UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF
PREVENTION, PESTICIDES
AND TOXIC SUBSTANCES

MEMORANDUM

DATE: 20-MAY-2002

SUBJECT: **2,4- Dichlorophenoxyacetic Acid (2,4-D)**. Acute and Chronic Dietary Exposure Assessments for Section 3 Registration for Use on Soybeans. PP# 4E03060. PC Code 030001. DP Barcode D280885. Case 191490. Submission S610168.

FROM: Jennifer R. Tyler, Chemist
Registration Action Branch (RAB1)
Health Effects Division (HED) (7509C)

THROUGH: G. Jeffrey Herndon, Branch Senior Scientist
RAB1/HED (7509C)

and

Amelia Acierto, Chemist
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TO: G. Jeffrey Herndon, Chemist
RAB1/HED (7509C)

The purpose of this memorandum is to summarize the results of the dietary exposure assessment for the general U.S. population and various population subgroups resulting from exposure to 2,4-D through food. Based on time constraints and given that RD has requested that HED perform a "Section 18 like" risk assessment for 2,4-D, RAB1 has chosen to refine only those crops/commodities that contribute significantly to the dietary risk cup for 2,4-D. The refinements were made to the most recent Dietary Exposure Evaluation Model (DEEM™) analyses for 2,4-D for the Section 18 request on hops (D266939, W. Donovan, 7/6/00).

EPA Reviewer: Jennifer R. Tyler, Date 20-MAY-2002

STUDY TYPE: 2,4-D Acute and Chronic Dietary Exposure Assessments for Extension of Time-Limited Tolerance on Soybeans.

ACTIVE INGREDIENT: 2,4-D

RESIDUE OF CONCERN: *Plants and Livestock*: 2,4-D *per se*

Executive Summary

Acute and chronic dietary exposure analyses were requested in order to determine the dietary exposure estimates associated with the request for the extension of a time-limited tolerance on soybeans.

A conservative, slightly refined Tier 2 (using anticipated residues (ARs) from field trials for citrus, tolerance level residues for all other commodities, and assuming 100% crop treated (% CT) for all commodities) acute dietary exposure assessment was conducted for general U.S. population and all population subgroups. This assessment concludes that the acute dietary exposure estimates are below HED's level of concern (<100% aPAD[1]) at the 95th exposure percentile for general U.S. population (7.0% of the aPAD) and all population subgroups. The most highly exposed population subgroups are females 13-50 years old and children 1-6 years old, both at 12% of the aPAD.

A moderately refined, Tier 3 (using ARs calculated from field trial data for some commodities and % CT information or market share information for all commodities) chronic dietary exposure assessment was conducted for the general U.S. population and various population subgroups. This assessment concludes that the chronic dietary exposure estimates are below HED's level of concern (<100% cPAD[1]) for the general U.S. population (8.0% of the cPAD) and all population subgroups. The most highly exposed population subgroup is children 1-6 years old at 46% of the cPAD.

I. Introduction

Exposure to pesticides can occur through food, water, residential and occupational means. Risk assessment incorporates both exposure and toxicity of a given pesticide. The risk is expressed as a percentage of a dose that could be expressed as a daily or a long term dose, to pose no unreasonable adverse effects. This is called the population adjusted dose (PAD), and is

expressed as %PAD. References are available on the EPA/pesticides web site which discuss the acute and chronic risk assessments in more detail: "Available Information on Assessing Exposure from Pesticides, A User's Guide", 6/21/2000, web link: http://www.epa.gov/fedrgstr/EPA-PEST/2000/July/Day-12/6061.pdf ; or see SOP 99.6, 8/20/99.

The purpose of this memorandum is to summarize the results of the dietary exposure assessment for the general U.S. population and various population subgroups resulting from exposure to 2,4-D through food. Based on time constraints and given that RD has requested that HED perform a "Section 18 like" risk assessment for 2,4-D, RAB1 has chosen to refine only those crops/commodities that contribute significantly to the dietary risk cup for 2,4-D. The refinements were made to the most recent Dietary Exposure Evaluation Model (DEEM™) analyses for 2,4-D for the Section 18 request on hops (D266939, W. Donovan, 7/6/00).

II. Toxicological Information

On 1/10/02, the HED Hazard Identification Assessment Review Committee (HIARC) re-evaluated the results of the developmental toxicity study in rats to assess the potential for increased susceptibility to infants and children following exposure to 2,4-D. This re-evaluation/re-assessment of susceptibility was in response to comments received from the World Wildlife Fund (WWF) (Letter from Thayer *et al* dated 11/21/01; Docket No. PF-1045). On 5/14/96, the Toxicology Endpoint Selection (TES) Committee selected toxicology endpoints for acute dietary and non-dietary exposure risk assessments (TXR.No. 013171). The HED FQPA Safety Factor Committee met on 1/22/02 and recommended that the Food Quality Protection Act (FQPA) safety factor (as required by FQPA of 8/3/96) be reduced to 3x when assessing all exposures resulting from the use of this pesticide. A summary of the toxicological doses and endpoints selected for dietary exposure assessment is provided in Table 1.

Table 1. Summary of Toxicological Doses and Endpoints for 2,4-D for Use in Dietary Exposure Assessment.

Exposure Scenario	Dose Used in Risk Assessment, UF	FQPA SF and Endpoint for Risk Assessment	Study and Toxicological Effects
Acute Dietary (females 13-50 years of age)	NOAEL = 25 mg/kg/day UF = 100 Acute RfD = 0.25 mg/kg/day	FQPA SF = 3 aPAD = 0.083 mg/kg/day	LOAEL = 75 mg/kg/day based on skeletal variations, reduced ossification of the vertebral arches, and unossified sternebrae observed in the prenatal developmental study in rats
Acute Dietary (general population including infants and children)	NOAEL = 67 mg/kg/day UF = 100 Acute RfD = 0.67 mg/kg/day	FQPA SF = 3 aPAD = 0.22 mg/kg/day	LOAEL = 227 mg/kg/day based on increased incidence of incoordination and slight gait abnormalities in both sexes on Day 1 FOB measurements in the acute neurotoxicity study in rats
Chronic Dietary (all Populations)	NOAEL = 1 mg/kg/day UF = 100 Chronic RfD = 0.01 mg/kg/day	FQPA SF = 3 cPAD = 0.0033 mg/kg/day	LOAEL = 5 mg/kg/day based on alterations in serum chemistry with corroborative histopathological lesions in the liver and kidneys in the chronic dog study
Cancer - the HED Cancer Peer Review Committee (7/17/96) classifies 2,4-D as a Group D chemical ("not classifiable as to human carcinogenicity") on the basis that "the evidence is inadequate and cannot be interpreted as showing either the presence or absence of a carcinogenic effect".			

