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HgCalc Software Manual

HgCalc Capabilities

HgCalc is used to calculate your total mercury emissions quickly and easily using your XC-6000 MercSampler data and your Trap Analysis Report Info.

HgCalc will imported XC-6000 MercSampler sample run data, then the trap analysis data is entered, and the application calculates the hourly, Daily, Weekly, and Yearly total mercury mass in micro-grams, grams and pounds and total mercury emissions Wet or Dry depending on permit as specified in 40CFR part 75.

HgCalc also verifies QA/QC specifications regarding section 2 breakthrough, calculates normalized HG mass also HG concentration, checks relative deviation, and section 3 spike recovery as shown in 40CFR Part 75 Appendix K table K-1

HGCALC Version 91124

The screenshot shows the HgCalc software interface with the following data:

Sample A			Sample B		
Trap ID	28930		Trap ID	28941	
Section 1 Hg Mass (M1), incl. plug	39,102	ng	Section 1 Hg Mass (M1), incl. plug	40,603	ng
Section 2 Hg Mass (M2)	62	ng	Section 2 Hg Mass (M2)	79	ng
Section 2 Breakthrough (%B)	0.16	percent	Section 2 Breakthrough (%B)	0.19	percent
Section 3 Spike Value (Ms)	10,000	ng	Section 3 Spike Value (Ms)	10,000	ng
Section 3 Spike Recovery (M3)	9,251	ng	Section 3 Spike Recovery (M3)	9,061	ng
Section 3 Recovery Percentage (%R)	92.51	percent	Section 3 Recovery Percentage (%R)	90.61	percent
Normalized Total Hg Mass (M*)	42,335	ng	Normalized Total Hg Mass (M*)	44,898	ng
Total Sample Volume (Vt)	2,403	liters	Total Sample Volume (Vt)	2,357	liters
Sample Mercury Concentration (C)	17.618	ug/scm	Sample Mercury Concentration (C)	19.049	ug/scm
Total Stack Mercury (Wet)	261,700,251	ug	Total Stack Mercury (Wet)	282,956,527	ug
Stack Mercury (Wet)	2,623,561	ug/hr	Stack Mercury (Wet)	2,836,657	ug/hr

Trap Data		Run Data	
Trap Manufacturer	STLS	Stack Volume	482,603,500 scf
Trap Analysis Source	STLS	Average Mercury Concentration	18.334 ug/scm
Trap Analysis Technician Name	Bob Tester	Percent Moisture	8.000
Trap Analysis Method	Thermal Desorption	Total Sampling Duration	4d 3h 45m
		Relative Deviation (RD)	3.90%
		Technician Name	Terry Tester
		Source Site Name	Apex Big Stack # 1

Messages

- [11:24:19][Global] External flow mode enabled (constant disabled)
- [11:24:19][Parser] Run data loaded from: C:\HgCalc 90530\Sample Run Data\TBP 5Day Sample Run updated.csv

HgCalc Installation Instructions:

- 1) Access or open the CD drive and locate the directory **HgCalc**.
- 2) Copy this directory by highlighting the folder HgCalc then right click the mouse and select copy.
- 3) Now navigate to the C: drive and right click the mouse and select paste this will put the **HgCalc** directory on the "C:" drive.
- 4) Double click on the **HgCalc** directory and find **HgCalc.exe** next right click on **HgCalc.exe** and select send to desktop (create shortcut)
- 5) The shortcut to start the application is now located on desktop.

Getting Started with HgCalc

- 1) Double click the shortcut on your desktop and the application will open to start using application. Notice the software version number in the blue banner on top, this identifies HgCalc version. See Fig – 1

Fig 1

The screenshot shows the HgCalc software interface for 'XC-6000 Mercury Analysis' (version 91124). The interface is divided into two main sections: 'Sample A' and 'Sample B'. Each section has a 'Trap' field with a tooltip that reads: 'The mercury mass collected from Section 1 of the Sample A sorbent trap during analysis.' Below the 'Trap' field are several input fields for mercury mass (M1, M2), breakthrough (%B), spike values (Ms), and recovery percentages (M3, %R). The 'Trap Data' section includes dropdown menus for 'Trap Manufacturer' (Ohio Lumex), 'Trap Analysis Source' (Ohio Lumex), 'Trap Analysis Technician Name' (Technician # 1), and 'Trap Analysis Method' (Thermal Desorption). The 'Run Data' section includes input fields for 'Stack Volume' (0 scm), 'Average Mercury Concentration' (ug/scm), 'Percent Moisture' (0.000), and 'Relative Deviation (RD)' (0.00%). A 'Messages' box at the bottom left shows a log entry: '[11:17:04][Global] Application loaded'. The 'Total Sampling Duration' is set to 0 days, 0 hours, and 0 minutes.

