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OFFICE OF
PREVENTION, PESTICIDES AND
TOXIC SUBSTANCES

November 3, 1999

MEMORANDUM

SUBJECT: MALATHION: Preliminary Dietary Risk Assessment (Revised)
Chemical Number: 057701

FROM: Richard Griffin *Rich Griffin 11/3/99*
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The October 6, 1999 dietary risk assessment for malathion (R. Griffin memo) has been revised to reflect a revision to the chronic population adjusted dose (cPAD) made by the Hazard Identification Assessment Review Committee on 10/28/99 (J. Rowland memo, 11/1/99). The cPAD has been revised by the Committee from 0.04 mg/kg/day to 0.024 mg/kg/day based on a re-evaluation of test substance intake data.

The following dietary risk assessment for malathion is based on information and conclusions found in the following documents:

MALATHION: RE-EVALUATION Report of the Hazard Identification Assessment Review Committee (J. Rowland, 12/22/98)

MALATHION: Revised NOAEL for Derivation of the Chronic Reference Dose - Report of the Hazard Identification Assessment Review Committee (J. Rowland, 11/1/99)

Malathion Quantitative Risk Assessment (Q₁) Based on Fischer 344 Rat Chronic Dietary Study Using mg/kg b.w. 3/4's/day Cross Species Scaling Factor (L. Brunsmann, 7/13/99)*

FQPA Safety Factor Recommendations for the Organophosphates - A Combined Report of the HIARC and FQPA Safety Factor Committee (7/6/98)

Malathion: Anticipated Residues for Acute and Chronic Dietary Risk from Uses being Supported for Reregistration (W. Smith, 5/10/99)

Endpoint / Dose Selection for Dietary Risk Assessment

Non-Carcinogenic Endpoints for Risk Assessment

The HED Hazard Identification Assessment Review Committee (HIARC) established the following doses for dietary risk assessment based on *non-carcinogenic* effects:

Acute Population Adjusted Dose (aPAD): Estimates of acute dietary exposure are compared to a dose of 0.5 mg/kg body weight/day based on a NOAEL of 50 mg/kg bw/day and uncertainty factors of 10x for interspecies extrapolation and 10x for intraspecies variability (no additional factor for FQPA considerations). The endpoint is maternal toxicity, established in developmental studies in rabbits.

Chronic Population Adjusted Dose (cPAD): Estimates of chronic dietary exposure are compared to a dose of 0.024 mg/kg body weight/day based on a NOAEL of 2.4 mg/kg body weight/day and uncertainty factors of 10x for interspecies extrapolation and 10x for intraspecies variability (no additional factor for FQPA considerations). The endpoint is plasma cholinesterase inhibition, established in a chronic toxicity/carcinogenicity study in rats.

Carcinogenic Risk Assessment

The HED Cancer Assessment Review Committee (CARC) met on June 23, 1999 and the *draft* report states that malathion should be classified as a "likely human carcinogen". The draft report also recommends a linear low-dose approach (Q₁*) for human risk characterization and extrapolation, based on the nasal and liver tumors in rats at all dose levels tested. Subsequently, the *upper-bound* potency factor (Q₁*) was calculated to be $1.5 \times 10^{-3} \text{ (mg/kg bw/day)}^{-1}$ (L. Brunsmann memo, 7/13/99).

Usage Data

Annual usage of malathion has been estimated by the Biological and Economic Analysis Division (Quantitative Usage Analysis, G. Ali, 11/97) based on EPA, USDA,

and NCFAP data. Estimates were made, per commodity, of the weighted average yearly use, and an estimated maximum yearly use. This assessment has used the estimated maximum percent as a factor in the *chronic* dietary risk assessment. Percent crop treated estimates are summarized in Table 1 (May 10, 1999 W. Smith memo).

Residue Estimates for Risk Assessment

Residues of Concern

Tolerances for residues in/on food/feed commodities are currently expressed in terms of malathion *per se* (O,O-dimethyl dithiophosphate of diethyl mercaptosuccinate) [40 CFR §180.111, §185.3850, §185.7000, and §186.3850]. The HED Metabolism Assessment Review Committee has determined that the parent compound malathion and the oxygen analog metabolite, malaoxon, are the compounds to be regulated in plant commodities, and risk assessment is based on considerations for both.

Data Sources / Malaoxon

Field trial and processing data used to derive residue estimates for risk assessment include analysis for both malathion and malaoxon. Field trial and metabolism studies also indicate that malaoxon is usually a minor metabolite, if detected at all. Monitoring data on malathion and malaoxon are reported separately by the Food and Drug Administration (FDA) and not all analytical methods used are capable of detecting both metabolites. Between 1992 and 1996 the FDA monitored 37,492 food samples for malaoxon, with only four positive samples. Three samples of bread imported from Russia had low levels of malaoxon, and one sweet pea sample from the United States had a positive detection. The Pesticide Data Program (PDP) reports residues only for malathion.

Two approaches to estimating the non-detectable malaoxon residues in the monitoring data were considered. One was to assume that malaoxon was present in all malathion samples at a level of $\frac{1}{2}$ the limit of detection (LOD). The other procedure was to assume that malaoxon was not detectable in any sample and use a more conservative estimate of malathion residues in those samples for which it was nondetectable, i.e., use $\frac{1}{2}$ the limit of quantitation (LOQ), with the assumption that the overestimate of residues (the LOQ is generally over 3 times higher than the LOD) would cover any trace levels of malaoxon that could be present in any of the samples. The second approach was adopted in this assessment.

