

# **UCL Calculator v 1.0**

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# *Exposure Point Concentration*

A key element of the risk assessment process for suspected contaminated sites is the estimation of the concentration of chemicals of concern in various environmental media. This concentration is commonly referred to as the exposure point concentration or EPC.

The EPC is typically a conservative estimate of the average chemical concentration.

The “conservative estimate” commonly used is the upper limit of a one-sided 95% confidence interval for the concentration mean.

- Need a method of estimating the concentration mean.
- Need a method of computing the one-sided 95% confidence interval.

# *Calculating the Concentration Term for a Risk Assessment*

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EPA, 2002, Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites, Office of Emergency and Remedial Response, US EPA, Washington, DC. OSWER 9285.6-10, December 2002.

Discussion of all the issues (non-detects, non-normal distributions, etc)  
– Recommendation for the use of different methods.

EPA Recommendations are implemented in PROUCL v3. But PROUCL v3 does not provide methods to handle BDL (censored) data.

UCL Calculator version 1.0 (FI UCL) implements most of the EPA 2002 recommendations but does provide methods of estimating with BDL data.

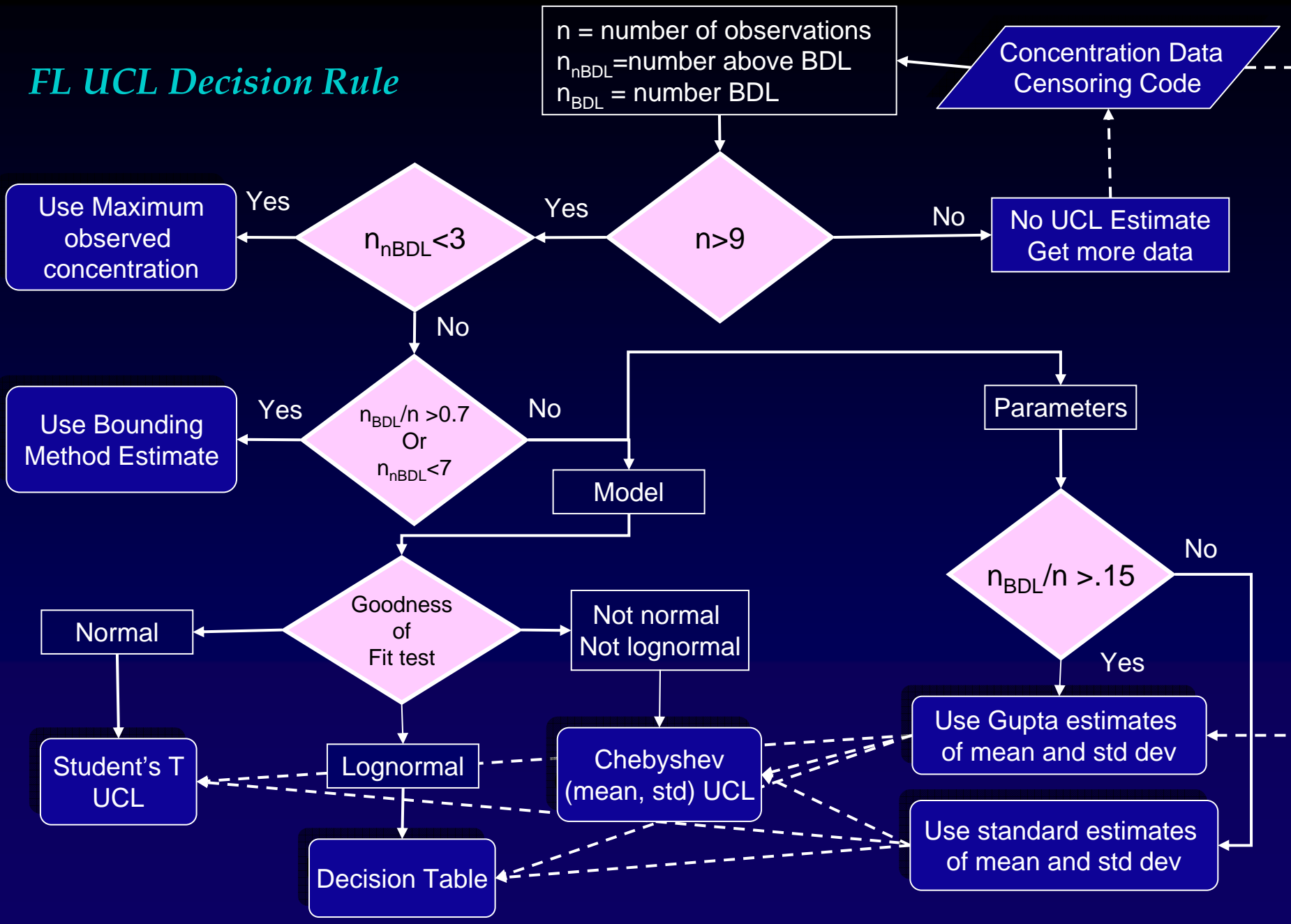
# *What is the Florida UCL Calculator?*

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- An Excel Add-In tool that implements a set of decision rules to aid risk assessors in the appropriate selection and computation of the 95% UCL for a set of concentration data.