Note: Hold your cursor over field description and an info box will pop up explaining value.

Note: Before importing a file click on **options/preferences (fig-2)** and turn off any of the features you don't want enabled like leak check verification or wet mode which adds moisture back in for total mercury output calculations.

Preferences can also be set for various fields which will become the default values.

Also click on **penalties (Fig-3)** and turn off any of the **Appendix K penalty calculations** if you don't want them applied.

Fig 2

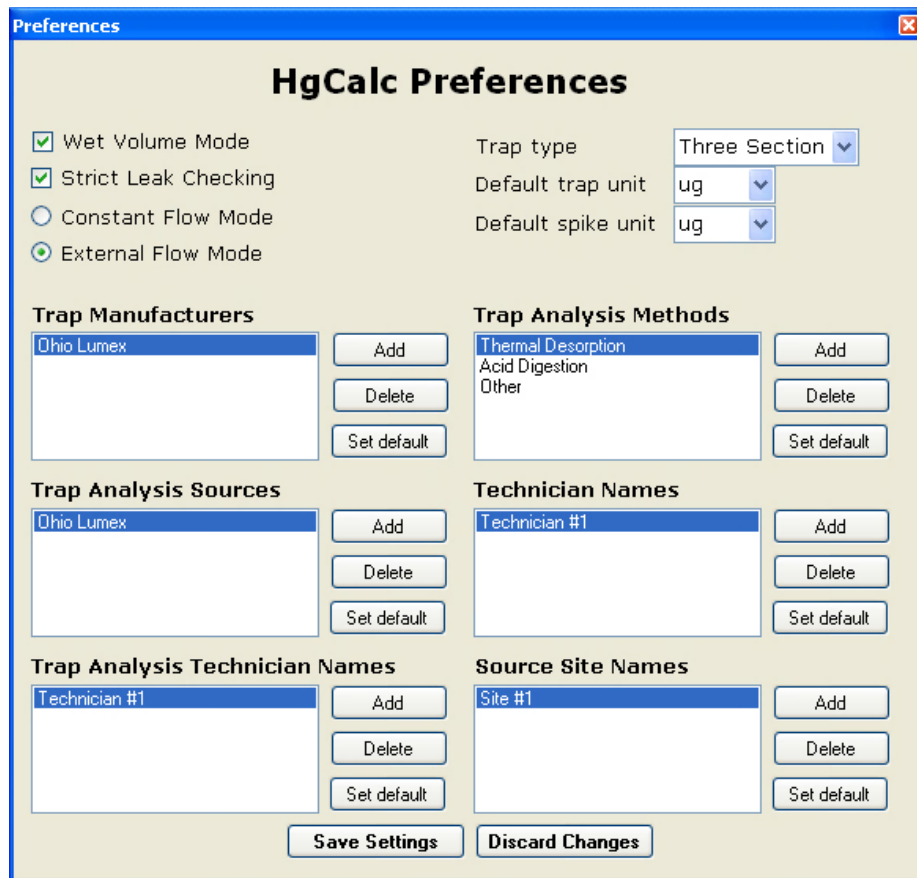
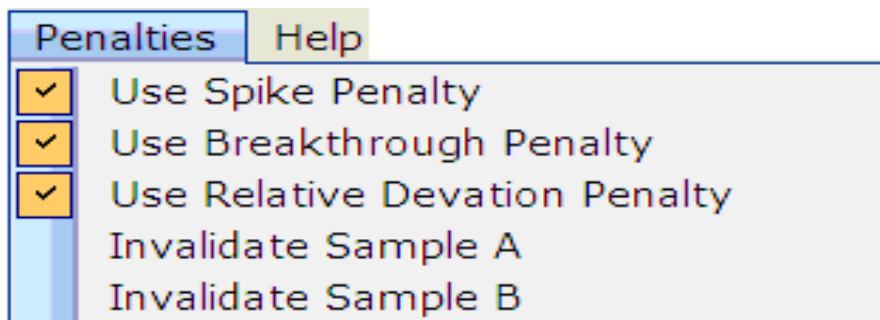


Fig 3



- 2) Click on **File (Fig-4)** and select “ **Import XC-6000 Data** “ then locate in the folder (**Fig-5**) that has your sample data files and select the .CSV data file you wish to import then click open.

