E-04	9.5E-05
FRACTILE 90.0	4.3E-05	5.8E-05	9.1E-05	7.2E-05	5.5E-05	5.0E-05
FRACTILE 50.0	9.5E-07	9.5E-07	4.8E-06	8.7E-06	1.8E-05	2.5E-05
MEAN DOSES	4.6E-05	4.3E-05	4.2E-05	3.9E-05	3.6E-05	3.8E-05

RADIUS (KM)	1.500	2.000	3.200	4.600	6.800	10.000
MAX. DOSES	8.8E-04	5.5E-04	2.5E-04	1.7E-04	8.9E-05	5.5E-05
FRACTILE 99.0	1.9E-04	1.5E-04	9.3E-05	7.6E-05	4.7E-05	2.5E-05
FRACTILE 95.0	8.7E-05	1.0E-04	8.1E-05	7.2E-05	3.1E-05	1.9E-05
FRACTILE 90.0	8.3E-05	8.7E-05	6.9E-05	5.5E-05	2.3E-05	1.2E-05
FRACTILE 50.0	1.8E-05	1.4E-05	7.2E-06	4.1E-06	2.3E-06	1.0E-06
MEAN DOSES	4.0E-05	3.7E-05	2.6E-05	1.9E-05	8.3E-06	4.3E-06

CAT-IV-St-elevated, EDE with ingestion (Cadarache)

RADIUS (KM)	.145	.180	.320	.460	.680	1.000
MAX. DOSES	8.6E-01	7.1E-01	4.2E-01	3.0E-01	2.0E-01	1.2E-01
FRACTILE 99.0	7.2E-02	6.0E-02	3.8E-02	2.9E-02	2.2E-02	1.6E-02
FRACTILE 95.0	1.3E-03	1.8E-03	3.5E-03	3.7E-03	3.0E-03	2.1E-03
FRACTILE 90.0	9.3E-04	1.3E-03	2.0E-03	1.6E-03	1.2E-03	1.1E-03
FRACTILE 50.0	1.6E-06	7.2E-06	1.0E-04	1.9E-04	3.8E-04	5.5E-04
MEAN DOSES	3.4E-03	3.0E-03	2.2E-03	1.8E-03	1.4E-03	1.3E-03

RADIUS (KM)	1.500	2.000	3.200	4.600	6.800	10.000
MAX. DOSES	7.2E-02	4.5E-02	2.1E-02	1.3E-02	7.1E-03	4.5E-03
FRACTILE 99.0	1.1E-02	8.9E-03	6.2E-03	4.0E-03	2.3E-03	1.4E-03
FRACTILE 95.0	1.9E-03	2.2E-03	1.8E-03	1.6E-03	1.0E-03	8.5E-04
FRACTILE 90.0	1.9E-03	2.0E-03	1.5E-03	1.4E-03	5.8E-04	5.4E-04
FRACTILE 50.0	3.9E-04	3.1E-04	1.6E-04	9.5E-05	5.1E-05	2.2E-05
MEAN DOSES	1.2E-03	1.0E-03	7.1E-04	5.0E-04	2.4E-04	1.6E-04

CAT-IV-ACP-ground, early dose (Cadarache)

NO.	NUCLIDE	SUM
16	CR- 51	1.270E+11
20	MN- 54	7.700E+10
23	FE- 55	3.820E+11
27	CO- 57	1.650E+11
29	CO- 58	2.440E+11
31	CO- 60	2.870E+10

RADIUS (KM)	.145	.180	.320	.460	.680	1.000
MAX. DOSES	1.8E-03	1.6E-03	9.6E-04	6.3E-04	3.7E-04	1.9E-04
FRACTILE 99.0	7.2E-04	6.6E-04	4.8E-04	3.5E-04	2.5E-04	1.5E-04
FRACTILE 95.0	7.1E-04	6.6E-04	4.8E-04	3.5E-04	2.4E-04	1.5E-04
FRACTILE 90.0	7.1E-04	6.6E-04	4.8E-04	3.5E-04	2.3E-04	1.5E-04
FRACTILE 50.0	8.9E-05	7.2E-05	4.2E-05	2.6E-05	1.5E-05	8.5E-06
MEAN DOSES	2.6E-04	2.4E-04	1.6E-04	1.2E-04	7.6E-05	4.7E-05