III. Residue Information

Registered and Proposed 2,4-D Tolerances: Tolerances for 2,4-D are published in 40 CFR §180.142. In 40 CFR §180.142(a)(3), a tolerance for residues of 2,4-D from application of its dimethylamine salt to irrigation ditch banks in the Western United States is established at 0.1 ppm in/on hops. However, in 40 CFR §180.142(a)(6), tolerances for residues of 2,4-D from application of its dimethylamine salt for water hyacinth control in ponds, lakes, reservoirs, marshes, bayous, drainage ditches, canals, rivers and streams that are quiescent or slow moving are established at 1.0 ppm for a variety of crops including hops. The current "Section 18 like" request is for a tolerance for residues of 2,4-D in/on soybeans. A tolerance of 0.02 ppm was used in the acute and chronic dietary exposure assessment.

Nature of the Residue: The nature of the residue in plants is adequately understood. The residue of concern is 2,4-D *per se*, as stated in 40 CFR 180.142. The nature of the residue in livestock is adequately understood based upon acceptable ruminant and poultry metabolism studies. The HED Metabolism Committee (6/16/93) has concluded that the residues of concern in animals is 2,4-D, per se, as specified in 40 CFR 180.142.

% CT: No % CT information was used for the acute assessment. For the chronic assessment, % CT information or market share data provided by BEAD was used for all commodities (Memo,

4

A. Halvorson 6/20/00; Barcode 266727).

ARs: For the acute assessment, ARs calculated from field trial data were used for citrus and tolerance level residues were used for all other commodities. For the chronic assessment, ARs calculated from field trial data were used for wheat, rye and other small grains, sugarcane, and citrus commodities. Tolerance level residue were used for all other commodities. See Attachment 5 for further information on the ARs used in this assessment.

Processing Factors: Modified processing factors for wheat, rye and other small grains, sugarcane, and citrus commodities were incorporated in the acute and chronic assessments as Adjustment Factor #1. DEEM™ default concentration factors were used for all other commodities. See Attachment 5 for further information on the processing factors used in this assessment.

IV. DEEM™ Program and Consumption Information

2,4-D acute and chronic dietary exposure assessments were conducted using DEEM™ software Version 7.76, which incorporates consumption data from USDA's Continuing Surveys of Food Intake by Individuals (CSFII), 1989-1992. The 1989-92 data are based on the reported consumption of more than 10,000 individuals over three consecutive days, and therefore represent more than 30,000 unique "person days" of data. Foods "as consumed" (e.g., apple pie) are linked to raw agricultural commodities and their food forms (e.g., apples-cooked/canned or wheat-flour) by recipe translation files internal to the DEEM™ software. Consumption data are averaged for the entire US population and within population subgroups for chronic exposure assessment, but are retained as individual consumption events for acute exposure assessment.

For chronic exposure and risk assessment, an estimate of the residue level in each food or food-form (e.g., orange or orange-juice) on the commodity residue list is multiplied by the average daily consumption estimate for that food/food form. The resulting residue consumption estimate for each food/food form is summed with the residue consumption estimates for all other food/food forms on the commodity residue list to arrive at the total estimated exposure. Exposure estimates are expressed in mg/kg body weight/day and as a percent of the cPAD. This procedure is performed for each population subgroup.

For acute exposure assessments, individual one-day food consumption data are used on an individual-by-individual basis. The reported consumption amounts of each food item can be multiplied by a residue point estimate and summed to obtain a total daily pesticide exposure for a deterministic (Tier 1 or Tier 2) exposure assessment, or "matched" in multiple random pairings with residue values and then summed in a probabilistic (Tier 3/4) assessment. The resulting distribution of exposures is expressed as a percentage of the aPAD on both a user (i.e., those who reported eating relevant commodities/food forms) and a per-capita (i.e., those who reported eating the relevant commodities as well as those who did not) basis. In accordance with HED policy, per capita exposure and risk are reported for all tiers of analysis. However, for tiers 1 and 2, significant differences in user vs. per capita exposure and risk are identified and noted in the risk assessment.

V. Results/Discussion

HED's level of concern is >100% of the PAD. That is, estimated exposures above this level are of concern, while estimated exposures at or below this level are not of concern. The DEEM analyses estimate the dietary exposure of the U.S. population and 26 population subgroups. The results reported in Tables 3 and 4 are for the U.S. Population (total), all infants (<1 year old), children 1-6, children 7-12, females 13-50, males 13-19, males 20+, and seniors 55+. The results for the other population subgroups are included in the Appendices.

Results of Acute Dietary Exposure Analysis

Table 3. Results of Acute Dietary Exposure Analysis at the 95th Percentile of Exposure.

Population Subgroup	aPAD (mg/kg/day)	Exposure (mg/kg/day)	% aPAD
U.S. Population	0.22	0.015388	7
All Infants (<1 year old)	0.22	0.019675	9
Children 1-6 years old	0.22	0.025769	12
Children 7-12 years old	0.22	0.018548	8
Females 13-50 years old	0.083	0.009737	12
Males 13-19 years old	0.22	0.013944	6
Males 20+ years old	0.22	0.010307	5
Seniors 55+ years old	0.22	0.08162	4

Chronic Dietary Exposure Analysis

Table 4. Results of Chronic Dietary Exposure Analysis.

Population Subgroup	cPAD (mg/kg/day)	Exposure (mg/kg/day)	% cPAD
U.S. Population (total)	0.0033	0.000802	24
All Infants (< 1 year)	0.0033	0.000622	19
Children 1-6 years	0.0033	0.001510	46
Children 7-12 years	0.0033	0.001180	36
Females 13-50	0.0033	0.000645	20
Males 13-19	0.0033	0.000786	24
Males 20+ years	0.0033	0.000715	22
Seniors 55+	0.0033	0.000634	19

VI. Discussion of Uncertainties

2,4-D residue estimates, or ARs (listed in Table 2) used in the chronic dietary exposure assessment are based on field trial data, submitted by the registrant to support tolerances. Field trial residue data are generally considered by HED as an upper-end or a worst case scenario of possible residues and are more suited to the requirements of tolerance setting, because it requires highest rates of application and shortest preharvest interval (PHI), than to the requirements of dietary exposure assessment (when a more realistic estimate is desired).