Fig 4

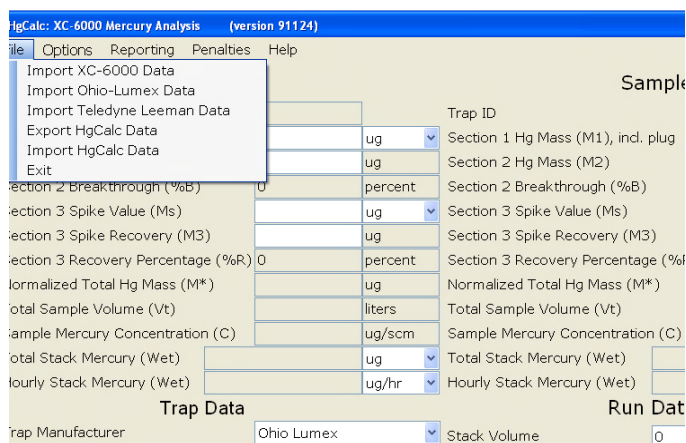
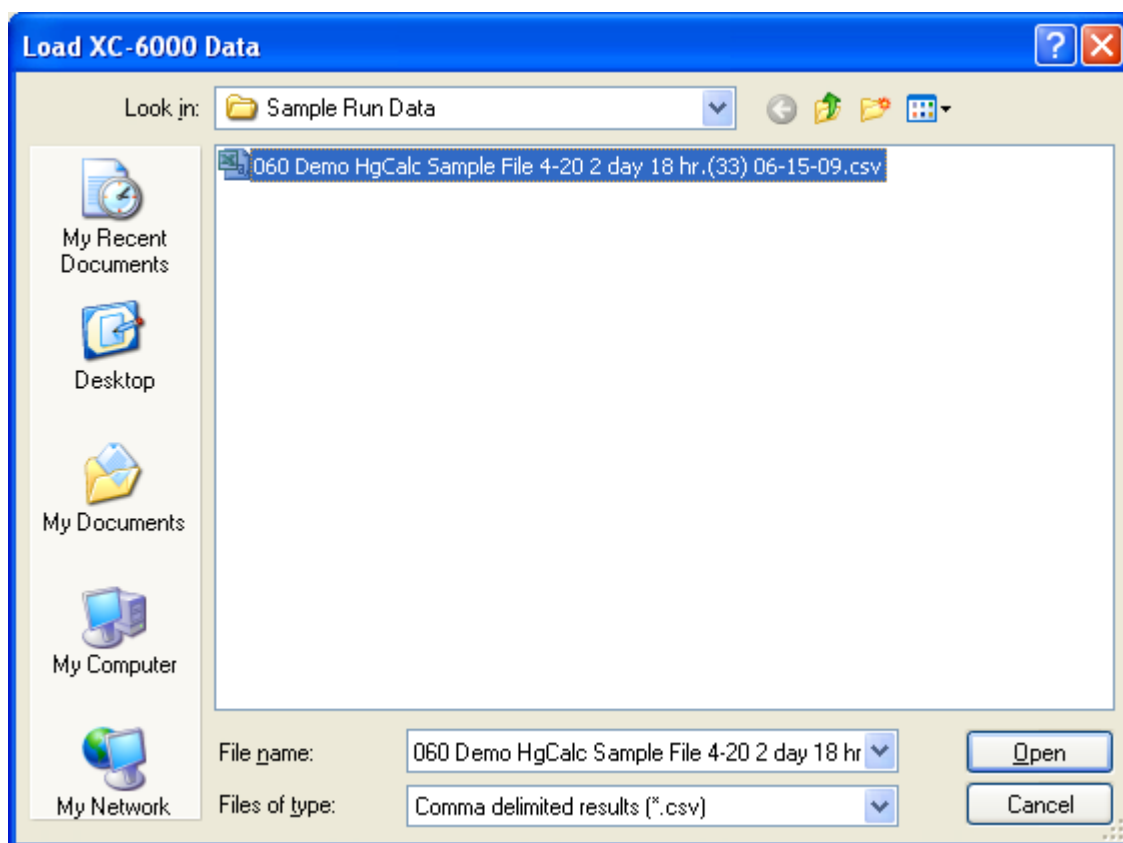


