
State of Alaska

**DEPARTMENT OF
ENVIRONMENTAL CONSERVATION
DIVISION OF WATER**



**Alaska Statistical Spreadsheet Tools
for Natural Condition Evaluation,
User Guides, Version 2**

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Introduction

This document provides a brief User Guide for the Alaska Statistical Spreadsheet Tools for natural condition evaluation. These comprise two separate tools – the Alaska Natural Conditions Tool and the Alaska Concurrent Measurements Tool. The Natural Conditions Tool is designed to evaluate the statistical distribution of natural condition or reference data, providing a basis for permits or compliance monitoring. The Concurrent Measurements Tool is designed to aid analysis of cases where the natural condition is defined on an *ad hoc* basis by comparison to concurrent measurements at an unimpacted reference site. Both spreadsheets are designed to be used with the Alaska Natural Conditions Guidance (ADEC, 2006).

The original spreadsheets and User Guide were provided to Alaska DEC (ADEC) in June 2007. The tools were initially developed with a focus on metals and other naturally occurring priority pollutants. Since that time, Alaska DEC has expressed interest in using the approach for other types of parameters, such as turbidity and DO. These parameters also need to meet the less restrictive of the published criterion and the natural condition, so a similar analysis is appropriate. Indeed, turbidity standards are expressed only in relationship to the natural background, so an analysis of background is particularly important there.

Based on initial experience in applying the tools, ADEC requested several updates. Most significantly these address:

- Removing the limitation on the number of observations that can be analyzed – particularly important for analysis of results from continuous dataloggers,
- Allowing analysis to proceed with data from two different years at a minimum (rather than data expanding at least two full years),
- Allowing the user to define an arbitrarily short season of interest (e.g., spawning season),
- Corrections for serial correlation when continuous data are used,
- Conversion to Excel 2007, and
- General bug fixes.

The Natural Conditions Tool is an Excel 2007 macro-enabled spreadsheet and is provided in two versions: Alaska_NC_Tool_Base_v2.xlsm and Alaska_NC_Tool_Continuous_V2.xlsm. The “base” version is intended for the initially envisioned analysis of grab sample data. The alternative, “continuous” version is intended for the analysis of data from continuous sampling devices that collect samples at approximately regular intervals, such as dataloggers. These two versions of the spreadsheet differ only in the implementation of a correction of serial correlation. Both versions of the spreadsheet can now handle up to 30,000 individual data points.

Finally, note that the Concurrent Measurements spreadsheet has not been updated at this time. The previous version, released in 2007, remains applicable.

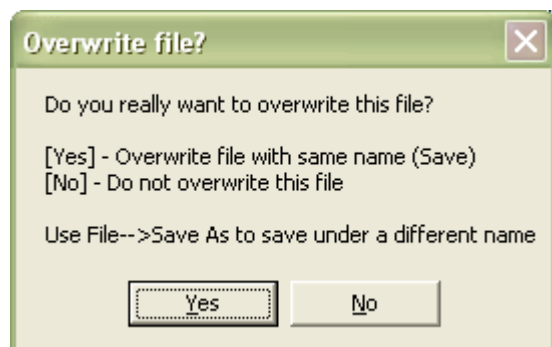
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1 User Guide for the Alaska Natural Conditions Tool (2010 Revision)

Before using the tool, make sure the three accompanying dynamic link library files are located in the same directory/folder as the Excel file itself. The three files are named **Conf95DLL.dll**, **swilk.dll**, and **wilcox.dll**. The file **wilcox.dll** is updated with this version of the spreadsheets to allow for analysis of larger data sets; any older versions should be deleted.

To run the Alaska Natural Conditions Tool spreadsheet, you must have macros enabled in Excel. If you have difficulty using the spreadsheet (e.g., buttons do not work), please refer to Section 3 of this memo for instructions about enabling macros in Excel.

The tool also provides protection against overwriting accidentally. When the file is saved, the following box appears, allowing the user to make a decision.



The tool has one sheet for user data input, two sheets for data analysis, and one sheet for viewing final results. The **DataInput** sheet is used for data entry, specification of seasonal range, and other information relevant to analysis. The **Screen** sheet shows the results of the seasonality test, displays statistics related to screening tests for minimum data requirements, and allows the user to select analysis of the full or seasonal data (provided the data meet the requirements). The **Trim** sheet provides the means to trim the data based on the presence of non-detects and potential outliers. Once the data are ready, the user may proceed to the **Results** sheet for viewing and printing the results for the site. The **Results** sheet is configured to automatically print on one page.

