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National Nuclear Security Administration

Office of Nonproliferation and International Security (NIS)

www.nnsa.doe.gov

Visual Sample Plan (VSP) Overview

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Needs a SAND #

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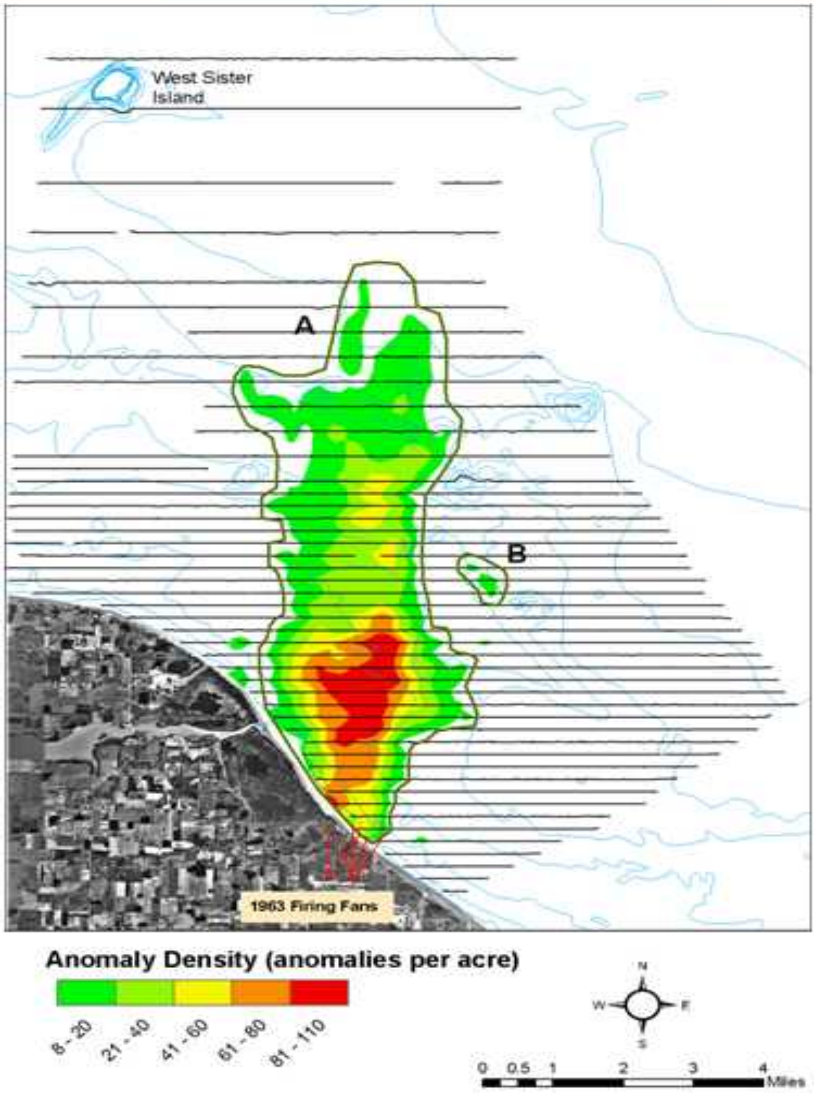
What is Visual Sample Plan (VSP)?

- Data Quality Objectives (DQO) based systematic planning software
- Determines the number and location of samples/transects
- Ensures confident, statistically defensible decisions
- Performs statistical and data quality assessment in support of decision making process.

- Sponsored by DHS, DOE, EPA, DoD, UK, CDC
- Free VSP Download at http://vsp.pnl.gov/
- >5000 Users



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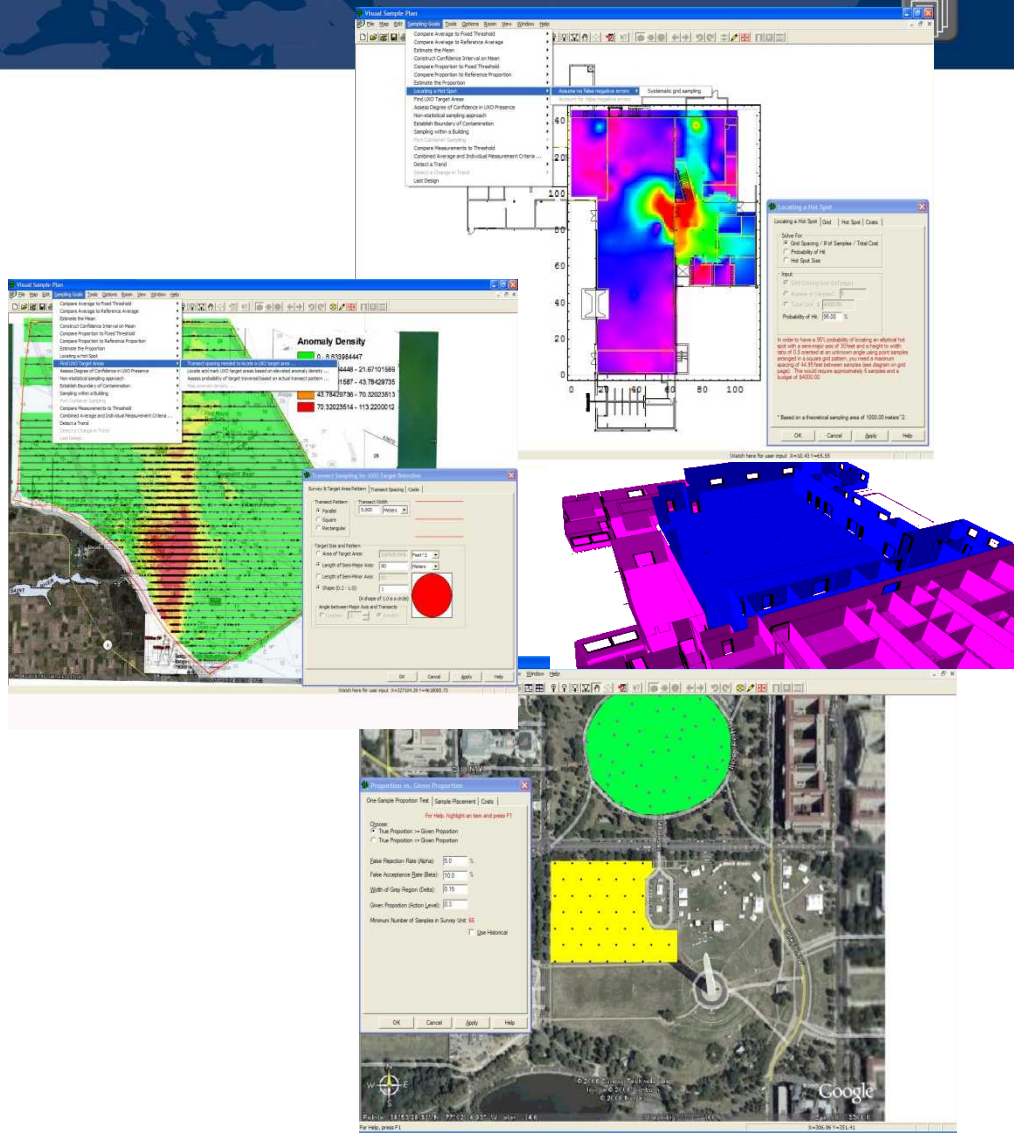
Current VSP Applications