Residues for Acute Risk Assessment

Residue levels for acute dietary risk are based on the reassessed tolerances recommended in the residue chemistry chapter for the malathion RED (W. Smith

Anticipated Residue memo, 4/14/99). Reassessed tolerances are based primarily on field trial data submitted in support of reregistration. Revocation of meat, milk, poultry and egg tolerances is recommended, with the understanding that any dermal use of malathion will be canceled. Processing factors based on data submissions have been used for grape juice, citrus juice, apple juice, raisins, tomato puree, tomato catsup, milled rice, corn oil, cottonseed oil, and cottonseed meal. DEEM default processing factors have been used for dried commodities.

Residues for Chronic Risk Assessment

Table 1. of the 5/10/99 W. Smith memo summarizes the elements that went into calculations of the chronic anticipated residues, for each commodity. Adjustments based on percent crop treated data and processing factors have been incorporated into the value listed in the anticipated residue (AR) column. Default concentration factors of the DEEM™ model are not used for those commodities with available processing studies, including all juices, since the cumulative results demonstrate that residues of malathion do not concentrate in juices. In the case of juice concentrates, the default factors have been amended to reflect the ratio of the concentrate factor and the ready-to-drink juice factor. DEEM™ default processing factors have been used for dried commodities. [See Table 2. (W. Smith memo, 5/10/99) for a complete description of the monitoring data, Table 3. for processing factors, and Table 4. for field trial data].

Residue estimates for chronic risk assessment were calculated from these data as either:

$$\begin{aligned} & (\text{Tolerance}) * (\text{applicable processing factor}) * (\% \text{ crop treated} / 100) \\ & \qquad \qquad \qquad \text{or} \\ & (\text{Average field trial data}) * (\text{processing factor}) * (\% \text{ crop treated} / 100) \\ & \qquad \qquad \qquad \text{or} \\ & (\text{Average of monitoring data adjusted as described below}) * (\text{processing factor}). \end{aligned}$$

Average residue estimates, based on monitoring data, were calculated by assuming that the percent crop treated should reflect the proportion of the monitoring samples possibly containing any residues. Therefore, the samples reported as nondetectable were adjusted so that a proportion of the samples equal to the percent of the crop not treated were zero and the rest were assigned a value of ½ the LOQ.

Food Consumption Estimates / DEEM™ Software

The Agency is currently using software named the *Dietary Exposure Evaluation Model*, or DEEM™ to calculate acute and chronic dietary risk estimates for the general U.S. population and defined population subgroups, including infants and children. Food consumption data used in the program is based on the *USDA Continuing Survey of*

Food Intake by Individuals (CSFII). The Agency is currently using the CSFII 1989-92 consumption data, which is based on the reported food consumption of 10,383 individuals over a 3 day interval. Foods "as eaten" (such as cherry pie) are linked to Raw Agricultural Commodities (RACs) such as cherries, wheat, oil, etc. by the use of "recipe" translation files.

For chronic dietary risk assessment, consumption data are averaged for the entire U.S. population, and within population subgroups such as "all infants". The averaged consumption estimate of each population group is multiplied by an averaged residue estimate, based on field trial and/or monitoring data (PDP/FDA), for each crop (apples) or processed commodity (apple-juice) of interest. Chronic dietary exposure estimates are calculated by the DEEM™ program in mg/kg body weight/day and dietary risk is calculated as a percent of the cPAD.

Acute dietary exposure estimates are not based on averaged consumption data. Instead, the program references each individual day of recorded consumption and produces a distribution of daily exposures for individuals comprising the U.S. population and population subgroups. A dietary exposure distribution based on point estimates for residues in foods is termed "deterministic", and can be used to estimate an upper-bound for acute risk. A more refined probabilistic (Monte Carlo) type acute exposure estimate can be made if appropriate residue data (a distribution of residue in foods of interest) are available. Probabilistic exposure estimates also typically incorporate percent crop treated data to reflect the probability that a commodity has zero residue due to non-treatment. Acute dietary exposure estimates are calculated by the DEEM™ program in mg/kg body weight/day and risk is calculated as a percent of the aPAD.

Acute Dietary Risk Estimates

The DEEM™ model was used to calculate acute dietary exposure estimates based on *total single-day* (rather than single-serving) consumption data. Based on the residue and consumption data outlined above, the DEEM™ program estimates that the “U.S. population - all seasons” and all population subgroups, including infants and children, are acutely exposed to malathion at a level equal to or less than 46% (at the 95% exposure level) of the aPAD. HED refers to the 95% exposure level for this risk assessment based on the use of upper-end residues (tolerances) in a deterministic-type risk assessment.

Acute Dietary Exposure and Risk Estimates

Population Subgroup	95 th Percentile		99 th Percentile		99.9 th Percentile	
	Exposure (mg/kg/d)	%aPAD ^a	Exposure (mg/kg/d)	%aPAD ^a	Exposure (mg/kg/d)	%aPAD ^a
U.S. Population	0.100107	20	0.165842	33	0.273560	55
Non-nursing Infants	0.177455	35	0.246274	49	0.315179	63
Children 1-6	0.190584	38	0.258212	52	0.367081	73
Children 7-12	0.126309	25	0.177277	35	0.238364	48
Females 13-50	0.065749	13	0.095128	19	0.134975	27
Males 13-19	0.082187	16	0.108873	22	0.176309	35
Males 20+	0.069027	14	0.103178	21	0.152970	31

^a The aPAD is 0.5 mg/kg bw/day

Chronic Dietary Risk Estimates

The DEEM™ model was used to calculate chronic dietary exposure estimates based on average consumption data for the US population and population subgroups including infants and children. Based on the residue and percent crop treated data outlined above, the DEEM™ model estimates that the "U.S. population - all seasons" and all population subgroups, including infants and children, are chronically exposed to malathion at a level less than or equal to 4% of the cPAD.