For the acute assessment, additional refinements using percent crop treated data, additional anticipated residue data from field trials, and/or use of monitoring data would further reduce risk

estimates. For the chronic assessment, additional refinements using additional anticipated residue data from field trials and/or use of monitoring data would further reduce risk estimates.

The agency notes that there is a degree of uncertainty in extrapolating exposures for certain population subgroups from the general U.S. population which may not be sufficiently represented in the consumption surveys, (e.g., nursing and non-nursing infants or Hispanic females). Therefore, dietary risks estimated for these population subgroups were included in representative populations having sufficient numbers of survey respondents (e.g., all infants or females, 13-50 years).

VII. Conclusions

Table 5. Summary of Dietary Exposure and Risk for 2,4-D.

Population Subgroup	Acute Dietary[1]		Chronic Dietary[2]		Cancer Risk or MOE
	Dietary Exposure (mg/kg/day)	% aPAD	Dietary Exposure (mg/kg/day)	% cPAD	
U.S. Population (total)	0.015388	7	0.000802	24	NA[3]
All Infants (< 1 year)	0.019675	9	0.000622	19	
Children 1-6 years	0.025769	12	0.001510	46	
Children 7-12 years	0.018548	8	0.001180	36	
Females 13-50	0.009737	12	0.000645	20	
Males 13-19	0.013944	6	0.000786	24	
Males 20+ years	0.010307	5	0.000715	22	
Seniors 55+	0.08162	4	0.000634	19	

1. Acute dietary endpoint applies to general U.S. population and all population subgroups.
2. Chronic dietary endpoint applies to general U.S. population and all population subgroups.
3. NA = not applicable.

VIII. List of Attachments

Attachment 1: 2,4-D Residue File for Acute DEEM™ Analysis.
Attachment 2: 2,4-D Acute DEEM™ Analysis.
Attachment 3: 2,4-D Residue File for Chronic DEEM™ Analysis.
Attachment 4: 2,4-D Chronic DEEM™ Analysis.
Attachment 5: Percent Crop Treated Information, Anticipated Residue Calculations, and Processing Factor Information for Acute and Chronic DEEM™ Analyses.

7

cc (w/ Attachments): J. Tyler (HED/RAB1); D. Kenny (RD 7505C)
RDI: DE SAC [A. Acierto (05/16/02), W. Cutchin (05/16/02)]; G. Herndon (05/20/02)
J.Tyler:809B:CM#2:(703)305-5564: 7509C:RAB1

Attachment 1

Filename: C:\MyFiles\DEEM\24D\modified2-04030001a.RS7 Chemical: 2,4,-D
RfD(Chronic): .01 mg/kg bw/day NOEL(Chronic): 0 mg/kg bw/day
RfD(Acute): .67 mg/kg bw/day NOEL(Acute): 0 mg/kg bw/day
Date created/last modified: 02-04-2002/11:03:06/8 Program ver. 7.75
Comment: PV Shah, 00WA0033, ARs for blended commodities; aPAD = 0.083 females 13+, 0.22 all other

Food Code	Crop Grp	Food Name	Def Res (ppm)	Adj.Factors #1	Adj.Factors #2	Comment
22	10	Grapefruit-peeled fruit	0.079000	1.000	1.000	6E1678,AR Grapefruit=0.079
23	10	Grapefruit-juice	0.079000	0.120	1.000	6E1678,AR Grapefruit=0.079
26	10	Lemons-peeled fruit	0.605000	1.000	1.000	6E1678, AR Lemons = 0.605
27	10	Lemons-peel	0.605000	1.000	1.000	6E1678, AR Lemons = 0.605
28	10	Lemons-juice	0.605000	0.110	1.000	6E1678, AR Lemons = 0.605
33	10	Oranges-juice-concentrate	0.050000	0.370	1.000	6E1678, AR Oranges = 0.050
34	10	Oranges-peeled fruit	0.050000	1.000	1.000	6E1678, AR Oranges = 0.050
35	10	Oranges-peel	0.050000	1.000	1.000	6E1678, AR Oranges = 0.050
36	10	Oranges-juice	0.050000	0.100	1.000	6E1678, AR Oranges = 0.050
38	10	Tangerines	0.050000	1.000	1.000	6E1678,AR Tangerines=0.050
39	10	Tangerines-juice	0.050000	0.130	1.000	6E1678,AR Tangerines=0.050
237	15	Corn/pop	1.000000	1.000	1.000	8F0670
238	15	Corn/sweet	1.000000	1.000	1.000	8F0670
260	O	Asparagus	5.000000	1.000	1.000	5E1475
265	15	Barley	1.000000	1.000	1.000	6F0459
266	15	Corn grain-endosperm	1.000000	1.000	1.000	8F0670
267	15	Corn grain-bran	1.000000	1.000	1.000	8F0670
268	15	Corn grain/sugar/hfcs	1.000000	1.500	1.000	8F0670
269	15	Oats	1.000000	1.000	1.000	6F0459
270	15	Rice-rough (brown)	1.000000	1.000	1.000	8F0670
271	15	Rice-milled (white)	1.000000	1.000	1.000	8F0670
272	15	Rye-rough	1.000000	1.000	1.000	8F0670
273	15	Rye-germ	2.000000	1.000	1.000	8F0670
274	15	Rye-flour	1.000000	1.000	1.000	8F0670
275	15	Sorghum (including milo)	1.000000	1.000	1.000	8F0670
276	15	Wheat-rough	1.000000	1.000	1.000	6F0459
277	15	Wheat-germ	2.000000	1.000	1.000	6F0459
278	15	Wheat-bran	2.000000	1.000	1.000	6F0459
279	15	Wheat-flour	2.000000	1.000	1.000	6F0459
280	15	Millet	1.000000	1.000	1.000	6F0459
283	O	Sugar-cane	2.000000	1.000	1.000	No petition #
284	O	Sugar-cane/molasses	5.000000	1.000	1.000	No petition #
286	15	Buckwheat	1.000000	1.000	1.000	8F0670
289	15	Corn grain-oil	1.000000	1.000	1.000	8F0670
318	D	Milk-nonfat solids	0.004000	1.000	1.000	8F0670, AR
319	D	Milk-fat solids	0.004000	1.000	1.000	8F0670, AR
320	D	Milk sugar (lactose)	0.004000	1.000	1.000	8F0670, AR
321	M	Beef-meat byproducts	0.200000	1.000	1.000	8F0670
322	M	Beef-other organ meats	0.200000	1.000	1.000	8F0670
323	M	Beef-dried	0.200000	1.920	1.000	8F0670
324	M	Beef-fat w/o bones	0.200000	1.000	1.000	8F0670
325	M	Beef-kidney	2.000000	1.000	1.000	8F0670
326	M	Beef-liver	0.200000	1.000	1.000	8F0670
327	M	Beef-lean (fat/free) w/o bones	0.200000	1.000	1.000	8F0670
328	M	Goat-meat byproducts	0.200000	1.000	1.000	8F0670
329	M	Goat-other organ meats	0.200000	1.000	1.000	8F0670
[illegible]	M	[illegible]	0.200000	1.000	1.000	8F0670
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

