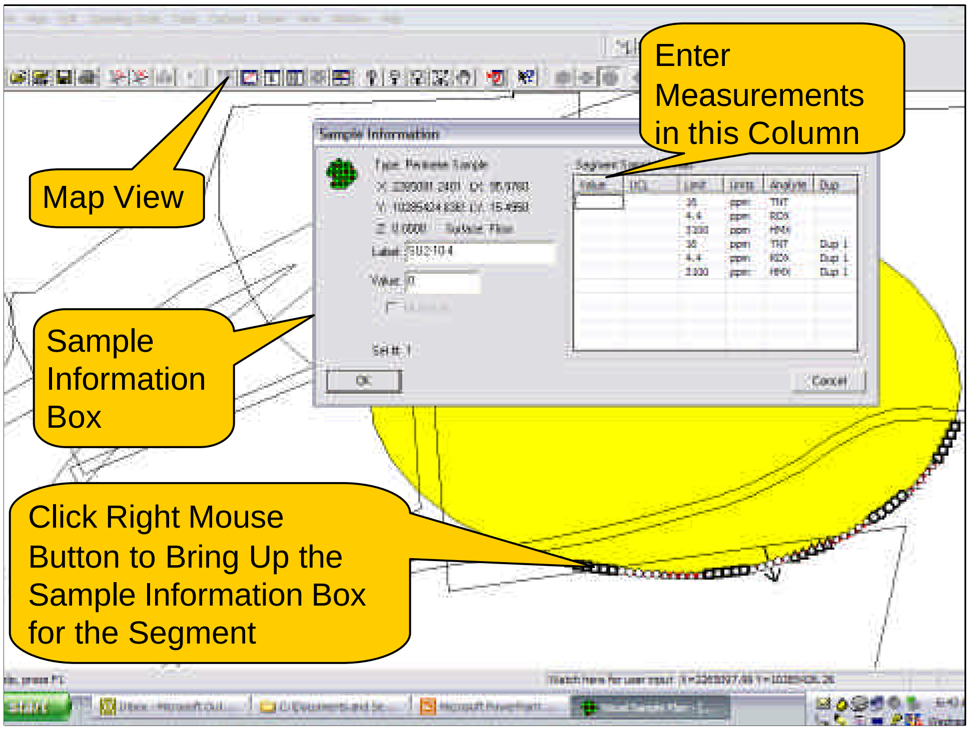
Enter Measurements in this Column
Map View
Sample Information Box
Click Right Mouse Button to Bring Up the Sample Information Box for the Segment
Sample Information

Sample Information Box

- The next slide shows a close-up of the **Sample Information** box and the enclosed **Segment Sample Results** box.
- UCLs computed by VSP are placed in the UCL column

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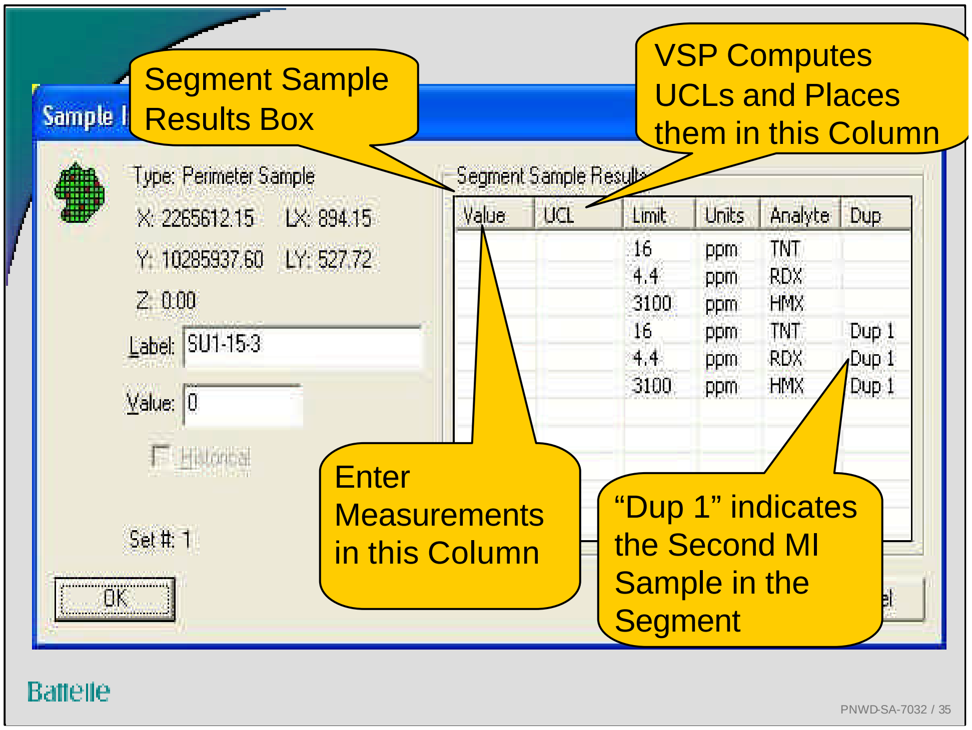

The Segment Sample Results box displays the geographical coordinates of the Primary Sample Locations for the segment that was clicked. It also display the "Label" for that location, which provides a unique number for the location. This label is assigned by VSP, but it can be changed by the VSP user. Directly below the Label box is a "Value" box. For the Primary Sampling Location clicked, the VSP user can enter an individual value if desired. VSP does not use that value.

