

QC MINE

User Manual



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If the file is distributed, the following restrictions apply:

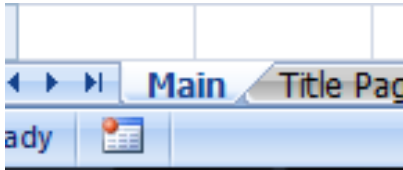
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Quick Start

1. Read the User Manual.
2. Go to the worksheet "Main" and click the button labeled "Start".



	A	B
1		
2		Start
3		

3. Follow the directions that appear.

Overview

The original data are compiled in an Excel worksheet. Any number of elements and samples can be included.

QC Mine walks the user through a number of different steps to:

- a) identify where the program will find sample numbers, dates (if available), elements, units and analytical results;
- b) identify issues in the data and select options for treating them;
- c) load expected values and tolerances from the RM Library if a matching RM and element are found;
- d) request that the user supply the expected values and tolerances for RMs not present in the RM Library;
- e) ask if the user wants to reject Outliers or QC failures;
- f) ask if the user wants to plot control graphs with Outliers excluded;
- g) ask if the user wants to plot control graphs with QC failures excluded.

When all of the necessary information is provided, the program creates control graphs.

The user is prompted for the name of a subdirectory to save the data in and a title for the control graphs.

A macro-free workbook is created for each element (e.g. Ag - Project A.xlsx) in the new subdirectory.

The new workbook includes:

- a) summary statistics for all of the reference materials (RMs);
- b) summary statistics without Outliers or QC Failures;
- c) a listing, by element, of all Outliers and QC Failures;
- d) a worksheet for each control graph, both with and without QC Failures or Outliers.

Before You Start

QC Mine is a series of Excel macros designed to help organize and interpret Quality Control data for the geological and mining industries. Given a large QC data set, QC Mine can aid in finding and correcting errors in the data, produce some basic statistics, and plot easy to interpret control charts. All data is saved as a series of intuitively named macro-free Excel workbooks for ease of distribution. A copy of the macro with all of the data is also saved in a ready-to-plot format that allows for quick and easy modification, reanalysis and replotting.

The first thing you should do is customize QC Mine's control charts to suit your individual needs. All control charts are based off of the chart in the sheet "Template", so any changes to this chart will be reflected in the control charts generated later.



Feel free to adjust the colours, fonts and styles to your liking. **Do not delete the title, axis labels or any of the five series on the chart.** QC Mine will be using these later and will crash if they are absent. If you want one of the series to not display, simply edit its appearance to have neither markers nor lines.

You can save QC Mine as any file name you like so long as it is a macro-enabled workbook. This can help distinguish between different instances of QC Mine as a new QC Mine workbook will be created each time it runs to completion.

Any changes that QC Mine makes to the data are logged in the worksheet "Data QC" to allow tracking of problems back to source.

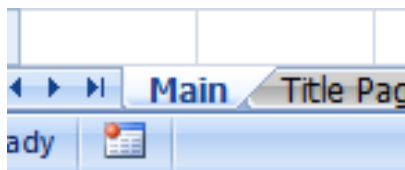
Getting Started

QC Mine is designed to retrieve data from any format that Excel can interpret without modifying the original data file. To begin:

1. Open your data file in Excel. QC Mine needs the data to be arranged so that each row contains one record with a sample number, reference material ID and at least one analysis. All you need is that in each row:
 - A date of analysis for each record is optional but useful.
 - Headers are very helpful, but as long as you know what each column contains, you can proceed without them at this point.
 - Don't worry if there are blanks and other data, QC Mine will take care of that in a moment.

Do not copy this to QC Mine, it will just get erased.

2. In the QC Mine workbook, go to the "Main" worksheet and click "Start".

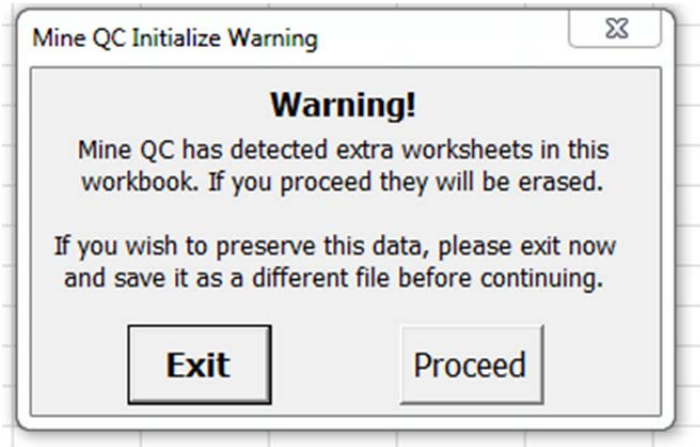


	A	B
1		
2		Start
3		

If nothing happens:

- Make sure that macros are enabled.
- Make sure that the macros are present.
 - If there is no "Main" worksheet then you are likely in a macro-free workbook generated by QC Mine. Exit it and open a version with the macro.
 - If the file does not have an ".xlsm" extension, then you are likely in a macro-free workbook.
 - Hold the "Alt" key and press "F11". This will show you all of the macros in the workbook. Look for a module named "QCMine". If there are no modules, then the QC Mine macro isn't part of this workbook. Close it and look for a file with the ".xlsm" extension.

