PERCHLORATE STUDY GROUP

A coalition of aerospace, defense, chemical and allied industries

July 24, 2007

US Environmental Protection Agency
Office of Water Docket (Mailcode 2822T)
1200 Pennsylvania Avenue, NW
Washington, DC 20460

RE: Supplemental Comments on Regulatory Determinations Regarding Contaminants on the Second Drinking Water Contaminant Candidate List Rule, Docket ID: EPA-HQ-OW-2007-0068

In May 2007, the US Food and Drug Administration posted a Preliminary Estimation of Perchlorate Dietary Exposure Based on FDA 2004/2005 Exploratory Data on the web at www.cfsan.fda.gov/~news/whatsnew.html. Perchlorate exposure from consumption of 27 foods and beverages was estimated via a Monte Carlo simulation. The Monte Carlo simulation sums perchlorate exposure values based on food intake and perchlorate concentration levels randomly drawn from a range of possible values for each food from a particular iteration to yield a total exposure for an individual. The summary of their analysis is presented in their Table as follows:

Summary of Population-Based Perchlorate Exposures

Population	Monte Carlo estimate using @Risk software with 5,000 iterations* (µg/kg-bw/d)	
	Mean	**90th Percentile**
All ages 2+ Years	0.053	0.12
Children, 2-5 Years	0.17	0.34
Females, 15-45 Years	0.037	0.074

FDA did not consider other dietary goitrogens such as nitrate and thiocyanate in their analysis in order to place these results in perspective. Although thiocyanate is the most significant dietary goitrogen that shares the same mechanism of action as perchlorate, the food content of thiocyanate precursors is not widely reported. On the other hand, the nitrate contents of various dietary sources has been widely reported in the peer reviewed literature and nitrate is known to share the same mechanism of action as perchlorate (competitive inhibition of iodine uptake by the thyroid). Nitrate is known to be approximately 1/240th as potent as perchlorate on a weight ingested basis in the inhibition of iodide uptake (IUI). (Tonacchera *et al*., 2004)

Due to the data gap, the Perchorate Study Group (PSG) contracted with Kenny Crump and Cynthia Van Landingham of Environ in Ruston, LA to perform a similar Monte Carlo analysis of nitrate consumption to assess the relative importance of these two dietary goitrogens on IUI. Using the relative potencies of nitrate and perchlorate derived from *Tonacchera*, the nitrate data summaries from *Crump & Van Landingham*, Table 4 can be compared directly with the perchlorate summaries from FDA in their Table 2. These comparisons are presented below.

Relative Iodine Uptake Inhibition of Nitrate and Perchlorate in the US Diet (ug/kg body weight/day)						
	Ages 2-5 Males and Females		**Ages 14-45 Females**		**Ages 2 and older Males and Females**	
	Mean	**90th %tile**	**Mean**	**90th %tile**	**Mean**	**90th %tile**
Total dietary Nitrate (Crump & Van Landingham)	**1788.13**	**3189.24**	**1288.86**	**2919.55**	**1397.35**	**2927.09**
Perchlorate Equivalence of Nitrate (from Tonacchera et al)	**7.45**	**13.29**	**5.37**	**12.16**	**5.82**	**12.20**
FDA Total dietary perchlorate	**0.17**	**0.34**	**0.037**	**0.074**	**0.053**	**0.12**
Equivalence ratio ntrate/perchlorate	**43.8**	**39.1**	**145.1**	**164.4**	**109.9**	**101.6**

Thus, this analysis indicates that dietary nitrate is two to three orders of magnitude more significant than dietary perchlorate in IUI by the thyroid. Controlling dietary perchlorate is thus relatively insignificant to overall thyroid health than is controlling dietary nitrate intake.

PSG
PERCHLORATE STUDY GROUP
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Thank you for allowing us the opportunity to submit this supplemental information for consideration by the Agency in making a regulatory determination on perchlorate.

Sincerely,

Michael Girard
The Perchlorate Study Group

Attach:

Estimation of Nitrate Dietary Exposure
A Monte Carlo Analysis

by

ENVIRON International
1900 North 18th Street
Monroe, LA 71201

for

The Perchlorate Study Group

June 2007

At the request of and funded by the Perchlorate Study Group, ENVIRON International estimated the dietary nitrate exposure from consumption of 21 foods using Monte Carlo techniques. This Monte Carlo simulation was performed using the CrystalBall software (Decisioneering 2007). This simulation estimates the nitrate exposure from the 21 food items based on food intake distributions from the ENVIRON Dietary Exposure Assessment (EDEA) software and concentration data obtained from several published articles and one article soon to be published. Exposure was estimated for three populations, children ages 2 to 5, females ages 15 to 45 and all ages 2 and up in both sexes.

