



Brian R. Leahy
Director

MEMORANDUM

Edmund G. Brown Jr.
Governor

TO: Shelley DuTeaux, PhD MPH, Chief
Human Health Assessment Branch

FROM: Pete Lohstroh, PhD, Staff Toxicologist *[original signed by P. Lohstroh]*
Svetlana Koshlukova, PhD, Senior Toxicologist *[original signed by S. Koshlukova]*
Risk Assessment Section
Human Health Assessment Branch

DATE: February 23, 2017

SUBJECT: EVALUATION OF THE POTENTIAL HUMAN HEALTH EFFECTS FROM
DRINKING GROUND WATER CONTAINING DACTHAL (DCPA) DEGRADATES

On February 09, 2017, the Human Health Assessment (HHA) Branch was notified by the Environmental Monitoring Branch that degradates of the herbicide Dacthal (dimethyl tetrachloroterephthalic acid, or DCPA) were recently detected in 3 of 7 wells sampled. Degradates included monomethyl tetrachloroterephthalic acid (MTP; CAS 887-54-7) and tetrachloroterephthalic acid (TPA; CAS 2136-79-0), with ground water concentrations ranging from 0.916 ppb to 101 ppb (average = 41.6 ppb). The Environmental Monitoring Branch requested that HHA determine if there is a health concern for individuals using these wells as a source of drinking water. This memo is in response to that request.

Recommendations:

1. For TPA cases referred to HHA for risk assessment, the US EPA health reference level (HRL) of 70 $\mu\text{g/L}$ or ppb will be used to evaluate risk.
2. TPA concentrations of 101 ppb in California ground water should be considered a health concern.

Background:

Per the US EPA *Health Effects Support Document for Dacthal Degradates*:

“DCPA (*Dacthal*) (Chemical Abstracts Service Registry Number 1861-32-1) is a chlorinated terephthalic acid ester that is used as a pre-emergence herbicide to control annual grasses and some annual broad-leaved weeds. TPA (Chemical Abstracts Service Registry Number 2136-79-0) is the terminal DCPA degradate. It is extremely mobile and persistent in the environment and will leach to ground water wherever DCPA is used, regardless of soil properties. MTP (Chemical Abstracts Service Registry Number 887-54-7) is a minor DCPA metabolite. No data were found on the physical and chemical properties of TPA or MTP. The properties of both compounds have many similarities common with the parent dacthal. Their aqueous solubility is predicted to be higher than dacthal (0.5 mg/L at



25°C) because one or two of the ester functional groups are replaced by a free acid functional group.” (USEPA, 2008(a)).

Summary of Toxicology:

The toxicology database for TPA is limited. DPR has not conducted a risk assessment for Dacthal or its degradates TPA and MTP. In 2008, the US EPA Office of Water released a Drinking Water Health Advisory for Dacthal, TPA, and MTP (USEPA, 2008(b)). US EPA established a reference dose (RfD) of 0.01 mg/kg/day for DCPA based on a no-observed-adverse-effects-level (NOAEL) of 1 mg/kg/day from a chronic toxicity study using rats and a total uncertainty factor of 100. This RfD was used to calculate a health reference level (HRL) for DCPA of 70 µg/L or ppb (USEPA, 2008(c)). The same HRL (70 ppb) was then applied to both TPA and MTP based on the following criteria (USEPA, 2008(c)):

- The toxicological data for TPA and MTP are limited, however, neither TPA nor MTP appear to be more toxic than DCPA. The reference dose (RfD) for DCPA should be protective of the effects for all three compounds.
- Both TPA and MTP result from DCPA metabolism and their toxicity should be “reflected in the observed toxicity of the parent compound.”
- No sensitive subpopulations have been identified.

In 2012, the DPR Medical Toxicology Branch updated the toxicological information for TPA and recommended that monitored concentrations of TPA be compared to the HRL of 70 ug/L established for the parent DCPA (Schreider, 2012).

