Radiological Data Assessment Guidance for Emergency Response

Job Aid: Assess Confidence in Discrete Samples

PNNL-34480

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Prepared for the U.S. Department of Homeland Security Science and Technology Directorate under the U.S. Department of Energy Contract DE-AC05-76RL01830, via funding provided on Interagency Agreement 70RSAT21KPM000055.

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 sufficient samples have been collected to make a conclusion about an entire population. One example is sampling a set of farms in an area to determine whether crops need to be embargoed. This test is described in Section 5.4.5 Radiological Data Assessment Guidance for Emergency Response[2].

Assumptions:

- This test uses the results of sampling collected over time from the population where conditions have not significantly changed.
- The total size of the population is known. The minimum size of the population is 1 and the number of samples must not exceed the size of the population.
- This test requires at least one measurement value.
- Each sample result can be categorized as a binary outcome, such as being acceptable or unacceptable as defined by an action level threshold
- 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[3].

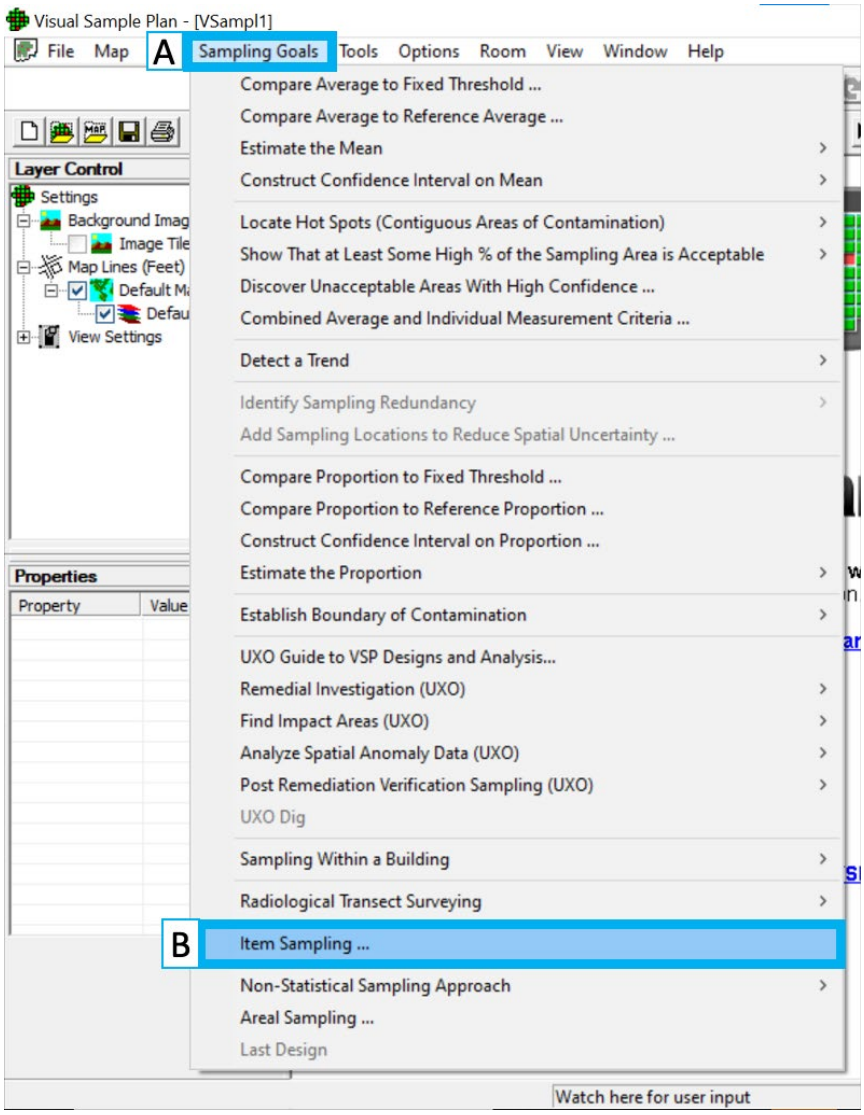
Throughout this job aid, markers such as “(A)” indicate a highlight in the next VSP screenshot after the marker.