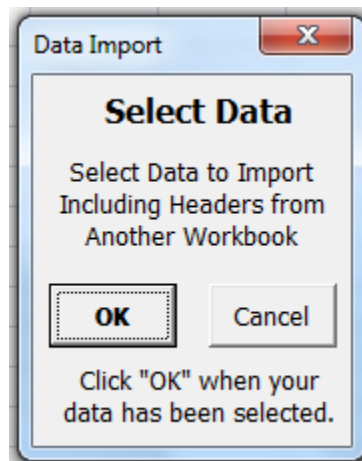
3. An ominous warning indicating that you're about to wipe the workbook to a pristine state should pop up.



If you need to save something in the workbook, click "Exit". Otherwise, click "Proceed".

The "Start" button also serves as a master reset. If something goes terribly wrong, you can always click it to reset to the very beginning.

4. A new dialogue box should appear asking you to select your data **including the headers (sample number, date and analyses)**. We will need those headers in a moment. Select the data in the other workbook and then click "OK".



Step 1: Organizing Data

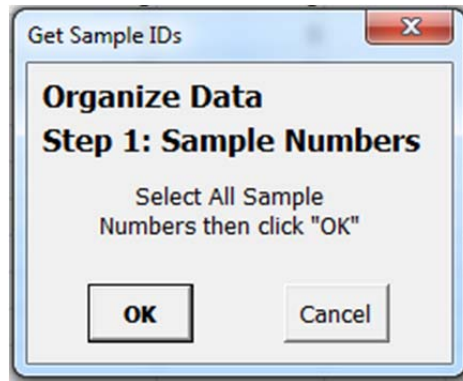
Before you proceed, pause and check your imported data over.

- Close your source data file.
- Make sure it's all there. Go to the worksheet "Original Data" in the QC Mine workbook and have a look.
- Add or modify any headers. The macro will use these to identify the analytes when it searches the RM Library later. "Au" will likely be recognized. "Au_FA-AAS_ppm" likely won't and will make more work for you.
 - These headers will be used to name both worksheets and output files. As such, the length is constrained to a maximum of 17 characters. Special characters such as "/?\\%." and the like are not valid as worksheets or filenames and must be avoided.
- Beneath the headers, add units of analysis for each analyte. We will need these in a moment.
- If you are evaluating multi-element data, then organize all of the elements of interest into a block. You can leave extraneous data amongst the data of interest, but you will either have to remove it later or it will slow down processing.
- QC Mine doesn't explicitly support analysis of multi-method data for the same element. Multi-method data can be evaluated by changing the header to reflect the different methods, e.g.: "Au_AR", "Au_FA", "Au_Grav". This will require some slight tweaking of the final output.

When you are ready, go to the workbook "Main" and click "Organize Data".

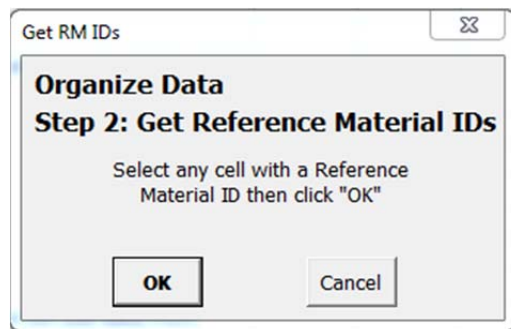
	A	B	C	D	E	F	G	I
1								
2		Start						
3								
4								
5								
6		1 - Organize Data				Revert to Start		
7								

1. Get the sample numbers.



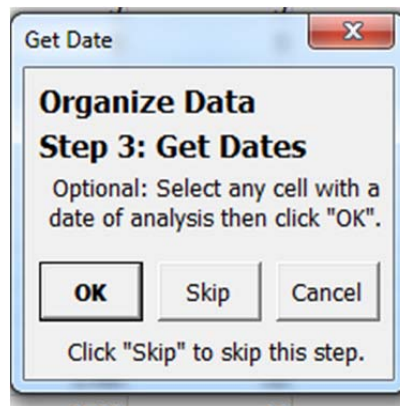
In the Mine QC workbook, go to the worksheet "Original Data" and select all of the sample numbers you want to analyze. Once selected, click "OK".

2. Get Reference Material IDs.



In the worksheet "Original Data", select any one cell with a reference material ID and click "OK". You don't need to select all of the cells, the macro remembers the row numbers from Step 1. Click "OK".

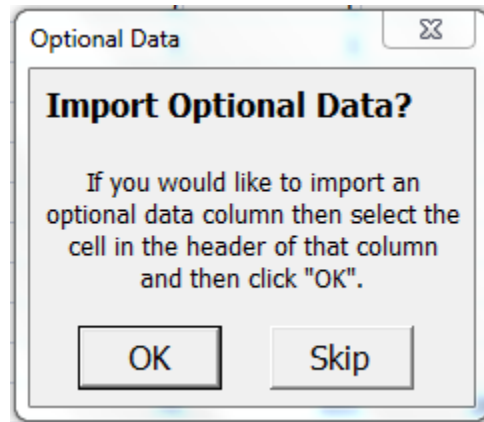
3. Get Dates (optional)



If your analyses have dates, select any one date in the worksheet "Original Data" and click "OK".