Chronic Dietary Exposure and Risk Estimates

Population Subgroup	Exposure (mg/kg bw/day)	Percent of Chronic PAD ^a
U.S. Population	0.000386	2
Non-nursing Infants <1 year	0.000832	4
Children 1-6	0.000845	4
Children 7-12	0.000625	3
Females 13-50	0.000295	1
Males 13-19	0.000426	2
Males 20+	0.000307	1

^a The cPAD is 0.024 mg/kg bw/day

Carcinogenic Risk

Carcinogenic risk for malathion is quantified, based on the estimated average dietary exposure of the General U.S. population (0.000386 mg/kg bw/day) multiplied by the upper-bound potency factor (Q_1^*) of 1.5×10^{-3} (mg/kg bw/day)⁻¹. On this basis, the upper-bound carcinogenic risk estimate for malathion is calculated to be 5.8×10^{-7} , which is less than the level (10^{-6}) generally considered negligible by the Agency.

cc: RF, Reg. Std. File, R. Griffin.

RDI: A. Nielsen ~~10/6/99~~ 11/3/99. CM2: Rm 712B: 703.305.5715

DEEM INPUT FILE (R96) / ACUTE

RfD(Acute): .5 mg/kg bw/day NOEL(Acute): 50 mg/kg bw/day

Food Code	Crop Grp	Food Name	RESIDUE (ppm)	RDF #	Adj. Factors	
					#1	#2
52	11	Apples	8.000000	0	1.000	1.000
53	11	Apples-dried	8.000000	0	8.000	1.000
54	11	Apples-juice/cider	8.000000	0	0.130	1.000
377	11	Apples-juice-concentrate	8.000000	0	0.390	1.000
410	12	Apricot juice	1.000000	0	1.000	1.000
59	12	Apricots	1.000000	0	1.000	1.000
60	12	Apricots-dried	1.000000	0	6.000	1.000
260	0	Asparagus	2.000000	0	1.000	1.000
70	0	Avocados	0.200000	0	1.000	1.000
265	15	Barley	8.000000	0	1.000	1.000
258	6C	Beans-dry-blackeye peas/cowpea	2.000000	0	1.000	1.000
249	6C	Beans-dry-broadbeans	2.000000	0	1.000	1.000
259	6C	Beans-dry-garbanzo/chick pea	2.000000	0	1.000	1.000
227	6C	Beans-dry-great northern	2.000000	0	1.000	1.000
256	6C	Beans-dry-hyacinth	2.000000	0	1.000	1.000
228	6C	Beans-dry-kidney	2.000000	0	1.000	1.000
229	6C	Beans-dry-lima	2.000000	0	1.000	1.000
230	6C	Beans-dry-navy (pea)	2.000000	0	1.000	1.000
231	6C	Beans-dry-other	2.000000	0	1.000	1.000
251	6C	Beans-dry-pigeon beans	2.000000	0	1.000	1.000
232	6C	Beans-dry-pinto	2.000000	0	1.000	1.000
250	6B	Beans-succulent-broadbeans	2.000000	0	1.000	1.000
234	6A	Beans-succulent-green	2.000000	0	1.000	1.000
257	6	Beans-succulent-hyacinth	2.000000	0	1.000	1.000
233	6B	Beans-succulent-lima	2.000000	0	1.000	1.000
235	6A	Beans-succulent-other	2.000000	0	1.000	1.000
236	6A	Beans-succulent-yellow/wax	2.000000	0	1.000	1.000
253	6	Beans-unspecified	2.000000	0	1.000	1.000
197	1AB	Beets-garden-roots	0.500000	0	1.000	1.000
165	2	Beets-garden-tops(greens)	4.000000	0	1.000	1.000
1	13A	Blackberries	6.000000	0	1.000	1.000
7	13B	Blueberries	8.000000	0	1.000	1.000
452	5B	Bok choy	8.000000	0	1.000	1.000
2	13A	Boysenberries	6.000000	0	1.000	1.000
168	5A	Broccoli	8.000000	0	1.000	1.000
169	5A	Brussels sprouts	8.000000	0	1.000	1.000
170	5A	Cabbage-green and red	8.000000	0	1.000	1.000
198	1AB	Carrots	1.000000	0	1.000	1.000
143	9A	Casabas	1.000000	0	1.000	1.000
171	5A	Cauliflower	8.000000	0	1.000	1.000
166	4B	Celery	8.000000	0	1.000	1.000
384	4B	Celery juice	8.000000	0	1.000	1.000
61	12	Cherries	3.000000	0	1.000	1.000
62	12	Cherries-dried	3.000000	0	4.000	1.000
63	12	Cherries-juice	3.000000	0	1.000	1.000
43	14	Chestnuts	1.000000	0	1.000	1.000
114	1AB	Chicory	8.000000	0	1.000	1.000
167	4A	Chicory(french/belgian endive)	8.000000	0	1.000	1.000
172	5B	Collards	8.000000	0	1.000	1.000
267	15	Corn grain-bran	8.000000	0	1.000	1.000
266	15	Corn grain-endosperm	8.000000	0	1.000	1.000
289	15	Corn grain-oil	8.000000	0	0.010	1.000
268	15	Corn grain/sugar/hfcs	8.000000	0	1.500	1.000
388	15	Corn grain/sugar-molasses	8.000000	0	1.500	1.000
237	15	Corn/pop	8.000000	0	1.000	1.000
238	15	Corn/sweet	0.100000	0	1.000	1.000

Acute cont.

