

# Radiological Data Assessment Guidance for Emergency Response

## Job Aid: Calculating a Confidence Interval on the Mean

PNNL-34480

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This job aid has been developed to guide readers through performing statistical testing for data quality assessment using Visual Sample Plan<sup>1</sup>. More information about data quality assessment can be found in the Radiological Data Assessment Guidance for Emergency Response<sup>2</sup> document on CBRN Responder.

**Use Case:** Estimate the average for a set of measurements that will be compared to an incident action level or used to estimate other values. One example is quantifying the average radionuclide concentration present in an area. This test is described in Section 5.6.5 of the Radiological Data Assessment Guidance for Emergency Response<sup>2</sup>.

### Assumptions:

- This test is performed on data collected in various locations over a period of time in which conditions have not significantly changed.
- The data have all already been transformed into the same units and decay corrected if necessary.
- The reader has already successfully installed VSP on their computer. VSP is currently only compatible with Windows operating systems.

If any of the assumptions above are not true for your particular situation or data, this test may not be appropriate. Consult EPA guidance QA/G-9 “Practical Methods for Data Analysis” for more information<sup>3</sup>.

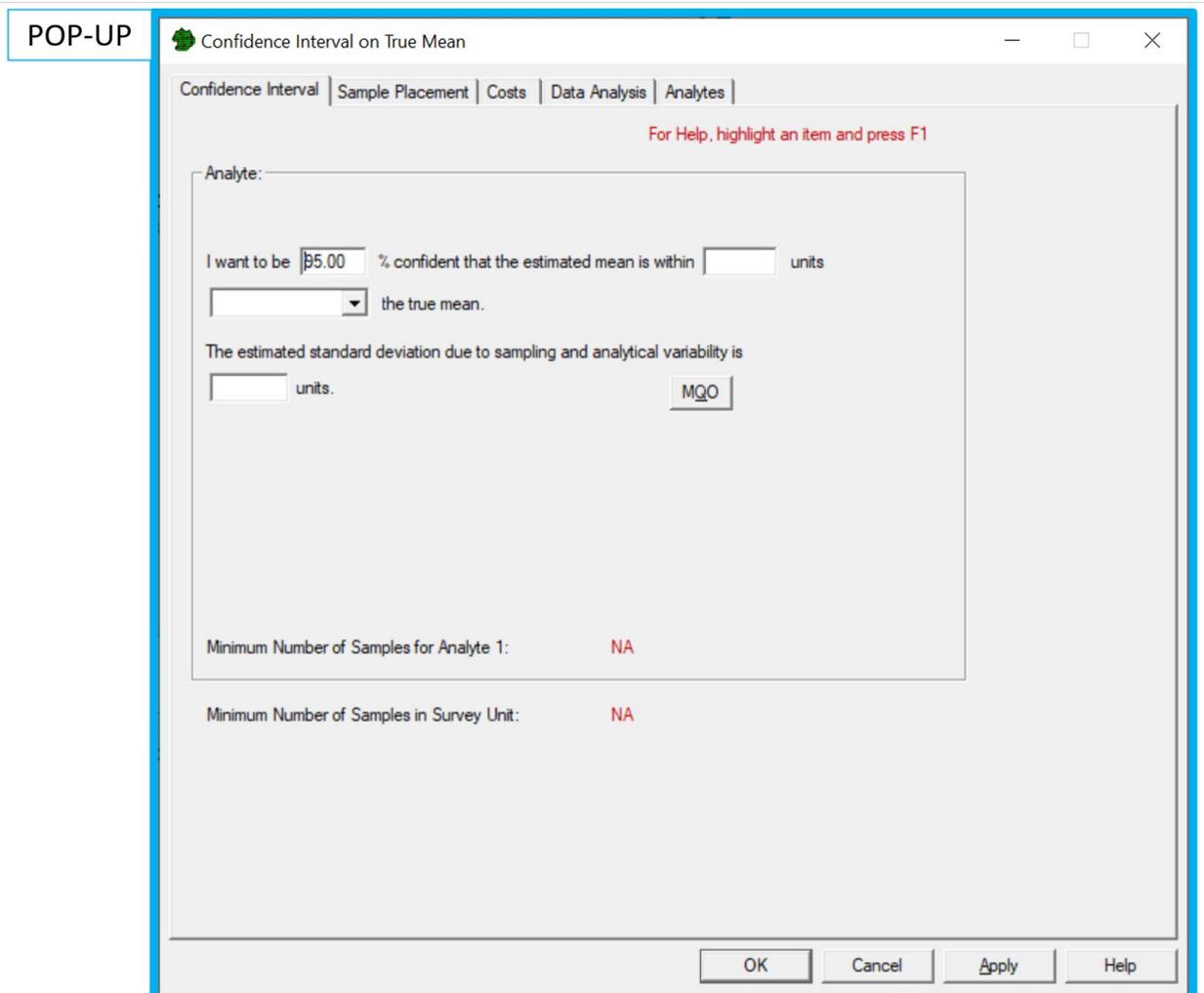
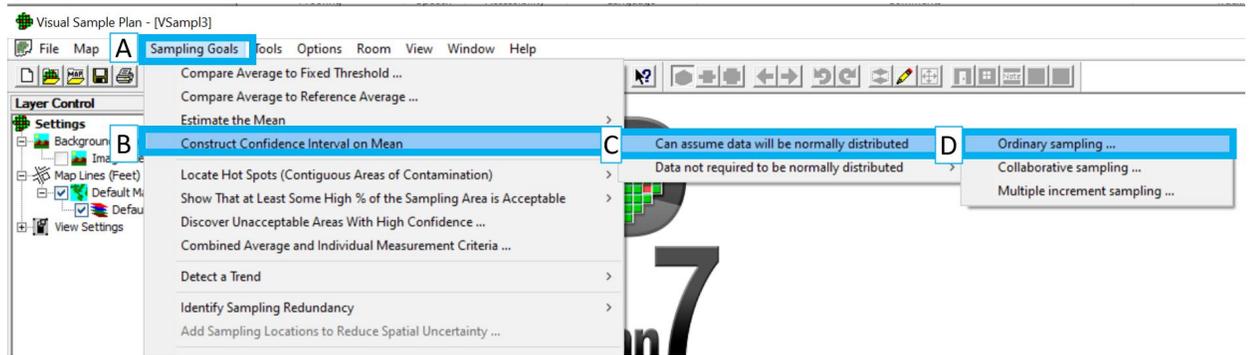
Throughout this job aid, markers such as “(A)” indicate a highlight in the next VSP screenshot after the marker.

