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This copy of the Validation Protocol / Report

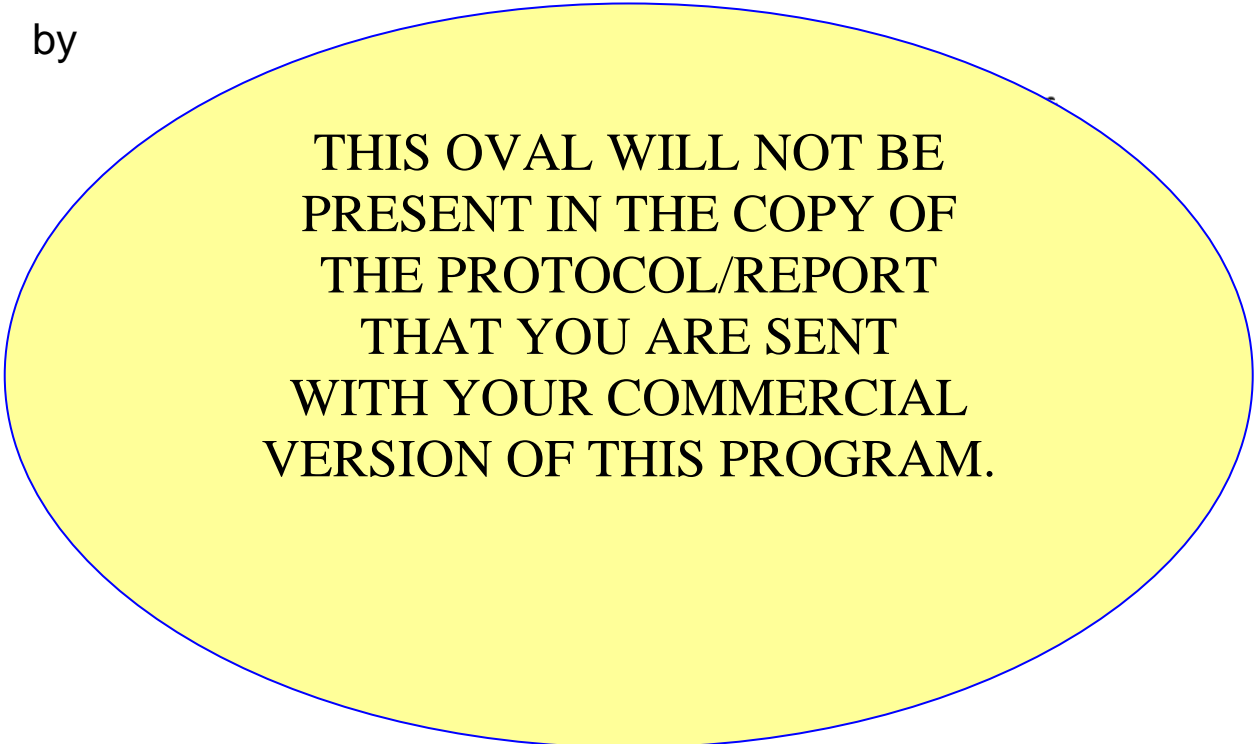
ZTC-8, for version 3 of ZTC's

"Variables Data SPC"

was prepared and performed for use only** by and at

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VALIDATION PROTOCOL #ZTC-8

for version 3 of ZTCP's

"VARIABLES DATA SPC"

*For the name and signature of the author of this Protocol,
see the cover-page of this combined Protocol + Report PDF file.*

1.0 OBJECTIVE

This document outlines a validation protocol for version 3 of the file named by Zorich Technical Consulting & Publishing (ZTCP) as "Variables Data SPC" or "VDS".

2.0 SCOPE

This document applies to the MS Excel file named in the "Objective" section above, but which might be named differently by purchasers of this file. Even if the file name is changed by the purchaser, the "Instructions" worksheet inside the file will always have the original file name on its first row.

It applies to all versions 3.XX of this program, starting with version 3.01. The XX refers to minor variations in the program that are designed to change the appearance of worksheets or to improve the clarity of messages. The calculation cells (including those that provide output) remain unchanged in all 3.XX versions. Changes are implemented in the new

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- "N=1" control chart, for when sample size = 1, comprising one control chart for sample measurements, and one for the moving range of sample measurements.
- "Red circles" around all control chart data points that are beyond the control limits or are a member of a run or series of at least 9 data points.
- Capability and related information, including:
 - ✓ capability indices (Cp and Cpk, Pp and Ppk)
 - ✓ frequency distribution of the data, shown as a histogram
 - ✓ % of data that is beyond the "boundaries" of the histogram
 - ✓ tests of data Normality, correlation, and autocorrelation

3.0 POLICY

Custom statistical software must be formally validated for its intended use. The purpose of "Variables Data SPC" (i.e., "VDS") is to provide statistical process control for manufacturing processes where measurements are taken on samples taken from consecutive batches or lots.

By using the word "validation" in this protocol, it is not meant to imply that VDS's program "code" is being validated. VDS is a relatively simple "application" based upon a commercial program, MS Excel, which has been sold by Microsoft Corporation for more than a dozen years. By saying that VDS is to be "validated" is to say that its functions and features will be critically and systematically checked, to see if they meet their pre-determined design requirements and intended end-user purposes. VDS contains no "macros" or other code-based add-ons (such as VBA scripts); VDS does not even use any ActiveX controls. VDS contains only mathematical and statistical equation functions to validate.

4.0 REFERENCE

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Statgraphics

Understanding Statistical Process Control, 2nd edition, by D. Wheeler and D. Chambers, 1992 by SPC Press, Inc.

5.0 DEFINITIONS

VDS The MSEXcel file named by Zorich Technical Consultants as "Variables Data SPC" (see "note" in Installation section, below).

SGP and SGC SGP = StatGraphics-Plus (version 3.1) the commercial software package used to validate VDS. This program has been available commercially, in its various versions, for many years; version 3.x had been sold for 3 years prior to this copy of v.3.1 being purchased by ZTCP. Most parts of this validation were performed with this version, except for re-validations that were performed in 2009 or later (they used SGC, below, instead; the report indicates which version was used for what part of the validation/revalidation).

SGC = StatGraphicsCenturion XV (the copyright 2007, upgrade-version of StatGraphics that was purchased by ZTCP in 2009, to

SPC (the term)

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VBA or Microsoft VBA 5.0 or later (that is, "Excel 97" or later)

NOTE: Excel versions 97 thru Excel XP and 2003 all use the same file format (XLS extension). Excel 2007 and later use a new file format ("XLSX" extension); these newer versions of Excel can automatically configure themselves to be fully compatible with "XLS" files.

Installation validation is performed by verifying that the file is installed on a computer running one of those versions of Excel (or their Apple-computer equivalents). Since the file cannot run on any other type of installation, this validation is self-evident and will not be documented as part of implementing this protocol.

7.0 DESIGN VALIDATION

VDS is designed based upon standard statistic and SPC textbook methods. Design validation is achieved by ensuring that

a) No one

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d) SPC charts and Midline as do the textbooks. Those results remain the "same" no matter where in the "VDS DATA ENTRY" worksheet the data is located (by "same" here is meant identical +/- one unit in the last significant digit in the textbook values, or +/- 0.1%, whichever is greater; those criteria make allowance for the typical differences encountered between results derived from, on the one hand, the multiple intermediate rounding steps in textbook examples, and, on the other hand, a complete lack of rounding during multiple steps in an electronic calculation by the computer spreadsheet used by VDS). The output must be checked for all SPC chart types that can be produced by VDS, namely:

- Sample Average Value = \bar{X} , with control limits based on either
 - sample range
 - sample standard deviation
 - sample average moving range
 - standard error of the sample mean
- Sample Average Moving Range
- Sample Range
- Sample Standard Deviation
- Individual Sample Measurement = X (that is, when $N = 1$), with control limits based on either

- individual value moving range
 - population standard deviation
 - Individual Sample Moving Range
- e) SPC charts in VDS have identified "out of control" situations by placing "red circles" around data points, runs, and series that are specified on the VDS "OPTIONS" worksheet, and that the DATA ENTRY worksheet and NOTES & INCLUSIONS worksheets both identify such points by showing relevant text messages.
- f) Histogram calculated by VDS (for the data identified as being "included" in the Histogram on the NOTES&INCLUSIONS worksheet) is the "same" as that of SGP (the frequency that is output by SGP is a visual bar-chart only, whereas VDS outputs a numerical value as well; additionally, VDS creates one additional bar, on each end of the histogram that is not part of a standard histogram [the lower and upper "residuals" bars, smaller or larger, respectively, for the

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- g) The histogram calculated by VDS (for the data identified as being "included" in the Histogram on the NOTES&INCLUSIONS worksheet) is the "same" as that of SGP (the frequency that is output by SGP is a visual bar-chart only, whereas VDS outputs a numerical value as well; additionally, VDS creates one additional bar, on each end of the histogram that is not part of a standard histogram [the lower and upper "residuals" bars, smaller or larger, respectively, for the histogram]). The histogram calculated by VDS is the "same" as that of SGP (the frequency that is output by SGP is a visual bar-chart only, whereas VDS outputs a numerical value as well; additionally, VDS creates one additional bar, on each end of the histogram that is not part of a standard histogram [the lower and upper "residuals" bars, smaller or larger, respectively, for the histogram]). The histogram calculated by VDS is the "same" as that of SGP (the frequency that is output by SGP is a visual bar-chart only, whereas VDS outputs a numerical value as well; additionally, VDS creates one additional bar, on each end of the histogram that is not part of a standard histogram [the lower and upper "residuals" bars, smaller or larger, respectively, for the histogram]).
- h) Process capability indices (C_p , C_{pk} , P_p , P_{pk}) calculated by VDS for data included in the Histogram are the "same" as those calculated SGC (by "same" is meant that the results are identical to the nearest +/- 0.001, and that those results remain the "same" no matter where in the VDS "DATA ENTRY" worksheet the data is located). Indirectly, this test verifies that VDS calculates the population standard deviations correctly, because if the standard deviations were significantly different, the capability indices would differ significantly. In addition, a check will be performed of the ability of the program to achieve those "same" results even if the control limits are set "manually" (using option # 1 on the OPTIONS worksheet --- the "manual" settings that are entered into that option will be the

same control limits etc. as are calculated/used by the non-manual, i.e., "automatic", method).

