New Ultra Low Water Quality Based Effluent Limitations

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40 Code of Federal Regulations 122.44(d)(ii) REASONABLE POTENTIAL

When determining whether a discharge causes, has the reasonable potential to cause, or contributes to an in-stream excursion above a narrative or numeric criteria within a State water quality standard, the permitting authority **SHALL** use procedures which account for existing controls on point and nonpoint sources of pollution, the variability of the pollutant or pollutant parameter in the effluent …

Water Quality Model

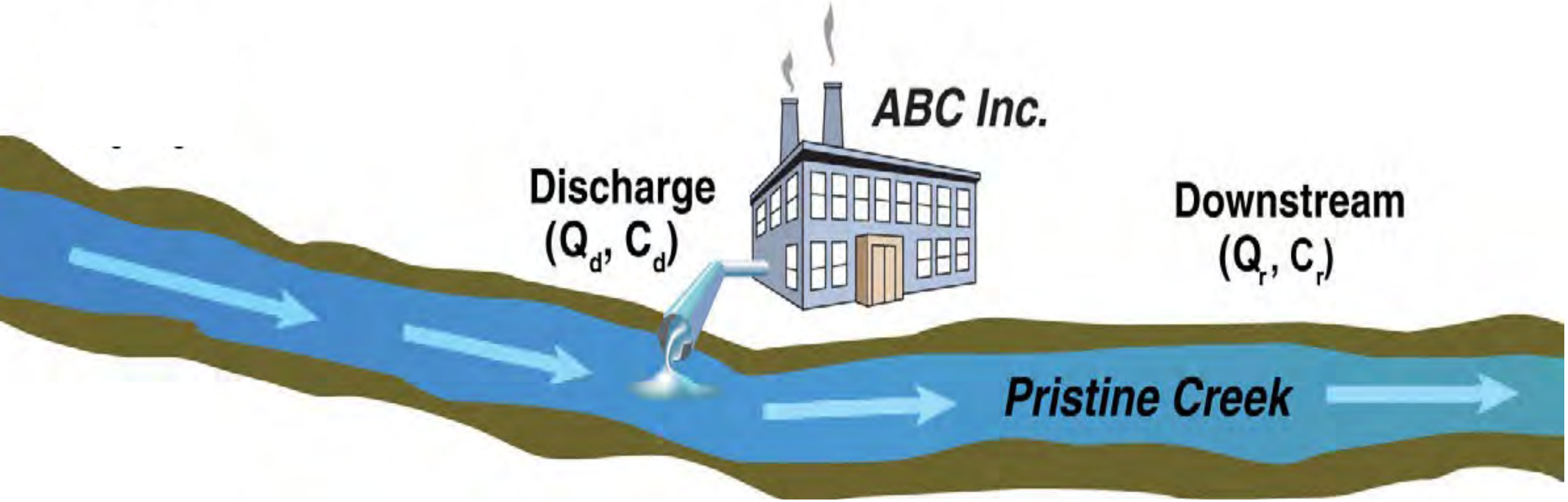
Essentially, all models are wrong, some however are useful.

George Box

THE SOLUTION TO POLUTION IS DILUTION

Massachusetts Tittle 314 CMR 4.03(3)(a) For rivers and streams, the lowest flow condition at and above which aquatic life criteria must be applied is the lowest mean flow for seven consecutive days to be expected once in
ten years (7Q10)

New Hampshire Standards (RSA 485-A:8VI, Env-Wq 1705.02), available dilution for rivers and streams is based on a known or estimated value of the 7Q10. 10 percent of the assimilative capacity is held in reserve.



$$Q_r C_r = Q_d C_d$$

Qd = effluent flow in mgd or cfs
Cd = effluent pollutant concentration in mg/L (median reported value)
Qr = resultant in-stream flow, after discharge in mgd or cfs
Cr = downstream pollutant concentration in mg/L (after complete mixing occurs)

What is the downstream pollutant concentration?

$$Q_r\ C_r = Q_d\ C_d$$

$$C_r = \frac{Q_d\ C_d}{Q_r}$$

Qd = effluent flow in mgd or cfs
Cd = effluent pollutant concentration in mg/L (highest reported value)
Qr = resultant in-stream flow, after discharge in mgd or cfs
Cr = resultant in-stream pollutant concentration in mg/L (after complete mixing occurs)

Not to Exceed State Fresh Water Quality Criteria
Example

Metal	Total Recoverable Criteria	
	Acute Criteria (CMC) (ug/L)	Chronic Criteria (CCC) (ug/L)
Aluminum	750	87
Cadmium*	0.8	0.13
Copper*	5.63	4.08
Lead*	23.82	0.93
Nickel*	206.93	23.01
Zinc*	52.78	52.78
* 38 mg/L $CaCO_3$ instream hardness		

Determining the Need for a Limit

- If projected receiving water concentration > State WQ criterion, then need to establish a WQ-based limit.
- If projected receiving water concentration ≤ State WQ criterion, then no need to establish a WQ-based limit.

