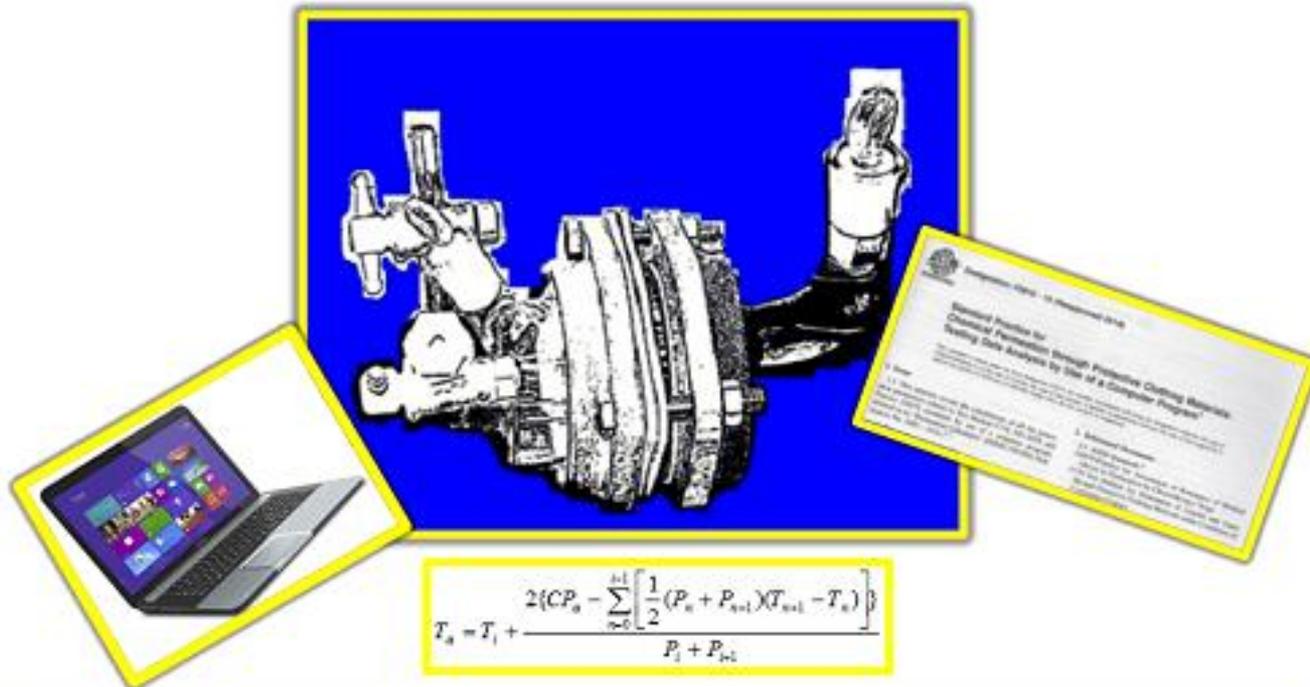


Permeation Calculator V.2.5.0



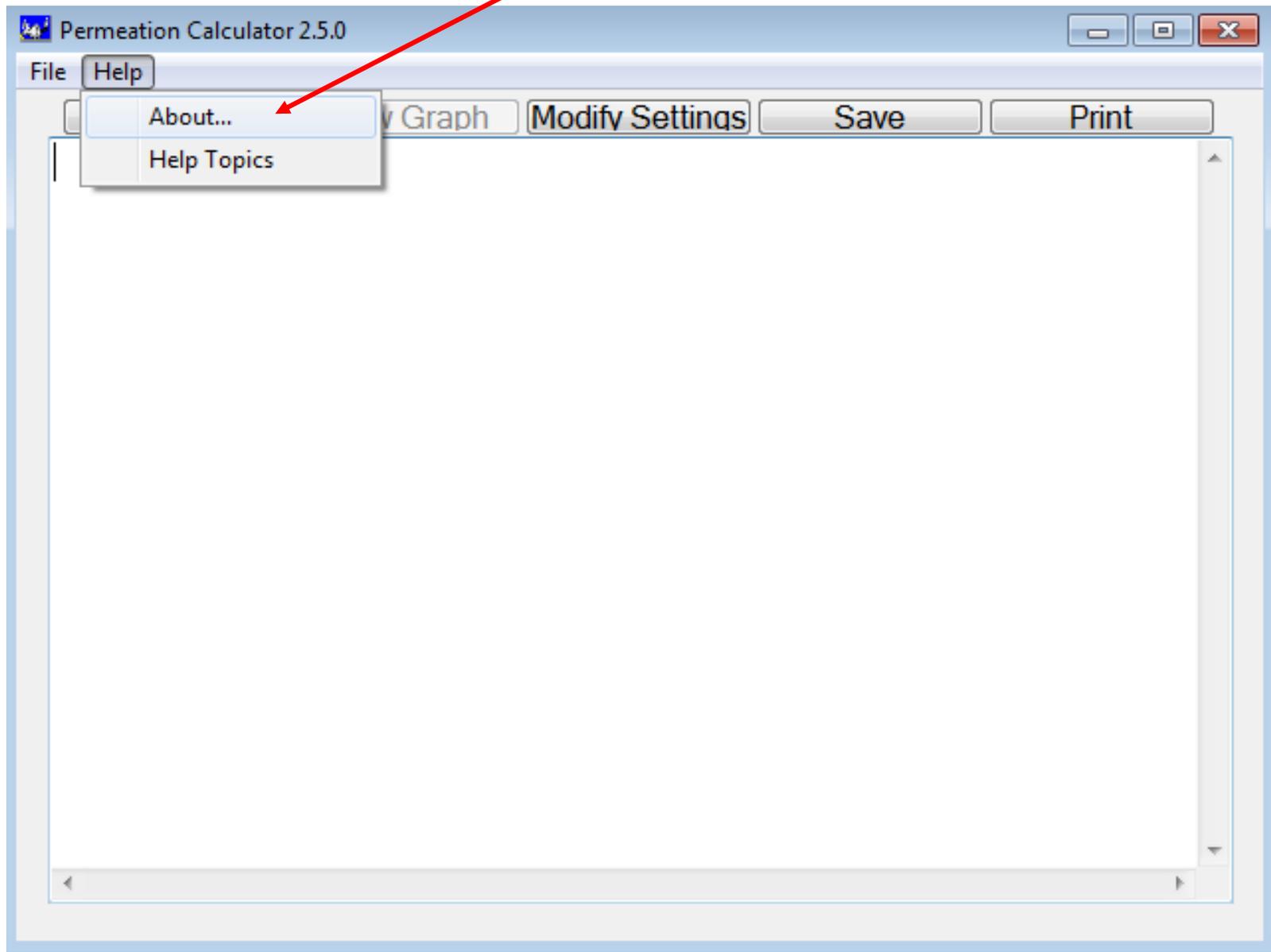
CDC Workplace
Safety and Health

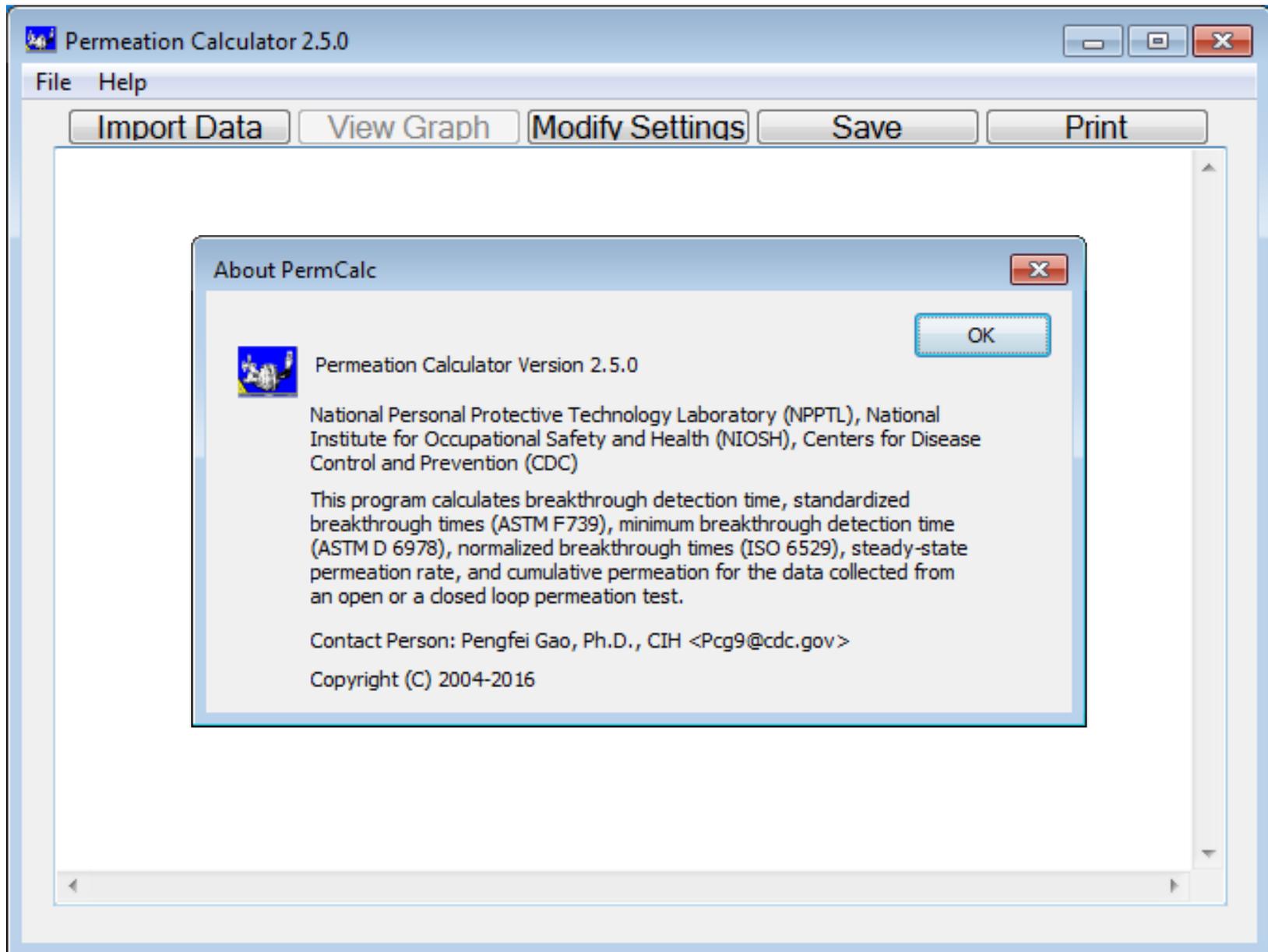
NIOSH

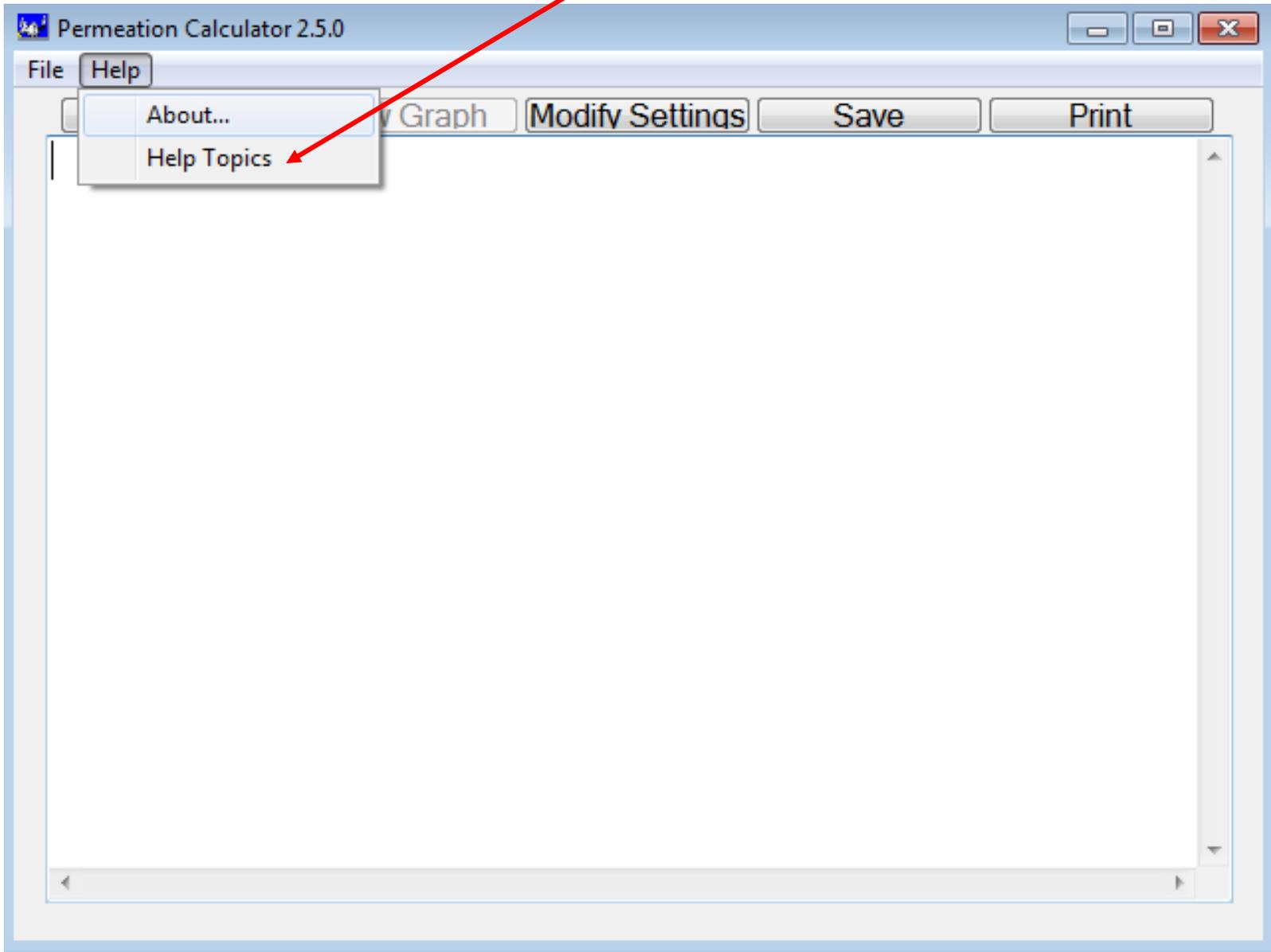
NPPTL *Research to Practice
through Partnerships*