1. **Launch the Confidence Interval on a Mean dialog in VSP:** Follow the steps below to launch the design dialog to import data and calculate the UCL.
  - 1.1. In the top-left menu bar, click on (A) “**Sampling Goals**”.
  - 1.2. In the pop-up drop-down menu, follow the nested menus through from (B) “**Construct Confidence Interval on Mean**” to (C) “**Can assume data will be normally distributed**” and then click on (D) “**Ordinary sampling**” to launch the Confidence Interval on a Mean dialog

<sup>1</sup> <https://www.pnnl.gov/projects/visual-sample-plan>

<sup>2</sup> <https://www.cbrnresponder.net/app/index#resources/documents/download/2308>

<sup>3</sup> <https://www.epa.gov/sites/default/files/2015-06/documents/g9-final.pdf>



2. **Specify the percent confidence and the type of confidence interval:** Follow the steps below to set the necessary test parameters.
  - 2.1. Specify the desired (E) **confidence**. This is commonly set to 95%.
  - 2.2. Specify the (D) **type of confidence interval**. Selecting “above or below” will result in both the upper and lower sides of the confidence interval being calculated.
  - 2.3. None of the other parameters need to be set in order to calculate the confidence interval.

Confidence Interval on True Mean

Confidence Interval | Sample Placement | Costs | Data Analysis | Analytes

For Help, highlight an item and press F1

Analyte:

I want to **E** 95.00 % confident that the estimated mean is within  units

**F** above or below the true mean. (Two-sided confidence interval)

The estimated standard deviation due to sampling and analytical variability is  units.

