SAND2010-0474C

Monitoring, Assessment and Mitigation

Sandia is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company,
for the United States Department of Energy's National Nuclear Security Administration
under contract DE-AC04-94AL85000.

NNSA

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Topics

- Monitoring Systems
- Data Collection, Analysis and Communication
- Characterization Techniques to Lead into Remediation

Vehicle-Mounted Monitoring Systems

All-Wheel Drive
GPS-Coupled Surveys

Tractor-Pulling Trailer
Arrangement

9 FIDLER Detector
Arrangement

Precision Differential Global
Positioning System (PDGPS)

Other Common Monitoring Systems

Vehicle-Mounted & Backpack GPS-Coupled Surveys

Stroller-Mounted System

Remote tunnel surveyor with radiological detection equipment

Data Collection, Analysis and Communication

Data Collection

- Define Data Collection Objectives
  - EPA 2001: U.S. Environmental Protection Agency, “EPA Requirements for Quality Assurance Project Plans,” EPA QA/R-5, U.S. EPA, Office of Environmental Information, Washington D.C. (2001).
  - Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM), NUREG-1575, DOE/EH-0624, 2000.
  - Multi-Agency Radiation Survey and Assessment of Materials and Equipment Manual (MARSAME), NUREG-1575, Supp.1, DOE/HS-0004, 2009.
- Define Data Quality Objectives
- How Many Samples?
- Field (in-Situ) Sampling?
- Lab Assay?
- Field/Lab Correlation

Common Data Collection Errors

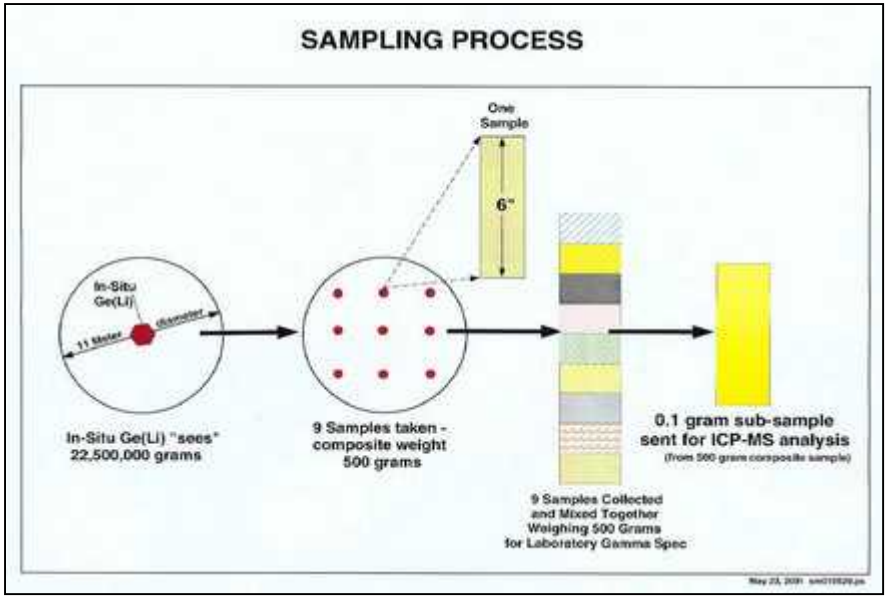
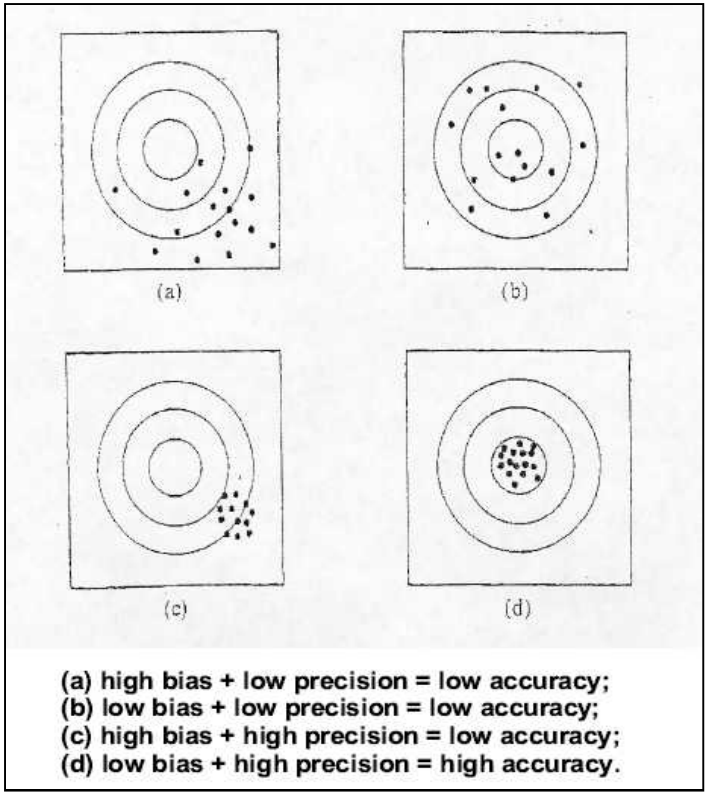