THE TSD

United States
Environmental Protection
Agency

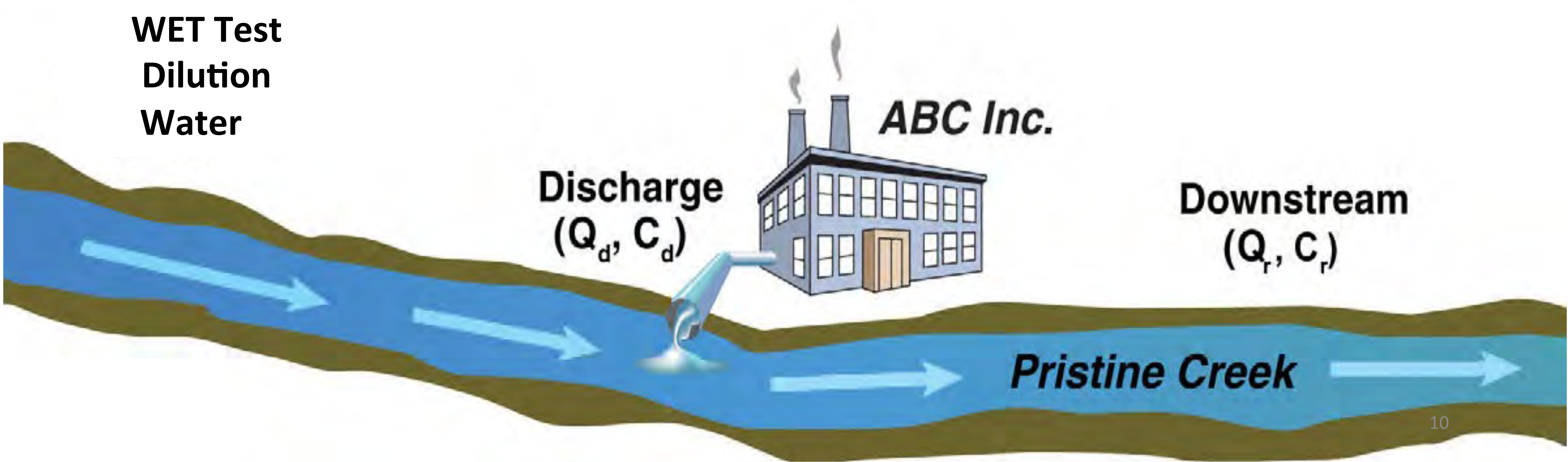
Office Of Water
(EN-336)

EPA/505/2-90-001
PB91-127415
March 1991

EPA

Technical Support Document For Water Quality-based Toxics Control

You have been providing EPA with upstream pollutant concentration data with your WET tests



