

Comparison of Arithmetic Mean Stage vs. Weighted Mean Stage in Refuge Compliance Calculations

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Calculation Methods for Average Stage in Refuge

Current Method - Arithmetic Mean

1. Compute daily mean of 3 stages
2. Calculate arithmetic mean of daily mean stages

Alternative Method – Weighted Mean

1. Compute daily mean of 3 stages
2. Weight daily mean by number of stations sampled
3. Divide sum of weighted daily stages by total number of stations sampled

Calculation of Mean Stage in Refuge

Scenario	Arithmetic vs. Weighted Mean Stage	Number of Months*
1) All samples on same day	Same	15
2) Same number of samples on 2 days	Same	25
3a) Different number of samples on 2-3 days	Same	54
3b) Different number of samples on 2-3 days	Slight Difference (<0.1 feet)	16
Total		110

*Period of record: February 1999 – March 2008 (110 months)

Potential Compliance Impacts for Arithmetic vs. Weighted Mean Stage

Month Year*	Mean Stage Difference (feet)	Interim Level Difference (ppb)	Long-Term Level Difference (ppb)	Compliance Affected?
Jun 2000	0.001	-0.1	none	No
Dec 2000	-0.003	0.1	0.1	No
Feb 2003	-0.003	0.1	0.1	No
Mar 2003	-0.005	0.1	none	No
Apr 2003	-0.002	none	0.1	No
May 2003	-0.006	0.1	0.1	No
Jun 2003	-0.004	0.1	none	No
Nov 2003	-0.002	0.1	none	No
Apr 2004	-0.004	none	0.1	No
Apr 2005	-0.006	0.1	0.1	No
Sep 2005	0.003	none	-0.1	No
May 2006	0.007	-0.1	-0.1	No
Dec 2006	-0.001	none	0.1	No
Sep 2007	-0.044	N/A	0.2	No

*Mean stage differences in July 2000 and April 2002 did not impact interim or long-term levels.

Comparison of Arithmetic and Weighted Mean Stage

- No difference in mean stage in 94 of 110 months (85%)
- Very small difference in mean stage (<0.1 feet) resulted in ≤ 0.1 ppb change in interim or long-term levels in 16 of 110 months (15%)
- Differences in interim levels and long-term levels caused by rounding

No difference in compliance status

Recommendations

- **Sample all 14 compliance stations within 3 days**
- **Continue using an arithmetic mean to calculate the mean stage**

Questions?