RADIUS (KM)	1.500	2.000	3.200	4.600	6.800	10.000
MAX. DOSES	1.5E-04	8.1E-05	3.5E-05	2.2E-05	2.0E-05	2.3E-05
FRACTILE 99.0	1.0E-04	5.6E-05	2.0E-05	2.2E-05	8.3E-06	6.9E-06
FRACTILE 95.0	9.8E-05	5.5E-05	1.7E-05	1.1E-05	6.3E-06	3.5E-06
FRACTILE 90.0	8.5E-05	3.2E-05	1.3E-05	6.9E-06	3.0E-06	1.7E-06
FRACTILE 50.0	4.8E-06	3.2E-06	9.3E-07	5.0E-07	2.3E-07	1.3E-07
MEAN DOSES	2.8E-05	1.2E-05	4.6E-06	2.7E-06	1.2E-06	7.2E-07

CAT-IV-ACP-ground, EDE with ingestion (Cadarache)

RADIUS (KM)	.145	.180	.320	.460	.680	1.000
MAX. DOSES	1.3E-01	1.1E-01	7.0E-02	4.7E-02	2.8E-02	1.5E-02
FRACTILE 99.0	1.9E-02	1.7E-02	1.1E-02	8.5E-03	5.8E-03	3.8E-03
FRACTILE 95.0	1.6E-02	1.5E-02	1.1E-02	7.9E-03	5.4E-03	3.5E-03
FRACTILE 90.0	1.6E-02	1.4E-02	1.0E-02	7.8E-03	5.2E-03	3.3E-03
FRACTILE 50.0	2.0E-03	1.6E-03	9.3E-04	5.8E-04	3.3E-04	1.9E-04
MEAN DOSES	6.2E-03	5.6E-03	3.8E-03	2.7E-03	1.8E-03	1.1E-03

RADIUS (KM)	1.500	2.000	3.200	4.600	6.800	10.000
MAX. DOSES	8.0E-03	5.6E-03	2.6E-03	1.8E-03	1.5E-03	1.7E-03
FRACTILE 99.0	3.0E-03	1.7E-03	9.5E-04	9.1E-04	5.1E-04	4.1E-04
FRACTILE 95.0	2.2E-03	1.2E-03	6.9E-04	3.7E-04	2.6E-04	2.1E-04
FRACTILE 90.0	2.1E-03	8.9E-04	3.3E-04	2.5E-04	1.5E-04	1.1E-04
FRACTILE 50.0	1.2E-04	6.9E-05	2.1E-05	1.1E-05	5.1E-06	2.9E-06
MEAN DOSES	6.8E-04	3.1E-04	1.3E-04	8.9E-05	5.2E-05	3.7E-05

Probabilistic potential doses from source terms of case 3 (CAT-IV-bypass)

CAT-IV-bypass-Cu-elevated, early dose (Cadarache)

NO.	NUCLIDE	SUM
	HTO	0.85100E+16
16	CR- 51	0.38000E+10
20	MN- 54	0.23100E+10
21	MN- 56	0.64600E+11
23	FE- 55	0.11500E+11
27	CO- 57	0.49600E+10
29	CO- 58	0.53600E+11
30	CO- 60M	0.88900E+12
31	CO- 60	0.54800E+11
34	NI- 63	0.10100E+11
36	CU- 62	0.18800E+14
37	CU- 64	0.39700E+14
38	CU- 66	0.12300E+14
157	TA-182	0.19000E+11

RADIUS (KM)	0.145	0.180	0.320	0.500	0.680	1.000
MAX. DOSES	3.4E-03	2.9E-03	1.9E-03	1.7E-03	1.6E-03	1.2E-03
FRACTILE 99.0	6.9E-04	9.5E-04	1.4E-03	1.4E-03	1.2E-03	9.3E-04
FRACTILE 95.0	4.5E-04	6.0E-04	8.1E-04	7.4E-04	6.5E-04	6.3E-04
FRACTILE 90.0	2.2E-04	5.0E-04	6.0E-04	5.6E-04	4.8E-04	4.4E-04
FRACTILE 50.0	3.1E-06	4.5E-06	4.3E-05	1.0E-04	1.5E-04	2.4E-04
MEAN DOSES	7.6E-05	1.1E-04	2.0E-04	2.3E-04	2.4E-04	2.8E-04

