Radiological Data Assessment Guidance for Emergency Response

Job Aid: Assess an Area Against an Action Level

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[1]. More information about data quality assessment can be found in the Radiological Data Assessment Guidance for Emergency Response[2] document on CBRN Responder.

Use Case: Determine whether a specified area has suspected contamination or radiation levels that can be said to below an incident action level (threshold). One example is assessing whether an affected area should be considered a radiologically controlled area when comparing measured values to an action level. This test is described in Section 5.2.5 of the Radiological Data Assessment Guidance for Emergency Response[2].

Assumptions:

- The test area should contain terrain that is roughly homogeneous throughout the area.
- Data collected is representative of the area being assessed.
- The area being assessed does not include regions known to have drastically different contamination or radiation levels, such as hot spots.
- This test is performed on data collected over time in various locations in which conditions have not significantly changed.
- The data have all already been transformed into the same units.
- The data contains no outliers that would indicate potential hotspots.
- The reader has already successfully installed VSP on their computer. VSP is currently only compatible with Windows operating systems.
- This test requires at least four measurement values.

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[3].

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

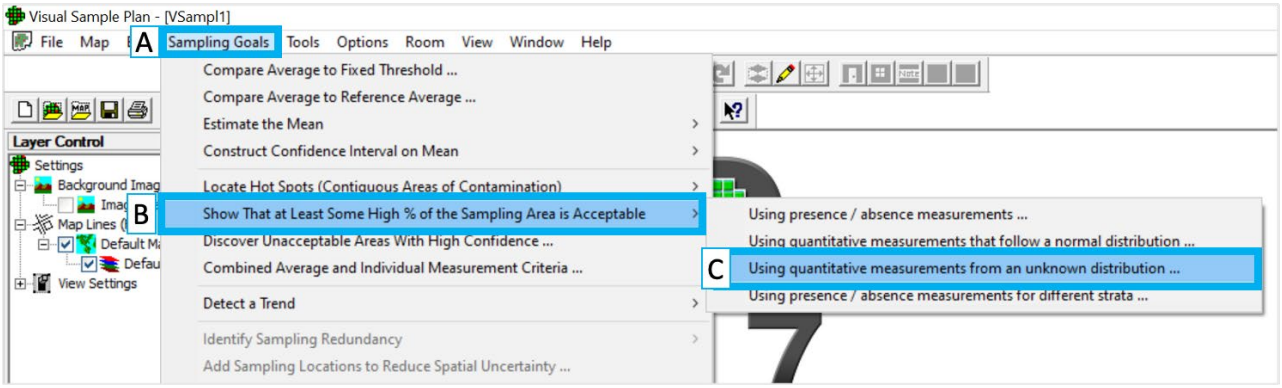
1. **Launch the Upper Tolerance Limit (UTL) dialog in VSP**: Follow the steps below to launch the design dialog to import data and perform the test.
    1.1. In the top-left menu bar, click on (A) “**Sampling Goals**”.
    1.2. In the pop-up drop-down menu, hover over each item in order from (B) to (C):

[1] https://www.pnnl.gov/projects/visual-sample-plan
[2] https://www.cbrnresponder.net/app/index#resources/documents/download/2308
[3] https://www.epa.gov/sites/default/files/2015-06/documents/g9-final.pdf