If not, click "Skip". Don't click "Cancel" or you're back to square 1.

Get Optional Data



You can include up to three columns of optional data such as certificate numbers, lab names, drill holes, etc. QC Mine will not process this data but will carry it through to the final steps unaltered to help with the tracking of QC failures.

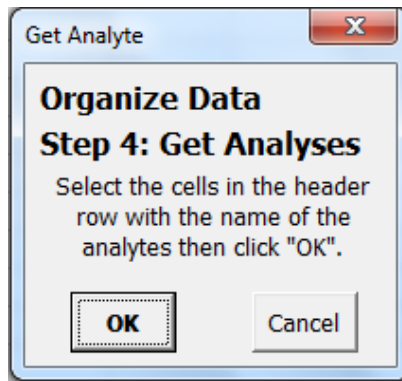
In the header row, select the header of the column that you would like to import.

	A	B	C	D	E	F
1	Sample ID	RM ID	Drill Hole	Lab	Certificate	Ag
2						ppm

Click "OK".

This step can be repeated three times, once for each optional data column.

4. Get the Analytes

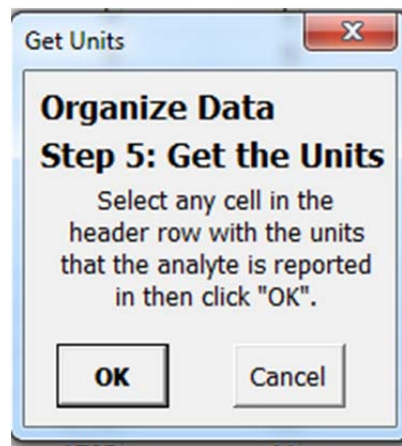


In the header row, select all of the analytes that you want to evaluate.

C	D	E	F	G
Au	Ag	As	Cu	Pb
(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
	0.5	5	1	2
	0.5	5	1	2

Click "OK".

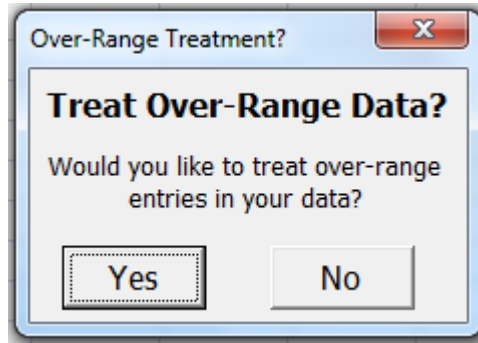
5. Get the Units of Measurement



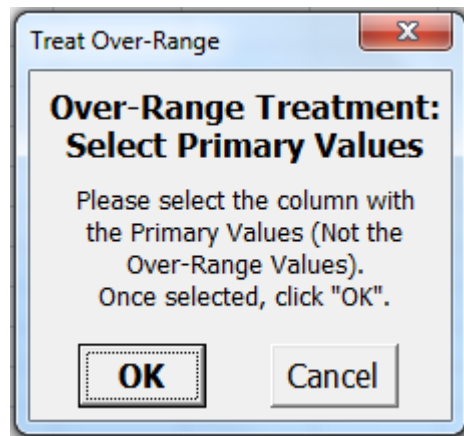
In the header row, select a single cell with a unit. The macro remembers which columns to use from Step 4. Click "OK".

Over-Range Data Treatment

At this step, you have the option to let QC Mine treat any over-range data that you might have.



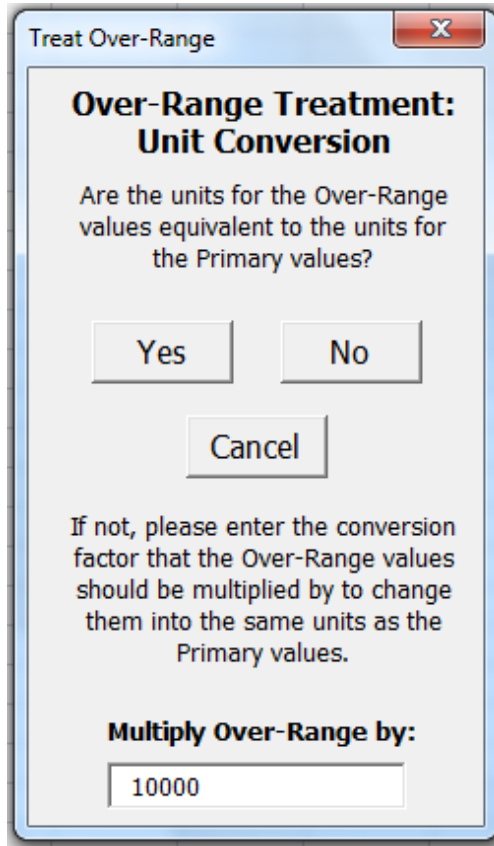
First, you will be prompted to select the column with the Primary values (not the Over-Range values). Select any cell in the column and then click "OK".