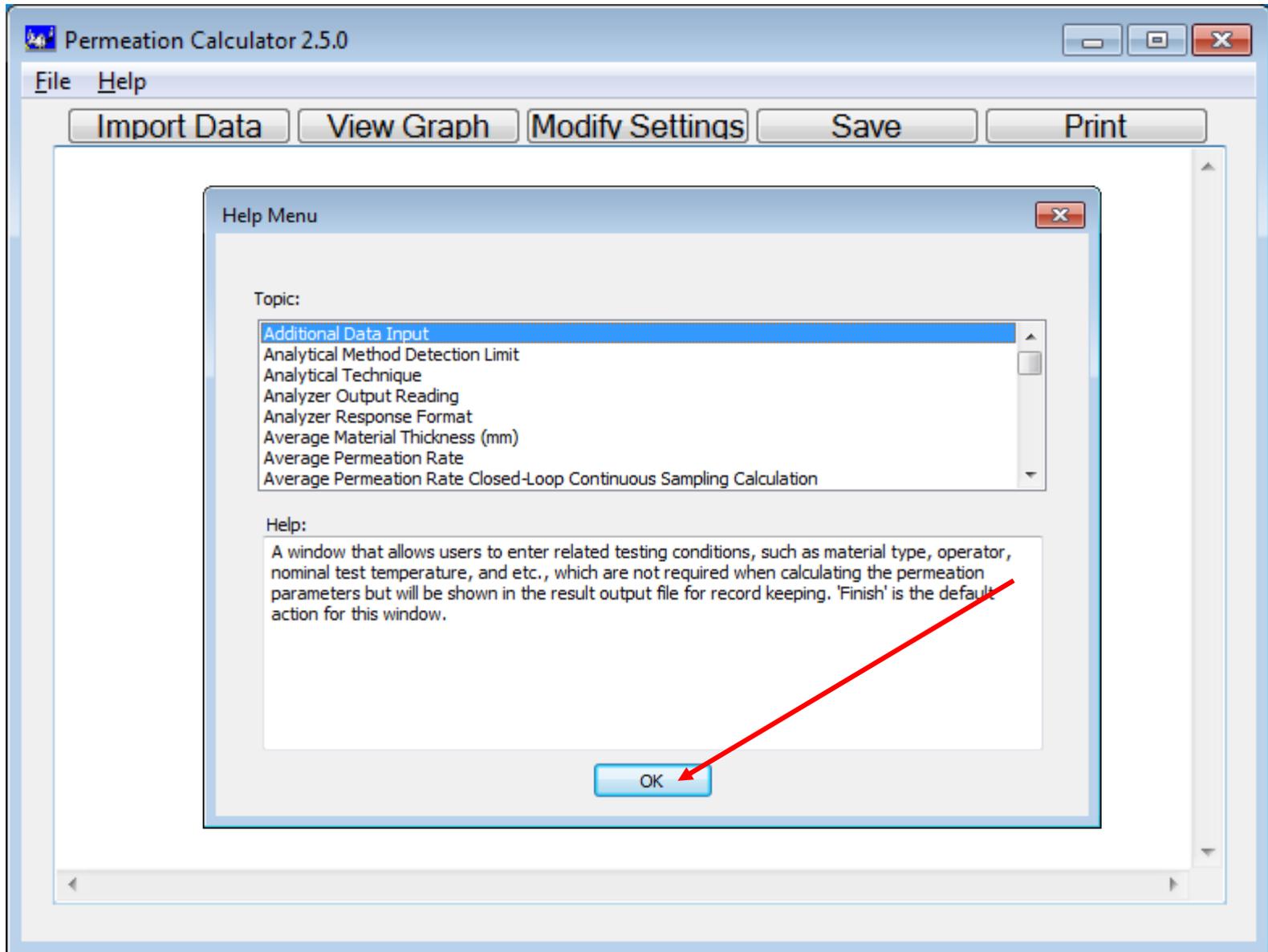
[Click Here](#)