M	Goat-lean (fat/free) w/o bone	0.200000	1.000	1.000	8F0670	
334	M	Horsemeat	0.200000	1.000	1.000	8F0670
336	M	Sheep-meat byproducts	0.200000	1.000	1.000	8F0670
337	M	Sheep-other organ meats	0.200000	1.000	1.000	8F0670
338	M	Sheep-fat w/o bone	0.200000	1.000	1.000	8F0670
339	M	Sheep-kidney	2.000000	1.000	1.000	8F0670
340	M	Sheep-liver	0.200000	1.000	1.000	8F0670
341	M	Sheep-lean (fat free) w/o bone	0.200000	1.000	1.000	8F0670
342	M	Pork-meat byproducts	0.200000	1.000	1.000	8F0670
343	M	Pork-other organ meats	0.200000	1.000	1.000	8F0670
344	M	Pork-fat w/o bone	2.000000	1.000	1.000	8F0670
345	M	Pork-kidney	0.200000	1.000	1.000	8F0670
346	M	Pork-liver	0.200000	1.000	1.000	8F0670
347	M	Pork-lean (fat free) w/o bone	1.000000	1.000	1.000	3E1390
349	F	Fish-shellfish	1.000000	1.000	1.000	3E1390
351	F	Fish-roe/caviar	1.000000	1.000	1.000	3E1390
352	F	Fish-finfish/freshwater	1.000000	1.000	1.000	3E1390
353	F	Fish-finfish/saltwater (incl. tu	1.000000	1.600	1.000	3E1390
354	F	Fish-finfish-saltwater-dried	0.050000	1.000	1.000	8F0670
355	P	Turkey-byproducts	0.050000	1.000	1.000	8F0670
356.	P	Turkey-giblets (liver)	0.050000	1.000	1.000	8F0670
357	P	Turkey--fat w/o bones	0.050000	1.000	1.000	8F0670
358	P	Turkey- lean/fat free w/o bones	0.050000	1.000	1.000	8F0670
360	P	Poultry-other-lean (fat free) w/	0.050000	1.000	1.000	8F0670
361	P	Poultry-other-giblets(liver)	0.050000	1.000	1.000	8F0670
362	P	Poultry-other-fat w/o bones	0.050000	1.000	1.000	8F0670
363	P	Eggs-whole	0.050000	1.000	1.000	8F0670
364	P	Eggs-white only	0.050000	1.000	1.000	8F0670
365	P	Eggs-yolk only	0.050000	1.000	1.000	8F0670
366	P	Chicken-byproducts	0.050000	1.000	1.000	8F0670
367	P	Chicken-giblets(liver)	0.050000	1.000	1.000	8F0670
368	P	Chicken-fat w/o bones	0.050000	1.000	1.000	8F0670
369	P	Chicken-lean/fat free w/o bones	0.050000	1.000	1.000	8F0670
385	P	Chicken-giblets (excl. liver)	0.050000	1.000	1.000	8F0670
388	15	Corn grain/sugar-molasses	1.000000	1.500	1.000	8F0670
398	D	Milk-based water	0.004000	1.000	1.000	8F0670, AR
399	15	Oats-bran	1.000000	1.000	1.000	6F0459
408	15	Rice-bran	1.000000	1.000	1.000	8F0670
409	15	Rice-wild	1.000000	1.000	1.000	6E4636
420	10	Tangerines-juice-concentrate	0.050000	0.420	1.000	6E1678,AR Tangerines=0.050
424	M	Veal-fat w/o bones	0.200000	1.000	1.000	8F0670
425	M	Veal-lean (fat free) w/o bones	0.200000	1.000	1.000	8F0670
426	M	Veal-kidney	2.000000	1.000	1.000	8F0670
427	M	Veal-liver	0.200000	1.000	1.000	8F0670
428	M	Veal-other organ meats	0.200000	1.000	1.000	8F0670
429	M	Veal-dried	0.200000	1.920	1.000	8F0670
430	M	Veal-meat byproducts	0.200000	1.000	1.000	8F0670
437	15	Wheat-germ oil	2.000000	1.000	1.000	6F0459
441	10	Grapefruit-juice-concentrate	0.079000	0.472	1.000	6E1678,AR Grapefruit=0.079
442	10	Lemons-juice-concentrate	0.605000	0.630	1.000	6E1678, AR Lemons = 0.605
448	10	Grapefruit peel	0.079000	1.000	1.000	6E1678,AR Grapefruit=0.079
449	P	Turkey-other organ meats	0.050000	1.000	1.000	8F0670

Attachment 2

U.S. Environmental Protection Agency
DEEM ACUTE Analysis for 2,4,-D Ver. 7.74
Residue file: modified2-04030001a.RS7 (1989-92 data)
Analysis Date: 02-04-2002/11:57:32 Adjustment factor #2 NOT used.
Acute Pop Adjusted Dose (aPAD) varies with population; see individual reports Residue file dated: 02-04-2002/11:55:00/8
Daily totals for food and foodform consumption used.
Run Comment: "PV Shah, 00WA0033, ARs for blended commodities; aPAD = 0.083 fem

9

ales 13+, 0.22 all other subgroups"

Summary calculations (per capita):