- The UCL Calculator decision protocol is designed to:
  - » Yield a 95% UCL estimate that is closest among all methods to the true mean while continuing to provide 95% coverage probability.
  - » Use state of the science estimation methods to handle below detection limit data.
  - » Use state of the science tests of distributions on data containing below detection limit data.
  - » Choose the method based on sample size, coefficient of variation, underlying distribution and **degree of censoring**.

# FL UCL Decision Rule

$n$  = number of observations  
 $n_{nBDL}$  = number above BDL  
 $n_{BDL}$  = number BDL



# Lognormal Data Decision Table

CV	Number of Observations			
	10-14	15-24	25-50	50+
0 - 0.25	Method A			
0.25 - 1.25	Method B		Method C	
1.25 - 1.80	Method C			
1.80 - 2.00			Method D	
2.00 - 2.20	Method C			
>2.20	Method D			

Method A – UCL estimated using the 95% Chebychev (MVUE) method.

Method B – UCL estimated as the minimum of 1) EPA H-statistic UCL, and 2) 95% Chebychev (MVUE) UCL.

Method C – UCL estimated as the minimum of 1) EPA H-statistic UCL, 2) 95% Chebychev (MVUE) UCL, and 3) 95% Chebychev (sample mean, sample standard deviation) UCL.

Method D – UCL estimated as the minimum of 1) EPA H-statistic UCL, 2) 95% Chebychev (MVUE) UCL, 3) 95% Chebychev (sample mean, sample standard deviation) UCL and 4) the Central Limit Theorem UCL

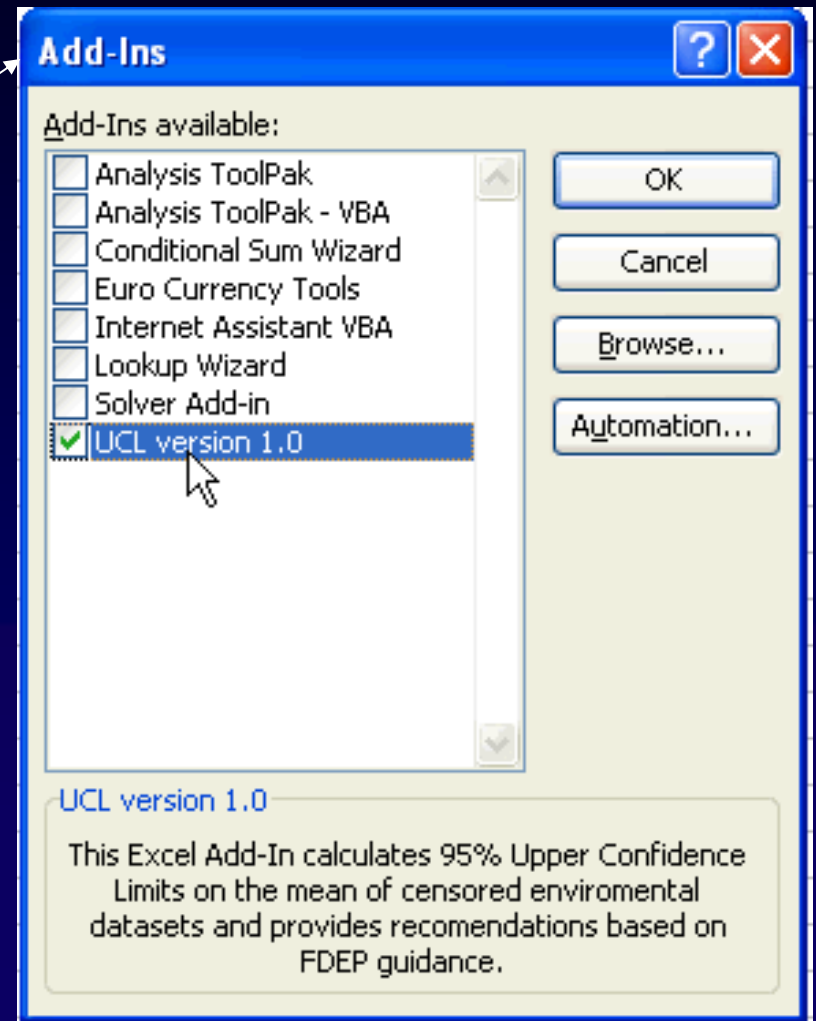
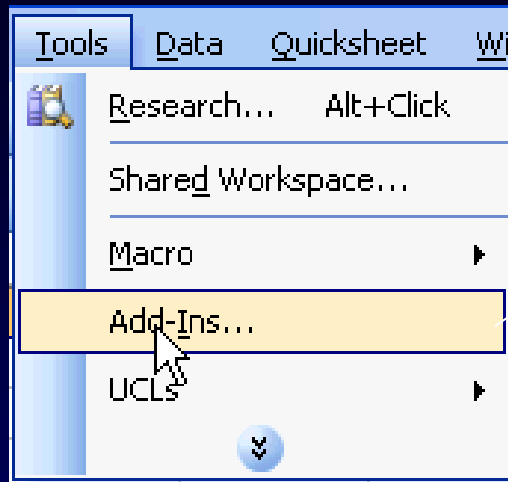
## *How is UCL Calculator v 1.0 different from UCL Calculator v 0.96*

