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A STANDARD GUIDE FOR DOSE ASSESSMENT OF ROUTINE RELEASES OF TRITIUM FORE ANY TRITIUM FACILITY*

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ABSTRACT

An improved dose model for tritium routine releases is proposed including explicitly the contribution of organically bound tritium (OBT) and the dry deposition of tritiated water vapors. The transfer factors from forage to animal products are considered using a recent metabolic derivation. Site specific parameters are introduced for local food production and drink water contamination. The model was partially tested in BIOMASS and can be operated for realistic or conservative assumptions.

In the frame of a sustainable development policy, the nuclear industry is subjected to major changes toward a high safety requirement and transparent public communication in respect of radiological risk. For the future fusion reactor as well as for some of actual installation, tritium is emitted in quite large quantities. From many years, tritium is considered as a radionuclide with low radiotoxicity, but recently there have been claims of an increase of its relative radiobiological efficiency (Straume 1993), increase dose coefficients (Hamby 1999, Harisson 2002) and also, it has realized that tritium in organic forms (organically bound tritium-OBT) is more persistent in any ecosystem than tritiated water (HTO) and must be treated with more attention and included in the dose assessment. After 5 years of coordinated research, the tritium working group in IAEA CRP BIOMASS concluded that, for routine releases of tritium, our present knowledge on HTO are reliable but research on OBT must be enhanced in order to make defendable radiological assessment (IAEA 2001). In the past, all regulatory guidance for tritium used the specific activity (SA) approach, with no distinction between chemical form and supposing full equilibrium in all environment, as CAP88 (Paks 1997) or mix the specific activity approach in crops with transfer factors for animal products (CSA 1987). In practice, even for routine release, there is no full equilibrium between tritium in various media, and distinction between tritium chemical forms must be considered. Tritium is emitted from major nuclear facilities as tritiated gas, HT, tritiated water, HTO, and trace of organic tritium. Tritiated gas has a dose coefficient about 20000 less than tritiated water, but if it is deposited on soil, it is converted to HTO and enters HTO cycle. Plants and animals convert HTO to OBT and public dose will contain the contribution of dietary OBT. This contribution was taken into account in a simplified mode some times ago (Galeriu 1994) and was introduced in a dose model recently (Petersen & Davis. 2002). This last model, NEWTRIT, uses the SA model slightly reduced to calculate concentrations of HTO in water, and then the OBT is slightly reduced over the HTO. For animals it use SA with the intakes and can distinguish OBT in animal product. The code is intended to be conservative and some parameters (as contamination of drink water) can not be changed by the users, In the present paper, we will introduce an improved model, incorporating advances in BIOMASS work as well a recent metabolic derivation of transfer coefficients in farm animal product. The proposed model explicitly considers OBT, makes a distinction between dry and wet deposition of HTO as well as between drink water in soil water. The operational version of the model needs only easy available parameters and can be used for uncertainty studies. as the users have access to all site specific parameters.

Tritium concentration in plant products

In the case of a prolonged exposure where the tritiated water concentration in the soil water and air moisture is quite constant and other environmental characteristics are close with average value, the concentration of tritiated water in the leafy plant part is

dependent of the tritium concentration in air moisture and soil water (Belot 1984, Murphy 1984, Belot 1996):

$$C_{leafW,HTO} = 1.1 \left(\frac{\rho_a}{\rho_v} \right) \cdot C_a + 1.17 \left(1 - \frac{\rho_a}{\rho_v} \right) \cdot C_s \quad [1]$$

where

$C_{leafW,HTO}$ is the HTO concentration in leaf water

C_a is HTO concentration in air moisture

C_s is HTO concentration in the rooting depth of soil

ρ_a is water vapor mass per unit air volume- average value for summer

ρ_v is saturated water vapor mass per unit volume at leaf temperature- average value for summer

The numerical constants in equation [1] are obtained from the isotopic ratio of HTO and H₂O vapor and from the difference of exchange velocity at leaf surface.