About the Software

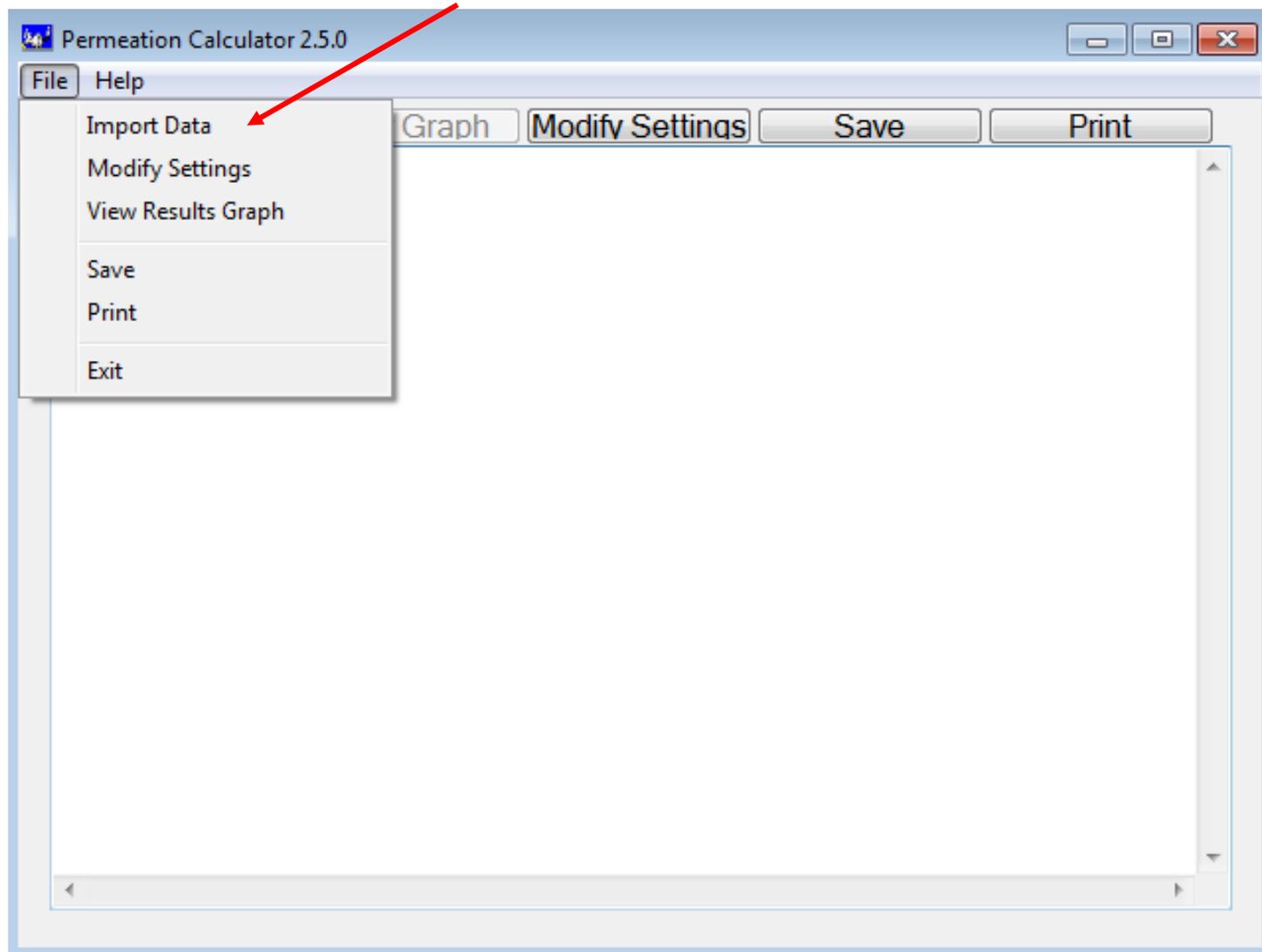


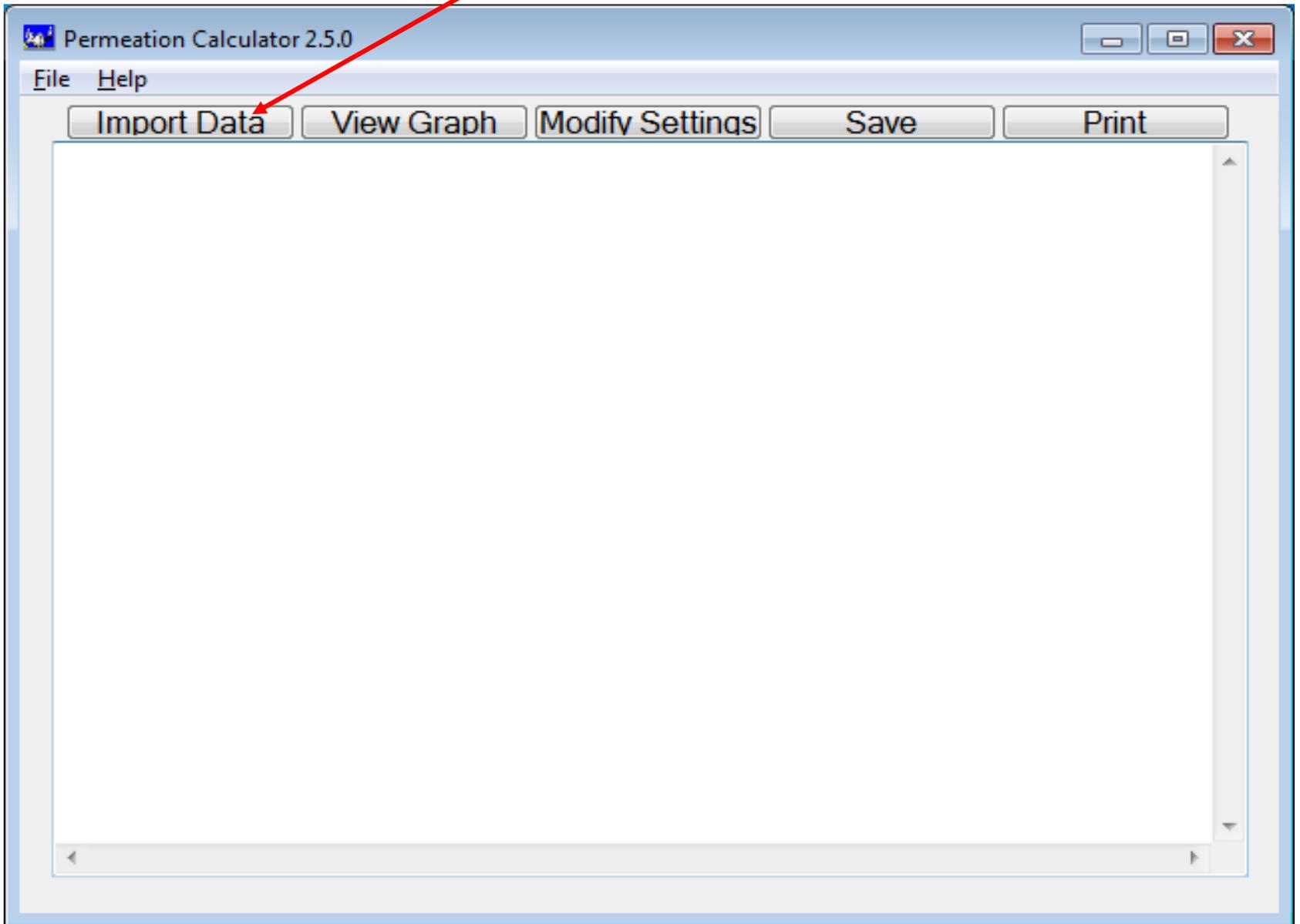


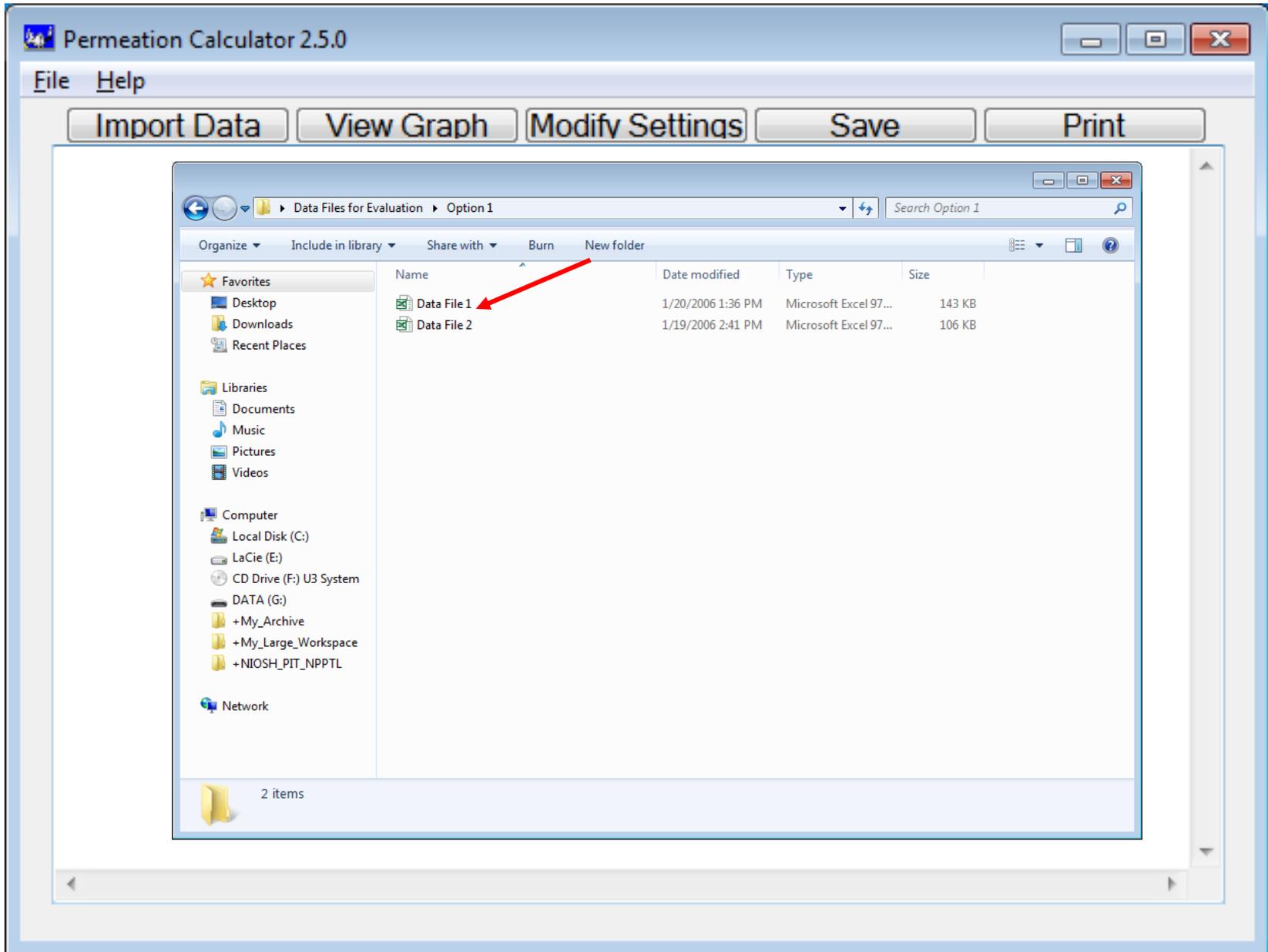


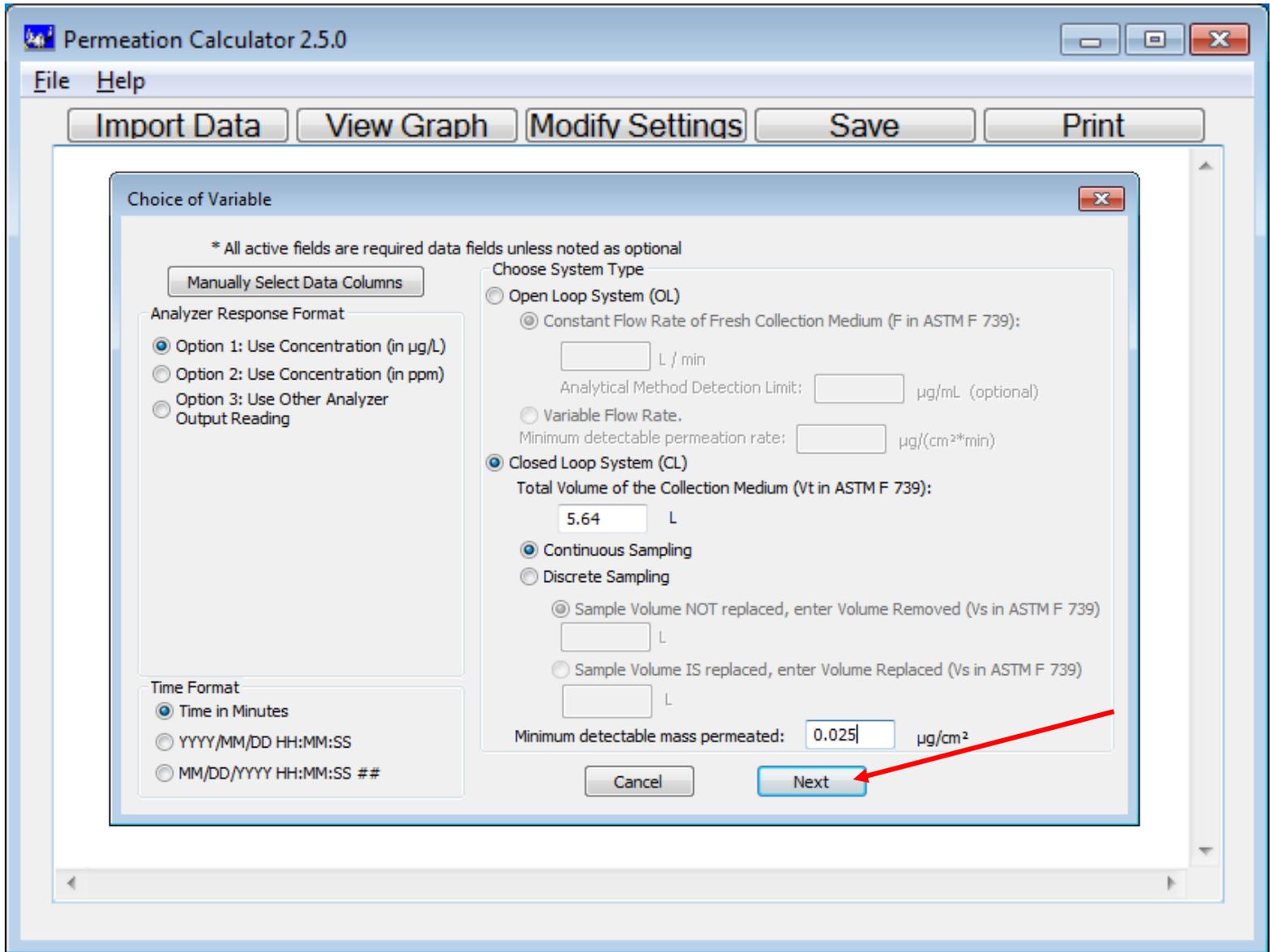


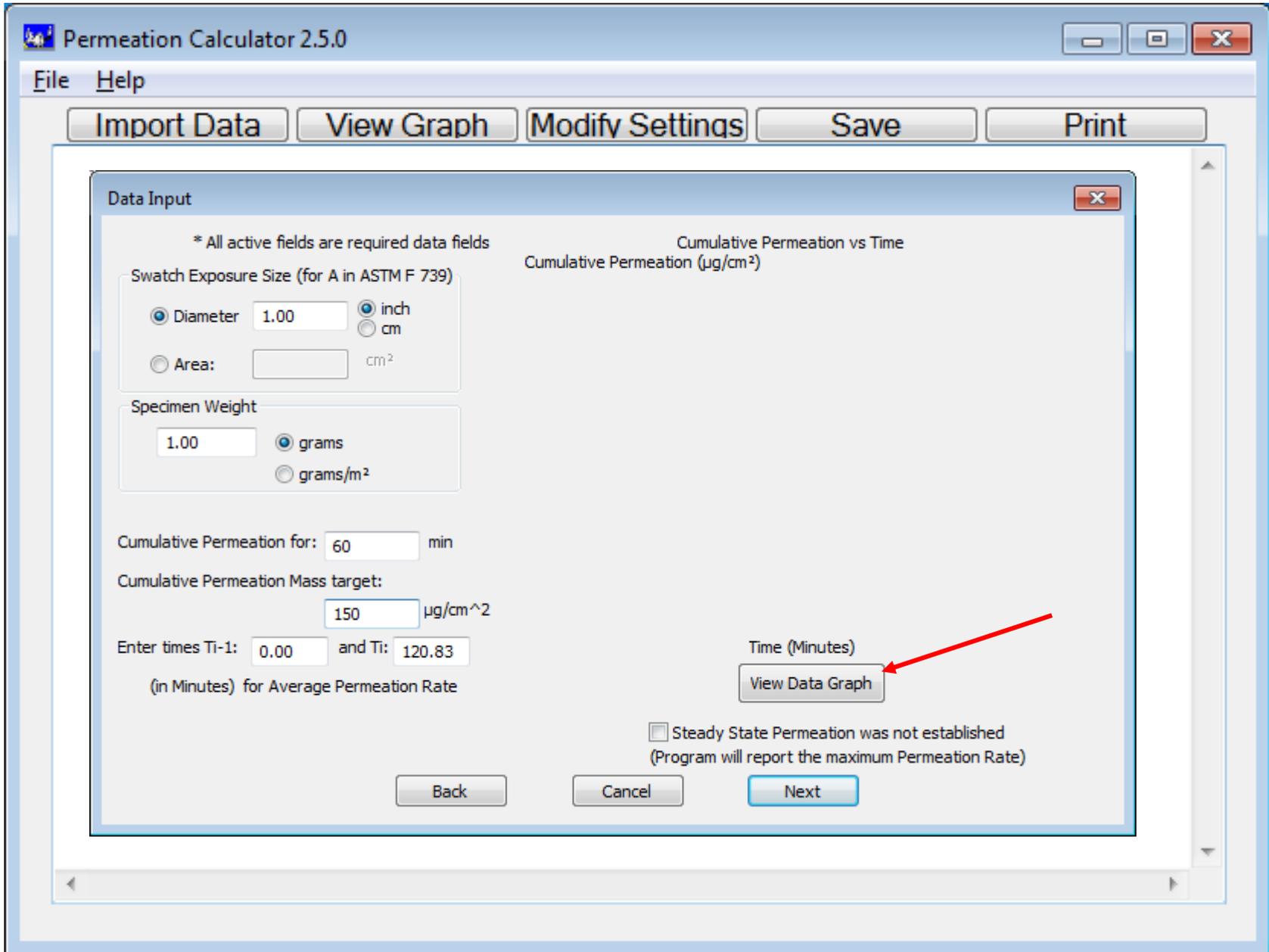
An Example for a Closed-loop System with Continuous Sampling











Import Data

View Graph

Modify Settings

Save

Print

Data Input ✕

* All active fields are required data fields

Swatch Exposure Size (for A in ASTM F 739)

Diameter inch cm

Area: cm²

Specimen Weight

grams grams/m²

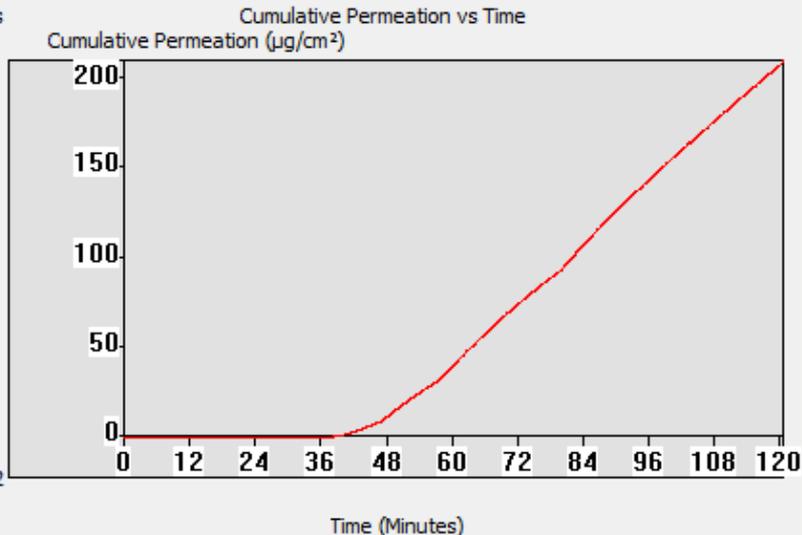
Cumulative Permeation for: min

Cumulative Permeation Mass target: $\mu\text{g}/\text{cm}^2$

Enter times T_{i-1}: and T_i: (in Minutes) for Average Permeation Rate

View Data Graph

Steady State Permeation was not established (Program will report the maximum Permeation Rate)



Additional Data Input

* All fields are optional data fields (values entered here will not affect the results)

Report Title: Neoprene Against Acetone

Project Number: PR-1234

Date: 2/5/2016 MM/DD/YYYY

Operator: Jane Doe

Material Type (Manufacture/Product): Neoprene

Experiment Setting

Instrument Type (e.g., MIRAN IR, GC, etc.): MIRAN IR

Average Material Thickness (mm): 0.685

Instrument Settings: Wavelength 8.5 μm Pathlength 20.25 meters

Chemical Information:

Test Chemical: Acetone, 99.5% min

Physical State

Liquid

Gas

Collection Medium: Air (e.g., N2, He, or air)

CAS #: 67-64-1 Manufacturer: isher Chemicals

Instrument ID Number: CDC-1236

Lot/Batch #: 034404 Expiration Date: May 30, 2016

Pump ID Number: Wr-156p

Data Sampling Interval (second): 3

Comments: This is to compare decontamination methods.

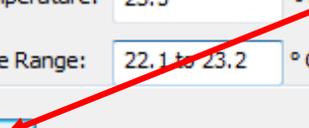
Nominal Test Temperature: 23.5 °C

Temperature Range: 22.1 to 23.2 °C

Back

Cancel

Finish



Permeation Calculator 2.5.0

File Help

Import Data View Graph Modify Settings Save Print

Report Title: Neoprene Against Acetone

Project Number: PR-1234

Experiment type: Closed Loop, Continuous Sampling.