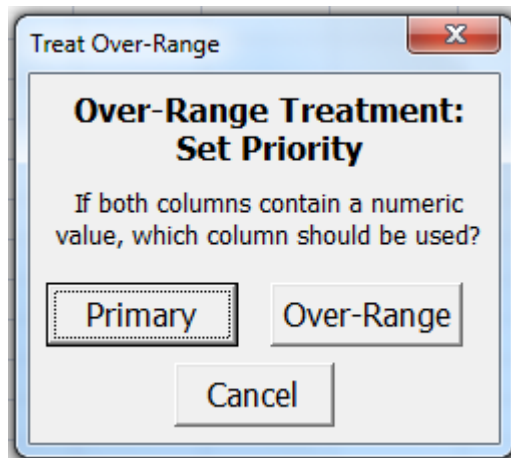
Next, select the column with the Over-Range values in the same manner.



If QC Mine detects different units in the two columns you will be asked if they are equivalent (e.g.: "ppm" and "g/t") or not. If not, you will need to enter a conversion factor. This is the amount that the Over-Range values should be multiplied by to get them into the same units as the Primary values.



Lastly, you will be asked which column should take priority if both have numeric values. These are the values that will be retained.



Once QC Mine has finished treating your Over-Range data, you will be given the option to treat more Over-Range data or to continue on to the next step.

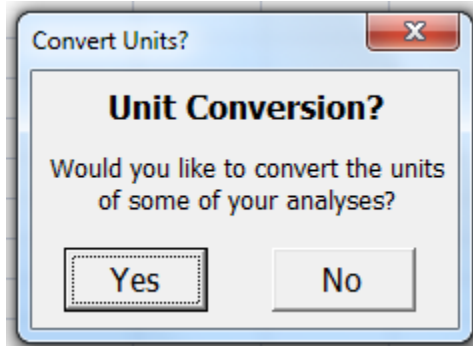


Important Note! After this step, all columns should have unique headers. If you still have two columns with "Au" (for example) in row 1, then your data will get mangled in subsequent steps.

If your data still has this problem, don't worry. You can change the headers when QC Mine pauses in a few steps to deal with non-numeric values.

Unit Conversion

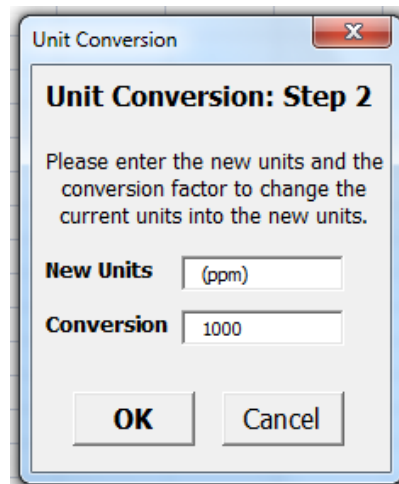
Next, QC Mine presents an option to convert the units of measurement. This can be handy if your data is in oz/ton, but the RM values are in ppm.



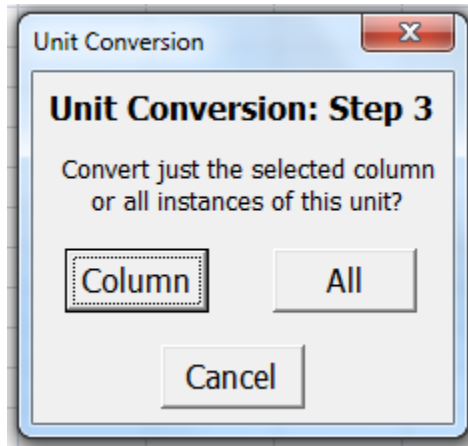
First, select a column to convert the units in. Select any cell in the column and then click "OK".



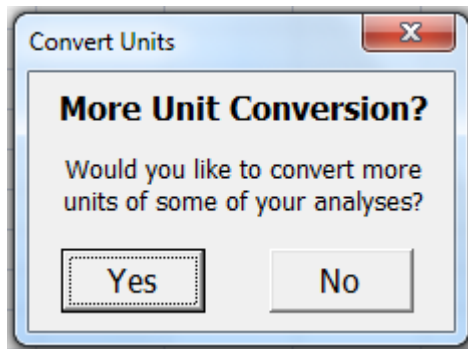
Next, provide the new units and the conversion factor. The conversion factor is the amount that your data will need to be multiplied by to convert them from the old units to the new units. That's 10,000 if converting from wt% to ppm, 0.0001 converting from ppm to wt%.



Next, you have the option to convert just this one column or every instance of this unit.

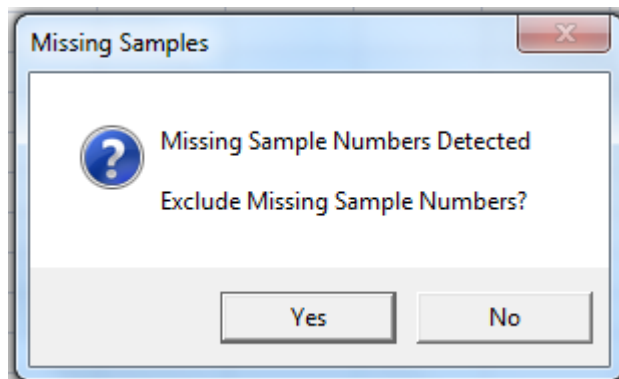


After QC Mine has finished converting your units, you will be prompted to convert more units or continue to the next step.



