EXPOSURE OF LABORATORY ANIMALS TO POLYCHLORINATED DIBENZODIOXINS AND POLYCHLORINATED DIBENZOFURANS FROM COMMERCIAL RODENT CHOW

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Objective: In dioxin dosing experiments, the only source of dioxin is assumed to be the dose. Since food is the major source of dioxin in humans with no special exposure, we sought to determine laboratory animals' intake of dioxin from commercial rodent chow. This paper presents a summary of our analysis of the brand of laboratory chow used in the laboratory by one of us (JO), and compares the level of dioxin intake from the chow with the dose that causes toxicological effects.

Methods: Prolab RMH 1000 Standard diet for laboratory rats, mice and hamsters was obtained from Agway Inc., Syracuse, NY. The rodent diet was analyzed for PCDDs and PCDFs by high resolution gas chromatography - mass spectroscopy following extraction and clean-up by previously described methods.[1]

Results and Conclusions: Table 1 summarizes the PCDD and PCDF analysis of the Prolab RMH 1000 rodent chow. On a whole weight basis, the rodent diet had a toxic equivalent ("international" or I-TEq)[2,3] content for total PCDDs and PCDFs of 0.13 ng/kg (ppt). The I-TEq content of the rodent diet was similar to that of levels in U.S. food previously reported for bologna and crunchy haddock and about 10-fold less than that in ground beef.[4] Animal fat is generally considered a major source of PCDDs and PCDFs in the human diet and is probably the main source of PCDDs and PCDFs in the Prolab RMH 1000 rodent chow.

The daily intake of PCDD and PCDF TEqs in laboratory rats from the consumption of commercial rodent chow is estimated in Table 2. Daily ingestion of I-TEqs range is from 3.9-6.5 pg/kg/day for the rat. This is slightly higher than the estimated background adult human exposure from the U.S. diet of between 0.3 and 3.0 pg TEQ/kg/day and lower than that of a nursing infant which may consume from 35 to 53 pg TEQ/kg/day in its first year of life.[4] Thus, as with humans, laboratory animals are exposed to PCDDs and PCDFs through consumption of commercially prepared food. It is therefore important to consider the potential for background exposure to PCDDs and PCDFs when conducting studies with laboratory animals. This is particularly vital when sensitive responses, such as enzyme induction, immunotoxicity, and developmental/reproductive toxicity, are being investigated at very low exposures to this class of compounds (Table 3). Although only one commercial rodent diet was investigated, it is likely that other laboratory animal diets with

animal derived ingredients will contain low levels of PCDDs and PCDFs. Removing animal fat and other animal derived materials from commercial lab animal diets is a possible means of reducing or eliminating the low level exposure of laboratory animals to these compounds.

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TABLE 1

PCDDs and PCDFs in Prolab RMH 1000 Laboratory Rodent Diet

Congener	whole weight	I-TEq [2,3]
2,3,7,8-TCDD	<0.04 (m)	0.02
Total PCDD	14.12	0.08
Total PCDF	1.80	0.05
Total PCDD/F	15.92	0.13

(m) = maximum value with possible contribution of artifacts.

TABLE 2

Estimated Daily Intake of PCDDs PCDFs in Laboratory Animals from the Consumption of Commercial Rodent Chow

Rat	
Adult Male Body Weight (g)	300 - 400
Daily Food Consumption (g)[a]	12 - 15
Daily I-TEq from Chow (pg/day)[b]	1.56 - 1.95
(pg/kg/day)	3.9 - 6.5

[a] from Agway Inc., Syracuse, NY
[b] Based on rodent chow in Table 1 with 0.13 I-TEq (ppt,ng/kg).

Table 3

Sensitive Responses to TCDD Exposure Observed in Laboratory Animals

Effect	Animal	TCDD Exposure
Induction of Hepatic cytochrome P-4501A1 Reference (5)	Rat	Single dose of 1 ng/kg body weight
Immuno Suppression (enhanced viral susceptibility) Reference (6)	Mouse	Single dose of 10 ng/kg body weight
Decreased glucose uptake into adipocytes Reference (7)	Guinea Pig	Single dose of 30 ng/kg body weight
Developmental, behavioral, endocrine, decreased sperm count Reference (8)	Rat	Single Maternal dose of 64 ng/kg body weight on gestation day 15
Cancer-liver, thyroid, lung Reference (9)	Rat	100 ng/kg per day for 2 year