--Results based on NIOSH's Permeation Calculator Version 2.5.0--

Breakthrough Time--
Standardized Breakthrough Time (permeation rate at 0.10 $\mu\text{g}/(\text{cm}^2\cdot\text{min})$): 39.4 min
Breakthrough Detection Time (BDT): 37.2 min
Normalized Breakthrough Time (permeation mass at 2.5 $\mu\text{g}/\text{cm}^2$): 40.9 min

Steady-State Permeation Rate (SSPR)--
SSPR: 2.74 $\mu\text{g}/(\text{cm}^2\cdot\text{min})$
Correlation Factor (R^2) in the steady-state region from 93.5 to 109 min: 0.999718

Cumulative Permeation--
Elapsed Time for Cumulative Permeation Mass of 150 $\mu\text{g}/\text{cm}^2$: 98.3 minutes
Cumulative Permeation for 60 minutes: 39.9 $\mu\text{g}/\text{cm}^2$
Average Permeation Rate from 0.00 to 120.83 min: 1.73 $\mu\text{g}/(\text{cm}^2\cdot\text{min})$

Operator: Jane Doe
Date: 2/10/2016
Data Filename: Data File 1.xls

Experiment Information--
Test Duration: 2.01 hours

An Example of Using Modify Settings

- Change Cumulative Permeation from 60 min to 120 min

Permeation Calculator 2.5.0

File Help

Import Data View Graph **Modify Settings** Save Print

Report Title: Neoprene Against Acetone

Project Number: PR-1234

Experiment type: Closed Loop, Continuous Sampling.

--Results based on NIOSH's Permeation Calculator Version 2.5.0--

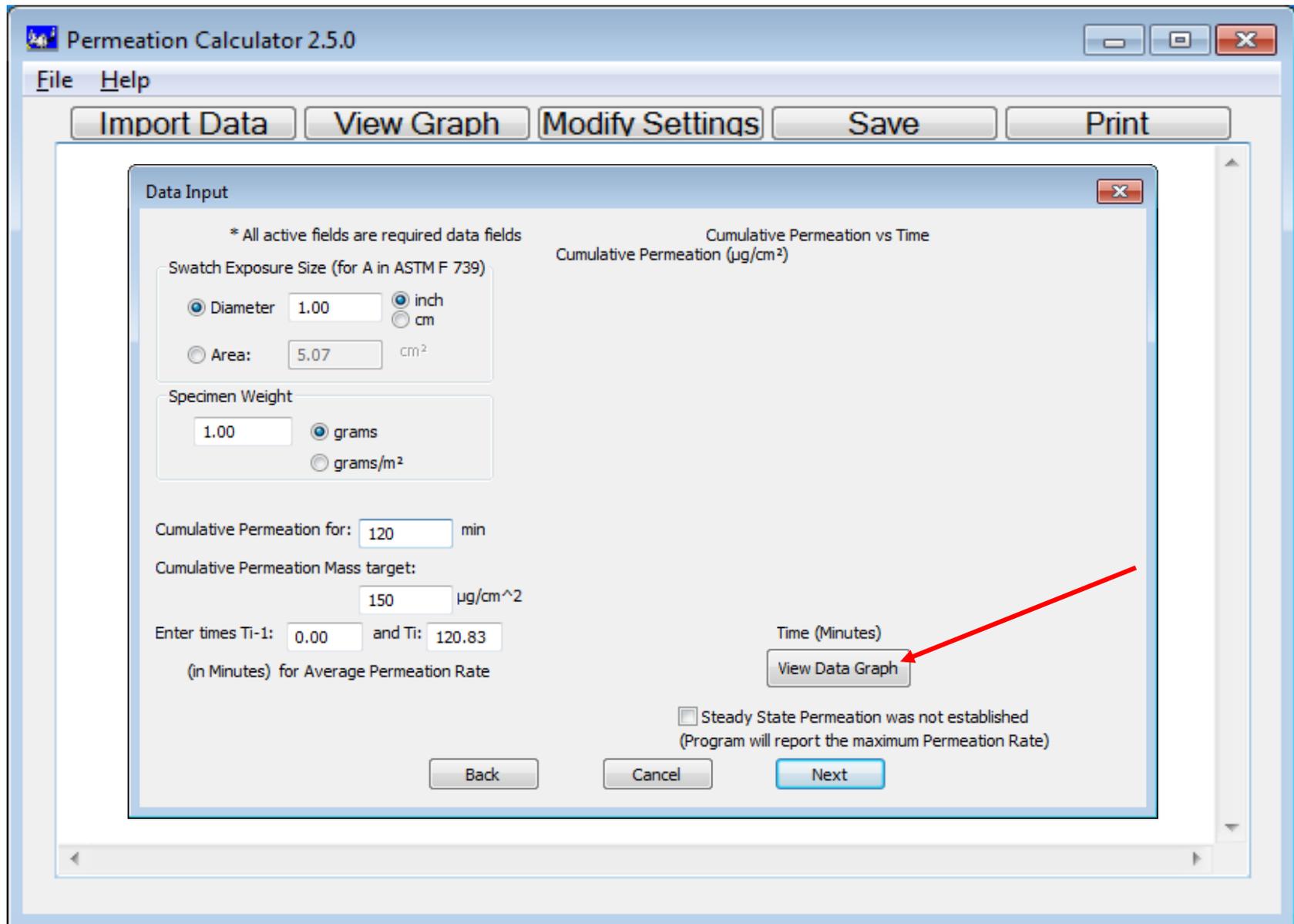
Breakthrough Time--
Standardized Breakthrough Time (permeation rate at 0.10 $\mu\text{g}/(\text{cm}^2\cdot\text{min})$): 39.4 min
Breakthrough Detection Time (BDT): 37.2 min
Normalized Breakthrough Time (permeation mass at 2.5 $\mu\text{g}/\text{cm}^2$): 40.9 min

Steady-State Permeation Rate (SSPR)--
SSPR: 2.74 $\mu\text{g}/(\text{cm}^2\cdot\text{min})$
Correlation Factor (R^2) in the steady-state region from 93.5 to 109 min: 0.999718

Cumulative Permeation--
Elapsed Time for Cumulative Permeation Mass of 150 $\mu\text{g}/\text{cm}^2$: 98.3 minutes
Cumulative Permeation for 60 minutes: 39.9 $\mu\text{g}/\text{cm}^2$
Average Permeation Rate from 0.00 to 120.83 min: 1.73 $\mu\text{g}/(\text{cm}^2\cdot\text{min})$

Operator: Jane Doe
Date: 2/10/2016
Data Filename: Data File 1.xls

Experiment Information--
Test Duration: 2.01 hours



Import Data

View Graph

Modify Settings

Save

Print

Data Input

* All active fields are required data fields

Swatch Exposure Size (for A in ASTM F 739)

Diameter inch
 Area: cm²

Specimen Weight

grams
 grams/m²

Cumulative Permeation for: min

Cumulative Permeation Mass target:
 $\mu\text{g}/\text{cm}^2$

Enter times T_{i-1}: and T_i:
 (in Minutes) for Average Permeation Rate

Steady State Permeation was not established
 (Program will report the maximum Permeation Rate)

Back Cancel Next

Cumulative Permeation vs Time

Cumulative Permeation ($\mu\text{g}/\text{cm}^2$)

View Data Graph

Permeation Calculator 2.5.0

File Help

Import Data View Graph Modify Settings Save Print

Report Title: Neoprene Against Acetone

Project Number: PR-1234

Experiment type: Closed Loop, Continuous Sampling.

--Results based on NIOSH's Permeation Calculator Version 2.5.0--

Breakthrough Time--
Standardized Breakthrough Time (permeation rate at $0.10 \mu\text{g}/(\text{cm}^2\cdot\text{min})$): 39.4 min
Breakthrough Detection Time (BDT): 37.2 min
Normalized Breakthrough Time (permeation mass at $2.5 \mu\text{g}/\text{cm}^2$): 40.9 min

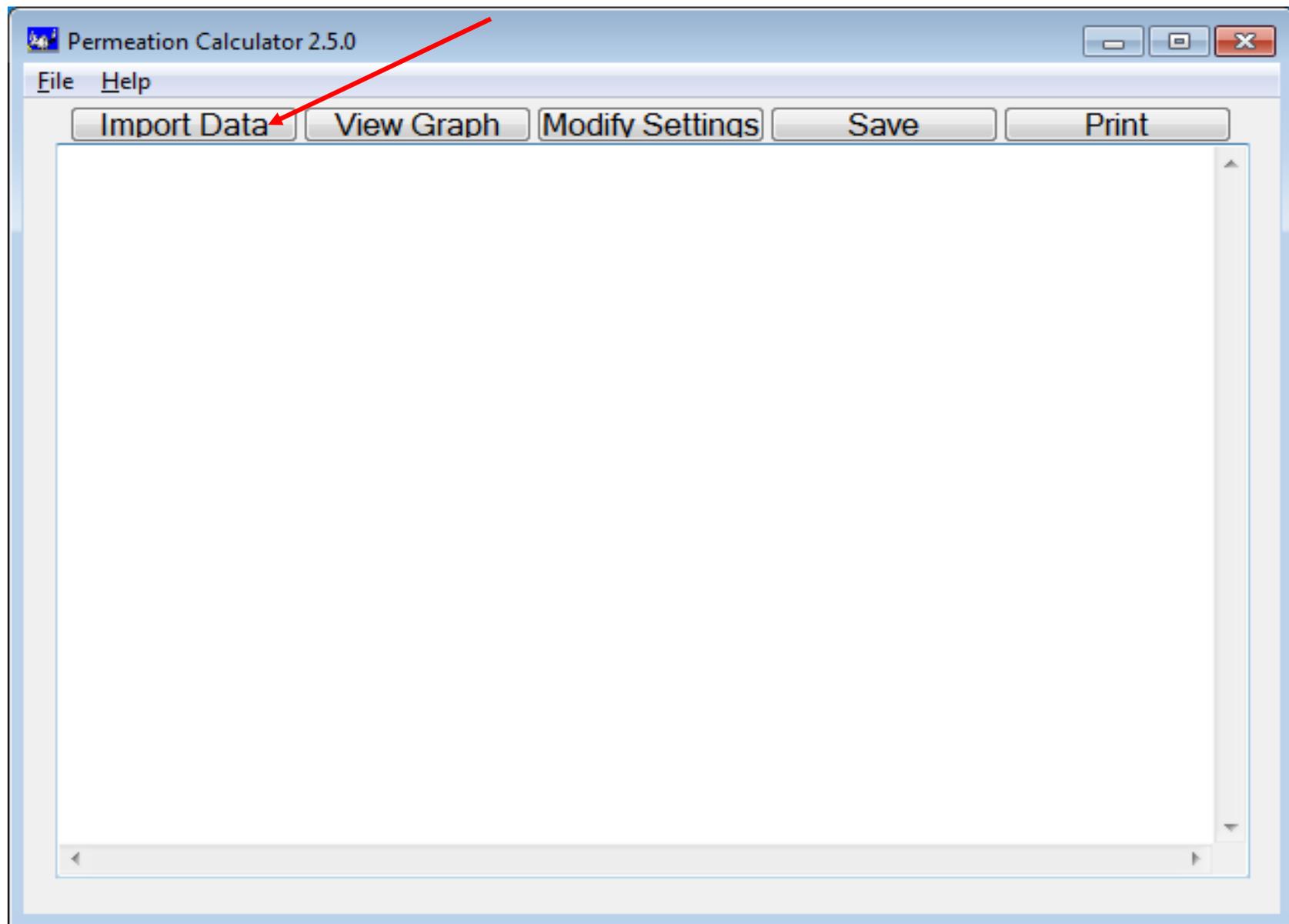
Steady-State Permeation Rate (SSPR)--
SSPR: $2.74 \mu\text{g}/(\text{cm}^2\cdot\text{min})$
Correlation Factor (R^2) in the steady-state region from 93.5 to 109 min: 0.999718

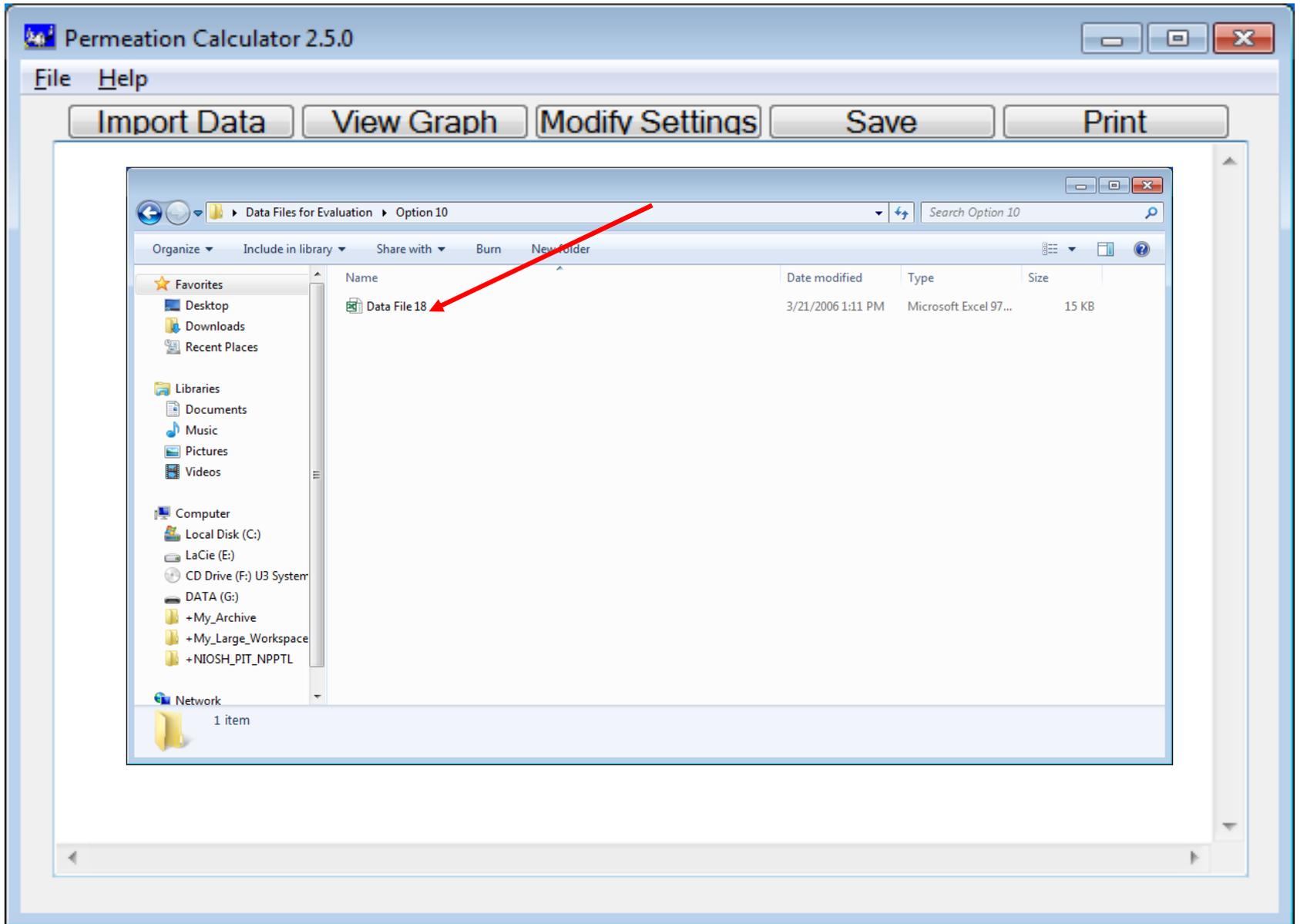
Cumulative Permeation--
Elapsed Time for Cumulative Permeation Mass of $150 \mu\text{g}/\text{cm}^2$: 98.3 minutes
Cumulative Permeation for 120 minutes: $208 \mu\text{g}/\text{cm}^2$
Average Permeation Rate from 0.00 to 120.83 min: $1.73 \mu\text{g}/(\text{cm}^2\cdot\text{min})$