	95th Percentile Exposure	95th Percentile % aPAD	99th Percentile Exposure	99th Percentile % aPAD	99.9th Percentile Exposure	99.9th Percentile % aPAD
U.S. Population:	0.015388	6.99	0.023155	10.52	0.034697	15.77
All infants:	0.019675	8.94	0.024676	11.22	0.033834	15.38
Nursing infants (<1 yr old):	0.008890	4.04	0.014883	6.76	0.017127	7.79
Non-nursing infants (<1 yr old):	0.022065	10.03	0.026871	12.21	0.034033	15.47
Children 1-6 yrs:	0.025769	11.71	0.033899	15.41	0.041026	18.65
Children 7-12 yrs:	0.018548	8.43	0.022939	10.43	0.030264	13.76
Females 13+ (preg/not nursing):	0.008654	10.43	0.011319	13.64	0.014794	17.82
Females 13+ (nursing):	0.011514	13.87	0.012914	15.56	0.014576	17.56
Females 13-19 (not preg or nursing):	0.011013	13.27	0.014792	17.82	0.019827	23.89
Females 20+ (not preg or nursing):	0.008953	10.79	0.013400	16.14	0.023073	27.80
Females 13-50 yrs:	0.009737	11.73	0.013895	16.74	0.022132	26.66
Males 13-19 yrs:	0.013944	6.34	0.018365	8.35	0.022885	10.40
Males 20+ yrs:	0.010307	4.68	0.014667	6.67	0.020531	9.33
Seniors 55+:	0.008162	3.71	0.012284	5.58	0.020345	9.25

Attachment 3

Filename: C:\MyFiles\DEEM\24D\modified2-04030001c.RS7 Chemical: 2,4,-D
RfD(Chronic): .01 mg/kg bw/day NOEL(Chronic): 0 mg/kg bw/day
RfD(Acute): 0 mg/kg bw/day NOEL(Acute): 67 mg/kg bw/day
Date created/last modified: 02-04-2002/11:05:33/8 Program ver. 7.75
Comment: PV Shah, 00WA0033; cPAD = 0.0033 mg/kg/day all population subgroups

Food Code	Crop Grp	Food Name	Def Res (ppm)	Adj.Factors #1	#2	Comment
22	10	Grapefruit-peeled fruit	0.060000	1.000	0.020	6E1678,AR Grapefruit=0.06
23	10	Grapefruit-juice	0.060000	0.120	0.020	6E1678,AR Grapefruit=0.06
26	10	Lemons-peeled fruit	0.410000	1.000	0.010	6E1678, AR Lemon = 0.41
27	10	Lemons-peel	0.410000	1.000	0.010	6E1678, AR Lemon = 0.41
28	10	Lemons-juice	0.410000	0.110	0.010	6E1678, AR Lemon = 0.41
33	10	Oranges-juice-concentrate	0.050000	0.370	0.040	6E1678, AR Oranges = 0.05
34	10	Oranges-peeled fruit	0.050000	1.000	0.040	6E1678, AR Oranges = 0.05
35	10	Oranges-peel	0.050000	1.000	0.040	6E1678, AR Oranges = 0.05
36	10	Oranges-juice	0.050000	0.100	0.040	6E1678, AR Oranges = 0.05
38	10	Tangerines	0.050000	1.000	0.040	6E1678,AR Tangerines=0.05
39	10	Tangerines-juice	0.050000	0.130	0.040	6E1678,AR Tangerines=0.05
237	15	Corn/pop	1.000000	1.000	0.150	8F0670
238	15	Corn/sweet	1.000000	1.000	0.090	8F0670
260	O	Asparagus	5.000000	1.000	0.130	5E1475
265	15	Barley	0.012000	1.000	0.370	6F0459, AR
266	15	Corn grain-endosperm	1.000000	1.000	0.090	8F0670
267	15	Corn grain-bran	1.000000	1.000	0.090	8F0670
268	15	Corn grain/sugar/hfcs	1.000000	1.500	0.090	8F0670
269	15	Oats	0.012000	1.000	0.150	6F0459, AR
270	15	Rice-rough (brown)	1.000000	1.000	0.140	8F0670
271	15	Rice-milled (white)	1.000000	1.000	0.140	8F0670
272	15	Rye-rough	0.012000	1.000	0.140	8F0670, AR
273	15	Rye-germ	0.012000	0.300	0.140	8F0670, AR
274	15	Rye-flour	0.012000	0.100	0.140	8F0670, AR
275	15	Sorghum (including milo)	1.000000	1.000	0.130	8F0670
276	15	Wheat-rough	0.012000	1.000	0.340	6F0459, AR
277	15	Wheat-germ	0.012000	0.300	0.340	6F0459, AR
278	15	Wheat-bran	0.012000	3.600	0.340	6F0459, AR
279	15	Wheat-flour	0.012000	0.100	0.340	6F0459, AR
280	15	Millet	0.012000	1.000	1.000	3F2876, AR
283	O	Sugar-cane	0.011000	0.350	0.350	No petition #
284	O	Sugar-cane/molasses	0.011000	7.000	0.350	No petition #
286	15	Buckwheat	1.000000	1.000	1.000	8F0670
289	15	Corn grain-oil	1.000000	1.000	0.090	8F0670
318	D	Milk-nonfat solids	0.004000	1.000	1.000	8F0670, AR
319	D	Milk-fat solids	0.004000	1.000	1.000	8F0670, AR
320	D	Milk sugar (lactose)	0.004000	1.000	1.000	8F0670, AR
321	M	Beef-meat byproducts	0.200000	1.000	1.000	8F0670
322	M	Beef-other organ meats	0.200000	1.000	1.000	8F0670
323	M	Beef-dried	0.200000	1.920	1.000	8F0670
324	M	Beef-fat w/o bones	0.200000	1.000	1.000	8F0670
325	M	Beef-kidney	2.000000	1.000	1.000	8F0670
326	M	Beef-liver	0.200000	1.000	1.000	8F0670
327	M	Beef-lean (fat/free) w/o bones	0.200000	1.000	1.000	8F0670
328	M	Goat-meat byproducts	0.200000	1.000	1.000	8F0670
329	M	Goat-other organ meats	0.200000	1.000	1.000	8F0670
330	M	Goat-fat w/o bone	0.200000	1.000	1.000	8F0670
331	M	Goat-kidney	2.000000	1.000	1.000	8F0670
332	M	Goat-liver	0.200000	1.000	1.000	8F0670
333	M	Goat-lean (fat/free) w/o bone	0.200000	1.000	1.000	8F0670
334	M	Horsemeat	0.200000	1.000	1.000	8F0670
336	M	Sheep-meat byproducts	0.200000	1.000	1.000	8F0670