Nitrate Food Concentration Data

The concentration data for lettuces, greens, and spinach were a subset of the data used by Sanchez *et al*. (2005). These data were subset to exclude the Canadian data and data from unknown locations. The remaining data were from the states of California, Colorado, New Jersey, New York, Michigan and Ohio. The lettuce types included head lettuce, green leaf, red leaf, Boston, arugula, endive, romaine, and spring mix. The distribution of nitrate concentrations in greens was based on the combined data for kale, mustard greens, beet tops, collards, and dandelion greens. Dr Sanchez also provided us with nitrate concentration data for broccoli, cauliflower and cabbage from a paper soon to be published (Sanchez *et al.* 2007). All these data were provided as individual data values and discrete uniform distributions were used to sample this data for the simulations.

Additional data for other vegetables were obtained from Siciliano *et al* (1975). This publication contained individual sample nitrate concentrations for carrots and celery. Uniform discrete distributions were used for sampling these data. The nitrate concentration data for most of the other vegetables in this publication were provided as means and standard deviations. Since the publication did not supply any additional information about the distribution of the concentration data and many of the sample numbers were small, we chose a triangular distribution for sampling these data using the mean as the most likely value and the mean ± 2 × the standard deviation as the upper and lower bounds of the distribution. In cases in which the lower bound was negative a lower bound of zero was used. The data on nitrate concentration in potatoes consisted on only one value and that value was used as a constant in this simulation.

Data for the concentration of nitrates in cucumbers, milk and bacon were taken from Choi (1985). As with the potato data from Siciliano *et al.*, the nitrate concentration data provided in cucumbers was a single value and that value was used as a constant in this simulation. The mean nitrate concentrations for several different types of bacon were provided and all were used to form a discrete uniform distribution. The concentration of nitrate in milk given by Choi was 0.5 mg/L but the NRC states (NRC (Committee on Toxicology National Research Council) 1995, NRC (National Research Council) 1981) that the concentration of nitrate in milk rarely exceeds 5 mg/L. For this simulation, a triangular distribution was used for the nitrate concentration in milk with a lower bound and most likely value of 0.5 mg/L and an upper bound of 5 mg/L.

Table 1 gives the average nitrate concentration, number of data points, and the source reference for the nitrate concentration in each of the food items used in this simulation.

Food Intake Data

EDEA is a system developed by ENVIRON for the U.S. Food and Drug Administration, which incorporates data from reports of foods consumed by participants in the U.S. Department of Agriculture (USDA) Continuing Survey of Food Intakes by Individuals (CSFII, 1994-1996 and 1998 Supplemental Children's Survey) (U.S. Department of Agriculture (USDA) 2000). Participants in these surveys were asked to identify and quantify all foods and beverages consumed over 24 hours on two separate days, approximately but not exactly two weeks apart.

Many of the over 5800 foods reported in the CSFII 1994-96, 98 are complex food mixtures. EDEA uses information from the **Food Commodity Intake Database** (FCID) developed by USDA and the U.S. Environmental Protection Agency Office of Pesticide Programs to estimate exposure to constituents in raw agricultural commodities (http://www.ars.usda.gov/Services/docs.htm?docid=8498).

The intake estimates are presented in units of grams per kilogram body weight per day, and represent averages of food intakes reported on the two survey days. The intake percentiles apply to consumers of the foods included in each analysis (i.e. people who did not consume the food are excluded from the analysis). All intake estimates were computed using USDA weighting factors. Intake values used in this simulation are given in Table 2.

To give a representation of the total population, the simulation also included the percentage of eaters. A uniform distribution between 0 and 100% was sampled for each food item to choose if that simulation was to be for a person who ate this food item. If the sampled value was greater than the percentage of people eating that food item, then the simulation for that iteration was assumed to be for a person who did not eat that food item and an intake of 0 was given dietary nitrate intake from that food item in that iteration. Table 3 gives the information on the percent of the population that eats each of the food items used in this simulation. Using this data in the simulation results in values for the mean, median and 90^{th} percentile of nitrate intake that are adjusted by the percentage of the population eating the food items and therefore represent the mean, median and 90^{th} percentile of the nitrate intake from these food items for the entire US population of children 2 to 5, females of 14 to 45 or the general US population ages 2 and older.