Quick Start Checklist

- Select a template spreadsheet (Alaska_NC_Tool_Base.xlsm or Alaska_NC_Tool_Continuous.xlsm). The “continuous” template should be used with large data sets of closely spaced observations, such as are obtained from automated dataloggers. The “base” version should be used for other data sets.
- Save the spreadsheet under a new name. Note that the three **dll** files must be present in the same directory.
- Assemble data for input in a separate Excel file. The data should be in column format, with each entry containing date, concentration, and a possible non-detect flag. The data should be quality assured prior to pasting into the natural condition spreadsheet.
- Paste the data into the natural condition **DataInput** sheet. Fill in site information and define a seasonal range for testing.
- Click the button to proceed to the **Screen** sheet. Follow the instructions to determine whether to analyze the full data set or a seasonal dataset.
- Click the button to proceed to the **Trim** sheet. Follow the instructions to adjust the dataset for nondetects and extreme outliers, and to select the method for estimating central tendency.
- If using the “continuous” template, select whether a correction for serial correlation should be included in the confidence limits.
- Click the button to proceed to the **Results** sheet.

To begin using the tool, the user must first select a template spreadsheet (Alaska_NC_Tool_Base_v2.xlsm or Alaska_NC_Tool_Continuous_v2.xlsm). The “continuous” template should be used with large data sets of closely spaced observations, such as are obtained from automated dataloggers. The “base” version should be used for other data sets. Open the template file in Excel, then immediately save it under a new name. As noted above, the three .dll files must be present in the same directory.

Instructions for each of the four constituent sheets in the tool are provided below. These instructions are applicable to both the “base” and “continuous” versions of the Natural Conditions Tool.

1.1 DATAINPUT SHEET

To start, the user enters the observed data in the columns on the left side of the worksheet. All data entered into the tool should have previously undergone thorough quality assurance checks. Use of the tool with raw, unreviewed data sets may lead to erroneous results.

Step 1 - Enter data (do not skip lines)

Date	Concentration	Non-detect (enter "<")
5/15/2004 1:00	0.1	<
5/15/2004 1:00	12.1	
5/15/2004 5:30	12	
5/15/2004 8:15	10.3	
5/15/2004 15:30	13.5	
5/15/2004 18:45	13.6	
5/15/2004 20:15	14.9	
5/16/2004 1:00	16.2	
5/16/2004 4:30	15.6	
5/16/2004 12:45	12.8	
5/16/2004 19:30	10.7	
5/17/2004 1:00	13.1	

Version 2 of the tool requires that data span more than one full year. This is a revision of the previous version, which required at least two full years of data. Dates must be entered in a recognized Excel date or date:time format (slash or dash between the month, day and year, followed (if needed) by hour and minute, separated by a colon). Non-detects must be specified with the “<” symbol (no quotes) in the third column. There can be no blank lines between the records; data underneath the first blank line will be ignored. Data can be pasted in from another source, provided they are pre-formatted correctly. If using the continuous data version of the spreadsheet with correction for serial correlation, the user should clean the data to ensure that it does not contain exact duplicate times.

A “Clear All Data” button is provided if the user wishes to clean out all previously entered data on the sheet.

Next, the user must enter information about the site and analysis, and a definition of the desired seasonal range. The seasonal range can be used to highlight critical periods during which different criteria may apply. A season must be specified in all cases; however, the user will later have the option to analyze all of the data in one set. The seasonal range must be at least 7 days in length.

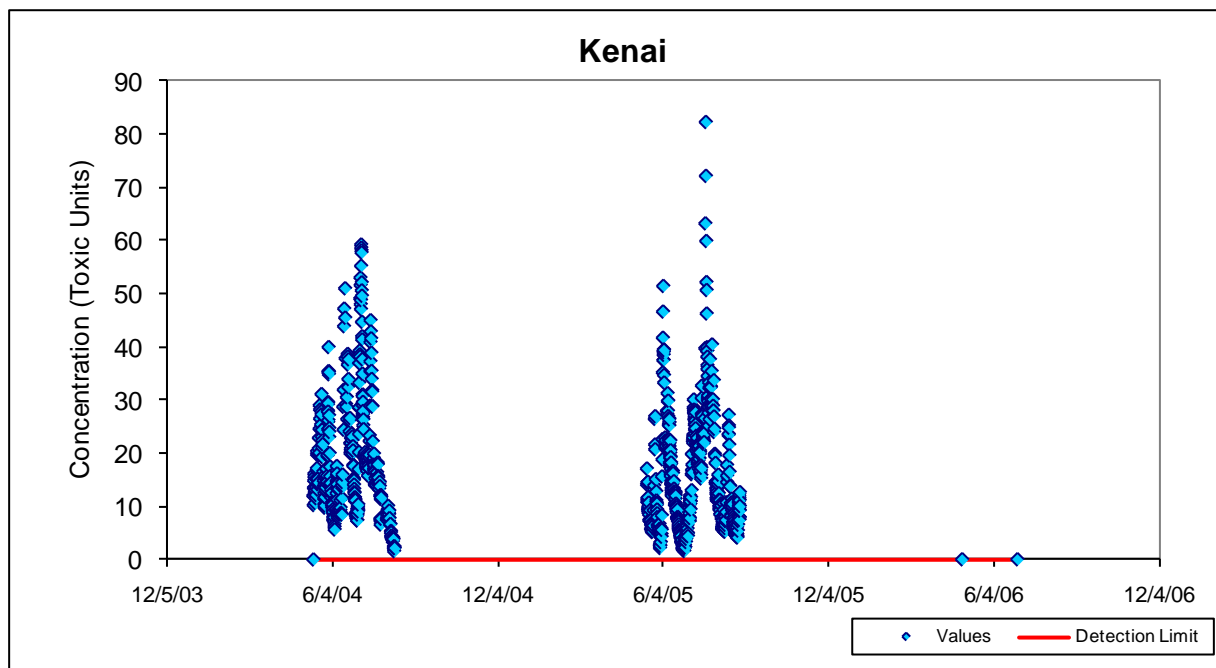
Step 2 - Enter Other Information	
Site:	Kenai
Concentration Units:	Toxic Units ▼
Analyst:	Sam
Date:	6/10/2010