The WET Protocol requires dilution water sampling

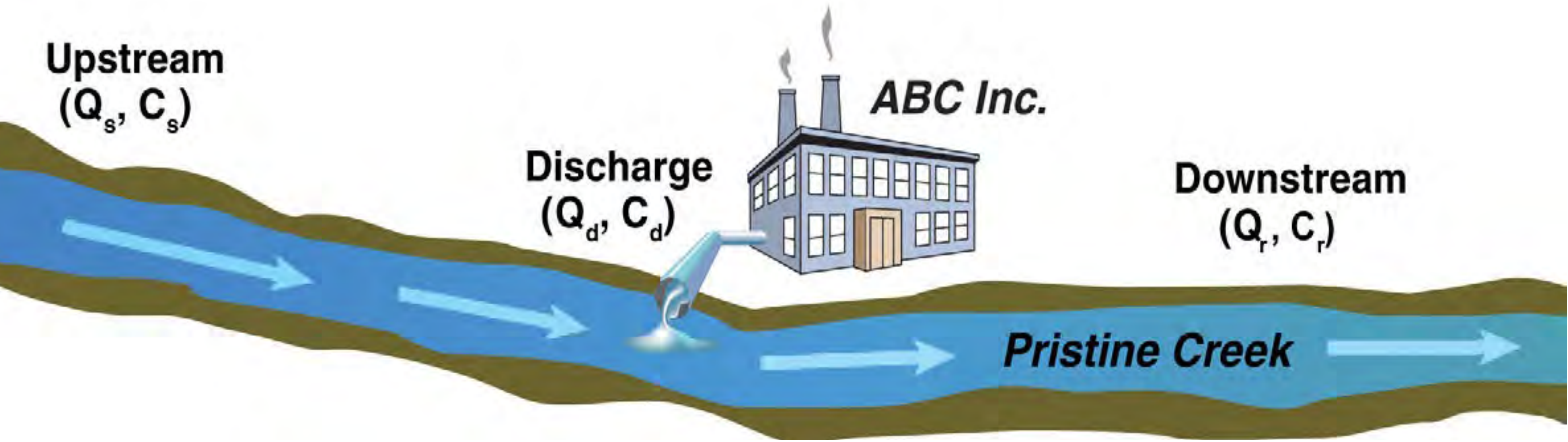
VI. CHEMICAL ANALYSIS

As part of each toxicity test's daily renewal procedure, pH, specific conductance, dissolved oxygen (DO) and temperature must be measured at the beginning and end of each 24-hour period in each test treatment and the control(s).

The additional analysis that must be performed under this protocol is as specified and noted in the table below.

Upstream Metals Data

Parameter	Effluent	Receiving Water	ML (mg/l)
Hardness[1, 4]	x	x	0.5
Total Residual Chlorine (TRC)[2, 3, 4]	x		0.02
Alkalinity[4]	x	x	2.0
pH[4]	x	x	--
Specific Conductance[4]	x	x	--
Total Solids [6]	x		--
Total Dissolved Solids [6]	x		--
Ammonia[4]	x	x	0.1
Total Organic Carbon [6]	x	x	0.5
Total Metals [5]			
Cd	x	x	0.0005
Pb	x	x	0.0005
Cu	x	x	0.003
Zn	x	x	0.005
Ni	x	x	0.005
Al	x	x	0.02
Other as permit requires			



$\mathbf{Q_sC_s + Q_dC_d = Q_rC_r}$ where

Qs = stream flow in mgd or cfs above point of discharge
Cs = background in-stream pollutant concentration in mg/L
Qd = effluent flow in mgd or cfs
Cd = effluent pollutant concentration in mg/L
Qr = resultant in-stream flow, after discharge in mgd or cfs
Cr = resultant in-stream pollutant concentration in mg/L (after complete mixing occurs)

What is the downstream pollutant concentration?

$$Q_r C_r = Q_d C_d + Q_s C_s$$

$$C_r = \frac{Q_d C_d + Q_s C_s}{Q_r}$$

Qs = stream flow in mgd or cfs above point of discharge
Cs = background in-stream pollutant concentration in mg/L
Qd = effluent flow in mgd or cfs
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Qr = resultant in-stream flow, after discharge in mgd or cfs
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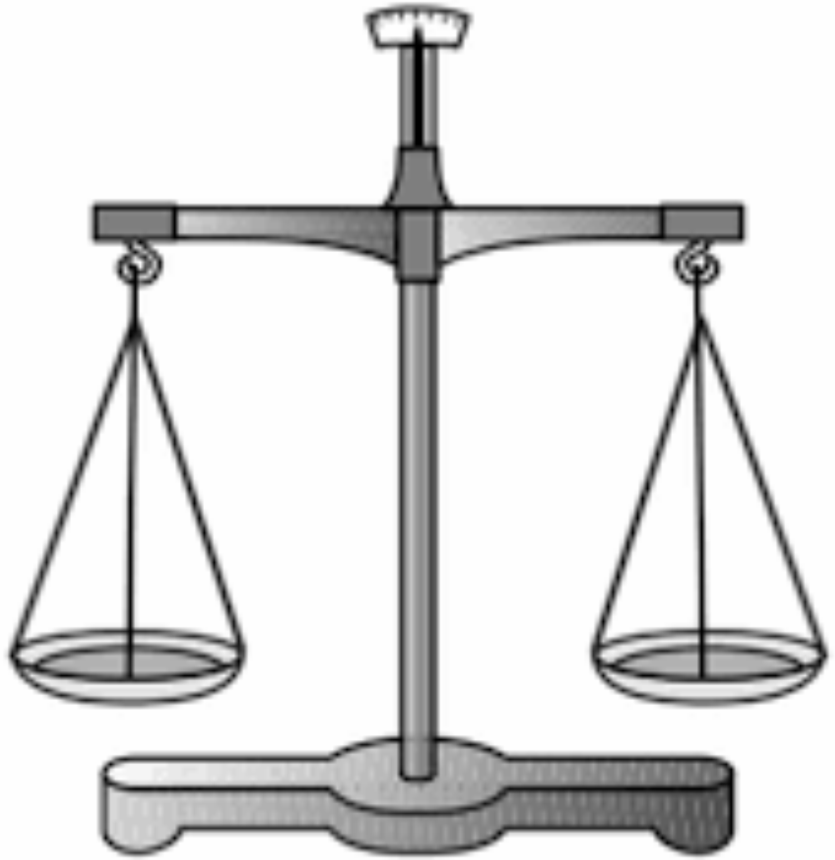
Limit