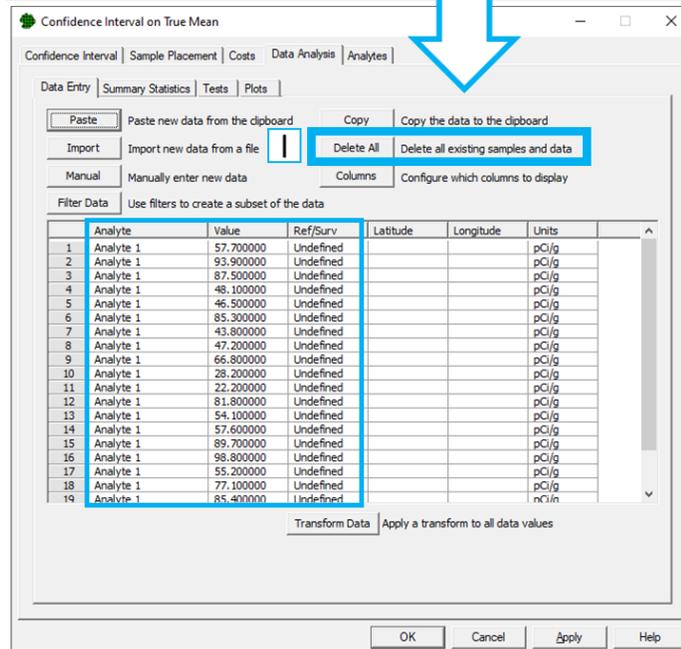
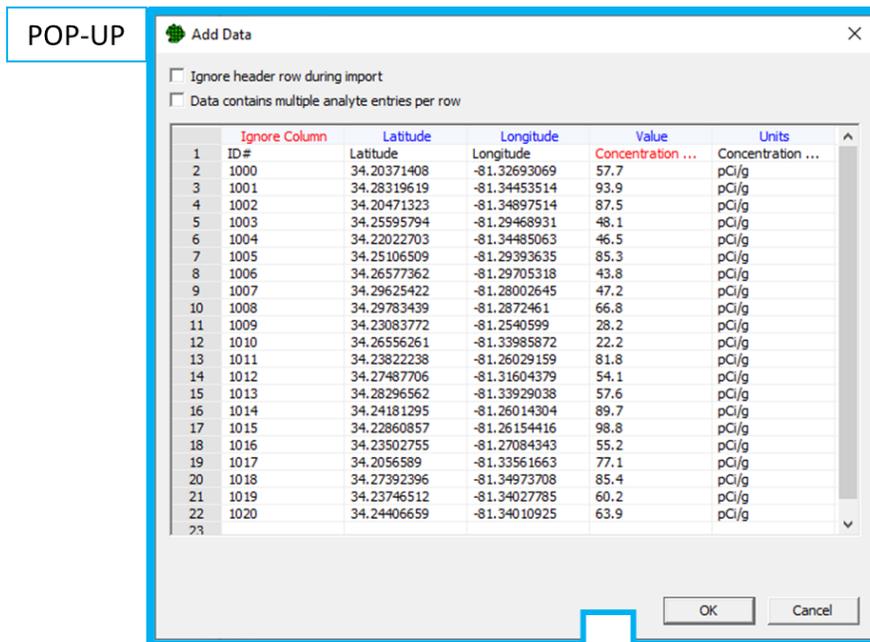
Minimum Number of Samples for Analyte 1: NA

Minimum Number of Samples in Survey Unit: NA

3. **Prepare your data to be loaded into VSP:** Follow the steps below to prepare to load your data into VSP.
  - 3.1. Open your data in **Excel** (recommended) or a text editor.
  - 3.2. **Note on format:** VSP does not accept comma delimited data, only tab delimited. Ensure that the data is in a columnar format (i.e., tab delimited).
  - 3.3. Select and copy the rows to be imported into VSP. The test can still be computed if there are missing data, extra columns, or if the order of the columns differs from the example shown below, but ensure that there are columns for (G) the **data values**.



- 4.3. In the new pop-up dialog, preview the pasted data and ensure it matches what was copied in step 3.3.
- 4.4. Click on the column headers to map the appropriate columns to **Value**.
- 4.5. Check the box **“Ignore header row during import”** if copied data has a header row.
- 4.6. Press OK to import data.
- 4.7. Ensure the data has been imported as expected. If data needs to be reimported, click on the (E) **“Delete All”** button within the **“Data Entry”** tab and follow steps 3.1 - 3.6.



5. **Perform the test:** The name of the statistical test used here is called the “Confidence Interval on a Mean”. Follow the steps below to perform this test in VSP.
  - 5.1. Click on the “**Tests**” tab on the **Confidence Interval on True Mean** dialog.
  - 5.2. View the test results in the section of the Tests tab labeled **Confidence Interval on the Mean**.
    - 5.2.1. If the data do not appear to be normally distributed, the non-parametric confidence interval on the median is also calculated and is recommended
  - 5.3. The values in **statements highlighted in red** provided in VSP can be used to appropriately state the confidence interval on the mean.
    - 5.3.1. In the example below, using the recommended non-parametric confidence interval on the median, the statement would be “We have 95% confidence that the true median is in the range (0.622, 1.296)”
  - 5.4. Consider the Upper 95% Confidence Interval when deciding what the average concentration value is as a conservative estimate that includes the uncertainty of the measurements.