290	0	Cottonseed-oil	20.000000	0	0.007	1.000
144	9A	Crenshaws	1.000000	0	1.000	1.000
180	4A	Cress-garden/field	8.000000	0	1.000	1.000
191	4A	Cress-upland	8.000000	0	1.000	1.000
148	9B	Cucumbers	0.200000	0	1.000	1.000
10	13B	Currants	8.000000	0	1.000	1.000
177	4A	Dandelion-greens	8.000000	0	1.000	1.000
77	0	Dates	8.000000	0	1.000	1.000
3	13A	Dewberries	6.000000	0	1.000	1.000
154	8	Eggplant	2.000000	0	1.000	1.000
178	4A	Endive-curley and escarole	8.000000	0	1.000	1.000
179	19B	Fennel	8.000000	0	1.000	1.000
78	0	Figs	1.000000	0	1.000	1.000
292	0	Flax seed	0.100000	0	1.000	1.000
202	3	Garlic	1.000000	0	1.000	1.000
12	13B	Gooseberries	8.000000	0	1.000	1.000
23	10	Grapefruit-juice	4.000000	0	0.060	1.000
441	10	Grapefruit-juice-concentrate	4.000000	0	0.240	1.000
448	10	Grapefruit peel	4.000000	0	1.000	1.000
22	10	Grapefruit-peeled fruit	4.000000	0	1.000	1.000
13	0	Grapes	4.000000	0	1.000	1.000
15	0	Grapes-juice	4.000000	0	0.100	1.000
392	0	Grapes-juice-concentrate	4.000000	0	0.300	1.000
14	0	Grapes-raisins	4.000000	0	0.400	1.000
315	0	Grapes-wine and sherry	4.000000	0	1.000	1.000
393	0	Guava-juice	1.000000	0	1.000	1.000
79	0	Guava	1.000000	0	1.000	1.000
125	0	Hops	1.000000	0	1.000	1.000
126	1AB	Horseradish	0.500000	0	1.000	1.000
174	5B	Kale	8.000000	0	1.000	1.000
175	5A	Kohlrabi	8.000000	0	1.000	1.000
24	10	Kumquats	4.000000	0	1.000	1.000
204	3	Leeks	6.000000	0	1.000	1.000
28	10	Lemons-juice	4.000000	0	0.060	1.000
442	10	Lemons-juice-concentrate	4.000000	0	0.340	1.000
27	10	Lemons-peel	4.000000	0	1.000	1.000
26	10	Lemons-peeled fruit	4.000000	0	1.000	1.000
243	6C	Lentils	2.000000	0	1.000	1.000
182	4A	Lettuce-unspecified	8.000000	0	1.000	1.000
176	4A	Lettuce-leafy varieties	8.000000	0	1.000	1.000
192	4A	Lettuce-head varieties	8.000000	0	1.000	1.000
32	10	Limes-juice	4.000000	0	0.060	1.000
443	10	Limes-juice-concentrate	4.000000	0	0.180	1.000
30	10	Limes-peeled fruit	4.000000	0	1.000	1.000
4	13A	Loganberries	6.000000	0	1.000	1.000
46	14	Macadamia nuts (bush nuts)	0.200000	0	1.000	1.000
80	0	Mangoes	0.200000	0	1.000	1.000
141	9A	Melons-cantaloupes-juice	1.000000	0	1.000	1.000
142	9A	Melons-cantaloupes-pulp	1.000000	0	1.000	1.000
145	9A	Melons-honeydew	1.000000	0	1.000	1.000
146	9A	Melons-persian	1.000000	0	1.000	1.000
244	6C	Mung beans (sprouts)	2.000000	0	1.000	1.000
261	0	Mushrooms	0.200000	0	1.000	1.000
183	5B	Mustard greens	8.000000	0	1.000	1.000
64	12	Nectarines	1.000000	0	1.000	1.000
269	15	Oats	8.000000	0	1.000	1.000
245	0	Okra	3.000000	0	1.000	1.000
206	3	Onions-dehydrated or dried	1.000000	0	9.000	1.000
205	3	Onions-dry-bulb (cipollini)	1.000000	0	1.000	1.000
262	3	Onions-green	6.000000	0	1.000	1.000
36	10	Oranges-juice	4.000000	0	0.060	1.000
33	10	Oranges-juice-concentrate	4.000000	0	0.220	1.000
35	10	Oranges-peel	4.000000	0	1.000	1.000
34	10	Oranges-peeled fruit	4.000000	0	1.000	1.000
85	0	Papayas-dried	1.000000	0	1.800	1.000
86	0	Papayas-juice	1.000000	0	1.000	1.000

Acute cont.