No Limit

Which is greater

Downstream Receiving Water Concentration



Surface Water Quality Criteria

If the background pollutant concentration is ≥ the Water Quality Criteria, the criteria is your limit!

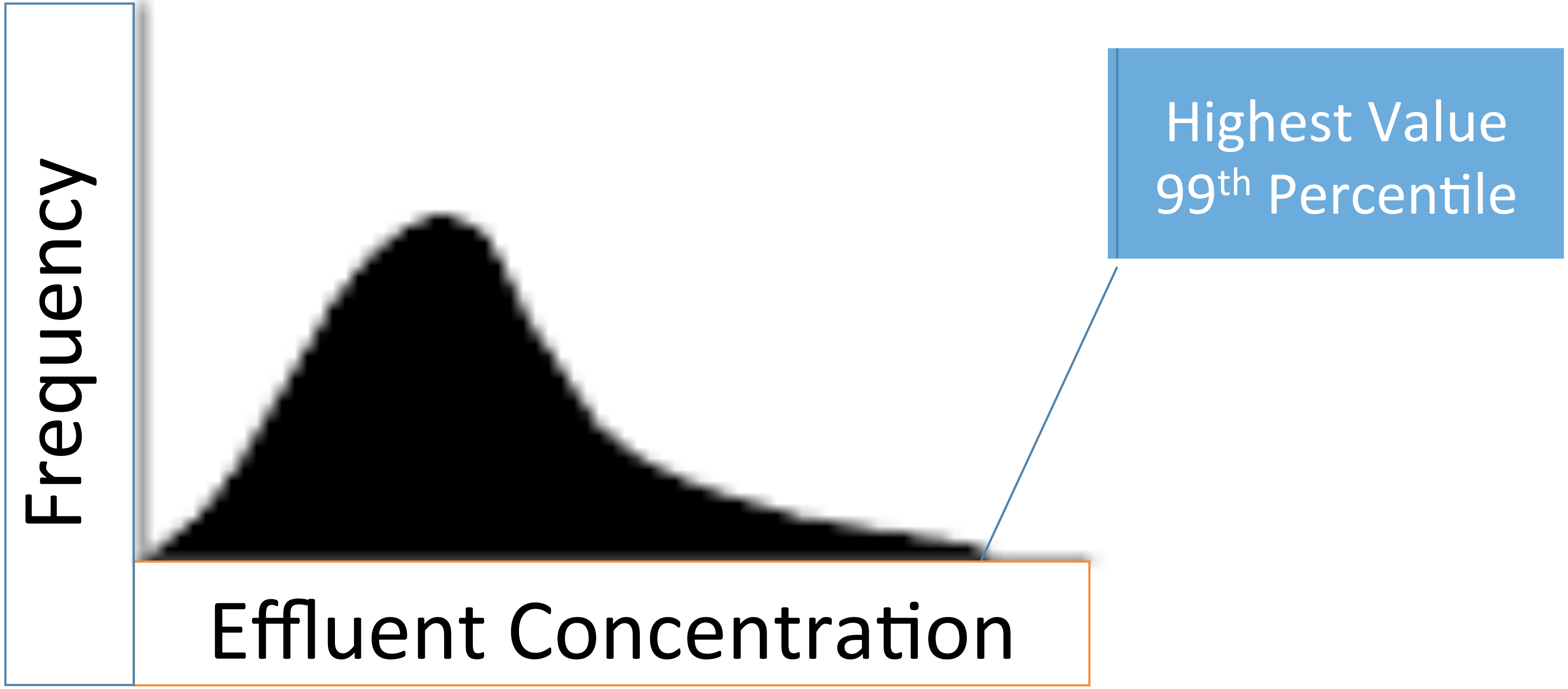
The cup is already full

NUTRIENTS

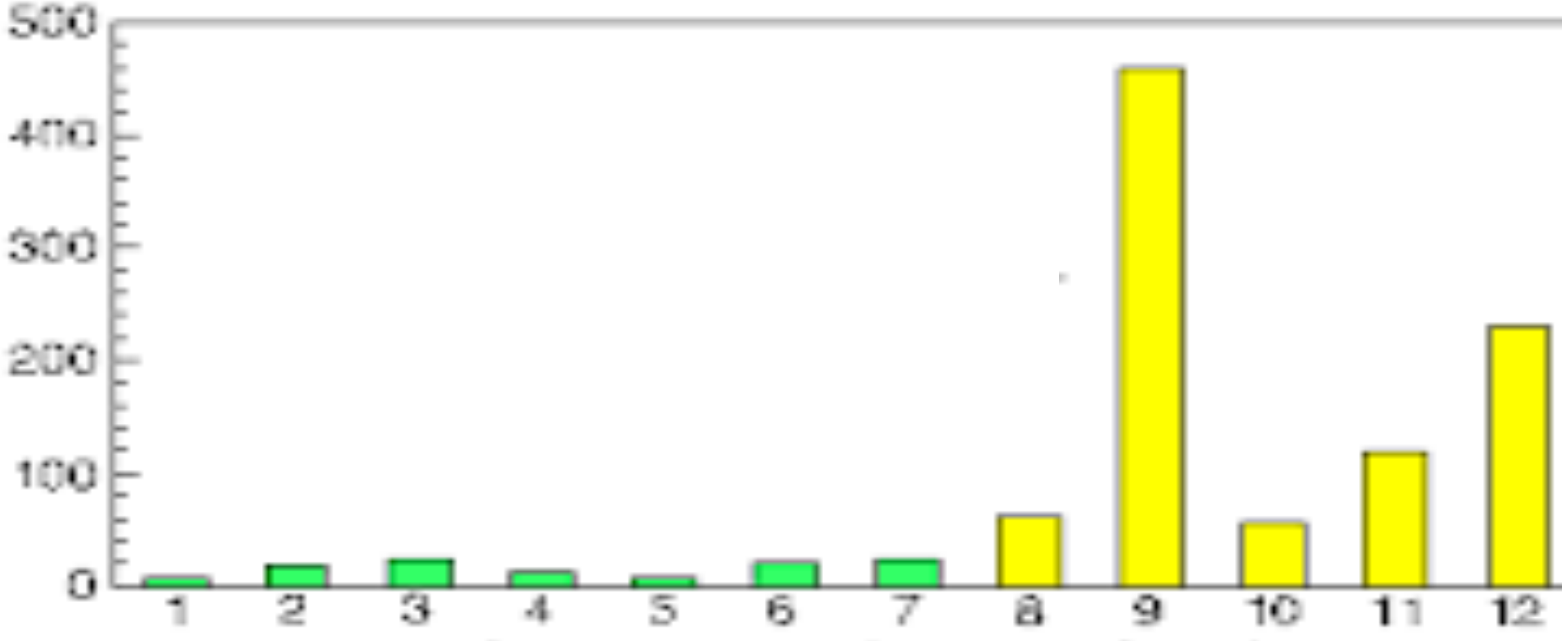
EPA is Now using ambient or up-stream background concentrations of nutrients in the mass balance equation!