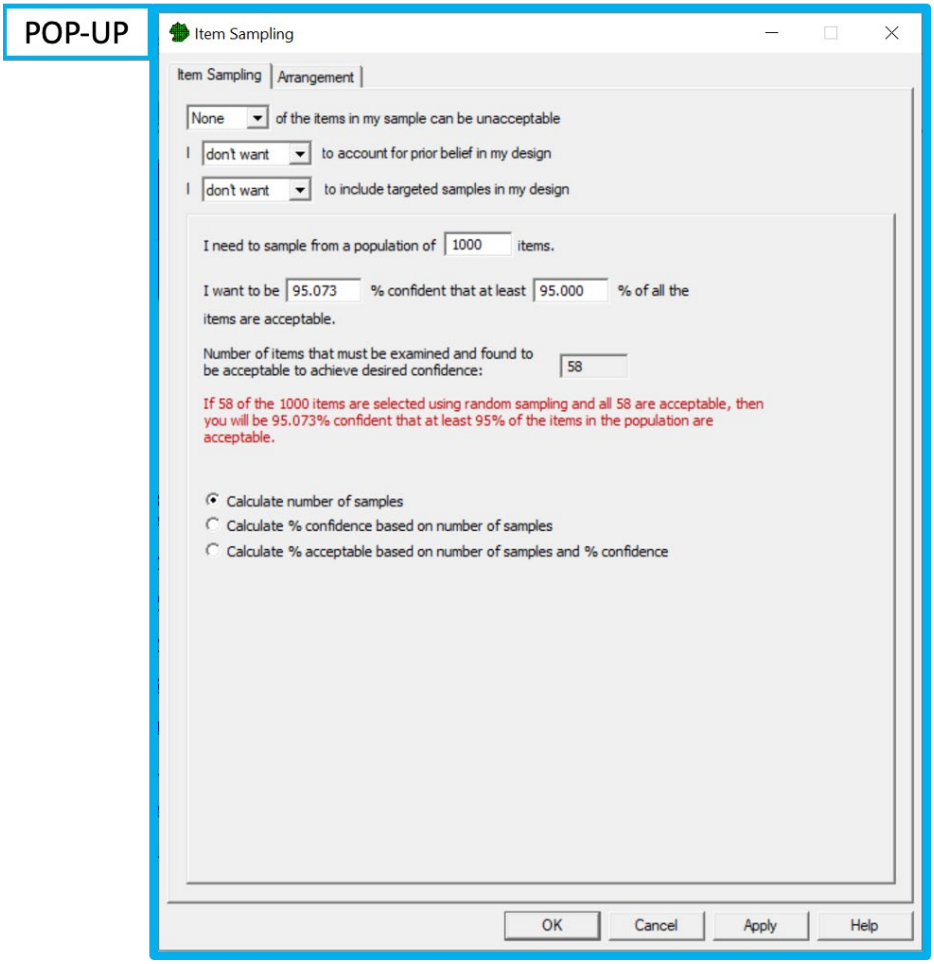
1. **Launch the Discrete Plan Development dialog in VSP**: Follow the steps below to launch the design dialog to import data and perform a sampling.

   1.1. In the top-left menu bar, click on (A) “**Sampling Goals**”.

   1.2. In the pop-up drop-down menu, click on (B) **“Item Sampling ..."** to launch the Discrete Item Sampling test in a new dialog that will pop up.