337	M	Sheep-other organ meats	0.200000	1.000	1.000	8F0670	
338	M	Sheep-fat w/o bone	0.200000	1.000	1.000	8F0670	
339	M	Sheep-kidney	2.000000	1.000	1.000	8F0670	
340	M	Sheep-liver	0.200000	1.000	1.000	8F0670	
341	M	Sheep-lean (fat free) w/o bone	0.200000	1.000	1.000	8F0670	
342	M	Pork-meat byproducts	0.200000	1.000	1.000	8F0670	
343	M	Pork-other organ meats	0.200000	1.000	1.000	8F0670	
344	M	Pork-fat w/o bone	0.200000	1.000	1.000	8F0670	
345	M	Pork-kidney	2.000000	1.000	1.000	8F0670	
346	M	Pork-liver	0.200000	1.000	1.000	8F0670	
347	M	Pork-lean (fat free) w/o bone	0.200000	1.000	1.000	8F0670	
349	F	Fish-shellfish	1.000000	1.000	1.000	P, 3E1390	
351	F	Fish-roe/caviar	1.000000	1.000	1.000	P, 3E1390	
352	F	Fish-finfish/freshwater	1.000000	1.000	1.000	P, 3E1390	
353	F	Fish-finfish/saltwater (incl. tu	1.000000	1.000	1.000	P, 3E1390	
354	F	Fish-finfish-saltwater-dried	1.000000	1.600	1.000	P, 3E1390	
355	P	Turkey-byproducts	0.050000	1.000	1.000	8F0670	
356	P	Turkey-giblets (liver)	0.050000	1.000	1.000	8F0670	
357	P	Turkey--fat w/o bones	0.050000	1.000	1.000	8F0670	
358	P	Turkey- lean/fat free w/o bones	0.050000	1.000	1.000	8F0670	
360	P	Poultry-other-lean (fat free) w/	0.050000	1.000	1.000	8F0670	
361	P	Poultry-other-giblets(liver)	0.050000	1.000	1.000	8F0670	
362	P	Poultry-other-fat w/o bones	0.050000	1.000	1.000	8F0670	
363	P	Eggs-whole	0.050000	1.000	1.000	8F0670	
364	P	Eggs-white only	0.050000	1.000	1.000	8F0670	
365	P	Eggs-yolk only	0.050000	1.000	1.000	8F0670	
366	P	Chicken-byproducts	0.050000	1.000	1.000	8F0670	
367	P	Chicken-giblets(liver)	0.050000	1.000	1.000	8F0670	
368	P	Chicken-fat w/o bones	0.050000	1.000	1.000	8F0670	
369	P	Chicken-lean/fat free w/o bones	0.050000	1.000	1.000	8F0670	
385	P	Chicken-giblets (excl. liver)	0.050000	1.000	1.000	8F0670	
388	15	Corn grain/sugar-molasses	1.000000	1.500	0.090	8F0670	
398	D	Milk-based water	0.004000	1.000	1.000	8F0670, AR	
399	15	Oats-bran	0.012000	3.600	0.150	6F0459	
408	15	Rice-bran	1.000000	1.000	1.000	8F0670	
409	15	Rice-wild	1.000000	1.000	1.000	6E4636	
420	10	Tangerines-juice-concentrate	0.050000	0.420	0.040	6E1678, Tangerines = 0.05	
424	M	Veal-fat w/o bones	0.200000	1.000	1.000	8F0670	
425	M	Veal-lean (fat free) w/o bones	0.200000	1.000	1.000	8F0670	
426	M	Veal-kidney	2.000000	1.000	1.000	8F0670	
427	M	Veal-liver	0.200000	1.000	1.000	8F0670	
428	M	Veal-other organ meats	0.200000	1.000	1.000	8F0670	
429	M	Veal-dried	0.200000	1.920	1.000	8F0670	
430	M	Veal-meat byproducts	0.200000	1.000	1.000	8F0670	
437	15	Wheat-germ oil	2.000000	1.000	0.550	6F0459	
441	10	Grapefruit-juice-concentrate	0.060000	0.472	0.020	6E1678,AR Grapefruit=0.06	
442	10	Lemons-juice-concentrate	0.410000	0.630	0.010	6E1678, AR Lemon = 0.41	
448	10	Grapefruit peel	0.060000	1.000	0.020	6E1678,AR Grapefruit=0.06	
449	P	Turkey-other organ meats	0.050000	1.000	1.000	8F0670	

12

Attachment 4

U.S. Environmental Protection Agency
DEEM Chronic analysis for 2,4,-D Ver. 7.73
Residue file name: C:\MyFiles\DEEM\24D\modified2-04030001c.RS7 (1989-92 data)

Analysis Date 02-04-2002/11:59:03 Adjustment factor #2 used.
Reference dose (RfD, Chronic) = .0033 mg/kg bw/day Residue file dated: 02-04-2002/11:55:48/8
COMMENT 1: PV Shah, 00WA0033; cPAD = 0.0033 mg/kg/day all population subgroups

Total exposure by population subgroup

Population Subgroup	Total Exposure mg/kg body wt/day	Total Exposure Percent of Rfd
U.S. Population (total)	0.000802	24.3%
U.S. Population (spring season)	0.000800	24.2%
U.S. Population (summer season)	0.000814	24.7%
U.S. Population (autumn season)	0.000799	24.2%
U.S. Population (winter season)	0.000791	24.0%
Northeast region	0.000845	25.6%
Midwest region	0.000802	24.3%
Southern region	0.000808	24.5%
Western region	0.000747	22.6%
Hispanics	0.000879	26.6%
Non-hispanic whites	0.000770	23.3%
Non-hispanic blacks	0.000907	27.5%
Non-hisp/non-white/non-black	0.000994	30.1%
All infants (< 1 year)	0.000622	18.9%
Nursing infants	0.000224	6.8%
Non-nursing infants	0.000790	23.9%
Children 1-6 yrs	0.001510	45.8%
Children 7-12 yrs	0.001180	35.8%
Females 13-19 (not preg or nursing)	0.000657	19.9%
Females 20+ (not preg or nursing)	0.000633	19.2%
Females 13-50 yrs	0.000645	19.6%
Females 13+ (preg/not nursing)	0.000597	18.1%
Females 13+ (nursing)	0.000634	19.2%
Males 13-19 yrs	0.000786	23.8%
Males 20+ yrs	0.000715	21.7%
Seniors 55+	0.000634	19.2%
Pacific Region	0.000764	23.2%

Attachment 5

Based on time constraints and given that RD has requested that HED perform a "Section 18 like" risk assessment for 2,4-D, RAB1 has chosen to refine only those crops/commodities that contribute significantly to the dietary risk cup for 2,4-D. The refinements were made to the most recent DEEM analyses for 2,4-D the Section 18 request on hops (D266939, W. Donovan, 7/6/00). The following information was used in the acute and chronic dietary exposure assessment (Memo, G. Herndon 1/31/02; D280618).