For the evaluation described here, we reviewed the US EPA 2008 health advisory and associated documents for Dacthal, as well as relevant evaluations prepared by other agencies, and reached the following conclusions:

- Since 2012, there are no new toxicity data for TPA to develop TPA-specific reference levels in drinking water.
- The HRL for DCPA uses a NOAEL (1 mg/kg/day), where effects were observed in the lung, liver, kidney, and thyroid of rats at the lowest adverse effect level (LOEL) (10 mg/kg/day) (USEPA, 2008(a)).
- Dacthal was classified as Group C, Possible Human Carcinogen¹ per US EPA 1986 guidelines (USEPA, 1999) based on thyroid tumors in both sexes of rats and liver tumors

¹ **Group C: "Possible Human Carcinogen"**

This group is used for agents with limited evidence of carcinogenicity in animals in the absence of human data. It includes a wide variety of evidence, e.g., (a) a malignant tumor response in a single well-conducted

in female rats and mice (USEPA, 2008(a)). There was inadequate information to assess the carcinogenic potential of TPA.

- Dacthal and TPA are extremely resistant to degradation and persistent in ground water, raising the risk of human exposure (USEPA, 2008(a)).
- The Dacthal HRL is consistent with health advisory level (70 ppb) used for detections in ground water in Michigan, Idaho, and Washington (ATSDR, 2009; Cook, 2014).

Evaluation of the TPA residue:

As part of this evaluation, we performed deterministic acute and chronic drinking water exposure analyses of concentrations of 101 ppb TPA in ground water. We used the Dietary Exposure Evaluation Model - Food Commodity Intake Database (DEEM-FCID, version 4.02, 5-10c) and the National Health and Nutrition Examination Survey/“What We Eat in America” (NHANES/WWEIA) two-day dietary survey data collected from 2005 to 2010 for the US population and select subgroups. The DCPA NOEL (1 mg/kg/day) was used to calculate the risk in terms of margins of exposure (MOE; ratio of the NOEL and an estimate of human exposure). The target MOE was 100, assuming that humans are 10 times more sensitive than rats and there is a 10-fold variation in the sensitivity of humans. A calculated MOE lower than the target of 100 indicates a potential health concern.

The acute and chronic MOEs at the 95th percentile for the US population, women of childbearing age (13 to 50 years old), and children 1 to 12 years old were higher than 100. However, the MOEs were below 100 for acute 95th-percentile exposures to all infants (MOEs = 50 to 82) and chronic exposures to non-nursing infants (MOE = 99).

TPA concentrations in California wells were also compared to the US EPA HRL of 70 µg/L or ppb. In this case, 101 ppb TPA exceeds the 70 ppb HRL and should be considered a potential health concern. Further, children from 0 to 2 years of age should be considered the most vulnerable subpopulation based on their high rates of water intake (as mL/kg body weight) (OEHHA, 2012).

experiment that does not meet conditions for sufficient evidence, (b) tumor responses of marginal statistical significance in studies having inadequate design or reporting, (c) benign but not malignant tumors with an agent showing no response in a variety of short-term tests for mutagenicity, and (d) responses of marginal statistical significance in a tissue known to have a high or variable background rate. USEPA 1999. Guidelines for Carcinogen Risk Assessment (Review Draft). U.S. Environmental Protection Agency, Risk Assessment Forum, Washington, DC.

Conclusions

1. Based on our assessment and the approaches used by other agencies, we recommend that TPA detections in California wells be compared to the US EPA HRL of 70 $\mu\text{g/L}$ or ppb until sufficient data is available to derive TPA-specific NOELs to evaluate risk to human health.
2. The concentration of 101 ppb TPA in ground water should be considered a health concern.