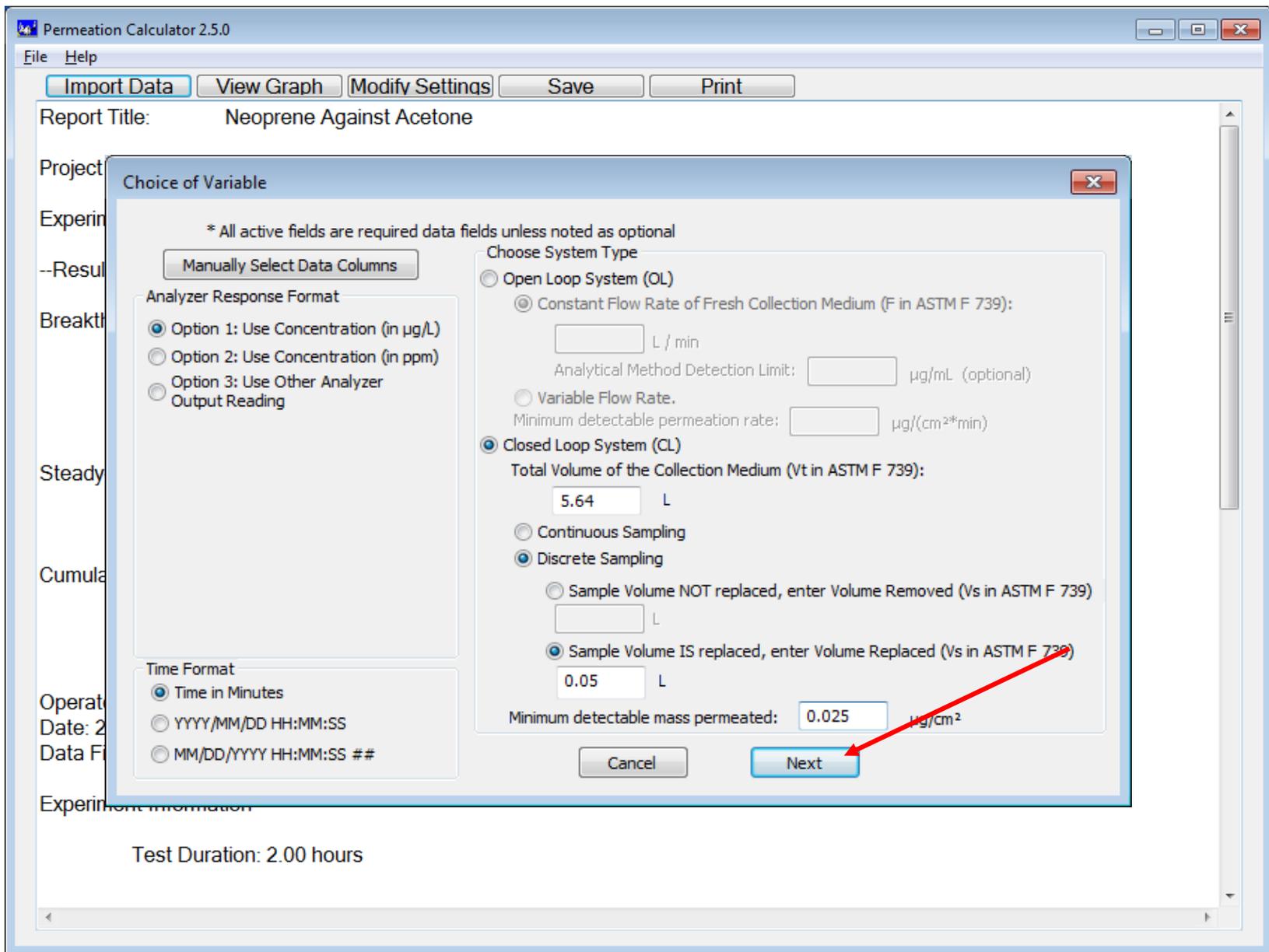
Operator: Jane Doe
Date: 2/10/2016
Data Filename: Data File 1.xls

Experiment Information--
Test Duration: 2.01 hours

An Example for a Closed-loop System with Discrete Sampling and the Sampling Volume is Replaced







Permeation Calculator 2.5.0

File Help

Import Data View Graph Modify Settings Save Print

Data Input

* All active fields are required data fields

Cumulative Permeation vs Time
Cumulative Permeation ($\mu\text{g}/\text{cm}^2$)

Swatch Exposure Size (for A in ASTM F 739)

Diameter 1.00 inch
 cm

Area: 5.07 cm^2

Specimen Weight

1.00 grams
 grams/m^2

Cumulative Permeation for: 60 min

Cumulative Permeation Mass target:
150 $\mu\text{g}/\text{cm}^2$

Enter times T_{i-1} : 0.00 and T_i : 120.00
(in Minutes) for Average Permeation Rate

Time (Minutes)
View Data Graph

Steady State Permeation was not established
(Program will report the maximum Permeation Rate)

Back Cancel Next

Permeation Calculator 2.5.0

File Help

Import Data View Graph Modify Settings Save Print

Data Input

* All active fields are required data fields

Swatch Exposure Size (for A in ASTM F 739)

Diameter: 1.00 inch cm

Area: 5.07 cm²

Specimen Weight

1.00 grams grams/m²

Cumulative Permeation for: 60 min

Cumulative Permeation Mass target: 150 $\mu\text{g}/\text{cm}^2$

Enter times T_{i-1}: 0.00 and T_i: 120.00
(in Minutes) for Average Permeation Rate

View Data Graph

Steady State Permeation was not established
(Program will report the maximum Permeation Rate)

Back Cancel Next

Time (Minutes)	Cumulative Permeation ($\mu\text{g}/\text{cm}^2$)
0	0
12	0
24	0
36	0
48	~10
60	~50
72	~80
84	~100
96	~130
108	~160
120	200

Permeation Calculator 2.5.0

File Help

Import Data View Graph Modify Settings Save Print

Additional Data Input

* All fields are optional data fields (values entered here will not affect the results)

Report Title: Neoprene Against Acetone Project Number: PR-1234

Date: 2/10/2016 MM/DD/YYYY Operator: Jane Doe

Material Type (Manufacture/Product): Neoprene

Average Material Thickness (mm): 0.685

Chemical Information:

Test Chemical: Acetone, 99.5% min

Physical State:
 Liquid
 Gas

CAS #: 67-64-1 Manufacturer: Fisher Chemicals

Lot/Batch #: 034404 Expiration Date: May 30, 2016

Comments: This is to compare decontamination methods.

Experiment Setting

Instrument Type (e.g., MIRAN IR, GC, etc.): MIRAN IR

Instrument Settings: Wavelength 8.5 μ m
Pathlength 20.25 meters

Collection Medium: Air

Instrument ID Number: CDC-1236

Pump ID Number: Wr-156p

Data Sampling Interval (second): 3

Nominal Test Temperature: 23.5 °C

Temperature Range: 22.1 to 23.2 °C

Back Cancel Finish

Permeation Calculator 2.5.0

File Help

Import Data View Graph Modify Settings Save Print

Report Title: Neoprene Against Acetone

Project Number: PR-1234

Experiment type: Closed Loop, Discrete Sampling, Volume Replaced.

--Results based on NIOSH's Permeation Calculator Version 2.5.0--

Breakthrough Time--

- Standardized Breakthrough Time (permeation rate at $0.10 \mu\text{g}/(\text{cm}^2\cdot\text{min})$): 21.1 min
- Breakthrough Detection Time (BDT): 30.3 min
- Normalized Breakthrough Time (permeation mass at $2.5 \mu\text{g}/\text{cm}^2$): 40.5 min
- Minimum Breakthrough Detection Time (permeation rate at $0.01 \mu\text{g}/(\text{cm}^2\cdot\text{min})$): 18.5 min

Steady-State Permeation Rate (SSPR)--

- SSPR: $2.92 \mu\text{g}/(\text{cm}^2\cdot\text{min})$
- Correlation Factor (R^2) in the steady-state region from 93.0 to 108 min: 0.998340

Cumulative Permeation--

- Elapsed Time for Cumulative Permeation Mass of $150 \mu\text{g}/\text{cm}^2$: 97.9 minutes
- Cumulative Permeation for 60 minutes: $40.2 \mu\text{g}/\text{cm}^2$
- Average Permeation Rate from 0.00 to 120.00 min: $1.75 \mu\text{g}/(\text{cm}^2\cdot\text{min})$

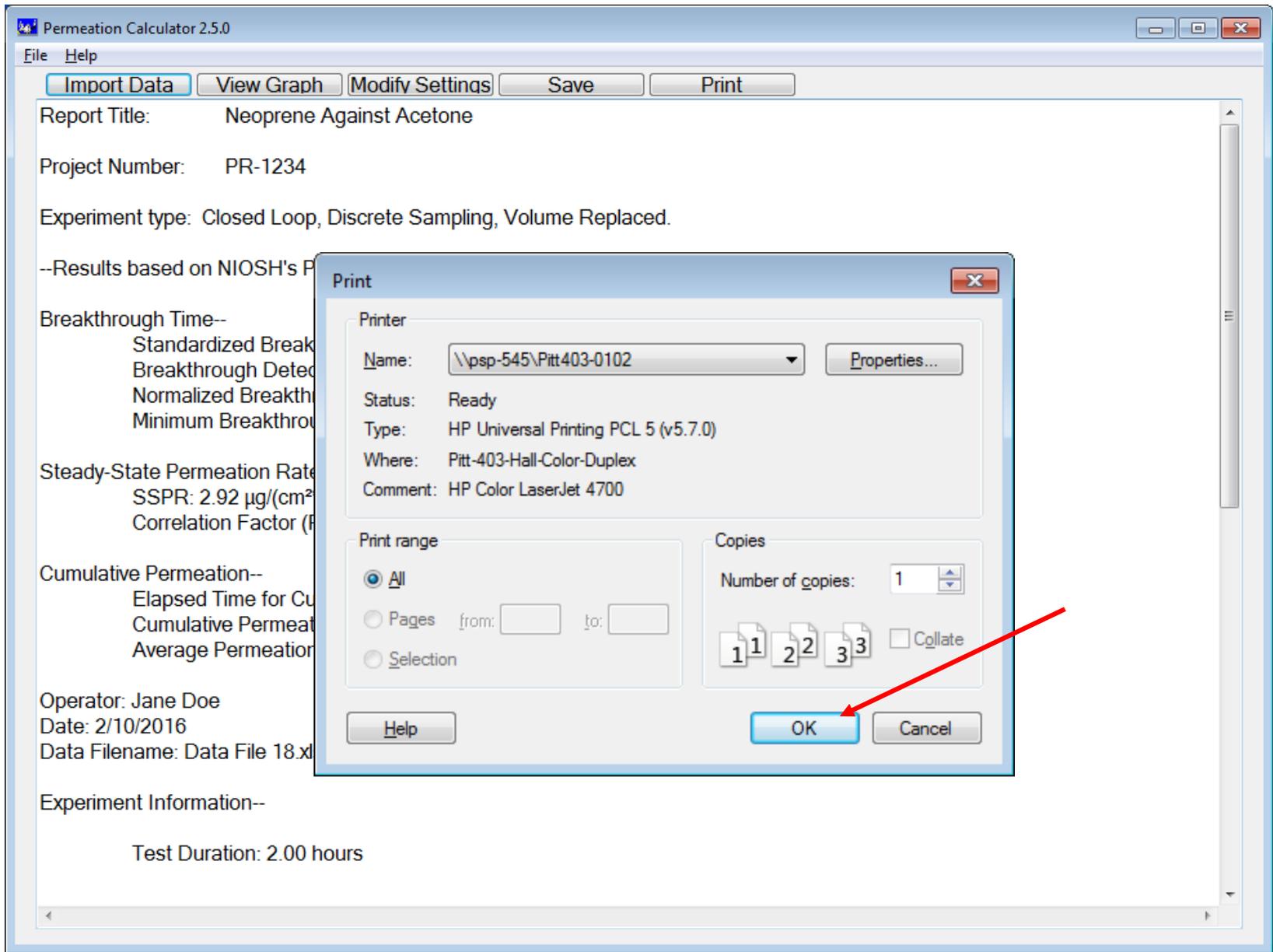
Operator: Jane Doe

Date: 2/10/2016

Data Filename: Data File 18.xls

Experiment Information--

- Test Duration: 2.00 hours



Permeation Calculator 2.5.0

File Help

Graph Modify Settings Save Print

1234

Loop, Discrete Sampling, Volume Replaced.