Simulation Model

For each simulation in which the iteration was of a person who ate the food item, the model used to simulate the amount of dietary nitrate from that food item was

$$\textit{Dietary Nitrate}(\mu g / kgBW / day) = \textit{Concentration}(mg / kg) \times \frac{\textit{Food Intake}(g / kgBW / day)}{1000(g / kg)} \times 1000(\mu g / mg)$$

Since one mg/L is approximately one mg/kg for milk, this formula was also used for milk consumption.

Latin hypercube sampling was used for the simulation with a required precision of 1% at the 90th percentile. To achieve the required precision, 250,000 iterations were run.

For each iteration, the sum of the dietary intake from each item was computed, including zeros for those food items which that iteration determined were not eaten. The totals reported are the mean, median and 90th percentile of the distribution of these totals.

Results

The results of this Monte Carlo simulation are given in Table 4. The values in this table are in terms of the average, median or 90th percentile dietary intake over the entire population for each of the three populations considered since these values were simulated considering the percent of the population eating each food item.

Tables 5 through 7 give the results separated by population. Results for children of ages 2 to 5 males and females are in Table 5, results for females of ages 14 to 45 are in Table 6 and the results for the general US population ages 2 and older are in Table 7. These tables are sorted to show the food items which contribute the most nitrates to the diet down to those which contribute the least. The foods which contributed the most nitrates to the diet were broccoli, lettuce, celery, potatoes, greens, cabbage and spinach which provided more than 90% of the nitrate in all three populations. The highest contributor for children 2 to 5 (Table 5) was broccoli (22%). Lettuces contributed the most nitrates to the diets of females 14 to 45 (Table 6 – 40%) and general population ages 2 and older both sexes (Table 7 - 33%).

Tables

Table 1 Concentration of Nitrate in each Food Item (mg/kg or mg/L)			
Food Item	**# of samples**	**Mean**	**Concentration Data Source**
Artichoke	2	12	(Siciliano *et al.* 1975)
Asparagus	6	16	(Siciliano *et al.* 1975)
Bacon, (any type)	5	84	(Choi 1985)
Broccoli	55	1716	(Sanchez *et al.* 2007)
Brussels sprouts	7	84	(Siciliano *et al.* 1975)
Cabbage	19	1001	(Sanchez *et al.* 2007)
Carrots	8	72	(Siciliano *et al.* 1975)
Cauliflower	38	1037	(Sanchez *et al.* 2007)
Celery	3	2220	(Siciliano *et al.* 1975)
Corn, sweet	3	45	(Siciliano *et al.* 1975)
Cucumber	1	110	(Choi 1985)
Green Beans	4	270	(Siciliano *et al.* 1975)
Greens	19	3021	(Sanchez *et al.* 2005)
Lettuce	372	1465	(Sanchez *et al.* 2005)
Lima Beans	4	27	(Siciliano *et al.* 1975)
Milk	1	0.5	(Choi 1985)
Okra	3	74	(Siciliano *et al.* 1975)
Peppers, sweet	3	50	(Siciliano *et al.* 1975)
Potatoes	1	150	(Siciliano *et al.* 1975)
Spinach	10	2731	(Sanchez *et al.* 2005)
Squash, Summer	2	160	(Siciliano *et al.* 1975)