Susceptible and Unregistered Crops

2,4-D is intended to kill broadleaf weeds (dicotelydons) and leave grass-like crops (monocotelydons) unscathed. In discussions with Larry Hammond of the Industry Task Force II on 2,4-D Research data (multiple phone conversations during 1/02), many of the crops contained in the 7/6/00 DEEM analyses have no 2,4-D registrations and would be killed if 2,4-D were applied to them (over the top) at labeled rates for grass-like plants.

2,4-D is also registered for application to aquatic sites to kill broadleaf weeds. According to Larry Hammond, the label specifies that a 2 ppm concentration in the water must be achieved in order to be efficacious. Larry Hammond also indicated that if water containing a 2 ppm concentration of 2,4-D were applied over-the-top to broadleaf crops (e.g. used as irrigation water), damage and-or death would occur to broadleaf crops. Even though susceptible crops may be damaged or killed by overhead irrigation, residues of 2,4-D from potential use of 2,4-D-contaminated irrigation water was also examined. RAB1 re-examined the results of the confined rotational crop study (D207980, D. Miller, 11/30/95). HED concluded that the results of the confined rotational crop study performed on lettuce, wheat, and radish "indicate that additional limited field trials are not required, that no rotational tolerances are necessary, and that no plant-back interval following 2,4-D application is needed". From this information, RAB1 concluded that, even if 2 ppm irrigation water were used for in-furrow irrigation of both susceptible and non-susceptible crops, measurable residues in the resulting edible plant parts would not be likely. For the reasons stated above, the following crops were removed from both the acute and chronic dietary exposure analyses of 7/6/00 due to their being NOT REGISTERED on that crop AND that crop would be SUSCEPTIBLE to 2,4-D damage and/or death:

blackberries, boysenberries, dewberries, loganberries, raspberries, youngberries, currants, elderberries, gooseberries, huckleberries, juneberries, mulberries, citrus citron, kumquats, limes, tangelos, Brazil nuts, cashews, chestnut, hickory nuts, macadamia nuts, butter nuts, beech nuts, quinces, avocados, loquats, chicory, ginger, hops, horseradish, turmeric, paprika, casabas, crenshaws, honeydew melons, Persian melons, watermelon, cucumbers, pumpkin, squash (all), bitter melon, towelgourd, eggplant, peppers, tomatoes, garden beets, celery, chicory, broccoli, Brussels sprouts, cabbage, cauliflower, collards, kale, kohlrabi, lettuce, dandelion, endive, fennel, cress, mustard greens, parsley, rhubarb, spinach, Swiss chrad, turnips, taro, carrots, celeriac, Jerusalem artichokes, white potatoes, radish, rutabagas, salsify, sweet potatoes, parsnips, yam-bean, cassava, beans, peas, lentils, mung beans, cottonseed, burdock, christophine, chervil, ginseng, bok choy, chayote, arugula, radicchio, balsam pear, amaranth, and chrysanthmum

The following crops have 2,4-D registrations. However, based on the use pattern (application below the canopy to the vegetation below the crop, prior to crop emergence, or a directed spray), and the results of the confined rotational crop studies, residues would not be expected. These are

also SUSCEPTIBLE crops if 2,4-D were to contact the leaves to any great extent. These crops were also removed from the acute and chronic dietary exposure analyses:

> blueberries, cranberries, grapes, strawberries, almonds, filberts, pecans, walnuts, pistachios, apples, crabapples, pears, apricots, cherries, nectarines, peaches, plums, prunes, sugarbeet, and soybean

Use of Treated Irrigation Water on Non-Susceptible and Registered Crops

The potential exists for application of 2,4-D-contaminated water (from the 2 ppm concentration used in aquatic sites to kill broadleaf weeds) to non-susceptible and crops which have a 2,4-D registration. The rotational crop data indicate that, if applied in-furrow, measurable residues would not likely result. However, overhead irrigation could result in detectable residues. In order to account for this possibility, RAB1 examined field trial residue data from 0-day PHI grass forage samples (D213641, D. Miller, 6/3/96). Of all the 0-day grass forage samples analyzed in that memo (26 locations and/or formulation types applied), the highest residue was 358 ppm from a trial in Pennsylvania (MRID# 43610802), and the average of all trials was 207 ppm. The field trials were conducted with 2 applications each at about 2 lbs.ae./A. (total of about 4 lbs.ae./A./season). The resulting residue level would likely be the result of the last application (0-day PHI), so RAB1 assumed the resulting residues value was the result of a 2 lb.ae./A. application rate (a conservative assumption). Each application was made in a final spray volume of 5 gallons/A. Assuming the density of the spray solution is the same as water (1 gallon of water weighs 8.34 lbs), the 5 gallons of spray that was applied per acre would weigh 41.7 lbs.. 2 lbs.ae. in 41.7 lbs of spray solution would yield a 48,000 ppm spray solution. This 48,000 ppm spray solution resulted in a field trial residue value of 358 ppm (max) or 207 ppm (average). Since the target plant is not likely to bioaccumulate 2,4-D during application of irrigation water (the plant would only hold a certain amount of 2 ppm irrigation water - after that, the additional irrigation water would carry 2,4-D to the ground with it), 2 ppm in irrigation water would likely result in 0.015 ppm (max) or 0.0086 ppm (average) in a grass or similar plant. For the purposes of chronic anticipated residues (AR), on a non-susceptible crop on which 2,4-D is registered, RAB1 will not assume an AR value less than 0.01 ppm, even if the AR from the direct application indicates an AR of less than 0.01 ppm.

Wheat, Oats, Barley, Millet, Rye

The current maximum use rate is 1.0 lb.ae./A. applied after the crop is tillered but before the boot stage (about 4-8 inches tall) plus 0.5 lb.ae./A. at the dough stage (14-day PHI). However, according to Larry Hammond, almost all (99%) of the 2,4-D applications to small grains occur early in the season (after the crop is tillered but before the boot stage), with only about 1% applied close to harvest (14-day PHI). According to Larry Hammond, this late application would only be used when earlier applications of herbicides were ineffective and the weeds are tall enough to interfere with harvesting the crop. BEAD verified the early season vs. late season breakout of 2,4-D applications.