- Identification, Delineation, and Remediation of UXO Sites
- Within-Building Bio/Chem/Rad Terrorist Event
- Environmental Remediation
- Decontamination and Decommissioning
- Long-Term Legacy and Groundwater Monitoring
- Natural Disaster Assessments (Katrina)
- Outdoor Bio/Chem/Rad Terrorist Event
- Item audits and surveillance.



Wherever Sampling Is Used to Support Decisions

A Little VSP History

- 1992-1997: DQO Training and DOE DQO Pilot Studies
- 1996-1998: PNNL Tools: SampTool and NonPar
- 1995-1997: ORNL Tools: Ellipgrid and Initial VSP
  - -- Jim Davidson & John Wilson developers
- 1997-1998: PNNL and ORNL combine forces
  - PNNL hires Davidson & subcontracts to Wilson.
  - Many new features added to VSP
- Version 1.0 / 2001
  - Interactive Graphs, QA, Tech Document, User's Guide
  - PNNL hires Wilson; Davidson exits.
- Version 2.0 / 2002
  - Report Generator, G5S, UXO / Swath, QA
- Version 3.0 / 2004
  - UXO, Collaborative Sampling, Boundary Delineation, Rooms
- Version 4.0 / 2005
  - More Rooms Capability, Acceptance Sampling, UTL, DQA, Data Analysis
- Version 5.0/ 2007
- Version 6.0/ June 2010

Free / Public Domain. vsp.pnl.gov

Current VSP Sponsors

- U.S. Environmental Protection Agency (EPA)
  - Office of Solid Waste and Emergency Response
  - Office of Environmental Information
- U.S. Dept. of Energy (DOE)
  - HSS, LM, EM
- U.S. Dept. of Defense (DoD)
  - Navy
  - SERDP/ESTCP
- U.S. Dept. of Homeland Security (DHS)
  - Technical Support Working Group (TSWG)
  - Chemical and Biological Countermeasures
- United Kingdom Atomic Weapons Establishment
- U.S. Centers for Disease Control (CDC/NIOSH)

Tools Integration and Leveraging Off All Investments

VSP User Profile

VSP Users (Since 5.0 as of 3/17/11)		
USA	**Sites**	**# Users**
	EPA	913
	DOE	467
	States	355
	Army	510
	Navy	303
	Air Force	149
	Other DoD	40
	NRC	58
	Other	1282
Total USA		**3707**
International	UK	259
	Canada	165
	Australia/NZ	96
	Brazil	48
	Spain	46
	Other	575
Total International		**1189**
Total Recent Users		**4886**

Visual Sample Plan (VSP)

- Sampling Strategy Design
  - Determines “How Many Samples” and “Location” to ensure confident, statistically defensible decisions.
- Statistical Analysis for Decisions
  - Performs Statistical Tests When Data Are Entered
  - Provides Summary Statistics of Data Sets
  - Performs Statistical and Graphical Tests of Distribution Assumptions
- Use Made Easy
  - Designed for the Non-Statistician
  - Visual, Graphical, User-Friendly Interface
  - Expert Mentor