- Additional software help provided from Help item on Menu bar.
  - » Technical help.
  - » Sample size issues help.
  - » Developers and contacts help.
- Indicates when the maximum observed concentration might be acceptable as an estimate for the Exposure Point Concentration.
- Incorporates best recommendations for providing an estimate for the Exposure Point Concentration in the situation where there are many samples but few detectable observations.

# What UCL Calculator v 1.0 Does Not Do!

- Will not make recommendations when there are too few observations (total observations less than 10).
- Will not make recommendations when the number of observations that are greater than detection is too few (the actual number depends on the total sample size with fewer needed with larger sample sizes but at a minimum you need 3 observations above DL).
- Does not test for the Gamma distribution, nor does it use the Gamma based 95% UCL ( a feature incorporated in ProUCL 2004).

## Enabling the Add-In



If installation is successful, UCL version 1.0 will show up as an available Add-In.

# Assessing Help

**FL UCL V1.0 Help**

Hide Back Print Options

Contents Search

- Help Home
- Installation Guide
- Situation
- What is a 95% UCL?
- Why a 95% UCL tool?
- How does this tool compare to PROUC
- The FI UCL Protocol
- Have enough observations been made
- Sample Size Issues.
- What is the form of the underlying conc
- How does FI UCL estimate the 95% UC
- What is the basis for the decision rules
- Estimation in the presence of below del
- Estimating the mean and standard devi
- Minimum variance unbiased estimates f
- Estimating the Coefficient of Variation
- A note on the jackknife and bootstrap e
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- List of the 9 UCL estimation methods co
- Description of the Monte Carlo experim
- Parameter settings for distributions in M
- Assessing Normality for Censored Data
- Computing a Normal quantile plot
- Formal goodness of fit tests.
- The central limit theorem method of esti
- Student's T method of estim
- The EPA H-statistic Method of estimatir
- The Chebychev Method of estimating t
- The Bounding method of estimating a S
- Using the Maximum Observed Concent
- References and Related Literature
- FI UCL Developers and Contact Inform.

## Welcome to FI UCL

FL UCL is an Excel Add-In tool designed to properly calculate the average concentration of a potential contaminant for a study site. For most risk calculations, the value of the upper 95% confidence interval bound for the sample mean is used. There are a number of methods currently developed to perform this calculation. This program has implemented most of these methods as well as the graphical and statistical tests needed to make the decision on the appropriate method to use in specific situations. Using knowledge derived from simulation studies and experienced users, a decision algorithm has been implemented which produces a recommended value for the 95% UCL.

For an overview of methods for calculating upper confidence limits for exposure point concentrations at hazardous waste sites see [EPA \(2002\)](#).