RADIUS (KM)	1.500	2.000	3.200	5.000	6.800	10.000
MAX. DOSES	8.5E-04	8.8E-04	7.3E-04	7.3E-04	3.9E-04	2.0E-04
FRACTILE 99.0	7.6E-04	8.8E-04	6.9E-04	6.3E-04	3.9E-04	2.0E-04
FRACTILE 95.0	7.4E-04	8.1E-04	6.0E-04	6.0E-04	2.2E-04	1.0E-04
FRACTILE 90.0	7.2E-04	7.2E-04	5.9E-04	4.5E-04	1.5E-04	7.2E-05
FRACTILE 50.0	1.8E-04	1.2E-04	7.1E-05	3.9E-05	2.2E-05	9.5E-06
MEAN DOSES	3.1E-04	3.0E-04	2.1E-04	1.5E-04	6.3E-05	2.8E-05

CAT-IV-bypass-Cu-elevated, EDE with ingestion (Cadarache)

RADIUS (KM)	0.145	0.180	0.320	0.500	0.680	1.000
MAX. DOSES	2.0E-01	1.7E-01	1.0E-01	6.9E-02	5.2E-02	3.6E-02
FRACTILE 99.0	2.7E-02	2.2E-02	2.2E-02	1.6E-02	1.3E-02	1.1E-02
FRACTILE 95.0	6.0E-03	8.3E-03	1.1E-02	1.2E-02	1.0E-02	7.4E-03
FRACTILE 90.0	3.9E-03	5.1E-03	7.4E-03	7.4E-03	6.3E-03	4.5E-03
FRACTILE 50.0	1.3E-05	4.5E-05	6.3E-04	9.1E-04	1.3E-03	1.9E-03
MEAN DOSES	1.8E-03	2.1E-03	3.1E-03	3.2E-03	3.0E-03	2.7E-03

RADIUS (KM)	1.500	2.000	3.200	5.000	6.800	10.000
MAX. DOSES	2.2E-02	1.4E-02	6.8E-03	6.4E-03	3.5E-03	1.5E-03
FRACTILE 99.0	9.1E-03	6.9E-03	4.1E-03	2.8E-03	1.7E-03	1.3E-03
FRACTILE 95.0	4.7E-03	4.0E-03	2.9E-03	2.3E-03	1.2E-03	6.3E-04
FRACTILE 90.0	4.3E-03	3.3E-03	2.7E-03	2.2E-03	9.5E-04	5.1E-04
FRACTILE 50.0	2.3E-03	1.9E-03	1.0E-03	5.9E-04	3.2E-04	1.3E-04
MEAN DOSES	2.3E-03	2.0E-03	1.3E-03	8.7E-04	4.4E-04	2.1E-04

CAT-IV-bypass-St-elevated, early dose (Cadarache)

NO.	NUCLIDE	SUM
	HTO	0.85100E+16
16	CR- 51	0.21400E+13
20	MN- 54	0.41200E+12
21	MN- 56	0.78100E+13
23	FE- 55	0.25300E+13
27	CO- 57	0.52500E+12
28	CO- 58M	0.14200E+13
29	CO- 58	0.86200E+12
30	CO- 60M	0.54200E+12
31	CO- 60	0.86900E+11
75	MO- 99	0.40700E+12
80	TC- 99M	0.35600E+12