Seven Steps of DQO Process

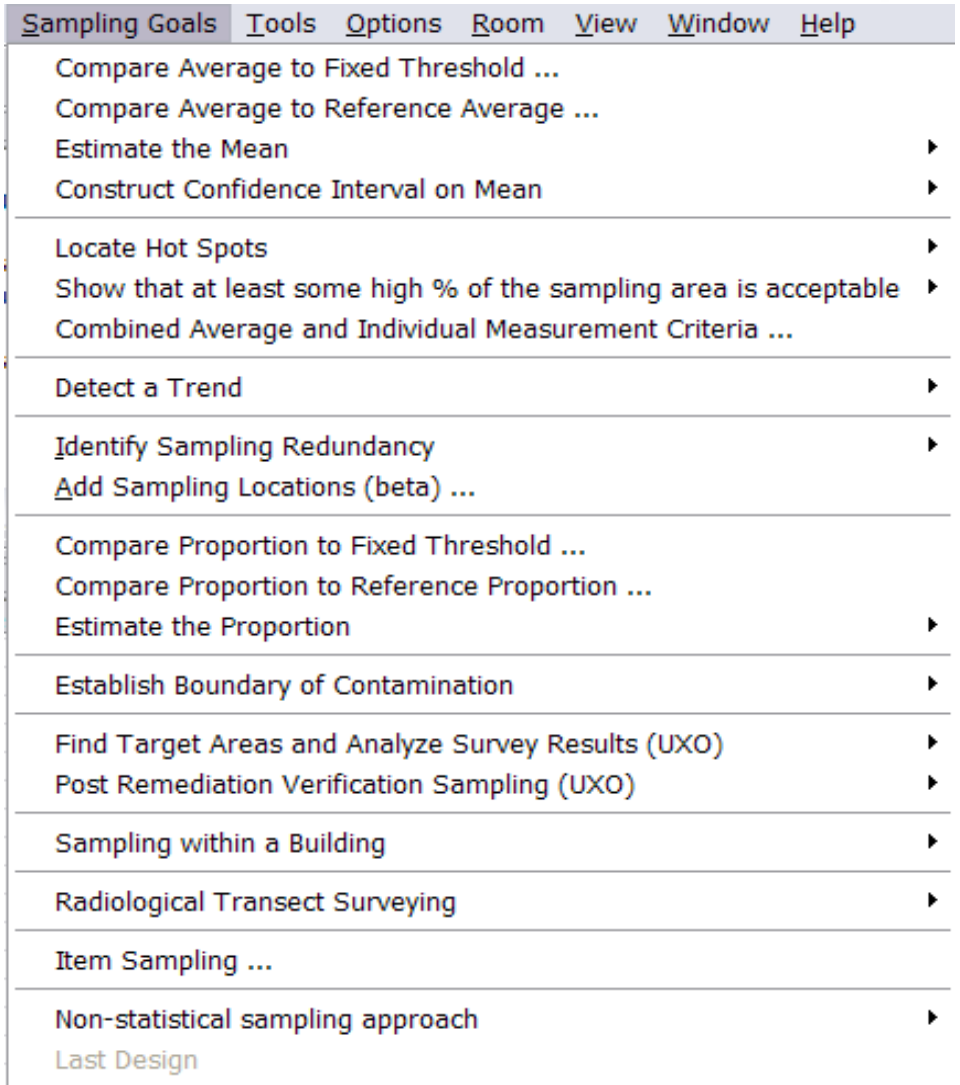
1. State the problem
2. Identify the goals of the study (decisions)
3. Identify information inputs
4. Define the boundaries of the study
5. Develop the analytical approach (decision rules)
6. Specify performance or acceptance criteria (tolerance for decision errors)
7. Develop the plan for obtaining data (sampling design)

VSP

VSP Assumes You Got Steps 1-5 Right! Expert Mentor Can Help.

VSP Decision Objectives

- Supports Many Decision Objectives
- How will data be used/summarized to support a decision?



VSP Features

Supports Various Statistical Sampling Options;
Most are in EPA's G-5S Guidance

- Simple Random Sampling
- Systematic Grid Sampling
- Sequential Sampling
- Collaborative Sampling
- Stratified Sampling
- Rank-Set Sampling
- Adaptive Cluster Sampling
- Continuous Transect Sampling
- Judgmental Sampling
- Combined Judgmental and Probabilistic Sampling

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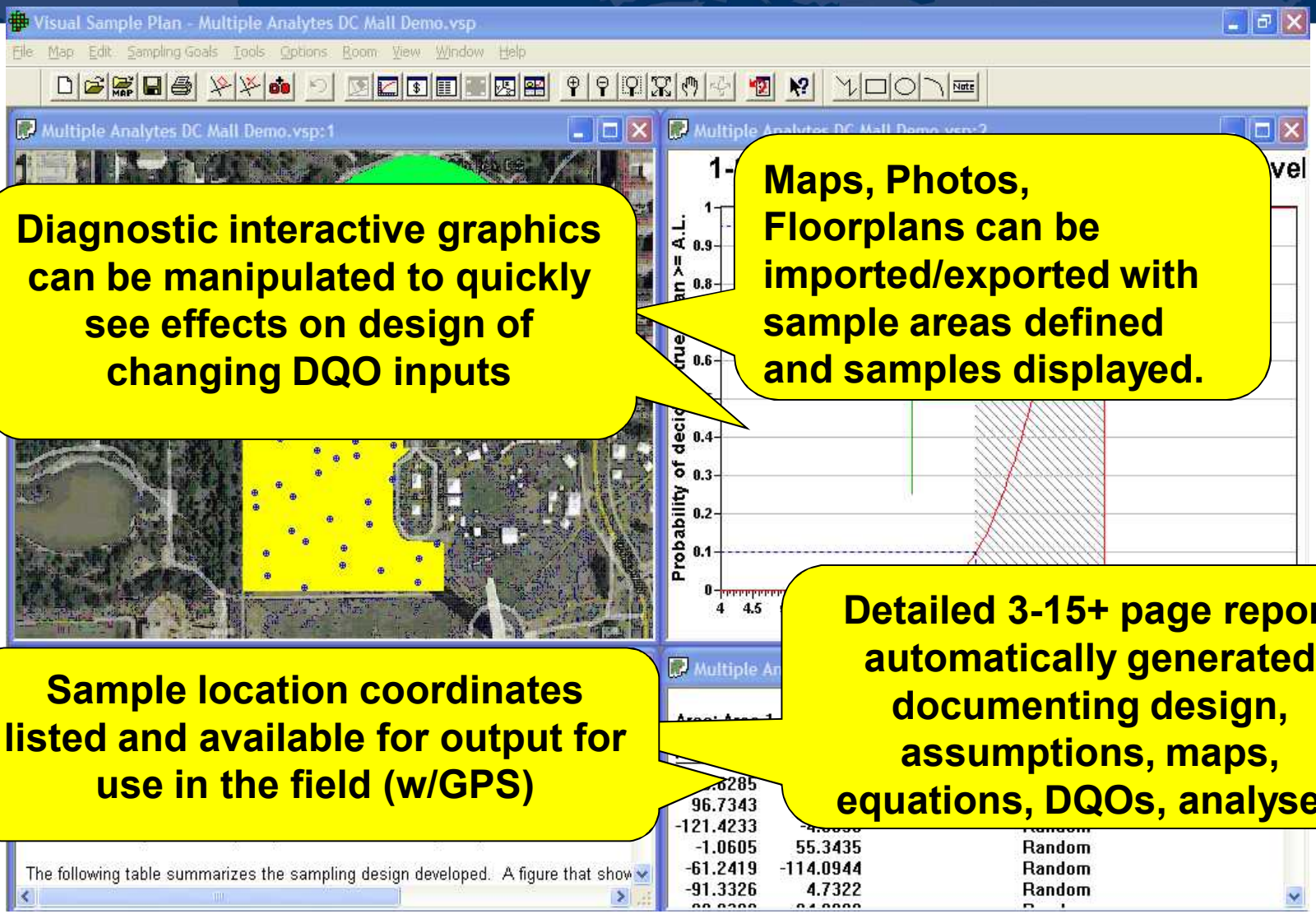
VSP Screen Shot