These help files describe in some detail the estimation methods, simulation studies, graphics, statistical tests and decision rules that are the foundation of the FI UCL tool. Specific topics are assessable using the CONTENTS tag in the left panel. Use the SEARCH tag in the left panel to search specific words from the whole help file.

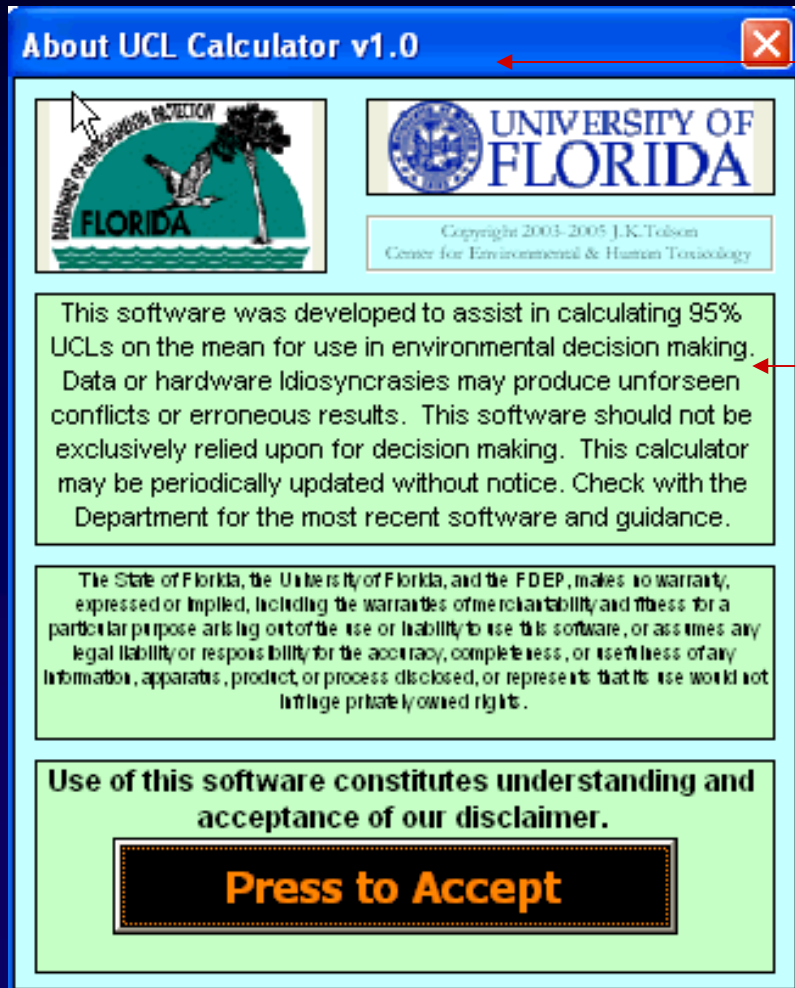
Microsoft Excel Help F1

- Contact Us
- Customer Feedback Options...
- About Microsoft Office Excel
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- Technical Background
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- Contacts
- About

- Help files require Internet Explorer v 4.0 or higher.
- Help files are in .chm (compiled html) formats.
- The help files are on the distribution and you can use a converter to get them to a browser-based help system.

Should see only once.