i) Chi-Square test for normality of the data included in the Histogram in VDS yields the "same" probability result as does SGP (by "same" is meant results that are identical to the nearest +/- 0.001, and that those results remain the "same" no matter where in the VDS "DATA ENTRY" worksheet the data is located).

j) Skewness and Kurtosis as calculated by VDS for raw data included in the Histogram are the "same" as that calculated by SGP (by "same" is meant that the results are identical to the nearest +/- 0.001, and that those results remain the "same" no matter where in the VDS "DATA ENTRY" worksheet data is located).

k) Linear regression "correlation" analysis between observed and expected frequency classes (under the assumption of "normal distribution") by VDS yields a correlation coefficient that is the "same" as calculated by SGP; (NOTE: VDS groups categories with a count of less than 5, which is not the case in SGP)

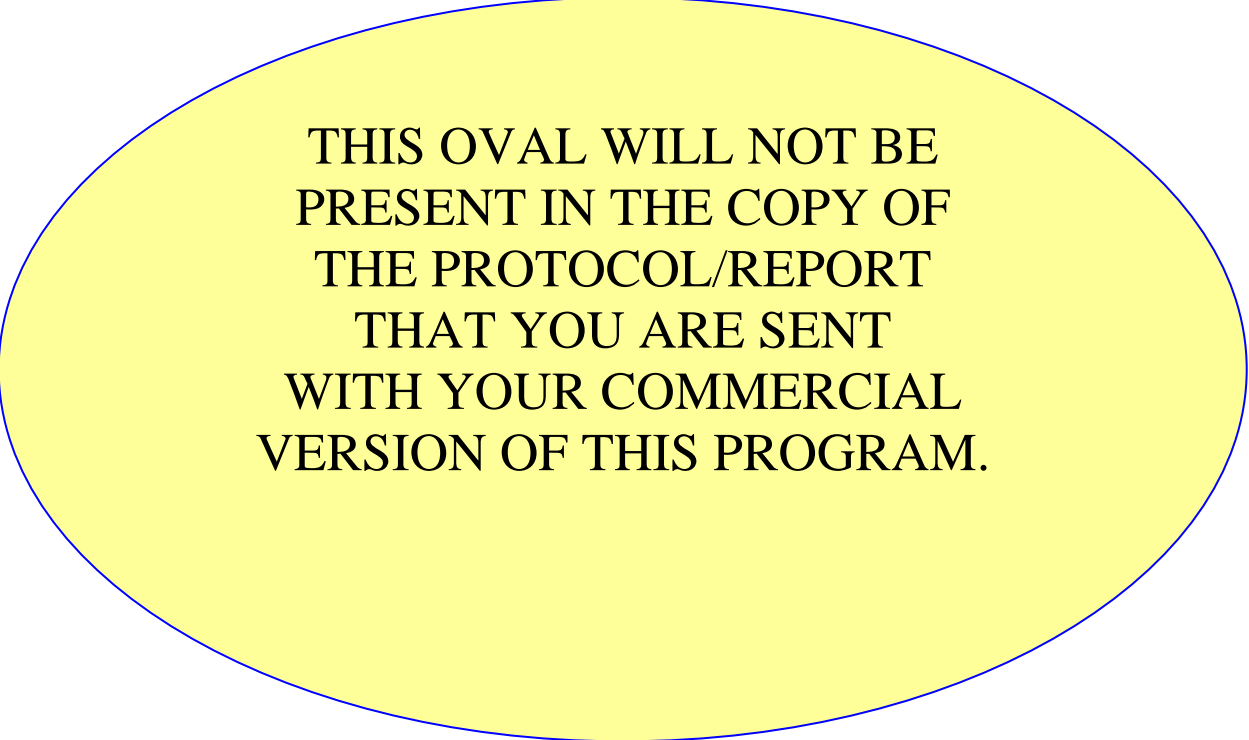
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m) Control charts are plotted on the OPTIONS worksheet, only when the "chart" option is set to "yes".

n) Relevant default SPC and default Histogram conditions are used by VDS whenever the user has not made proper choices (e.g., marking more than one choice on a given Option category, or not marking any choices on relevant Options on the OPTIONS worksheet; or e.g., "include[ing]" (i.e., "marking") an insufficient number of lots on the NOTES+INCLUSIONS worksheet). Default conditions include:

- Range is used to calculate control limits for the Sample Average
- Range is charted as the Within-Sample-Variation
- All available data is used

- Histogram "boundaries" are set at approximately 1 percentile and 99 percentile.



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VALIDATION REPORT for Protocol # ZTC-8

For version 3 of ZTCP's

"VARIABLES DATA SPC"

*For the name and signature of the author of this Report,
see the cover-page of this combined Protocol + Report PDF file.*

NOTE: For details on all literature referenced in this report, see the Protocol

1.0 INSTALLATION VALIDATION

Self-evident -- see Protocol for discussion.

2.0 DESIGN VALIDATION

- a) The only user-modifiable cells that were found on any of the user-accessible worksheets were the non-calculation ones intended for user input; the entire "Report#1" worksheet was modifiable, by design, as is the "DOC#Etc" worksheet.

CONCLUSION: All of the Protocol's section "a" requirements were met

- b) All of the SPC, capability, and Chi-Square equations on the (hidden) calculations worksheets were consistent with those in published statistical

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from (where obtained in the Protocol).

One at a time, each of those sets of sample data was placed into the first rows on the DATA_ENTRY worksheet, starting with "Auto Sample ID" #1. Then the data was copy/pasted to the next set of empty rows, and so on until data had been placed into all rows of the table.

For example, for the 20 rows of data shown in Attachment 1, the 20 rows were first entered into ID#s 1-20, and then copied into ID#s 21-40, then 41-60, and so on down to 181-200. However, for each set of 20 rows, data was not always placed into columns 1-4, but rather, in a semi-random fashion, was placed into different Measurement columns (e.g., columns 3-6, or 7-10) so that at least some data was entered into every Measurement column and every ID# row. SPC limits were then checked after using the NOTES+INCLUSIONS worksheet to "include" only ID#s 1-20, and then only ID#s 21-40, and so on until the limits were checked based on data sets thruout the DATA_ENTRY table. That entire process was performed with each set of data in Attachments 1 thru 13, if possible (e.g., not possible with data in Attachment #12 because it contains 2000 data points, which is the maximum possible number of entries to the data entry table). The "semi-random" placement of data into columns was varied from data set to data set, so that after all SPC-chart checks had been completed with all data sets, there had been at least one SPC-control-limits check using each of the 2000 data entry cells (2000 = 200 rows x 10 columns).

The location of the reference data and comparative VDS results are listed below:

- Sample Average Value, with control limits based on either:
 - sample range (see Attachments 1, 2, and 3)
 - sample standard deviation (see Attachment 2, 3, and 4)
 - sample standard deviation (see Attachment 5)
 - sample standard deviation (see Attachment 4)

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e, P... was
P... used to
calcul... remaining 190
rows of data... supposed to be red-
circled or not red-circled... for all 7 charts that are
generated by the 3 "chart" worksheets, under conditions of either manual or automatic
setting of Control Chart limits. In all cases, points outside the control limits were red-
circled, as were runs or series of nine points or more; but runs or series of eight points
or less were not red circled. The DATA ENTRY and NOTE&INCLUSIONS

worksheets exhibit only if the data-points
for those appear that
ind whether "Sample

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as stated results.

CONCLUSION: All of the Protocol's section "f" requirements were met.

- g) The % of data outside the histogram boundaries was tested by placing the data in Attachment 12 into the Data Entry table on the DATA ENTRY worksheet. See Attachment 13 for other input data and method & results details. The results demonstrate that VDS correctly tabulates the % of data that is beyond the boundaries of the histogram.

CONCLUSION: All of the Protocol's section "g" requirements were met.

- h) CAPABILITY ANALYSES: Using the same data and worksheet locations as in "f" above, Cp, Cpk, Pp and Ppk were generated by VDS and compared to those generated by Minitab 19b.

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- k) LINEAR REGRESSION / CORRELATION ANALYSIS: Using the data and worksheet locations stated in Attachment 10a, Linear Regression Correlation Coefficients were generated by VDS, for the Observed vs. Expected Histogram Frequencies. The same data was inputted to StatGraphics Plus. See results in Attachment 10b.

CONCLUSION: All of the Protocol's section "k" requirements were met.

- l) AUTOCORRELATION: The coefficient of autocorrelation was calculated using textbook data. The data was placed at the beginning middle and end of the DATA ENTRY worksheet, in 3 different "Measurements" columns. That data plus its "Lag 1" counterpart was entered into SGP, to determine the correlation coefficient. The raw data and results are shown in Attachment 11.