References

- ATSDR 2009. Agency for Toxic Substances & Disease Registry: Health Consultation; Dacthal Groundwater Contamination; Coloma Township, Berrien County, Michigan (<https://www.atsdr.cdc.gov/HAC/pha/pha.asp?docid=379&pg=1>).
- Cook, K. V. 2014. Monomethyl tetrachloroterephthalic acid (MTP) and Tetrachloroterephthalic acid (TPA) Groundwater Occurrence in Washington State. Washington State Department of Agriculture, Natural Resource Assessment Section, Olympia, WA.
- OEHHA 2012. Technical Support Document for Exposure Assessment and Stochastic Analysis; Chapter 8: Water Intake Rates. Office of Environmental Health Hazard Assessment, Sacramento, CA.
- Schreider, J. 2012. Internal Communication: Toxicological Significance of Degradation Product of Dacthal. California Environmental Protection Agency, Department of Pesticide Regulation, Medical Toxicology Branch, Sacramento, CA.
- USEPA 1999. Guidelines for Carcinogen Risk Assessment (Review Draft). U.S. Environmental Protection Agency, Risk Assessment Forum, Washington, DC.
- USEPA 2008(a). Health Effects Support Document For Dacthal Degredates: Tetrachloroterephthalic Acid (TPA) and Monomethyl Tetrachloroterephthalic Acid (MTP). US Environmental Protection Agency, Office of Water, Health and Ecological Criteria Division, Washington. DC.
- USEPA 2008(b). Drinking Water Health Advisory For Dacthal and Dacthal Degredates: Tetrachloroterephthalic Acid (TPA) and Monomethyl Tetrachloroterephthalic Acid (MTP). US Environmental Protection Agency, Health and Ecological Criteria Division, Office of Science and Technology, Office of Water, Washington. DC.
- USEPA 2008(c). Regulatory Determinations Support Document for Selected Contaminants from the Second Drinking Water Contaminant Candidate List (CCL 2); Chapter 4: DCPA Mono- and Di-Acid Degradates. US Environmental Protection Agency, Office of Water, Health and Ecological Criteria Division, Washington, DC.

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Appendices

Appendix 1. DPR TPA Memo (2012) (3 pages)



Department of Pesticide Regulation



Edmund G. Brown Jr.
Governor

MEMORANDUM

TO: Lisa Ross, Ph.D.
Environmental Program Manager
Environmental Monitoring Branch

FROM: Jay Schreider, Ph.D.
Senior Toxicologist
Medical Toxicology Branch

DATE: January 31, 2012

SUBJECT: Toxicological Significance of Degradation Product of Dacthal

Medical Toxicology was asked to update the information in its 1991 memo regarding the toxicological significance of tetrachloroterephthalic acid (TPA), the primary degradation product of dacthal. There are no new TPA toxicology studies on file at DPR or, apparently, with USEPA, so the toxicity information has not changed. However, USEPA has released several relevant evaluations in the intervening years.

In a 2004 Federal Register Notice (**Federal Register** /Vol. 69, No. 161 / Friday, August 20, 2004 /Rules and Regulations), EPA sets tolerances of DCPA and its metabolites on a number of crops. EPA describes the toxicity data on TPA in a table:

Table 2.—TPA (tetrachloroterephthalic acid) Degradate of DCPA Subchronic Toxicity

Guideline No.	Study Type	Results
N/A	30-day Intubation toxicity—rodents (rats)	NOAEL = 500 mg/kg/day LOAEL = 2,000 mg/kg/day based on soft stools and occult blood in urine.
870.3100	90-day oral toxicity—rodents (rats)	NOAEL ≥ 500 mg/kg/day (HDT)
870.3700	Prenatal developmental—rodents (rats)	Maternal NOAEL = 1,250 mg/kg/day Maternal LOAEL = 2,500 mg/kg/day based on soft stools and salivation Developmental NOAEL ≥ 2,500 mg/kg/day (HDT)

These are the same studies as discussed in our 1991 memo and with essentially the same conclusions. Later in the document, EPA discusses the toxicological endpoints for use in risk assessment:



Table 4.—Summary of Toxicological Dose and Endpoints for TPA for Use in Human Risk Assessment

Exposure Scenario	Dose Used in Risk Assessment and UFs	Special FQPA SF and Level of Concern for Risk Assessment	Study and Toxicological Effects
Acute Dietary	An endpoint of concern attributable to a single dose (exposure) was not identified from the available studies. An acute RfD was not established		
Chronic Dietary (All populations)	NOAEL= 500 mg/kg/day UF = 1,000 Chronic RfD = 0.5 mg/kg/day	Special FQPA SF = 1XcPAD = chronic RfD/Special FQPA SF = 0.5 mg/kg/day	90-day feeding study in rats NOAEL = 500 mg/kg/day (HDT)
Cancer (oral, dermal, inhalation)	TPA is not likely to be a carcinogen for humans because no liver and thyroid precursor events occurred after treatment with TPA at very large doses, and because neither TPA nor DCPA are mutagens.		

