

Exposure Point Concentrations and You: Calculating 95% UCLs and Employing ProUCL to compute them for use as EPCs

Course Overview and Objectives:

MassDEP has stated that they plan to propose revisions to the Exposure Point Concentration (EPC) section of the MCP at 310 CMR 40.0926. Under the current MCP, a data set's maximum concentration level, its arithmetic average, or its 95th percentile upper confidence limit (UCL) can be used to estimate an EPC. It is anticipated that the MCP revisions may separate Disposal Sites into categories of "simple" and "complex," with options that would be available for each category for calculating an EPC. Because complex sites are characterized by contamination that is likely to be dispersed and therefore highly variable, the LSPA expects that MassDEP may likely require more rigorous data evaluations, including the use of a 95% UCL as an EPC, for these sites. To prepare you for these possible changes to the MCP and familiarize you with 95% UCLs, this course will summarize 1) how 95% UCLs are calculated, 2) how you can calculate 95% UCLs using freely available software, and 3) how to apply 95% UCLs in your work as an LSP (or for other professional services), including use of the 95% as an EPC for a risk characterization.

The course will also address a variety of methodological issues, all of which are necessary for calculating and understanding the 95% UCL. In addition to data-distribution issues, we will address problems commonly encountered with environmental data: censored data; non-detects; attempting to make reliable inferences based on small sample size. We will apply the 95% UCL methodology to a variety of data sets, each focusing on a different problem or issue. We will use the ProUCL software (a free software for PCs developed by USEPA) to perform the calculations. We will analyze and interpret the ProUCL output based on what we learned earlier in the course.

Participants should bring a laptop with ProUCL installed (<https://www.epa.gov/land-research/proucl-software>). Note that ProUCL is only available for PCs.

Participants will be asked to do calculations on their own as well as watch the instructors demonstrate calculations.

Course Prerequisites:

It is helpful but not required that participants have a working knowledge of key descriptive statistics such as mean, median, mode, range, variance, and standard deviation. Familiarity with the z-table and t-table for the purpose of calculating probabilities is desirable. Familiarity with the Central Limit Theorem is desirable but not expected.

Instructor Biographies:

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Bernie Morzuch, PhD has taught introductory statistics and intermediate statistics at the undergraduate level for 40 years to approximately 13,000 students at the University of Massachusetts. He has also taught managerial economics and econometrics at the undergraduate level. At the graduate level, he has taught econometrics and time series/forecasting techniques. He has written instructors' manuals and students' solutions manuals for a popular undergraduate textbook used in statistics. He has offered introductory and advanced courses in statistics several times to LSPs in Massachusetts and to LEPs in Connecticut. Bernie holds a PhD in Agricultural Economics from the University of Missouri, Columbia and an MBA from Southern Illinois University, Carbondale.

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Course Syllabus:

Each session below will include opportunities for Q&A.

7:30 - 8:00 Registration

8:00 – 10:00 Why a 95% UCL? Methods of EPC calculation in the MCP (JPK)

The necessary mathematical underpinnings for any 95% UCL (BM):

- Central Limit Theorem; sample mean; sample standard deviation;
- The “appropriate” probability distribution to use;
- Straightforward examples and applications to establish a framework; and
- Interpretation.

10:00 – 10:15 Break

10:15 - 12:00 Different data distributions: normal; log-normal; gamma. (BM)

- Distributional influence on the specification of a 95% UCL.
- Statistical tests for determining which distribution to use.
- What do these tests mean and how do they factor into EPC calculations?

12:00 - 1:00 Lunch

1:00 – 3:00 ProUCL – the vehicle for applications (BM):

- Importing data from Excel spreadsheets into ProUCL; and
- Applying the procedures presented in the course manual and DEP documentation

Fine Tuning: Data problems and their impact on the 95% UCL (BM)

- Censored data; non-detects; small sample size.

Techniques for developing the 95% UCL under these circumstances.

Various other statistical tests and techniques:

- What they mean; how they should be used

3:00 – 3:15 Break

3:15 - 5:00 Application and Case Studies

- Applying the 95% UCL calculation in the context of an MCP risk assessment (JPK)
- How to provide documentation supporting the legitimacy of our 95% UCL calculations for MCP deliverables (JPK)
- Case Studies (BM and JPK)

5:00 Adjourn