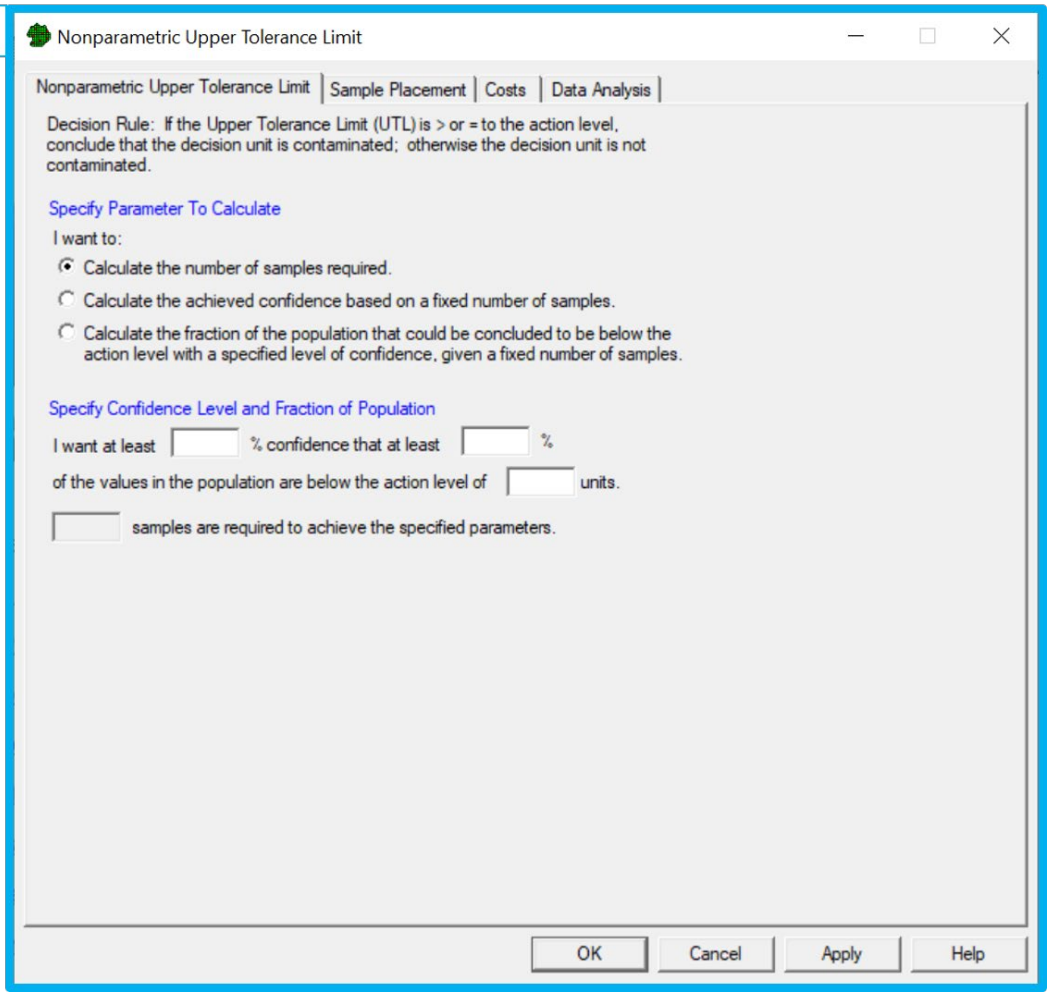
(B) “**Show That at Least Some High % of the Sampling Area is Acceptable**”

(C) “**Using quantitative measurements from an unknown distribution … ”**

1.3. Click on “**Using quantitative measurements from an unknown distribution … ”** to launch the Nonparametric Upper Tolerance Limit test in a new **dialog** that will pop up.



POP-UP



2. **Specify the percent confidence, fraction of population, and the action level**: Follow the steps below to set the necessary test parameters.