RADIUS (KM)	0.145	0.180	0.320	0.500	0.680	1.000
MAX. DOSES	5.2E-03	4.4E-03	2.7E-03	2.2E-03	1.9E-03	1.5E-03
FRACTILE 99.0	7.1E-04	9.5E-04	1.4E-03	1.5E-03	1.2E-03	9.5E-04
FRACTILE 95.0	4.5E-04	6.0E-04	8.3E-04	7.4E-04	7.2E-04	6.5E-04
FRACTILE 90.0	2.4E-04	5.0E-04	6.0E-04	5.8E-04	4.9E-04	4.4E-04
FRACTILE 50.0	2.0E-06	4.7E-06	4.3E-05	1.0E-04	1.6E-04	2.5E-04
MEAN DOSES	8.2E-05	1.2E-04	2.1E-04	2.3E-04	2.5E-04	2.9E-04

RADIUS (KM)	1.500	2.000	3.200	5.000	6.800	10.000
MAX. DOSES	9.4E-04	9.0E-04	7.5E-04	7.3E-04	4.0E-04	2.0E-04
FRACTILE 99.0	7.8E-04	9.0E-04	7.1E-04	6.3E-04	4.0E-04	2.0E-04
FRACTILE 95.0	7.6E-04	8.1E-04	6.2E-04	6.2E-04	2.3E-04	1.1E-04
FRACTILE 90.0	7.4E-04	7.4E-04	6.0E-04	4.6E-04	1.6E-04	7.4E-05
FRACTILE 50.0	1.8E-04	1.2E-04	7.2E-05	3.9E-05	2.2E-05	9.8E-06
MEAN DOSES	3.2E-04	3.0E-04	2.1E-04	1.6E-04	6.5E-05	2.9E-05

CAT-IV-bypass-St-elevated, EDE with ingestion (Cadarache)

RADIUS (KM)	0.145	0.180	0.320	0.500	0.680	1.000
MAX. DOSES	4.5E-01	3.8E-01	2.3E-01	1.5E-01	1.1E-01	7.3E-02
FRACTILE 99.0	4.8E-02	4.2E-02	2.8E-02	2.2E-02	1.9E-02	1.5E-02
FRACTILE 95.0	6.3E-03	8.7E-03	1.3E-02	1.3E-02	1.2E-02	7.9E-03
FRACTILE 90.0	4.2E-03	5.6E-03	7.9E-03	7.8E-03	6.6E-03	4.7E-03
FRACTILE 50.0	1.2E-05	4.6E-05	6.6E-04	1.0E-03	1.4E-03	2.0E-03
MEAN DOSES	2.8E-03	3.0E-03	3.7E-03	3.7E-03	3.4E-03	3.1E-03

RADIUS (KM)	1.500	2.000	3.200	5.000	6.800	10.000
MAX. DOSES	4.3E-02	2.7E-02	1.3E-02	9.3E-03	5.6E-03	2.4E-03
FRACTILE 99.0	1.1E-02	9.1E-03	5.5E-03	3.3E-03	2.2E-03	1.4E-03
FRACTILE 95.0	5.1E-03	4.5E-03	3.4E-03	2.6E-03	1.9E-03	7.9E-04
FRACTILE 90.0	4.4E-03	3.9E-03	3.1E-03	2.4E-03	1.1E-03	5.9E-04
FRACTILE 50.0	2.7E-03	1.9E-03	1.0E-03	6.0E-04	3.4E-04	1.5E-04
MEAN DOSES	2.7E-03	2.3E-03	1.5E-03	9.8E-04	5.1E-04	2.5E-04

CAT-IV-bypass-W-elevated, early dose (Cadarache)

NO.	NUCLIDE	SUM
	HTO	0.85100E+16
16	CR- 51	0.38000E+10
20	MN- 54	0.23100E+10
21	MN- 56	0.64600E+11
23	FE- 55	0.11500E+11
27	CO- 57	0.49600E+10
29	CO- 58	0.73100E+10
31	CO- 60	0.86200E+09
90	AG-110	0.71000E+10
155	TA-179	0.26100E+11
157	TA-182	0.21500E+11
159	W -181	0.23900E+13
160	W -183M	0.14300E+14
161	W -185	0.50500E+13
162	W -187	0.14100E+14
166	RE-186	0.47200E+12
167	RE-188M	0.13500E+11
168	RE-188	0.19800E+12