In practice, the average leaf temperature can be considered equal with the average air temperature and the ratio in above expression is equal with the relative humidity (in the growing season)

Equation [1] is applied for leafy vegetable, pasture and hay. Other food items as fruit vegetables, fruits, tubers, grain have a higher contribution of the soil water and the HTO concentration is approximated by:

$$C_{no-leafW,HTO} = 1.1 \left(\frac{\rho_a}{\rho_v} \right) \cdot 0.33 \cdot C_a + 1.17 \left(1 - \frac{\rho_a}{\rho_v} \cdot 0.33 \right) \cdot C_s \quad [2]$$

The edible part of various plants contains a fraction of water. If FD is the dry matter fraction, the HTO concentration in the fresh edible plant part is simply

$$C_{fresh,HTO} = (1 - FD) \cdot C_{plantW,HTO} \quad [3]$$

with $C_{plantW,HTO}$ the plant water HTO concentraion givem by equation [1] or [2].

A revision of experimental data on OBT concentration in plants, under equilibrium conditions, (Peterson 2002), shows that the tritium concentration of OBT combustion water is related with the concentration of HTO in plant water by a factor 0.7 to 0.9 (average 0.8).. It results that the OBT concentration of dry matter is close to 0.51 of the HTO concentration in the plant water. We will use a conservative factor of 0.6. The OBT concentration in the fresh plant $C_{fresh,OBT}$ will be :

$$C_{frash,OBt} = 0.6 * FD * C_{plantW,HTO} \quad [4]$$

The HTO concentration in air moisture is obtained from available atmospheric transport models and site specific data. It is important that both the dispersion factor and the absolute humidity are averaged on the vegetation period, in order to be representative for growth of plants.

The concentration in soil water (rooting depth average) is assessed as a sum of wet and dry deposition

$$C_s = C_{sw} + C_{sd} = F_w/I_r + f_d * C_a \quad [5]$$

The wet deposition contribution is given by the average HTO concentration in rain water, in the vegetation period, and is computed in the frame of statistical Gaussian model.

The long-term time averaged wet deposition flux at the receptor is estimated by the sector-averaged formula :

$$F_w = Q\Lambda\Phi/(ux\theta) \quad [6]$$

where Q is the average emission rate ; Λ is the washout rate of tritiated water for the average precipitation rate during the period of interest; Φ is the joint frequency of rain and wind into the sector containing the receptor j ; u is the average wind speed; x the distance between source and receptor and θ the angle of the wind direction sector. The washout rate of tritiated water depends on source height, distance from the source and rain intensity. In case of elevated sources, the washout rate coefficient is nearly constant over a wide area (Belot 1994,1998) The average concentration of tritium in rainwater is simply obtained by dividing the wet deposition flux F_w so obtained by the corresponding average precipitation rate I_r . The scavenging rate appropriate for HTO [Belot2002] as given in figure 1.