# About Screen

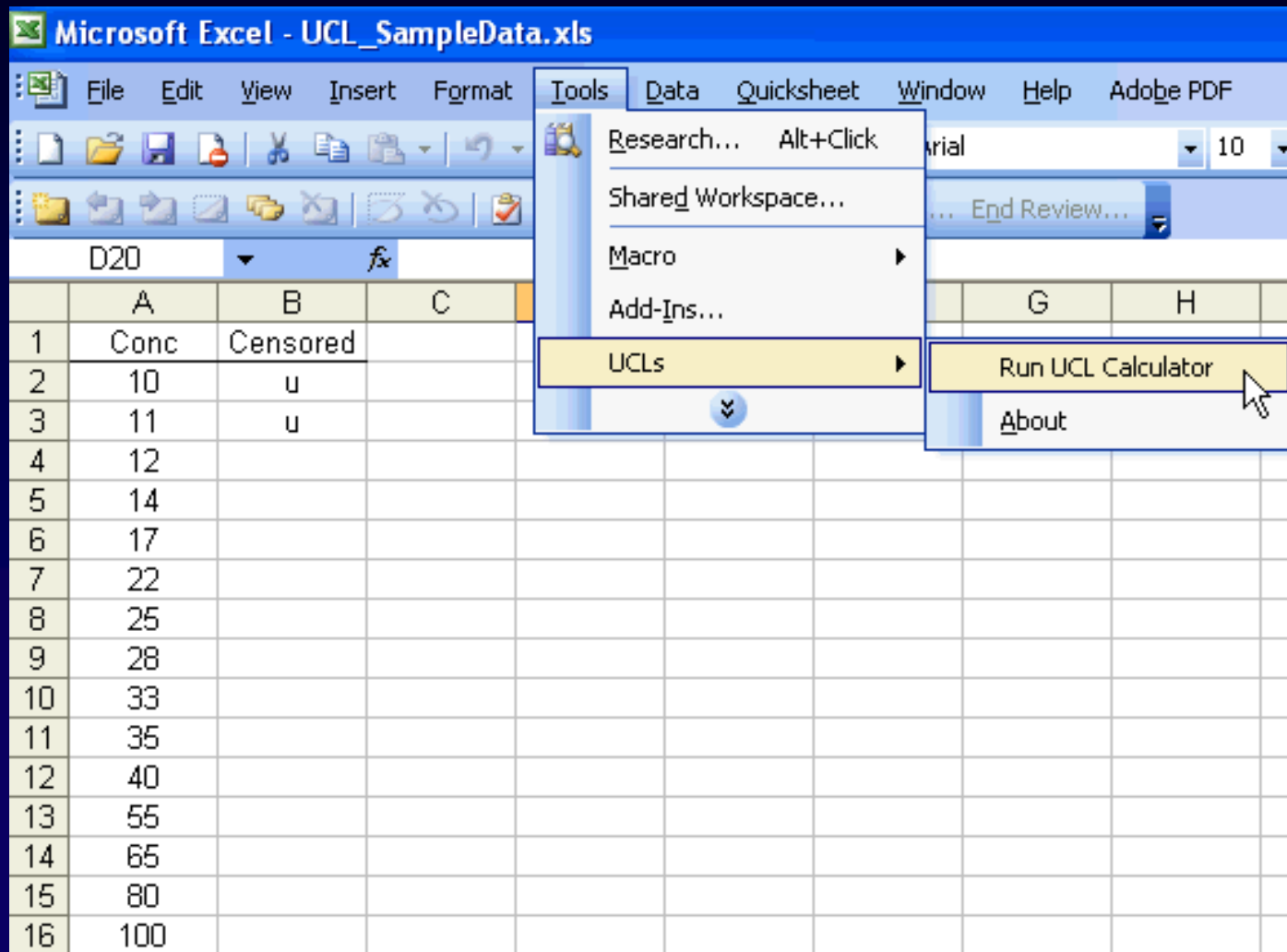


Version: 1.0

Disclaimers

Read and proceed

# Run the UCL Calculator



The screenshot shows the Microsoft Excel interface with the 'Tools' menu open. The 'UCLs' option is selected, and a sub-menu is displayed with 'Run UCL Calculator' highlighted. The spreadsheet data is as follows:

	A	B	C
1	Conc	Censored	
2	10	u	
3	11	u	
4	12		
5	14		
6	17		
7	22		
8	25		
9	28		
10	33		
11	35		
12	40		
13	55		
14	65		
15	80		
16	100		

	A	B
1	Conc	Censored
2	10	u
3	11	u
4	12	
5	14	
6	17	
7	22	
8	25	
9	28	
10	33	
11	35	
12	40	
13	55	
14	65	
15	80	
16	100	

# Identifying Data

**UCL Calculator Add-In** ✕

Select a TWO column Data Range that includes the data in the first column and any lab qualifiers in the second. Data below the censoring level are assumed reported at the detection limits unless specified.

**Data Range**

Enter Data Columns/Range

First Row Contains Labels

**Laboratory Qualifier Coding**

Code for Estimated  (A-Z upper case)

Code for Below Detection  (A-Z upper case)