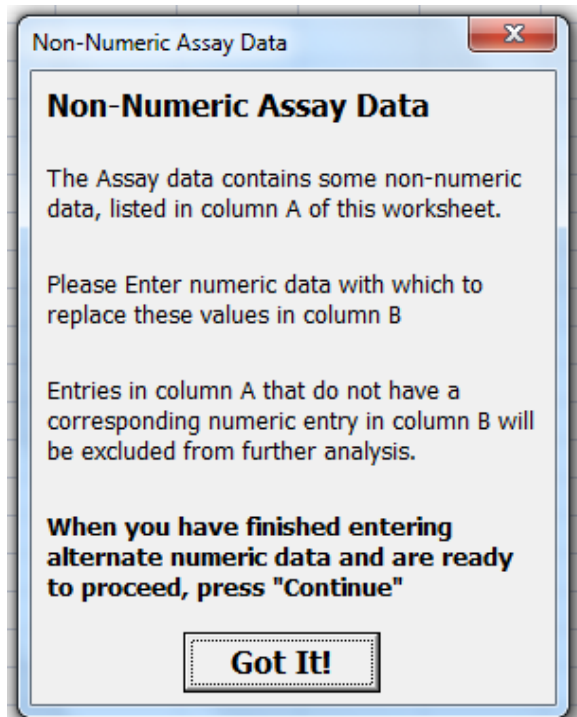
Next, QC Mine will search for and attempt to repair a variety of data issues:

- Entirely empty rows will be deleted.
- QC Mine will search for missing sample numbers. There is an option to exclude any found. Excluded data is moved to the worksheet "Excluded Data".



If not excluded, they will be highlighted for manual correction. Any missing sample numbers that are not corrected will be skipped during evaluation.

- A similar procedure is done for reference material IDs. Missing RM IDs may be excluded automatically or highlighted for correction. RM IDs that are left empty will be skipped by subsequent steps.
- If present, dates will be checked for missing and non-date values. Missing dates are treated the same way that missing sample and reference materials are handled. Non-date values (the wrong format or misspelled) are highlighted for manual correction.
- Lastly, QC Mine checks for missing analyses, non-numeric analyses, and analyses with values of zero or less.
 - Missing analyses may be excluded or simply highlighted. **Don't select the "Exclude Missing Analyses" option if working with multi-element data.** A record that is missing data for one element may well have data for others.
 - Non-numeric assays and analyses with values of zero or less are listed on a separate workbook for automatic replacement with numeric values.



Click "Got It!" when you are done reading the instructions.

- The worksheet lists the non-numeric values for each analyte in column A.

	A	B	C	D	E
1	Analyte	Value	Replace With		
2				Continue	
3	Au	<DL			
4	Ag	<DL			
5	As	<DL			
6	Cu	<DL			
7	Cu	NSS			
8	Pb	<DL			
9	Pb	NSS			
10	Zn	<DL			
11	Zn	NSS			
12					

- Enter a numeric value in column B to replace all instances of the non-numeric data.

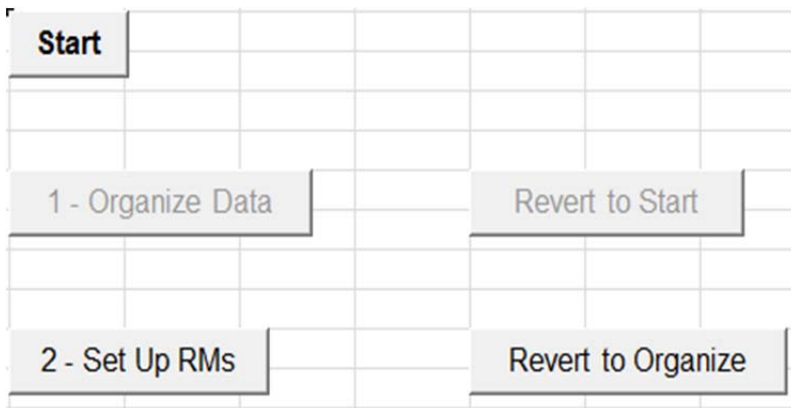
	A	B	C	D	E
1	Analyte	Value	Replace With		
2				Continue	
3	Au	<DL	10		
4	Ag	<DL	0.005		
5	As	<DL	2		
6	Cu	<DL	1		
7	Cu	NSS			
8	Pb	<DL	2		
9	Pb	NSS			
10	Zn	<DL	2		
11	Zn	NSS			

If column B is left empty, the non-numeric data will not be altered, but will be skipped in subsequent steps.

