

Health Basis of MassDEP Drinking Water Values for Six PFAS

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Overview

- MA Drinking Water Guidelines and Standards
- MCL Derivation Process
- Health Effects of PFAS
- Derivation of MassDEP MMCL for six PFAS



How is drinking water (DW) regulated?

US EPA - National

- Standards - Maximum Contaminant Levels (MCLs)
 - Enforceable standard
 - Adopted by states
- Guidance – Health Advisories (HAs)

Massachusetts

- Adopt EPA MCLs and HAs
- ➔ • Guidance – Office of Research and Standards Guideline (ORSG) - not itself enforceable
- ➔ • Standard – Massachusetts MCL (MMCL) – enforceable standard

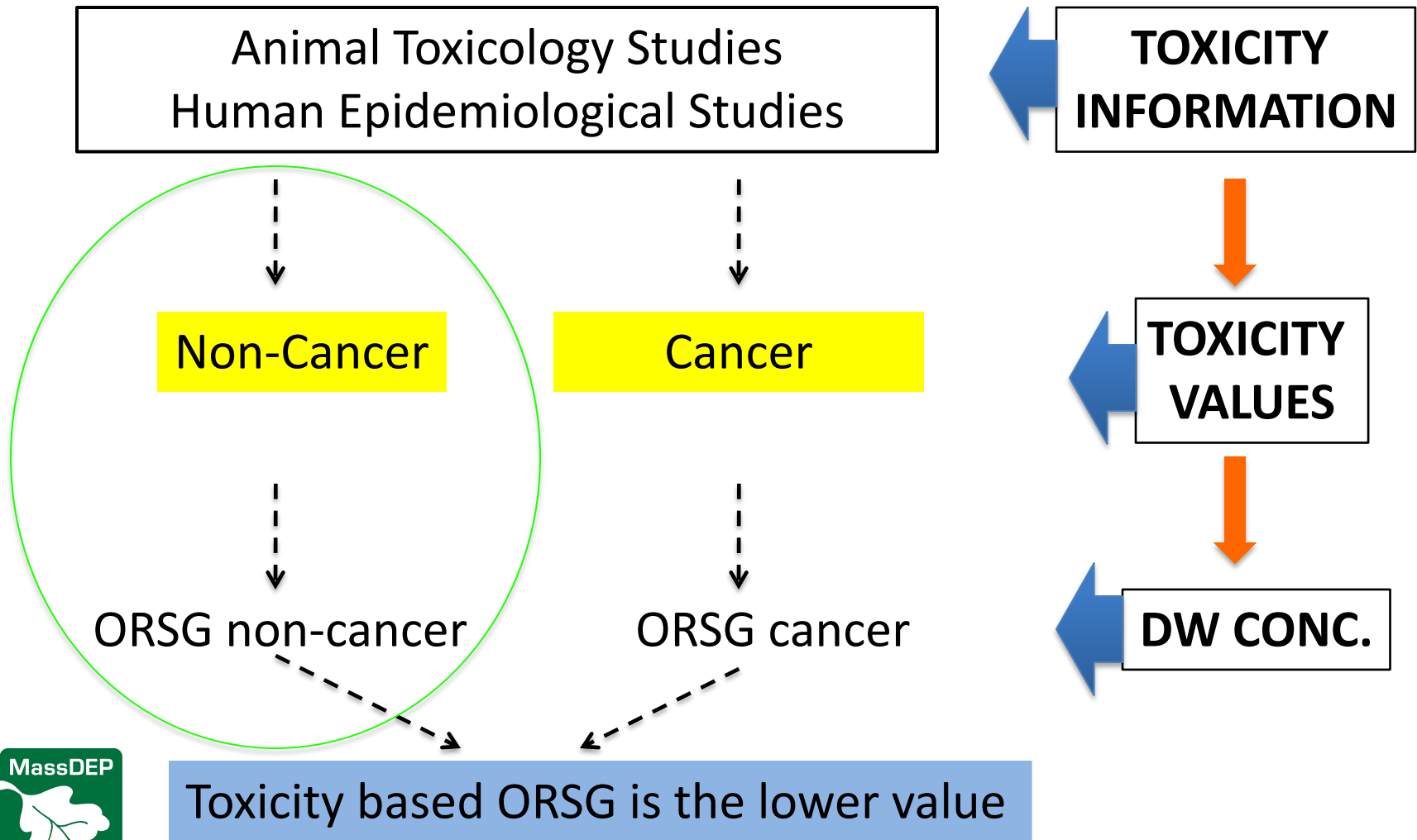


MassDEP Maximum Contaminant Levels (MMCLs)