84	0	Papayas-pulp	1.000000	0	1.000	1.000
184	4A	Parsley	8.000000	0	1.000	1.000
220	1AB	Parsnips	0.500000	0	1.000	1.000
401	0	Passion fruit-juice	0.200000	0	1.000	1.000
92	0	Passion fruit (granadilla)	0.200000	0	1.000	1.000
65	12	Peaches	6.000000	0	1.000	1.000
66	12	Peaches-dried	6.000000	0	7.000	1.000
402	12	Peaches-juice	6.000000	0	1.000	1.000
56	11	Pears	3.000000	0	1.000	1.000
57	11	Pears-dried	3.000000	0	6.250	1.000
404	11	Pears-juice	3.000000	0	1.000	1.000
241	6AB	Peas (garden)-green	2.000000	0	1.000	1.000
405	6B	Peas-succulent/blackeye/cowpea	2.000000	0	1.000	1.000
47	14	Pecans	0.200000	0	1.000	1.000
310	0	Peppermint	2.000000	0	1.000	1.000
311	0	Peppermint-oil	15.000000	0	1.000	1.000
156	8	Peppers-chilli incl jalapeno	0.500000	0	1.000	1.000
157	8	Peppers-other	0.500000	0	1.000	1.000
155	8	Peppers-sweet(garden)	0.500000	0	1.000	1.000
158	8	Pimientos	0.500000	0	1.000	1.000
90	0	Pineapples-dried	0.200000	0	5.000	1.000
91	0	Pineapples-juice	0.200000	0	1.000	1.000
406	0	Pineapples-juice-concentrate	0.200000	0	1.000	1.000
89	0	Pineapples-peeled fruit	0.200000	0	1.000	1.000
210	1C	Potatoes/white-dry	0.100000	0	6.500	1.000
209	1C	Potatoes/white-peeled	0.100000	0	1.000	1.000
211	1C	Potatoes/white-peel only	0.100000	0	1.000	1.000
208	1C	Potatoes/white-unspecified	0.100000	0	1.000	1.000
207	1C	Potatoes/white-whole	0.100000	0	1.000	1.000
149	9B	Pumpkin	1.000000	0	1.000	1.000
58	11	Quinces	8.000000	0	1.000	1.000
212	1AB	Radishes-roots	0.500000	0	1.000	1.000
5	13A	Raspberries	6.000000	0	1.000	1.000
185	4B	Rhubarb	8.000000	0	1.000	1.000
408	15	Rice-bran	30.000000	0	1.000	1.000
271	15	Rice-milled (white)	30.000000	0	0.020	1.000
270	15	Rice-rough (brown)	30.000000	0	1.000	1.000
214	1AB	Rutabagas-roots	0.500000	0	1.000	1.000
274	15	Rye-flour	8.000000	0	1.000	1.000
273	15	Rye-germ	8.000000	0	1.000	1.000
272	15	Rye-rough	8.000000	0	1.000	1.000
216	1AB	Salsify(oyster plant)	0.500000	0	1.000	1.000
217	3	Shallots	6.000000	0	1.000	1.000
275	15	Sorghum (including milo)	8.000000	0	1.000	1.000
312	0	Spearmint	2.000000	0	1.000	1.000
313	0	Spearmint-oil	15.000000	0	1.000	1.000
186	4A	Spinach	8.000000	0	1.000	1.000
150	9B	Squash-summer	0.200000	0	1.000	1.000
415	9B	Squash-spaghetti	1.000000	0	1.000	1.000
151	9B	Squash-winter	1.000000	0	1.000	1.000
17	0	Strawberries	1.000000	0	1.000	1.000
416	0	Strawberries-juice	1.000000	0	1.000	1.000
103	0	Sugar apples (sweetsop)	0.500000	0	1.000	1.000
218	1CD	Sweet potatoes (incl yams)	0.100000	0	1.000	1.000
187	4B	Swiss chard	8.000000	0	1.000	1.000
37	10	Tangelos	4.000000	0	1.000	1.000
38	10	Tangerines	4.000000	0	1.000	1.000
39	10	Tangerines-juice	4.000000	0	0.060	1.000
420	10	Tangerines-juice-concentrate	4.000000	0	0.190	1.000
163	8	Tomatoes-catsup	2.000000	0	0.800	1.000
423	8	Tomatoes-dried	2.000000	0	14.300	1.000
160	8	Tomatoes-juice	2.000000	0	0.030	1.000
162	8	Tomatoes-paste	2.000000	0	1.000	1.000
161	8	Tomatoes-puree	2.000000	0	0.600	1.000
159	8	Tomatoes-whole	2.000000	0	1.000	1.000
219	1AB	Turnips-roots	0.500000	0	1.000	1.000

Acute cont.

188	2	Turnips-tops	4.000000	0	1.000	1.000
431	14	Walnut oil	0.200000	0	1.000	1.000
48	14	Walnuts	0.200000	0	1.000	1.000
189	0	Watercress	0.200000	0	1.000	1.000
147	9A	Watermelon	1.000000	0	1.000	1.000
436	9A	Watermelon-juice	1.000000	0	1.000	1.000
278	15	Wheat-bran	8.000000	0	1.000	1.000
279	15	Wheat-flour	8.000000	0	1.000	1.000
277	15	Wheat-germ	8.000000	0	1.000	1.000
437	15	Wheat-germ oil	8.000000	0	1.000	1.000
276	15	Wheat-rough	8.000000	0	1.000	1.000

DEEM OUTPUT FILE / ACUTE RISK

U.S. Environmental Protection Agency
 DEEM ACUTE analysis for MALATHION
 Acute Reference Dose (aRfD) = 0.500000 mg/kg body-wt/day
 NOEL (Acute) = 50.000000 mg/kg body-wt/day
 Ver. 6.78
 (1989-92 data)

Summary calculations:

	95th Percentile		99th Percentile		99.9th Percentile		MOE
	Exposure	% aRfD	Exposure	% aRfD	Exposure	% aRfD	
U.S. pop - all seasons:	0.100107	20.02	0.165842	33.17	0.273560	54.71	182
Non-nursing infants (<1 yr):	0.177455	35.49	0.246274	49.25	0.315179	63.04	158
Children (1-6 years):	0.190584	38.12	0.258212	51.64	0.367081	73.42	136
Children (7-12 years):	0.126309	25.26	0.177277	35.46	0.238364	47.67	209
Females (13-50 years):	0.065749	13.15	0.095128	19.03	0.134975	27.00	370
Males (13-19 years):	0.082187	16.44	0.108873	21.77	0.176309	35.26	283
Males (20+ years):	0.069027	13.81	0.103178	20.64	0.152970	30.59	326