--Results based on NIOSH's Permeation Calculator Version 2.5.0--

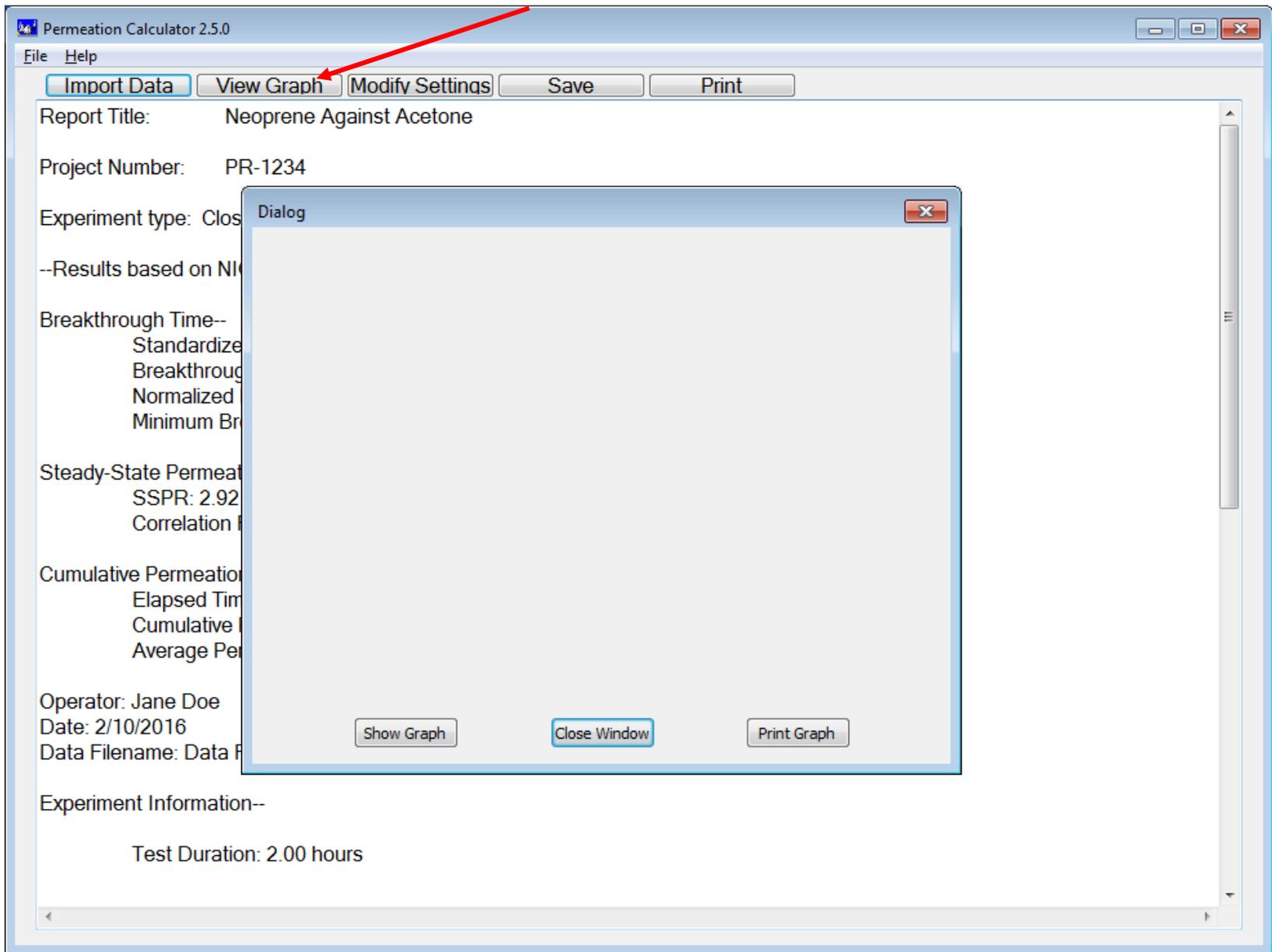
Breakthrough Time--
Standardized Breakthrough Time (permeation rate at $0.10 \mu\text{g}/(\text{cm}^2\cdot\text{min})$): 21.1 min
Breakthrough Detection Time (BDT): 30.3 min
Normalized Breakthrough Time (permeation mass at $2.5 \mu\text{g}/\text{cm}^2$): 40.5 min
Minimum Breakthrough Detection Time (permeation rate at $0.01 \mu\text{g}/(\text{cm}^2\cdot\text{min})$): 18.5 min

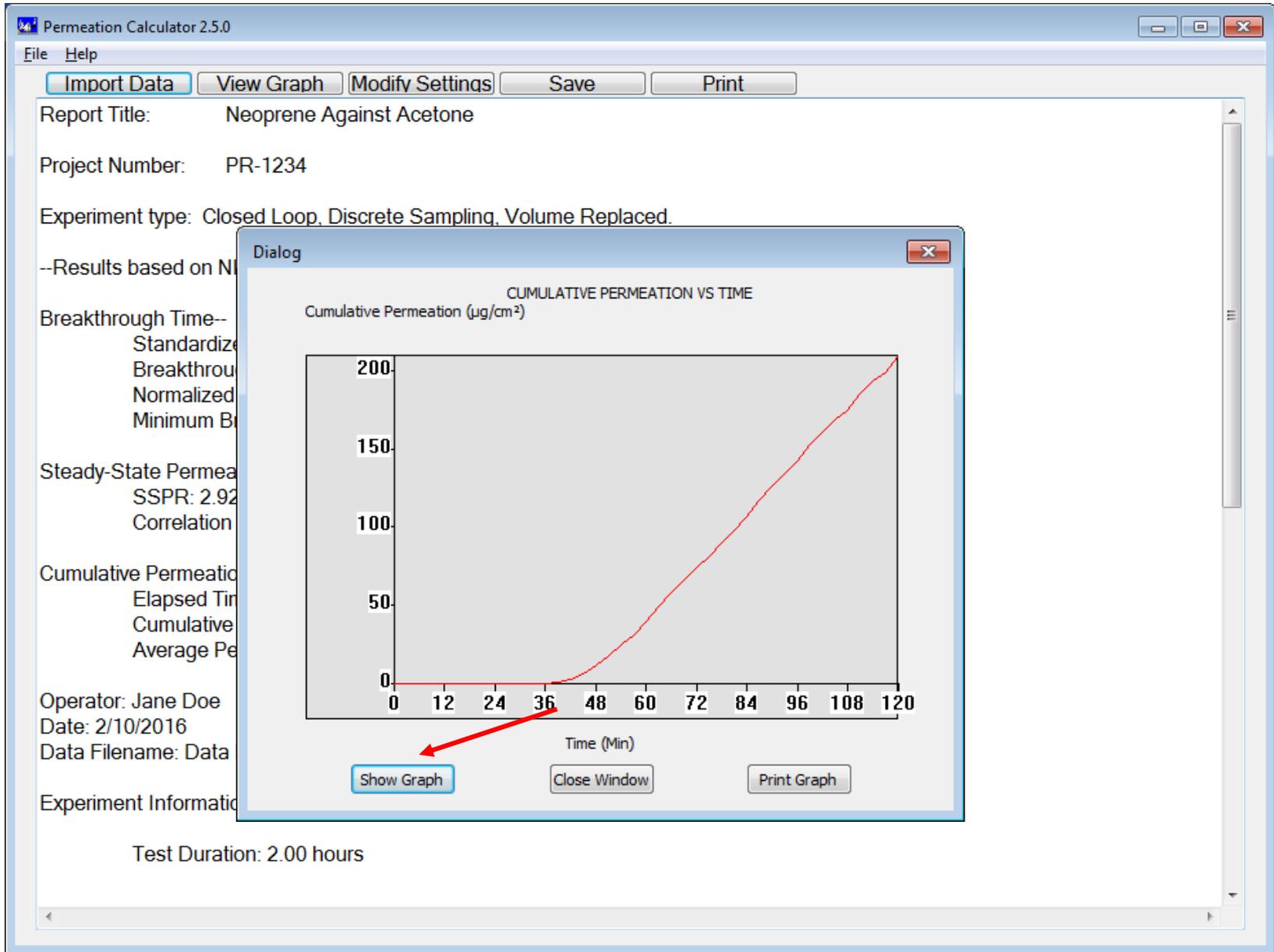
Steady-State Permeation Rate (SSPR)--
SSPR: $2.92 \mu\text{g}/(\text{cm}^2\cdot\text{min})$
Correlation Factor (R^2) in the steady-state region from 93.0 to 108 min: 0.998340

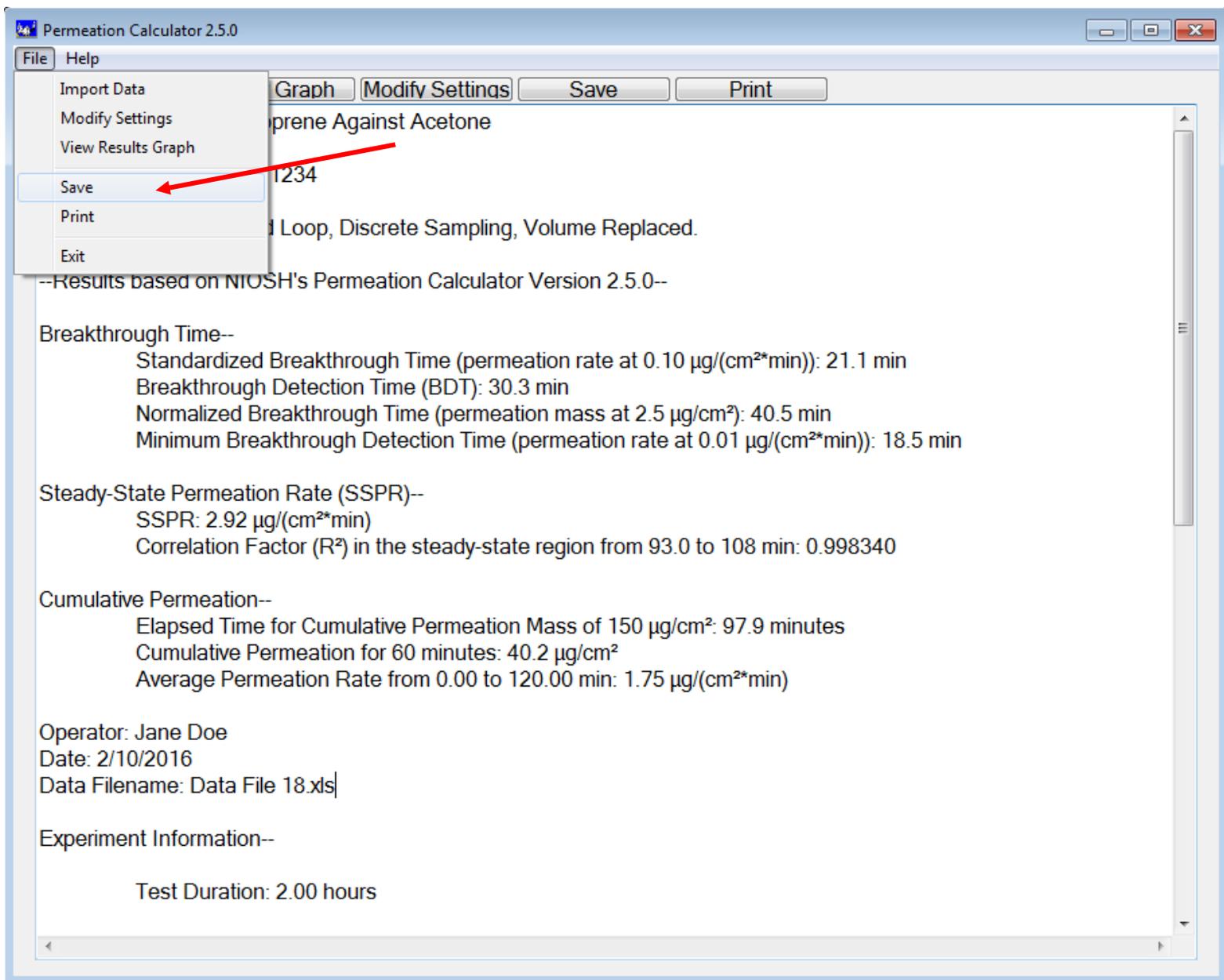
Cumulative Permeation--
Elapsed Time for Cumulative Permeation Mass of $150 \mu\text{g}/\text{cm}^2$: 97.9 minutes
Cumulative Permeation for 60 minutes: $40.2 \mu\text{g}/\text{cm}^2$
Average Permeation Rate from 0.00 to 120.00 min: $1.75 \mu\text{g}/(\text{cm}^2\cdot\text{min})$

Operator: Jane Doe
Date: 2/10/2016
Data Filename: Data File 18.xls

Experiment Information--
Test Duration: 2.00 hours







Permeation Calculator 2.5.0

File Help

Import Data View Graph Modify Settings Save Print

Report Title: Neoprene Against Acetone

Project Number: PR-1234

Experiment type: Closed Loop, Discrete Sampling, Volume Replaced.