[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

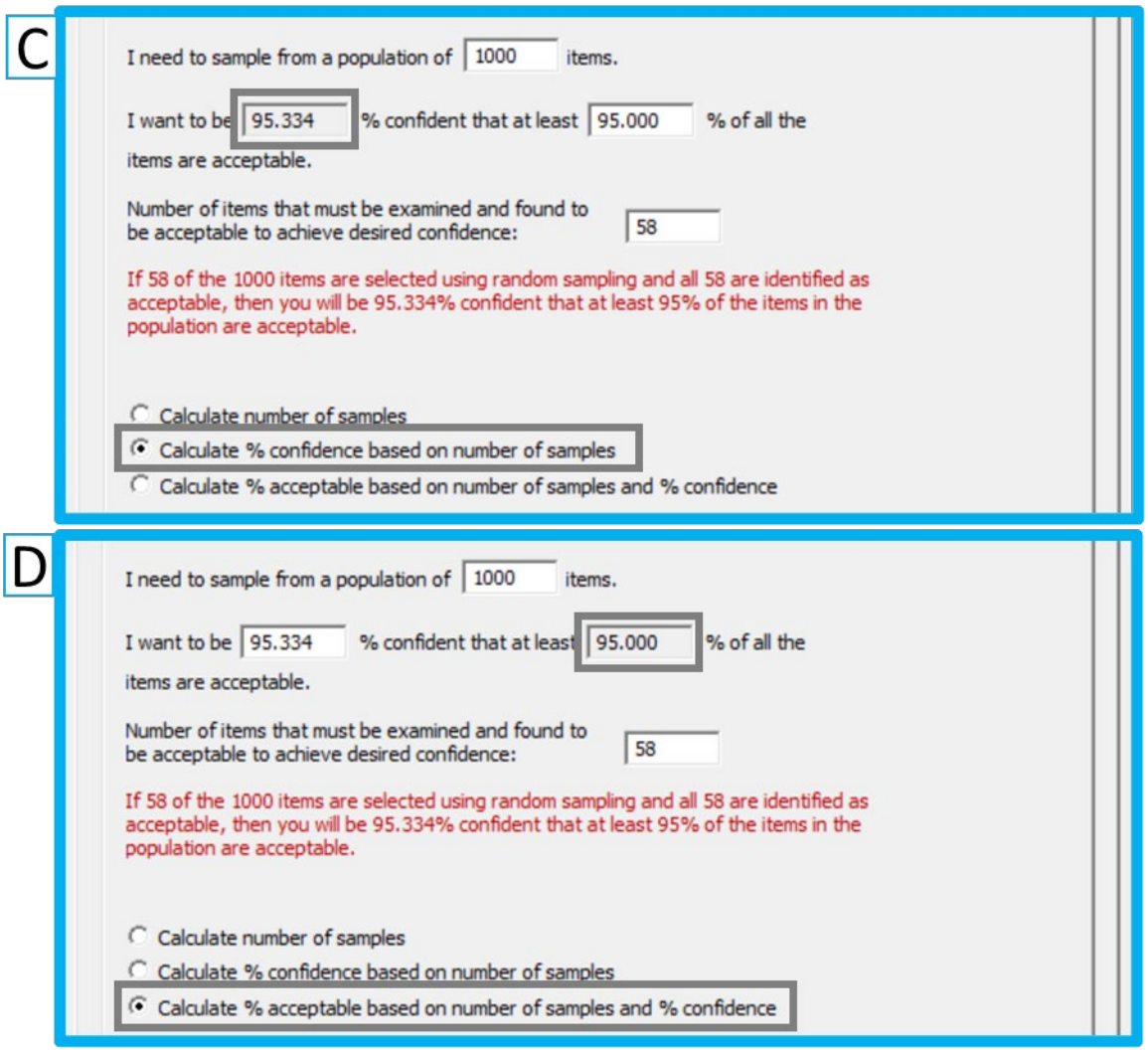

Visual Sample Plan - [VSampl1]
File
Map
A
Sampling Goals
Tools
Options
Room
View
Window
Help
Layer Control
Settings
Background Imag
Image Tile
Map Lines (Feet)
Default Ma
Defau
View Settings
Properties
Property
Value
Compare Average to Fixed Threshold ...
Compare Average to Reference Average ...
Estimate the Mean
Construct Confidence Interval on Mean
Locate Hot Spots (Contiguous Areas of Contamination)
Show That at Least Some High % of the Sampling Area is Acceptable
Discover Unacceptable Areas With High Confidence ...
Combined Average and Individual Measurement Criteria ...
Detect a Trend
Identify Sampling Redundancy
Add Sampling Locations to Reduce Spatial Uncertainty ...
Compare Proportion to Fixed Threshold ...
Compare Proportion to Reference Proportion ...
Construct Confidence Interval on Proportion ...
Estimate the Proportion
Establish Boundary of Contamination
UXO Guide to VSP Designs and Analysis...
Remedial Investigation (UXO)
Find Impact Areas (UXO)
Analyze Spatial Anomaly Data (UXO)
Post Remediation Verification Sampling (UXO)
UXO Dig
Sampling Within a Building
Radiological Transect Surveying
B
Item Sampling ...
Non-Statistical Sampling Approach
Areal Sampling ...
Last Design
Watch here for user input



2. **Perform the test:** The name of the test used here is “Compliance Sampling”. Follow the steps below to perform this test in VSP.