DEEM INPUT FILE (R96) / CHRONIC

RfD(Chronic): .024 mg/kg bw/day NOEL(Chronic): 2.4 mg/kg bw/day

Food Code	Crop Grp	Food Name	RESIDUE (ppm)	RDF #	Adj. Factors #1	Adj. Factors #2	Comment
52	11	Apples	0.003000	0	1.000	1.000	
53	11	Apples-dried	0.003000	0	8.000	1.000	
54	11	Apples-juice/cider	0.000390	0	1.000	1.000	
377	11	Apples-juice-concentrate	0.000390	0	3.000	1.000	
410	12	Apricot juice	0.000500	0	1.000	1.000	
59	12	Apricots	0.000500	0	1.000	1.000	
60	12	Apricots-dried	0.000500	0	6.000	1.000	
260	0	Asparagus	0.000200	0	1.000	1.000	
70	0	Avocados	0.010000	0	1.000	1.000	
265	15	Barley	0.065000	0	1.000	1.000	
258	6C	Beans-dry-blackeye peas/cowpea	0.000100	0	1.000	1.000	
249	6C	Beans-dry-broadbeans	0.000100	0	1.000	1.000	

Chronic cont.

259	6C	Beans-dry-garbanzo/chick pea	0.000100	0	1.000	1.000
227	6C	Beans-dry-great northern	0.000100	0	1.000	1.000
256	6C	Beans-dry-hyacinth	0.000100	0	1.000	1.000
228	6C	Beans-dry-kidney	0.000100	0	1.000	1.000
229	6C	Beans-dry-lima	0.000100	0	1.000	1.000
230	6C	Beans-dry-navy (pea)	0.000100	0	1.000	1.000
231	6C	Beans-dry-other	0.000100	0	1.000	1.000
251	6C	Beans-dry-pigeon beans	0.000100	0	1.000	1.000
232	6C	Beans-dry-pinto	0.000100	0	1.000	1.000
250	6B	Beans-succulent-broadbeans	0.000500	0	1.000	1.000
234	6A	Beans-succulent-green	0.000500	0	1.000	1.000
257	6	Beans-succulent-hyacinth	0.000500	0	1.000	1.000
233	6B	Beans-succulent-lima	0.000500	0	1.000	1.000
235	6A	Beans-succulent-other	0.000500	0	1.000	1.000
236	6A	Beans-succulent-yellow/wax	0.000500	0	1.000	1.000
253	6	Beans-unspecified	0.000100	0	1.000	1.000
197	1AB	Beets-garden-roots	0.001000	0	1.000	1.000
165	2	Beets-garden-tops(greens)	0.772000	0	1.000	1.000
1	13A	Blackberries	0.008900	0	1.000	1.000
380	13A	Blackberries-juice	0.008900	0	1.000	1.000
7	13B	Blueberries	0.009300	0	1.000	1.000
452	5B	Bok choy	0.000300	0	1.000	1.000
2	13A	Boysenberries	0.008900	0	1.000	1.000
168	5A	Broccoli	0.001000	0	1.000	1.000
169	5A	Brussels sprouts	0.001000	0	1.000	1.000
170	5A	Cabbage-green and red	0.000300	0	1.000	1.000
198	1AB	Carrots	0.000500	0	1.000	1.000
143	9A	Casabas	0.010000	0	1.000	1.000
171	5A	Cauliflower	0.000600	0	1.000	1.000
166	4B	Celery	0.002000	0	1.000	1.000
384	4B	Celery juice	0.002000	0	1.000	1.000
61	12	Cherries	0.012000	0	1.000	1.000
62	12	Cherries-dried	0.012000	0	4.000	1.000
63	12	Cherries-juice	0.012000	0	1.000	1.000
43	14	Chestnuts	0.261000	0	1.000	1.000
167	4A	Chicory(french/belgian endive)	8.000000	0	1.000	1.000
172	5B	Collards	0.000500	0	1.000	1.000
267	15	Corn grain-bran	0.173400	0	1.000	1.000
266	15	Corn grain-endosperm	0.173400	0	1.000	1.000
289	15	Corn grain-oil	0.001730	0	1.000	1.000
268	15	Corn grain/sugar/hfcs	0.173400	0	1.500	1.000
388	15	Corn grain/sugar-molasses	0.173400	0	1.500	1.000
237	15	Corn/pop	0.173000	0	1.000	1.000
238	15	Corn/sweet	0.000100	0	1.000	1.000
291	0	Cottonseed-meal	0.001200	0	1.000	1.000
290	0	Cottonseed-oil	0.001200	0	1.000	1.000
144	9A	Crenshaws	0.010000	0	1.000	1.000
180	4A	Cress-garden/field	8.000000	0	1.000	1.000
191	4A	Cress-upland	8.000000	0	1.000	1.000
148	9B	Cucumbers	0.000300	0	1.000	1.000
10	13B	Currants	0.009300	0	1.000	1.000
177	4A	Dandelion-greens	8.000000	0	1.000	1.000
77	0	Dates	7.280000	0	1.000	1.000
3	13A	Dewberries	0.008900	0	1.000	1.000
154	8	Eggplant	0.001600	0	1.000	1.000
178	4A	Endive-curley and escarole	0.001000	0	1.000	1.000
179	19B	Fennel	8.000000	0	1.000	1.000
78	0	Figs	0.012200	0	1.000	1.000
292	0	Flax seed	0.001000	0	1.000	1.000
202	3	Garlic	0.002400	0	1.000	1.000
12	13B	Gooseberries	0.009300	0	1.000	1.000
23	10	Grapefruit-juice	0.000010	0	1.000	1.000
441	10	Grapefruit-juice-concentrate	0.000010	0	3.970	1.000
448	10	Grapefruit peel	0.000100	0	1.000	1.000
22	10	Grapefruit-peeled fruit	0.000100	0	1.000	1.000
13	0	Grapes	0.000100	0	1.000	1.000

Chronic cont.

