

Range Sustainability Module Using Visual Sample Plan (VSP) Software

Brent A. Pulsipher, John E. Wilson and Richard O. Gilbert
Statistical Sciences
Battelle Pacific Northwest Division
Richland, Washington

Prepared for
Department of the Navy
Naval Sea Systems Command
NAVSEA Programs Field Office
Goose Creek, SC

Battelle

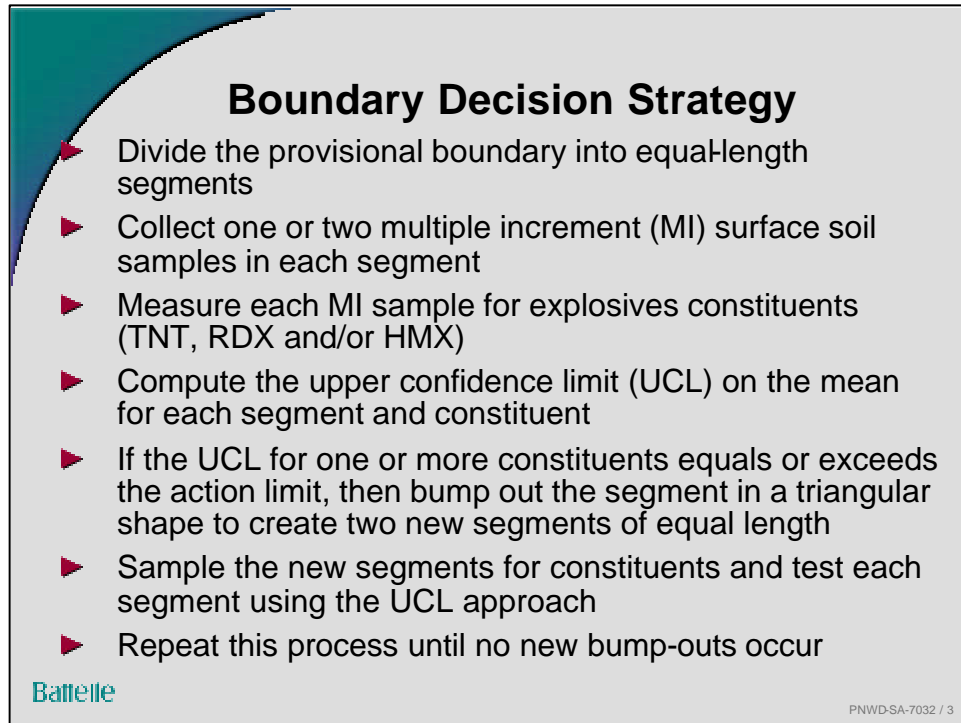
PNWD-SA-7032

Objective

- ▶ Learn how to use the Range Sustainability (RS) Module in the Visual Sample Plan (VSP) software
 - ⚡ to determine if explosives constituents in surface soil may have migrated beyond the provisional boundary of an active training range, and if so,
 - ⚡ to estimate the location of a new provisional boundary that may enclose the area where mean concentrations exceed action limits.

Battelle

PNWD-SA-7032 / 2

A slide titled "Boundary Decision Strategy" with a teal and grey background. It contains a list of seven steps for handling boundary decisions based on soil sampling results. The steps are: 1. Divide the provisional boundary into equal-length segments. 2. Collect one or two multiple increment (MI) surface soil samples in each segment. 3. Measure each MI sample for explosives constituents (TNT, RDX and/or HMX). 4. Compute the upper confidence limit (UCL) on the mean for each segment and constituent. 5. If the UCL for one or more constituents equals or exceeds the action limit, then bump out the segment in a triangular shape to create two new segments of equal length. 6. Sample the new segments for constituents and test each segment using the UCL approach. 7. Repeat this process until no new bump-outs occur. The slide includes the Battelle logo in the bottom left and the reference code PNWD-SA-7032 / 3 in the bottom right.

