Draft Health-based MCL Recommendation for 1,2,3-Trichloropropane (1,2,3-TCP)

New Jersey Drinking Water Quality Institute
Health Effects Subcommittee

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October 28, 2015
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Introduction

- Health-based MCL recommended in March 2009 was 0.0013 µg/L (1.3 ng/L).
- Review of basis for this recommendation was requested by DEP Commissioner in September 2015.
- Health Effects Subcommittee has completed its review, including relevant information that became available after March 2009.

Summary of 2009 Health Effects Subcommittee Assessment

- 1,2,3-TCP is a potent carcinogen in male and female mice and rats (NTP, 1993).
  - Tumors in multiple organs beginning early in life caused early mortality.
  - Acts through mutagenic mode of action.
- Cancer potency factor based on forestomach tumors in female mice: 26 $(mg/kg/day)^{-1}$.
  - Most frequent tumor type in male and female mice and rats.
  - Considered relevant to humans.
  - Time-to-tumor model used because of early occurrence of fatal tumors.

Relevant Information Since March 2009: USEPA IRIS Assessment of 1,2,3-TCP (Sept. 2009)

- "Likely to be carcinogenic to humans".
- Forestomach tumors are relevant to humans.
- Cancer potency factors (female mice; NTP, 1993)
  - Based on alimentary tumors (>95% forestomach): 26 $(mg/kg/day)^{-1}$
  - Based on all tumors combined: 28 $(mg/kg/day)^{-1}$
  - Recommended factor, rounded to one significant figure: 30 $(mg/kg/day)^{-1}$
- Mutagenic mode of action for carcinogenicity
  - More potent during early life exposure.
  - Recommend use of age dependent adjustment factors (ADAFs) with age-specific exposure assumptions.
    - 10-fold for first 2 years of life.
    - 3-fold for next 14 years of life.

Relevant Information Since March 2009: USEPA Office of Water Reference Concentration (2014)

- Health-based benchmark for evaluation of UCMR3 data: 0.0004 µg/L (0.4 ng/L) at 10^{-6} risk level.
- Based on:
  - IRIS cancer potency factor
  - Age Dependent Adjustment Factors combined with age-specific drinking water consumption values.
    - 90th percentile from USEPA studies – consistent with past USEPA and DWQI practice.
    - Lifetime time weighted average (L/kg/day) similar to standard adult exposure assumptions (70 kg, 2 L/day).

ADAFs and Age-Specific Drinking Water Ingestion Factors			
Age period	ADAF	Ingestion rate (L/kg/day)	Fraction of Lifetime
birth to < 1 month	10	0.235	0.001
1 to < 3 months	10	0.228	0.002
3 to < 6 months	10	0.148	0.004
6 to < 12 months	10	0.112	0.007
1 to < 2 years	10	0.056	0.014
2 to < 3 years	3	0.052	0.014
3 to < 6 years	3	0.043	0.043
6 to < 11 years	3	0.035	0.071
11 to < 16 years	3	0.026	0.071
16 to < 18 years	1	0.023	0.029
18 to <21 years	1	0.026	0.043
21 to <70 years	1	0.034	0.700

Relevant Information Since March 2009: Tardiff and Carson (2010)

- Propose drinking water concentration of 200-280 ug/L
- Assumption of threshold for mutagenicity/carcinogenicity*:*
  - Inconsistent with USEPA guidance and is not based on data on 1,2,3-TCP or similar chemicals.
- Conclusion that forestomach tumors from 1,2,3-TCP are not relevant to humans:
  - Inconsistent with IARC and USEPA IRIS.
- Conclusion that Maximum Tolerated Dose was exceeded in NTP (1993):
  - Not applicable because effects (↓ body weight and deaths) were due to tumors, not non-cancer toxicity.

Relevant Information Since March 2009: Conclusions of TetraTech (2012) Review of Hawaii MCL

- Reviewed Hawaii MCL: 0.6 µg/L, adopted in 2005.
  - Based on 10^{-6} cancer risk from potency factor for pancreatic tumors in male rats developed by Tardiff (2001).
- Rejected threshold mutagenicity assumption of Tardiff & Carson.
- Tetra Tech (2012) evaluated cancer risks of Hawaii MCL with five potency factors using ADAFs.
  - IRIS (with and without forestomach), Tardiff (1992, 2001), and Tetra Tech (2012) "alternative" factor based on geometric mean of IRIS factors for male and female rats and mice.
  - For all potency factors cancer risk ranges from 2.8×10^{-6} to 1.4×10^{-3}
  - DWQI Health-based MCLs are based on 10^{-6} cancer risk level required by NJ law.
    - Hawaii is not legally required to base MCLs on specified cancer risk level.
    - Health-based drinking water level at 10^{-6} risk level using Tetra Tech "alternative" factor is 0.002 µg/L (2 ng/L).

Health Effects Subcommittee Conclusions

- There is no reason to revise 2009 DWQI cancer potency factor, 26 $(mg/kg/day)^{-1}$.
  - Identical to USEPA IRIS cancer potency factor based on same tumors.
- Age Dependent Adjustment Factors (ADAFs) combined with age-specific drinking water ingestion factors should be applied in 1,2,3-TCP risk assessment.
  - Consistent with current USEPA guidance for mutagenic carcinogens in general.
  - Consistent with USEPA IRIS and USEPA Office of Water risk assessments for 1,2,3-TCP.

Draft Recommendation and Future Steps

- Draft Health-based MCL recommendation is **0.0005 µg/L (0.5 ng/L)**
  - Slight difference from USEPA Office of Water value (0.0004 µg/L; 0.4 ng/L)
  - USEPA cancer potency factor, 30 $(mg/kg/day)^{-1}$, is slightly higher than DWQI's factor because of rounding to one significant figure.
- Health-based MCL recommendation will be finalized after consideration of public comments.