RADIUS (KM)	0.145	0.180	0.320	0.500	0.680	1.000
MAX. DOSES	4.6E-03	3.9E-03	2.4E-03	2.0E-03	1.8E-03	1.4E-03
FRACTILE 99.0	6.9E-04	9.3E-04	1.3E-03	1.4E-03	1.2E-03	9.3E-04
FRACTILE 95.0	4.4E-04	5.9E-04	8.1E-04	7.2E-04	6.9E-04	6.3E-04
FRACTILE 90.0	2.2E-04	4.8E-04	5.9E-04	5.6E-04	4.7E-04	4.3E-04
FRACTILE 50.0	2.2E-06	4.0E-06	4.1E-05	9.5E-05	1.5E-04	2.4E-04
MEAN DOSES	7.7E-05	1.1E-04	2.0E-04	2.3E-04	2.4E-04	2.8E-04

RADIUS (KM)	1.500	2.000	3.200	5.000	6.800	10.000
MAX. DOSES	9.0E-04	8.7E-04	7.2E-04	7.2E-04	3.8E-04	2.0E-04
FRACTILE 99.0	7.4E-04	8.7E-04	6.8E-04	6.3E-04	3.8E-04	2.0E-04
FRACTILE 95.0	7.2E-04	7.9E-04	5.9E-04	6.0E-04	2.2E-04	1.0E-04
FRACTILE 90.0	7.1E-04	7.2E-04	5.8E-04	4.5E-04	1.5E-04	7.1E-05
FRACTILE 50.0	1.7E-04	1.2E-04	7.1E-05	3.8E-05	2.1E-05	9.3E-06
MEAN DOSES	3.1E-04	2.9E-04	2.1E-04	1.5E-04	6.3E-05	2.8E-05

CAT-IV-bypass-W-elevated, EDE with ingestion (Cadarache)

RADIUS (KM)	0.145	0.180	0.320	0.500	0.680	1.000
MAX. DOSES	1.8E-01	1.5E-01	9.1E-02	6.3E-02	4.8E-02	3.3E-02
FRACTILE 99.0	2.5E-02	2.1E-02	2.2E-02	1.6E-02	1.3E-02	1.1E-02
FRACTILE 95.0	5.9E-03	8.1E-03	1.1E-02	1.2E-02	1.0E-02	7.2E-03
FRACTILE 90.0	3.8E-03	4.8E-03	7.4E-03	7.4E-03	6.3E-03	4.5E-03
FRACTILE 50.0	1.1E-05	4.4E-05	6.2E-04	8.9E-04	1.3E-03	1.8E-03
MEAN DOSES	1.7E-03	2.0E-03	3.0E-03	3.2E-03	3.0E-03	2.6E-03

RADIUS (KM)	1.500	2.000	3.200	5.000	6.800	10.000
MAX. DOSES	2.0E-02	1.3E-02	6.3E-03	6.3E-03	3.3E-03	1.4E-03
FRACTILE 99.0	9.1E-03	6.9E-03	4.1E-03	2.8E-03	1.6E-03	1.3E-03
FRACTILE 95.0	4.7E-03	3.8E-03	2.8E-03	2.3E-03	1.2E-03	6.3E-04
FRACTILE 90.0	4.3E-03	3.2E-03	2.6E-03	2.1E-03	9.5E-04	5.0E-04
FRACTILE 50.0	2.2E-03	1.9E-03	1.0E-03	5.8E-04	3.2E-04	1.3E-04
MEAN DOSES	2.3E-03	1.9E-03	1.3E-03	8.6E-04	4.3E-04	2.1E-04

Probabilistic potential doses from source terms of case 4 (CAT-V-bypass)

CAT-V-Cu- bypass-ground, early dose (Cadarache)

NO.	NUCLIDE	SUM
	HTO	0.15540E+17
16	CR- 51	0.46100E+10
20	MN- 54	0.28000E+10
21	MN- 56	0.78400E+11
23	FE- 55	0.13900E+11
27	CO- 57	0.60200E+10
29	CO- 58	0.88700E+10
30	CO- 60M	0.32700E+14
31	CO- 60	0.19900E+13
34	NI- 63	0.37400E+12
36	CU- 62	0.69200E+15
37	CU- 64	0.14600E+16
38	CU- 66	0.45500E+15
157	TA-182	0.70200E+12

