TDEC Regulatory Approach to Mercury Effluent Limits

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22 October 09

TDEC-WPC Regulatory Approach

Summary

- **TN Water Quality Control Act**
- **TN Water Quality Criteria**
- **TDEC Fish Consumption Advisories**
- **EPA WQC and MeHg Guidance**
- **NPDES Permitting Strategy:**
  Y-12 National Security Complex
- **Calculating Effluent Hg Limits**

TN Water Quality Control Act

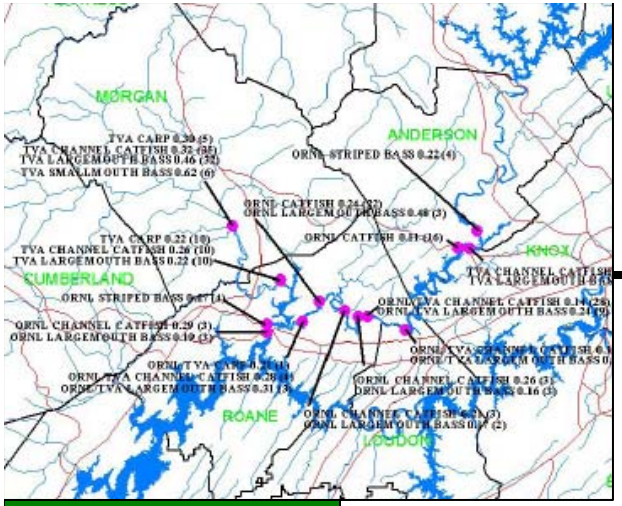
- **Use Classifications**
- **Water Supply, Fish & Aquatic Life, Recreation**
- **Water Quality Criteria**
- **Physical, Chemical (Metals, VOCs)**
- **Bacteriological**
- **Biological Integrity**
- **Antidegradation**
- **Available/Nonavailable Conditions**
- **Exceptional TN Waters**
    - **Economic/Social Necessity**
- **Groundwater**

TN Water Quality Criteria, 2008

Total Mercury

WATER COLUMN, DISSOLVED

Use	Concentration, ug/l
Domestic Water Supply	2.0
Fish and Aquatic Life	1.4 acute 0.77 chronic
Recreation	0.05 Water & Organisms (stream classed for Water Supply) 0.051 Organisms Only



TN Fish Consumption Advisories

- **Sensitive Population must be protected**
- **2007 Legislative change: use EPA 2001 fish tissue guidance**
- **May 2007 - TDEC Updated Fish Advisories**

TN Fish Consumption Advisories

•May 2007 - TDEC posted 30 stream and lake segments statewide

- **27 streams/lakes: Airborne Deposition**

  Nonpoint sources

- **3 streams/lakes: Point sources**

  North Fork Holston River

  Hiwassee River

  EAST FORK POPLAR CREEK

  (Posted since 1980's ….)

EPA WQC and MeHg Guidance

- **NPDES permitting approach (Sec 7.2.1)**
- **MeHg criterion: as Water Column**
- **Water Column translation if data exists**

- **Permit Limits: Sec 5.4.4 of TSD Document***

***Technical Support Document for WQ-based Toxics Control, USEPA, 1991**

EPA WQC and MeHg Guidance

- **Permit Limits: Sec 5.4.4 of TSD Document***
  - **"EPA Recommendations for Permitting for Human Health Protection"**
    - **Exposure period is longer than 1 month.**
    - **Average exposure <u>not</u> maximum exposure**
    - **Daily Maximum Limit = impractical**

- **Monthly Average Limit=Wasteload Allocation**

***Technical Support Document for WQ-based Toxics Control, USEPA, 1991**

NPDES Permitting Strategy:
Y-12 National Security Complex

- **Permit Issued:** 13 March 2006
- **Expired:** 31 December 2008

- **<u>Effluent Limits for Mercury</u>**
  - **WWTR Treatment Systems: no limit (report only)**
  - **Outfall 200, 125, 051, 055: no limit (report only)**
  - **Outfall 135, 109, 077, 021: no limit**
  - **Station 17, C11 no limit (report only)**
  - **Central/East End MTS: 2 ug/l Mo. Ave.**
    4 ug/l Daily Max.