MI sample measurements can also be entered into VSP using a spreadsheet such as Excel. Details for doing this are in the VSP User's Guide for the RS module.

"Dup 1" in the Sample Information Box refers to the 2nd MI sample collected in that segment.

Deciding if a Provisional Boundary Segment Should be Bumped Out

1. Enter all data into the VSP Segment Sample Results box
2. For each explosives constituent measured, VSP uses the pooled measurements from all segments that have two MI samples to compute the relative standard deviation (RSD), which is assumed to apply to all segments
3. For each segment, VSP multiplies RSD for the constituent by the estimated mean for that segment/constituent to estimate the standard deviation for the segment/constituent
4. VSP user specifies the confidence desired in making the decision to bump out a segment, 100(1-a)%. If a is selected to be 0.05, then the confidence is 100(0.95) = 95%
5. For each constituent, VSP computes the one-sided upper confidence limit (UCL) on the segment mean

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It is expected that 100a % of the statistical tests for the segments that compare the UCL to the action limit will incorrectly conclude that the segment does not need to be bumped out. In that case, the spread of contamination beyond the provisional boundary has not been detected by the test. However, the probability of this happening can be controlled to as small a value as required. The VSP user simply specifies a larger confidence level (smaller a value) for the UCL.

If the UCL test incorrectly indicates that the segment *should* be bumped out, then the UCL tests on the two new bumped out segments are expected to indicate that no further bump outs are required. Hence, the effects of that incorrect decision are minimized.

Deciding if a Provisional Boundary Segment Should be Bumped Out

6. If the UCL for the segment equals or exceeds the action limit (AL) for the constituent, then VSP bumps out that segment in the shape of a triangle with sides of equal length
7. One or two new MI samples are formed for each new bumped-out segment (sides of the triangle).
8. VSP computes the UCL for each new segment using updated estimates of the RSD
9. If a new bump-out occurs, the measurement-UCL process outlined above is repeated
10. If new bump-outs do not occur, the new boundary delineation effort ceases

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Depending on the shape of the enclosing boundary, the bump-out may not always be a triangle; sometimes it will fill an indentation when necessary to maintain a boundary that does not cross over itself.

The UCLs are not computed until data for all segments that have duplicate MI samples have been entered into the Segment Sample Results box.

There are two cases where VSP will bump out a triangle before the UCL is computed:

- when only one MI sample is collected in a segment and the measurement for that sample exceeds the AL
- when two MI samples are collected in a segment and the mean of those two samples exceeds the AL

If the VSP user specified that a percentage of the segments should have duplicate MI samples, then that percentage of the newly bumped-out segments will have duplicate MI samples

Method for Computing UCLs

1. First, compute the relative standard deviation (RSD) using measurements obtained for the initial set of n segments for which two MI samples were obtained:

$$RSD = \sqrt{\frac{1}{n}\sum_{i=1}^{n}\frac{s_i^2}{\overline{x}_i^2}}$$

where

$s_i^2 = \sum_{j=1}^{2}\left(x_{ij} - \overline{x}_i\right)^2$ = variance of the two MI sample measurements in the i^{th} segment

$\overline{x}_i = \frac{1}{2}\sum_{j=1}^{2} x_{ij}$ = mean of the two MI sample measurements in the i^{th} segment

n = number of segments for which two MI samples were obtained

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Method for Computing UCLs (continued)

2. Compute the standard deviation for each segment along the initial boundary, even those segments that had only one MI sample. The standard deviation for the i^th^ segments is computed as

$$SD_i = (RSD)(\bar{x}_i)$$

where

$\bar{x}_i = \frac{1}{m_i}\sum_{j=1}^{m_i} x_{ij}$ = mean of the MI sample measurements in the i^{th} segment

m_i = number of MI sample measurements (1 or 2) in the i^{th} segment

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Method for Computing UCLs (continued)

3. Compute the 100(1-a)% UCL on the mean for each segment along the initial boundary. The UCL for the i^th segment is computed as

$$UCL_i = \bar{x}_i + t_{1-\alpha,n} \frac{SD_i}{\sqrt{m_i}}$$

where $\bar{x}_i = \frac{1}{m_i} \sum_{j=1}^{m_i} x_{ij}$ $\quad SD_i = (RSD)(\bar{x}_i)$

$t_{1-\alpha,n}$ = 100(1-a) percentile of the t distribution with n degrees of freedom,

m_i = number of MI sample measurements (1 or 2) in the i^th segment

and 0 < a < 0.5, where a is the selected probability that can be tolerated of falsely rejecting the null hypothesis that the segment needs to be bumped out.

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The percentiles of the t distribution are tabulated in many statistics books, e.g., Gilbert, R.O. 1987. *Statistical Methods for Environmental Pollution Monitoring,* Wiley, NY.