EPA uses these data to calculate chronic Drinking Water Levels of Concern (DWLOC):

Table 9.—Aggregate Risk Assessment for Chronic (Non- Cancer) Exposure to TPA

Population Subgroup	cPAD mg/kg/day	% cPAD (Food)	Surface Water EEC (ppb)	Ground Water EEC (ppb)	Chronic DWLOC (ppb)
U.S. Population	0.5	0.02	116	192	17,500
All Infants	0.5	0.02	116	192	5,000
Children 1- 6	0.5	0.02	116	192	5,000
Females 13 - 50	0.5	0.02	116	192	15,000

Elsewhere, EPA uses these same values for short term DWLOC. In addition to the conclusions of our 1991 memo, the TPA DWLOC values (5,000 ppb) can be compared to monitored TPA water levels to evaluate the health concern for the TPA levels.

In Chapter 4 from “Regulatory Determinations Support Document for selected Contaminants from the Second Drinking Water Contaminant Candidate List (CCL2)”, (EPA Report 815-R-08-012), released by EPA in 2008, EPA uses a somewhat different approach:

“The present toxicity database for MTP and TPA is not sufficient to derive reference doses (RfDs) for these two chemicals. However, since the available data indicate that neither MTP nor TPA is more toxic than their parent compound, DCPA, the Agency believes that the RfD for the DCPA parent would be protective against exposure from the two DCPA metabolites. Both compounds are formed in the body from the DCPA parent, and therefore the toxicity of the degradates is reflected in the observed toxicity of the parent compound. The RfD of 0.01

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January 31, 2012
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mg/kg/day for DCPA is based on a chronic rat study with a no-observed-adverse-effect level (NOAEL) of 1.0 mg/kg/day, and incorporates an uncertainty factor of 100. Using the DCPA RfD of 0.01 mg/kg/day and a 20 percent screening relative source contribution (RSC), the Agency calculated a health reference level (HRL) of 0.07 mg/L or 70 µg/L for DCPA and used this HRL for TPA and MTP. No sensitive subpopulations have been identified. Based on the cancer data for DCPA and evidence that neither TPA nor DCPA is mutagenic, the Agency concludes that TPA is unlikely to pose a cancer risk.”

Thus, the monitored TPA could be compared to 70 ug/L, the value that would be used for judging DCPA.

I hope this information is helpful

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Appendix 2. Acute Drinking Water Exposure Analysis (11 pages)

Ver. 4.02, 05-10-c
 NHANES 2005-2010 2-Day
 Adjustment factor #2 NOT used.

DEEM-FCID ACUTE Analysis for
 Residue file: TPA Water 14 Feb 17.R10
 Analysis Date: 02-14-2017/13:30:00 Residue file dated: 02-14-2017/13:27:28
 NOEL (Acute) = 1.000000 mg/kg body-wt/day
 RAC/FF intake summed over 24 hours
 Run Comment: ""

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Summary calculations--per capita:

	95th Percentile		99th Percentile		99.9th Percentile	
	Exposure	MOE	Exposure	MOE	Exposure	MOE
	-----	-----	-----	-----	-----	-----
Total US Population:	0.005374	186	0.009568	104	0.018171	55
Nursing Infants:	0.009920	100	0.015468	64	0.036500	27
Non-Nursing Infants:	0.019594	51	0.025864	38	0.034348	29
All Infants:	0.018438	54	0.025327	39	0.034379	29
Female 13-50:	0.005303	188	0.007743	129	0.011589	86
Children 1-2:	0.007761	128	0.011732	85	0.030279	33
Children 3-5:	0.006111	163	0.009314	107	0.015812	63
Children 6-12:	0.004794	208	0.007957	125	0.013190	75

Ver. 4.02, 05-10-c
 NHANES 2005-2010 2-Day
 Adjustment factor #2 NOT used.