Illustration of Aliquoting Error

Accuracy vs. Precision Illustration



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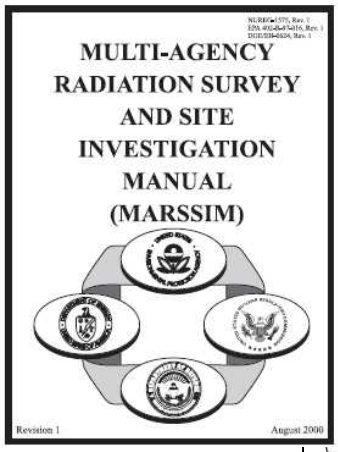
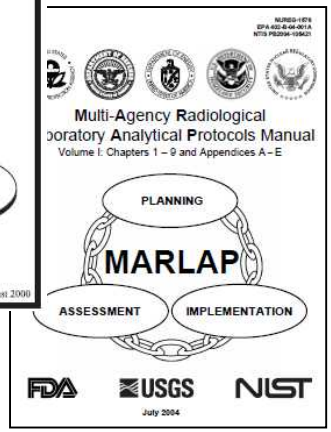
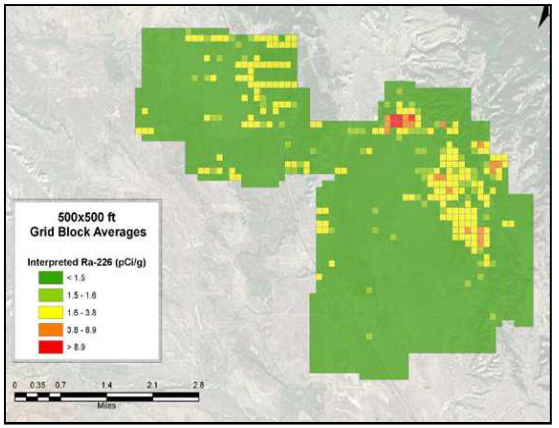
Analysis

- Statistics
  - Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM), NUREG-1575, DOE/EH-0624, 2000.
  - Multi-Agency Radiological Laboratory Analytical Protocols Manual (MARLAP), NUREG-1576, EPA 402-B-04-001A, 2004.
- Computer-Aided (Calculation and Display)
- Manual (Calculators)
- Group-Averaging
- Graphics and Plotting