Table 2 Intake of Food Item by Population Group (g/kg body weight/day)												
Percentile	**Artichoke**			**Asparagus**			**Bacon (all types)**			**Broccoli**		
	2-5 MF	**15-45 F**	**2+ MF**	**2-5 MF**	**15-45 F**	**2+ MF**	**2-5 MF**	**15-45 F**	**2+ MF**	**2-5 MF**	**15-45 F**	**2+ MF**
1	0.124	0.080	0.061	0.007	0.008	0.008	0.038	0.013	0.013	0.046	0.024	0.026
5	0.124	0.080	0.080	0.113	0.041	0.196	0.126	0.034	0.037	0.162	0.051	0.069
10	0.149	0.090	0.125	0.318	0.223	0.276	0.172	0.052	0.056	0.266	0.101	0.118
15	0.258	0.090	0.153	0.369	0.276	0.320	0.205	0.061	0.067	0.333	0.144	0.155
20	0.258	0.223	0.222	0.492	0.397	0.397	0.227	0.071	0.078	0.433	0.173	0.189
25	0.258	0.223	0.223	0.615	0.397	0.418	0.267	0.081	0.088	0.548	0.197	0.230
30	0.258	0.239	0.226	0.649	0.397	0.465	0.303	0.090	0.096	0.650	0.225	0.275
35	0.258	0.239	0.231	0.716	0.495	0.522	0.345	0.096	0.107	0.831	0.270	0.312
40	0.258	0.239	0.239	0.734	0.529	0.552	0.377	0.104	0.118	0.974	0.311	0.373
45	0.258	0.239	0.265	0.920	0.537	0.594	0.392	0.119	0.132	1.123	0.367	0.427
50	0.258	0.291	0.291	1.053	0.602	0.631	0.424	0.131	0.147	1.266	0.412	0.495
55	0.387	0.291	0.340	1.200	0.636	0.662	0.460	0.143	0.157	1.407	0.451	0.563
60	1.887	0.291	0.568	1.435	0.662	0.709	0.503	0.148	0.176	1.605	0.554	0.635
65	1.887	0.485	0.584	1.464	0.809	0.809	0.550	0.161	0.194	1.759	0.598	0.735
70	1.887	0.747	0.661	1.519	0.919	0.871	0.588	0.185	0.214	2.089	0.717	0.860
75	1.887	0.747	0.747	1.586	0.988	0.993	0.663	0.200	0.241	2.453	0.846	1.008
80	1.887	1.026	0.957	1.967	1.528	1.213	0.732	0.224	0.275	2.707	1.014	1.183
85	1.887	1.026	1.130	2.095	1.682	1.488	0.820	0.254	0.323	3.172	1.200	1.324
90	1.887	1.130	1.202	3.445	1.755	1.755	0.942	0.299	0.386	4.080	1.503	1.645
95	1.887	1.130	1.322	4.966	2.302	2.149	1.395	0.373	0.504	5.795	2.095	2.258
97	1.887	1.523	1.456	5.323	2.302	2.302	1.589	0.419	0.628	6.610	2.541	2.909
98	1.887	1.523	1.523	5.323	2.302	2.472	1.656	0.504	0.735	6.802	3.011	3.557
99	1.887	1.523	2.271	5.323	2.302	3.079	1.953	0.621	0.920	8.106	3.678	4.510
100	1.887	1.523	2.271	5.323	2.302	7.035	2.970	0.920	2.970	18.749	10.379	18.749

Table 2 (continued)
Intake of Food Item by Population Group
(g/kg body weight/day)

Percentile	Brussels sprouts			Cabbage			Carrots			Cauliflower		
	2-5 MF	15-45 F	2+ MF	2-5 MF	15-45 F	2+ MF	2-5 MF	15-45 F	2+ MF	2-5 MF	15-45 F	2+ MF
1	0.685	1.314	0.096	0.007	0.004	0.003	0.001	3.1E-04	2.8E-04	1.6E-05	1.4E-05	6.8E-06
5	0.685	1.314	0.096	0.011	0.007	0.007	0.016	0.009	0.010	3.2E-05	2.2E-05	0.011
10	0.685	1.314	0.216	0.017	0.011	0.015	0.036	0.019	0.021	0.025	0.019	0.033
15	0.685	1.314	0.352	0.026	0.019	0.024	0.059	0.031	0.034	0.078	0.030	0.053
20	0.685	1.314	0.434	0.043	0.022	0.045	0.082	0.039	0.047	0.118	0.046	0.076
25	0.827	1.314	0.476	0.065	0.041	0.074	0.115	0.054	0.061	0.130	0.060	0.098
30	0.827	1.314	0.658	0.084	0.053	0.099	0.156	0.067	0.078	0.164	0.082	0.121
35	0.827	1.314	0.683	0.128	0.087	0.141	0.200	0.085	0.096	0.220	0.108	0.146
40	1.221	1.314	0.842	0.162	0.119	0.181	0.254	0.110	0.119	0.253	0.123	0.167
45	1.221	1.385	0.877	0.215	0.169	0.229	0.311	0.135	0.146	0.326	0.156	0.190
50	1.339	1.385	0.926	0.273	0.208	0.286	0.394	0.167	0.176	0.365	0.178	0.223
55	1.339	1.385	1.068	0.333	0.254	0.339	0.476	0.198	0.208	0.466	0.208	0.240
60	1.649	1.385	1.178	0.425	0.300	0.401	0.567	0.229	0.249	0.689	0.256	0.275
65	2.257	1.385	1.314	0.551	0.351	0.460	0.685	0.281	0.293	0.834	0.336	0.319
70	2.257	1.488	1.314	0.730	0.426	0.550	0.829	0.319	0.341	0.988	0.441	0.411
75	2.795	1.488	1.373	0.978	0.536	0.642	1.014	0.385	0.413	1.048	0.525	0.512
80	2.795	1.488	1.385	1.294	0.581	0.797	1.293	0.473	0.492	1.232	0.565	0.622
85	3.088	1.488	1.557	1.838	0.723	0.979	1.626	0.564	0.612	1.405	0.728	0.768
90	3.500	2.313	2.013	2.365	1.022	1.222	1.998	0.705	0.810	1.690	0.896	0.896
95	3.500	2.313	2.313	3.577	1.271	1.697	2.830	0.974	1.180	2.500	1.136	1.322
97	3.500	2.313	2.642	4.256	1.605	2.022	3.463	1.234	1.500	2.924	1.847	1.644
98	3.500	2.313	2.642	4.738	1.883	2.284	4.086	1.464	1.720	3.988	2.096	2.029
99	3.500	2.313	2.642	6.587	2.174	3.067	5.077	1.914	2.165	4.327	2.144	2.214
100	3.500	2.313	3.500	7.489	2.551	8.303	9.226	6.403	10.885	5.670	2.146	5.670