--Results based on NIOSH's Permeation Calculator Version 2.5.0--

Breakthrough Time--

- Standardized Breakthrough Time (permeation rate at $0.10 \mu\text{g}/(\text{cm}^2\cdot\text{min})$): 21.1 min
- Breakthrough Detection Time (BDT): 30.3 min
- Normalized Breakthrough Time (permeation mass at $2.5 \mu\text{g}/\text{cm}^2$): 40.5 min
- Minimum Breakthrough Detection Time (permeation rate at $0.01 \mu\text{g}/(\text{cm}^2\cdot\text{min})$): 18.5 min

Steady-State Permeation Rate (SSPR)--

- SSPR: $2.92 \mu\text{g}/(\text{cm}^2\cdot\text{min})$
- Correlation Factor (R^2) in the steady-state region from 93.0 to 108 min: 0.998340

Cumulative Permeation--

- Elapsed Time for Cumulative Permeation Mass of $150 \mu\text{g}/\text{cm}^2$: 97.9 minutes
- Cumulative Permeation for 60 minutes: $40.2 \mu\text{g}/\text{cm}^2$
- Average Permeation Rate from 0.00 to 120.00 min: $1.75 \mu\text{g}/(\text{cm}^2\cdot\text{min})$

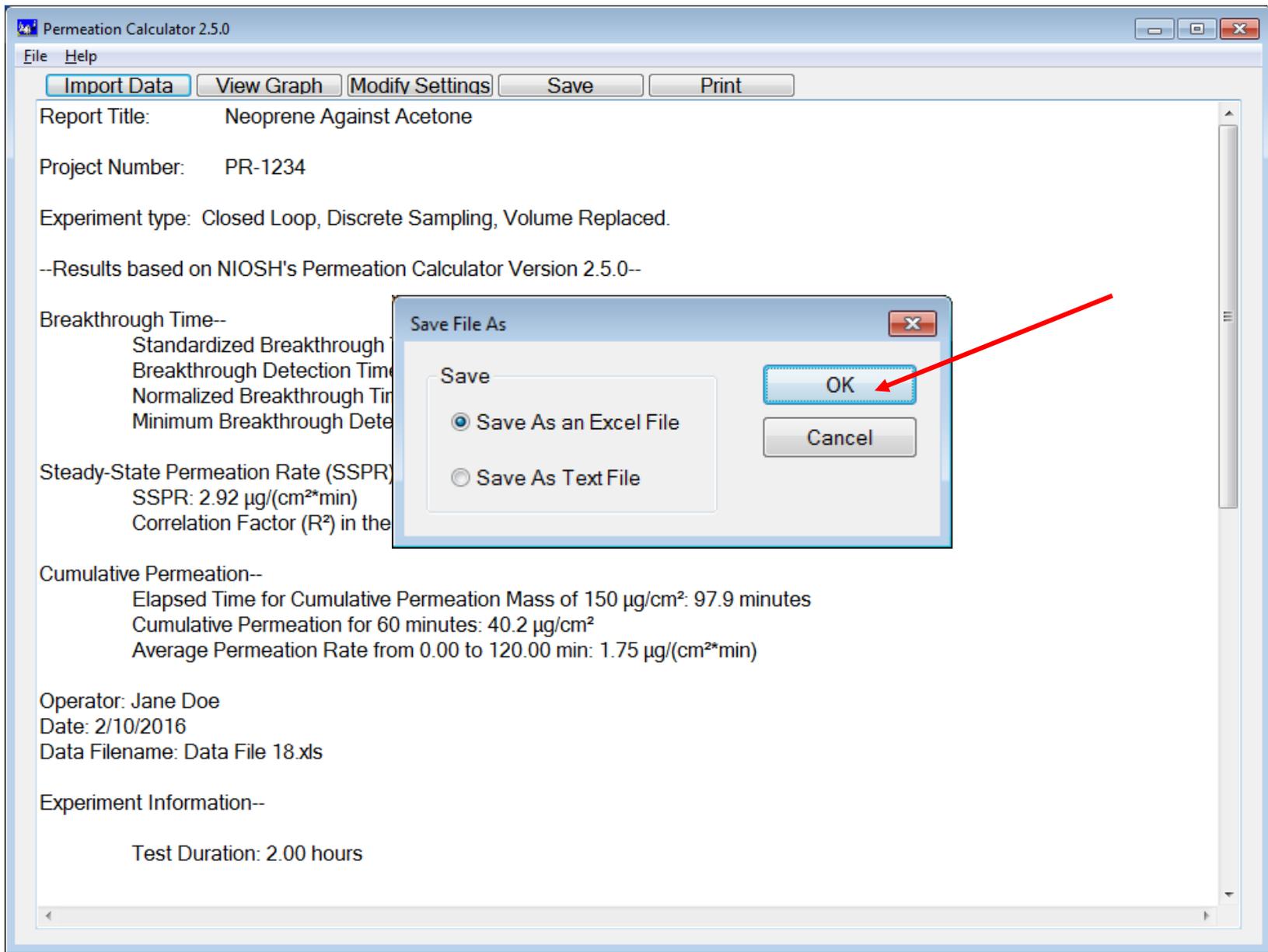
Operator: Jane Doe

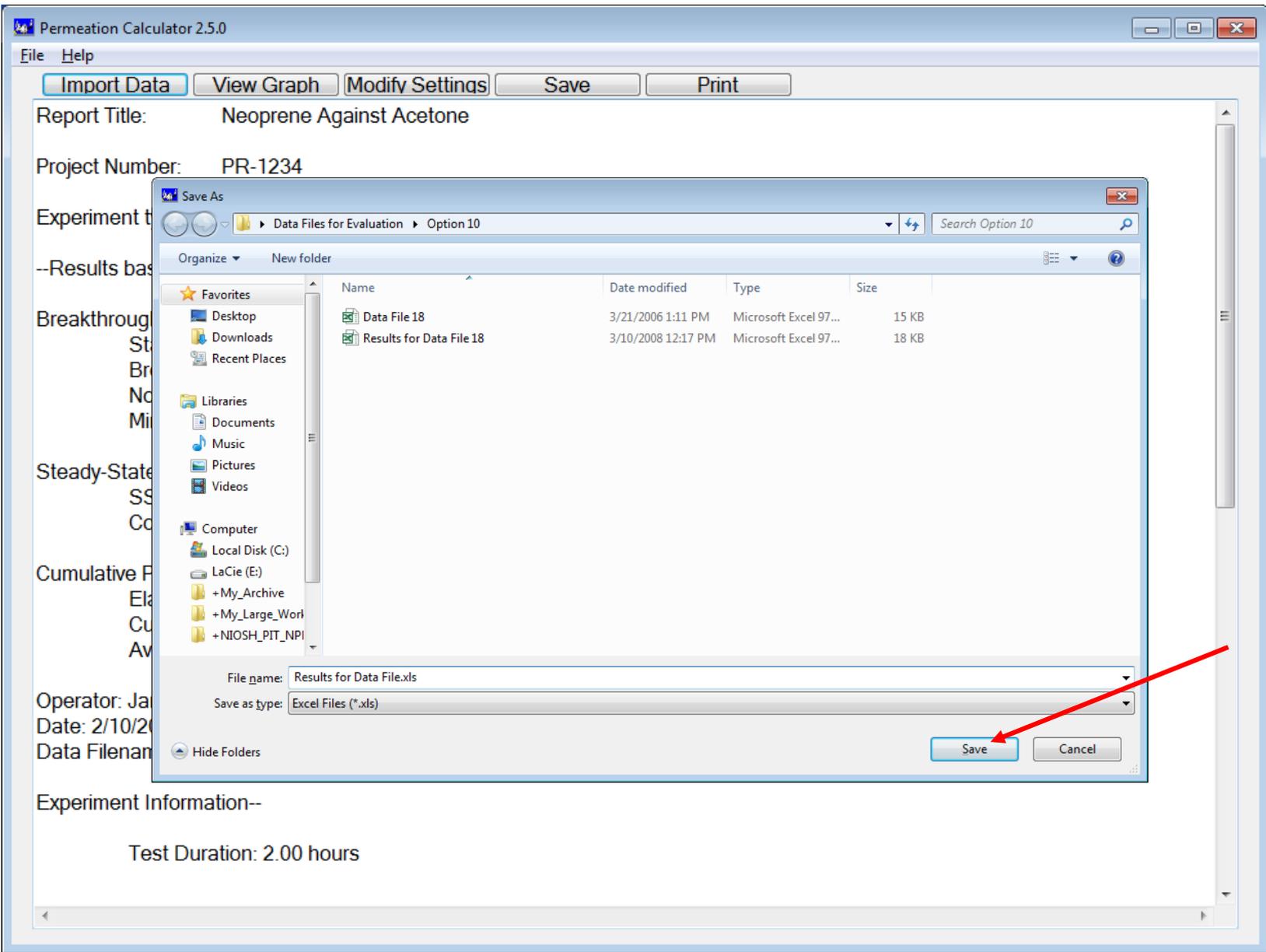
Date: 2/10/2016

Data Filename: Data File 18.xls

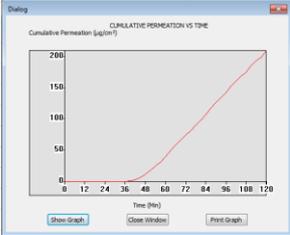
Experiment Information--

- Test Duration: 2.00 hours





A	B	C	D	E
1	Report Title:	Neoprene Against Ac	Results based on NIOSH Permeation Calculator	Version 2-5-0
2				
3	Operator:	Jane Doe		
4	Date:	2/10/2016		
5	Data Filename:	Data File 18.xls		
6	Project Number:	PR-1234		
7				
8		Standardized Breakthrough Time (permeation rate at 0.10 $\mu\text{g}/(\text{cm}^2\text{min})$):		21.1 min
9		Breakthrough Detection Time (BDT):		30.3 min
10		Normalized Breakthrough Time (permeation mass at 2.5 $\mu\text{g}/\text{cm}^2$):		40.5 min
11		Minimum Breakthrough Detection Time (permeation rate at 0.01 $\mu\text{g}/(\text{cm}^2\text{min})$):		18.5 min
12		Steady-State Permeation Rate (SSPR):		2.92 $\mu\text{g}/(\text{cm}^2\text{min})$
13		Correlation Factor (R^2) in the Steady-State Region:		0.99834
14		Start Time in the Steady-State Region:		93 min
15		End Time in the Steady-State Region:		108 min
16		Elapsed Time for Cumulative Permeation Mass of 150 $\mu\text{g}/\text{cm}^2$:		97.9 minutes
17		Cumulative Permeation for 60 minutes:		40.2 $\mu\text{g}/\text{cm}^2$
18		Average Permeation Rate from 0.00 to 120.00 minutes:		1.75 $\mu\text{g}/(\text{cm}^2\text{min})$
19				
20	Experiment Information			
21		Test Duration:		2 hours
22	Material	Manufacturer & Product:	Neoprene	
23		Average Thickness:		0.685 mm
24		Exposure Area:		5.07 cm^2
25		Weight Per Unit Area of Specimen:		1970 g/m^2
26	Test Chemical	Physical State:	Liquid	
27		Test Chemical:	Acetone, 99.5% min	
28		CAS #:	67-64-1	
29		Manufacturer:	Fisher Chemicals	
30		Lot/Batch #:	034404	
31		Expiration Date:	May 30, 2016	
32	Temperature	Nominal Test:	23.5 degrees Celsius	
33		Range:	22.1 to 23.2 degrees Celsius	
34	Analytical Technique	Instrument Type:	MIRAN IR	
35		Instrument ID Number:	CDC-1236	
36		Instrument Settings:	Wavelength 8.5 μm Pathlength 20.25 meters	
37		Sampling Pump ID:	Wr-156p	
38	Collection System	Medium:	Air	
39		Total Volume of the Collection Medium (V_t):		5.64 L
40	System Type:	Closed Loop, Discrete Sampling, Volume Replaced.		
41		Volume of Discrete Sample (V_s) Removed from Collection Medium:		0.05 L
42		Data Sampling Interval (seconds):		3
43	Additional Comments	This is to compare decontamination methods.		



The permeation curve can be copied into the Excel file formatted report by selecting “View Graph” and pressing “Ctrl/Print Scrn”, then pasting the image into the report.