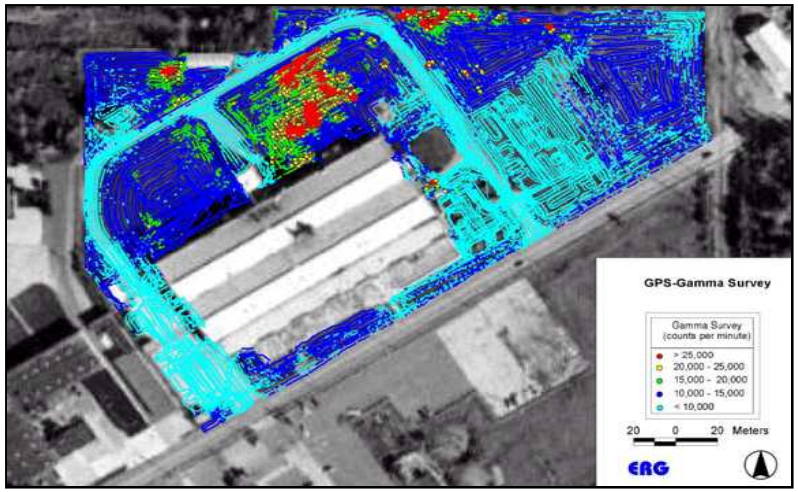
Analysis

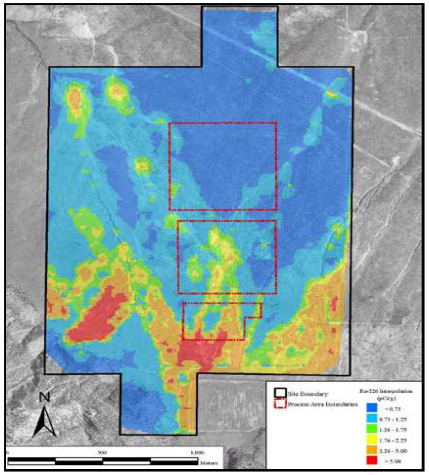






ArcView Computer Viewing and Displays Plus Data Manipulation





ArcView Computer Viewing and Displays

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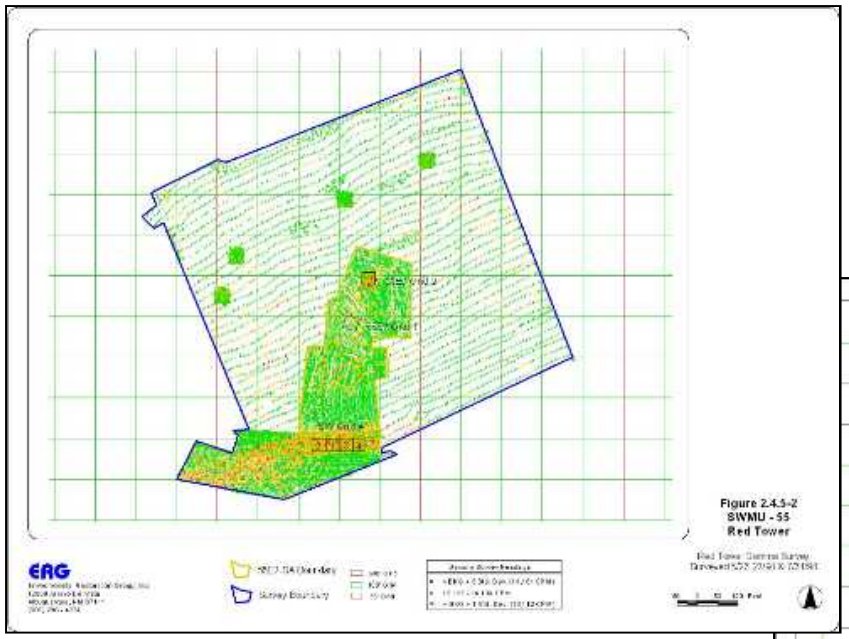
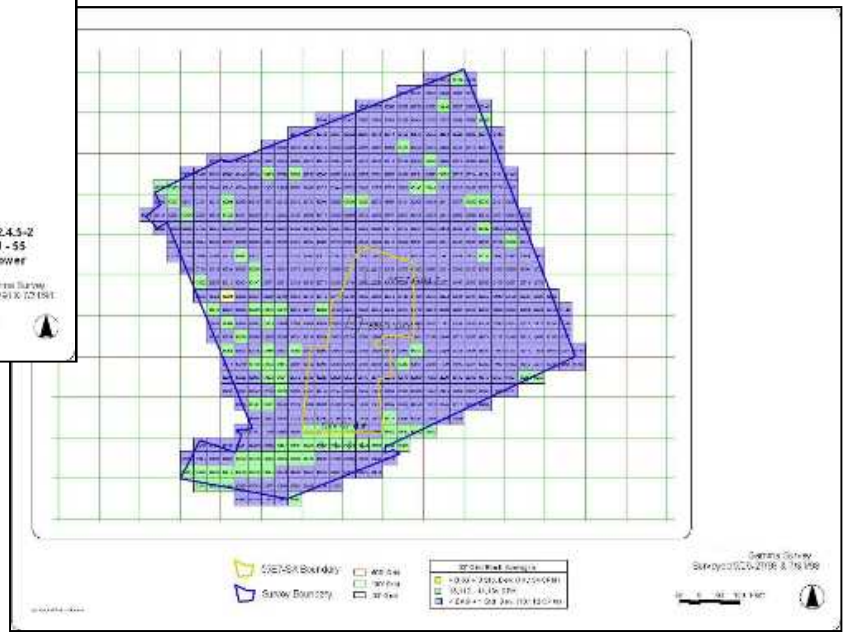
Analysis