Residue Data: The previously reviewed residue data on small grains does not correspond very well with the current use pattern. Therefore, RAB1 examined data which the Task Force had previously submitted but has not undergone a complete HED review. Wheat field trial data were submitted from 6 trials using the 2-ethylhexyl ester form of 2,4-D (MRID# 441903-01) and 6 trials using the dimethylamine salt form of 2,4-D (MRID# 441903-02). Applications were made

to wheat at 1.25 lb.ae./A. to wheat at < 8 inches tall (12 sites, 24 samples) and also the combination of applications at 1.25 lb.ae./A. to wheat at < 8 inches tall PLUS 0.50 lb.ae./A. at a 14-day PHI (12 sites, 24 samples). The overall average residue value in wheat grain from the early season application only was 0.0105 ppm. The overall average residue value in wheat grain from the early season plus late season application was 0.20 ppm. Combined with the application information, the following chronic wheat grain values were calculated:

99% early season use X average early season residue = 99 X 0.0105 ppm = 1.04 ppm
1% early + late season X average combined residue = 1 X 0.20 ppm = 0.20 ppm

1.04 ppm + 0.20 ppm = 1.24 ppm divided by 100% = 0.0124 ppm average

These will also be translated to the other similar small grains with the same use pattern: barley, oats, millet, and rye.

Processing Study: A wheat processing study was previously submitted (MRID# 436937-01) and reviewed by HED (D213641, D Miller, 6/3/96). In that review, the following concentration factors were calculated: wheat middlings - 0.289X, wheat bran - 3.63X, and wheat patent flour - 0.0955X. Based on current definitions, middlings is translated to germ. RAB1 calculated the following wheat and rye commodity (AR) to be used in the chronic DEEM analysis:

Commodity	AR (ppm)	DEEM adj. factor #1
wheat-germ	0.012	0.30
wheat-bran	0.012	3.6
wheat-flour	0.012	0.10
rye-germ	0.012	0.30
rye-flour	0.012	0.10

Sugarcane

The current label allows a maximum of 2 lbs.ae./A. preemergence and 2 lbs.ae./A. postemergence.

Residue Data: The following data were previously reviewed by HED (D213641, D. Miller, 6/3/96). Sugarcane field trial data were submitted from 6 trials using the Dimethylamine salt form of 2,4-D (MRID# 43736101) and 2 trials using the acid form of 2,4-D (MRID# 43736102). In each trial, 2 applications were made, each at about 2 lbs.ae./A. (total of about 4 lbs.ae./A./season) and a PHI of 137 - 214 days. The average residue was 0.0106 ppm.
Processing Study: A sugarcane processing study was previously submitted (MRID# 00068889) and reviewed by HED (2,4-D Registration Standard, 2/16/88). In that review, 7 of the cane samples processed exhibited measurable residues (1 was non-detectable (ND) and was not used in the calculations shown below). The 7 samples showed an average concentration factor of 0.7x in juice, with a further concentration of 0.2 - 0.5X from juice to raw sugar (overall 0.35X concentration factor from cane to raw sugar). A 7X concentration of 2,4-D residues in molasses was shown (D213641, D Miller, 6/3/96). RAB1 calculated the following sugarcane commodity ARs to be used in the chronic DEEM analysis:

Commodity	AR (ppm)	DEEM adj. factor #1

sugar-cane	0.011	0.35
sugar-cane/molasses	0.011	7.0

Citrus

2,4-D is currently registered as a stop-drop agent (preharvest) on grapefruit, lemons, oranges, and tangerines only. Citrus in Florida is not treated with 2,4-D preharvest. The registration is for the IPE formulation only (according to Larry Hammond, this formulation flashes off faster than the other esters, and therefore is much less phytotoxic). The rates are very low (24 ppm solution is used) and there is a 7-day PHI. Lemons also have a postharvest dip use of 2,4-D (applied as a 500 ppm solution).

Residue Data:

Grapefruit and Oranges: The following data were previously reviewed by HED (D221853, D. Miller, 7/8/96). Field trial residue data were submitted on grapefruit and oranges representing the stop-drop use. A net rate of 32 to 54 g.ae./A. was applied to 6 plots of grapefruit and 2 plots of navel oranges. In grapefruit, the highest residue was 0.079 ppm, with an average of 0.06 ppm. In oranges, all residues were < 0.05 ppm. The orange data can be translated to tangerines.

Lemons: The following data were previously reviewed by HED (D221853, D. Miller, 7/8/96). Field trial residue data were submitted on lemons from a combination of the stop-drop use plus postharvest application. A net rate of 21 to 25 g.ae./A. was applied to 2 plots of lemons. Lemons were harvested at a 7-day PHI and further treated with a water/wax emulsion of 2,4-D at about a 400 ppm concentration. The lemons were then stored in a commercial facility for 28-112 days. Samples were taken after 0, 28, 56, and 112 days. The highest residue was 0.605 ppm, with an average of 0.41 ppm.

Processing Study: A lemon processing study was previously submitted and reviewed by HED (D221853, D. Miller, 7/8/96). Lemons bearing measurable residues were processed into juice (0.11X), wet pulp (0.88X), dry pulp (4.28X), and oil (< 1.02X). Combined with the updated DEEM citrus processing factors ("Adjustments to DEEM Default Processing Factors for Hops, Tea, and Juices", 8/18/00), RAB1 calculated the following citrus commodity AR and processing factors to be used in the acute and chronic DEEM analyses:

Commodity	Acute AR (ppm)	Chronic AR (ppm)	DEEM adj. factor #1
grapefruit-peeled fruit	0.079	0.06	1.0
grapefruit-juice	0.079	0.06	0.12
grapefruit-juice concentrate	0.079	0.06	0.472
grapefruit -peel	0.079	0.06	1.0
lemons-peeled fruit	0.605	0.41	1.0
lemons-peel	0.605	0.41	1.0
lemons-juice	0.605	0.41	0.11
lemons-juice concentrate	0.605	0.41	0.63
oranges-juice-concentrate	0.050	0.050	0.37
oranges-peeled fruit	0.050	0.050	1.0
oranges-peel	0.050	0.050	1.0
oranges-juice	0.050	0.050	0.10
tangerines	0.050	0.050	1.0
tangerines-juice	0.050	0.050	0.13

tangerines-juice-concentrate	0.050	0.050	0.42

[1] aPAD/cPAD = acute/chronic Population Adjusted Dose = $\frac{\text{Acute or Chronic RfD}}{\text{FQPA Safety Factor}}$