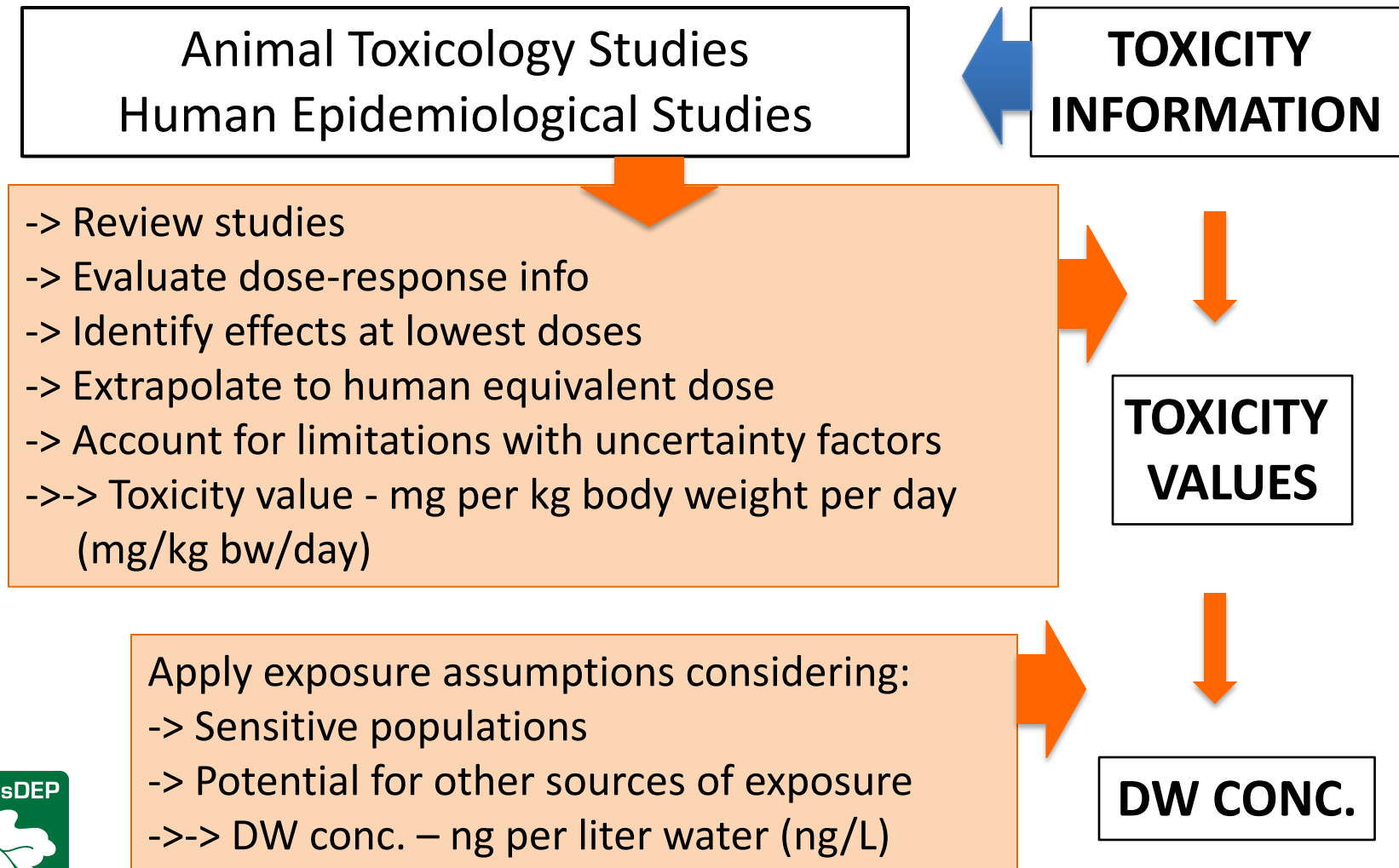
- MassDEP derives MMCLs in two steps:
 - Identify health-based goal – Office of Research and Standard Goal (ORSG)
 - Other factors considered: detection capability, treatment
- MMCLs are enforceable standards



Health Basis of ORSGs: Toxicity Values



Health Basis of ORSGs: Toxicity Values



ORSG: Source of Toxicity Values

- US EPA – Integrated Risk Information System and Health Advisories
- Values developed by other states, federal or international toxicology programs with review
- Developed by ORS



Per and Polyfluoroalkyl Substances (PFAS) Regulated by MMCL

PFOA – Perfluorooctanoic acid

PFOS – Perfluorooctane sulfonic acid

PFHxS – Perfluorohexane sulfonic acid

PFHpA - Perfluoroheptanoic acid

PFNA - Perfluorononanoic acid

PFDA - Perfluorodecanoic acid

PFAS6

This subgroup of long-chain PFAS have similar:

- structures (8 ± 2 carbons)
- toxicological effects
- long persistence in the body



Why Are Long-Chain PFAS a Concern?