Diagnostic interactive graphics can be manipulated to quickly see effects on design of changing DQO inputs

Maps, Photos, Floorplans can be imported/exported with sample areas defined and samples displayed.

Sample location coordinates listed and available for output for use in the field (w/GPS)

Detailed 3-15+ page report automatically generated documenting design, assumptions, maps, equations, DQOs, analyses

VSP Features (cont.)

- Interactive Diagnostic Graphics Allow Immediate Evaluation of Tradeoffs
- Visual Features with Sampling Locations Displayed on Maps
- Both Normal and Non-Normal Distribution Methods
- Sensitivity Analysis Features
- Automatic Report Generator for Easy Insertion into QAPPs, SAP
- Online help, User's Manual, Technical Basis Docs
- Download Version 6.0 from http://vsp.pnl.gov/

VSP Features that Help Prevent Misuse

- Statistical methods provided for:
  - Normally distributed data
  - Non-normal or unknown data distribution
- Data Quality Assessment checks of assumptions
  - Tests to assess if data are normally distributed
  - Estimation of variability in the data over space or time
  - Testing and estimation of trends over time
  - Summary statistics of data (mean, max, min, variance, etc.) entered into VSP for the site or sub areas

VSP Features that Help Prevent Misuse (Cont.)

- VSP Expert Mentor to guide use of VSP
  - Systematic Planning Primer
  - Setting up Sites, Maps, and Sample Areas
  - Selecting the Right Sampling Design Module
  - Selecting the Right Parameter Values (not yet implemented)
- Visual map of site and data at sampling locations
  - Help confirm the design is compatible with prior knowledge and the conceptual site model
- Ability to assess cost-effectiveness of alternative measurement methods
  - Field versus lab
- Easily accessed on-line HELP
  - Describes statistical methods used and their underlying assumptions
  - References EPA and other scientific documents
  - Provides definitions of statistical terms

VSP Features that Help Prevent Misuse (Cont.)

- Automatically generated report that documents:
  - Summary of the design, sampling objective and approach
  - Assumptions
  - Design parameters entered into VSP
  - Equations used to compute number of samples
  - Graph of the VSP user's specified performance of the design
  - Assessment of how the number of samples and costs change if design inputs change or are incorrect
  - Guidelines for data analysis

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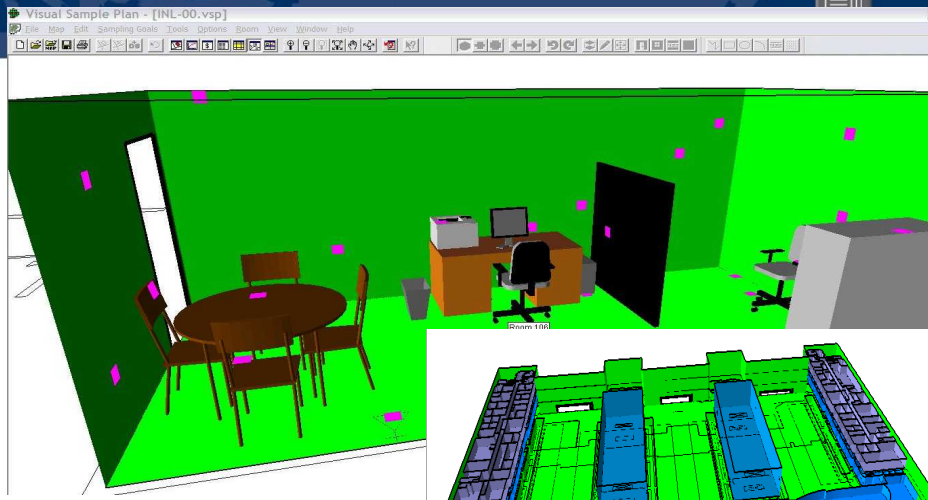
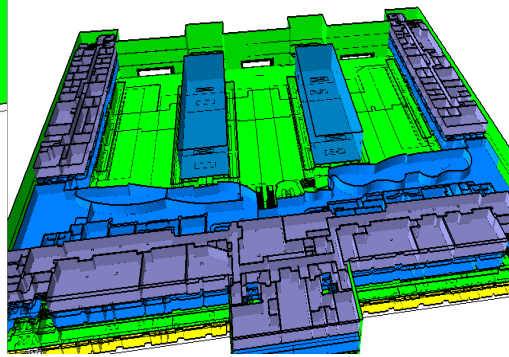
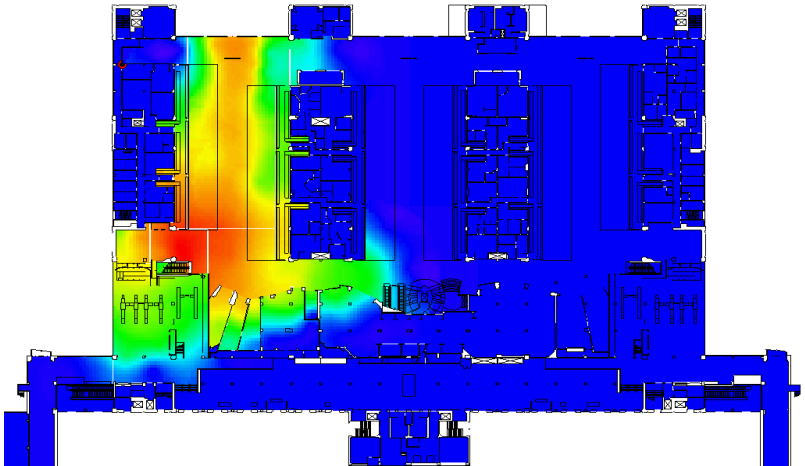
Indoor Surface Sampling and Analysis