Table 2 (continued) Intake of Food Item by Population Group (g/kg body weight/day)												
Percentile	**Celery**			**Corn, sweet**			**Cucumber**			**Green Beans**		
	2-5 MF	**15-45 F**	**2+ MF**	**2-5 MF**	**15-45 F**	**2+ MF**	**2-5 MF**	**15-45 F**	**2+ MF**	**2-5 MF**	**15-45 F**	**2+ MF**
1	3.6E-05	1.3E-05	1.8E-05	0.031	2.6E-05	5.9E-05	1.2E-03	5.0E-06	2.0E-05	0.017	0.003	0.003
5	9.3E-05	4.3E-05	5.4E-05	0.165	0.048	0.066	0.014	0.005	0.006	0.055	0.013	0.012
10	3.1E-04	8.4E-05	1.2E-04	0.264	0.091	0.108	0.036	0.015	0.016	0.129	0.027	0.040
15	0.001	1.6E-04	2.0E-04	0.345	0.130	0.140	0.052	0.021	0.025	0.219	0.051	0.077
20	0.001	2.2E-04	3.1E-04	0.424	0.159	0.174	0.073	0.031	0.036	0.290	0.092	0.113
25	0.001	3.2E-04	4.5E-04	0.498	0.196	0.210	0.084	0.039	0.046	0.399	0.133	0.141
30	0.001	4.5E-04	0.001	0.645	0.227	0.252	0.102	0.048	0.055	0.511	0.164	0.180
35	0.002	0.001	0.001	0.802	0.290	0.315	0.116	0.054	0.066	0.642	0.206	0.236
40	0.002	0.004	0.002	0.998	0.345	0.375	0.130	0.069	0.077	0.762	0.259	0.295
45	0.003	0.014	0.012	1.182	0.414	0.442	0.143	0.081	0.090	0.885	0.308	0.353
50	0.004	0.022	0.025	1.326	0.466	0.511	0.161	0.094	0.103	1.055	0.361	0.410
55	0.016	0.034	0.036	1.507	0.548	0.581	0.189	0.110	0.119	1.156	0.413	0.463
60	0.041	0.048	0.050	1.680	0.603	0.658	0.225	0.127	0.140	1.300	0.496	0.542
65	0.062	0.062	0.065	1.991	0.681	0.744	0.280	0.153	0.164	1.467	0.574	0.620
70	0.090	0.081	0.084	2.235	0.754	0.837	0.352	0.185	0.192	1.644	0.649	0.715
75	0.127	0.101	0.105	2.482	0.822	0.958	0.442	0.234	0.234	1.803	0.775	0.808
80	0.184	0.122	0.134	2.808	0.952	1.136	0.574	0.273	0.294	2.001	0.924	0.940
85	0.254	0.165	0.174	3.256	1.198	1.358	0.875	0.326	0.385	2.313	1.005	1.086
90	0.358	0.222	0.232	3.939	1.401	1.691	1.261	0.452	0.538	2.867	1.154	1.323
95	0.564	0.347	0.353	5.231	1.731	2.307	2.196	0.683	0.904	4.021	1.538	1.756
97	0.788	0.451	0.454	6.255	2.004	2.800	3.519	0.979	1.250	5.080	1.849	2.160
98	0.964	0.510	0.544	7.649	2.205	3.314	4.128	1.247	1.482	5.508	2.052	2.402
99	1.299	0.591	0.737	8.968	2.680	4.265	5.291	1.813	2.216	7.038	2.263	3.084
100	3.721	2.204	3.805	27.797	5.229	27.797	17.955	3.857	17.955	20.742	4.052	20.742

Table 2 (continued)
Intake of Food Item by Population Group
(g/kg body weight/day)