CONCLUSION: All of the Protocol's section "l" requirements were met.

- m) The data (control limits, sample size, standard deviation) entered into the Manually Set feature ("Option" #1, on the OPTIONS worksheet) were observed not to be used if the top white cell on that feature's window contained numbers, or numbers and text, or is blank, or contained any text other than the word "yes". For this test, the DATA ENTRY worksheet contained the data in Attachment 12, and Option #1 contained the data shown in this next table:

	Sample Avg	Moving Range	Sample Range	Sample StdDev
UCL	100	10	30	20
Centerline	90	8	20	15
LCL	80	6	10	10
Population Std Dev	20			
Sample Size	2			

For this test, the challenge-entries to the top white cell (the one that is required to have the word "Yes" in it) included the following: blank (i.e., the cell was left empty), "no", "xxx", "123", and "123yes". However, whenever only the word "Yes" or "yes" or "YES" was entered, then the control limits on the charts were observed to be exactly as shown in the table above, and the Cpk population standard deviation was seen to be exactly 20 (on the "Histogram & Capability" worksheet), and the sample size was seen to be exactly 2 (on the hidden "SPC Calcs" worksheet).

Whenever manual-setting of a control limit was chosen correctly (as described above), then the "red" control limit number was placed into the "AutoSampleID#" --

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- Multiple "Options" choice cells for Options 3 and 4 on the "OPTIONS" worksheet, have been checked (Note: "Multiple option choices" is an error, because in all cases, the user is not supposed to choose more than one option per option category; in this test, the number of options chosen were 0, 2, 3, or 4, as possible for the given category)
- When text is entered instead of the required numbers in the "Options choice cells in option 5 and 6, on the OPTIONS worksheet
- No data lots, or an insufficient number of lots, are "include[d]" for SPC or Histogram use on the NOTES+INCLUSIONS worksheet.

- Note# 1 SPC calculations require that at least one set of 3 lots in a row be "include[d]", and the Histogram/Capability calculations require that at least 2 lots be chosen. These requirements are more correctly said to be mathematical necessities rather than VDS ones; for example, to calculate a Cpk, a standard deviation is needed, but a standard deviation cannot be calculated unless there are at least 2 data points.
- Note# 2 The observed boundaries calculated by VDS under error conditions were 75.2610856 and 123.0056394; these could be seen on the main OPTIONS worksheet window. The % out of boundaries was observed (on the "Histogram Parameters" section of the CAPABILITY+NORMALITY worksheet) to be 1.000000% high and 1.000000% low.
- Note# 3 Under the default conditions, the Histogram was observed to have 17 total bars and, visually, to have an approximately "normal" distribution. The related correlation coefficient was observed (on the CAPABILITY+NORMALITY worksheet) to always be 0.985.
- Note# 4 If the "Specifications" are not entered in "Option 6", then the (visually cannot be)

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For details, see the attachments, and the

ATTACHMENT 1

XbarR Control Chart (reference: Wheeler & Chambers, p. 43)						
Raw Data				"Sample Average" chart (limits based on Sample Range)		
					Textbook values	VDS values (in all cases)
1	4	6	4	UCI	7.715	7.715
3	7	5	5			4.762
4	5	5	7			1.812
6	2	4	5			
1	6	7	5			
8	3	5	4			
7	5	4	6			
5			3			
4			6			
7			3			
4			6			
6			7			
3			6			
6			5			
7			6			
6			5			
5			6			
6			6			
6	4		6			
6	2		6			

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ATTACHMENT 2

							391)
11							
							ses)
90							
103							(in all cases)
97	9						(= 0.06% ^Δ)
103	100	9					14.76
90	101	96	1				0.00
97	106	97	105	96			
99	94	96	98	90	"Sample Average" chart, based on "Sample Std Deviation"		
106	93	104	93	99		Textbook values	VDS values (in all cases)
90	95	98	109	110	UCL	108.37	108.36
96	96	108	97	103	Midline	99.5	99.5
109	96	91	98	109	LCL	90.63	90.62
90	95	94	107	99			
91	101	96	96	109	"Sample Standard Deviation" chart		
108	97	101	103	94		Textbook values	VDS values (in all cases)
96	97	106	96	98	UCL	12.989	12.989
101	107	104	109	104	Midline	6.218	6.218
96	91	96	91	105	LCL	0.000	0.000

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ATTACHMENT 3

XbarR and XbarSD Control Charts (reference: Wheeler, pp. 86 and 96)													
#	Raw Data				#								
1	5045	4350	4350	3975									
2	4290	4430	4485										
3	3980	3925											
4	3300	36											
5	5100												
6	4635												
7	4410												
8	472												
9	479												
10	4110												
11	4790												
12	4740												
13	4170	38											
14	4170	4255											
15	4175	4550	445										
16	2920	4375	4375	48									
17	4090	5000	4335	5000	48								
18	4640	4335	5000	4615	44	5075	4925	5250	4915				
19	4215	4275	4275	5000	45	5600	5075	4450	4215				
20	4615	4735	4215	4700	46	4325	4665	4615	4615				
21	4700	4700	4700	4095	47	4500	4765	4500	4500				
22	4095	3940	3700	3650	48	4850	4930	4700	4890				
23	4445	4000	4845	5000	49	4625	4425	4135	4190				
24	4560	4700	4310	4310	50	4080	3690	5050	4625				
25	5000	4575	4700	4430	51	5150	5250	5000	5000				
26	4850	4850	4570	4570									

"Average" chart (limits based on Sample Range)		
	Textbook values	VDS values (in all cases)
	4978.32	4978.32 (= 0.0004% ^Δ)
		4498.18
		4018.06
"Sample Standard Deviation" chart		
	Textbook values	VDS values (in all cases)
UCL	685.33	685.33
Midline	302.44	302.44
LCL	0.00	0.00

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ATTACHMENT 4

XbarSD and Xbar(SE) Control Charts (reference: Wheeler & Chambers, pp. 56-59)						
Raw Data				Average" chart (limits based on Sample Std Dev.)		
#1	4	5	5	4	8	
#2	0	2	1	5		VDS values (in all cases)
#3	6	9	9			6.68
						5.0
						3.32
						VDS values (in all cases)
						2.768
						1.525
						0.282
						Std Error of Mean)
						VDS values (in all cases)
						14.0
						5.0
					ve 4.0	negative 4.0

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ATTACHMENT 5

"3-WAY" Control Chart (reference: Wheeler & Chambers p. 222)							
Raw Data					"Sample Average" chart (limits based on Moving Average)		
						Textbook values	VDS values (in all cases)
52.0	52.0	52.5	52.5	52.5			
56.0	55.5	56.0	55.5	55.5			
54.0	54.0	53.5	54.0	58.0	UCI	61.882	61.882
58.0	58.5	58.0	58.0	58.0			55.145
56.5	57.0	57.0	55.0				407
49.5	50.0	50.0					
56.0	55.0	55.0					
57.5	57.5						
53.0	53.0						
58.5	58.5						
53.5	53.5						
57.0	57.0						
57.5	57.5						
55.5	55.5						
52.5	52.5						
50.5	50.5						
53.5	53.5						
55.5	55.5						
56.0	55.5	56.0					
54.5	54.5	55.0	55.0				
55.5	55.5	55.5	56.0	55.5			
56.5	57.0	56.0	56.0	55.5			
55.5	56.0	56.0	56.0	56.0			
57.5	57.5	57.5	57.5*	57.5			
57.5	57.0	57.5	57.0	57.5			

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...ed this data point as
 ... error because the range listed in
 the textbook for that row of data is "0.00" and in 2 different
 locations in the textbook the average for that row is listed
 as "57.5".

ATTACHMENT 6

"N=1" (mR) Control Chart (reference: Wheeler & Chambers, p. 49)			
Raw Data			
39	"Individual Values" chart		
41		Textbook values	VDS values (in all cases)
41	UCL	46.02	46.01
41	Midline	41.42	41.42
43	LCL	36.82	36.82
44			
41			
			(in all cases)

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ATTACHMENT 8

"N=1" (SD) Control Chart	
Raw Data	
104.3	"Individual Value" (Simulation Std. Deviation)
104.9	(in all cases)
100.6	
98.7	
97.5	
103.5	
102.4	
103.3	

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ATTACHMENT 9a

Raw Data (= 490 data point from 45 to 55, plus 5 points less than 45, & 5 points greater than 55)