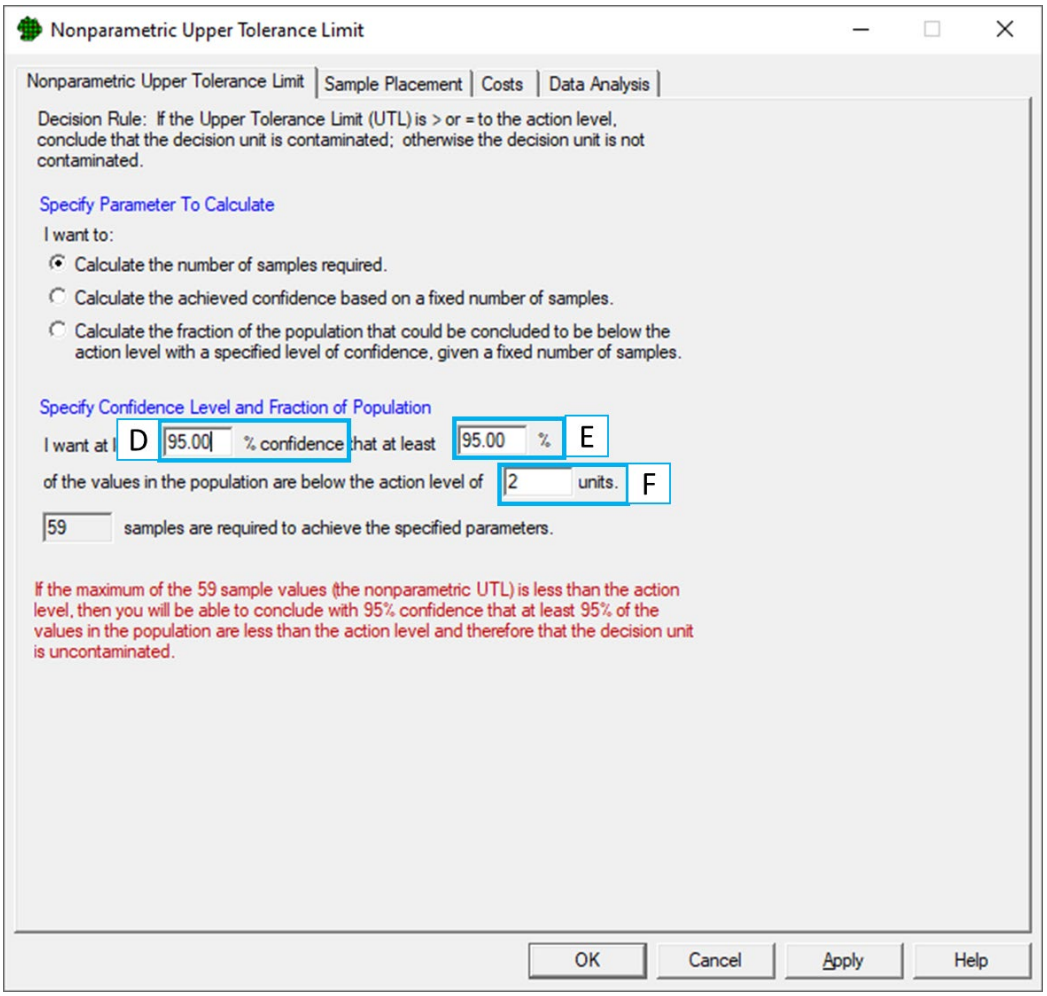
2.1. Specify the established (F) **action level**. For example, 2 mR/hr is a commonly-used limit.

2.2. Specify the (D) **percent confidence** and the (E) **fraction of the population** such that there is enough reason to consider an area as a radiologically controlled

area. The maximum possible value to specify for either parameter is 99.99%, and the lowest possible value is 50.00%.

2.3. VSP will calculate how many samples are needed to perform the UTL test. The higher the percent confidence and faction of the population, the more samples are needed.

2.4. The three radio buttons in the Specify Parameter To Calculate section allow different parameters of interest to be calculated. For example, if a fixed level of confidence is required and a known number of data values have been collected, selecting the third radio button will allow the confidence and the number of data values in order to calculate the fraction of the population that can be confidently determined to be below a particular level.