- **Infants/children at risk**
 - Crosses placenta
 - Expressed in breast milk
- **Toxicity at low exposure levels**
- **Persistent**
 - Do not appreciably breakdown in the environment
 - Stay for many years in the body
- **Water soluble**



Health Effects Associated with Long-Chain PFAS Exposure

- Effects on the immune system
 - decreased response to vaccines
- Developmental effects
 - decreased birth weight, delayed development
- Endocrine disruption
 - thyroid hormone effects
- Liver effects
 - increased cholesterol and markers of stress
- Elevated cancer risks
 - kidney and testes (epi data); liver and pancreas (animal data)



Considerations for Evaluating Health Effects of PFAS

- Information about health effects of PFAS is evolving at a rapid pace
- PFOA and PFOS are the most studied of PFAS6 subgroup
- Less data on other PFAS in this subgroup, but similar responses and potencies as seen



MassDEP Drinking Water Guidelines

- June 2018 - Office of Research and Standards Guideline (ORSG) for Drinking Water
 - 70 ppt for PFOS, PFOA, plus **PFHxS, PFHpA, PFNA**
 - Based on 2016 USEPA PFOS/PFOA Health Advisory values
 - Extended to closely related compounds with less data
- New assessments and data, including but not limited to, the draft ATSDR Toxicological Profile issued later in June 2018, prompted reassessment



Why Revise the Toxicity Values?

- Multiple effects in multiple studies at lower exposure levels
 - Thyroid
 - Liver
 - Development
 - Immune function
- Taken together these raise compelling concerns
- However, individual studies have limitations
- ORS concluded that it was appropriate to apply an additional uncertainty factor of ~ 3 to the toxicity value to account for more sensitive effects



MassDEP Drinking Water Guidelines

- January 2020 - Office of Research and Standards Guideline (ORSG) for Drinking Water
 - **20 ppt** for PFOS, PFOA, PFHxS, PFHpA, PFNA, **PFDA**
 - **Toxicity value decreased by a factor of ~3**
 - **Added PFDA**
 - Other elements of the ORSG (2018) are the same
- [Technical Support Document: Per- and Polyfluoroalkyl Substances \(PFAS\): An Updated Subgroup Approach to Groundwater and Drinking Water Values](#)



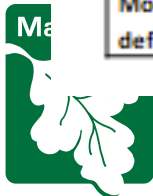
MassDEP MMCL

- **September 16, 2020** MassDEP MMCL adopted
Based on January 2020 ORSG of
 - **20 ppt** for PFAS6 (PFOS, PFOA, PFHxS, PFHpA, PFNA, PFDA)
- MMCL of 20 ppt (ng/L) is applicable to each PFAS individually and the sum of all together
- The MMCL is an enforceable standard
- Regulation includes 3-year reassessment of MMCL



Comparison of Drinking Water Values for PFAS (ppt)

as of Jan. 2020	PFOS	PFOA	PFNA	PFHxS	PFHpA	PFDA
USEPA Health Advisories	70 Sum of two		NA	NA	NA	NA
MA MCL, GW standard	70 (2018 ORSG) → 20 (MCL; MCP GW standard) Sum of five → Sum of six (adds PFDA)					
VT MCL	20 Sum of five					NA
CT Action Levels	70 Sum of five					NA
WI Recommended GW standard	20					
ATSDR draft ATSDR toxicity values and EPA exposure parameters	7	11	10	70	NA	NA
NY MCL	10	10	NA	NA	NA	NA
NJ MCL	13	14	13	NA	NA	NA
CA Notification levels (Response levels)	6.5 (40)	5.1 (10)	NA	NA	NA	NA
MI MCL	16	8	6	51	NA	PFNA value recomm ended
MN guidelines	15	35	NA	47	NA	NA
NH MCL	15	12	11	18	NA	NA
Most other states (EPA value by default)	70		NA	NA	NA	NA



Conclusions

- The MMCL of 20 ppt (ng/L) for PFAS6 (PFOA, PFOS, PFHxS, PFHpA, PFNA, PFDA) is applicable to each PFAS individually and the sum of all together
- The MMCL is health-based, protective of the most sensitive population and accounts for exposure to PFAS from sources in addition to drinking water
- Every 3 years MassDEP will perform a review for relevant developments in the science, assessment and regulation of PFAS in drinking water



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