Step 3 - Define Season Range			
Beginning:	Day	Month	
	5 ▼	May ▼	
Ending:	Day	Month	
	6 ▼	August ▼	

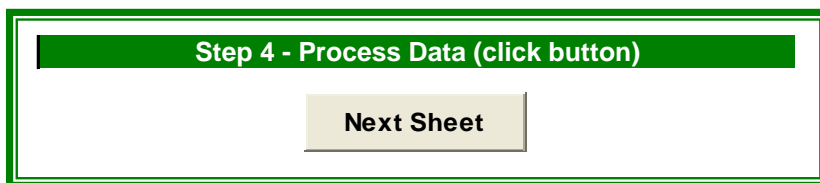
The day and month designations for the season range are chosen from the drop-down box that appears when the cell is selected:

The screenshot shows the 'Step 3 - Define Season Range' form. The 'Beginning' day dropdown is open, showing a list of months: Apr, May, Jun, Jul, Aug, Sep, Oct, Nov. The 'Ending' day dropdown is also open, showing a list of days: 5, 6, 7, 8, 9, 10, 11, 12, 13, 14. The 'Month' dropdown for 'Beginning' is set to 'May' and the 'Month' dropdown for 'Ending' is set to 'August'.

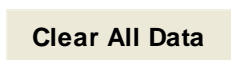
The tool creates a graphical time series plot as data are entered, also showing the detection limit if non-detects are present:



When the user has completed data entry, the **Next Sheet** button processes the data and transfers it to the **Screen** sheet. If any errors were made during data entry, the tool will alert the user to the problem that needs to be corrected.



The **Clear All Data** button will remove all of the data from all of the sheets, providing a way to reset the tool.



1.2 SCREEN SHEET

The Screen worksheet is used for initial data screening and analysis of the significance of seasonal effects. The transferred data are shown on the left of the sheet, with the addition of a column specifying the season of the observation. Results of the full data and seasonal screening tests are shown, followed by basis statistics:

	Pass	Fail	
Screening Tests	All Data	In Season	Out of Season
Count	983	901	82
% Non-detects	0%	0%	0%
Date Range (years)	2.13	2.13	0.70
Basic Stats	All Data	In Season	Out of Season
Mean	16.46	17.22	8.19
Median	13.80	14.50	7.85
Standard Dev.	11.24	11.41	3.00

“In Season” refers to the data contained in the seasonal range selected on the DataInput sheet, while “Out of Season” refers to the remainder of the data. In this example, the out-of-season dataset fails to meet the minimum date range criterion of at least one year (i.e., the time between the first and last datapoint must exceed one calendar year).

Next, the result of the Wilcoxon Rank Sum Test for seasonality is shown, and the user is allowed to select the desired analysis for the available data sets.

Step 5 - Transfer data to next sheet to test for trimming

Wilcoxon Rank Sum Test (includes non-detects)
Test positive for seasonality.

All Data

Full dataset may be transfered, but seasonality is indicated.

InSeason

Transfer in season dataset.

Out Season

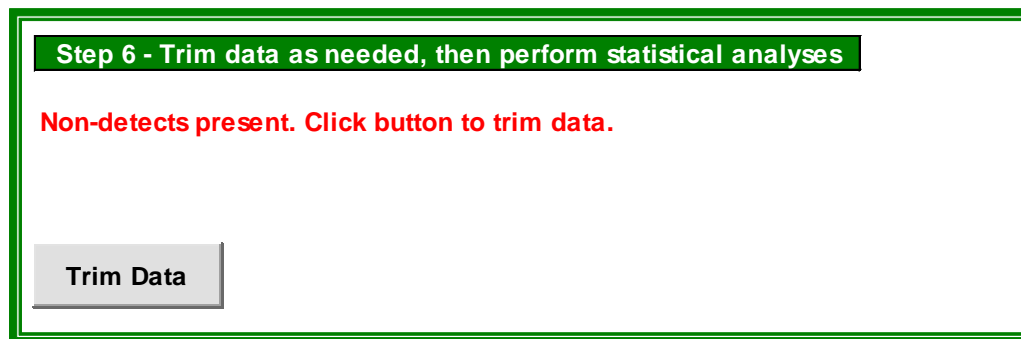
Seasonality indicated but out of season data do not meet minimum criteria.