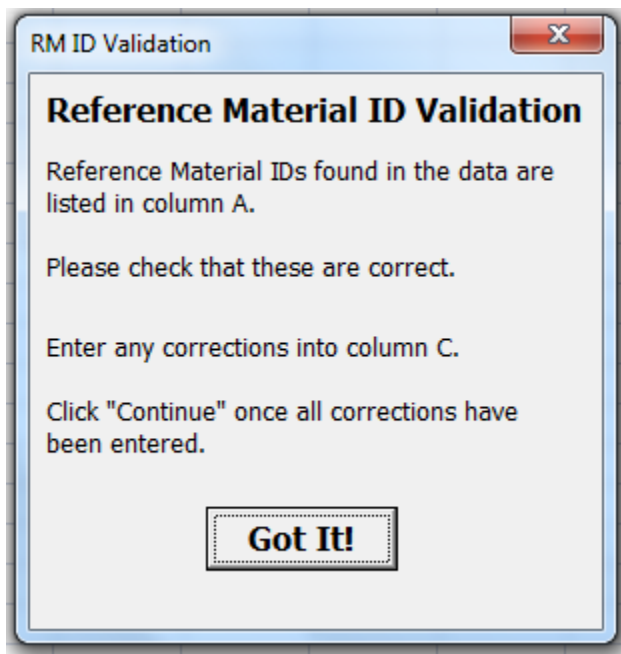
When you are done entering numeric equivalents, click "Continue".

Step 2: Set Up RMs

Now that the analyses have been organized, we need to organize the reference materials. Back on the "Main" worksheet, click the button "Set Up RMs".



1. First, all of the different RM IDs are listed in a temporary spreadsheet.



Click "Got it!" once you've read the instructions.

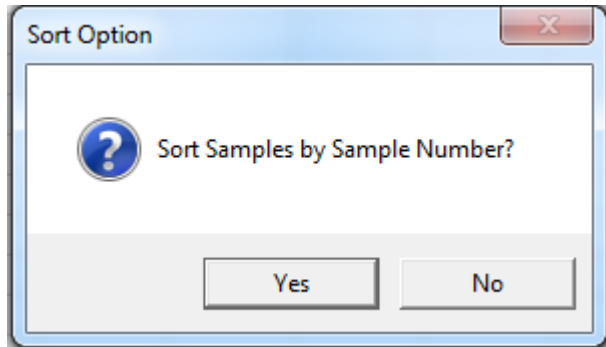
	A	B	C	D	E	F
1	RM ID	Instances	Replace With			
2					Continue	
3	Fine Blank	267				
4	OREA-131a	1				
5	OREAS 131	1				
6	OREAS 131a	258				
7	OREAS 131b	249				
8	OREAS 132a	418				
9	OREAs 133b	2				
10	OREAS 133b	357				
11	OREAS-131a	5				
12	OREAS-132a	3				
13	OREAS-133b	4				
14						

Next to them is listed the number of times that particular RM ID occurs in the data. Entering a value in column C will cause the macro to replace all instances of the RM ID in column A with the RM ID in column C.

	A	B	C	D	E	F
1	RM ID	Instances	Replace With			
2					Continue	
3	Fine Blank	267				
4	OREA-131a	1	OREAS 131a			
5	OREAS 131	1	OREAS 131a			
6	OREAS 131a	258				
7	OREAS 131b	249				
8	OREAS 132a	418				
9	OREAs 133b	2	OREAS 133b			
10	OREAS 133b	357				
11	OREAS-131a	5	OREAS 131a			
12	OREAS-132a	3	OREAS 132a			
13	OREAS-133b	4	OREAS 133b			

This step serves two functions. First, typographical errors can be quickly detected and treated, eliminating variant spellings of an RM ID. Second, valid RM IDs can be changed to match the values in the RM Library. Values for the RMs will be imported from the RM Library in the next step, but **only if the RM IDs match exactly.**

2. Next there is an opportunity to sort your data by Sample Number. Use this option wisely.



If your sampling program employed consecutive and orderly sample numbers, then this can sort your samples into the order in which they were analyzed.

If a less orderly sampling number system was employed, then sorting by sample number should not be done as it may group samples inappropriately.

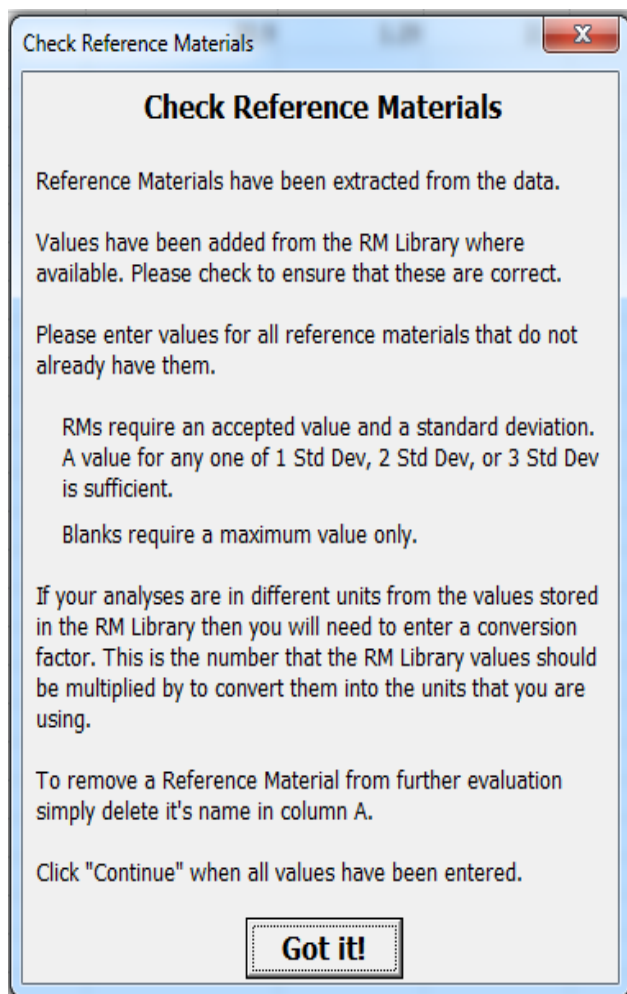
3. Finally, all RMs are listed in the workbook "Reference Materials"