40	41	42	43	44	56	57	58	59	60
47.911	52.596	48.276	54.26	51.402	51.864	47.259	47.524	54.493	52.712
49.363	45.83	45.528	50.412	53.647	49.653	51.087	46.253	51.427	53.157
46.203	53.046	48.501	53.304	53.678	45.021	45.903	46.384	54.171	52.565
47.524	48.94	52.068	49.144	46.056	53.694	51.398	45.946	45.949	52.076
51.438	46.492	46.717	53.278	50.776	46.642	45.442	46.445	51.862	46.597
51.278	49.329	46.714	46.935	47.443	48.083	47.849	54.098	54.209	47.602
48.681	49.872	47.897	53.335	53.695	46.296	52.578	51.626	47.212	51.605
46.365	45.614	45.088	48.034	45.089	51.68	46.93	47.072	54.103	50.502
53.052	49.867	51.614	52.657	48.631	50.315	52.459	50.938	47.844	50.286
50.224	53.951	54.153	45.658	48.659	48.361	50.849	54.745	53.044	54.847
49.781	49.749	48.309	45.701	45.178	52.681	52.518	52.737	45.804	54.646
51.641	54.649	49.581	45.972	54.052	45.476	54.664	47.193	47.554	53.008
53.369	46.39	53.047	48.36	47.404	50.201	46.98	45.801	49.404	53.344
52.988	50.248	54.437	47.229	53.5	49.503	52.761	54.79	51.474	47.16
52.431	50.639	47.735	48.923	54.378	45.095	48.641	49.99	48.369	54.931
45.397	51.501	48.648	54.497	54.867	48.036	47.698	50.276	45.857	47.957
51.63	52.835	46.499	49.076	47.903	52.768	51.191	49.898	49.075	46.416
45.001	49.302	48.126	52.816	45.929	53.043	51.125	47.648	47.294	48.587
49.133	52.534	51.148	49.674	45.332	50.011	51.444	51.948	48.022	51.868
51.609	52.238	45.405	49.821	47.53	46.287	47.623	45.267	49.925	53.77
48.105	53.876	47.006	49.605	45.188	45.516	50.789	53.408	50.749	47.911
45.587	46.756	48.899	54.914	45.58	46.346	54.755	53.446	46.253	53.607
53.534	49.218	51.23	47.781	46.069	48.598	46.505	46.077	49.423	52.201
50.949	50.132	49.964	53.701	47.367	54.12	46.31	48.43	45.76	48.871
48.146	50.654	53.562	54.524	51.288	51.07	52.869	52.511	54.327	49.847
49.278	47.516	46.978	52.52	49.869	45.36	45.455	46.689	45.579	53.001
49.014	46.618	48.827	53.051	48.641	52.863	46.726	54.99	48.437	52.912
46.023	49.79	54.538	47.459	52.11	54.601	49.172	50.826	48.958	51.097
51.242	50.839	45.851	45.143	51.762	53.075	49.926	51.898	46.554	47.921
54.619	47.715	47.374	46.586	50.397	47.145	49.888	48.887	52.387	48.559
49.678	53.137	52.386	53.907	53.621	51.429	49.32	52.078	54.755	50.882
48.445	45.326	45.755	53.289	49.351	50.707	45.329	50.342	53.689	51.782
48.267	47.665	54.125	48.142	54.113	50.532	46.018	52.709	53.775	46.091
49.958	52.076	51.024	45.941	46.466	47.138	54.039	51.226	51.189	49.895
49.565	50.215	51.876	53.468	46.245	52.201	53.839	46.416	52.566	49.723
49.182	45.892	51.763	51.386	53.404	47.36	51.855	51.074	52.831	50.609
51.649	48.31	53.9	54.725	52.9	45.572	53.004	46.833	50.305	46.406
48.978	46.704	46.609	50.489	46.817	49.162	53.092	45.709	49.261	47.461
48.694	48.402	45.792	51.204	51.745	47.402	52.539	48.463	47.383	49.687
46.942	48.05	53.049	54.483	48.233	50.956	51.143	47.665	45.555	48.411
49.789	52.902	51.512	54.692	49.449	54.476	45.066	52.963	49.877	50.889
48.893	53.164	53.002	47.896	49.168	51.282	48.844	48.727	46.313	45.821
50.045	53.948	50.027	49.909	49.21	48.099	50.693	50.292	47.984	46.308
53.225	48.768	54.316	53.971	54.963	52.212	48.484	46.797	52.555	52.964
53.04	50.928	54.936	54.962	53.9	53.869	46.532	46.607	49.024	52.467
50.609	45.463	51.702	47.214	45.33	54.584	53.758	49.925	45.382	46.2
48.837	54.487	54.67	48.978	45.557	49.562	45.999	52.882	54.874	54.866
46.689	54.384	53.666	52.44	47.797	47.418	53.382	46.345	52.15	50.308
45.761	48.106	49.032	46.537	51.343	47.83	45.207	48.193	53.308	51.293

Histogram and Capability Analyses		
		VDS values (in all cases) Control Limits NOT calculated)
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		1.073291
Ppk (with USL+LSL, or just LSL)		1.064998
Histogram Frequency in....		
Bar 1	(hand count = 5)	5
Bar 2	33	33
Bar 3	36	36
Bar 4	37	37
Bar 5	31	31
Bar 6	33	33
Bar 7	35	35
Bar 8	29	29
Bar 9	38	38
Bar 10	24	24
Bar 11	36	36
Bar 12	23	23
Bar 13	35	35
Bar 14	37	37
Bar 15	30	30
Bar 16	33	33
Bar 17	(hand count = 5)	5

NOTE CONCERNING HISTOGRAM ANALYSIS: The data in Bar 1 and Bar 17 (the 2 extreme categories) represent "Series" set by VDS, namely 45 and 55, and are per Protocol, these categories

NOTE
Cpk differ
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VERSION OF THIS PROGRAM.**

- UCLavg
- Centerline(a
- LCLavg = 47.3617
- Standard Deviation of the raw data = 5.105711133
- SampleSize = 10

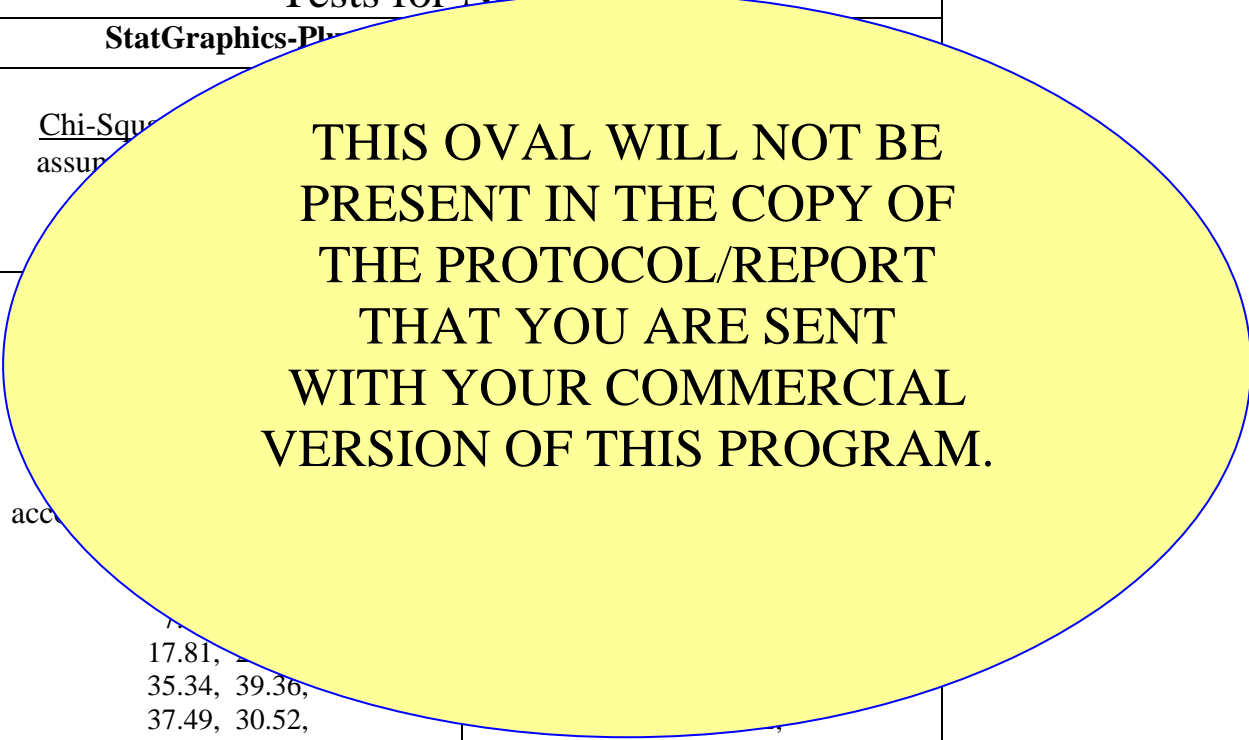
ATTACHMENT 10a

Raw Data:

84.15865	102.84822	107.17150	96.81954	94.33692	103.37500	100.65645	97.08639	101.46288	90.26063
104.37144	102.66150	104.74147	107.15668	90.78213	93.71505	106.56044	95.90552	122.68207	102.65198
95.76200	103.86099	98.21232	108.87919	95.96369	88.27141	95.23284	102.74481	79.87725	103.28121
125.13225	104.16529	97.57713	117.89022	96.30661	127.16770	101.69526	111.74078	89.80043	95.95539
109.51802	100.50165	98.95119	106.48852	105.56724	85.58842	113.03010	97.21068	96.68082	100.90890
93.74112	81.91697	92.74315	85.08647	113.90313	112.97130	85.62721	100.58747	90.95967	122.31682
97.69748	85.06082	98.17421	102.15665	90.14194	99.07343	117.25966	99.86497	99.61780	92.34310
114.77088	88.19651	94.77784	93.81539	84.05583	92.11341	98.65918	102.79091	115.64331	108.51408
104.29077	108.41665	99.27377	99.42249	91.16835	111.64078	97.70612	100.21078	119.32103	93.63000
105.84724	85.71052	100.52540	86.48832	111.41775	114.40294	81.09242	103.39526	109.72339	97.69826
104.67651	105.43464	98.47601	113.28458	104.85218	98.12519	113.00509	87.19718	100.44269	83.21578
109.79360	98.29076	98.93735	115.02376	96.77606	86.63361	100.99496	93.87455	110.37226	94.32704
90.76340	113.00866	102.34181	107.55067	98.40167	95.82385	86.79632	107.21609	107.29274	106.06190
99.16712	103.08485	94.51207	94.79448	98.60977	115.99342	111.01173	102.56571	80.68879	120.94730
88.18730	74.62655	87.54693	121.37049	114.00849	102.12065	114.71867	102.13161	90.75869	95.49942
115.87632	104.14777	98.34120	85.03272	103.34423	95.71174	111.45600	94.65822	78.03789	85.05614
92.71026	103.46258	90.69873	93.77272	99.67521	100.36307	89.57915	84.24655	111.56432	95.99188
94.77345	102.43942	108.96348	106.66421	118.53259	85.57978	93.43197	97.53220	107.02780	91.54186
101.19737	118.82145	125.58954	96.65172	98.25660	110.21760	81.31616	86.62427	108.26392	96.45037
100.53460	111.65738	96.79217	89.51043	104.22963	102.71543	93.54072	106.21428	95.25768	89.91557
98.22319	106.36437	97.25280	93.53884	118.97197	97.68727	112.99263	112.52481	109.67198	107.02389
93.58965	95.53072	108.09821	94.74450	113.16901	120.01952	97.95361	111.54194	105.78746	96.83241
90.72934	101.68440	97.73124	100.59589	105.33296	104.56331	85.94240	108.53827	104.17948	124.51616
95.21398	110.19957	120.48946	87.33142	101.97379	107.41403	108.99438	91.03882	108.34384	102.41027
105.02503	86.89805	102.65674	102.46623	100.71318	91.95581	91.16724	113.16355	96.67355	114.12782

The data above was placed into rows 1-25 of the DATA ENTRY worksheet, and then copied to rows 26-50, 51-75, and so on down thru to rows 176-200. Using the "Include" feature on the NOTES&INCLUSIONS worksheet, Chi-Square probability was calculated separately for rows 1-25, 26-50, and so on for a total of 8 different results. See results in Table 10b.

Tests for Normality	
StatGraphics-Plus	
<p><u>Chi-Square</u> assum</p>	
<p>acc</p>	
<p>17.81, 2 35.34, 39.36, 37.49, 30.52, 21.25, 12.65, 10.73</p>	<p>21.25, 12.65, 10.73</p>
<p><u>Observed Chi-Square Frequencies (in sequential order)</u></p>	
<p>7, 13, 15, 27, 40, 37, 38, 27, 21, 11, 14</p>	<p>7, 13, 15, 27, 40, 37, 38, 27, 21, 11, 14</p>
<p>Skewness</p>	
<p>0.165362</p>	<p>0.165362</p>
<p>Kurtosis</p>	
<p>- 0.209941</p>	<p>- 0.209941</p>
<p>Linear Regression Correlation Coefficient between "Observed" and "Expected" Histogram Frequencies</p>	
<p>0.989349</p>	<p>0.989349</p>



ATTACHMENT 11

Autocorrelation Analysis (reference: Wheeler, pp. 276-277)				
#	Raw Data	#	Raw Data	Autocorrelation Coefficient
1	8.09	28	8.02	
2	8.14	29	8.02	Autocorrelation Coefficient
3	7.90	30	8.02	Autocorrelation Coefficient
4	8.00	31	8.02	Autocorrelation Coefficient
5	8.00	32	8.02	Autocorrelation Coefficient
6	8.00	33	8.02	Autocorrelation Coefficient
7	8.00	34	8.02	Autocorrelation Coefficient
8	8.00	35	8.02	Autocorrelation Coefficient
9	8.00	36	8.02	Autocorrelation Coefficient
10	8.00	37	8.02	Autocorrelation Coefficient
11	8.00	38	8.02	Autocorrelation Coefficient
12	8.00	39	8.02	Autocorrelation Coefficient
13	8.00	40	8.02	Autocorrelation Coefficient
14	8.00	41	8.02	Autocorrelation Coefficient
15	8.00	42	8.02	Autocorrelation Coefficient
16	8.00	43	8.02	Autocorrelation Coefficient
17	8.00	44	8.02	Autocorrelation Coefficient
18	8.00	45	8.02	Autocorrelation Coefficient
19	8.00	46	8.02	Autocorrelation Coefficient
20	7.77	47	8.02	Autocorrelation Coefficient
21	7.70	48	8.02	Autocorrelation Coefficient
22	7.80	49	8.27	Autocorrelation Coefficient
23	7.87	50	8.00	Autocorrelation Coefficient
24	8.00	51	7.90	Autocorrelation Coefficient
25	8.24	52	7.84	Autocorrelation Coefficient
26	8.25	53	7.79	Autocorrelation Coefficient
27	8.23	54	7.77	Autocorrelation Coefficient

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ATTACHMENT 12

Raw Data: The data in Attachment 12 was created using the MS Excel menu feature: "Data Analysis, Random Number Generation, Normal Distribution" with mean = 100 and standard deviation = 10.

92.38918	103.2465	88.49371	91.92619	102.5958	110.0337	94.55561	104.1178	91.98856	104.4161
92.95162	95.27138	95.82385	90.64555	100.1939	111.8466	98.36059	111.0821	98.78952	87.56352
93.39109	114.5359	105.4063	83.918	92.77795	104.5896	113.1037	100.8229	94.65206	108.911
86.57734	100.5959	105.1626	99.02425	104.8212	110.7763	88.03373	101.4057	99.21624	116.2201
102.7004	102.5657	98.25504	109.015	102.2633	95.41291	114.9555	93.64311	100.7669	93.48692
85.32412	97.07521	99.12797	108.3818	103.9469	94.29286	80.66405	106.6442	104.9609	91.87734
88.73795	111.3841	108.8294	114.7029	119.2767	101.1858	100.3554	103.2239	100.1366	116.9524
103.7213	84.74032	80.69379	114.4832	80.54873	95.77288	84.99511	114.132	103.2651	119.4666
91.76725	91.40321	91.654	104.5956	122.4765	104.5616	107.3417	99.18477	102.3575	102.2021
111.5912	101.0173	97.72026	96.01093	82.06408	102.3198	90.66094	107.1478	92.62518	113.1436
109.8307	86.73388	113.6057	121.5464	108.1397	115.2867	97.52115	131.9385	104.009	101.5286
85.07014	110.1674	92.40246	103.4293	92.56279	86.02207	107.6548	115.431	89.95745	100.8559
97.3385	85.03745	87.5685	110.5268	97.78537	103.8857	106.8914	108.1578	105.5075	89.23734
121.3331	99.94989	117.2733	104.6007	97.34326	102.3583	100.0853	85.98132	99.16943	95.68154
80.18611	99.75403	106.9663	102.8084	103.3782	104.8591	84.93354	87.24907	101.8577	103.1748
117.3554	95.32349	90.60281	92.03801	101.3462	111.6906	91.42201	111.1474	122.136	105.8255
93.61501	111.3461	98.85654	102.8148	99.89482	85.61648	93.09505	104.6586	82.78427	117.6346
104.097	93.90498	103.0376	102.8984	92.6793	113.4547	107.0053	103.0488	90.09208	103.7894
112.4597	98.16877	95.89553	101.7053	116.6237	91.79406	114.1216	106.8275	102.4915	106.0261
107.8668	99.18093	108.4396	94.78484	110.5962	110.6974	110.8147	94.98018	103.7746	115.4059
101.8413	95.83471	116.286	89.80043	104.4574	99.82749	84.51085	94.55382	91.94101	110.7191
99.77622	82.15881	82.22229	105.1548	100.1105	114.4549	81.64758	97.06084	98.61594	79.11409
92.97904	102.9871	92.64426	81.91302	101.9052	114.8326	114.7277	93.51054	92.99862	83.85638
109.0657	119.0889	100.9881	88.69312	109.7837	106.0545	91.33547	95.99602	110.0147	91.96004
111.6559	120.9267	101.6495	124.4701	86.43284	98.46982	104.7132	116.3877	72.86286	93.02497
112.3836	103.203	100.6518	102.1496	98.5232	95.60498	88.08835	97.98251	116.6267	92.88971
102.8657	103.7336	73.52861	94.4104	104.326	97.6039	96.27546	89.40777	119.5382	82.64111
91.76832	80.13136	114.9955	106.0518	98.09637	103.6778	113.1218	95.2294	88.93763	87.15189
106.084	98.27602	101.531	114.7595	103.4561	95.62941	101.5317	90.24833	92.81365	102.0956
106.0674	103.3442	106.0077	85.62721	99.61933	94.79537	118.009	97.36227	85.10038	118.0323
102.2774	87.90597	108.8758	127.6945	109.4485	122.5344	103.5749	100.6204	88.96719	103.7968
89.96127	106.5434	96.32053	106.9926	94.17724	105.058	100.829	92.03696	107.2808	93.50676
80.68388	97.2242	102.4103	104.5082	88.04469	122.9935	101.7574	95.66137	105.7685	99.64995
85.32635	89.69172	97.31631	106.6222	96.32134	94.86793	94.61936	108.8577	95.14351	101.9714

ATTACHMENT 12 (continued)