In this example, seasonality is indicated by the Wilcoxon Rank Sum test; however, the “Out of Season” data do not span enough time for a separate analysis. Either the full data set or the in-season data set may be further analyzed, but the out-of-season data set does not meet the minimum criteria. If the **All Data** button is clicked, all of the data will be transferred to the **Trim** sheet; if the **In Season** is clicked, only the observations occurring during the defined seasonal time period will be transferred to the **Trim** sheet.

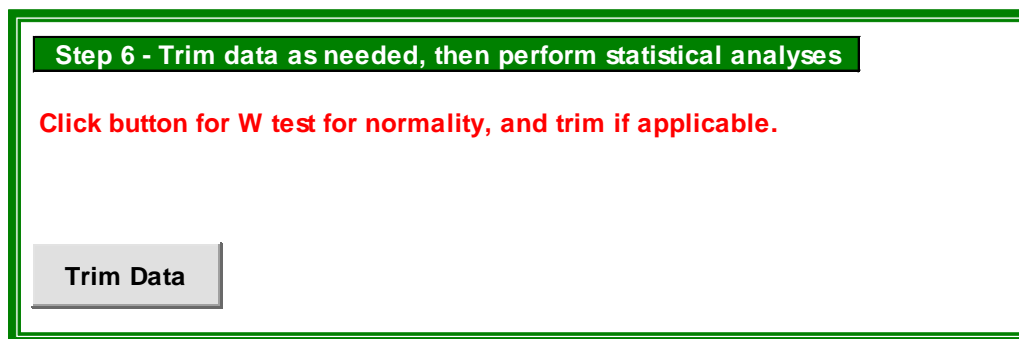
1.3 TRIM SHEET

On the Trim sheet, the user is prompted to perform a series of analyses in the following order:

1. If non-detects are present, the user is prompted to trim the non-detects (and an equal number of observations at the upper end of the distribution, not to exceed more than 25% of the dataset). Clicking the button will perform the operation.



2. Next, potential outliers must be tested for and removed. The untransformed or log transformed data (depending on which has the lower skew) are tested for normality under the Shapiro-Wilk W test. If the W test p value is less than 0.05, two observations will be trimmed, one each at the lower and upper end of the distribution. The user may have to perform several iterations of the W test, especially if the data set is large and has many outliers.



3. The data are ready for the final statistical analyses once they have passed the W test, or the data fail the W test but further trimming would exceed the 25% threshold. Depending on the type of distribution and the results of the W test, one of three statistical methods for estimating confidence limits on the central tendency will be used. As described in Appendix C of ADEC (2006), these are the Student's *t* confidence limits for normal distribution, Land's method for lognormal distributions, and Conover's non-parametric method for generalized distributions that do not pass a test of normality.

Step 6 - Trim data as needed, then perform statistical analyses

Click button for W test for normality, and trim if applicable.

W test unnecessary (N >= 50).

Data ready for statistical analysis.

Proceed

Method for estimation of central tendency
Student's t method for normal distribution

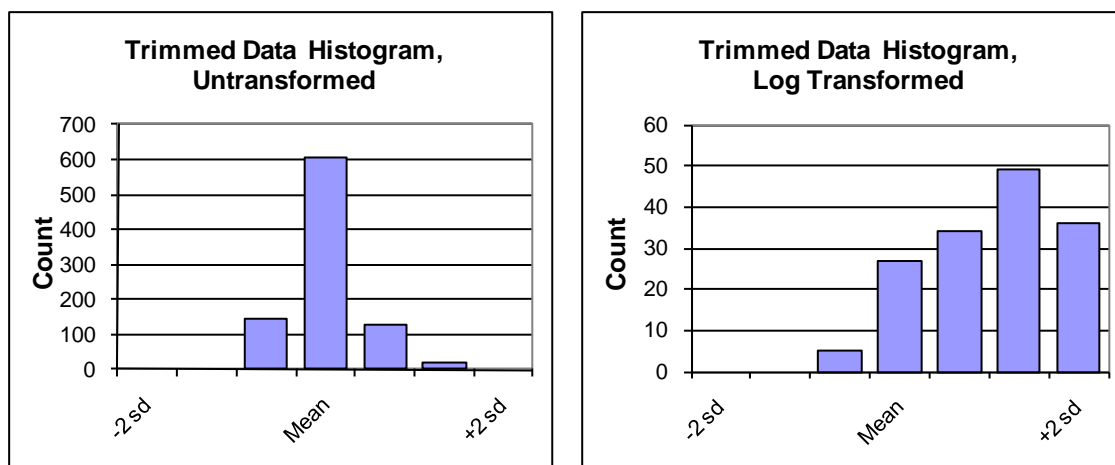
The Trim sheet also shows a listing of the data (sorted in increasing order), including the natural log of each concentration, and an indicator showing whether observations have been trimmed. In this case, the entry with a value of 0.1 was originally flagged as a non-detect. After processing, two values with observed data less than the highest reported detection limit are also shifted to non-detect status. The same number of points are trimmed from the high values at the bottom of the data listing.

Note: Valid data point(s) with concentration lower than the highest reported detection limit marked with a red star.