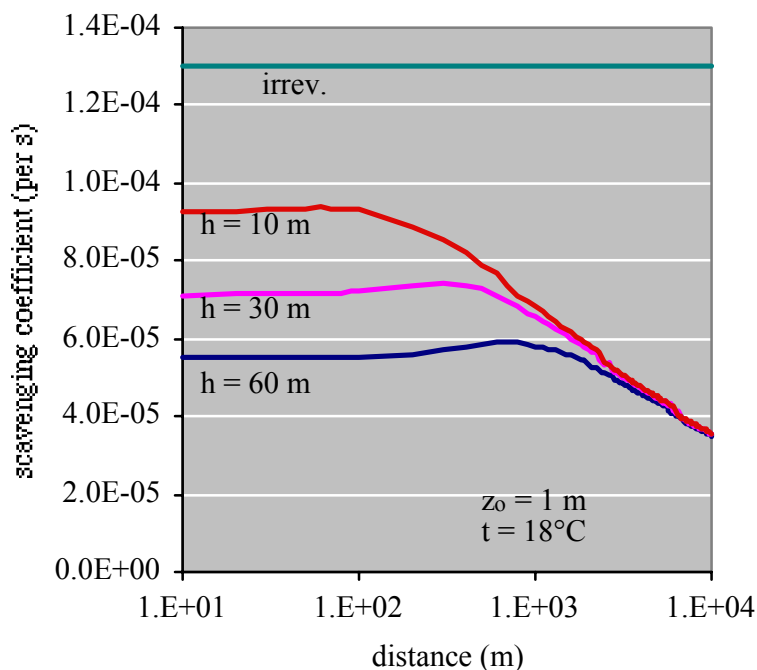


Fig.1. Scavenging coefficient $\Lambda(x)$ derived from the Hales' model. The plume originates from different release heights ranging from $h = 10$ m to $h = 60$ m. The rain intensity is 1 mm hr^{-1} . The diffusion coefficient of HTO in the gaseous phase at drop surface is $D_g = 2.28 \times 10^{-5} \text{ m}^2 \text{ s}^{-1}$. The coefficient is nearly constant for x smaller than 40 times the release height.

The dry deposition contribution is a fraction f_d from the air moisture HTO concentration. In the past it was generally ignored but recent studies and modeling exercises (BIOMASS-IAEA2001) have demonstrated that it can not be ignored generally.

The fraction f_d was initially taken to be 0.3 but latter was decreased at 0.15. We derived this fraction considering an uniform wind rose with 12 sectors, and the experimental values on reemission of HTO after a short (1 h) deposition event of HTO (ref). Initially we takes the values of reemission rates in morning and evening, and we use this to derive a history of deposition (one hour) and reemission (11 hours) which

was repeated until equilibrium. Later we observed that the morning and evening reemission are lower than midday, and the final value of 0.15 was obtained (the user can change to the conservative value of 0.3).

The importance of dry deposition has been demonstraed in a recent experiment done in the frame of BIOMASS CRP (Täschner 2000 draft report). Air, rain and soil HTO concentration was measured daily for two sites difering in the plume patern. The west site was mostly dry and the east one mostly wet. Corelation coefficent between measured values are given in the table

TABLE 1: REGRESSION COEFFICIENTS (R^2) OF THE LINEAR CORRELATION OF HTO CONCENTRATIONS IN THE COMPARTMENTS OF SOIL, AIR AND RAIN WATER

Compartment 1	Compartment 2	East SP	West SP
Top Soil	Rain	0.75	0.06
Top Soil	Air	0.16	0.71
Soil (0-20 cm)	Rain	0.74	0.21
Soil (0-20 cm)	Air	0.32	0.83
Air	Rain	0.14	0.19

This experiment demonstrates that for site with low joint frequency-wind and rain- the dry deposition predominates and the fraction f_d is near 0.2, while for sites with high joint frequency f_d is close to 0.05. Our default values of $f_d = 0.15$ seems appropriate.

In case of a HT emission we can use empirical relations between HT air concentration and HTO concentration in soil water or air moisture (Davis et al. 1995) which can be analysed as constant ratio (Davis and Bickel 2000) :

Table 2. Recommended best-estimate and conservative values for the HTO/HT ratios for air moisture, soil and plants for use in calculating doses to members of the public.

Compartment	Best Estimates $\text{Bq L}^{-1}/(\text{Bq m}^{-3})$	Conservative Defaults $\text{Bq L}^{-1}/(\text{Bq m}^{-3})$
Air Moisture	4	8
Soil	6	12
Plants	6	12

APPLICATION I Tritium in plants

We consider a site at a distance $x = 1000$ m from the tritium source with an effective release hight of 50 m and a release rate of tritiated water vapor (HTO) $Q = 2.4 \cdot 10^7$ Bq/s (typical for a CANDU600 at maturity, no detritiation). The summer (growing period) dispersion factor is $5 \cdot 10^{-7}$ s/m³, about 2 times more than the yearly value. The summer average absolute humidity ρ_a is 0.014 kg/m³. We will obtain the air moisture HTO concentration at

$$C_a = 850 \text{ Bq/L}$$

For assesing the HTO concentration in rain we need the mean rain intensity in the vegetation period and values of parameters in formula [6]. Let's take the total rain to be 300 mL (a dry climate) for the vegetation period of 183 days and let's consider that

the site atmospheric dispersion model have 12 sectors. In this case, θ , the angle of the wind direction sector is given by $\theta = 2\pi/12$

The mean wind speed in the rainy hours is taken to be $u = 5$ m/s, and the appropriate washout rate (fig 1) $\Lambda = 6 \cdot 10^{-5} \text{ s}^{-1}$.