   2.1. Leave the three drop-down options as is (“None”, “don’t want”, and “don’t want”, respectively).

   2.2. In the “**Item Sampling**” tab, there are three calculation options. Use either option (C) or (D), below. The grey boxes indicate the selected calculation and its output value.



2.2.1. If you want to calculate the percent confidence, select (C) "**Calculate % confidence based on number of samples**". Then, specify the size of the total population, the known number of samples, and the percent of samples that must be acceptable.

2.2.2. If you want to calculate the percent of the population that will be acceptable, select (D) "**Calculate % acceptable based on number of samples and % confidence"**. Then, specify the size of the population, the known number of samples that have been collected, and the required percent confidence.

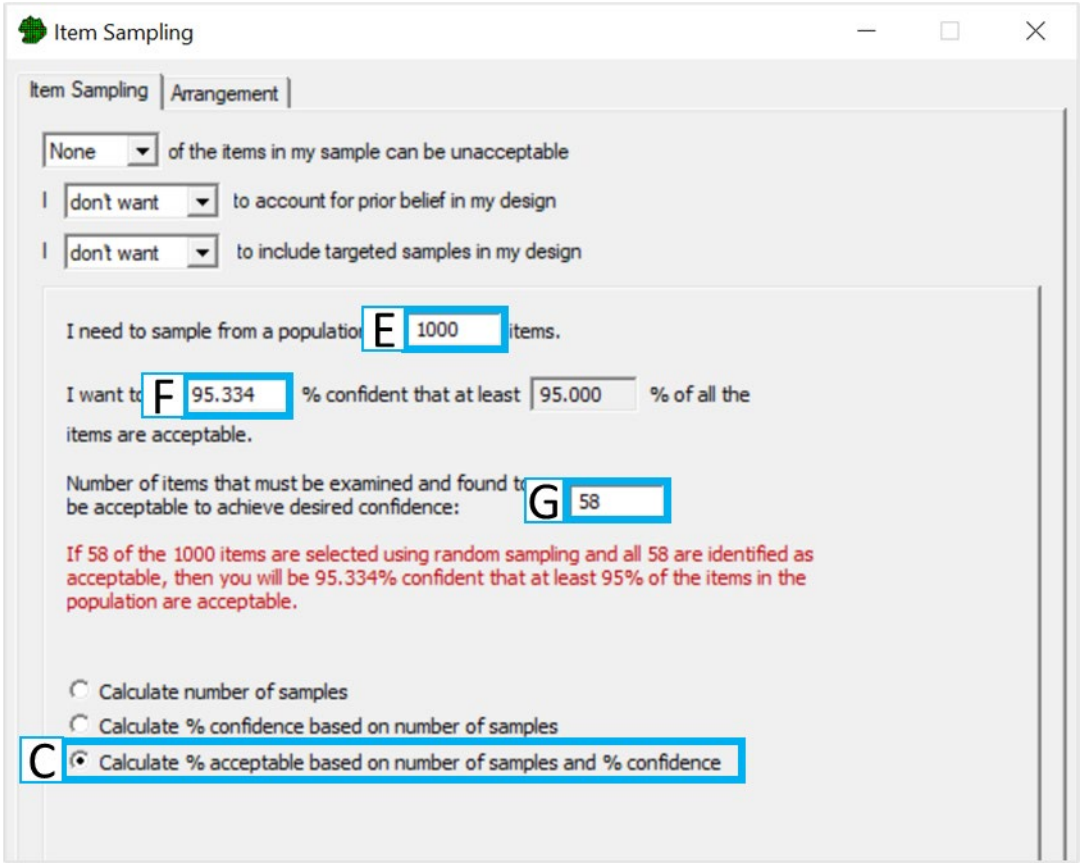
2.3. Adjust and reconsider values as needed. For example, if 95% of samples are accepted then radiation levels for 95% of the population are said to be below the known incident action level. If a higher confidence or percent accepted is desired, then more samples need to be collected.

