Ed Sand
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on Comm

1403

draft
plain paper

But if there is [illegible]
@ 10 PPT in cattle
as found in those [illegible]
245T land then
then Humans would get
2 PPT a day instead of
.2 PPT — More than
enough to get 10 PPT
Background.

What ... ?

In the ... 2,3,7,8-TCDD

in human adi... ...tly) (1,2)

They found 2,3 ... specimen

generally — in ... nam.

(wet) adipose tissue (ppt). (Two specimens out of about 50 total are reported in the 50-100 ppt range). Tentative conclusion: essentially all ... TCDD in

their adipose tiss...).

Alsons statement Re
10-20 PPT in Cattle
who grazed on
245T Soil

Assuming 70 kg ...

TCDD stored elsew...

about 2×10^{-7} gm

probably 0.05 – 1.0 μg / person. (... in liver will increase the burden, but not enough to affect this order-of-magnitude calculation.)

~~Ed Sand~~
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~~on copy~~

lit03

draft - plain paper

What are the sources of Human Exposure to 2,3,7,8-TCDD?

In the last two years four studies of 2,3,7,8-TCDD in human adipose tissue have been reported (one privately) (1,2). They found 2,3,7,8-TCDD in essentially all specimens, generally in the range $1-20 \times 10^{-12}$ gm TCDD per gram (wet) adipose tissue (ppt). (Two specimens out of about 50 total are reported in the 50-100 ppt range). Tentative conclusion: essentially all adults carry a burden of TCDD in their adipose tissue of ca 10 ppt (10^{-11} gm TCDD / gm tissue). Assuming 70 kg average body mass, 20% fat, and little TCDD stored elsewhere, that implies a body burden of about 2×10^{-7} gm (0.2 μg) per person, with a range probably 0.05 - 1.0 μg / person. (The amount stored in liver will increase the burden, but not enough to affect this order-of-magnitude calculation.)

This raises a question: What is the source of ~~the~~ the TCDD exposure implied by these findings? Whilst not enough data are available to answer this question, ~~the data available~~ enough are available to suggest the direction future research should take.

(Note: A recent paper on sources of PCB exposure (3) ~~attributed~~ attributed the 10-fold higher body burdens almost entirely to food.)

Three ~~Four~~ possible sources of exposure are considered here: breathing air, drinking water, and food, ~~and deodorant bar soap containing hexachlorophene.~~ The approach taken is to see if data available allow us to rule out any or all of these, given realistic assumptions about intake, absorption, and elimination. I conclude that food is the only significant source.

C05062

Method: 1.) Assume that ~~the~~ body burden is described by a steady-state equilibrium; thus: amount in

equals amount out.

2) Assume elimination from the fat stores follows first-order kinetics (in TCDD), with a half-time for depuration of 100 days (Case I) or 1000 days (Case II).

3) From $\ln (C_0/C) = kt$

$\ln (2) = k t_{1/2}$

$t = 100$ days $\Rightarrow k_1 = 6.9 \times 10^{-3}$ day^{-1}

$t = 1000$ days $\Rightarrow k_2 = 6.9 \times 10^{-4}$ day^{-1}

Rate (in) = rate (out) = kC

If $C = 10^{-11}$ gm TCDD / gm fat

Rate I = 6.9×10^{-14} gm TCDD / gm fat / day

Rate II = 6.9×10^{-15} " " "

Results

4) ~~[illegible]~~ Air

Assume air intake at 10 m^3_{air}/person/day

Assume 14 kg fat/person

Thus air intake = 7×10^{-4} m^3 / gm fat / day.

Air concentration = rate in / air intake

$C_{air}(I) = 6.9 \times 10^{-14} / 7 \times 10^{-4} \approx 10^{-10}$ gm TCDD/m^3 air

$C_{air}(II) = 10^{-11}$ gm TCDD/m^3 air

10^{-10} gm/m^3 = 100 pg/m^3

10^{-11} gm/m^3 = 10 pg/m^3

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No data on air concentrations have been published.

Dow has reported finding ca 5×10^{-9} gm TCDD/gm in urban dust (4). If we take 20 µg = 2×10^{-5} gm dust per m^3 as a typical dust loading, we estimate

air concentrations (from dust) of 10^{-13} gm TCDD/m^3 air.

Thus air is unlikely to be the major source of human exposure to 2,3,7,8-TCDD.

5) Water.

Assume intake of 2ℓ/person/day.
Thus water intake = 0.14 gm H_2O/gm fat/day

Thus C_{water} (I) $\approx 5 \times 10^{-13}$ gm TCDD/gm water = 0.5 ppt
C_{water} (II) $\approx 5 \times 10^{-14}$ gm TCDD/gm water = 0.05 ppt.

One report of surface water with $\geq$0.01 ppt TCDD has been published and the water sample came from the Tittabawasee River. All other reports we have seen claim < 0.01 ppt (the detection limit).

Conventional water treatment will decrease TCDD concentration.

Thus drinking water is not a significant source of exposure.

6) Food.

Assume intake of 2×10^3 gm/person/day.
Thus food intake = 0.14 gm/gm fat/day.

Thus C_{food} (I) $\approx$ 0.5 ppt
C_{food} (II) $\approx$ 0.05 ppt.

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Very few data are available on TCDD in food. We found < 0.5 ppt in pork fat from a Dayton-area market.

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~~The Meselon et~~ Meselson, et al. reported <10 ppt in beef fat ~~from~~ Boston but 10-20 ppt in fat from cows grazing on 2,4,5-T— sprayed land. I conclude that meat is very unlikely to average more than 1 ppt TCDD, and thus the average diet (~~of~~ (meat constitutes about 15%) will be very unlikely to exceed 0.2 ppt. However 0.05-0.1 ppt would be sufficient to supply a 10 ppt-in fat background.

7) Hexachlorophene

Assume ca. 2×10^{-6} gm hexachlorophene per gm fat per day (by analogy with absorption of TCC® from bar soaps)[?].

Thus $C_{hexa.}$ (I) ≈ 4×10^{-8} gm TCDD / gm hexachlorophene = 40 pp
$C_{hexa.}$ (II) ≈ 4×10^{-9} gm TCDD / gm hexachlorophene = 4 pp

The concentration of TCDD in U.S.-produced hexachloroph. is not known, but is believed to have been < 10 ppb (based on the manufacturing processes used).

→ Ruppe quotes Baughman as finding 0.2-0.5 ppb in 1974

Thus hexachlorophene probably was not a significant source of exposure for the general public, but it may ~~have~~ been for individuals who were heavy users of ~~[illegible]~~ hexachlorophene-containing products.

Note: hexachlorophene contains a unique trace impurity, 1,2,4,6,8,9-hexachloroxanthene, that might serve to trace exposure from this source. We will test the possibility

C05065

(Note: Given the assumptions listed above, 0.05 ppt TCDD in food corresponds to a daily dose of 100 pg TCDD per person per day!)

Comment: [redacted] It does not appear that the data available on TCDD in air, water, or foodstuffs are consistent with a depuration half-life of the order of 100 days. They do seem to be consistent with a several-year halflife for clearance from fat.

JDW
2/22/84