Reference Material	Type	Full Name	Analyte	Assayed Units	Units on File	Conversion Factor	Accepted Value	1 Std Dev	2 Std Dev	3 Std Dev	Maximum
Fine Blank	Blank	Silver	Ag	(ppm)	(ppm)						5
OREAS 131a	RM	Silver	Ag	(ppm)	(ppm)		30.9	1.29	2.58	3.87	
Fine Blank	Blank	Arsenic	As	(ppm)	(ppm)						50
OREAS 131a	RM	Arsenic	As	(ppm)	(ppm)		82	6.9	13.8	20.7	

The Reference Material, Analyte and Assayed Units are listed. If QC Mine is able to find the same RM ID for the same Analyte in the RM Library, then the rest of the data will be filled in. **Please check to ensure that these values are accurate.** Many RMs have different values depending on which analytical technique was employed. Please make sure that these values are correct for your application. The units of measurement stored in the RM Library may also differ from the units which your samples were analyzed in.

If you don't want a particular RM to be evaluated, simply remove its entry in column A and QC Mine will ignore it.

If QC Mine does not find a matching entry for an RM, then you will have to provide the missing data.



All Reference Materials require a Full Name, e.g.: Gold for Au.

Blanks require only a maximum value in column L that should not be exceeded.

RMs require an Accepted Value and **any one** of 1 Std Dev, 2 Std Dev or 3 Std Dev. QC Mine will cheerfully calculate the other two values.

The type ("Blank" or "RM") is determined by QC Mine based on the presence or absence of an Accepted Value.

If the units your samples were analyzed in do not match those that were loaded from the RM Library, then you will need to provide a Conversion Factor. This is the value that the RM Library's values should be multiplied by to convert them to your units.

Click "Continue" when all necessary data has been added.

If necessary data is missing, QC Mine will highlight the affected cells and continue to prompt you to provide values.

Once data has been added for an RM, it is automatically stored in the RM Library. The next time you use QC Mine, the data will be loaded for you.

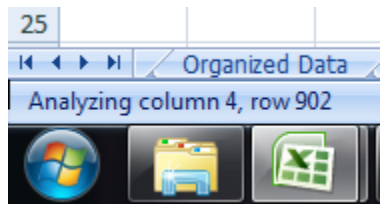
Data stored in the RM Library can be edited to remove errors or inappropriate values. Data is stored in intuitively labeled columns.

	A	B	C	D	E	F	G	H
1	Reference Material	Type	Analyte	Units	Full Name	Accepted Value	1 Std Dev	Maximum
2								
3	Fine Blank	Blank	Ag	(ppm)	Silver			5
4	OREAS 131a	RM	Ag	(ppm)	Silver	30.9	1.29	
5	OREAS 131b	RM	Ag	(ppm)	Silver	33.3	1.21	
6	OREAS 132a	RM	Ag	(ppm)	Silver	57	3.04	

The RM Library only stores the 1 Std Dev value for RMs and calculates the other values from that. Take care not to enter a 2 or 3 Std Dev value in its place.

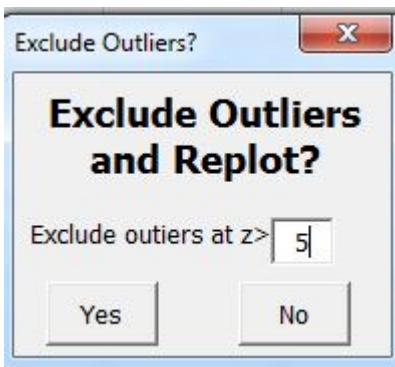
Step 3: Analyze

In this step, all of the analyses in the "Organized Data" worksheet are extracted and compared to the appropriate RM, and some statistics are calculated. If you are working with a large, multi-element data set, this can be a good time to go grab a coffee. To help reassure you that your computer hasn't simply crashed, a status bar will display activity in the lower left corner.



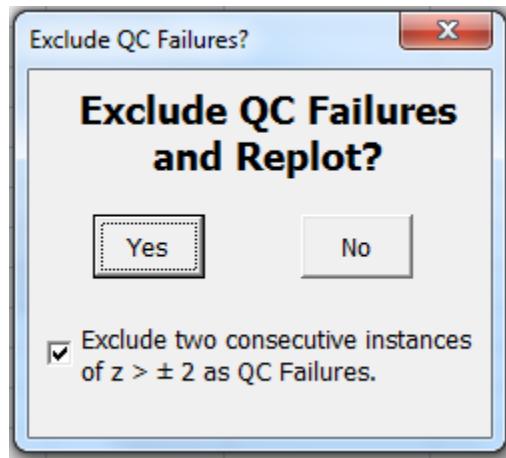
The status bar should remain relatively active, give or take a few seconds between switching tasks. If the status bar remains inactive for more than a minute, then either QC Mine is waiting for you to do something or something has gone badly wrong.

