ProUCL Utilization 2020
BTVs and UCLs

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Summary of Session 1: ProUCL A to Z

• Objective:
  • Get familiar with ProUCL and some commonly used data analysis features

• We talked about:
  • Starting ProUCL
  • Preparing data for analysis and loading in ProUCL
  • Basics of dealing with missing values and NDs
  • Exploratory Data Analysis
  • Outliers
  • Hypothesis testing
Summary of Session 2: Trend Analysis

• Objective:
  • Use and understand trend analysis tools available within ProUCL

• We talked about:
  • The trickiness of NDs in trend analysis
  • Non-parametric trend tests
  • Ordinary Least Squares Regression
  • Analysis of residuals
  • Data transformations
Learning Objectives

• Objectives
  • Dive into Background threshold values and UCLs within ProUCL

• Today we will discuss:
  • Background threshold values/Upper Tolerance Limits (UTLs)
  • Upper confidence limits (UCLs)
ProUCL Software

- Statistical software for environmental data analysis
- User Guide
  - Provides instructions on how to use ProUCL
- Technical Guide
  - Provides detailed background on statistical methods
Navigating ProUCL
Data Sets

• Superfund.xls
  • In ProUCL Data folder

• TCE-NDs-Blanks-data.xls
  • In ProUCL Data folder
Coverage vs Confidence

• Confidence: We believe an something will occur 95% of the time.

• Coverage: We believe that 95% of our future samples will be below our value.

• Combined UTL95-95: We believe that 95% of all future samples will be below our value, 95% of the time.
Background Threshold Values

- Upper percentiles
- Upper prediction limits (UPLs)
- Upper tolerance limits (UTLs)
- Upper Simultaneous Limits (USLs) – New in ProUCL 5.0/ProUCL 5.1
Background Threshold Values

- **Upper percentiles**
- **Upper prediction limits (UPLs)**
- **Upper tolerance limits (UTLs)**
- **Upper Simultaneous Limits (USLs) – New in ProUCL 5.0/ProUCL 5.1**

Based upon an established background data set, a 95th percentile represents that statistic such that 95% of sampled data will be less than or equal to the value of the 95th percentile.
Background Threshold Values

• Upper percentiles
• Upper prediction limits (UPLs)
• Upper tolerance limits (UTLs)
• Upper Simultaneous Limits (USLs) – New in ProUCL 5.0/ProUCL 5.1

• 95% UPL is the value such that we are 95% sure that a single sample from an established population will fall below it.
UPLs and UCLs

Classical Regression

confidence intervals

prediction intervals
Background Threshold Values

- Upper percentiles
- Upper prediction limits (UPLs)
- Upper tolerance limits (UTLs)
- Upper Simultaneous Limits (USLs) – New in ProUCL 5.0/ProUCL 5.1

- UTL95-95 is the value such that 95% of recorded samples will fall below it 95% of the time.
Background Threshold Values

- Upper percentiles
- Upper prediction limits (UPLs)
- Upper tolerance limits (UTLs)
- Upper Simultaneous Limits (USLs) – New in ProUCL 5.0/ProUCL 5.1

- USL95 is the value such that ALL sample values fall below it with 95% confidence.
1. Click **Upper Limits/BTVs ➤ Full (w/o NDs)**

**UTLs Without NDs**

- Options for Normal, Gamma, and Non-parametric
- Represent not to exceed background values
- Can compute for next K observations
- Bare minimum 6 background samples
1. Click **Upper Limits/BTVs** ➤ **With NDs** ➤ **Non-Parametric**

**UTLs with NDs**

- Options for Normal, Gamma, and Non-parametric
- Represent not to exceed background values
- Can compute for next $K$ observations
- Bare minimum 6 background samples
Click UCLs/EPCs ➤ Full (w/o NDs) ➤ Normal

UCLs without NDs

- Options for Normal, Gamma, and Non-parametric
- Represent upper estimate of the mean
- Minimum 8 samples for parametric
- Minimum 14 samples for non-parametric
1. Click UCLs/EPCs ➤ Full (w/o NDs) ➤ Gamma, Lognormal, Non-Parametric, or All

UCLs with NDs

- Options for Normal, Gamma, and Non-parametric
- Represent upper estimate of the mean
- Minimum 8 Detects for parametric
- Minimum 14 Detects for non-parametric
## Limits summary

<table>
<thead>
<tr>
<th>Limit</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>95% - UCL</td>
<td>Mean of sample set falls below UCL 95% of the time</td>
</tr>
<tr>
<td>95% - UTL</td>
<td>95th percentile of sample data falls below UTL 95% of the time</td>
</tr>
<tr>
<td>95% - UPL</td>
<td>Next observed point falls below UPL 95% of the time</td>
</tr>
<tr>
<td>95% - USL</td>
<td>All values in sample data fall below USL 95% of the time</td>
</tr>
</tbody>
</table>
Final remarks

• Consider which BTV make sense for your site
• Consider the benefits of different limit generating methodology
• Double check your sample size
• When in doubt consult statistician
• Document any analysis steps and decisions made
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