91.64099	97.66605	85.74021	89.85945	95.21398	91.01708	97.74694	86.2343	118.1145	93.08729
93.78479	92.78489	110.9238	118.8576	98.0309	77.51383	87.09054	104.967	102.5309	102.725
99.96213	92.16966	123.2711	85.75076	100.5775	107.7847	101.5294	79.86561	96.17113	97.60942
85.98337	89.70732	95.08404	92.52238	93.21207	100.3677	95.2594	109.5881	110.1418	104.5922
98.93197	86.9824	94.80062	103.2659	97.45405	102.6734	102.7369	105.1591	107.3929	89.09286
116.223	93.56615	89.91175	94.34142	121.0095	100.4825	112.468	105.7929	90.86835	89.02606
94.48626	88.72063	87.49695	132.6399	98.79876	97.30917	84.51594	113.2772	96.21965	119.326
74.1598	98.79569	95.28163	86.87999	89.23324	111.4516	101.8686	106.2971	86.19869	91.05023
76.51721	116.1605	78.66689	95.58222	109.3142	101.1712	106.3223	104.1678	91.75652	105.578
71.60339	100.9373	105.0163	100.0593	86.30497	94.22612	97.27108	110.4182	114.9485	95.52396
105.0667	82.82456	110.1803	108.2984	103.5097	92.34926	86.39623	95.23884	102.6472	117.1488
95.09612	95.90219	99.39108	97.20114	92.97611	107.0936	113.7028	76.52922	99.31289	86.84734
115.2328	101.783	110.0895	79.94055	97.81672	91.50132	93.18507	101.6503	104.744	91.55061
95.16331	104.4414	112.5332	103.2691	110.4789	100.0991	94.28385	88.12559	99.32132	91.84859
123.1468	79.71827	94.34051	98.32569	102.783	97.31472	86.4654	97.63852	88.38477	109.9681
115.7244	108.9087	96.10684	107.1794	101.3346	94.61052	102.4095	83.14652	96.1917	109.2848
103.9419	105.0598	104.8978	106.6089	108.1099	99.32822	82.79773	107.4999	113.4095	85.68287
104.2229	105.2995	100.2613	109.8419	100.7469	89.15368	103.4001	101.1127	83.93191	80.31517
98.08547	96.47805	98.16488	92.34414	99.60631	97.80966	77.16495	118.0557	104.072	81.71716
104.8841	98.35438	97.92002	93.15996	101.6642	93.59154	99.98508	99.47077	117.982	91.95793
116.3236	83.48494	83.97625	110.9405	92.56077	99.24923	87.18499	101.0004	101.2382	85.9956
104.3437	94.13641	85.66154	83.89285	106.4895	88.66554	90.33412	94.73922	88.69891	101.1781
94.88538	94.86793	85.70629	91.02051	111.2289	98.18588	99.82979	109.7185	97.90203	105.303
105.1181	109.4532	102.8953	103.7139	85.44654	104.1186	99.66832	89.19629	102.1113	88.46699
89.31346	112.822	99.74026	106.4386	102.9583	101.2421	92.63723	106.6891	69.20815	110.7028
110.3552	99.10415	100.458	89.86584	111.3432	93.71878	104.768	99.03424	83.00559	123.3289
92.3718	96.30251	110.2966	82.81446	112.8761	88.56756	90.7164	118.4439	113.387	92.42898
87.12392	107.9788	120.2996	101.3941	87.73574	112.0181	111.037	103.61	107.4009	105.3136
96.7559	90.8579	89.49452	83.05402	101.6154	82.91082	117.1788	93.98126	95.20626	92.56279
109.427	89.97139	111.6137	108.7618	101.6154	104.6902	102.1911	97.841	110.603	101.6991
97.53377	93.47272	94.63262	109.5518	97.58894	93.44241	89.69822	87.0287	114.2619	94.04531
107.3247	79.16802	98.72707	78.40659	80.43586	100.5982	122.6821	102.0276	106.6795	92.09879
73.98336	93.76437	99.45928	104.5099	103.1001	102.246	100.3998	119.0044	92.57086	86.29912
103.3232	89.53429	89.73587	114.5491	96.27628	117.488	101.2213	111.1332	93.79778	104.2748
90.54676	101.449	90.15811	88.77249	90.81599	107.3107	100.5415	82.66176	103.0079	100.8298
91.24943	99.96672	107.3377	107.3527	104.3428	107.7475	120.3238	96.8316	113.2939	101.3146
90.31213	96.72364	83.80263	94.81374	103.2393	86.0119	122.7023	94.46043	95.31751	113.4585
89.33511	107.9064	94.05171	106.6346	98.07767	111.6967	94.52718	99.94147	105.3453	103.7213

ATTACHMENT 12 (continued)

101.5712	109.3853	107.1735	115.7297	97.65347	102.1645	86.9538	103.2344	106.8342	75.97806
99.40487	99.16405	100.4955	90.14567	105.424	100.7707	101.9106	105.8463	98.48607	95.87388
97.69984	101.6317	99.8535	101.4814	90.80317	93.52469	101.3339	100.236	94.72692	114.2303
104.395	94.40862	91.96533	100.9904	99.36886	107.3217	100.06	92.37589	99.85886	93.78665
80.98156	99.51519	99.68056	90.21381	91.24606	71.68925	91.77369	92.94671	81.06496	73.89205
99.59483	82.04112	94.41488	104.2171	85.09111	125.0966	87.55688	104.3067	86.13298	104.5328
99.80224	97.8731	101.2752	109.5397	92.76404	113.4095	111.0483	102.6718	97.88952	110.0679
103.2102	104.2079	90.56706	115.879	106.4085	99.99197	110.8905	86.79996	91.43306	106.5424
94.72604	93.17349	98.14154	105.5646	91.95477	105.16	103.6729	74.18126	101.6766	105.2213
85.72325	98.33733	115.9825	75.26174	100.1878	82.0946	102.1786	95.61426	75.17916	99.74102
94.55738	93.70293	94.31445	104.7269	109.6598	105.3745	101.5441	106.3111	128.2278	94.55649
96.27055	93.54638	120.1811	114.0679	87.4281	87.34338	91.95054	108.8735	81.15154	97.78537
96.06059	92.97904	88.72495	93.31765	100.3095	96.97527	106.2143	102.0292	99.97973	96.14561
100.0279	110.9196	84.24391	117.7703	94.65822	87.01803	115.3959	92.47576	108.9429	101.0303
110.0742	88.01179	97.20511	113.596	115.6433	103.8585	112.0797	96.31807	87.38076	108.8837
85.12817	115.8146	100.4274	95.71845	96.63471	63.88797	109.5481	111.8081	98.75793	82.42661
99.71042	104.5031	99.57722	101.8149	97.87935	85.03745	100.4488	102.2491	105.2038	88.60862
112.274	123.0042	98.10962	106.1347	82.64802	106.312	95.9645	92.30201	104.4608	79.98611
99.66756	89.9359	103.3669	92.61514	98.18588	90.67632	98.73248	117.0793	95.2011	100.1266
113.7795	112.7251	96.15136	90.19528	102.9991	111.3621	110.6285	96.60637	109.8084	106.5424
102.6805	91.01478	105.5833	101.5464	101.2883	118.0206	85.9218	104.2941	103.0913	101.8025
112.4034	84.37488	106.3803	117.6165	103.1411	108.8826	105.5896	88.19958	101.572	108.5504
90.35242	113.2459	97.85509	101.2105	90.12452	109.8146	87.29036	98.06209	103.7582	94.9089
90.53837	83.85356	98.29076	95.57717	106.2319	89.39436	108.8113	94.75504	94.94719	101.1912
99.83667	108.3633	100.2421	109.506	78.92755	126.4714	120.0881	89.0442	94.22973	104.5251
98.15632	103.3985	96.54797	97.43586	93.74484	94.3459	94.22159	111.1702	104.2054	94.52364
109.8345	120.9063	99.36119	113.8331	92.67529	103.842	115.6225	81.41602	101.8709	111.5748
101.4049	88.73361	117.3796	89.8017	78.7773	87.32119	93.72808	104.9626	104.157	101.3454
95.67733	100.2115	94.58396	115.576	104.3849	116.1212	109.0415	95.1805	96.14889	102.2052
101.5116	116.5842	93.56145	89.73458	106.0013	103.5561	95.88222	97.20909	110.4038	114.205
124.5473	99.71807	105.0042	85.26548	94.69876	83.16866	98.46517	84.03127	91.70052	88.63057
104.4262	95.36271	95.88138	98.57268	116.1183	103.2723	103.137	90.60637	98.71243	106.5842
94.40594	99.52897	102.1097	94.18721	100.6695	92.59906	115.4461	98.26437	96.77606	116.5812
100.2919	114.1988	137.4159	102.2327	102.7846	114.8556	85.44213	82.49427	95.6496	93.85886
95.73438	83.48794	81.96772	102.6552	84.56396	98.93735	105.1828	74.66475	101.2413	96.41776
101.8258	102.3159	94.69085	91.31876	84.01208	101.6324	81.41602	94.23515	89.95872	97.74066
92.59805	112.2773	100.0608	101.088	95.01833	94.2559	92.84234	90.91469	88.544	110.642
107.8054	106.2561	115.9251	110.4327	108.9692	99.3451	100.8659	104.8677	97.28933	107.982

ATTACHMENT 12 (continued)