Example of Data Manipulation





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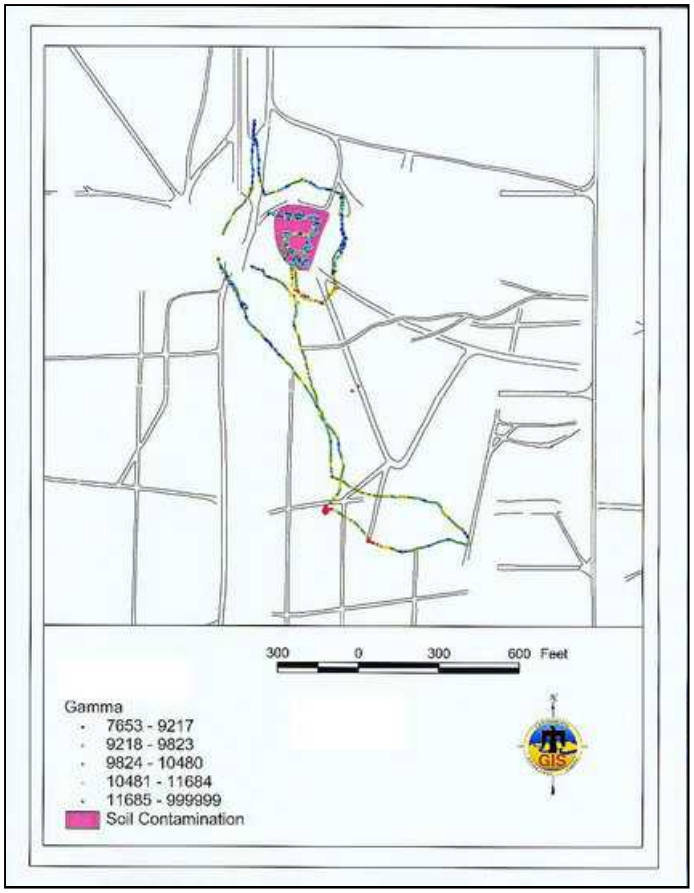
Analysis

GPS/Gamma Shows Where You Surveyed and Logs 100's More Data Points!