DEEM-FCID ACUTE Analysis for
 Residue file: TPA Water 14 Feb 17.R10
 Analysis Date: 02-14-2017/13:30:00 Residue file dated: 02-14-2017/13:27:28
 NOEL (Acute) = 1.000000 mg/kg body-wt/day
 RAC/FF intake summed over 24 hours
 Run Comment: ""

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Summary calculations--users:

	95th Percentile		99th Percentile		99.9th Percentile	
	Exposure	MOE	Exposure	MOE	Exposure	MOE
	-----	-----	-----	-----	-----	-----
Total US Population:	0.005465	182	0.009672	103	0.018425	54
Nursing Infants:	0.012126	82	0.021264	47	0.036545	27
Non-Nursing Infants:	0.019651	50	0.025931	38	0.034357	29
All Infants:	0.019031	52	0.025566	39	0.034446	29
Female 13-50:	0.005361	186	0.007815	127	0.011609	86
Children 1-2:	0.007882	126	0.011759	85	0.030423	32
Children 3-5:	0.006276	159	0.009734	102	0.016827	59
Children 6-12:	0.004927	202	0.008015	124	0.013229	75

Ver. 4.02, 05-10-c
NHANES 2005-2010 2-Day

DEEM-FCID ACUTE Analysis for
 Residue file: TPA Water 14 Feb 17.R10 Adjustment factor #2 NOT used.
 Analysis Date: 02-14-2017/13:30:00 Residue file dated: 02-14-2017/13:27:28
 NOEL (Acute) = 1.000000 mg/kg body-wt/day
 RAC/FF intake summed over 24 hours
 Run Comment: ""

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Total US Population	Daily Exposure Analysis /a	
-----	(mg/kg body-weight/day)	
	per Capita	per User
	-----	-----
Mean	0.002041	0.002134
Standard Deviation	0.001971	0.001965
Standard Error of mean	0.000009	0.000009
Margin of Exposure 2/	490	468

Percent of Person-Days that are User-Days = 95.62%

Estimated percentile of user-days falling below calculated exposure
 in mg/kg body-wt/day with Margin of Exposure (MOE)

Percentile	Exposure	MOE	Percentile	Exposure	MOE
-----	-----	-----	-----	-----	-----
10.00	0.000426	2,349	90.00	0.004207	237
20.00	0.000742	1,347	95.00	0.005465	182
30.00	0.001038	963	97.50	0.007063	141
40.00	0.001342	745	99.00	0.009672	103
50.00	0.001665	600	99.50	0.011808	84
60.00	0.002042	489	99.75	0.014588	68
70.00	0.002505	399	99.90	0.018425	54
80.00	0.003117	320			

Estimated percentile of per-capita days falling below calculated exposure
 in mg/kg body-wt/day with Margin of Exposure (MOE)

Percentile	Exposure	MOE	Percentile	Exposure	MOE
-----	-----	-----	-----	-----	-----
10.00	0.000260	3,846	90.00	0.004141	241
20.00	0.000632	1,582	95.00	0.005374	186
30.00	0.000938	1,065	97.50	0.006969	143
40.00	0.001259	794	99.00	0.009568	104
50.00	0.001590	628	99.50	0.011720	85
60.00	0.001970	507	99.75	0.014452	69
70.00	0.002435	410	99.90	0.018171	55
80.00	0.003048	328			

a/ Analysis based on all two-day participant records in NHANES 2005-2010 2-Day with 2 days of valid drinking water records.
 2/ Margin of Exposure = NOEL/ Dietary Exposure.

Ver. 4.02, 05-10-c
NHANES 2005-2010 2-Day

DEEM-FCID ACUTE Analysis for
Residue file: TPA Water 14 Feb 17.R10 Adjustment factor #2 NOT used.
Analysis Date: 02-14-2017/13:30:00 Residue file dated: 02-14-2017/13:27:28
NOEL (Acute) = 1.000000 mg/kg body-wt/day
RAC/FF intake summed over 24 hours
Run Comment: ""

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Nursing Infants	Daily Exposure Analysis	
-----	(mg/kg body-weight/day)	
	per Capita	per User
	-----	-----
Mean	0.002321	0.004047
Standard Deviation	0.003838	0.004324
Standard Error of mean	0.000141	0.000197
Margin of Exposure	430	247

Percent of Person-Days that are User-Days = 57.37%

Estimated percentile of user-days falling below calculated exposure
in mg/kg body-wt/day with Margin of Exposure (MOE)