15	0	Grapes-juice	0.000010	0	1.000	1.000
392	0	Grapes-juice-concentrate	0.000010	0	3.000	1.000
14	0	Grapes-raisins	0.000040	0	1.000	1.000
315	0	Grapes-wine and sherry	0.000010	0	1.000	1.000
79	0	Guava	0.159000	0	1.000	1.000
125	0	Hops	0.010000	0	1.000	1.000
126	1AB	Horseradish	0.067000	0	1.000	1.000
174	5B	Kale	0.001000	0	1.000	1.000
175	5A	Kohlrabi	0.000600	0	1.000	1.000
24	10	Kumquats	0.001200	0	1.000	1.000
204	3	Leeks	0.002400	0	1.000	1.000
28	10	Lemons-juice	0.000070	0	1.000	1.000
442	10	Lemons-juice-concentrate	0.000070	0	5.700	1.000
27	10	Lemons-peel	0.001200	0	1.000	1.000
26	10	Lemons-peeled fruit	0.001200	0	1.000	1.000
243	6C	Lentils	0.000100	0	1.000	1.000
182	4A	Lettuce-unspecified	0.000900	0	1.000	1.000
176	4A	Lettuce-leafy varieties	0.000900	0	1.000	1.000
192	4A	Lettuce-head varieties	0.000900	0	1.000	1.000
32	10	Limes-juice	0.000070	0	1.000	1.000
443	10	Limes-juice-concentrate	0.000070	0	3.000	1.000
31	10	Limes-peel	0.001200	0	1.000	1.000
30	10	Limes-peeled fruit	0.001200	0	1.000	1.000
4	13A	Loganberries	0.008900	0	1.000	1.000
46	14	Macadamia nuts (bush nuts)	0.003000	0	1.000	1.000
80	0	Mangoes	0.010000	0	1.000	1.000
141	9A	Melons-cantaloupes-juice	0.005700	0	1.000	1.000
142	9A	Melons-cantaloupes-pulp	0.005700	0	1.000	1.000
145	9A	Melons-honeydew	0.000800	0	1.000	1.000
146	9A	Melons-persian	0.010000	0	1.000	1.000
244	6C	Mung beans (sprouts)	0.000100	0	1.000	1.000
261	0	Mushrooms	0.010000	0	1.000	1.000
183	5B	Mustard greens	0.010000	0	1.000	1.000
64	12	Nectarines	0.000800	0	1.000	1.000
399	15	Oats-bran	0.056400	0	1.000	1.000
269	15	Oats	0.056400	0	1.000	1.000
245	0	Okra	0.007000	0	1.000	1.000
397	9B	Okra/chinese (luffa)	0.007000	0	1.000	1.000
206	3	Onions-dehydrated or dried	0.002400	0	9.000	1.000
205	3	Onions-dry-bulb (cipollini)	0.002400	0	1.000	1.000
262	3	Onions-green	0.001000	0	1.000	1.000
36	10	Oranges-juice	0.000010	0	1.000	1.000
33	10	Oranges-juice-concentrate	0.000037	0	1.000	1.000
35	10	Oranges-peel	0.000650	0	1.000	1.000
34	10	Oranges-peeled fruit	0.000200	0	1.000	1.000
85	0	Papayas-dried	0.001250	0	1.800	1.000
86	0	Papayas-juice	0.001250	0	1.000	1.000
84	0	Papayas-pulp	0.001250	0	1.000	1.000
184	4A	Parsley	8.000000	0	1.000	1.000
220	1AB	Parsnips	0.500000	0	1.000	1.000
401	0	Passion fruit-juice	0.056400	0	1.000	1.000
92	0	Passion fruit (granadilla)	0.056400	0	1.000	1.000
65	12	Peaches	0.001000	0	1.000	1.000
66	12	Peaches-dried	0.001000	0	7.000	1.000
402	12	Peaches-juice	0.001000	0	1.000	1.000
56	11	Pears	0.000200	0	1.000	1.000
57	11	Pears-dried	0.000200	0	6.250	1.000
404	11	Pears-juice	0.000200	0	1.000	1.000
241	6AB	Peas (garden)-green	0.000800	0	1.000	1.000
47	14	Pecans	0.003500	0	1.000	1.000
310	0	Peppermint	0.009380	0	1.000	1.000
311	0	Peppermint-oil	0.119100	0	1.000	1.000
156	8	Peppers-chilli incl jalapeno	0.005700	0	1.000	1.000
157	8	Peppers-other	0.005700	0	1.000	1.000
155	8	Peppers-sweet(garden)	0.000400	0	1.000	1.000
158	8	Pimientos	0.005700	0	1.000	1.000

Chronic cont.