Boundary Decision Strategy

- ▶ Divide the provisional boundary into equal-length segments
- ▶ Collect one or two multiple increment (MI) surface soil samples in each segment
- ▶ Measure each MI sample for explosives constituents (TNT, RDX and/or HMX)
- ▶ Compute the upper confidence limit (UCL) on the mean for each segment and constituent
- ▶ If the UCL for one or more constituents equals or exceeds the action limit, then bump out the segment in a triangular shape to create two new segments of equal length
- ▶ Sample the new segments for constituents and test each segment using the UCL approach
- ▶ Repeat this process until no new bump-outs occur

Battelle

PNWD-SA-7032 / 3

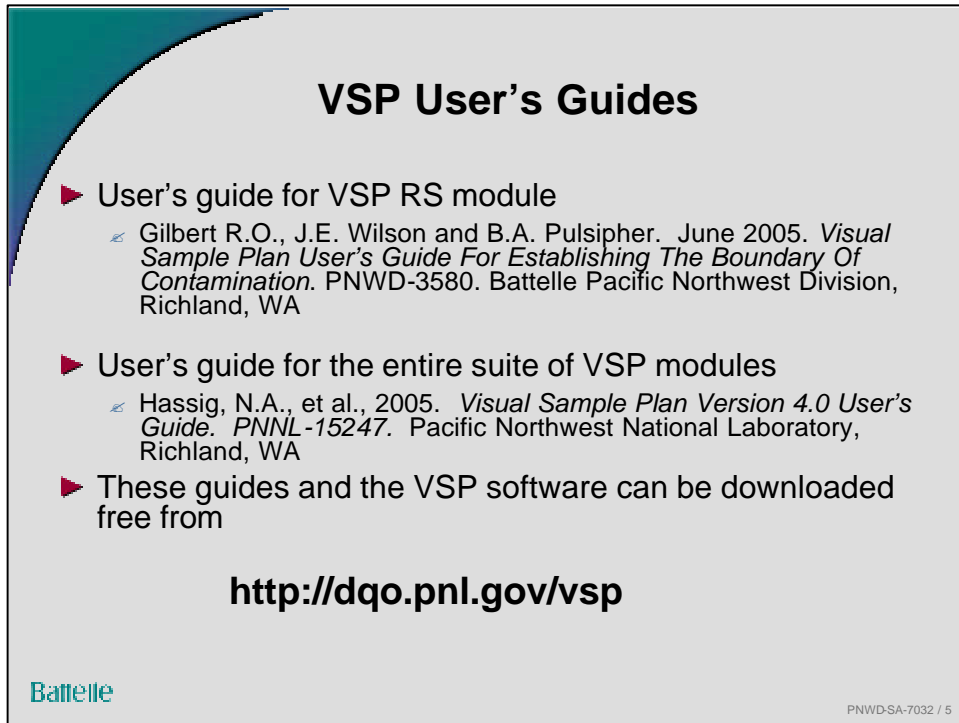
It is assumed that explosives constituents in surface soil are not resuspended and transported through the air to distinct isolated hot spots outside the boundary. That is, it is assumed that explosives constituents in surface soil move as a plume across the boundary with no discontinuities over space.

Outline of This Training

- ▶ Introduce Visual Sample Plan (VSP) software
- ▶ Outline the steps in using the VSP-RS module
- ▶ Describe each step
 - ✦ Provide illustrations, screen shots, and a case study

Battelle

PNWD-SA-7032 / 4

A slide titled "VSP User's Guides" with a teal and grey background. It lists three bullet points about user guides, a URL, and the Battelle logo. The slide is framed by a thin black border.

VSP User's Guides

- ▶ User's guide for VSP RS module
 - ◀ Gilbert R.O., J.E. Wilson and B.A. Pulsipher. June 2005. *Visual Sample Plan User's Guide For Establishing The Boundary Of Contamination*. PNWD-3580. Battelle Pacific Northwest Division, Richland, WA
- ▶ User's guide for the entire suite of VSP modules
 - ◀ Hassig, N.A., et al., 2005. *Visual Sample Plan Version 4.0 User's Guide*. PNNL-15247. Pacific Northwest National Laboratory, Richland, WA
- ▶ These guides and the VSP software can be downloaded free from

<http://dgo.pnl.gov/vsp>

Battelle

PNWD-SA-7032 / 5

The Visual Sample Plan “Quick-Start Guide” that is automatically downloaded along with the VSP software provides very help instructions on use of basic VSP features.

What is Visual Sample Plan (VSP) Software?