Date	Season	Non-detect	Concentration	LN (Conc)	Trim	
7/1/2006 0:00	S	<	0.01	-4.6052	Y	*
5/1/2006 0:00	X	<	0.01	-4.6052	Y	*
5/15/2004 1:00	S	<	0.1	-2.3026	Y	
8/12/2004 2:15	S		1.6	0.4700		
6/28/2005 8:30	S		1.6	0.4700		
6/27/2005	S		1.8	0.5878		
6/27/2005 7:45	S		1.9	0.6419		

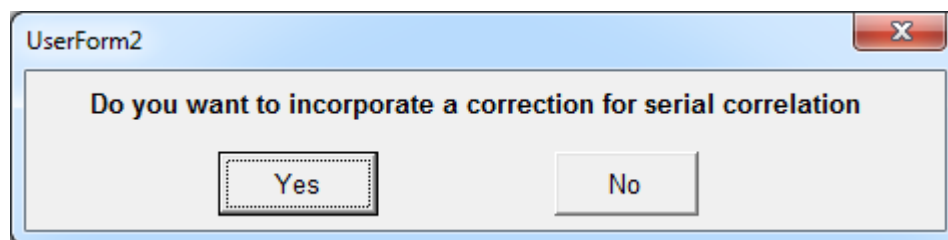
Basic statistics and a histogram of the untransformed and log transformed data are also shown. The histograms bins range from \pm two standard deviations from the mean.

Basic Stats	Raw Data	Log Transformed
Count	981	981
Mean	16.4141896	2.5598
Median	13.8	2.6247
Standard dev.	11.0394301	0.7722
Skew	1.308469423	-1.8351



Clicking the **Proceed** button displays a popup prompting the user that the analysis is complete.

Additional functionality is provided on the **Trim** sheet for the Continuous version. In that version of the tool, when the user clicks the **Proceed** button on the **Trim** sheet a pop-up asks if a correction for serial correlation should be incorporated.



Clicking “Yes” performs the correction for both the raw and log transformed dataset and displays the modified and original standard deviations. The original standard deviations without correction for serial correlation are shown to the right as *StDev RD* and *StDev LT*, where *RD* stands for “raw data” and *LT* stands for log-transformed data:

Basic Stats	Raw Data	Log Transformed
Count	899	899
Mean	17.16463849	2.6130
Median	14.5	2.6741
Standard dev. *	36.37093473	2.3427
Skew	1.215128644	-1.3788

StDev RD StDev LT
11.20014 0.746971


* Corrected for serial correlation

If significant serial correlation is present its effect is to increase the confidence limits on the mean, represented by an increase in the effective standard deviation. This results in a lower chronic criterion, but does not affect the acute criterion, which is calculated by a non-parametric method. After performing the correction for serial correlation the **Results** sheet is displayed. If “No” is clicked then correction for serial correlation is not performed and the **Results** sheet is displayed with uncorrected data.

The mathematical implementation of the correction for serial correlation is described in Section 1.5.

1.4 RESULTS SHEET

Alaska NCBWQS Analysis (Version 2.0) - Results	
Site: Kenai	
Analyst: Sam	
Date: 6/10/2010	
Data points:	901 In-Season (5/15-8/16)
Lower 95% Confidence Limit (CL) on 90th Percentile (Conover's Nonparametric Method)	
Value:	29.7 NTU
Lower 95% Confidence Limit (CL) on Central Tendency	
Method:	Land's Method for lognormal distributions (corrected for serial correlation)
Value:	13.919 NTU
Published Criteria for Site (enter below)	
Acute:	<input type="text"/> NTU
Chronic:	<input type="text"/> NTU
<input checked="" type="checkbox"/> Define as allowance above natural background of <input type="text"/> 10 NTU	
Natural Condition-Based Criteria for Site	
Acute:	39.7 NTU
Chronic:	23.919 NTU
= Natural background plus 10.0 NTU = Natural background plus 10.0 NTU	
Alternative Calculations for MDL	
Lower 95% CL on 95th Percentile:	37.514 NTU
Lower 95% CL on 90th Percentile:	29.7 NTU
Estimated Mean:	17.604 NTU
Estimated 90th Percentile:	31.8 NTU



The **Results** sheet provides a one-page summary of the analysis. Information about the analysis is transferred here; the final number of data points used and the type of data set (all, in-season, or out-of-season) is also shown. The results of the natural condition-based criteria are displayed in the top section.

In the lower portion of the **Results** sheet, the user may enter information on published criteria for the site, which are compared to the natural condition-based criteria. This can be done in two ways: the user may enter published numeric criteria for comparison or select the checkbox for the case in which criteria are defined as an elevation above natural background. If this checkbox is selected, the user is prompted to enter the allowable excursion above natural background (e.g., 10 NTU).

For the case where there are published numeric criteria for the parameter of interest, the “Natural Condition-Based Criteria for Site” are equal to the confidence limits on the 90th percentile and central tendency shown in the top portion of the sheet. For the case where the published criteria are equal to the natural condition plus an allowable excursion, the “Natural Condition-Based Criteria for the Site” are equal to these confidence limits plus the allowance above natural background.