A realistic value for the frequency of rain in the sector Φ is 0.007. With the data above, easy available from stack monitoring and site meteorological tower as statistic, we can obtain the flux of tritiated water ($\text{Bq}/(\text{m}^2\text{s})$), averaged on the vegetation period. The average water flux is simply the total rain ($300 \text{ kg}/(\text{m}^2\text{s})$) divided by total time (s) of the vegetation period (183 days in our example). Finally, the rain HTO concentration is

$$C_{\text{sw}} = 201 \text{ Bq/L}$$

Considering our default value for the parameter $f_d = 0.15$, and adding wet and dry contribution for the soil water we have

$$C_s = 201 + 0.15 \cdot 850 = 328.5 \text{ Bq/L}$$

From the site meteorology we extract the relative humidity in summer $\rho_a / \rho_v = 0.6$, as a typical value.

All above data are from normal monitoring (stack and meteorological). We can now assess tritium concentration in plants, using equations 1-4. Consider the table below giving plant name, dry matter fraction, HTO and OBT concentration

Table 3 Concentration of HTO and OBT in plants

	grains	potato	Leafy_v	root-v	fruit-v	fruits	oil	sugar	grass	hay
FD	0.85	0.2	0.1	0.17	0.1	0.15	0.99	0.99	0.2	0.8
HTO	74.15	395.47	642.89	410.30	444.90	420.18	4.94	4.94	571.45	142.86
OBT	364.30	85.72	42.86	72.86	42.86	64.29	424.31	424.31	85.71	342.87

We have introduced a single species –grains- to be used for wheat, barley and maize grain, as they have very close dry matter fraction. Vegetables have been split in leafy, root and fruit vegetables. We add sugar and oil for their high content of OBT. For forage we will consider later grain, grass and hay. Equation 1 is used only for grass, hay and leafy vegetables.

Tritium concentration in animal products

As in other guidance, we use the concept of transfer factor from forage to animal product. Let's consider $C_{\text{ap,HTO}}$ the concentration of HTO in the animal product and $C_{\text{ap,OBT}}$ the corresponding OBT concentration. Generically the concentration C in animal product depends on the transfer factor F and intake activity I :

$$C = F \cdot I$$

The intake activity is a result of a weighted sum for various diet items with intake rates Q_i , concentration of radionuclide $C_{\text{feed},i}$ and fraction f_i of intake which is contaminated:

$$I = \sum_i Q_i \cdot f_i \cdot C_{\text{feed},i} \quad [7]$$

In case of tritium we have two main chemical form, HTO and OBT and we must consider also the metabolic transformation between. Let's define the following transfer factors:

F_{HH} the transfer factor from HTO in food to HTO in animal product,

F_{HO} the transfer factor from HTO in food to OBT in animal product,

F_{OH} the transfer factor from OBT in food to HTO in animal product,

F_{OO} the transfer factor from OBT in food to OBT in animal product

The concentration of HTO or OBT in animal product will be

$$C_{\text{HTO}} = F_{\text{HH}} * I_{\text{HTO}} + F_{\text{OH}} * I_{\text{OBT}}$$

$$C_{\text{OBT}} = F_{\text{HO}} * I_{\text{HTO}} + F_{\text{OO}} * I_{\text{OBT}}$$

[8]

There are sparse data on tritium transfer factors (IAEA 1994) but recently we give a metabolic derivation for all animal products, which give reliable results (Galeriu 2001) for animal with known intake needs. This depends on animal type, body mass, and production and diet structure. Consider some typical values: a lactating cow of 550 kg giving 14 L of milk per day; a beef of 400 kg growing at 0.8 kg/d; a sheep of 50 kg delivering 1.4 L/d milk; a lamb of 20 kg, a pig of 120 kg, a broiler of 1.5 kg and a laying hen of 3.5 kg. A generic diet for these animals is given below in kgfw/d. If the site specific diet or the production differ considerably, the transfer factors are affected and you must follow the procedure described (Galeriu 2001) or we can assist you with separate, site specific calculation (galdan@ifin.nipne.ro). With above production and diet, appropriate transfer factors are given in the table