- Accurate 3-D Representations
- Zoning of Areas
- Indoor Coordinate System
- Furniture Placement/Sampling
- Sample Results Visualized
- Wipe or Point Samples
- dxf or shp files imported/exported







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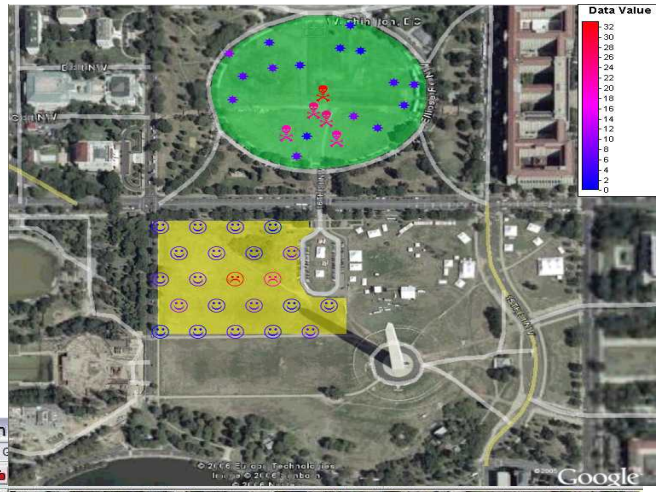
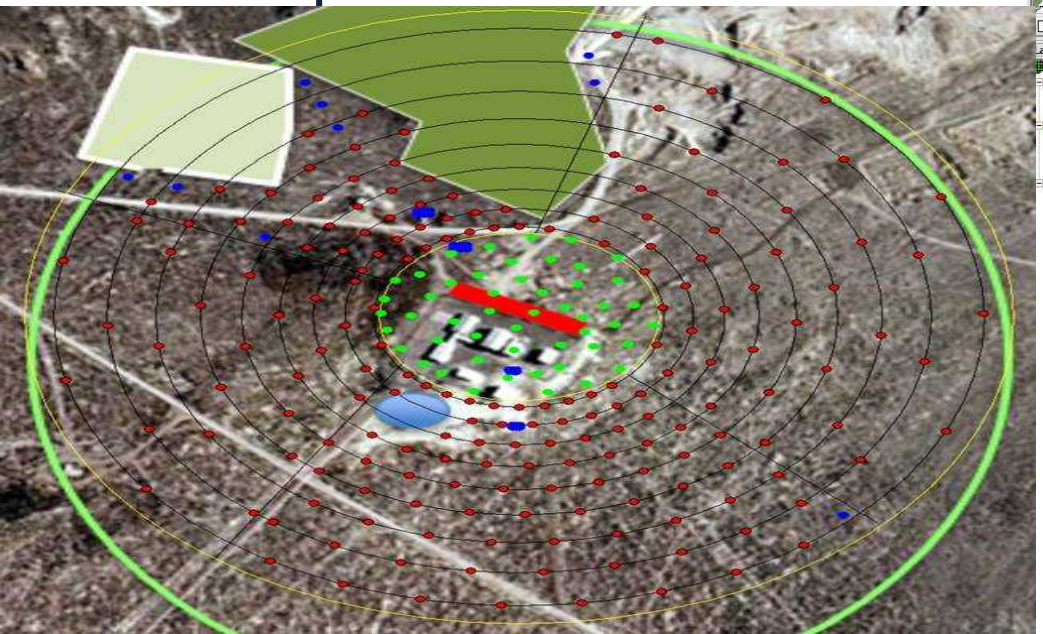
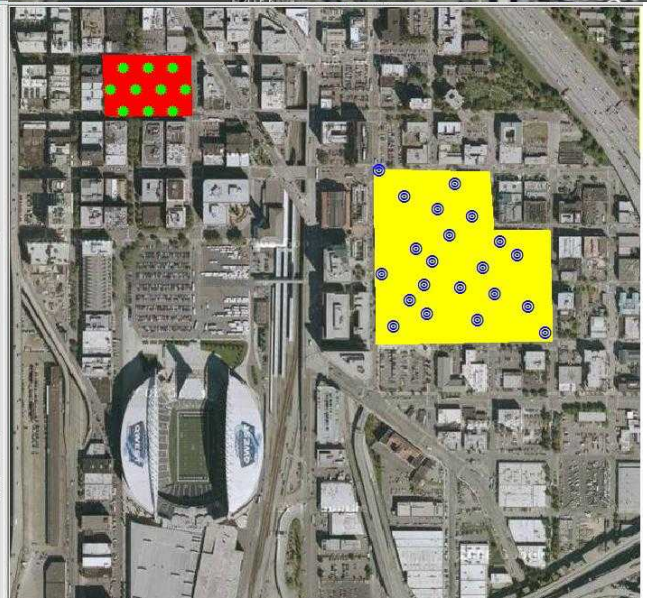
Outdoor Sampling and Analysis