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Communication

- Facts, not emotion
- Scientific Method
- Use Objective, Scientific Data Collected to Tell Story
- A Picture is Worth 1,000 Words!
- KISS!
- LISTEN as well as TALK!

Communication

- Tables or Graphs? You choose.
- 1,000s of data in a table versus the same data in a graph
- Environmental Cleanups Produce Large Amounts of Analytical Data!
  - If you're not taking data, you're just making conversation.
  - If you're not analyzing your data, you've wasted a lot of money.
  - Collecting the data is only ½ of the battle.

Environmental Cleanups Produce Large Amounts of Data

- Efficiently/conveniently analyze this data to determine possible “points of interest”
- Separate forest from the trees (maybe it’s ALL trees!)
- Others

How can you efficiently evaluate large amounts of data to identify anomalies that require further investigation?

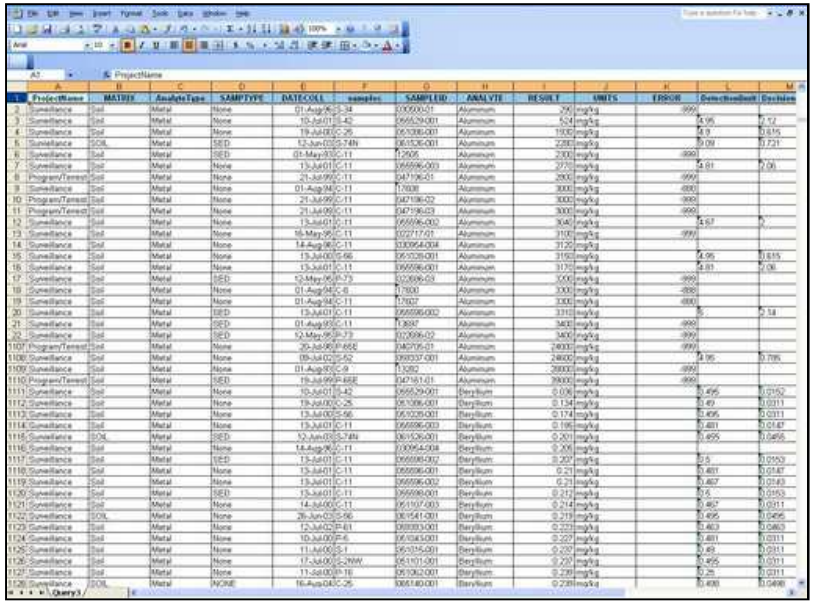
One Approach - Log-Probability Plotting

- A graphical means to examine small/LARGE data sets
- Only first step of several possible iterations
- See if the graphs “suggest” anything and conduct further investigations as suggested by the data themselves
- No pre-determined expectations, although experience will build as you gain practice

A picture is worth a thousand words, and HOURS of time!

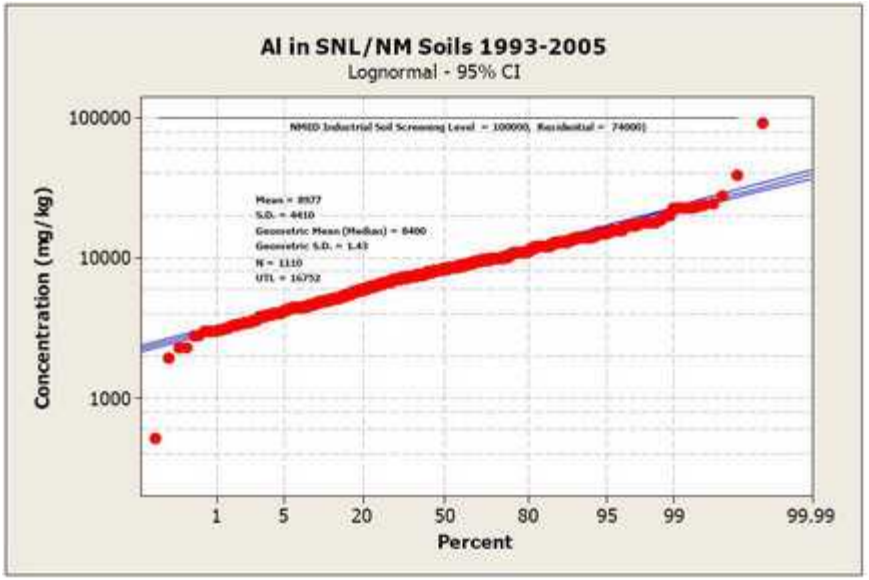
Data Tables vs. Graphical Representation

