99% Confidence Interval Calculation for Arsenic Concentration

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Given Data:

Sample mean ($\bar{x}$) = 100 parts per billion (ppb)

Standard deviation (s) = 10 ppb

Sample size (n) = 100

$t_{\left(\frac{\alpha}{2}, n-1\right)}$ for a 99% confidence interval = -2.797

$t_{\left(1-\frac{\alpha}{2}, n-1\right)}$ for a 99% confidence interval = 2.797

Using the equation for a 99% confidence interval:

$$\bar{x} + t_{\left(\frac{\alpha}{2}, n-1\right)} \cdot \sqrt{\frac{s^2}{n}} \leq \mu \leq \bar{x} + t_{\left(1-\frac{\alpha}{2}, n-1\right)} \cdot \sqrt{\frac{s^2}{n}} \tag{8}$$

$$100 - 2.797 \cdot \sqrt{\frac{10^2}{100}} \leq \mu \leq 100 + 2.797 \cdot \sqrt{\frac{10^2}{100}}$$

Where CI is the confidence interval, $\bar{x}$ is the sample mean, s is the standard deviation, $t_{\left(\frac{\alpha}{2}, n-1\right)}$ and $t_{\left(1-\frac{\alpha}{2}, n-1\right)}$ are for a 99% confidence interval, and n is the sample size.

Calculated Confidence Interval:

Lower Bound = 97.203 ppb

Upper Bound = 102.797 ppb

This means that we are 99% confident that the true mean arsenic concentration in the population lies between 97.203 ppb and 102.797 ppb.