- Maps, Photos/Images
- Maintains Coordinate System
- Output For GPS







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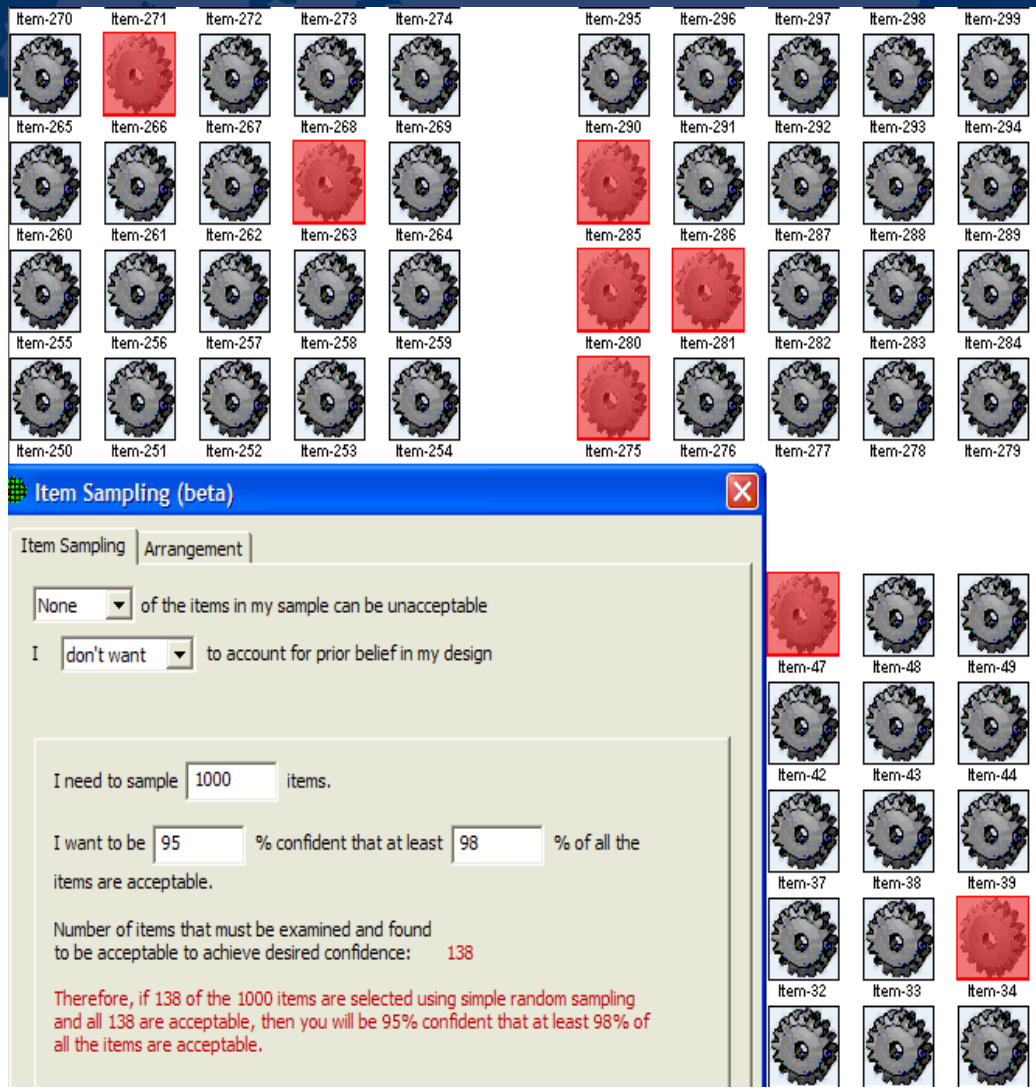
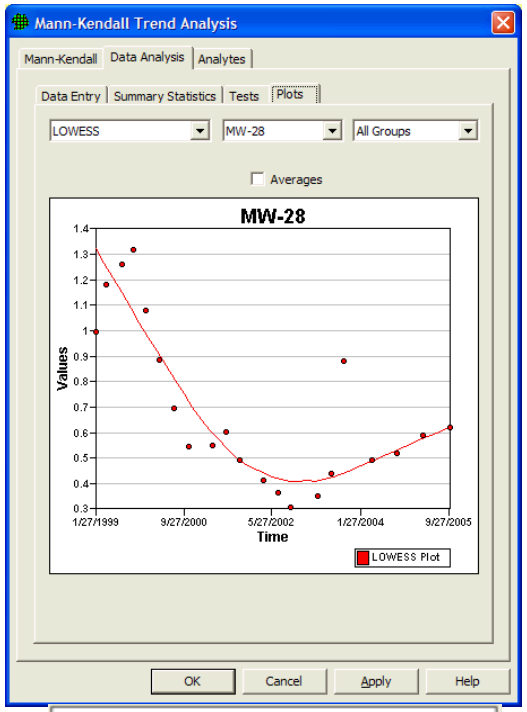
Item Sampling

