

# *Freshwater SQVs for WA/OR/ID*



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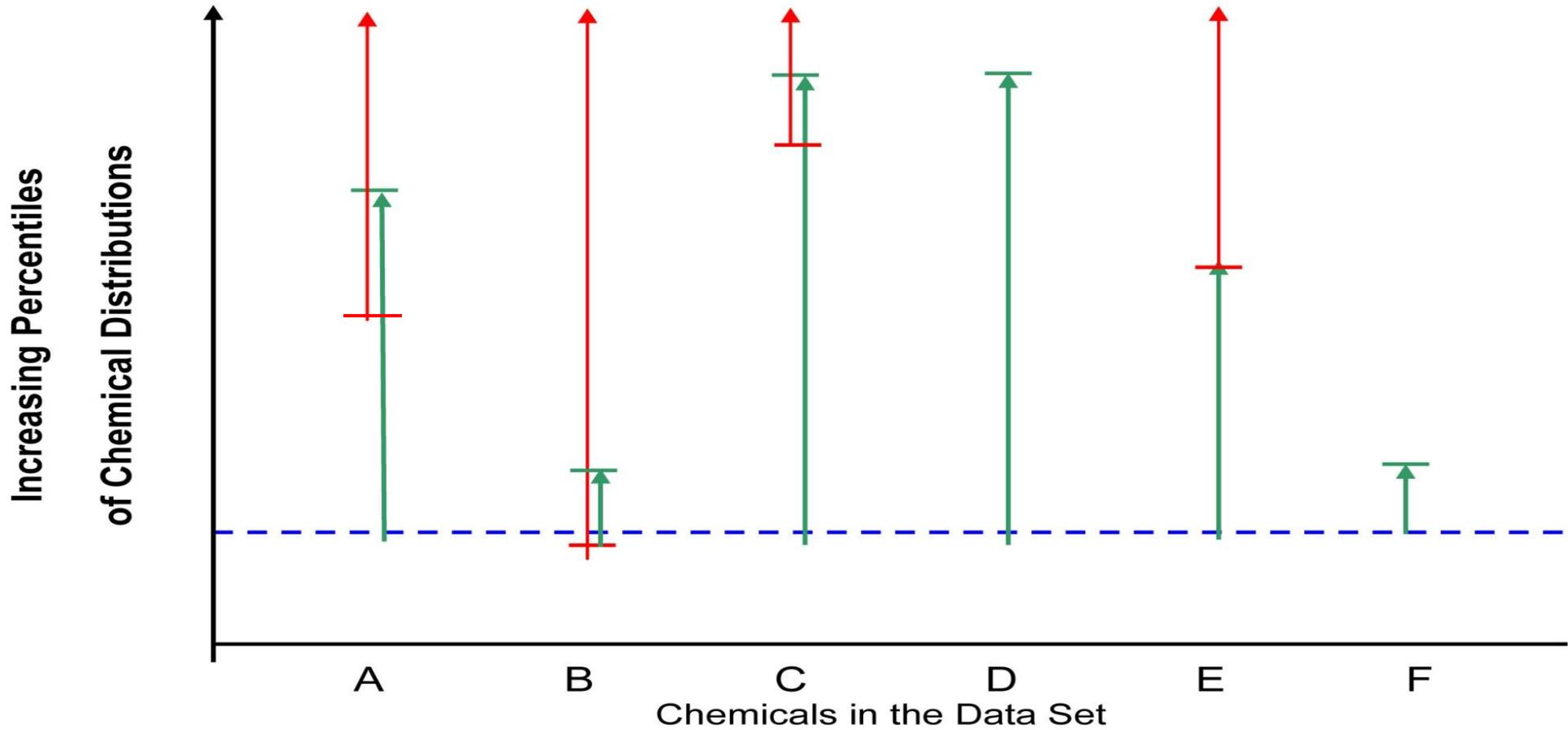
# *Floating Percentile Method*

- Goal: Minimize false negatives and false positives simultaneously
- Approach:
  - Data screening and summing
  - Initial range-finding
  - Iterative multivariate optimization routine treating each chemical or sum as an independent variable

# *Features*

- Multivariate → considers all chemicals at once
- Addresses covariance
- ANOVA screening of analytes for toxicity
- Selection of false negative targets
- Optimization of false positives
- Repeat for a range of false negative targets
- Thoroughly evaluates reliability
- Now mostly automated

Figure 2-1. Floating Percentile Method



Legend:

--- Fixed percentile for all chemicals



Region within which false positives occur



Toxicity range within and above which false negatives occur

# Reliability

- Sensitivity (100% – false negatives)
- Efficiency (100% – false positives)
- Predicted no-hit reliability
- Predicted hit reliability
- Overall reliability

*All measures of reliability were used for ALL effects levels (see p. 14 for diagram)*

## *Data Set – Bioassay Endpoints*

- Hyalella 10-day mortality – 366
- Chironomus 10-day mortality – 550
- Chironomus 10-day growth – 504
- Hyalella 28-day mortality – 319
- Hyalella 28-day growth – 79

# *FPM Runs & Issues Tested*

- East side vs. west side vs. combined
- TPH vs. PAH vs. combined
- Microtox – include?
- *Hyalella* growth – include Portland Harbor?
- Ammonia and sulfides issues
- N-qualified pesticides
- Blank-correction standardization
- Control vs. reference
- Revision of bioassay interpretive criteria