Table 4 Animal diet and transfer factors for tritium

DIET kgfw/d	dairy cow	beef	sheep	lamb	pork	chicken	laying hen
grass	30	17	5	2.2	0	0	0
hay	6	4	1.1	0.5	0	0	0
grain	2.5	1.5	0	0	2.5	0.1	0.14
drink water	35	25	5	3	8	0.2	0.27
TRANSFER FACTORS d/kg	cow milk	beef	sheep milk	lamb	pork	chicken	egg
F _{HH}	0.013	0.016	0.12	0.22	0.054	3.3	2.5
F _{HO}	0.001	0.0015	0.005	0.015	0.006	0.25	0.17
F _{OH}	0.0089	0.01	0.075	0.15	0.049	3	2.2
F _{OO}	0.0083	0.037	0.083	0.2	0.11	3.1	2

APPLICATION II Tritium in animal products

In practice, we also must know the drinking water contamination with HTO, outside fractions of contaminated feed (f_i). This is a key problem as much of tritium intake can be from drink water. Normally, animals drink water from surface waters or water plants (mixture of ground and surface waters). Due to large drainage area, water contamination is less than rain or soil water contamination. In our model we assess animal drink water concentration as a fraction f_w of air moisture HTO concentration. It is unrealistic to consider $f_w = 1$ (no data supporting) but is optimistic to take $f_w = 0.01$. By default, we recommend a value of 0.1 but site information can give a better estimation. For critical group we can assume that all diet items are fully contaminated, but for average situation it is hardly to believe that grain fodder is all produced on site. In our application we take a value 0.5 for grain fodder but 1 for grass and hay (see Table 5).

Table 5 contaminated fraction

drink water, as fraction air moisture	<1	assumed for animals
fraction of pasture contaminated	1	input, site specific
fraction of hay contaminated	1	input, site specific
fraction of grain_fodder contaminated	0.5	input, site specific

Using the concentration in feed (Table 3) and data in table 4 and 5, we can apply equation 7 in order to assess the daily HTO and OBT intake. With the transfer factors from table 5 and equations 8 we obtain the HTO and OBT concentrations in animal product, as exemplified in table 6. Here we use three options for the animal drink water. The extreme values, unrealistic, $f_w=0.01$ or 1, and our default value of 0.1. Depending on water contamination, the product concentration can vary up to a factor 10. This illustrates the importance of a realistic estimate of drink water contamination, using site monitoring data or advanced modeling.

Table 6 Concentration in animal product Bq/kgfw or Bq/L

$f_w = 1.$	milk	beef	sheepmilk	lamb	pork	chicken	egg
HTO	666.93	536.24	931.78	906.89	394.25	627.46	642.40
OBT	90.02	162.14	103.18	130.15	91.42	99.86	90.87
$f_w = 0.1$	milk	beef	sheepmilk	lamb	pork	chicken	egg
HTO	319.11	230.46	473.13	402.36	64.01	122.94	126.41
OBT	63.26	133.47	84.07	95.76	54.72	61.64	55.78
$f_w = 0.01$	milk	beef	sheepmilk	lamb	pork	chicken	egg
HTO	284.33	199.89	427.26	351.91	30.99	72.49	74.81
OBT	60.59	130.60	82.16	92.32	51.06	57.82	52.27

Doses to public

Because tritium is a weak beta emitter, we need only inhalation and ingestion pathways. Doses from HTO intake include inhalation of HTO from air, absorbed HTO by skin and ingestion of HTO from food. Doses from OBT intake is given only by ingestion of OBT from food. The intake and the dose conversion coefficients depend on age and we selected 3 typical age: 1 year, 10 years and adult. The dose coefficients DCF for HTO or OBT intake are those recommended and used now (ICRP 1993) and are given in table 7. The inhalation rate I_{inh} for each age is a standard one (see table 7). The intake rate of HTO by skin absorption is taken as 0.5 from inhalation rate (as in CSA87).