RADIUS (KM)	0.145	0.180	0.320	0.500	0.680	1.000
MAX. DOSES	2.6E-01	2.2E-01	1.3E-01	8.5E-02	6.3E-02	4.2E-02
FRACTILE 99.0	1.0E-01	1.0E-01	1.0E-01	8.5E-02	6.3E-02	3.9E-02
FRACTILE 95.0	1.0E-01	1.0E-01	1.0E-01	8.5E-02	6.2E-02	3.9E-02
FRACTILE 90.0	1.0E-01	1.0E-01	1.0E-01	8.3E-02	6.0E-02	3.7E-02
FRACTILE 50.0	2.4E-02	1.9E-02	1.1E-02	6.6E-03	4.5E-03	2.6E-03
MEAN DOSES	7.1E-02	6.1E-02	4.1E-02	2.7E-02	1.9E-02	1.2E-02

RADIUS (KM)	1.500	2.000	3.200	5.000	6.800	10.000
MAX. DOSES	3.2E-02	2.0E-02	7.5E-03	3.9E-03	2.2E-03	2.6E-03
FRACTILE 99.0	2.5E-02	1.4E-02	4.9E-03	2.6E-03	1.1E-03	7.4E-04
FRACTILE 95.0	2.5E-02	1.3E-02	3.5E-03	1.8E-03	8.3E-04	3.0E-04
FRACTILE 90.0	2.1E-02	7.8E-03	3.2E-03	1.3E-03	5.9E-04	2.7E-04
FRACTILE 50.0	1.5E-03	8.3E-04	2.5E-04	1.2E-04	6.9E-05	3.4E-05
MEAN DOSES	7.0E-03	2.9E-03	1.0E-03	4.7E-04	2.2E-04	9.5E-05

CAT-V-Cu- bypass-ground, early dose (Cadarache)

RADIUS (KM)	0.145	0.180	0.320	0.500	0.680	1.000
MAX. DOSES	5.6E+00	4.9E+00	3.0E+00	1.8E+00	1.2E+00	6.4E-01
FRACTILE 99.0	1.2E+00	1.0E+00	7.4E-01	5.1E-01	3.6E-01	2.3E-01
FRACTILE 95.0	1.1E+00	1.0E+00	7.1E-01	4.9E-01	3.5E-01	2.3E-01
FRACTILE 90.0	1.0E+00	9.5E-01	6.8E-01	4.8E-01	3.5E-01	2.2E-01
FRACTILE 50.0	2.4E-01	1.9E-01	1.1E-01	6.2E-02	3.9E-02	2.2E-02
MEAN DOSES	4.9E-01	4.2E-01	2.8E-01	1.8E-01	1.3E-01	7.9E-02

RADIUS (KM)	1.500	2.000	3.200	5.000	6.800	10.000
MAX. DOSES	3.4E-01	2.6E-01	1.2E-01	1.0E-01	6.4E-02	7.2E-02
FRACTILE 99.0	1.7E-01	9.1E-02	4.5E-02	2.8E-02	2.3E-02	1.7E-02
FRACTILE 95.0	1.4E-01	7.8E-02	3.2E-02	1.4E-02	1.2E-02	8.7E-03
FRACTILE 90.0	1.3E-01	5.5E-02	2.3E-02	1.1E-02	6.5E-03	4.4E-03
FRACTILE 50.0	1.2E-02	7.9E-03	3.1E-03	1.7E-03	9.3E-04	4.9E-04
MEAN DOSES	4.7E-02	2.3E-02	9.1E-03	4.4E-03	2.9E-03	1.8E-03

CAT-V-St- bypass-ground, early dose (Cadarache)

NO.	NUCLIDE	SUM
	HTO	0.15540E+17
16	CR- 51	0.79000E+14
20	MN- 54	0.15100E+14
21	MN- 56	0.28600E+15
23	FE- 55	0.92900E+14
27	CO- 57	0.19200E+14
28	CO- 58M	0.52300E+14
29	CO- 58	0.31500E+14
30	CO- 60M	0.20000E+14
31	CO- 60	0.31800E+13
75	MO- 99	0.15000E+14
80	TC- 99M	0.13100E+14