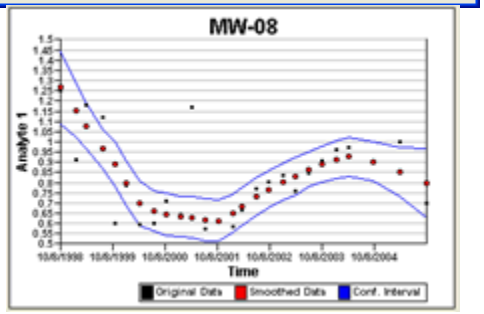
- How Many Items Should I Sample?
- Drums, Folders, Property, Equipment, Widgets….
- X% Confident that Y% Are Acceptable
- 4 Options Available
  - Using Prior Knowledge
  - Judgment w/ Random
  - Probabilistic Only
  - Allow Some

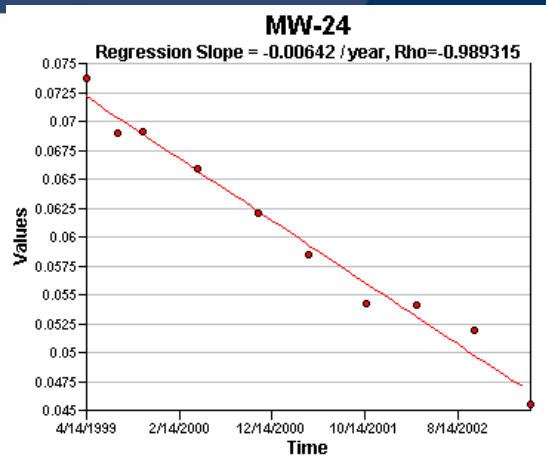


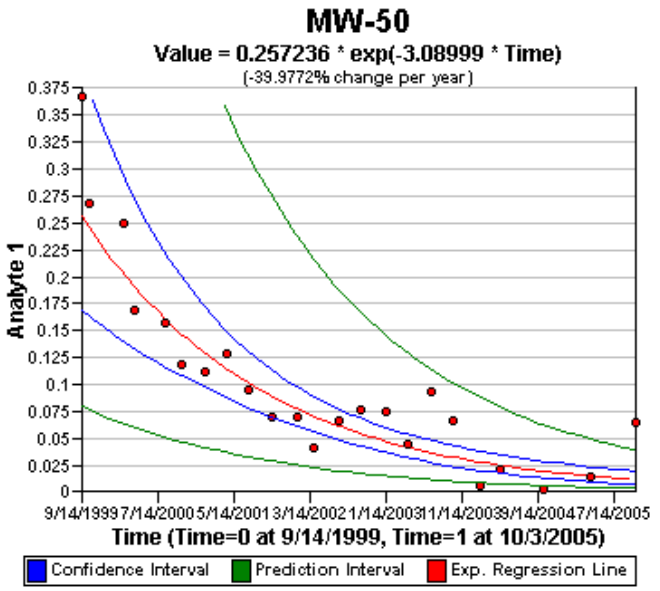
Sampling and Analysis Over Time

- Sample requirements for confidently detecting trends
- Fitting linear and exponential trends
- Evaluating consistency of trends over time
- Projections of when target concentration will be obtained
- Adjustments for seasonal effects
- Sampling frequency reduction analyses