Data Below Detection Limit Reported in Data Range as 1/2

Click on the dash to enable interactive identification of values and codes

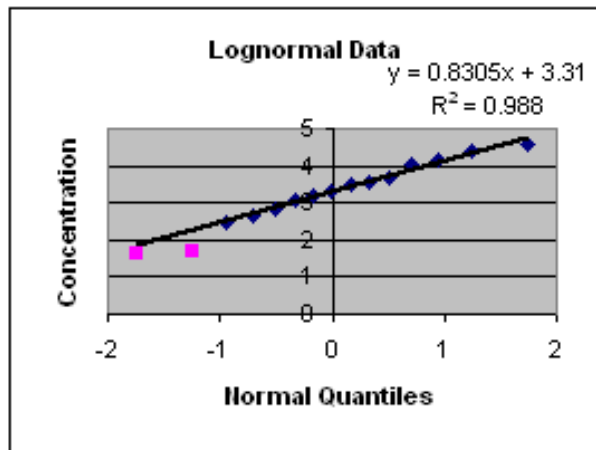
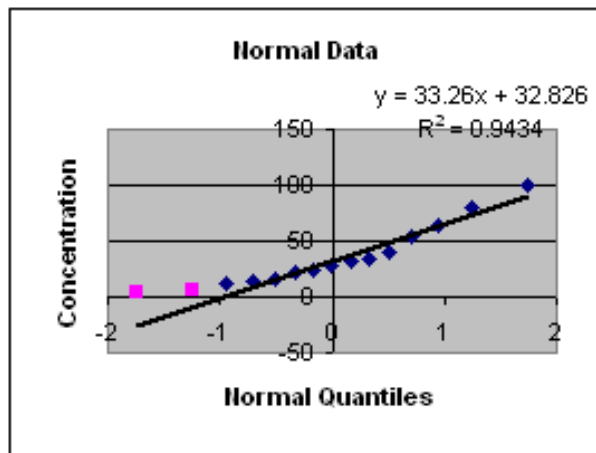
Press to Select Data

If there are BDL values, what is the code used in the censored data column.

# Goodness of Fit Test Results

## FDEP UCL Calculator Version 1.0

Goodness-of-fit test results



### Shapiro-Francia Results (Adjust for Censoring)

SF for Normal Distribution	0.9434
SF for LogNormal Distribution	0.988
Shapiro-Francia critical value for $p < 0.05$	0.94049

Test stat > critical value indicates a reasonable fit

### Shapiro-Wilk's Test Results for All Data (BDL replaced with 1/2 DL)

SW test statistic for Normal Distribution	0.896
SW test statistic for LogNormal Distribution	0.963
Shapiro-Wilk's critical value for $p < 0.05$	0.881

Test stat > critical value indicates a reasonable fit

**Based on the results of the Shapiro-Wilk's test  
 Distribution is best described as: Lognormal**

Lognormal

# Estimates Worksheet

	A	B	C	D	E	F	G	H	I	J
1	<b>FDEP UCL Calculator Version 1.0</b>						5/11/05			
2										
3										
4	<b>Summary Statistics for</b>					<b>Summary Statistics for ln()</b>				
5	Number of Samples			15	Minimum			1.609438		
6	Number of Censored Data			2	Maximum			4.60517		
7	Minimum			5	Mean			3.254876		
8	Maximum			100	Standard Deviation			0.891902		
9	Mean			35.76667	Variance			0.795489		
10	Median			28	<b>Goodness-of-Fit Results</b>					
11	Standard Deviation			27.96992	Distribution Recommended			Lognormal		
12	Variance			782.3167	Distribution Used			Lognormal		
13	Coefficient of Variation			0.782011	<b>Estimates Assuming Lognormal Distribution</b>					
14	Skewness			1.100581	MLE Mean			38.57562		
15										
16	<b>95% UCL (Assuming Normal Data)</b>				MLE Standard Deviation			42.52995		
17	Student's-t			48.4865	MLE Median			25.9164		
18										
19	<b>95% UCL (Adjusted for Skewness)</b>				MLE Coefficient of Variation			1.102508		
20	Adjusted-CLT			49.83968	MVUE Estimate of Mean			37.075		
21	Modified-t			48.82854	MVUE Estimate of Std. Dev.			35.9878		
22										
23	<b>95% Non-parametric UCL</b>				MVUE Estimate of SE			9.785651		
24	CLT			47.64653	MVUE Coefficient of Variation			0.970675		
25	Jackknife			NA	<b>UCL Assuming Lognormal Distribution</b>					
26	Standard Bootstrap			46.6317	95% H-UCL			72.9737		
27	Bootstrap-t			55.17154	95% Chebyshev (MVUE) UCL			79.72968		
28	Chebyshev (Mean, Std)			67.24651	99% Chebyshev (MVUE) UCL			134.4413		
29										
30										
31										
32										
33										
34										
35										

<b>FDEP Recommended UCL to Use:</b>
72.9737

What is displayed will change with datasets and distributional assumptions.

