The Arizona Border Study

An Extension of the
Arizona National Human Exposure Assessment Survey (NHEXAS)Study
Sponsored by the Environmental Health Workgroup of the Border XXI Program

Quality Systems and Implementation Plan for Human Exposure Assessment

The University of Arizona
Tucson, Arizona 85721

Cooperative Agreement CR 824719

Standard Operating Procedure **SOP-BCO-G-3.1**

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Verification and Transfer of Data to University of Arizona

1.0 Purpose and Applicability

This standard operating procedure (SOP) describes the process of entering analytical data into the analytical results database. This database consists of separate modules for each class of target compounds (pesticides, VOCs, metals, PAH) found in each sampling medium, e.g., metals in carpet dust, pesticides in indoor air, etc.

2.0 Definitions

2.1 OVM 3500 Organic Vapor Monitor: a passive sampler that collects volatile organic compounds (VOCs), such as benzene, toluene, trichloroethene, etc., based on the principal of diffusion.

2.2 Pumped Multisorbent Carbotrap Tube: an active sampler used to collect VOCs onto a sorbent tube.

2.3 Magnetic Storage Medium: any type of diskette, cartridge, tape, or fixed disk used to store computer data.

2.4 Microsoft Access 97 (or later): software program used to create relational computer databases.

2.5 Database: a file or group of files containing records on related data, including ancillary index, report, and query files.

2.6 Laboratory Duplicate First Member (LD1): the first of two aliquots of an environmental sample. Each aliquot is treated identically throughout the laboratory analytical procedure, from preparation through analysis.

2.7 Laboratory Duplicate Second Member (LD2): the second of the two aliquots described above.

2.8 Analytical Duplicate First Member (AD1): the first aliquot of a single environmental sample digestate or extract, used to assess analytical instrument precision.

2.9 Analytical Duplicate Second Member (AD2): the second aliquot of the single environmental sample digestate or extract described above.

2.10 Laboratory Sample Background for Pre-Preparation Spike (LSO): the first of two aliquots of an environmental sample. This aliquot is analyzed according to the analytical method to establish background concentrations prior to fortification (spiking) with the method analyte(s).

2.11 Laboratory Pre-Preparation Spiked Sample (LSF): the second of the two aliquots described above. This aliquot is subject to fortification (spiking) prior to sample preparation, and measurement(s) of the final concentration(s) are then made according to the analytical method.

2.12 Laboratory Sample Background for Post-Preparation Spike (LPO): an environmental sample exactly like the LSO, except that the aliquot is analyzed according to the analytical method to establish background concentrations prior to fortification (spiking) with the method analyte(s) *after* all sample preparation has been completed.

2.13 Laboratory Post-Preparation Spiked Sample (LPF): an environmental sample exactly like the LSF, except that the aliquot is fortified (spiked) with the method analyte(s) *after* all sample preparation has been completed.

2.14 Laboratory Fortified Blank (LFM): an aliquot of reagent water or equivalent neutral reference material, known to be below detection limits for an analyte(s), to which a known quantity(ies) of method analyte(s) was added. The LFM is then treated as an environmental sample in all respects in the laboratory. This includes the addition of all reagents, internal standards, surrogates, glassware, equipment, solvents, and analyses.

2.15 Laboratory Reagent Blank (LRB): an aliquot of reagent water or equivalent neutral reference material treated as an environmental sample in all respects in the laboratory. This includes the addition of all reagents, internal standards, surrogates, glassware, equipment, solvents, and analyses.

2.16 Pre-Shipment Blank (PSB): pre-cleaned, blank sampling medium treated as an environmental sample in all respects in the laboratory. This includes the addition of all reagents, internal standards, and surrogates; and the use of glassware, equipment, and solvents.

2.17 Laboratory Reference Material (LRM): an aliquot of sample having a certified value. These samples are usually obtained from NIST, EPA/EMSL, etc. The LRM is treated as an environmental sample in all respects in the laboratory. This includes the addition of all reagents, internal standards, surrogates, glassware, equipment, solvents, and analyses.