101.3339	98.5232	103.3362	107.6272	110.9433	100.5185	109.4234	99.89864	116.4112	81.84985
98.94274	102.5641	86.42129	114.0412	115.0498	105.3568	97.88326	95.77121	100.8052	91.48044
102.0729	96.74462	97.70926	110.101	87.03756	102.2091	87.20236	113.1545	85.89701	98.02621
97.68962	86.91969	100.5024	76.49302	87.0287	88.73939	106.7082	97.99657	94.28296	90.52641
92.84037	111.1988	116.0904	114.9626	97.64167	113.3851	98.68464	106.0803	102.4686	90.40226
99.60326	93.52754	110.2189	103.0969	96.47642	97.4493	103.6141	118.2626	77.92565	107.8407
94.65206	87.74547	103.8998	98.91427	88.13023	95.11595	99.4363	97.07362	69.53993	73.45149
95.88888	86.97526	103.3564	109.1922	107.0768	92.981	114.73	112.0118	92.1811	96.07877
113.468	110.6433	87.95038	101.3686	102.6924	108.191	95.38059	102.7456	91.70591	96.22951
105.4942	112.6057	85.09575	96.30334	101.5379	108.6112	108.2145	93.43197	94.97584	90.93893
116.2116	100.9704	98.58659	90.85674	103.8956	102.1606	85.22912	93.86071	104.6339	80.93945
116.1183	105.1924	91.42974	88.84405	99.34586	90.77511	109.4964	92.75708	100.0203	86.19869
91.36551	107.3929	96.68325	115.5222	101.4482	113.9597	87.56352	99.53434	107.7134	97.44535
89.86457	85.23372	91.45512	98.71011	101.7993	106.4367	102.4702	100.3034	85.59274	104.2941
117.1989	104.6024	111.3301	95.42481	85.39784	97.0824	103.7672	88.74371	107.1913	98.64915
103.6378	110.1944	108.5328	112.5483	92.07577	100.3899	91.91771	105.6775	108.0675	92.65126
86.27759	117.5448	103.044	100.0149	103.5276	95.16502	92.6873	99.96749	101.2729	102.7091
75.4993	121.945	96.18019	95.50366	107.019	90.59091	115.7034	104.1336	106.6594	95.23798
115.7192	86.43666	79.51054	95.34482	72.77046	84.66142	99.6974	88.82693	106.7341	109.0449
103.6737	91.84217	100.0578	108.8633	95.6092	109.7087	98.56495	111.3767	99.16865	102.1535
96.77123	100.8007	88.72063	104.9592	106.0343	103.2256	113.1836	102.6132	122.448	104.0986
114.1258	101.2891	90.64319	119.2572	98.52862	95.88804	101.185	93.64779	99.2523	91.69404
91.03995	98.84653	92.62118	118.6055	102.6663	99.61474	116.3527	95.77958	84.78429	78.39877
110.2202	100.8828	105.5226	102.6924	106.3307	89.45859	92.67129	97.05365	89.36478	96.80506
90.59924	106.4028	96.01922	101.3099	101.3871	85.48833	93.02986	89.35266	118.7279	89.2945
99.26533	83.51777	108.5714	77.00652	103.7442	99.50064	106.6881	90.18414	90.38891	90.83348
92.771	108.1546	99.35428	94.46845	121.523	108.5703	89.78369	103.2481	94.61318	101.5774
109.6087	104.028	93.10379	113.6677	92.54765	115.9578	98.93505	100.4044	94.5485	96.80666
102.1645	73.62902	109.5627	112.7268	90.71877	80.95354	100.4144	87.90281	85.05145	104.9574
105.5914	98.54253	118.8485	97.70533	121.4233	91.50789	97.56531	106.9809	106.3372	95.15901
103.2344	94.21254	110.885	80.00876	106.0987	110.5655	108.7416	93.58402	100.9412	102.1371
123.6549	86.28932	99.82136	108.7013	114.1841	111.8698	89.76948	91.74684	132.8	103.7319
99.50523	101.5921	95.74443	87.64433	101.6712	92.51124	101.0242	77.65535	117.0334	106.8391
111.4915	94.54139	92.22671	109.0013	104.0504	98.85654	114.979	112.102	96.38185	115.3386
106.1781	105.7838	93.8191	106.1911	101.7426	90.4071	89.57387	82.59254	111.0652	97.28616
107.8418	93.59154	104.8178	115.351	109.326	85.18801	102.5491	107.1774	110.0059	112.5399
97.69277	106.2654	122.0569	101.3848	95.95289	102.4891	90.55274	95.83304	116.0709	124.871
90.82065	95.30301	93.50676	100.3455	102.1935	90.80667	99.34662	96.37287	115.9989	95.30899

ATTACHMENT 12 (continued)

106.0628	102.6314	86.50924	101.2375	90.11454	103.1555	127.8022	88.35319	114.8764	105.0459
87.93137	97.76263	95.12629	94.81025	100.5507	65.12779	101.3532	92.15718	112.4183	99.19476
103.5456	108.9121	102.6393	104.0264	102.9519	105.9063	115.5529	105.119	103.7984	94.89845
107.6497	101.7636	98.33733	72.51216	104.2916	100.1779	90.48077	86.52634	105.318	118.8259
105.2213	110.188	88.079	100.8759	134.8722	105.5699	117.9207	98.31482	104.8617	97.84961
109.7566	82.75389	104.187	103.641	127.9892	87.47685	102.1754	93.36347	110.4776	117.2937
95.12888	102.3442	89.36883	101.2683	117.5057	113.6134	108.3558	100.9281	106.8923	98.90042
109.1688	92.37691	95.45112	91.8816	89.21271	103.7049	102.0589	111.4959	109.2942	101.6301
110.6974	86.84734	101.2097	104.3269	98.74404	98.25038	106.9079	106.084	92.61113	90.4988
96.95684	83.41877	99.31058	99.04269	101.811	114.4094	101.5852	108.9042	94.72604	98.68619
106.3447	100.132	93.63469	97.37495	100.2559	114.3065	75.1959	100.6426	116.6665	96.45199
103.768	77.6368	99.11261	95.07886	87.76004	96.28367	92.13844	107.9462	94.87666	99.88257
112.3033	105.1364	87.76975	98.88964	113.4491	108.7573	103.0961	93.71225	107.765	95.82803
100.3286	98.85576	105.9091	104.449	118.903	113.5845	92.92413	94.48626	85.08647	96.68082
107.9515	97.35356	76.07283	94.7717	91.09468	94.15094	88.87536	100.5928	116.9814	119.4564
87.34847	94.19626	91.3143	91.80798	90.12578	85.55595	91.33659	91.1548	111.9584	83.14338
98.34896	94.14913	95.23627	90.7868	87.03756	83.3427	114.0166	87.20409	107.6466	107.2171
91.8869	107.568	101.0419	110.749	100.3761	110.7286	121.3705	96.61852	106.9828	128.107
98.609	113.6173	103.6043	111.102	82.60992	92.76603	90.97004	91.76832	104.3176	108.6879
120.9199	103.9022	103.1419	102.1167	88.1426	103.782	80.97692	96.99368	87.94087	91.3555
104.4203	117.2157	110.0997	106.6232	98.84344	94.4113	108.5824	79.88307	87.03224	87.28863
104.0455	75.62045	93.00351	90.87183	98.45046	115.5657	103.1314	99.27531	96.31316	101.4041
99.00504	100.8229	101.7162	96.72525	106.1273	96.30005	110.5695	94.61052	99.10954	85.8243
102.2852	95.70252	106.6203	103.4918	114.0494	105.0294	101.0803	111.6152	101.1666	81.80597
83.58289	90.21506	82.02575	91.23033	104.8608	76.23054	83.35188	86.94125	97.62672	107.1103
97.27584	92.92413	99.5642	112.0449	95.54593	97.49432	97.92315	110.5788	127.9513	117.671
88.97283	91.50132	97.88874	101.6999	87.84697	106.0123	113.7244	98.26515	102.7583	99.40028
98.51237	82.92724	103.7606	97.25678	103.3248	102.2578	112.7268	94.36295	83.80545	109.6866
89.20314	87.62464	100.9051	107.6006	98.09481	82.98936	120.0424	110.021	103.3507	99.94454
101.1843	112.4249	101.2876	98.9312	104.9843	110.2979	90.01682	94.94457	109.8605	91.03538
92.6833	102.2939	92.26596	87.49026	118.9952	107.7309	105.424	103.9626	107.7011	101.4853
85.0163	101.5132	110.5962	104.3731	101.5371	86.72279	106.9926	110.073	93.68333	105.303
102.4363	110.6595	82.0564	106.5036	74.3286	92.63422	101.105	82.02575	101.4575	102.9104
92.57892	102.1019	107.5924	97.03527	103.7368	90.85906	97.22818	99.48685	84.63159	92.94082
77.48491	80.86832	106.3335	102.2256	110.9614	107.0445	107.508	100.481	106.3064	107.4574
118.1981	112.5888	109.1479	104.1411	100.7255	101.7162	101.7737	101.1812	89.06369	112.6209
93.60093	82.78427	90.04699	104.1586	97.05924	104.4786	100.3309	89.01208	101.3339	108.2995
80.80602	102.7814	84.53623	101.2722	106.3972	89.03304	106.9877	110.3657	77.02798	108.2758

ATTACHMENT 13

The term "Hand Count" in the table below means that the relevant raw data was (1) pasted to a blank MSEXcel worksheet, (2) sorted using the MSEXcel "Data, Sort" menu feature, and 3) eye-ball counted for the number of data points that were below or above the "boundary" values (in the table below) that were inputted to "boundary" cells of Options # 5 on the OPTIONS worksheet.. To perform this test, all of Attachment 12 was pasted into the Data Entry table on the DATA ENTRY worksheet, and then the listed "Data Set" Rows (= AutoSampleID#'s) were chosen using the "Include..Histogram" feature on the NOTES+INCLUSIONS worksheet.