1. After the first pass at analyzing the data, you will be given the option to exclude outliers.



A minimum value of $z \geq \pm 5$ is employed to prevent this step from screening out analytical failures. Higher z values may be advisable depending on the quality of your data. If found, outliers are extracted to a worksheet labeled "Outliers". A message box pops up to tell you how many were found.

2. Lastly, an option to exclude QC Failures is provided.

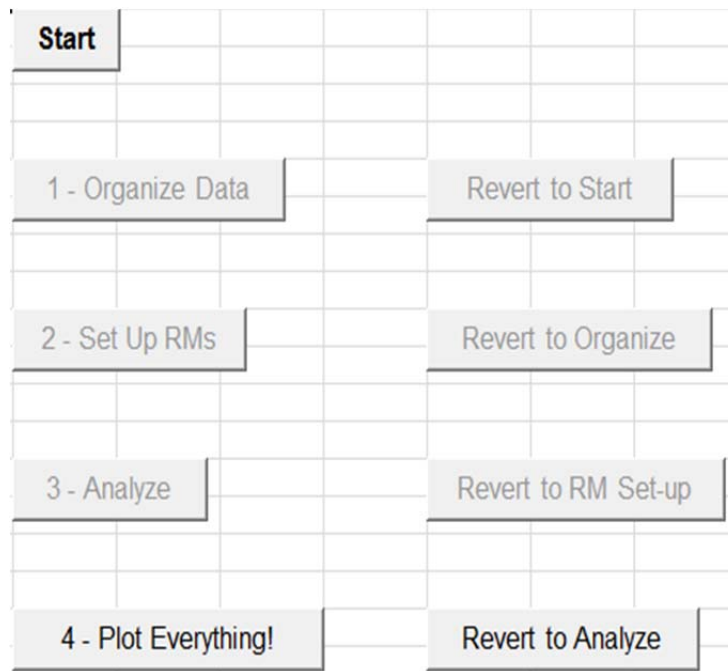


Blank analyses that exceed the maximum value are QC Failures. RM analyses with $z > \pm 3$ are QC failures. There is also an option to check for QC Failures on the basis of two consecutive RMS that are both $z > 2$ or both $z < -2$. Since this option relies on consecutive RM values, it should not be used if the sampling order is not well established.

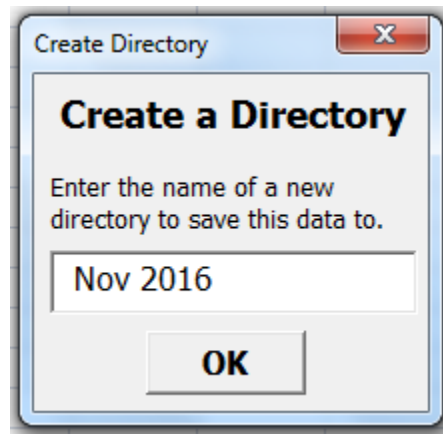
QC Failures are extracted to a worksheet labeled "Failures" and a message box notifies you of how many samples failed.

Step 4: Plot Everything!

On the "Main" worksheet, click the "Plot Everything" button.



First you will be prompted to provide a name for a new directory that QC Mine will create.

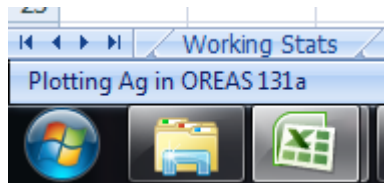


There will be a brief pause as QC Mine creates the directory and saves itself there.

Then you will be asked for a title for your control diagrams. This title will appear at the top of all your plots, so make it good.



After clicking "OK", a great deal of nothing will appear to happen, possibly for a long time, if you have a large, multi-element data set. After a short initial pause, the status bar in the lower left corner will show that each element is being plotted for its respective RMs.



For each element:

- Control charts are plotted for all data and summary statistics calculated.
- If outliers were excluded, control charts are replotted for those RMs and summary stats recalculated.
- If QC failures were excluded, control charts are again replotted for those RMs and summary stats once again recalculated.
- All control charts, summary stats, raw and processed data are saved to a macro-free workbook in the directory that you specified. The file name is the analyte plus the directory name, "Ag - Nov 2016.xlsx" in this case.

The End

At the end you are redirected to the welcome page and a little dialogue box pronounces "Done!" The QC Mine workbook will appear largely unchanged because the worksheets that were generated have been stored in the macro-free workbooks that are placed in the subdirectory you just created. QC Mine has also copied itself to this subdirectory, complete with all data organized, analyzed and ready to plot if you want to tweak any of it. No need to redo everything, just hit the "Plot Everything!" button.

The next time that you use QC Mine you can run it either from the original workbook or from the version that it saved in the subdirectory. The new version will have any new RMs that you used saved in the RM Library, which may save you a lot of work. The original version will lack these changes. To avoid further nesting of subdirectories within subdirectories you should copy it to a new location before you run it.