2.18 Pre-Shipment Spike (PSS): pre-cleaned sampling medium that is fortified (spiked) with a known amount of the method analyte(s), and treated as an environmental sample in all respects in the laboratory. This includes the addition of all reagents, internal standards, and surrogates; and the use of glassware, solvents, and equipment.

2.19 Field Duplicate First Member (FD1): the first aliquot of a single environmental matrix sampling event. Each aliquot is collected and treated identically throughout the field collection, storage, shipment, preparation and analysis procedures.

2.20 Field Duplicate Second Member (FD2): the second of the two aliquots as described above.

2.21 Field Method Blank (FMB): pre-cleaned, blank sampling medium that is not exposed, but otherwise treated as an environmental sample in all respects during field sample collection, storage, shipment, preparation and analysis procedures.

2.22 Field Method Spike (FMS): pre-cleaned sampling medium that is fortified (spiked) with a known amount of the method analyte(s), not exposed, but otherwise treated as an environmental sample in all respects during field sample collection, storage, shipment, preparation and analysis procedures.

2.23 Arizona Lab Blank (ALB): pre-cleaned, blank sampling medium that is not transported into the field, but otherwise treated as an environmental sample in all respects during any University of Arizona (UA) laboratory procedures. This includes the addition of all reagents, internal standards, and surrogates; and the use of glassware, solvents, and equipment.

2.24 VirusScan for Windows95 Version 3.0 (or higher): a computer virus-scanning program used to detect computer viruses and disinfect PC hard drives and diskettes. Battelle has a site license with McAfee International Associates (www.mcafee.com) and regularly receives upgraded versions of VirusScan.

3.0 References

3.1 "Microsoft Access for Windows 95 Power Toolkit: Cutting-Edge Tools & Techniques for Programmers," Michael Groh, Ventana, 1996.

3.2 "Office 97 Bible," Edward Jones and Derek Sutton II, IDG Books Worldwide, 1997.

3.3 "Running Microsoft Access 2 for Windows," John L. Viescas, Microsoft Press, 1994.

3.4 "Microsoft Excel Version 5.0 User's Guide," Microsoft Corporation, 1993-94.

3.5 "Implementation of EPA Order 2180.2 Standard Format for Media and Record Formats for the National Human Exposure Assessment Survey Pilot Studies," L.J. Barlion; Environmental Monitoring Systems Laboratory, U.S. Environmental Protection Agency, Cincinnati, OH, April 5, 1995.

4.0 Discussion

Using a relational database to compute human exposure assessment concentrations provides a consistent, integrated structure for the reporting of analytical results. All equations are validated, and cannot be altered in any way during data entry. Entered numbers can be compared directly with raw data values during the QA/QC proofreading process. All fields are searchable, and complex or simple reports can be generated with a few keystrokes.

5.0 Responsibilities

5.1 Analyst Entering Data into a Project Spreadsheet Template

5.1.1 The analyst receives a validated spreadsheet template (see Figure 1 for an example of a spreadsheet template) for a given pollutant in a given environmental matrix (e.g., "DWP.xlt" is the filename for the Excel spreadsheet template for dermal wipe pesticide results - see Table 1 for a list of monitored environmental matrices and their corresponding Excel template filenames and Access data entry form names) from the database technician.

5.1.2 The analyst enters the information as described in Section 7.0 ("Procedure") of this SOP.

5.1.3 The analyst saves the file as an Excel spreadsheet, using the following filename convention: the first three letters of the file are the sample's visual identifier code (VID); the next four letters of the file are the month and date on which the raw data was collected (mmdd), e.g., DWP0124.xls is a file containing results for dermal wipe pesticide samples analyzed on Jan. 24. Filenames can be appended with letters for cases when it requires

more than one file to report the analytical data for a given analysis date (e.g., DWP0124a.xls, DWP0124b.xls, etc.).