	Greens			Lettuce			Lima Beans			Milk		
Percentile	**2-5 MF**	**15-45 F**	**2+ MF**	**2-5 MF**	**15-45 F**	**2+ MF**	**2-5 MF**	**15-45 F**	**2+ MF**	**2-5 MF**	**15-45 F**	**2+ MF**
1	1.1E-05	9.4E-06	9.4E-06	0.034	0.016	0.019	0.001	0.002	0.001	0.106	0.001	0.002
5	0.100	0.024	0.056	0.084	0.045	0.046	0.003	0.006	0.005	0.291	0.018	0.027
10	0.138	0.138	0.135	0.117	0.063	0.063	0.006	0.012	0.009	0.449	0.045	0.061
15	0.300	0.271	0.207	0.145	0.075	0.078	0.013	0.016	0.012	0.582	0.070	0.089
20	0.360	0.504	0.295	0.177	0.088	0.094	0.026	0.021	0.018	0.687	0.093	0.117
25	0.630	0.552	0.423	0.203	0.104	0.114	0.035	0.024	0.023	0.796	0.116	0.144
30	0.845	0.583	0.512	0.227	0.125	0.136	0.040	0.035	0.033	0.896	0.139	0.173
35	0.918	0.587	0.571	0.253	0.152	0.166	0.049	0.046	0.041	0.997	0.164	0.201
40	1.088	0.645	0.652	0.277	0.196	0.200	0.058	0.052	0.048	1.092	0.188	0.232
45	1.212	0.735	0.717	0.310	0.237	0.239	0.076	0.058	0.056	1.201	0.212	0.266
50	1.464	0.821	0.812	0.347	0.294	0.289	0.093	0.069	0.068	1.314	0.240	0.306
55	1.880	0.821	0.883	0.404	0.350	0.337	0.111	0.091	0.085	1.424	0.269	0.349
60	2.055	0.988	0.941	0.480	0.418	0.396	0.127	0.104	0.110	1.550	0.299	0.399
65	2.111	1.033	1.034	0.571	0.485	0.458	0.175	0.135	0.135	1.707	0.338	0.465
70	2.292	1.034	1.108	0.688	0.572	0.527	0.216	0.169	0.170	1.881	0.375	0.539
75	2.531	1.199	1.243	0.805	0.688	0.621	0.262	0.193	0.233	2.101	0.429	0.636
80	2.983	1.322	1.334	0.948	0.827	0.728	0.389	0.279	0.351	2.355	0.496	0.785
85	3.284	1.343	1.509	1.127	0.964	0.867	0.598	0.365	0.509	2.739	0.592	1.011
90	3.867	1.558	1.786	1.441	1.131	1.067	1.195	0.620	0.774	3.365	0.781	1.378
95	6.570	1.948	2.333	2.022	1.472	1.432	2.087	1.262	1.300	5.253	1.138	2.153
97	7.186	2.452	2.718	2.544	1.894	1.757	2.362	1.569	1.641	7.045	1.472	3.039
98	7.779	3.072	3.188	2.880	2.165	1.980	3.027	1.569	1.887	8.654	1.829	3.852
99	15.301	3.072	3.900	3.459	2.600	2.412	3.309	3.806	2.290	12.184	2.552	5.423
100	20.482	3.072	20.482	7.170	5.952	7.170	6.704	3.806	6.704	53.598	6.877	53.598