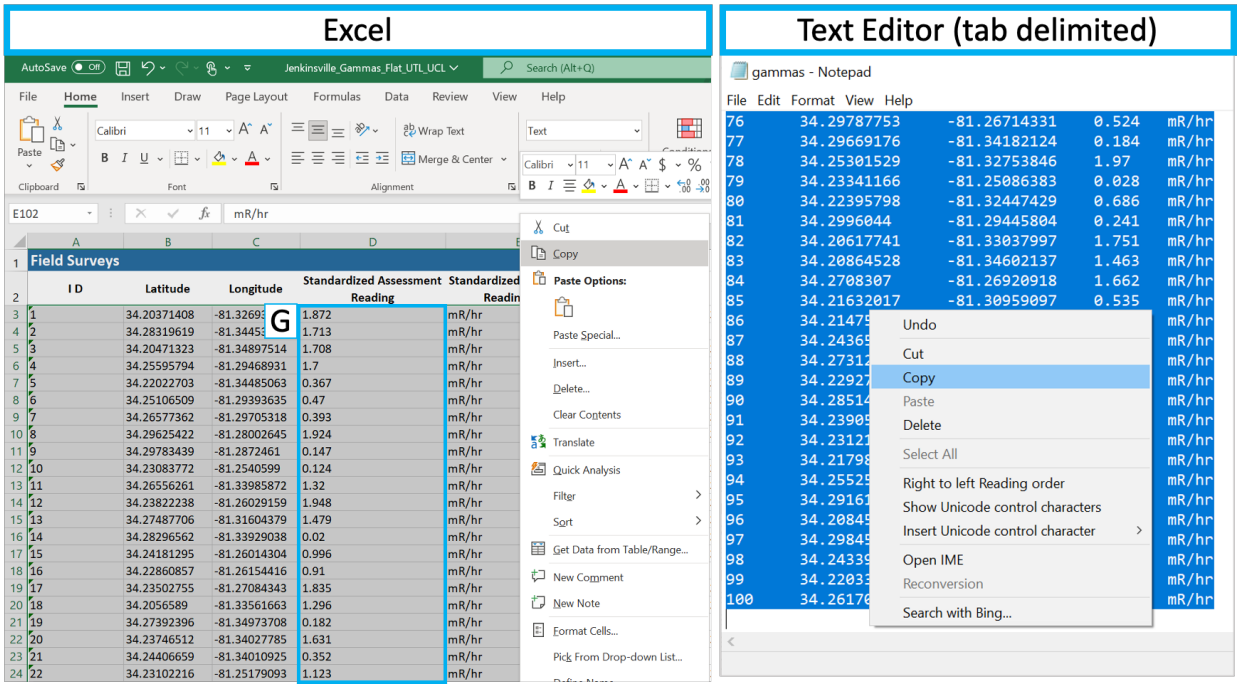


3. **Prepare your data to be loaded into VSP**: Follow the steps below to prepare to load your data into VSP.

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).

