Calculation of Rolling Statistics

Methods used to calculate rolling median and 95th percentile values for comparison to Regulation 85 effluent limits.

The Water Quality Control Division has developed this document in order to facilitate understanding of methods used to calculate rolling statistics for Regulation 85 purposes.

Definitions

Median: the value lying at the midpoint of observed values.

95th percentile: the value below which 95% of values fall.

Regulation 85 effluent limits statistics[1]

The regulation identifies two types of rolling statistics, as follows:

Annual median: The median of **all** samples taken in the most recent 12 calendar months. This value is to be calculated on a running or rolling basis of the last 12 months, regardless of calendar year or permit term.

95th percentile: The 95th percentile of **all** samples taken in the most recent 12 calendar months. This value is to be calculated on a running or rolling basis of the last 12 months, regardless of calendar year or permit term.

Note that all values collected within the last 12 calendar months should be included when calculating the statistic. For example, if you sample weekly, then you will have 4 values per month and 48 total samples per 12 month period.

Annual median calculation

The median value is identified by sorting all values (collected in the most recent 12 months) from smallest to largest. You then count the total number of values you have. The middle number in your list of values is the median. If the total number is odd (eg., 15 values), determine the number in the middle (eg., the value at position 8). If the total number of values is even (eg., 12), determine the pair of values at the middle (eg., values at positions 6 and 7). Add the pair together, then divide by 2 to determine the median value.

The median value can be calculated in Microsoft Excel© or Google Sheets© using the "MEDIAN" function.

95th percentile calculation

When calculating a percentile manually (without a computer), the 95th percentile is determined using the nearest rank method. Start by sorting all values (collected in the most recent 12 months) from smallest to largest. You then count the total number of values you have. You then multiply the total number of values by 0.95 to obtain the index position (eg., 12 x 0.95 = 11.4), rounding up if the index is not a whole number (in this case to 12). Starting from the smallest value, count up to the value in the index position (eg., the 12th value); this value is your approximate 95th percentile.

When calculating a percentile using a computer, the 95th percentile is determined using (most frequently) a linear interpolation method. The median value can be calculated in Microsoft Excel© or Google Sheets© using the "PERCENTILE" function.

Rolling Statistic

Each statistic is a rolling number, so each statistic you calculate is based on the data for the 12 most recent months. For example, the January 2016 statistic would include data for February 2015 through January 2016. The February 2016 statistic would be calculated from data for March 2015 through February 2016.

Example calculations

	A	B	C	D
1		Total inorganic	Statistic	
2	Date	nitrogen (mg/L)	Data Range	
3	1/13/2015	7.8	DECEMBER 2015 VALUES	
4	2/16/2015	6.4		JANUARY 2016 VALUES
5	3/14/2015	11		
6	4/14/2015	9.5		
7	5/15/2015	7.5		
8	6/17/2015	6.9		
9	7/18/2015	8.1		
10	8/14/2015	6.2		
11	9/18/2015	9.3		
12	10/15/2015	6.9		
13	11/16/2015	7.7		
14	12/13/2015	10.3		
15	1/13/2016	plant offline		

SPREADSHEET CALCULATIONS

DECEMBER 2015 STATISTICS

Statistic	Spreadsheet formula	Value
Median	=MEDIAN(B3:B14)	7.8
95th percentile	=PERCENTILE(B3:B14,0.95)	11

JANUARY 2016 STATISTICS

Statistic	Spreadsheet formula	Value
Median	=MEDIAN(B4:B15)	7.7
95th percentile	=PERCENTILE(B4:B15,0.95)	11

MANUAL CALCULATIONS

DECEMBER 2015 STATISTICS

Rank	Sorted values
1	6.2
2	6.4
3	6.9
4	6.9
5	7.5
6	7.7
7	7.8
8	8.1
9	9.3
10	9.5
11	10.3
12	11

Median calculation

middle pair of values

(7.7 + 7.8) / 2 = 7.75

round value to 7.8

median = 7.8 mg/L

95th percentile calculation

12 * 0.95 = 11.4

round index to 12

95th percentile = 11 mg/L

JANUARY 2016 STATISTICS

Rank	Sorted values
1	6.2
2	6.4
3	6.9
4	6.9
5	7.5
6	7.7
7	8.1
8	9.3
9	9.5
10	10.3
11	11

Median calculation

identify middle value

median = 7.7 mg/L

95th percentile calculation

11 * 0.95 = 10.45

round index to 11

95th percentile = 11 mg/L

References

1 - Regulation 85.5(1)(a)(iii) and 85.6(1)(b)