Header Note.

High degree of censoring.

Bounding Method

	A	B	C	D	E	F	G	H	I	
1	<b>FDEP UCL Calculator Version 1.0</b>							5/11/05		
2	<i>Note: Bounding estimates are worst case 95% UCLs based on the Chebyshev (mean, std) method.</i>									
3										
4	<b>Summary Statistics for</b>				<b>Summary Statistics for</b>					
5	Number of Samples			37	Minimum				NA	
6	Number of Censored Data			29	Maximum				NA	
7	Minimum			0.8	Mean				NA	
8	Maximum			45	Standard Deviation				NA	
9	Mean			3.516216	Variance				NA	
10	Median			0.6						
11	Standard Deviation			9.251171	<b>Goodness-of-Fit Results</b>					
12	Variance				Distribution Recommended				NA	
13	Coefficient of Variation			2.631002	Distribution Used				Neither	
14	Skewness			3.619367						
15										
16	<b>95% UCL (Assuming Normal Data)</b>				<b>Estimates Assuming Lognormal Distribution</b>					
17	Student's-t			NA	MLE Mean				NA	
18					MLE Standard Deviation				NA	
19	<b>95% UCL (Adjusted for Skewness)</b>				MLE Median				NA	
20	Adjusted-CLT			NA	MLE Coefficient of Variation				NA	
21	Modified-t			NA	MVUE Estimate of Mean				NA	
22					MVUE Estimate of Std. Dev.				NA	
23	<b>95% Non-parametric UCL</b>				MVUE Estimate of SE				NA	
24	CLT			NA	MVUE Coefficient of Variation				NA	
25	Jackknife			NA						
26	Standard Bootstrap			NA	<b>UCL Assuming Lognormal Distribution</b>					
27	Bootstrap-t			NA	95% H-UCL				NA	
28	Chebyshev (Mean, Std)			NA	95% Chebyshev (MVUE) UCL				NA	
29					99% Chebyshev (MVUE) UCL				NA	
30	<b>95% Bounding Method UCL</b>									
31	Bounding (Max)			10.14559	<b>FDEP Recommended UCL to Use:</b> 10.14559					
32	Bounding (1/2 DL)			9.98175						
33										
34										

Note

	A	B	C	D	E	F	G	H	I	
1	<b>FDEP UCL Calculator Version 1.0</b>							5/11/05		
2	<i>Note: Too few observations available to compute UCLs - Use Maximum.</i>									
3										
4	<b>Summary Statistics for</b>				<b>Summary Statistics for</b>					
5	Number of Samples			37	Minimum			NA		
6	Number of Censored Data			35	Maximum			NA		
7	Minimum			32	Mean			NA		
8	Maximum			45	Standard Deviation			NA		
9	Mean			3.516216	Variance			NA		
10	Median			0.6						
11	Standard Deviation			9.251171						
12	Variance									
13	Coefficient of Variation			2.631002						
14	Skewness			3.619367						
15										
16	<b>95% UCL (Assuming Normal Data)</b>									
17	Student's-t			NA						
18										
19	<b>95% UCL (Adjusted for Skewness)</b>									
20	Adjusted-CLT			NA						
21	Modified-t			NA						
22										
23	<b>95% Non-parametric UCL</b>									
24	CLT			NA						
25	Jackknife			NA						
26	Standard Bootstrap			NA						
27	Bootstrap-t			NA						
28	Chebyshev (Mean, Std)			NA						
29										
30										
31										
32										
33										
34										
--										
				<b>Goodness-of-Fit Results</b>						
				Distribution Recommended			NA			
				Distribution Used			Neither			
				<b>Estimates Assuming Lognormal Distribution</b>						
				MLE Mean			NA			
				MLE Standard Deviation			NA			
				MLE Median			NA			
				MLE Coefficient of Variation			NA			
				MVUE Estimate of Mean			NA			
				MVUE Estimate of Std. Dev.			NA			
				MVUE Estimate of SE			NA			
				MVUE Coefficient of Variation			NA			
				<b>UCL Assuming Lognormal Distribution</b>						
				95% H-UCL			NA			
				95% Chebyshev (MVUE) UCL			NA			
				99% Chebyshev (MVUE) UCL			NA			
				<b>FDEP Recommended UCL to Use:</b>						
				45						

Max  
Concentration