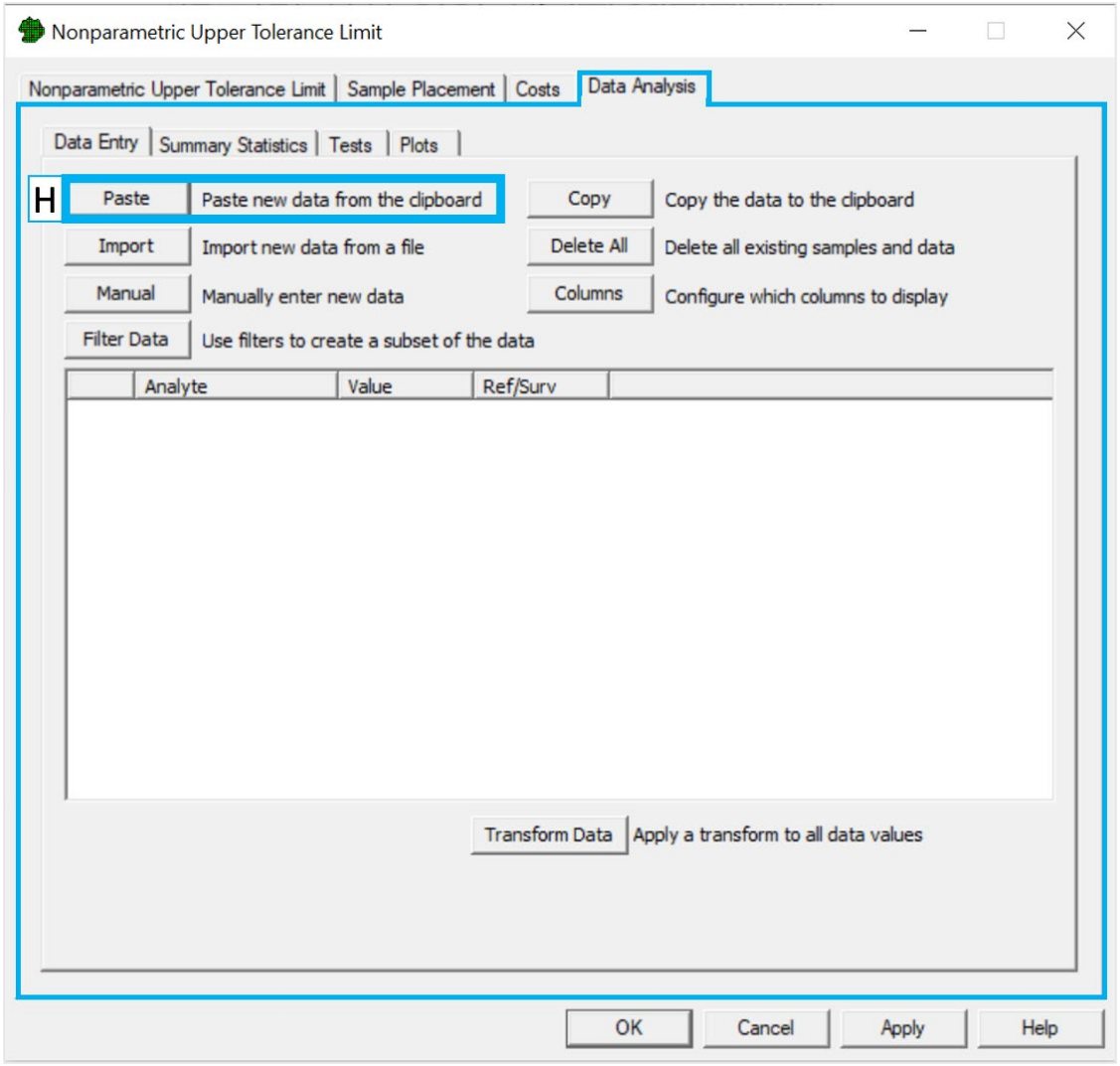
3.3. Select and copy the rows to be imported into VSP. The test can still be computed if there are missing data, extra columns, or no specific order to columns or rows, but ensure that there is a column for (G) the **sample values**.



4. **Load the data into VSP**: Follow the steps below to load your data into VSP.

    4.1. In the "**Nonparametric Upper Tolerance Limit**" dialog, click on the "**Data Analysis**" tab. Ensure the "**Data Entry**" sub tab is open. If not, click on it.