Percentile	Exposure	MOE	Percentile	Exposure	MOE
-----	-----	-----	-----	-----	-----
10.00	0.000281	3,562	90.00	0.009395	106
20.00	0.000792	1,262	95.00	0.012126	82
30.00	0.001343	744	97.50	0.014118	70
40.00	0.001896	527	99.00	0.021264	47
50.00	0.002558	390	99.50	0.024303	41
60.00	0.003475	287	99.75	0.031309	31
70.00	0.005155	193	99.90	0.036545	27
80.00	0.007104	140			

Estimated percentile of per-capita days falling below calculated exposure
in mg/kg body-wt/day with Margin of Exposure (MOE)

Percentile	Exposure	MOE	Percentile	Exposure	MOE
-----	-----	-----	-----	-----	-----
10.00	0.000000	>1,000,000	90.00	0.007646	130
20.00	0.000000	>1,000,000	95.00	0.009920	100
30.00	0.000000	>1,000,000	97.50	0.012182	82
40.00	0.000000	>1,000,000	99.00	0.015468	64
50.00	0.000394	2,535	99.50	0.021932	45
60.00	0.001355	737	99.75	0.024380	41
70.00	0.002386	419	99.90	0.036500	27
80.00	0.004085	244			

DEEM-FCID ACUTE Analysis for
 Residue file: TPA Water 14 Feb 17.R10
 Analysis Date: 02-14-2017/13:30:00
 NOEL (Acute) = 1.000000 mg/kg body-wt/day
 RAC/FF intake summed over 24 hours
 Run Comment: ""

Ver. 4.02, 05-10-c
 NHANES 2005-2010 2-Day
 Adjustment factor #2 NOT used.

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Non-Nursing Infants -----	Daily Exposure Analysis (mg/kg body-weight/day)	
	per Capita	per User
	-----	-----
Mean	0.010055	0.010345
Standard Deviation	0.005533	0.005338
Standard Error of mean	0.000137	0.000134
Margin of Exposure	99	96

Percent of Person-Days that are User-Days = 97.20%

Estimated percentile of user-days falling below calculated exposure
in mg/kg body-wt/day with Margin of Exposure (MOE)

Percentile	Exposure	MOE	Percentile	Exposure	MOE
-----	-----	-----	-----	-----	-----
10.00	0.003877	257	90.00	0.017255	57
20.00	0.005986	167	95.00	0.019651	50
30.00	0.007524	132	97.50	0.022545	44
40.00	0.008839	113	99.00	0.025931	38
50.00	0.009807	101	99.50	0.029643	33
60.00	0.010984	91	99.75	0.030292	33
70.00	0.012464	80	99.90	0.034357	29
80.00	0.014293	69			

Estimated percentile of per-capita days falling below calculated exposure
in mg/kg body-wt/day with Margin of Exposure (MOE)

Percentile	Exposure	MOE	Percentile	Exposure	MOE
-----	-----	-----	-----	-----	-----
10.00	0.002917	342	90.00	0.017178	58
20.00	0.005557	179	95.00	0.019594	51
30.00	0.007235	138	97.50	0.022208	45
40.00	0.008668	115	99.00	0.025864	38
50.00	0.009617	103	99.50	0.029623	33
60.00	0.010851	92	99.75	0.030213	33
70.00	0.012317	81	99.90	0.034348	29
80.00	0.014161	70			

Ver. 4.02, 05-10-c
NHANES 2005-2010 2-Day

DEEM-FCID ACUTE Analysis for
 Residue file: TPA Water 14 Feb 17.R10 Adjustment factor #2 NOT used.
 Analysis Date: 02-14-2017/13:30:00 Residue file dated: 02-14-2017/13:27:28
 NOEL (Acute) = 1.000000 mg/kg body-wt/day
 RAC/FF intake summed over 24 hours
 Run Comment: ""

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Female 13-50 -----	Daily Exposure Analysis (mg/kg body-weight/day) per Capita per User -----
Mean	0.002003 0.002094
Standard Deviation	0.001720 0.001704
Standard Error of mean	0.000016 0.000016
Margin of Exposure	499 477

Percent of Person-Days that are User-Days = 95.68%

Estimated percentile of user-days falling below calculated exposure
in mg/kg body-wt/day with Margin of Exposure (MOE)

