

## Statistical Methods for Contaminated Sites

A 2-day course in environmental statistics  
using ProUCL and/or R software

### Course Outline

1. Describing Data Characteristics
  - \* Which statistics for environmental data sets?
  - \* Estimating mass (chronic effects) versus frequency (acute effects)
  - \* What is a percentile? A UCL? Minimum samples sizes needed.
  - \* Dealing with outliers
  - \* When to transform the scale
  - \* Testing data distributions
  - \* Handling nondetect data
  - \* Exercise: describing contaminated soils
2. Using ProUCL 4 Software
  - \* Capabilities
  - \* Computing UCLs, testing data distributions
  - \* Why it recommends what it does
  - \* Exercise: reading in data with nondetects
3. Statistical intervals
  - \* How intervals work
  - \* Computing UCLs
  - \* Coping with skewed data
  - \* Incorporating nondetect data
  - \* Identifying concentrations above background
  - \* Exercise: using ProUCL to compute UCL95 of background data
4. How Hypothesis Tests Work
  - \* Their common denominators
  - \* Their jargon explained
  - \* Parametric and nonparametric tests
  - \* 1-sided and 2-sided tests
  - \* Exercise: testing background vs compliance wells

## DAY 2

### 5. Overview of Testing Group Differences

- \* Power of parametric and nonparametric tests – which is better?
- \* Methods to compare two groups
- \* Comparing more than two groups
- \* Have standards been met?
- \* Incorporating nondetect data
- \* Exercise: comparing previous data to data after cleanup

### 6. How Many Observations Do I Need?

- \* Power
- \* Which units to use?
- \* Parametric and nonparametric tests
- \* Exercise: minimum sample size for testing differences

### 7. Testing trends

- \* What is trend analysis?
- \* Methods available in ProUCL and other software
- \* Determining whether concentrations are increasing or decreasing
- \* Exercise: trend analysis

## QUALIFICATIONS OF INSTRUCTORS

Dr. Dennis Helsel (PhD, Environmental Science and Engineering, Virginia Tech) has 33 years experience applying statistics to practical issues in environmental sciences. He is the owner and lead scientist of Practical Stats, an environmental statistics training and consulting firm. He is the lead author of two textbooks, "Statistical Methods in Water Resources (2002), and "Nondetects And Data Analysis" (2005), as well chapters in two handbooks and over 50 journal articles. The methods from his nondetects book were chosen to be used in ProUCL 4, and he reviewed their implementation. Dr. Helsel was the 2003 recipient of the Distinguished Achievement Award from the American Statistical Association's section on Statistics and the Environment, and of the Dept. of Interior's Distinguished Service Award in 2007. He has been invited to conduct training classes on environmental statistics to the Chinese Ministry of Water Resources; to the Umweltbundesamt (German Environment Agency); to students at the Helsinki University of Technology, Finland; and in the United States through the American Statistical Association. The second edition of his book on nondetects will be released by Wiley in January 2012 under the title *Statistical Methods for Censored Environmental Data using Minitab and R*.

Dr. Edward Gilroy (PhD in Mathematical Statistics - Catholic Univ.) has over 35 years experience as a consulting statistician, most with the US Geological Survey, and coordinated its statistical training. Dr. Gilroy has authored numerous papers on applied statistics, with a focus on quality assurance and on quantifying contaminant mass loadings, and is coauthor of the chapter "Statistical Analysis of Hydrologic Data" in McGraw-Hill's Handbook of Hydrology (1993). Dr. Gilroy has planned and conducted technical training courses since 1990, and was a technical reviewer of the software package Scout, which incorporates ProUCL.