There may be no TMDL

All we need is 330 Samples



Effluent Variability



Lies, Damn Lies, and Statistics Benjamin Disraeli

Table 3-2. Reasonable Potential Multiplying Factors: 95% Confidence Level and 95% Probability Basis

Number of Samples	Coefficient of Variation																			
	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0
1	1.4	1.9	2.6	3.6	4.7	6.2	8.0	10.1	12.6	15.5	18.7	22.3	26.4	30.8	35.6	40.7	46.2	52.1	58.4	64.9
2	1.3	1.6	2.0	2.5	3.1	3.8	4.6	5.4	6.4	7.4	8.5	9.7	10.9	12.2	13.6	15.0	16.4	17.9	19.5	21.1
3	1.2	1.5	1.8	2.1	2.5	3.0	3.5	4.0	4.6	5.2	5.8	6.5	7.2	7.9	8.6	9.3	10.0	10.8	11.5	12.3
4	1.2	1.4	1.7	1.9	2.2	2.6	2.9	3.3	3.7	4.2	4.6	5.0	5.5	6.0	6.4	6.9	7.4	7.8	8.3	8.8
5	1.2	1.4	1.6	1.8	2.1	2.3	2.6	2.9	3.2	3.6	3.9	4.2	4.5	4.9	5.2	5.6	5.9	6.2	6.6	6.9
6	1.1	1.3	1.5	1.7	1.9	2.1	2.4	2.6	2.9	3.1	3.4	3.7	3.9	4.2	4.5	4.7	5.0	5.2	5.5	5.7
7	1.1	1.3	1.4	1.6	1.8	2.0	2.2	2.4	2.6	2.8	3.1	3.3	3.5	3.7	3.9	4.1	4.3	4.5	4.7	4.9
8	1.1	1.3	1.4	1.6	1.7	1.9	2.1	2.3	2.4	2.6	2.8	3.0	3.2	3.3	3.5	3.7	3.9	4.0	4.2	4.3
9	1.1	1.2	1.4	1.5	1.7	1.8	2.0	2.1	2.3	2.4	2.6	2.8	2.9	3.1	3.2	3.4	3.5	3.6	3.8	3.9
10	1.1	1.2	1.3	1.5	1.6	1.7	1.9	2.0	2.2	2.3	2.4	2.6	2.7	2.8	3.0	3.1	3.2	3.3	3.4	3.6
11	1.1	1.2	1.3	1.4	1.6	1.7	1.8	1.9	2.1	2.2	2.3	2.4	2.5	2.7	2.8	2.9	3.0	3.1	3.2	3.3
12	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.9	2.0	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0	3.0
13	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.1	2.2	2.3	2.4	2.5	2.5	2.6	2.7	2.8	2.9
14	1.1	1.2	1.3	1.4	1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.1	2.2	2.3	2.3	2.4	2.5	2.6	2.6	2.7
15	1.1	1.2	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.8	1.9	2.0	2.1	2.2	2.2	2.3	2.4	2.4	2.5	2.5
16	1.1	1.1	1.2	1.3	1.4	1.5	1.6	1.6	1.7	1.8	1.9	1.9	2.0	2.1	2.1	2.2	2.3	2.3	2.4	2.4
17	1.1	1.1	1.2	1.3	1.4	1.4	1.5	1.6	1.7	1.7	1.8	1.9	1.9	2.0	2.0	2.1	2.2	2.2	2.3	2.3
18	1.1	1.1	1.2	1.3	1.3	1.4	1.5	1.6	1.6	1.7	1.7	1.8	1.9	1.9	2.0	2.0	2.1	2.1	2.2	2.2
19	1.1	1.1	1.2	1.3	1.3	1.4	1.5	1.5	1.6	1.6	1.7	1.8	1.8	1.9	1.9	2.0	2.0	2.0	2.1	2.1
20	1.1	1.1	1.2	1.2	1.3	1.4	1.4	1.5	1.5	1.6	1.7	1.7	1.8	1.8	1.8	1.9	1.9	2.0	2.0	2.0

The Reasonable Potential Multiplying Factor RPMF

(RMPF)*(Highest Effluent Concentration) = Critical Value

What is the downstream pollutant concentration?