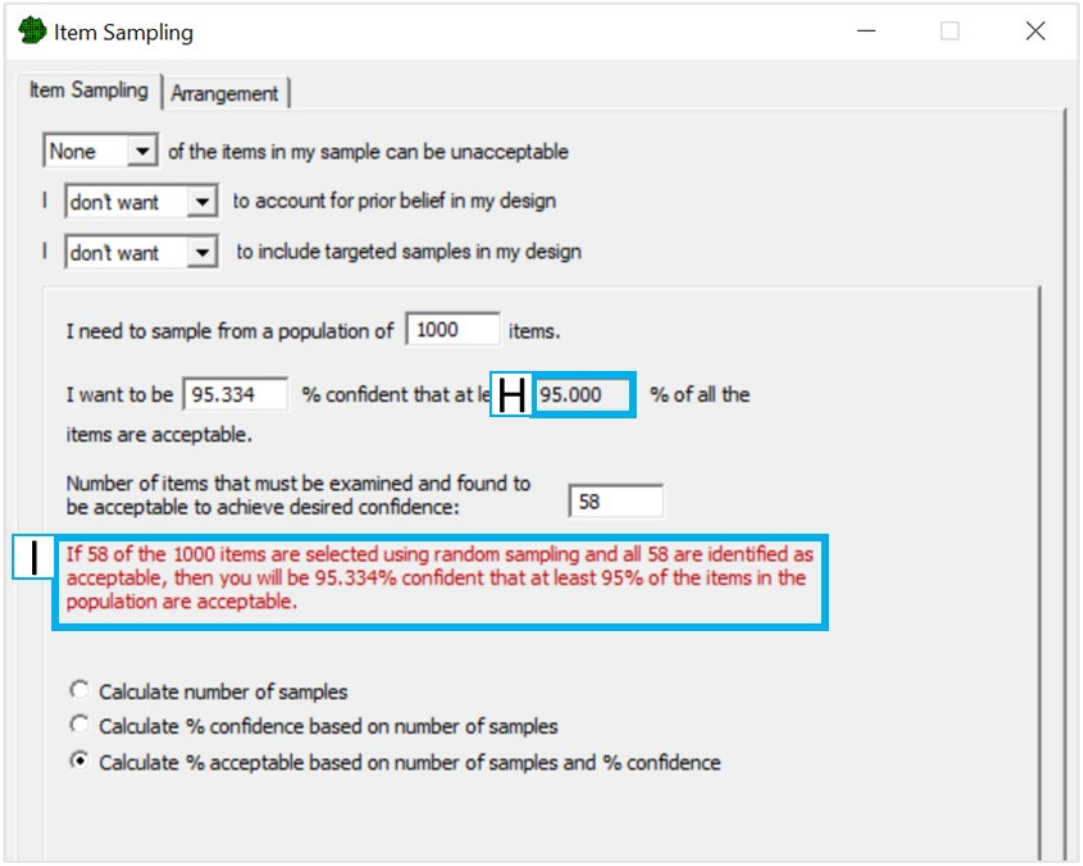
2.4. Use the statement highlighted in red to state the conclusions of the test. VSP will deliver a statement similar to the following:

2.4.1. "**If 58 of 1000 items are selected using random sampling and all 58 are acceptable, then you will be 95.334% confident that at least 95% of the items in the population are acceptable.**" This means that if all the measurements being

considered are below the action level, then the majority of the items in the total population are acceptable.

2.4.2. If sample sizes are close or equal to the population size, VSP may deliver an additional statement in the concluding text that reads something like "**The selected number of items to be sampled results in an even higher confidence/high percentage of acceptable items than you requested.**" In those cases, the test has either reached maximum percent confidence or maximum percent acceptance, 100%. This means that if all of the measurements being considered are below the action level, then a significant majority of the items in the total population are acceptable.




Item Sampling
Item Sampling
Arrangement
None
of the items in my sample can be unacceptable
I
don't want
to account for prior belief in my design
I
don't want
to include targeted samples in my design
I need to sample from a population of
1000
items.
I want to be
95.334
% confident that at le
H
95.000
% of all the
items are acceptable.
Number of items that must be examined and found to be acceptable to achieve desired confidence:
58
I
If 58 of the 1000 items are selected using random sampling and all 58 are identified as acceptable, then you will be 95.334% confident that at least 95% of the items in the population are acceptable.
Calculate number of samples
Calculate % confidence based on number of samples
Calculate % acceptable based on number of samples and % confidence