USDOE applied timely – administrative extension

NPDES Permitting Strategy:
Y-12 National Security Complex

***Option 1*: Limits = Water Quality Criterion**

Station 17: 0.051 ug/l Mo. Average

***Option 2*: Limits per EPA MeHg Guidance,**
Calculate Water Column value needed
to meet Fish Tissue target

NPDES Permitting Strategy:
Y-12 National Security Complex

***Option 1*: Limits = Water Quality Criterion**

Recreation Use & Organisms Only

Station 17:	**0.051 ug/l Mo. Average**
2008-9 discharge	**0.22-0.30 ug/l**

Problem:

NO correlation between 0.051 ug/l WQC and fish tissue concentration

NPDES Permitting Strategy:
Y-12 National Security Complex

***Option 2*: Limits per EPA 2009 MeHg Guidance, Calculate Water Column value needed to meet Fish Tissue target**

Definitions

AWQC	**Ambient WQ Criterion**
TRC	**Tissue Residue Criterion**
BAF	**Bioaccumulation Factor**

Option 2: Limits per EPA MeHg Guidance

AWQC = TRC / BAF

Where BAF = Ct / Cw

And

Ct = Conc'n of MeHg in fish tissue, mg/kg *

Cw = Conc'n of MeHg in Water, mg/L *

DEPARTMENT OF ENVIRONMENT & CONSERVATION

Calculating Bioaccumulation Factor

Ct = Conc'n of MeHg in fish tissue, mg/kg

Cw = Conc'n of MeHg in Water

Based on USDOE data 2001 - 2007

Column info	1	2	3	4	5	6	7	8
Station (upstm to downstm.)		Fish mg/kg	Total Hg ng/l	MeHg ug/l	Site-Specific BAF	Ratio Methyl-to-Total Hg	Target MeHg Conc'n, ug/l	**Target Total Hg** Conc'n, ng/l
2001	Spring	0.615	327	0.06	1.02E+07	1.83E-04	0.029	159.577
	Fall	0.867	420	0.39	2.22E+06	9.29E-04	0.135	145.287
2002	Spring	0.778	283	0.06	1.30E+07	2.12E-04	0.023	109.126
	Fall	0.840	332	0.17	4.94E+06	5.12E-04	0.061	118.642
2003	Spring	0.956	330	0.2	4.78E+06	6.06E-04	0.063	103.570
	Fall	0.871	353	0.22	3.96E+06	6.23E-04	0.076	121.525
2004	Spring	1.019	307	0.19	5.36E+06	6.19E-04	0.056	90.405
	Fall	1.212	403	0.13	9.32E+06	3.23E-04	0.032	99.780
2005	Spring	0.912	519	0.23	3.96E+06	4.43E-04	0.076	170.786
	Fall	0.680	274	0.2	3.40E+06	7.30E-04	0.088	120.882
2006	Spring	0.780	289	0.2	3.90E+06	6.92E-04	0.077	111.154
	Fall	0.940	353	0.26	3.62E+06	7.37E-04	0.083	112.660
2007	Spring	0.810	279	0.27	3.00E+06	9.68E-04	0.100	103.333
	Fall	0.710	198	0.14	5.07E+06	7.07E-04	0.059	83.662
			518.556	0.194		0.001	0.068	117.885

Site-specific BAF

Ct = Conc'n of MeHg in fish tissue, mg/kg averaged from each season from all fish sampled

Cw = Conc'n of MeHg in Water, ng/L

Example (Fall 2007):

Ct = 0.710 / 0.00014 = 5,071,000

Ratio of Methyl –to-Total Hg

Conc'n of MeHg Hg in water, ug/l

Conc'n of Total in Water, ug/L

Example (Fall 2007):

Ratio of Methyl-to-Total Hg = 0.00014/ 0.198

= 0.000707

Target Methyl Hg
Water Column Concentration

EPA Fish tissue guideline = 0.3 mg/kg

BAF (example) = 5,070,000

<u>Example (Fall 2007):</u>

Ratio = 0.3/ 5,070,000 = 0.059 ug/l

Calculated Total Hg Water Column Concentration

Target MeHg Concentration = 0.059 ug/l

Ratio of Methyl-to-Total Hg = 0.000707

Example (Fall 2007):

Target Total Hg WQC = 0.059/ 0.000707 = 0.0835 ug/l

Target varies by season and year:

2001 – 2007 average WQC = 0.118 ug/l

Calculated Total Hg Water Column Concentration

Using DOE Fish Tissue & Water Column Data, Spring 01 – Fall 07:

Target Total Hg WQC at Station 17 = 0.118 ug/l*

*** Water Column Concentration which produces Fish Tissue Concentration of 0.3 mg/kg**

PROPOSED PERMIT LIMIT, Station 17:

Monthly Average Conc. = 0.118 ug/l

Measured Weekly, 5-day flow composite