Table 2 (continued) Intake of Food Item by Population Group (g/kg body weight/day)												
Percentile	**Okra**			**Peppers, sweet, fresh**			**Whole Potatoes**			**Spinach**		
	2-5 MF	**15-45 F**	**2+ MF**	**2-5 MF**	**15-45 F**	**2+ MF**	**2-5 MF**	**15-45 F**	**2+ MF**	**2-5 MF**	**15-45 F**	**2+ MF**
1	0.028	0.024	0.010	7.1E-06	1.5E-06	2.4E-06	0.152	0.083	0.085	0.001	0.001	4.8E-04
5	0.036	0.032	0.024	0.003	0.002	0.002	0.352	0.171	0.205	0.003	0.001	0.001
10	0.054	0.032	0.033	0.005	0.004	0.003	0.721	0.254	0.308	0.007	0.002	0.001
15	0.058	0.040	0.054	0.006	0.009	0.006	0.900	0.303	0.393	0.015	0.010	0.004
20	0.066	0.170	0.112	0.008	0.018	0.013	1.082	0.384	0.482	0.085	0.045	0.013
25	0.068	0.179	0.170	0.011	0.025	0.021	1.196	0.474	0.558	0.118	0.074	0.047
30	0.093	0.228	0.206	0.014	0.032	0.029	1.374	0.516	0.626	0.169	0.100	0.075
35	0.112	0.286	0.239	0.020	0.039	0.039	1.597	0.549	0.708	0.267	0.133	0.101
40	0.113	0.319	0.286	0.040	0.048	0.048	1.736	0.636	0.761	0.328	0.170	0.131
45	0.410	0.348	0.319	0.052	0.057	0.058	1.981	0.727	0.837	0.391	0.195	0.165
50	0.572	0.371	0.371	0.073	0.070	0.071	2.189	0.838	0.922	0.477	0.227	0.202
55	0.701	0.387	0.399	0.094	0.084	0.084	2.321	0.922	0.983	0.536	0.278	0.254
60	0.846	0.390	0.470	0.115	0.098	0.099	2.511	0.990	1.044	0.714	0.302	0.323
65	1.003	0.484	0.484	0.134	0.119	0.120	2.668	1.066	1.149	0.824	0.428	0.428
70	1.184	0.525	0.548	0.167	0.148	0.151	2.933	1.151	1.251	0.973	0.474	0.526
75	1.302	0.525	0.571	0.202	0.191	0.189	3.084	1.269	1.393	1.379	0.570	0.612
80	1.369	0.565	0.701	0.252	0.228	0.233	3.336	1.385	1.565	1.569	0.678	0.737
85	2.206	0.565	0.940	0.310	0.290	0.293	3.833	1.509	1.881	2.100	0.856	1.058
90	2.598	0.571	1.126	0.426	0.348	0.374	4.949	1.964	2.184	2.956	1.124	1.291
95	3.158	1.193	1.691	0.738	0.526	0.568	5.735	2.598	2.925	3.919	1.654	1.661
97	6.174	1.694	1.770	0.976	0.726	0.751	6.718	3.228	3.419	5.245	1.786	2.117
98	6.174	1.694	2.067	1.101	0.865	0.876	7.777	3.780	3.912	5.357	2.117	2.622
99	6.174	1.694	2.608	1.656	0.990	1.281	9.458	4.585	4.585	6.515	5.956	3.533
100	8.299	1.694	8.299	3.821	4.111	4.111	20.944	5.561	20.944	12.459	5.956	12.459

Table 2 (continued) Intake of Food Item by Population Group (g/kg body weight/day)			
	Squash, Summer		
Percentile	2-5 MF	15-45 F	2+ MF
1	0.000	0.000	0.000
5	0.007	0.008	0.014
10	0.076	0.028	0.030
15	0.118	0.039	0.046
20	0.148	0.054	0.072
25	0.188	0.080	0.091
30	0.230	0.095	0.127
35	0.315	0.115	0.161
40	0.372	0.157	0.210
45	0.443	0.182	0.258
50	0.499	0.216	0.336
55	0.623	0.336	0.462
60	0.750	0.468	0.557
65	0.857	0.557	0.641
70	1.078	0.641	0.722
75	1.318	0.699	0.840
80	1.434	0.814	0.982
85	1.718	1.047	1.185
90	2.281	1.343	1.443
95	3.041	1.878	1.926
97	3.553	2.176	2.679
98	4.130	2.990	2.990
99	4.972	4.567	4.035
100	10.395	6.908	10.395

Table 3 Percentage of Population Consuming Each Food Item			
Food Item	**Ages 2-5 Males and Females**	**Ages 14-45 Females**	**Ages 2 and older Males and Females**
Artichoke	0.09	0.40	0.34
Asparagus	0.68	1.35	1.44
Bacon (all types)	12.09	13.85	16.00
Broccoli	11.13	15.34	14.07
Brussels sprouts	0.11	0.19	0.30
Cabbage	8.69	13.69	15.17
Carrot	46.76	49.79	50.44
Cauliflower	2.73	5.33	4.92
Celery	74.45	70.56	71.73
Corn, sweet	27.69	22.92	24.00
Cucumber	28.21	41.89	41.09
Green Beans	24.13	20.23	22.44
Greens	2.58	1.76	3.04
Lettuces	36.28	64.45	60.02
Lima Beans	5.86	4.99	5.70
Milk	99.99	99.74	99.85
Okra	0.94	1.31	1.42
Pepper, sweet (fresh or dried)	32.75	59.75	54.75
Potato (with or without peel)	62.59	60.14	63.78
Spinach	3.88	7.54	6.92
Squash, summer	3.66	6.51	5.69

Table 4
Nitrate Dietary Intake Adjusted by the Percentage of Population Eating These Food Items
(ug/kg body weight/day)