Table 7 Dose conversion coefficients and inhalation rates

DOSE CONVERSION COEFFICIENTS	data base		
DCF	adult	10 y	1 y
HTO	1.80E-11	2.30E-11	4.80E-11
OBT	4.20E-11	5.70E-11	1.20E-10
inhalation rate m3/y	8036	4346	1112

The dose from inhalation and skin exposure will be:

$$D_{inh} = DCF * 1.5 * C_a * I_{inh} \quad [9]$$

In order to assess the intake from food and drink water, we must consider the average contamination, as not all food is locally produced and drink water can be less contaminated than air moisture water. This contaminated fraction $f_{ing,i}$ for food and f_w for drink water are exemplified in table 8 but are site specific

Table 8 contaminated fraction for human consumption

Fraction of leafy veg diet contaminated	1	input, site specific
Fraction of root crop diet contaminated	1	input, site specific
Fraction of fruits and fruit veges contaminated	1	input, site specific
Fraction of grain contaminated	0.5	input, site specific
drink water, as fraction air moisture	0.1	assumed for humans

With a drink water intake rate I_w (L/d) and an intake rate of item j in the diet $I_{ing,j}$, we will have, for HTO or OBT the following intake activity A (Bq/d):

$$A_{HTO} = I_w f_w C_a + \sum_j I_{ing,j} \cdot f_j \cdot C_{HTO,j}$$

$$A_{OBT} = \sum_j I_{ing,j} \cdot f_j \cdot C_{OBT,j} \quad [10]$$

Now, the yearly dose D , as a sum of dose from HTO and OBT is:

$$D = 365 \cdot (A_{HTO} \cdot DCF_{HTO} + A_{OBT} \cdot DCF_{OBT}) \quad [11]$$

where we use the plant or animal product concentration of HTO or OBT from above relations and example and the constant converts from intake rate per day to yearly intake. Considering the diet used in Romania for assessments we will obtain the results in Table 9, with product concentrations from our applications.

In the table we can observe the age dependence as well the partial dose from inhalation, ingestion of HTO or OBT. But half of the ingestion dose is due to OBT (for this example)

We note that among diet items we considered also cheese, a product of milk industry. Concentration of tritium in cheese is assessed using the HTO and OBT concentration in milk and weighting with the composition: $C_{cheese,OBT} = (FD_{cheese}/FD_{milk})C_{milk,OBT}$ and a corresponding ratio for HTO. We have also considered oil and sugar, not included generally for other radionuclides. We must include them because of high dry matter content and OBT activity.

Our example results are dependent on drink water concentration and we have used the default value $f_w=0.1$, or we should use the maximum value, doses increases 6-8 times, but this is unrealistic in practical situations.

For adults, half of OBT dose is given by grains, while sugar+oil gives 13 %. For infants, oil and sugar is of minor importance and grain, animal product and vegetal product are of equal importance. In this example the contamination of sugar and oil was considered at maximum (full local production) in order to illustrate the importance of these food for the OBT intake. A best choice is to consider the same contaminated fraction as for grains.

Total dose in this example is in the range 7-10 $\mu\text{Sv}/\text{y}$, a low value. Note that our example is taken for a CANDU600 HWR at maturity, with today dose coefficient factors as recommended.