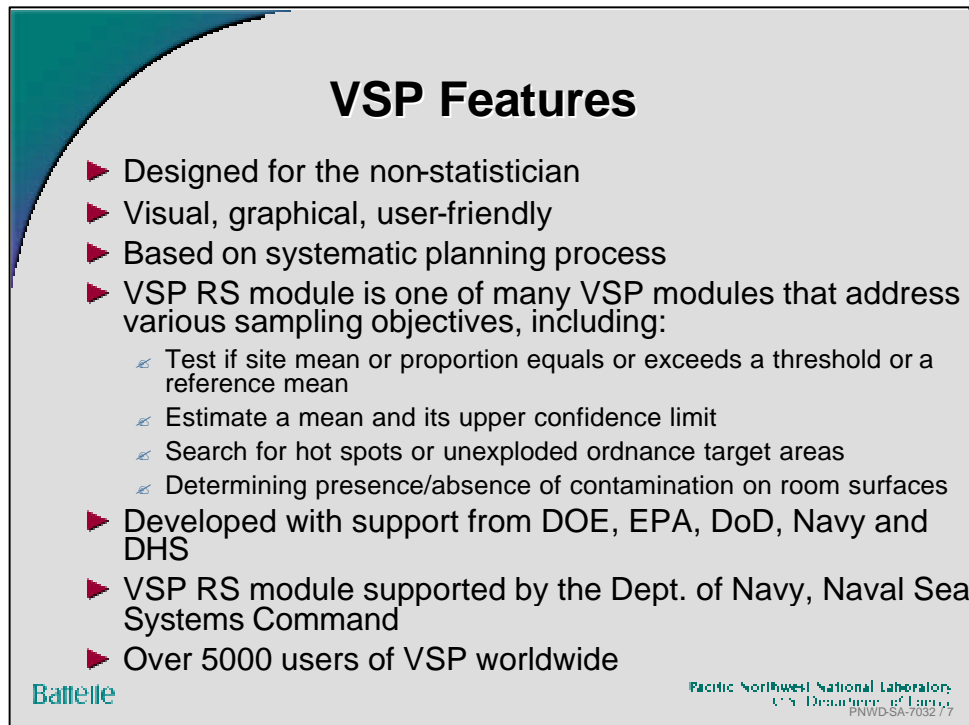
- ▶ Systematic, statistically-based planning software to answer
 - ✍ “How many samples?”
 - ✍ “Where should the samples be located?”

to achieve specified sampling goals and decisions with required confidence

Battelle

PNWD-SA-7032 / 6

The RS module of VSP differs from other VSP modules in that the number of samples per segment is fixed at 1 or 2. Other VSP modules compute the minimum number of samples on the basis of inputs (Data Quality Objectives) provided by the VSP user



VSP Features

- ▶ Designed for the non-statistician
- ▶ Visual, graphical, user-friendly
- ▶ Based on systematic planning process
- ▶ VSP RS module is one of many VSP modules that address various sampling objectives, including:
 - ◀ Test if site mean or proportion equals or exceeds a threshold or a reference mean
 - ◀ Estimate a mean and its upper confidence limit
 - ◀ Search for hot spots or unexploded ordnance target areas
 - ◀ Determining presence/absence of contamination on room surfaces
- ▶ Developed with support from DOE, EPA, DoD, Navy and DHS
- ▶ VSP RS module supported by the Dept. of Navy, Naval Sea Systems Command
- ▶ Over 5000 users of VSP worldwide

Battelle Pacific Northwest National Laboratory
U.S. Department of Energy
PNWD-SA-7032 / 7

VSP provides both well known and novel sampling approaches:

- Simple random sampling
- Systematic grid sampling
- Sequential sampling
- Collaborative sampling
- Stratified sampling
- Rand-Set sampling
- Adaptive cluster sampling
- Continuous transect sampling
- Judgmental sampling
- Composite sampling along boundaries

The VSP User's Guide (Hassig et al, 2005) provides full details.

What are the Steps in Using the VSP RS Module?

1. Download, install and open VSP
2. Define the provisional range boundary
3. Specify sampling design inputs and constituents of concern
4. VSP divides boundary into equal-length segments
5. Collect two multiple-increment (MI) soil samples in 5 or more segments or at least 10% of segments; collect one MI sample in remaining segments
6. Measure the MI soil samples for explosives contaminants of interest: TNT, RDX and/or HMS
7. Enter data into VSP

Battelle

PNWD-SA-7032 / 8