Some alternative calculations that may be useful for consideration when developing a Maximum Daily Load (MDL) for a discharge permit are also shown at the bottom of the **Results** sheet.

1.5 ADJUSTMENTS FOR SERIAL CORRELATION IN THE CONTINUOUS SIMULATION VERSION (*TRIM SHEET*)

A separate version of the spreadsheet is provided for use in situations in which automated data collection yields large amounts of sequential data. This differs from the main version in the addition of an analysis of the effects of serial correlation on predicted confidence intervals.

For data that are collected on a continuous basis – such as autologging of turbidity – the effect of serial correlation on uncertainty bounds on the central tendency of the distribution needs to be taken into account. In essence, serial correlation means that if one observation deviates from the mean in a particular direction the succeeding observation is also likely to deviate in the same direction. This may occur, for example, when anomalously high turbidity readings are associated with an event that persists over many hours. The observations recorded during such an event remain valid, but each consecutive observation provides less information than an independent observation because its characteristics can be largely predicted on the basis of the preceding observations. A series of 96 hourly observations recorded over three days provides more information relative to natural background than three single daily observations; however, it does not provide as much information as 96 observations separated by a day or more. Accordingly, the confidence intervals need to be adjusted when large sets of continuous data are analyzed.

Traditional confidence limits on the mean from a normal distribution are calculated as

$$\bar{x} \pm t \frac{s}{\sqrt{n}},$$

where s is the standard deviation of the series, t is a Student's t value at an appropriate confidence level, and n is the number of observations. When serial correlation is present, individual observations are not independent and the confidence limits must be expanded accordingly. The correct confidence limit for a normal distribution with serial correlation is given by (Gilbert, 1987):

$$\bar{x} \pm t s \left[\frac{1}{n} \left(1 + \frac{2}{n} \sum_{l=1}^{n-1} (n-l) \rho_l \right) \right]^{1/2},$$

where ρ_l is the serial correlation or autocorrelation coefficient at lag l , and the term after the t statistic is the standard error of the mean. Eliminating the term $1/n$ within the square brackets gives an adjustment on the standard deviation of the series, which is used in the spreadsheet.

A similar analysis applies to confidence limits for lognormal distributions. Note that in Land's method, as described in ADEC (2006), Appendix C, the lower confidence limit on the arithmetic mean at the α confidence level (LL_α) is given by

$$LL_\alpha = \exp \left(\bar{y} + 0.5 s_y^2 + \frac{s_y H_\alpha}{\sqrt{n-1}} \right),$$

where \bar{y} and s_y are the sample mean and standard deviation of the natural logarithms of the data, respectively, and H_α is obtained from tables developed by Land (1975). The first two terms within the bracket are an estimate of the mean, while the last term represents the confidence limit on the mean. When corrected for serial correlation, only the last term uses the adjusted standard deviation, i.e.

$$LL_{\alpha} = \exp \left(\bar{y} + 0.5s_y^2 + \frac{s_y^* H_a}{\sqrt{n-1}} \right),$$

where s_y is the standard deviation of the natural logarithms of the data prior to correction for serial correlation and s_y^* is the standard deviation of the natural logarithms of the data after correction for serial correlation.

The serial correlation coefficient at lag l is best estimated from the data as (Gilbert, 1987)

$$\hat{\rho}_l = \frac{\sum_{t=1}^{n-l} (x_t - \bar{x})(x_{t+l} - \bar{x})}{\sum_{t=1}^n (x_t - \bar{x})^2}.$$

The preceding equation may be difficult to implement in full for large data sets, as it potentially involves the estimation of up to $n-1$ lags. In practice, most of the effects of autocorrelation are typically captured in the first few lags, with longer lags tending toward zero or cancelling out.

Another issue is caused by the fact that data are not usually collected at precisely spaced intervals. For instance, reporting times for an autosonde may shift from 15 to 30 minutes, and there are usually gaps in the record.

The method implemented in the spreadsheet tool accounts for these potential complications through use of a “binning” approximation which assumes that consecutive observations generally represent a lag of 1, thus ignoring changes in the time base or gaps in the record. The method also assumes that any significant loss of information due to serial correlation is contained in the first ten lags. These assumptions may bias the estimate of individual lags of a specific length, but should not cause any significant discrepancies in the overall effect of serial correlation on confidence limits used by the worksheet.

1.6 DYNAMIC LINK LIBRARIES

Several specialized statistical routines used by the Alaska Natural Conditions Tool are contained in separate dynamic link library files (dlls) that are called from the main spreadsheet. These files must be present in the same directory as the Excel spreadsheet.

Wilcox.dll implements the Wilcoxon-Mann-Whitney rank sum test for non-parametric evaluation of the equality of two independent populations, consistent with USEPA (2006) and Gilbert (1987). The program was written in Fortran by Tetra Tech, but is largely adapted from the C++ program `twosamps_ranks.c` available at www.math.wustl.edu/~sawyr/m408s07c. The exact cumulative small-sample distribution of the test statistic is calculated using Algorithm AS 62 (Dinneen and Blakesley, 1973).