**Table 2-2. Quality Assurance and Adverse Effects Levels for Biological Tests**

Test	QA Control	QA Reference	SQS/SL1	CSL/SL2
<i>Hyalella azteca</i> 10-day mortality	$C \leq 20\%^a$	$R \leq 25\%$	$T - C > 15\%$	$T - C > 25\%$
<i>Hyalella azteca</i> 28-day mortality	$C \leq 20\%$	$R \leq 30\%$	$T - C > 10\%$	$T - C > 25\%$
<i>Hyalella azteca</i> 28-day growth	$CF \geq 0.15$ mg/ind	$RF \geq 0.15$ mg/ind	$T / C < 0.75$	$T / C < 0.6$
<i>Chironomus dilutus</i> 10-day mortality	$C \leq 30\%^a$	$R \leq 30\%$	$T - C > 20\%$	$T - C > 30\%$
<i>Chironomus dilutus</i> 10-day growth	$CF \geq 0.48$ mg/ind	$RF/CF \geq 0.8$	$T / C < 0.8$	$T / C < 0.7$

QA = Quality Assurance

SQS/SL1 = Sediment Quality Standard/Screening Level 1, CSL/SL2 = Cleanup Screening Level/Screening Level 2

C = Control, CF = Control Final, R = Reference, RF = Reference Final, T = Test Sample

<sup>a</sup> These control mortality limits are currently in the process of being reviewed by ASTM and may be lowered in the next few years (Ingersoll et al. 2008)

**Table 3-3. Reliability of the FPM Results and Existing SQG Sets at the SQS/SL1 Level**

**a. Chironomus 10-day growth**

FPM FN Percentiles	% False Negatives	% False Positives	Hit Reliability	NoHit Reliability	PredHit Reliability	PredNoHit Reliability	Overall Reliability
5	4.6	44.8	95.4	55.2	23.1	98.8	60.2
10	9.2	35.9	90.8	64.1	26.3	98.0	67.4
15	13.8	31.7	86.2	68.3	27.7	97.2	70.5
20	20.0	17.0	80.0	83.0	40.0	96.7	82.7
25	24.6	19.6	75.4	80.4	35.3	95.9	79.8
30	29.2	13.5	70.8	86.5	42.6	95.4	84.6

SQG	% False Negatives	% False Positives	Hit Reliability	NoHit Reliability	PredHit Reliability	PredNoHit Reliability	Overall Reliability
ERL	6.2	85.9	93.8	14.1	13.4	94.2	24.0
TEL	4.6	91.3	95.4	8.7	12.9	93.0	19.4
TEC	7.7	79.6	92.3	20.4	14.1	94.9	29.3
LEL	9.2	88.3	90.8	11.7	12.7	90.0	21.5

# Freshwater Standards Reliability

For SL1

	% False Negatives	% False Positives	% Overall Reliability
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acute endpoint (mortality)

FPM	19	22	79
others	7	86	33

sub-lethal endpoints (growth)

FPM	20	18	82
others	8	88	29

Values are averages  
across relevant assays

For SL2

	% False Negatives	% False Positives	% Overall Reliability
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acute endpoint (mortality)

FPM	22	15	84
others	36	36	64

sub-lethal endpoints (growth)

FPM	18	13	87
others	40	37	63

# Challenges – Criteria Selection

Expectation: SL1 values clustered below SL2 values



# Challenges – Criteria Selection

Bioassay endpoints did not behave as expected

SL1 ↓

SL2 ↓

→ use SSD



Table 3-7. Selection of Recommended Sediment Quality Guidelines

Analyte	Distribution of Floating Percentile Model Values <sup>a</sup>										SL1/SQS <sup>b</sup>	SL2/CSL <sup>c</sup>
	10	20	30	40	50	60	70	80	90	95		
<b>Conventional Pollutants (mg/kg)</b>												
Ammonia	230	300	> 780	> 780	> 780	> 780					230	300
Total sulfides	39	61	340	340	360	540	920	920			39	61
<b>Metals (mg/kg)</b>												
Antimony	0.3	0.3	12	42	42	42	42	> 63			0.3	12
Arsenic	14	14	16	16	120	120	120	180	200	200	14	120
Cadmium	2.1	2.1	5.4	6.3	6.3	13	13	> 23	> 23	> 23	2.1	5.4
Chromium	72	72	82	88	220	220	220	> 350	> 350		72	82
Copper	400	1200	1600	1600	1900	1900	> 1900	> 1900	> 11000		400	1200
Lead	360	360	> 1300	> 1300	> 1400	> 1400	> 1400	> 1400	> 1400	> 1400	360	> 1300
Mercury	0.66	0.66	0.8	0.8	0.8	0.87	0.87	> 0.87	3.04		0.66	0.8
Nickel	26	> 27	> 100	> 100	110	110	360	360	> 590	> 590	26	110
Selenium	11	11	> 20	> 20	> 20	> 20					11	> 20
Silver	0.58	0.64	1.7	1.7	4.1	4.1					0.58	1.7
Zinc	3200	3200	3200	> 4200	> 4200	> 14400	> 14400	> 14400			3200	> 4200
<b>Organic Chemicals (µg/kg)</b>												
4-Methylphenol	260	260	2000	2000	2400	2400	> 6300	> 6300			260	2000
Benzoic acid	2900	3800	3800	4100							2900	3800

- “>” values- no toxicity observed for that endpoint up to the listed concentration. Sample concentrations at or above this level should undergo toxicity testing.
- BPJ call regarding selection of CSL/SL2: “next significantly different value”.

# *Freshwater Standards*

## *Next Steps*

- Sediment Workgroup will continue peer review of draft SQV technical report
- Science Panel peer review of SQVs
- Complete draft rule language
- EPA review
- Formal public review