Table 9 Intake activities and Doses for exemplified situation

HUMAN INTAKE									
[diet is site specific]	adult			10y			1y		
	diet	HTO	OBT	diet	HTO	OBT	diet	HTO	OBT
	g/d	Bq/d	Bq/d	g/d	Bq/d	Bq/d	g/d	Bq/d	Bq/d
wheat_flour	373.00	13.83	67.94	240.00	8.90	43.72	81.00	3.00	14.75
Maize_grain	97.00	3.60	17.67	73.00	2.71	13.30	33.00	1.22	6.01
potato	136.00	53.78	11.66	93.00	36.78	3.99	39.00	15.42	3.34
Leafy_veg	74.00	47.57	3.17	69.00	44.36	2.96	38.00	24.43	1.63
Root_veg	65.00	26.67	4.74	59.00	24.21	4.30	35.00	14.36	2.55
Fruit_veg	80.00	35.59	3.43	70.00	31.14	3.00	55.00	24.47	2.36
Fruits	145.00	60.93	9.32	340.00	26.18	21.86	230.00	96.64	14.79
Fresh_milk	160.00	45.49	9.69	260.00	73.93	24.00	410.00	116.58	24.84
Cheese_cow	30.00	5.12	5.45	20.00	3.41	5.54	14.00	2.39	2.54
Cheese_sheep	12.00	2.56	2.96	5.00	1.07	1.23	0.00	0.00	0.00
Beef	24.00	4.80	3.13	22.00	4.40	2.87	4.50	0.90	0.59
Pork	53.00	1.64	2.71	38.00	1.18	1.94	15.00	0.46	0.77
Lamb	10.00	3.52	0.92	9.00	3.17	0.83	1.00	0.35	0.09
Chicken	41.00	2.97	2.37	31.00	2.25	1.79	16.00	1.16	0.93
Eggs	24.00	1.80	1.25	19.00	1.42	0.99	10.00	0.75	0.52
Oil	30.00	0.00	12.73	11.00	0.00	4.67	2.00	0.00	0.85
Sugar	27.00	0.00	11.46	28.00	0.00	11.88	12.00	0.00	5.09
Beer	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Wine	61.00	25.63	3.92	0.00	0.00	0.00	0.00	0.00	0.00
drink water	1300.00	110.42	0.00	1000.00	84.94	0.00	180.00	15.29	0.00
SUMM Bq/d		445.92	174.53		350.03	148.86		317.43	81.65
DOSE									
ingestion dose food	μSv/y	2.93	2.68		2.94	3.10		5.56	3.58
inhalation & skin absorption dose	μSv/y	1.44			0.999			0.533	
total dose	μSv/y	7.05			6.88			9.67	

NOTE an EXCEL application is available upon request.

The case of HT emission

In this case, the air moisture concentration and the soil water concentration are given as function of HT concentration on site, while the drink water concentration can be taken, conservatively, as fraction of air moisture concentration. Using the same release rate and meteorology as above, we will only change the value of C_a and C_s using ratios in table 2 and the rest of calculation is unchanged. Choosing best estimate in table 2, finally we obtain total dose in the range 1-1.8 $\mu\text{Sv/y}$, lesser than the HTO emission by factor 5-7.

For the conservative ratios in Table 2, the doses will be 2 times bigger.

Discussion

In past regulatory guidances for assessing tritium dose for routine emission it was a general belief that the specific activity approach suffices. Such an approach is in use in USA - CAP88, AIRDOS-PC and COMPLY models (Parks 1997, USEPA b USEPAc) and with few modification in Canada (CSA 87) where transfer factors are

used for animal products. NEWTRIT apply SA also for OBT in plant (relating with HTO) and animal products using the intake of OBT, but not the transformation between HTO and OBT. It also contains conservative assumptions as for regulatory purposes and ignore the dry deposition of HTO. A preliminary comparison for the same scenario shows that NEWTRIT ingestion dose is higher than ours (with default value for animal drink water contamination), due mainly to conservatism the contamination of animal drink water. Our model permits site specific factors to be handled and the assessed dose is less conservative. Also the influence of key parameters can be exercised and uncertainty range of model result can be obtained. Parts of our models were tested in the BIOMASS Coordinated Research Project (IAEA 2001) with good results. The contribution of dry deposition to HTO in soil was included in our assessment and the predicted to observed ratio for soil water was between 1 and 2, the prediction for plant HTO was between 1 and 3 while the prediction for grass OBT was between 1.4 and 2 for all three blind scenario . This demonstrate that the model does not underpredict and is moderately conservative (factor <2). Further validation will be useful in order to assess the degree of reliability and conservatism. Also for more realism, food storage and food processing factors can be introduced in future.

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