Conf95dll.dll implements the H-statistic method of Land (1971, 1975) for estimating confidence limits for linear functions of the normal mean and variance. The compiled dll and documentation are provided directly by the National Institute of Health at <http://conflimit.nci.nih.gov>. As linked to the spreadsheet, only the option for calculating a lower one-sided confidence limit on the lognormal distribution is implemented.

Swilk.dll implements the Shapiro-Wilk test for normality. The program is based on the revised algorithm AS R94 (Royston, 1995). A standalone Fortran version written by Alan Miller was obtained at <http://users.bigpond.net.au/amiller/apstat/as181.f90> and served as the basis for creation of `swilk.dll`.

1.7 REFERENCES

ADEC. 2006. Guidance for the Implementation of Natural Condition-Based Water Quality Standards, November 15, 2006. Alaska Dept. of Environmental Conservation, Juneau, AK.
http://www.dec.state.ak.us/water/wqsar/wqs/pdfs/natural_conditions_guidance_nov_15_re-adopt_v_11-27-06.pdf

Dinneen, L.C. and B.C. Blakesley. 1973. Algorithm AS 62, a generator for the sampling distribution of the Mann-Whitney U statistic. *Applied Statistics*, 22(2): 269-273.

Gilbert, R.O. 1987. *Statistical Methods for Environmental Pollution Monitoring*. Van Nostrand Reinhold, New York.

Land, C.E. 1971. Confidence intervals for linear functions of the normal mean and variance. *Annals of Mathematical Statistics*, 42: 1187-1205.

Land, C.E. 1975. Tables of confidence limits for linear functions of the normal mean and variance. *Selected Tables in Mathematical Statistics*, III: 385-419.

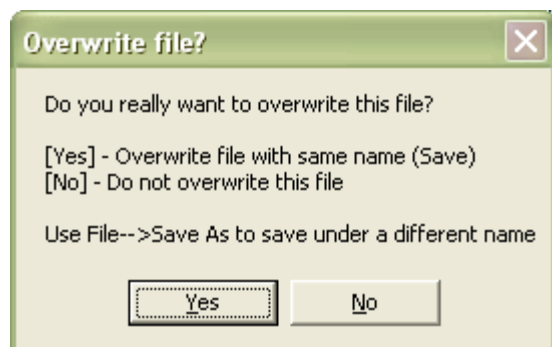
Royston, P. 1995. Remark AS R94: A remark on Algorithm AS 181: the W-test for normality. *Applied Statistics*, 44(4): 547-551.

USEPA. 2006. Data Quality Assessment: Statistical Methods for Practitioners, EPA QA/G-9S. EPA/240/B-06/003. Office of Environmental Information, U.S. Environmental Protection Agency, Washington, DC.

2 User Guide for the Alaska Concurrent Measurements Tool

To run the Alaska Concurrent Measurements Tool spreadsheet, you must have macros enabled in Excel. If you have difficulty using the spreadsheet (e.g., buttons do not work), please refer to the last page of this memo for instructions about enabling macros in Excel. There are no dynamic link libraries (dlls) required for the Concurrent Measurements Tool.

The tool also provides protection against overwriting accidentally. When the file is saved, the following box appears, allowing the user to make a decision.



The tool has two sheets. The **Main** sheet is used for data entry and viewing results. The **Calcs** sheet performs the behind-the-scenes analysis; while its structure is not explained here, the user may view it if desired.

The Main sheet is divided into three sections – entry of general information, data entry, and viewing results. In the general information section, the user may enter information about the site and analysis. The default assignments for coefficient of variation (CV) can be accepted or changed. Finally, the user must specify the applicable water quality criterion.

Step 1 - Enter General Information

Site:	Deer Creek
Analyst:	Jane Doe
Date:	5/31/2007
Concentration Units:	µg/L

Default assignments for CVs

CV _m	0.1
CV _s	0

These values are used to calculate CV_t until a full year's data have been input

Applicable published water quality criterion

µg/L:	0.05
-------	------

Effluent concentrations below this value are compliant

Next, the data entry section allows for successive entry of measurements. By default, the tool opens with example data in this section. To remove the data and reset the tool, the **Clear All Data** button should be clicked.

Clear All Data

The tool allows for the creation of one entry row at a time by clicking the **Add Data Row** button. A new empty row is added below the existing data. Dates must be entered in a recognized Excel date format (slash or dash between the month, day and year). Data must also be entered in ascending date order. Two replicates are *required* for each entry.

Step 2 - Enter Data (click button for new record)

Add Data Row

Clear All Data

	Reference Site		Effluent	
Date	Rep1	Rep2	Rep1	Rep2
1/1/2007	1	0.8	0.2	0.6

Once all the data have been entered, the **Calculate Results** button may be clicked to generate a new set of results. Note that adding data or changing data in the table will clear out the reporting of results, and the **Calculate Results** button must be clicked again. Results are calculated for the last date entered; the reference mean, effluent mean, and test results are displayed.