    4.2. Click on the (H) "**Paste**" button.



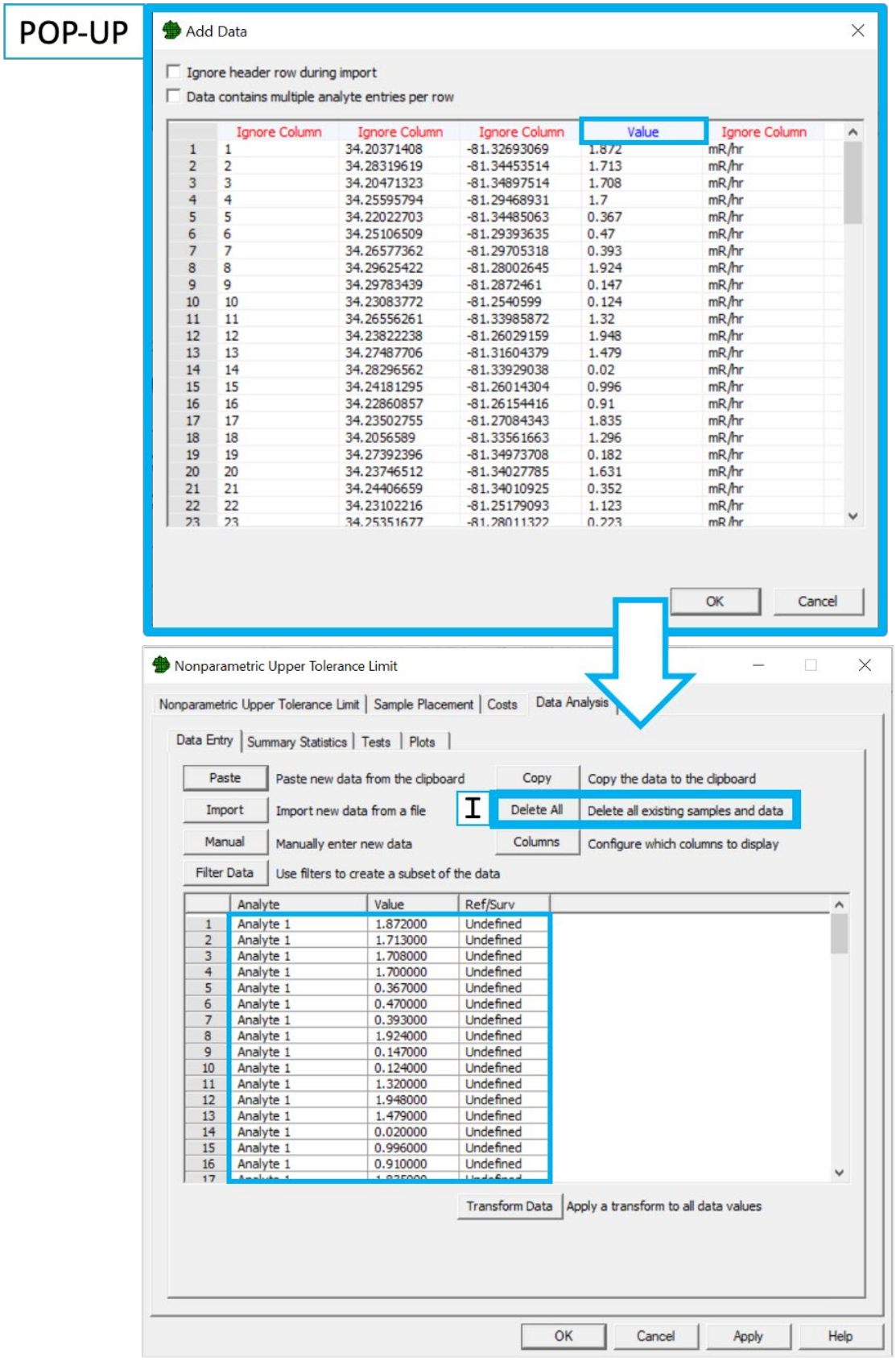
4.3. In the new pop-up dialog, preview the pasted data and ensure it matches what was copied in step 3.3. For example, in the data loaded below, 100 samples measuring gamma radiation (mR/hr) were collected in Jenkinsville, Arkansas, USA.

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.