Fig 5



- 3) The **Total Sample Volume** for both A&B, **Total Stack Volume**, **Percent Moisture**, **Trap ID's** and **Sample Time Elapsed** fields will be filled in upon importing sample run data. Any Errors detected during the Import will be displayed in the Messages Box See Fig – 6.

Fig 6

The screenshot shows the HgCalc software interface with the following data:

Sample A		Sample B	
Trap ID	28930	Trap ID	28941
Section 1 Hg Mass (M1), incl. plug	<input type="text"/> ug	Section 1 Hg Mass (M1), incl. plug	<input type="text"/> ug
Section 2 Hg Mass (M2)	<input type="text"/> ug	Section 2 Hg Mass (M2)	<input type="text"/> ug
Section 2 Breakthrough (%B)	0 percent	Section 2 Breakthrough (%B)	0 percent
Section 3 Spike Value (Ms)	<input type="text"/> ug	Section 3 Spike Value (Ms)	<input type="text"/> ug
Section 3 Spike Recovery (M3)	<input type="text"/> ug	Section 3 Spike Recovery (M3)	<input type="text"/> ug
Section 3 Recovery Percentage (%R)	0 percent	Section 3 Recovery Percentage (%R)	0 percent
Normalized Total Hg Mass (M*)	<input type="text"/> ug	Normalized Total Hg Mass (M*)	<input type="text"/> ug
Total Sample Volume (Vt)	2,052 liters	Total Sample Volume (Vt)	2,071 liters
Sample Mercury Concentration (C)	<input type="text"/> ug/scm	Sample Mercury Concentration (C)	<input type="text"/> ug/scm
Total Stack Mercury (Wet)	<input type="text"/> ug	Total Stack Mercury (Wet)	<input type="text"/> ug
Hourly Stack Mercury (Wet)	<input type="text"/> ug/hr	Hourly Stack Mercury (Wet)	<input type="text"/> ug/hr

Trap Data		Run Data	
Trap Manufacturer	Ohio Lumex	Stack Volume	856,362,000 scf
Trap Analysis Source	Ohio Lumex	Average Mercury Concentration	<input type="text"/> ug/scm
Trap Analysis Technician Name	Terry Tester	Percent Moisture	0.000
Trap Analysis Method	Thermal Desorption	Relative Deviation (RD)	0.00%
		Technician Name	Tom Tester
		Source Site Name	Apex Big Stack 1
		Total Sampling Duration	2 days 18 hours 0 minutes

Messages

```
[11:17:04][Global] Application loaded
[13:18:54][Parser] Run_data loaded from: C:\HgCalc 90925\Sample Run
Data\060 Demo HgCalc Sample File 4-20 2 day 18 hr.(33) 06-15-09.csv
```

Note: Unless flow data was sent to XC6000 to data log during sample run, no value will be in the **Stack Volume** field. Also **Percent Moisture** will be the value data logged or default value entered in sample configuration profile.

5) Enter both values into section 1 field into HgCalc for Trap A & B. see Fig-8

6) Enter both values for section 2 field into HgCalc for Trap A & B.