- You Choose -



Our eyes are not well designed to scan hundreds and thousands of individual data records to identify anomalies.

One picture can represent any number of data records.



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Characterization Techniques to Lead into Remediation

Site Characterization and Mitigation Techniques

- Hand-pickup
- Sophisticated Equipment (SGS)
- Familiar Equipment (Gravel Screener)
- Heavy Equipment (Front-end Loaders)

DU fragments fully corrode 25 - 35 years after impact

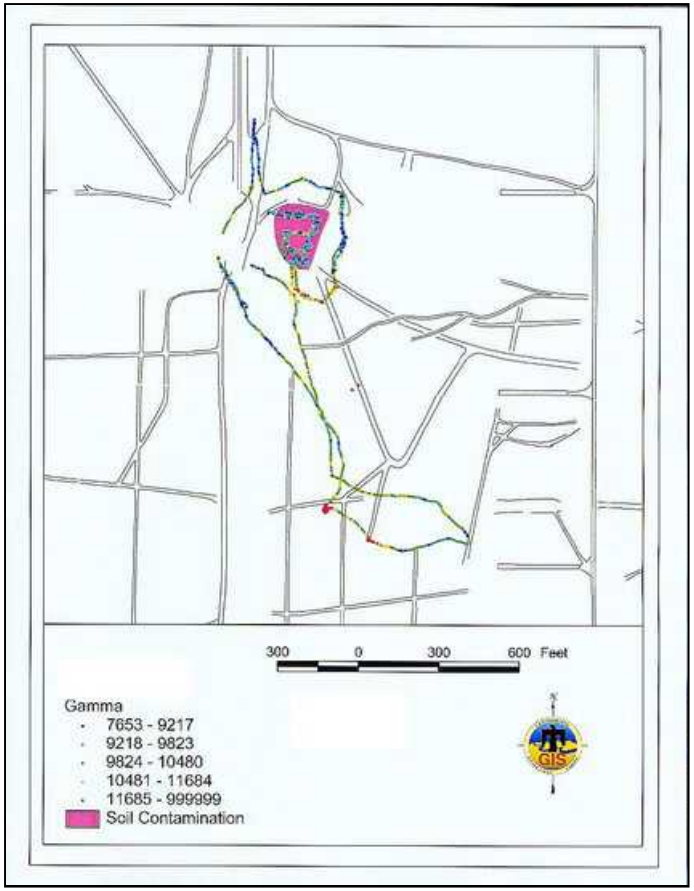
Site Characterization and Mitigation Techniques