Percentile	Exposure	MOE	Percentile	Exposure	MOE
-----	-----	-----	-----	-----	-----
10.00	0.000401	2,496	90.00	0.004305	232
20.00	0.000722	1,384	95.00	0.005361	186
30.00	0.001004	995	97.50	0.006483	154
40.00	0.001334	749	99.00	0.007815	127
50.00	0.001674	597	99.50	0.008988	111
60.00	0.002074	482	99.75	0.009766	102
70.00	0.002573	388	99.90	0.011609	86
80.00	0.003231	309			

Estimated percentile of per-capita days falling below calculated exposure
in mg/kg body-wt/day with Margin of Exposure (MOE)

Percentile	Exposure	MOE	Percentile	Exposure	MOE
-----	-----	-----	-----	-----	-----
10.00	0.000234	4,267	90.00	0.004232	236
20.00	0.000613	1,630	95.00	0.005303	188
30.00	0.000908	1,101	97.50	0.006447	155
40.00	0.001249	800	99.00	0.007743	129
50.00	0.001589	629	99.50	0.008753	114
60.00	0.001994	501	99.75	0.009688	103
70.00	0.002503	399	99.90	0.011589	86
80.00	0.003157	316			

Ver. 4.02, 05-10-c
NHANES 2005-2010 2-Day

DEEM-FCID ACUTE Analysis for
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 NOEL (Acute) = 1.000000 mg/kg body-wt/day
 RAC/FF intake summed over 24 hours
 Run Comment: ""

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Children 3-5 -----	Daily Exposure Analysis (mg/kg body-weight/day) per Capita per User -----
Mean	0.002284 0.002436
Standard Deviation	0.002060 0.002038
Standard Error of mean	0.000039 0.000039
Margin of Exposure	437 410

Percent of Person-Days that are User-Days = 93.74%

Estimated percentile of user-days falling below calculated exposure
in mg/kg body-wt/day with Margin of Exposure (MOE)

Percentile	Exposure	MOE	Percentile	Exposure	MOE
-----	-----	-----	-----	-----	-----
10.00	0.000444	2,253	90.00	0.004923	203
20.00	0.000808	1,237	95.00	0.006276	159
30.00	0.001170	854	97.50	0.007653	130
40.00	0.001547	646	99.00	0.009734	102
50.00	0.001985	503	99.50	0.011587	86
60.00	0.002456	407	99.75	0.014485	69
70.00	0.002945	339	99.90	0.016827	59
80.00	0.003724	268			

Estimated percentile of per-capita days falling below calculated exposure
in mg/kg body-wt/day with Margin of Exposure (MOE)

Percentile	Exposure	MOE	Percentile	Exposure	MOE
-----	-----	-----	-----	-----	-----
10.00	0.000172	5,815	90.00	0.004830	207
20.00	0.000642	1,557	95.00	0.006111	163
30.00	0.001034	967	97.50	0.007444	134
40.00	0.001393	717	99.00	0.009314	107
50.00	0.001826	547	99.50	0.011362	88
60.00	0.002321	430	99.75	0.013584	73
70.00	0.002842	351	99.90	0.015812	63
80.00	0.003593	278			

Ver. 4.02, 05-10-c
NHANES 2005-2010 2-Day

DEEM-FCID ACUTE Analysis for
Residue file: TPA Water 14 Feb 17.R10 Adjustment factor #2 NOT used.
Analysis Date: 02-14-2017/13:30:00 Residue file dated: 02-14-2017/13:27:28
NOEL (Acute) = 1.000000 mg/kg body-wt/day
RAC/FF intake summed over 24 hours
Run Comment: ""

=====

Children 6-12 -----	Daily Exposure Analysis (mg/kg body-weight/day) per Capita per User -----
Mean	0.001698 0.001839
Standard Deviation	0.001698 0.001692
Standard Error of mean	0.000021 0.000021
Margin of Exposure	588 543

Percent of Person-Days that are User-Days = 92.34%

Estimated percentile of user-days falling below calculated exposure
in mg/kg body-wt/day with Margin of Exposure (MOE)