Fig 8

Sample A			Sample B		
Trap ID	28930		Trap ID	28941	
Section 1 Hg Mass (M1), incl. plug	39,103	ng	Section 1 Hg Mass (M1), incl. plug	40,603	ng
Section 2 Hg Mass (M2)	62	ng	Section 2 Hg Mass (M2)	79	ng
Section 2 Breakthrough (%B)	0.16	percent	Section 2 Breakthrough (%B)	0.19	percent
Section 3 Spike Value (Ms)	10,000	ng	Section 3 Spike Value (Ms)	10,000	ng
Section 3 Spike Recovery (M3)	9,251	ng	Section 3 Spike Recovery (M3)	9,061	ng
Section 3 Recovery Percentage (%R)	92.51	percent	Section 3 Recovery Percentage (%R)	90.61	percent
Normalized Total Hg Mass (M*)	42,336	ng	Normalized Total Hg Mass (M*)	44,898	ng
Total Sample Volume (Vt)	2,052	liters	Total Sample Volume (Vt)	2,071	liters
Sample Mercury Concentration (C)	20.632	ug/scm	Sample Mercury Concentration (C)	21.679	ug/scm
Total Stack Mercury (Wet)	500.315	gm	Total Stack Mercury (Wet)	525.704	gm
Hourly Stack Mercury (Wet)	7.581	gm/hr	Hourly Stack Mercury (Wet)	7.965	gm/hr

Trap Data		Run Data	
Trap Manufacturer	Ohio Lumex	Stack Volume	856,362,000 scf
Trap Analysis Source	Ohio Lumex	Average Mercury Concentration	21.156 ug/scm
Trap Analysis Technician Name	Terry Tester	Percent Moisture	0.000
Trap Analysis Method	Thermal Desorption	Relative Deviation (RD)	2.47%
		Technician Name	Technician # 1
		Source Site Name	Apex Big Stack 1
		Total Sampling Duration	2 days 18 hours 0 minutes

Messages

```
[11:17:04][Global] Application loaded
[13:18:54][Parser] Run data loaded from: C:\HgCalc 90925\Sample Run
Data\060 Demo HgCalc Sample File 4-20 2 day 18 hr.(33) 06-15-09.csv
```

7) Enter the spike level value into HgCalc for both Trap A & B.

8) Enter both values for section 3 field spike recovery into HgCalc for Trap A & B.

9) Enter Technicians info and site & trap analysis source info. Drop down boxes displays a list entered in the preferences.

NOTE: Each time you click on another field or hit enter key the fields calculate values entered.

10) Verify all fields are filled in and calculations are performed and verify you don't have any penalties applied. See example of penalties applied in this case Sample A section 2 breakthrough was higher than spec of 5% so sample A was invalidated and a STAF (Single Trap Adjustment Factor) of 1.111 was used as a multiplier see Fig-9

Penalty Example – Trap A section 2 breakthrough greater than 5 %

Fig 9

HgCalc: XC-6000 Mercury Analysis (version 91124)

File Options Reporting Penalties Help

Sample A (invalidated)			Sample B (STAF applied)		
Trap ID	28930		Trap ID	28941	
Section 1 Hg Mass (M1), incl. plug	39,103	ng	Section 1 Hg Mass (M1), incl. plug	40,603	ng
Section 2 Hg Mass (M2)	6,200	ng	Section 2 Hg Mass (M2)	79	ng
Section 2 Breakthrough (%B)	15.86	percent	Section 2 Breakthrough (%B)	0.19	percent
Section 3 Spike Value (Ms)	10,000	ng	Section 3 Spike Value (Ms)	10,000	ng
Section 3 Spike Recovery (M3)	9,251	ng	Section 3 Spike Recovery (M3)	9,061	ng
Section 3 Recovery Percentage (%R)	92.51	percent	Section 3 Recovery Percentage (%R)	90.61	percent
Normalized Total Hg Mass (M*)	48,971	ng	Normalized Total Hg Mass (M*)	44,898	ng
Total Sample Volume (Vt)	2,052	liters	Total Sample Volume (Vt)	2,071	liters
Sample Mercury Concentration (C)	23.865	ug/scm	Sample Mercury Concentration (C)	21.679	ug/scm
Total Stack Mercury (Wet)	578.714	gm	Total Stack Mercury (Wet)	525.704	gm
Hourly Stack Mercury (Wet)	8.768	gm/hr	Hourly Stack Mercury (Wet)	7.965	gm/hr

Trap Data		Run Data	
Trap Manufacturer	Ohio Lumex	Stack Volume	856,362,000 scf
Trap Analysis Source	Ohio Lumex	Average Mercury Concentration	22.772 ug/scm
Trap Analysis Technician Name	Terry Tester	Percent Moisture	0.000
Trap Analysis Method	Thermal Desorption	Relative Deviation (RD)	4.80%
		Technician Name	Technician # 1
		Source Site Name	Apex Big Stack 1
		Total Sampling Duration	2 days 18 hours 0 minutes