	Ages 2-5 Males and Females			Ages 14-45 Females			Ages 2 and older Males and Females		
Food Item	**Mean**	**Median**	**90th %tile**	**Mean**	**Median**	**90th %tile**	**Mean**	**Median**	**90th %tile**
Artichoke	0.01	0.00	0.00	0.03	0.00	0.00	0.02	0.00	0.00
Asparagus	0.17	0.00	0.00	0.19	0.00	0.00	0.22	0.00	0.00
Bacon, (any type)	5.85	0.00	9.39	1.97	0.00	4.50	3.00	0.00	7.21
Broccoli	387.43	0.00	402.39	201.12	0.00	426.59	223.67	0.00	416.05
Brussels sprouts	0.22	0.00	0.00	0.29	0.00	0.00	0.34	0.00	0.00
Cabbage	82.27	0.00	0.00	56.62	0.00	46.40	86.21	0.00	128.78
Carrots	30.20	0.00	102.47	12.48	0.00	38.49	14.89	0.17	41.57
Cauliflower	23.49	0.00	0.00	22.58	0.00	0.00	22.71	0.00	0.00
Celery	254.99	3.93	817.23	155.63	1.14	488.61	175.88	1.84	515.75
Corn, sweet	25.99	0.00	88.44	7.10	0.00	25.47	10.19	0.00	29.23
Cucumber	20.91	0.00	34.26	10.73	0.00	29.49	15.48	0.00	31.12
Green Beans	6.31	0.00	20.42	31.39	0.00	105.67	44.44	0.00	136.54
Greens	178.56	0.00	0.00	49.30	0.00	0.00	99.25	0.00	0.00
Lettuce	375.52	0.00	1035.55	521.34	114.06	1483.21	460.56	90.70	1292.55
Lima Beans	0.71	0.00	0.00	0.43	0.00	0.00	0.50	0.00	0.00
Milk	4.47	2.40	8.95	0.85	0.43	1.94	1.85	0.57	3.50
Okra	0.85	0.00	0.00	0.44	0.00	0.00	0.64	0.00	0.00
Peppers, sweet, fresh	4.22	0.00	10.33	6.50	0.61	18.13	6.15	0.17	17.10
Potatoes	252.78	168.12	659.81	98.77	53.41	251.05	124.43	79.49	307.69
Spinach	127.17	0.00	0.00	104.79	0.00	0.00	100.49	0.00	0.00
Squash, Summer	6.00	0.00	0.00	6.34	0.00	0.00	6.40	0.00	0.00
Total	**1788.13**	**174.45**	**3189.24**	**1288.86**	**169.66**	**2919.55**	**1397.35**	**172.95**	**2927.09**

Table 5 Ages 2-5 Males and Females			
Food Item	**Mean Nitrate Intake (µg/kg BW/day)**	**Percentage**	**Cumulative Percentage**
Broccoli	387	22	22
Lettuce	376	21	43
Celery	255	14	57
Potatoes	253	14	71
Greens	179	10	81
Spinach	127	7	88
Cabbage	82	5	93
Carrots	30	2	94
Corn, sweet	26	1	96
Cauliflower	23	1	97
Cucumber	21	1	98
Broccoli	387	22	22
Green Beans, Squash, Summer Bacon, (any type) Milk Peppers, sweet, Okra Lima Beans Brussels sprouts Asparagus Artichoke	< 7	< 1 %	100
Total	**1788**		

Table 6 Ages 14-45 Females			
Food Item	**Mean Nitrate Intake (µg/kg BW/day)**	**Percentage**	**Cumulative Percentage**
Lettuce	521	40	40
Broccoli	201	16	56
Celery	156	12	68
Spinach	105	8	76
Potatoes	99	8	84
Cabbage	57	4	88
Greens	49	4	92
Green Beans	31	2	95
Cauliflower	23	2	96
Carrots	12	1	97
Cucumber	11	1	98
Corn, sweet	7	1	99
Peppers, sweet Squash, Summer Bacon, (any type) Milk Lima Beans Okra Brussels sprouts Asparagus Artichoke	< 7	< 1 %	100
Total	**1289**		

Table 7 Ages 2 and older Males and Females			
Food Item	**Mean Nitrate Intake (µg/kg BW/day)**	**Percentage**	**Cumulative Percentage**
Lettuce	461	33	33
Broccoli	224	16	49
Celery	176	13	62
Potatoes	124	9	70
Spinach	100	7	78
Greens	99	7	85
Cabbage	86	6	91
Green Beans	44	3	94
Cauliflower	23	2	96
Cucumber	15	1	97
Carrots	15	1	98
Corn, sweet	10	1	99
Squash, Summer Peppers, sweet Bacon, (any type) Milk Okra Lima Beans Brussels sprouts Asparagus Artichoke	< 7	< 1%	100
Total	**1398**		

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