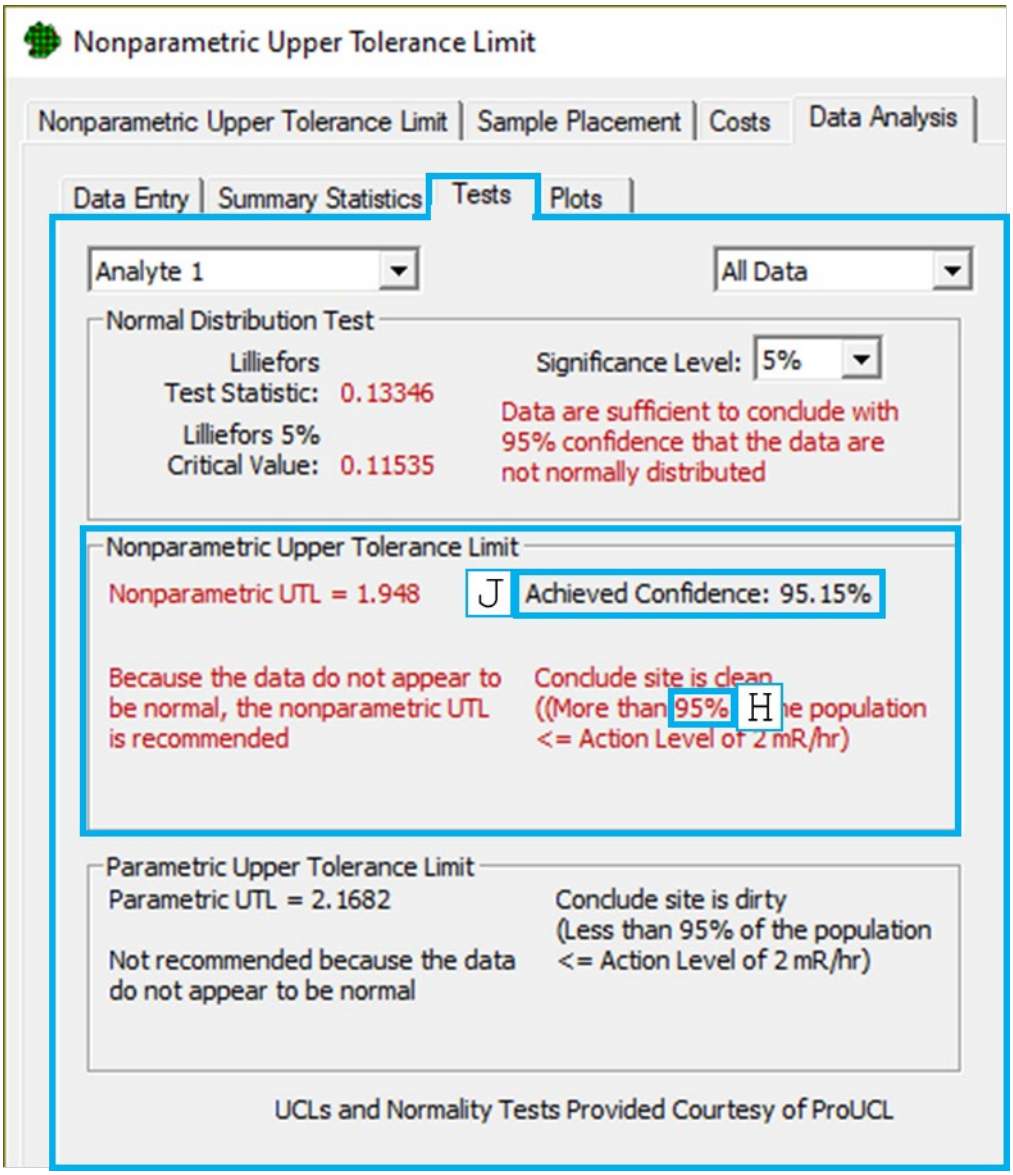
4.7. Ensure the data has been imported as expected. If data has been imported incorrectly and needs to be reimported, click on the (I) "**Delete All**" button and follow steps **4.1 - 4.6** again.



5. **Perform the test:** The name of the statistical test used here is called the “Upper Tolerance Limit” (UTL) test. Follow the steps below to perform this test in VSP.

    5.1. Click on the “**Tests”** tab on the Nonparametric Upper Tolerance Limit dialog.

5.2. View the test results in the section of the Tests tab under the "**Nonparametric Upper Tolerance Limit**" section. (J) is the percent confidence and (H) is the percent of the area that the test applies to.



5.3. Use the UTL value provided in VSP to appropriately state the statistical conclusion that can be drawn from this test.

5.3.1. The calculated UTL can be described as follows: "**Given *n* measurements, we can be *C* percent confident that *P* percent of the area is below the UTL**",. In the example above, there were 59 measurements (indicated when the data is loaded). The conclusion statement would thus read "**Given 59 measurements, we can be 95.15 percent confident that 95 percent of the area is below the UTL**".