Appendix C: Fecal Coliform - How To Calculate Geometric Mean

Determine the optimum number of colonies per plate based on the series of dilutions. The acceptable range is usually 20 to 60 colonies. If it is too dense to count refer to the "Most Commonly Asked Questions" section of Chapter 15 - Sampling and Reporting, for directions on reporting TNTC.

Table A3.1 - *Example Sampling Schedule*

Monday	20 colonies (20 colonies/100 mL x 100 = 20 colonies/100 mL)
Tuesday	60 colonies (60 colonies/100 mL x 100 = 60 colonies/100 mL)
Wednesday	45 colonies (45 colonies/100 mL x 100 = 45 colonies/100 mL)
Thursday	300 colonies (30 colonies/10 mL x 100 = 300 colonies/100mL)
Friday	550 colonies (55 colonies/10 mL x 100 = 550 colonies/100 mL)
Saturday	42 colonies (42 colonies/100 mL x 100 = 42 colonies/100 mL)
Sunday	27 colonies (27 colonies/100 mL x 100 = 27 colonies/100 mL)

There are two methods by which to calculate the geometric mean (GM). Method One is the product of all the values (n1 x n2 x n3.....) followed by taking the nth root of the multiplication factor, and Method Two is to average the sum of the logs (log n1 + log n2 + log n3.....) followed by the antilog of the average.

The example in Table A 3.1 is based on a 7x/week sampling schedule, using the optimum range for colony plate count (20 - 60 colonies) and sample filtration volumes of 100 mL, 10 mL, 1.0 mL, and 0.1 mL (the smallest filtration volume being of 0.1 mL):

Using the Method One Formula

GM = "nth" root of n1 x n2 x n3 .....

The 7-day fecal coliform geometric mean would be calculated by multiplying the seven values 20 x 60 x 45 x 300 x 550 x 42 x 27 and taking the seventh root of the multiplication product which yields a geometric mean of 72.

Using the Method Two Formula

$$X = \frac{\text{Sum of the Log for Sample Measurements}}{\text{\# samples}}$$

Then take the anti-log of X to obtain the GM.

The 7-day fecal coliform geometric mean would be calculated by adding the sum of the logs for each value (log 20 = 1.30103 + log 60 = 1.77815 + log 45 = 1.65321 + log 300 = 2047712 + log 550 = 2074036 + log 42 = 1.62325 + log 27 = 1.43136) , dividing the summation of 13.00448 by 7 = 1.85778, followed by the anti-log of the result which also yields a geometric mean of 72.

How to Average "<" Daily Max or 7-Day Averages into the 30-Day Average

For samples that have a value of "0 colonies" on a plate count, the value must be reported as less than (calculated value) / 100 mL, based upon the largest single volume filtered. For example, if 10 mL, 1.0 mL and 0.1 mL are filtered and all plates show zero counts, select the largest volume, and apply the general formula for determining fecal coliform counts at various dilutions and report the count as < (less than) value.

$$\frac{1}{10} \times 100 = <10 \text{ fecal coliforms / 100 mL}$$

If the geometric mean for a reporting period (i.e., the 7-day average or 30-day average) has a sample with a zero count, use the above formula to obtain a "< fecal coliform count ", and average that number (i.e. 10 from the above example) with the other samples taken.