RADIUS (KM)	0.145	0.180	0.320	0.500	0.680	1.000
MAX. DOSES	3.8E-01	3.3E-01	1.9E-01	1.1E-01	7.7E-02	5.1E-02
FRACTILE 99.0	1.0E-01	1.0E-01	1.0E-01	1.0E-01	7.7E-02	4.8E-02
FRACTILE 95.0	1.0E-01	1.0E-01	1.0E-01	1.0E-01	7.6E-02	4.8E-02
FRACTILE 90.0	1.0E-01	1.0E-01	1.0E-01	1.0E-01	7.2E-02	4.6E-02
FRACTILE 50.0	2.8E-02	2.2E-02	1.3E-02	7.8E-03	5.2E-03	3.1E-03
MEAN DOSES	8.4E-02	7.3E-02	5.0E-02	3.3E-02	2.4E-02	1.5E-02

RADIUS (KM)	1.500	2.000	3.200	5.000	6.800	10.000
MAX. DOSES	4.1E-02	2.4E-02	9.3E-03	6.1E-03	3.5E-03	4.1E-03
FRACTILE 99.0	3.1E-02	1.7E-02	6.2E-03	3.2E-03	1.5E-03	1.2E-03
FRACTILE 95.0	3.0E-02	1.6E-02	4.5E-03	1.9E-03	1.0E-03	5.2E-04
FRACTILE 90.0	2.6E-02	9.8E-03	4.0E-03	1.6E-03	7.4E-04	3.5E-04
FRACTILE 50.0	1.7E-03	1.0E-03	3.0E-04	1.4E-04	8.1E-05	4.3E-05
MEAN DOSES	8.6E-03	3.7E-03	1.3E-03	5.8E-04	2.9E-04	1.4E-04

CAT-V-St- bypass-ground, EDE with ingestion (Cadarache)

RADIUS (KM)	0.145	0.180	0.320	0.500	0.680	1.000
MAX. DOSES	2.0E+01	1.7E+01	1.1E+01	6.5E+00	4.3E+00	2.3E+00
FRACTILE 99.0	3.2E+00	2.8E+00	1.9E+00	1.3E+00	9.5E-01	6.3E-01
FRACTILE 95.0	2.8E+00	2.6E+00	1.9E+00	1.3E+00	9.3E-01	6.0E-01
FRACTILE 90.0	2.7E+00	2.5E+00	1.8E+00	1.3E+00	9.3E-01	5.8E-01
FRACTILE 50.0	4.6E-01	3.6E-01	1.9E-01	1.1E-01	7.6E-02	4.4E-02
MEAN DOSES	1.2E+00	1.0E+00	6.9E-01	4.5E-01	3.2E-01	2.0E-01

RADIUS (KM)	1.500	2.000	3.200	5.000	6.800	10.000
MAX. DOSES	1.2E+00	8.7E-01	4.1E-01	3.6E-01	2.3E-01	2.6E-01
FRACTILE 99.0	5.0E-01	2.8E-01	1.5E-01	8.7E-02	7.9E-02	6.3E-02
FRACTILE 95.0	3.8E-01	2.1E-01	1.1E-01	4.4E-02	4.2E-02	3.3E-02
FRACTILE 90.0	3.6E-01	1.5E-01	5.5E-02	4.0E-02	2.2E-02	1.7E-02
FRACTILE 50.0	2.5E-02	1.6E-02	5.5E-03	2.6E-03	1.5E-03	7.9E-04
MEAN DOSES	1.2E-01	5.7E-02	2.4E-02	1.2E-02	8.7E-03	5.9E-03

CAT-V-W- bypass-ground, early dose (Cadarache)