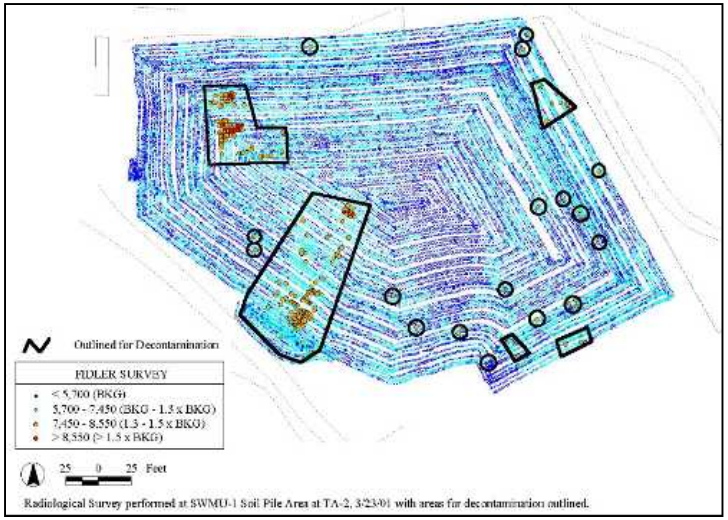
Segmented Gate System and Screen Plant

Survey and Flag For Later Pickup

QUICK Determination of the Extent of Contamination is Essential

- The first pass should be QUALITATIVE,
- Follow-up QUANTITATIVE, as appropriate





GPS / Gamma Survey

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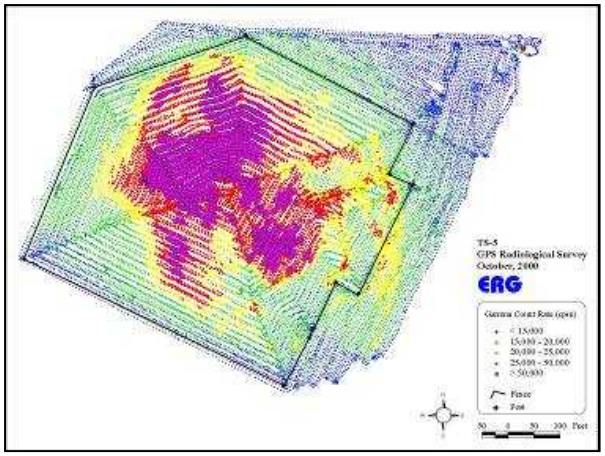
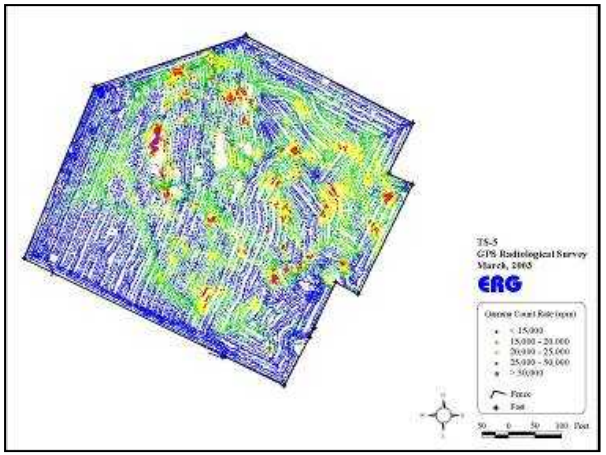
Site Characterization and Mitigation Techniques

Waste Disposal Considerations

- On-site burial?
- Low-level disposal facility?
- What's available?
- Cost?



Before Clean-up



During Clean-up

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Backup Slides

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Considerations

- Results of the soil and sediment samples were evaluated using probability plotting, which provided a visual representation of the entire data set for all locations and for all times sampled. If the results were similar, or fit a linear distribution when plotted on logarithmic or log-probability scales, then the results were attributable to natural origin.
- Summary statistics can be imbedded in each plot.
- If any samples indicated concentrations greater than expected from the rest of the sample distribution, further evaluation is conducted to determine cause for the observed result. Must “drill into” the original data if details are needed.
- Screening Levels (as appropriate) can be included on the graphs.
- Plots can be made for:
  - Dosimetry,
  - Area surveys,
  - Air samples,
  - Environmental samples
  - Other?

Make your plots work for YOU, for your applications.

Additional Applications

- Individual Radionuclides
- Dosimetry
- Area Surveys
- Air Samples
- Explosive Residues
- VOC/SVOC
- Industrial Hygiene
- Compare Calendar Year's Results with Historical Results
- Other?

The possibilities are only limited by your imagination.