5.1.4 The analyst delivers a backup copy of the spreadsheet file and the corresponding raw data and field forms to the database technician. The database technician electronically imports the file into the appropriate project database module using an Access 97 macro (see Figure 2).

5.1.5 The database technician prints out a copy of the report, proofreads the data, and makes any necessary corrections.

5.1.6 The database technician creates a backup copy of the modified database module.

5.1.7 Pending the analyst's review/approval of the corresponding QA/QC data, the database technician packages and ships, or electronically transfers the completed database modules (for a given sample set) to UA.

5.2 Electronically Transferring Data to Project Spreadsheet Template

5.2.1 The analyst electronically transfers the raw data for a given pollutant in a given environmental matrix to an Excel 97 spreadsheet (see Figure 3).

5.2.2 The information is imported into the appropriate project database template using an Excel 97 macro, as described in Section 7.0 ("Procedure").

5.2.3 The analyst proofreads the data in the template, makes any necessary corrections, and gives the final template and folder containing all relevant information to the database technician.

5.2.4 The database technician imports the final template into the database using an Access 97 macro. The folder is then filed with other project data in a locked file cabinet.

5.2.5 Pending the analyst's review/approval of the corresponding QA/QC data, the database technician packages and ships, or electronically transfers the completed database modules (for a given sample set) to UA.

6.0 Materials

6.1 Microsoft Access 97 (or later version)

6.2 Microsoft Excel 97 (or later version)

6.3 IBM-compatible personal computer, pentium processor or better

6.4 3.5" double-sided, high density IBM-compatible formatted diskettes

7.0 Procedure

7.1 Results will be electronically imported or entered into an Excel 97 project spreadsheet template by the analyst, using an Excel 97 macro. Then the spreadsheet template will be imported into the appropriate Access 97 project database module, by the database technician using an Access 97 macro.

7.2 Entering Data for Metals from Dermal and Surface Wipes, Floor Dust, and Foundation and Yard Soil.

7.2.1 Open the Excel 97 results template, (e.g., Excel filename: "DWM.xlt," for entering results for dermal wipe metals samples).

7.2.2 Positioning your cursor under the "Sample ID" column, enter the sample identification number for the sample for which you wish to enter results. Tab the cursor past the "Compound" to the "Raw Data" column. Enter the concentrations of each of the target metals (µg/mL) for that sample, taken directly from the raw data calibration curve.

7.2.3 Tab to the "Raw ID" column, and enter the raw data identification code. For metals: "visual identifier code-analysis date", e.g. "FFM-072196" denotes fixed filter metals, analyzed on July 7, 1996.

7.2.4 Tab to the "Det Limit" column, and enter the detection limit (µg/mL) for each of the target metals for the analyses conducted on that day.

7.2.5 Tab to the "FB ID" column, and enter the sample identification number of the appropriate field blank.

7.2.6 Tab to the "F Blank" column, and enter the concentration of each of the target metals (µg/mL) in the identified field blank.

7.2.7 Tab to the "Diln Fac" column, and enter the dilution factor (unitless) by which the sample result for each metal should be multiplied. If the sample is a dermal wipe, you have completed entering the information necessary to calculate a final concentration for the metals in this sample, and you

should continue with the next sample. However, if the sample is a QA/QC sample, proceed to section 7.6 to enter the rest of the information for this sample.

7.2.8 For surface wipe samples only, tab to the "Area 1" column and enter the of the first area wiped (cm^2), as indicated on the sample's field form. Tab to the "Area 2" column and enter the second area wiped (cm^2), as indicated on the sample's field form. For a QA/QC sample, proceed to section 7.6; otherwise proceed to the next sample.

7.2.9 For floor dust, foundation and yard soil samples only, tab to the "Weight" column and enter the weight of the digested dust or soil aliquot (g).

7.2.10 For floor dust samples only, tab to the "Area" column and enter the area vacuumed (m^2). Proceed to section 7.6 for a QA/QC sample; otherwise proceed to the next sample.