90	0	Pineapples-dried	0.010000	0	5.000	1.000
91	0	Pineapples-juice	0.010000	0	1.000	1.000
406	0	Pineapples-juice-concentrate	0.010000	0	1.000	1.000
89	0	Pineapples-peeled fruit	0.010000	0	1.000	1.000
210	1C	Potatoes/white-dry	0.000080	0	1.000	1.000
209	1C	Potatoes/white-peeled	0.000080	0	1.000	1.000
211	1C	Potatoes/white-peel only	0.000080	0	1.000	1.000
208	1C	Potatoes/white-unspecified	0.000080	0	1.000	1.000
207	1C	Potatoes/white-whole	0.000080	0	1.000	1.000
149	9B	Pumpkin	0.012700	0	1.000	1.000
58	11	Quinces	0.003000	0	1.000	1.000
407	1AB	Radishes-japanese (daiken)	0.000500	0	1.000	1.000
212	1AB	Radishes-roots	0.000500	0	1.000	1.000
213	2	Radishes-tops	0.000500	0	1.000	1.000
5	13A	Raspberries	0.008900	0	1.000	1.000
185	4B	Rhubarb	0.080000	0	1.000	1.000
408	15	Rice-bran	0.055300	0	1.000	1.000
271	15	Rice-milled (white)	0.001100	0	1.000	1.000
270	15	Rice-rough (brown)	0.055300	0	1.000	1.000
214	1AB	Rutabagas-roots	0.500000	0	1.000	1.000
215	2	Rutabagas-tops	0.500000	0	1.000	1.000
274	15	Rye-flour	0.065000	0	1.000	1.000
273	15	Rye-germ	0.065000	0	1.000	1.000
272	15	Rye-rough	0.065000	0	1.000	1.000
216	1AB	Salsify(oyster plant)	0.500000	0	1.000	1.000
217	3	Shallots	0.001000	0	1.000	1.000
275	15	Sorghum (including milo)	0.173400	0	1.000	1.000
312	0	Spearmint	0.009380	0	1.000	1.000
313	0	Spearmint-oil	0.119100	0	1.000	1.000
186	4A	Spinach	0.003300	0	1.000	1.000
150	9B	Squash-summer	0.000900	0	1.000	1.000
415	9B	Squash-spaghetti	0.000900	0	1.000	1.000
151	9B	Squash-winter	0.000900	0	1.000	1.000
17	0	Strawberries	0.013300	0	1.000	1.000
416	0	Strawberries-juice	0.013300	0	1.000	1.000
103	0	Sugar apples (sweetsop)	0.500000	0	1.000	1.000
218	1CD	Sweet potatoes (incl yams)	0.008000	0	1.000	1.000
418	2	Sweet potatoes-leaves	0.008000	0	1.000	1.000
187	4B	Swiss chard	0.001000	0	1.000	1.000
37	10	Tangelos	0.000200	0	1.000	1.000
38	10	Tangerines	0.000200	0	1.000	1.000
39	10	Tangerines-juice	0.000010	0	1.000	1.000
420	10	Tangerines-juice-concentrate	0.000010	0	3.200	1.000
163	8	Tomatoes-catsup	0.000240	0	1.000	1.000
423	8	Tomatoes-dried	0.000300	0	14.300	1.000
160	8	Tomatoes-juice	0.000010	0	1.000	1.000
162	8	Tomatoes-paste	0.000300	0	1.000	1.000
161	8	Tomatoes-puree	0.000180	0	1.000	1.000
159	8	Tomatoes-whole	0.000300	0	1.000	1.000
219	1AB	Turnips-roots	0.001000	0	1.000	1.000
188	2	Turnips-tops	0.001000	0	1.000	1.000
431	14	Walnut oil	0.004500	0	1.000	1.000
48	14	Walnuts	0.004500	0	1.000	1.000
189	0	Watercress	0.050000	0	1.000	1.000
147	9A	Watermelon	0.000500	0	1.000	1.000
436	9A	Watermelon-juice	0.000500	0	1.000	1.000
278	15	Wheat-bran	0.065000	0	1.000	1.000
279	15	Wheat-flour	0.063100	0	1.000	1.000
277	15	Wheat-germ	0.065000	0	1.000	1.000
437	15	Wheat-germ oil	0.065000	0	1.000	1.000
276	15	Wheat-rough	0.065000	0	1.000	1.000

DEEM OUTPUT FILE / CHRONIC RISK

U.S. Environmental Protection Agency
 DEEM Chronic analysis for MALATHION
 Reference dose (RfD, CHRONIC) = .024 mg/kg bw/day

Ver. 6.76
 (1989-92 data)

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 Total exposure by population subgroup

Population Subgroup	Total Exposure	
	mg/kg body wt/day	Percent of Rfd
U.S. Population (total)	0.000386	1.6%
U.S. Population (spring season)	0.000388	1.6%
U.S. Population (summer season)	0.000384	1.6%
U.S. Population (autumn season)	0.000405	1.7%
U.S. Population (winter season)	0.000368	1.5%
Northeast region	0.000374	1.6%
Midwest region	0.000381	1.6%
Southern region	0.000384	1.6%
Western region	0.000409	1.7%
Hispanics	0.000386	1.6%
Non-hispanic whites	0.000385	1.6%
Non-hispanic blacks	0.000389	1.6%
Non-hisp/non-white/non-black)	0.000413	1.7%
All infants (< 1 year)	0.000643	2.7%
Nursing infants	0.000193	0.8%
Non-nursing infants	0.000832	3.5%
Children 1-6 yrs	0.000845	3.5%
Children 7-12 yrs	0.000625	2.6%
Females 13-19(not preg or nursing)	0.000371	1.5%
Females 20+ (not preg or nursing)	0.000267	1.1%
Females 13-50 yrs	0.000295	1.2%
Females 13+ (preg/not nursing)	0.000269	1.1%
Females 13+ (nursing)	0.000317	1.3%
Males 13-19 yrs	0.000426	1.8%
Males 20+ yrs	0.000307	1.3%
Seniors 55+	0.000258	1.1%
Pacific Region	0.000403	1.7%