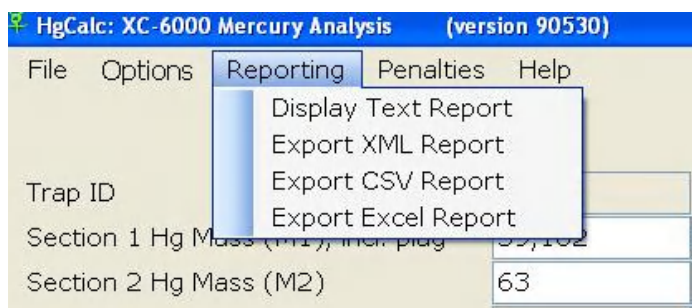
Messages

[13:18:54][Parser] Run data loaded from: C:\HgCalc 90925\Sample Run Data\060 Demo HgCalc Sample File 4-20 2 day 18 hr.(33) 06-15-09.csv

[13:30:19][Sample A] Breakthrough penalty applied

11) Reports may be generated in several formats. Text/PDF, CSV and Excel. To Generate a report select Reporting from the Menu and select the desired format. Enter the location and filename if prompted to do so. XML will be a future option. **See Fig-10.** If you are using Microsoft Office 2007 you may need to install MICROSOFT OFFICE 2007 PRIMARY INTEROP ASSEMBLIES. This can be found on the HgCalc CD.

Fig 10



HgCalc: XC-6000 Mercury Analysis Report

HgCalc: XC-6000 Mercury Analysis

Report Time: 6/1/2009 11:37 AM

HgCalc Version: 90530

Run Data

Total Stack Volume: 482,603,500 scf

Average Sample Concentration: 18.334 ug/scm

Percent Moisture: 8.000 %

Average Stack Temperature: 292.1 deg F

Average Probe Temperature: 321 deg F

Average Trap Temperature: 330.2 deg F

Average Barometric Pressure: 28.69 in Hg

Sampling Interval: 1 min

Total Time Elapsed: 4d 3h 45m

Technician Name: Terry Tester

Source Site Name: Apex Big Stack #1

XC-6000 Data File: JTBPU 5Day Sample Run updated.csv

Trap Manufacturer: STLS

Trap Analysis Source: STLS

Trap Analysis Technician Name: Bob Tester

Trap Analysis Data File:

Trap Analysis Method: Thermal Desorption

Sample A

Trap ID: 28930

Section 1 Mass: 39,102 ng

Section 2 Mass: 62 ng

Section 2 Breakthrough: 0.16 %

Section 3 Spike Value: 10,000 ng

Section 3 Spike Recovery: 9,251 ng

Section 3 Spike Recovery Percentage: 92.51 %

Normalized Total Hg Mass: 42,335 ng

Total Sample Volume: 2,403 liters

Average Flow Rate: 0.445 L/m

Maximum Observed Vacuum: 15.1 in Hg

Sample Mercury Concentration: 17.618 ug/scm

Total Stack Mercury (Wet): 261,700,251 ug

Stack Mercury (Wet): 2,623,561 ug/hr

Breakthrough Penalty: False

Spike Recovery Penalty: False

Sample B

Trap ID: 28941

Section 1 Mass: 40,603 ng

Section 2 Mass: 79 ng

Section 2 Breakthrough: 0.19 %

Section 3 Spike Value: 10,000 ng

Section 3 Spike Recovery: 9,061 ng

Section 3 Spike Recovery Percentage: 90.61 %

Normalized Total Hg Mass: 44,898 ng

Total Sample Volume: 2,357 liters

Average Flow Rate: 0.445 L/m

Maximum Observed Vacuum: 10.4 in Hg

Sample Mercury Concentration: 19.049 ug/scm

Total Stack Mercury (Wet): 282,956,527 ug

Stack Mercury (Wet): 2,836,657 ug/hr

Breakthrough Penalty: False

Spike Recovery Penalty: False

Paired Trap Agreement

Relative Deviation: 3.9 %

Relative Deviation Penalty: False

Logged Events:

08/19/08 14:14:58: Sample A: PRE-Leak Test PASSED at Maximum vacuum with Flow Rate 5 ccm (Max. allowed 16 ccm)