Step 3 - View Results

Calculate Results

More information

Results For: 2/1/2007
 Reference mean: 0.28
 Effluent mean: 0.55

Test Results:
 Current Measurement FAIL
 Three Consecutive PASS
 Annual FAIL

The three test results are evaluated as follows:

Current Measurement: PASS if current effluent measurement does not exceed the concurrent reference measurement plus a tolerance interval.

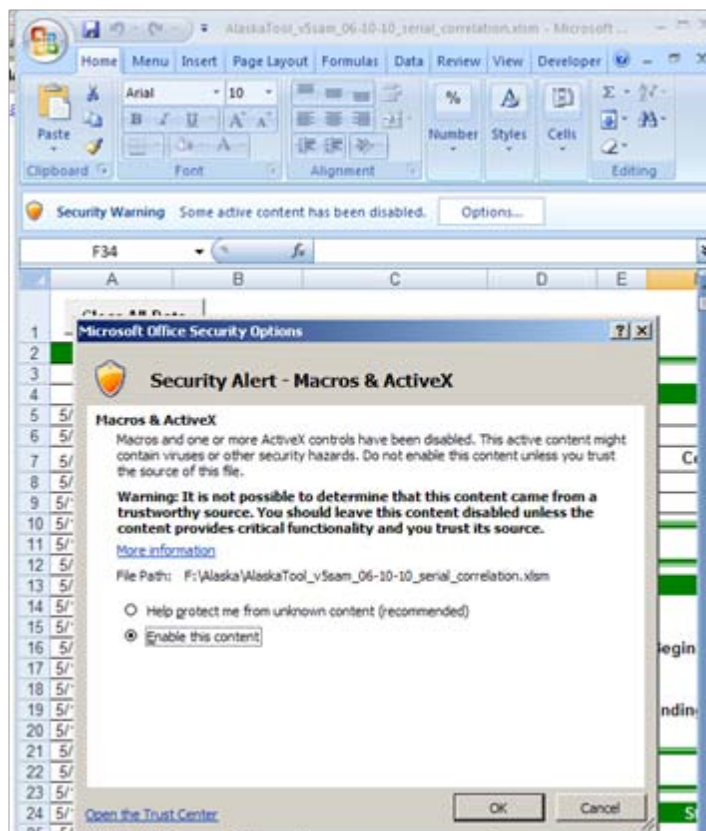
Three Consecutive: FAIL if the effluent concentration is greater than the concurrent reference concentration on three consecutive measurements.

Annual: FAIL if the average difference between effluent concentration and concurrent reference concentration is greater than zero when evaluated over the previous 12 months.

3 Enabling Macros in Excel

Both tools makes extensive use of Microsoft Visual Basic for Applications (VBA) script, both for navigation and for more complicated internal calculations. The use of these “macros” is essential for operating this tool. The current revision of the Natural Conditions tool is saved as an Excel 2007 macro-enabled (“.xlsm”) file. However, the user may still need to enable the running of macros.

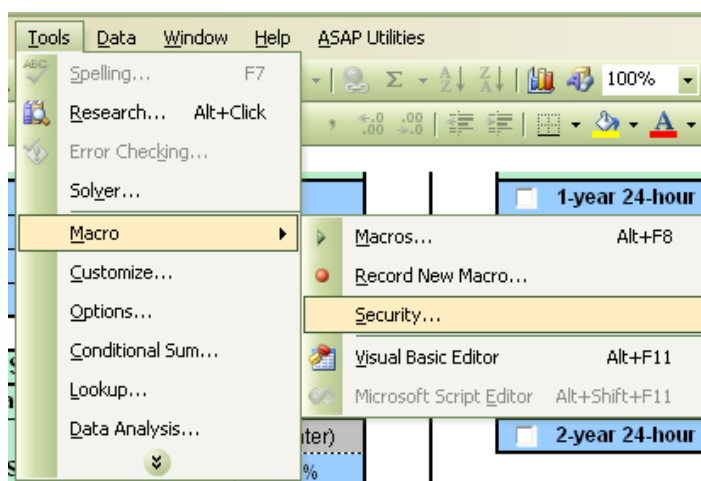
When the Natural Conditions tool is first opened, a message may appear below the ribbon “Security Warning Some active content has been disabled”, as shown at right. Clicking on the Options button will bring up the “Microsoft Office Security Options” security alert, as shown to the right. The user should select “Enable this content” and then click OK. At this point, the welcome screen for the Natural Conditions tool should appear.



The Concurrent Measurements tool is implemented in Excel 2003, but can be run in either Excel 2003 or Excel 2007. Macro security is handled a little differently in the 2003 version of Excel. To enable this tool to use its VBA Script in Excel 2003, please make the following changes to your Excel security settings.

On the menu, select **Tools**, choose **Macro**, and then choose **Security...**

In the window that opens, select the **Security Level** tab.



Select the button next to **Medium**, and click the **OK** button. Now when you open the tool, you should be given a choice to enable macros. You must enable macros for the tool to operate properly.

The **Security Level** will remain set to **Medium** even after you close the spreadsheet – this setting applies to Excel as a whole, not just the tool.

You may change the **Security Level** to a higher setting after you have finished, but you would need to reset it to **Medium** whenever you use the tool.