Data Set (= Attachment 12)	Upper Boundary	% above Upper Boundary		Lower Boundary	% below Lower Boundary	
		VDS	Hand Count		VDS	Hand Count
Rows 1 thru 200 (= 2000 data points)	100	49.95 %	999 / 2000 = 49.95 %	100	50.05 %	991 / 2000 = 50.05 %
	110	15.85 %	317 / 2000 = 15.85 %	100	16.60 %	317 / 2000 = 15.85 %
	120	2.40 %	48 / 2000 = 2.40 %	100	0.00 %	0 / 2000 = 0.00 %
	130	0.25 %	5 / 2000 = 0.25 %	100	0.00 %	0 / 2000 = 0.00 %
	140	0.00 %	0 / 2000 = 0.00 %	100	0.00 %	0 / 2000 = 0.00 %
Rows 151 thru 200 (= 500 data points)	100	51.60 %	257 / 500 = 51.60 %	100	0.00 %	0 / 500 = 0.00 %
	110	15.2 %	76 / 500 = 15.2 %	100	0.00 %	0 / 500 = 0.00 %
	120	2.20 %	11 / 500 = 2.20 %	100	0.00 %	0 / 500 = 0.00 %
	130	0.20 %	1 / 500 = 0.20 %	100	0.00 %	0 / 500 = 0.00 %
	140	0.00 %	0 / 500 = 0.00 %	100	0.00 %	0 / 500 = 0.00 %
Rows 71 thru 100 (= 300 data points)	100	48.33 %	145 / 300 = 48.33 %	100	0.00 %	0 / 300 = 0.00 %
	110	14.33 %	43 / 300 = 14.33 %	100	0.00 %	0 / 300 = 0.00 %
	120	2.67 %	8 / 300 = 2.67 %	100	0.00 %	0 / 300 = 0.00 %
	130	0.00 %	0 / 300 = 0.00 %	100	0.00 %	0 / 300 = 0.00 %
	140	0.00 %	0 / 300 = 0.00 %	100	0.00 %	0 / 300 = 0.00 %
Rows 1 thru 10 (= 100 data points)	100	55.00 %	55 / 100 = 55.00 %	60	0.00 %	0 / 100 = 0.00 %
	110	18.00 %	18 / 100 = 18.00 %	60	0.00 %	0 / 100 = 0.00 %
	120	1.00 %	1 / 100 = 1.00 %	60	0.00 %	0 / 100 = 0.00 %
	130	0.00 %	0 / 100 = 0.00 %	60	0.00 %	0 / 100 = 0.00 %
	140	0.00 %	0 / 100 = 0.00 %	60	0.00 %	0 / 100 = 0.00 %

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Summers Consulting
Process Development
Reagent Manufacturing
Mathematics

Livermore, CA 94550

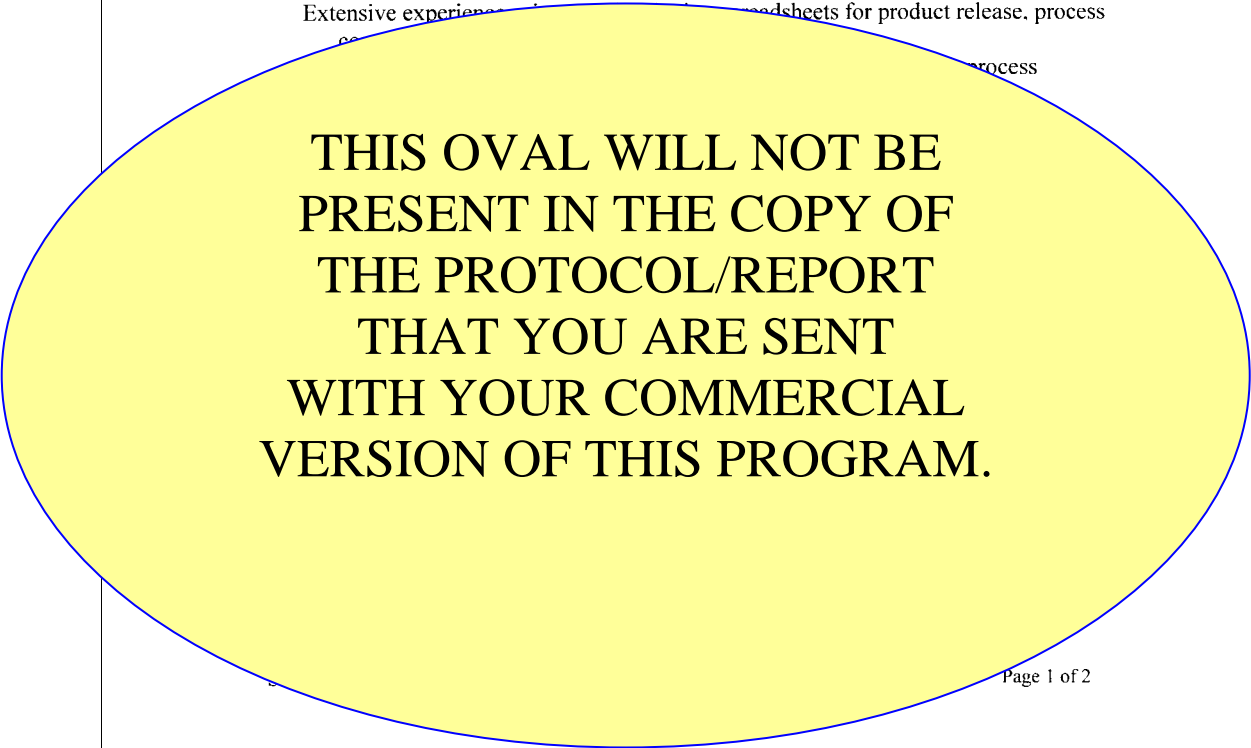
September 26, 2003

REPORT ON EVALUATION OF SPREADSHEET "VARIABLES DATA SPC" version 2.01, PRODUCED BY ZORICH TECHNICAL CONSULTANTS

Person who performed the evaluation: Ken Summers

Qualifications of person who performed the evaluation:

B.A. Chemistry, B.A. Biology, with additional university coursework in statistics, programming, and computer modeling
16 years experience in GMP/ISO environments (manufacturing, engineering, and management), including use of SPC for production processes
Extensive experience with spreadsheets for product release, process



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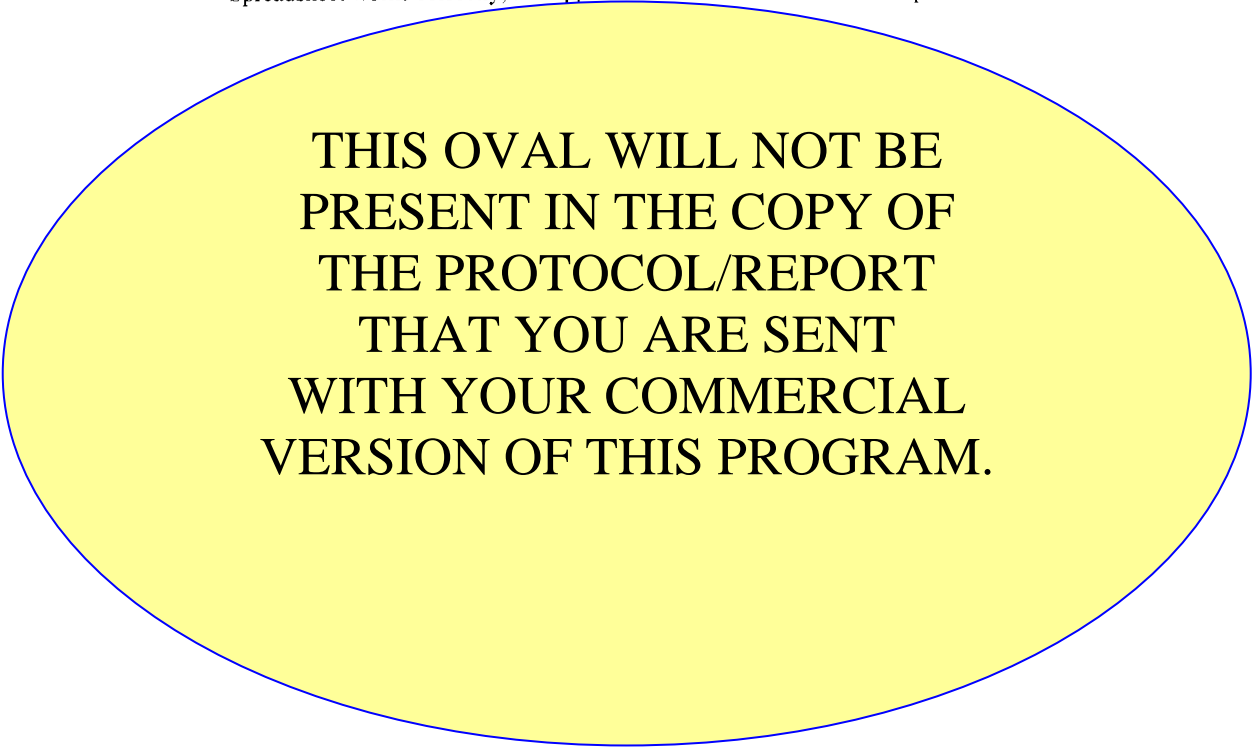
Page 1 of 2

Results of evaluation:

Errors and bugs found: None found

Summary statement of evaluation:

Spreadsheet works correctly, and appears to be robust to invalid user input.



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