$$Q_r\, C_r = Q_d\, C_d + Q_s\, C_s$$

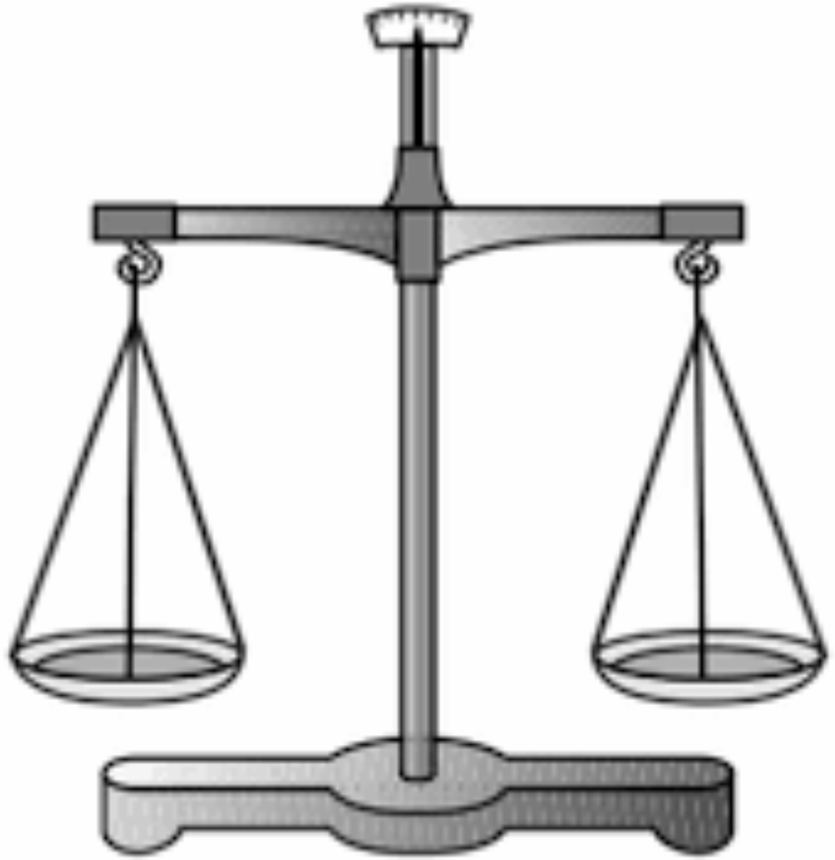
$$C_r = \frac{Q_d\, C_d + Q_s\, C_s}{Q_r}$$

Qs = stream flow in mgd or cfs above point of discharge
Cs = background in-stream pollutant concentration in mg/L
Qd = effluent flow in mgd or cfs
Cd = highest effluent pollutant concentration in mg/L * **RPMF** = **CRITICAL VALUE**
Qr = resultant in-stream flow, after discharge in mgd or cfs
Cr = resultant in-stream pollutant concentration in mg/L (after complete mixing occurs)

Limit

No Limit

Which is greater



Downstream Receiving Water Concentration

Surface Water Quality Criteria

Desirable	Why
Lots of dilution >25:1	Less reasonable potential/limit
High hardness concentration	Higher metals criteria
Low background pollutant Conc.	More assimilative capacity
Large number of samples >10 ★	Lower **RPMF**
Low sample variability	Lower **RPMF**
Good sample methods low ML ★	Less chance of error
Good QA/QC ★	Can refute bad data

May wish to rethink your sampling program

CLEAN TECHNIQUES

United States
Environmental Protection
Agency

Office of Water
(4303)

EPA 821-B-96-002
January 1996
DRAFT

EPA

Guidance on the Documentation and Evaluation of Trace Metals Data Collected for Clean Water Act Compliance Monitoring

Eliminate Contamination

Rigorous Quality Assurance and Quality Control

Example Detection Levels for Copper Analysis

Method Approved for NPDES	Detection Limit in ug/l	
3111 B (AA, flame)		10
3113 B (AA, furnace)		1
200.7 (ICP/AES)	Most Used	3
200.8 (ICP/MS)	Best	0.5
200.9 (STGFAA)		0.7
3500-Cu B*[1] (Colorimetric)		3
3500-Cu C*[1] (Colorimetric)		20
D4190-94, 99*[4] (DCP)		N/A

EPA Uses the Minimum Level (ML) for Detection

- Either the sample concentration equivalent to the lowest calibration point in a method or a multiple of the method detection limit (MDL).

- A quantifiable amount

Things To Know

Facts	Source
Dilution Ratio	Fact Sheet
Effluent Pollutant Concentrations	**Discharge Monitoring Reports** **Permit Application**
Surface Water Quality Criteria	**MassDEP/NHDES and EPA Websites**
Ambient or upstream pollutant concentration	**WET Reports, State Watershed Assessment Reports, USGS, etc.**
Down Stream Receiving Water Hardness	**WET Reports and USGS Do Mass Balance to establish down stream hardness**

See examples of Permits and Fact Sheets

http://**www.epa.gov/region1/npdes**

NPDES permits are online in the following categories

- Draft Individual Permits
- Final Individual Permits

Questions?

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