Permeation Calculator 2.5.0

File Help

Graph Modify Settings Save Print

1234

1 Loop, Discrete Sampling, Volume Replaced.

--Results based on NIOSH's Permeation Calculator Version 2.5.0--

Breakthrough Time--

- Standardized Breakthrough Time (permeation rate at $0.10 \mu\text{g}/(\text{cm}^2\cdot\text{min})$): 21.1 min
- Breakthrough Detection Time (BDT): 30.3 min
- Normalized Breakthrough Time (permeation mass at $2.5 \mu\text{g}/\text{cm}^2$): 40.5 min
- Minimum Breakthrough Detection Time (permeation rate at $0.01 \mu\text{g}/(\text{cm}^2\cdot\text{min})$): 18.5 min

Steady-State Permeation Rate (SSPR)--

- SSPR: $2.92 \mu\text{g}/(\text{cm}^2\cdot\text{min})$
- Correlation Factor (R^2) in the steady-state region from 93.0 to 108 min: 0.998340

Cumulative Permeation--

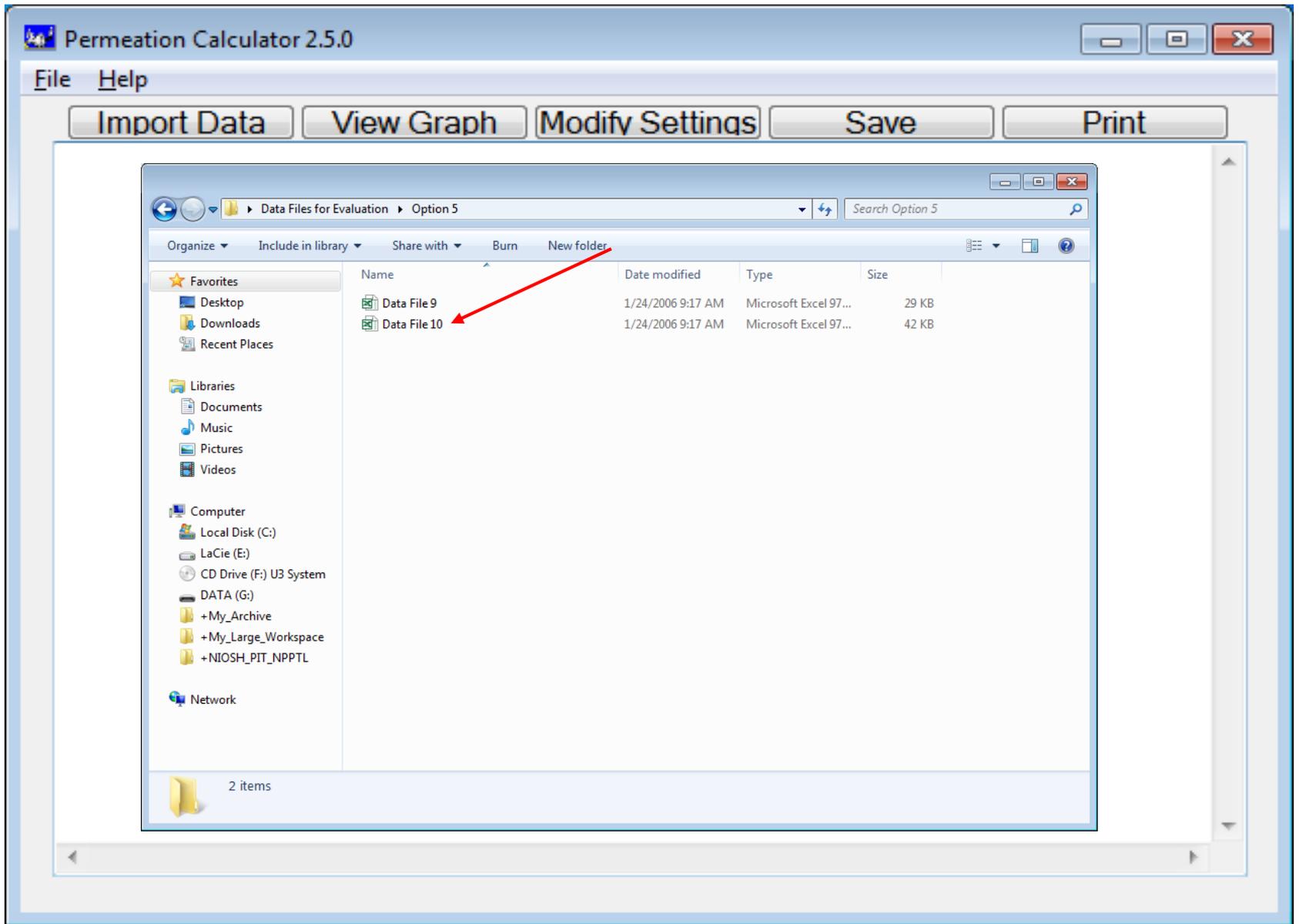
- Elapsed Time for Cumulative Permeation Mass of $150 \mu\text{g}/\text{cm}^2$: 97.9 minutes
- Cumulative Permeation for 60 minutes: $40.2 \mu\text{g}/\text{cm}^2$
- Average Permeation Rate from 0.00 to 120.00 min: $1.75 \mu\text{g}/(\text{cm}^2\cdot\text{min})$

Operator: Jane Doe
Date: 2/10/2016
Data Filename: Data File 18.xls

Experiment Information--

- Test Duration: 2.00 hours

An Example for an Open-loop System with Constant Flow Rate of Fresh Collection Medium



For open loop testing under a constant flow rate, there is an option to enter a value for the “Analytical Method Detection Limit” to calculate the “Minimum Detectable Permeation Rate” (see the report on the last slide)

Choice of Variable ✕

* All active fields are required data fields unless noted as optional

Manually Select Data Columns

Analyzer Response Format

- Option 1: Use Concentration (in $\mu\text{g/L}$)
- Option 2: Use Concentration (in ppm)
- Option 3: Use Other Analyzer Output Reading

Time Format

- Time in Minutes
- YYYY/MM/DD HH:MM:SS
- MM/DD/YYYY HH:MM:SS ##

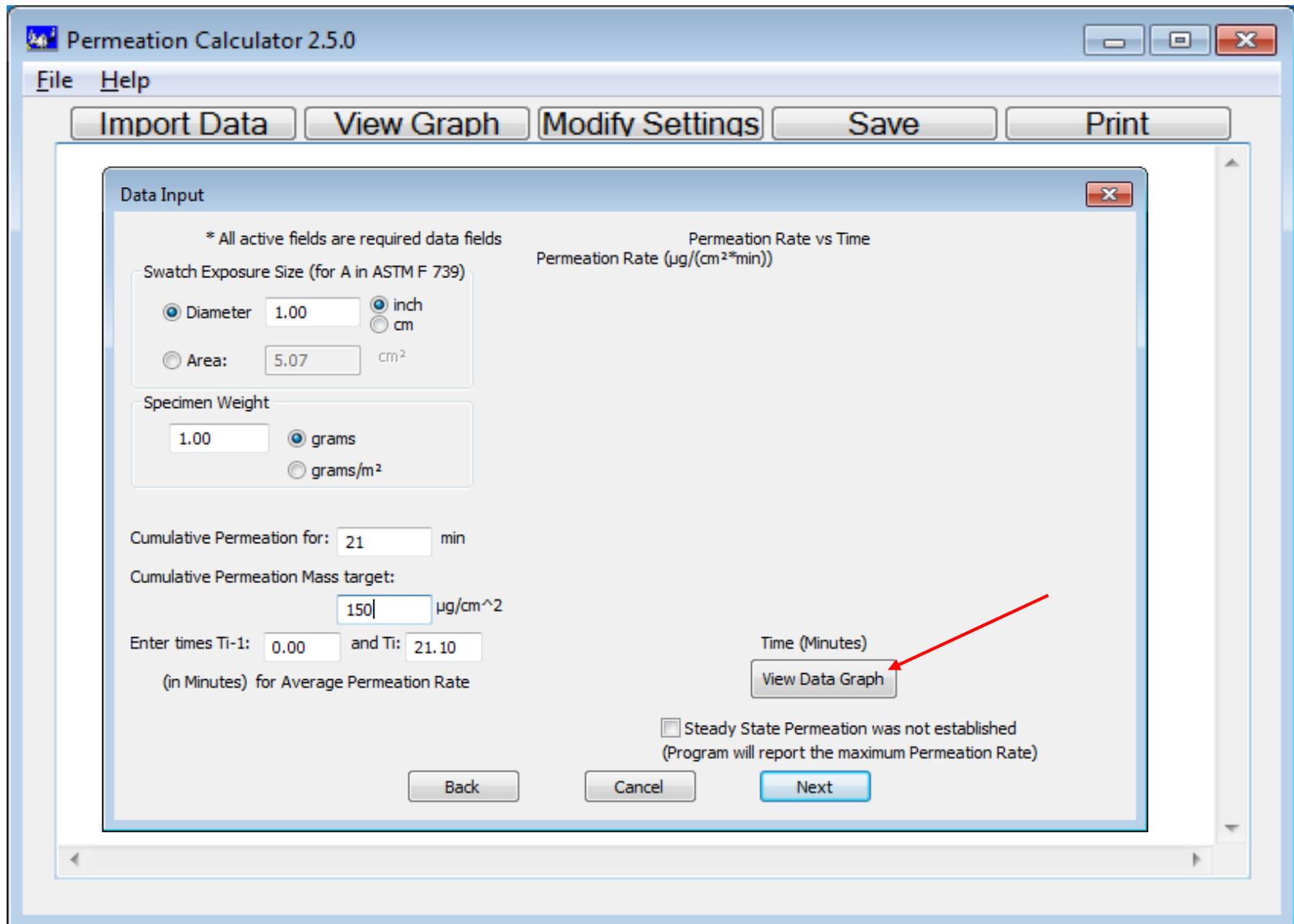
Choose System Type

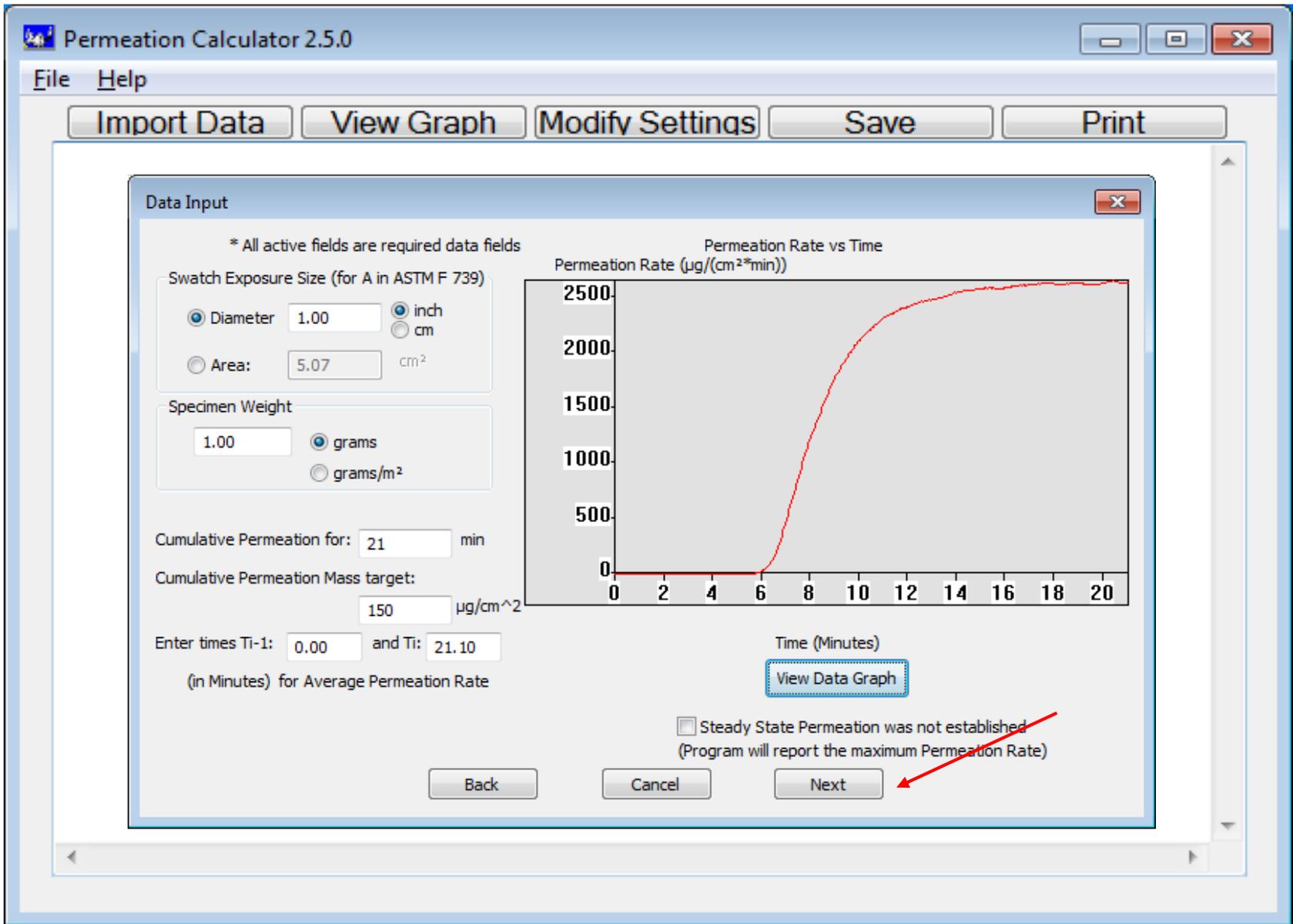
- Open Loop System (OL)
 - Constant Flow Rate of Fresh Collection Medium (F in ASTM F 739):
 L / min
Analytical Method Detection Limit: $\mu\text{g/mL}$ (optional)
 - Variable Flow Rate.
Minimum detectable permeation rate: $\mu\text{g}/(\text{cm}^2\cdot\text{min})$
- Closed Loop System (CL)
 - Total Volume of the Collection Medium (V_t in ASTM F 739):
 L
 - Continuous Sampling
 - Discrete Sampling
 - Sample Volume NOT replaced, enter Volume Removed (V_s in ASTM F 739)
 L
 - Sample Volume IS replaced, enter Volume Replaced (V_s in ASTM F 739)
 L

Minimum detectable mass permeated: $\mu\text{g}/\text{cm}^2$

Cancel Next







Permeation Calculator 2.5.0

File Help

Import Data View Graph Modify Settings Save Print

Additional Data Input

* All fields are optional data fields (values entered here will not affect the results)

Report Title: Neoprene Against Acetone Project Number: PR-1234

Date: 2/10/2016 MM/DD/YYYY Operator: Jane Doe

Material Type (Manufacture/Product): Neoprene

Average Material Thickness (mm): 0.685

Experiment Setting

Instrument Type (e.g., MIRAN IR, GC, etc.): MIRAN IR

Instrument Settings: Wavelength 8.5 μ m Pathlength 20.25 meters

Collection Medium: Air

Instrument ID Number: CDC-1236

Pump ID Number: Wr-156p

Data Sampling Interval (second): 3

Nominal Test Temperature: 23.5 $^{\circ}$ C

Temperature Range: 22.1 to 28.2 $^{\circ}$ C

Chemical Information:

Test Chemical: Acetone, 99.5% min Physical State: Liquid Gas

CAS #: 67-64-1 Manufacturer: Fisher Chemicals

Lot/Batch #: 034404 Expiration Date: May 30, 2016

Comments: This is to compare decontamination methods.

Back Cancel Finish