NO.	NUCLIDE	SUM
	HTO	0.15540E+17
16	CR- 51	0.46100E+10
20	MN- 54	0.28000E+10
21	MN- 56	0.78400E+11
23	FE- 55	0.13900E+11
27	CO- 57	0.60200E+10
29	CO- 58	0.88700E+10
31	CO- 60	0.10500E+10
90	AG-110	0.26200E+12
155	TA-179	0.96400E+12
157	TA-182	0.79500E+12
159	W -181	0.88200E+14
160	W -183M	0.52900E+15
161	W -185	0.18600E+15
162	W -187	0.52000E+15
166	RE-186	0.17400E+14
167	RE-188M	0.49700E+12
168	RE-188	0.73200E+13

RADIUS (KM)	0.145	0.180	0.320	0.500	0.680	1.000
MAX. DOSES	3.1E-01	2.7E-01	1.6E-01	9.5E-02	6.1E-02	3.5E-02
FRACTILE 99.0	1.0E-01	1.0E-01	1.0E-01	7.2E-02	5.4E-02	3.3E-02
FRACTILE 95.0	1.0E-01	1.0E-01	1.0E-01	7.1E-02	5.2E-02	3.2E-02
FRACTILE 90.0	1.0E-01	1.0E-01	1.0E-01	6.9E-02	5.0E-02	3.1E-02
FRACTILE 50.0	1.9E-02	1.6E-02	9.1E-03	5.4E-03	3.6E-03	2.1E-03
MEAN DOSES	6.0E-02	5.1E-02	3.5E-02	2.3E-02	1.6E-02	1.0E-02

RADIUS (KM)	1.500	2.000	3.200	5.000	6.800	10.000
MAX. DOSES	2.9E-02	1.7E-02	6.4E-03	5.1E-03	3.0E-03	3.4E-03
FRACTILE 99.0	2.1E-02	1.1E-02	4.3E-03	2.2E-03	1.3E-03	8.3E-04
FRACTILE 95.0	2.1E-02	1.1E-02	3.0E-03	1.7E-03	7.4E-04	3.9E-04
FRACTILE 90.0	1.8E-02	6.6E-03	2.7E-03	1.2E-03	5.8E-04	2.3E-04
FRACTILE 50.0	1.2E-03	7.1E-04	2.1E-04	1.0E-04	6.0E-05	2.9E-05
MEAN DOSES	5.9E-03	2.5E-03	9.0E-04	4.3E-04	2.1E-04	1.0E-04

CAT-V-W- bypass-ground, EDE with ingestion (Cadarache)

RADIUS (KM)	0.145	0.180	0.320	0.500	0.680	1.000
MAX. DOSES	4.5E+00	4.0E+00	2.4E+00	1.5E+00	9.7E-01	5.2E-01
FRACTILE 99.0	1.1E+00	8.9E-01	6.3E-01	4.4E-01	3.2E-01	1.9E-01
FRACTILE 95.0	9.8E-01	8.7E-01	5.9E-01	4.1E-01	3.0E-01	1.9E-01
FRACTILE 90.0	8.7E-01	8.1E-01	5.8E-01	4.0E-01	3.0E-01	1.8E-01
FRACTILE 50.0	2.2E-01	1.8E-01	9.8E-02	5.6E-02	3.7E-02	2.0E-02
MEAN DOSES	4.3E-01	3.7E-01	2.4E-01	1.6E-01	1.1E-01	6.7E-02

RADIUS (KM)	1.500	2.000	3.200	5.000	6.800	10.000
MAX. DOSES	2.7E-01	2.1E-01	9.7E-02	8.1E-02	5.2E-02	5.8E-02
FRACTILE 99.0	1.4E-01	7.8E-02	3.8E-02	2.3E-02	1.9E-02	1.3E-02
FRACTILE 95.0	1.2E-01	6.5E-02	2.6E-02	1.2E-02	9.5E-03	6.8E-03
FRACTILE 90.0	1.1E-01	4.9E-02	2.0E-02	8.9E-03	5.6E-03	3.4E-03
FRACTILE 50.0	1.1E-02	7.2E-03	2.9E-03	1.6E-03	8.9E-04	4.6E-04
MEAN DOSES	4.0E-02	1.9E-02	7.8E-03	3.8E-03	2.4E-03	1.4E-03