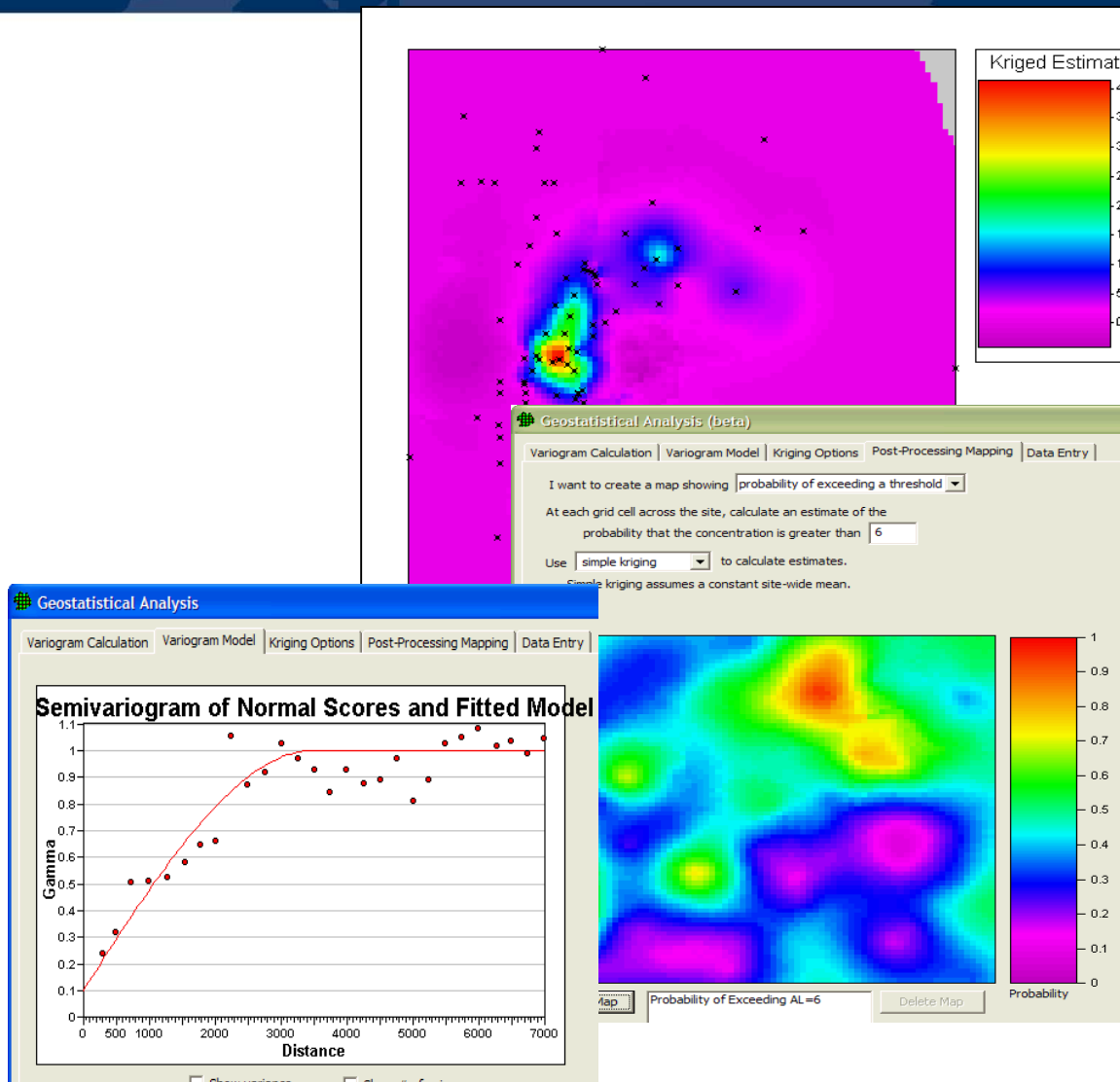






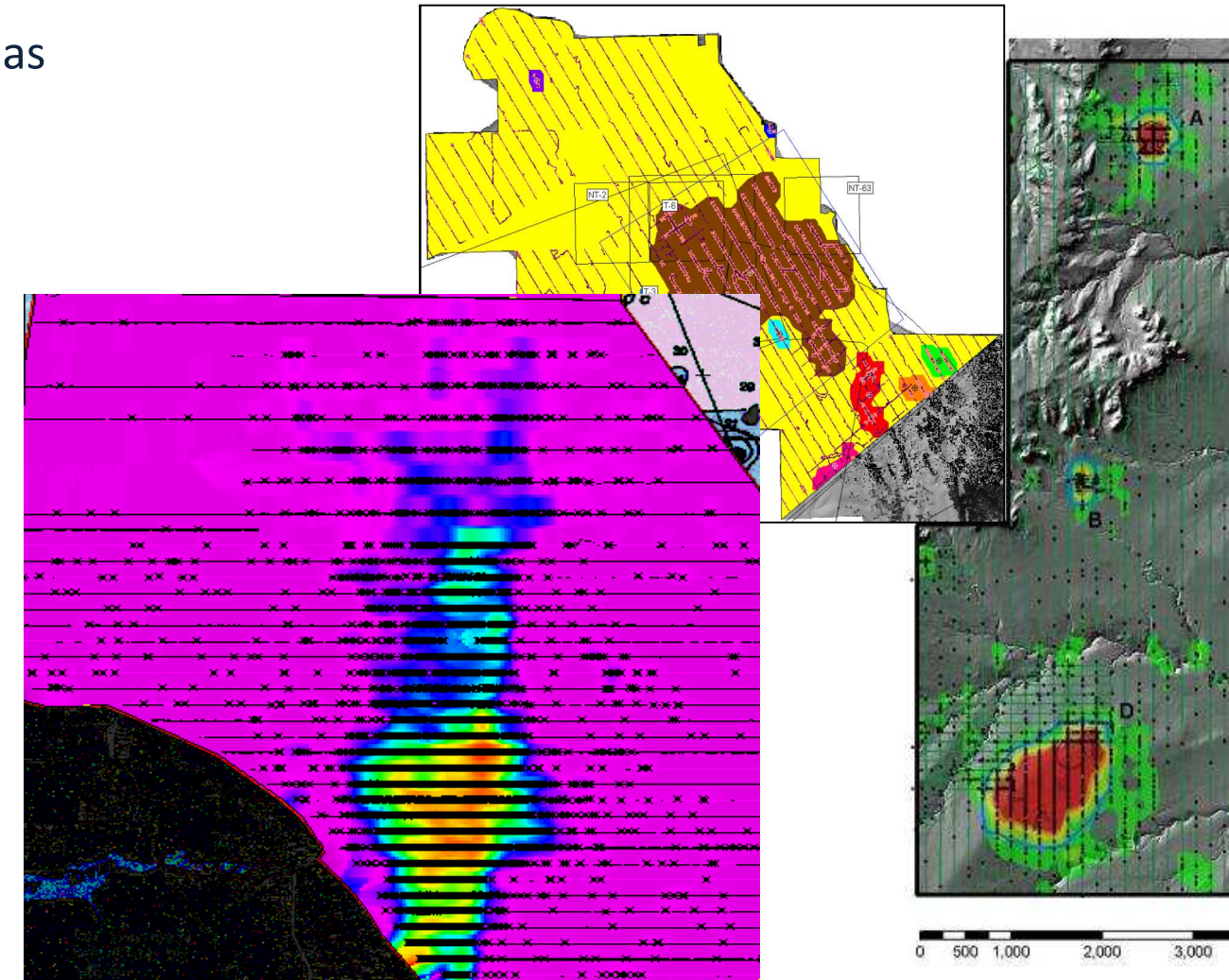
Spatial Sampling and Analysis

- Geospatial Kriging
- Spatial sample/well redundancy analysis
- Optimization of sample/well placement
- Maps of probability of exceeding concentration threshold



Unexploded Ordnance Sites

- Transect design for detection of target areas
- Target area flagging, delineation, anomaly density mapping and estimation
- Post-remediation verification sampling



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