Percentile	Exposure	MOE	Percentile	Exposure	MOE
-----	-----	-----	-----	-----	-----
10.00	0.000304	3,293	90.00	0.003748	266
20.00	0.000573	1,746	95.00	0.004927	202
30.00	0.000829	1,206	97.50	0.006362	157
40.00	0.001098	910	99.00	0.008015	124
50.00	0.001409	709	99.50	0.009651	103
60.00	0.001753	570	99.75	0.011122	89
70.00	0.002222	450	99.90	0.013229	75
80.00	0.002800	357			

Estimated percentile of per-capita days falling below calculated exposure
in mg/kg body-wt/day with Margin of Exposure (MOE)

Percentile	Exposure	MOE	Percentile	Exposure	MOE
-----	-----	-----	-----	-----	-----
10.00	0.000069	14,537	90.00	0.003597	277
20.00	0.000398	2,513	95.00	0.004794	208
30.00	0.000679	1,472	97.50	0.006117	163
40.00	0.000960	1,042	99.00	0.007957	125
50.00	0.001274	784	99.50	0.009566	104
60.00	0.001639	610	99.75	0.011056	90
70.00	0.002086	479	99.90	0.013190	75
80.00	0.002673	374			

DEEM-FCID Acute analysis for

Residue file name: H:\plohstroh\Documents\Memos\TPA 09 Feb 17\DEEM Files\TPA Water 14 Feb 17.R10

Analysis Date 02-23-2017

Residue file dated: 02-14-2017/13:27:28

EPA Code	Crop Grp	Food Name	Def Res (ppm)	Adj. Factors #1	Adj. Factors #2	Comment
8601000000	86A	Water, direct, all sources	0.101000	1.000	1.000	
8602000000	86B	Water, indirect, all sources	0.101000	1.000	1.000	

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Appendix 3. Chronic Drinking Water Exposure Analysis (2 pages)

Evaluation Copy

DEEM-FCID Chronic analysis for

Residue file name: H:\plohstroh\Documents\Memos\TPA 09 Feb 17\DEEM Files\TPA Water 14 Feb 17.R10

Ver. 4.02, 05-10-c

NHANES 2005-2010 2-day

Adjustment factor #2 NOT used.

Analysis Date 02-14-2017/13:31:34

Residue file dated: 02-14-2017/13:27:28

NOEL (Chronic) = 1 mg/kg bw/day

=====
Total exposure by population subgroup
=====

Population Subgroup	Total Exposure		
	mg/kg body wt/day	Percent of NOEL	Margin of Exposure
Total US Population	0.002041	0.20%	490
Hispanic	0.001991	0.20%	502
Non-Hisp-White	0.002093	0.21%	478
Non-Hisp-Black	0.001640	0.16%	610
Non-Hisp-Other	0.002399	0.24%	417
Nursing Infants	0.002321	0.23%	431
Non-Nursing Infants	0.010055	1.01%	99
Female 13+ PREG	0.002127	0.21%	470
Children 1-6	0.002447	0.24%	409
Children 7-12	0.001618	0.16%	618
Male 13-19	0.001341	0.13%	746
Female 13-19/NP	0.001531	0.15%	653
Male 20+	0.001895	0.19%	528
Female 20+/NP	0.002099	0.21%	476
Seniors 55+	0.001909	0.19%	524
All Infants	0.007623	0.76%	131
Female 13-50	0.002003	0.20%	499
Children 1-2	0.002806	0.28%	356
Children 3-5	0.002284	0.23%	438
Children 6-12	0.001698	0.17%	589
Youth 13-19	0.001439	0.14%	695
Adults 20-49	0.002027	0.20%	493
Adults 50-99	0.001972	0.20%	507
Female 13-49	0.001993	0.20%	502

Residue file: H:\plohstroh\Documents\Memos\TPA 09 Feb 17\DEEM Files\TPA Water 14 Feb 17.R10
Adjust. #2 NOT used

Analysis Date 02-23-2017 Residue file dated: 02-14-2017/13:27:28
Reference dose (NOEL) = 1 mg/kg bw/day

Food EPA Code	Crop Grp	Food Name	Residue (ppm)	Adj.Factors	
				#1	#2
8601000000	86A	Water, direct, all sources	0.101000	1.000	1.000
8602000000	86B	Water, indirect, all sources	0.101000	1.000	1.000