08/19/08 14:14:58: Sample B: PRE-Leak Test PASSED at Maximum vacuum with Flow Rate 3 ccm (Max. allowed 16 ccm)

08/19/08 14:37:56: Test START

08/19/08 14:38:57: Start Data Logging (End of Baseline)

08/19/08 14:39:17: Alarm Chg [---- ---- ---L M--]

08/19/08 14:39:36: Alarm Clr [-----]

08/19/08 14:39:57: Alarm Chg [---- ---- ---L M--]

08/19/08 14:40:17: Alarm Clr [-----]

08/19/08 14:40:38: Alarm Chg [---- ---- ---L M--]

08/19/08 14:40:52: Alarm Clr [-----]

08/19/08 14:41:13: Alarm Chg [---- ---- ---L M--]

08/19/08 14:41:47: Return from power failure

08/19/08 14:41:57: Alarm Chg [---- ---- ---- -P]

08/19/08 14:41:59: Zero Auto

08/19/08 14:42:06: Alarm Clr [-----]

08/19/08 14:43:17: Test Resumed

08/19/08 14:44:38: Alarm Chg [---- ---- ---- M--]

08/19/08 14:45:12: Alarm Clr [-----]

08/19/08 14:45:33: Alarm Chg [---- ---- ---- M--]

08/19/08 14:45:38: Alarm Clr [-----]

08/19/08 14:45:59: Alarm Chg [---- ---- ---- M--]

08/19/08 14:46:03: Alarm Clr [-----]

08/19/08 14:46:24: Alarm Chg [---- ---- ---- M--]

08/19/08 14:46:27: Alarm Clr [-----]

08/19/08 14:46:48: Alarm Chg [---- ---- ---- M--]

08/19/08 14:47:41: Alarm Clr [-----]

08/19/08 14:48:02: Alarm Chg [---- ---- ---- M--]

08/19/08 14:48:22: Alarm Clr [-----]

08/19/08 14:48:43: Alarm Chg [---- ---- ---- M--]

08/19/08 14:48:44: Alarm Clr [-----]

08/19/08 15:07:08: Alarm Chg [---- ---- ---- -N--]

08/20/08 12:58:47: Alarm Clr [-----]

08/20/08 13:10:18: Return from power failure

08/20/08 13:10:26: Alarm Chg [---- ---- ---- -P]

08/20/08 13:10:28: Zero Auto

08/20/08 13:10:35: Alarm Clr [-----]

08/20/08 13:19:57: Test Resumed

08/24/08 15:22:32: Alarm Chg [---- ---- |--- ----]

08/25/08 8:17:44: Test Resumed

08/25/09 4:39:26 PM: Actual Sampling Time: 4d 3h 44m 59s

08/25/08 8:17:48: Test END

08/25/08 8:24:07: Sample A: POST-Leak Test PASSED at maximum observed vacuum at 15.1 inHg with Flow Rate of 2 ccm (Max. allowed 18 ccm)

08/25/08 8:24:07: Maximum Observed Vacuum for A was 15.1 inHg

08/25/08 8:24:07: Sample B: POST-Leak Test PASSED at maximum observed vacuum at 10.4 inHg with Flow Rate of 1 ccm (Max. allowed 18 ccm)

08/25/08 8:24:07: Maximum Observed Vacuum for B was 10.4 inHg

Alarms Legend:

A - Not Used

B - Not Used

C - Not Used

D - No update from Modbus for Flow data

E - No update from Modbus for Moisture data

F - No Read request from Modbus master device

G - Unable to maintain proportional flow for A

H - Unable to maintain proportional flow for B

I - High Vac-A

J - High Vac-B
K - Current-loop for External Flow failure
L - Trap Temperature Out of Range
M - Probe Temperature Out of Range
Console Data:
 Flow Input Type: External
 Conversion (LO): Zero - 4 mA = .0001 kscfm
 Conversion (HI): Span - 20 mA = 173 kscfm
 Console Name: Apex Demo - 029
 Console ID: XC6KEPC-029
 DAC Board ID: 4170-6578-2044-656D
 Dry Gas Meter-A ID/Gamma: 8002844 / 0.991
 Dry Gas Meter-B ID/Gamma: 8002833 / 0.988
 Software-Firmware Ver: 90122-99

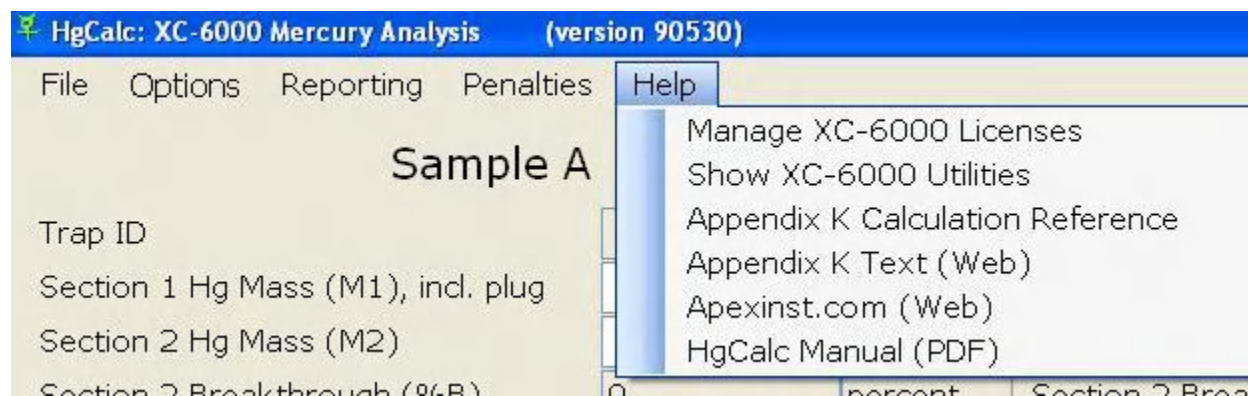
Reports are also available in Excel and CSV formats

HgCalc: XC-6000 Mercury Analysis													
Description	Data	Unit											
Run Data													
Total Stack Volume:	482,603,500	scf											
Average Sample Concentration:	18.334	ug/scm											
Percent Moisture:	8	%											
Average Stack Temperature:	292.1	deg F											
Average Probe Temperature:	321	deg F											
Average Trap Temperature:	330.2	deg F											
Average Barometric Pressure:	28.69	in Hg											
Sampling Interval:	1	min											
Total Time Elapsed:	4d 3h 45m												
Technician Name:	Terry Tester												
Source Site Name:	Apex Big Stack #1												
XC-6000 Data File:	JTBPU 5Day Sample Run updated.csv												
Trap Manufacturer:	STLS												
Trap Analysis Source:	STLS												
Trap Analysis Technician Name:	Bob Tester												
Trap Analysis Data File:													
Trap Analysis Method:	Thermal Desorption												
Sample A													

Help Tab

Click on **Help** you have option of **Manage XC-6000 licenses**, **Show XC-6000 Utilities**, **Appendix K Calculation Reference**, **Appendix K Text Link to www.apexinst.com** website and **Opening the HgCalc User Manual**. See Fig-11

Fig 11



Import and Export Data

Click on the File tab and select Import/Export to save and reuse the HgCalc Data file to be used at another time. Files must be manually saved to be imported.

Setting Preferences

Preferences are set by selecting the Options tab and selecting Preferences. See **Fig 12**. Preferences are saved and used as the default values in HgCalc.

Trap Type is selected based on using 2 or 3 section traps.

Either check/uncheck the options required or use the ADD button to add items to the drop down lists. Set Default will make the selected item in the list the default value.

Fig 12

Preferences

HgCalc Preferences

Wet Volume Mode
 Strict Leak Checking
 Constant Flow Mode
 External Flow Mode

Trap type: Three Section
Default trap unit: ug
Default spike unit: ug

Trap Manufacturers
Ohio Lumex
Add, Delete, Set default

Trap Analysis Methods
Thermal Desorption, Acid Digestion, Other
Add, Delete, Set default

Trap Analysis Sources
Ohio Lumex
Add, Delete, Set default

Technician Names
Technician #1
Add, Delete, Set default

Trap Analysis Technician Names
Technician #1
Add, Delete, Set default

Source Site Names
Site #1
Add, Delete, Set default

Save Settings, Discard Changes

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