7.2.11 For fixed site air samples only, tab to the "Time" column and enter the Actual Pump Run Time (min) for metals, as reported on the field form.

7.2.12 Tab to the "I-Flow" column and enter the Start Flow reading (L/min) measured during air sampler setup and reported on the field form.

7.2.13 Tab to the "F-Flow" column and enter the Stop Flow reading (L/min) measured during air sampler take-down and reported on the field form.

7.2.14 For a QA/QC sample, proceed to section 7.6; otherwise proceed to the next sample.

7.3 Entering Data for Pesticides from Dermal Wipes, and Floor Dust

7.3.1 Open the Excel 97 results template corresponding to the environmental matrix for which you wish to enter results (e.g., Excel filename: "DWP.xlt," for entering results for dermal wipe pesticides samples).

7.3.2 Position your cursor under the "Sample ID" column, and enter the sample identification number for the sample for which you wish to enter results. Tab the cursor past the "Compound" column to the "Raw Data" column. Enter the concentration of each of the target pesticides (µg/mL) for that sample, taken directly from the raw data calibration curve.

7.3.3 Tab to the "Raw ID" column and enter the raw data identification code listed on the raw data. For pesticides: "Visual identifier-analysis date", e.g. "DWP-071496" denotes dermal wipe pesticides, analyzed on July 14, 1996.

7.3.4 Tab to the "Det Limit" column and enter the detection limit (µg/mL) for each of the target pesticides for the analyses conducted on that day.

7.3.5 Tab to the "FB ID" column and enter the sample identification number of the appropriate field blank.

7.3.6 Tab to the "F Blank" column and enter the surrogate recovery-corrected concentration of each of the target pesticides (µg/mL) in the identified field blank.

7.3.7 Tab to the "Surr Rec" column and enter the recovery (%) of the surrogate recovery standard for that sample.

7.3.8 Tab to the "Diln Fac" column and enter the dilution factor (unitless) by which the sample result for each of the target pesticides should be multiplied. If the sample is a dermal wipe, you have completed entering the information necessary to calculate a final concentration for the pesticide in this sample and you should continue with the next sample. However, if the sample is a QA/QC sample, proceed to section 7.6 to enter the rest of the information for this sample.

7.3.9 For floor dust samples only, tab to the "Weight" column and enter the weight of the extracted dust or soil aliquot (g).

7.3.10 Tab to the "Area" column and enter the area vacuumed (m^2). Proceed to section 7.6 for a QA/QC sample; otherwise proceed to the next sample.

7.4 Entering Data for OVM 3500 Organic Vapor Monitor and Pumped Multisorbent Carbotrap (200 & 300) Tube Samples.

7.4.1 Open the Excel 97 results template corresponding to the environmental matrix for which you wish to enter results (e.g., Excel filename: "OVM.xlt," Access form: "OVM Results" for entering results for organic vapor monitor samples).

7.4.2 Position your cursor under the "Sample ID" column, and enter the sample identification number for the sample for which you wish to enter results.

Tab the cursor past the "Compound" column to the "Raw Data" column. Enter the amount of each of the VOCs measured (μg) for that sample, taken directly from the raw data calibration curve.

7.4.3 Tab to the "Raw ID" column and enter the raw data identification code. For VOCs: "Visual identifier-analysis date", e.g. "OVM-071896" denotes Organic Vapor Monitor, analyzed on July 18, 1996.

7.4.4 Tab to the "Det Limit" column and enter the detection limit (μg) for each of the VOCs for the analyses conducted on that day.

7.4.5 Tab to the "FB ID" column and enter the sample identification number of the appropriate field blank.

7.4.6 Tab to the "F Blank" column and enter the amount of each of the VOCs (μg) measured in the identified field blank.

7.4.7 Tab to the "Time" column, and enter the time (min) for which the passive sample was exposed (OVM 3500 organic vapor monitor) or the time (min) for which the pump sampled for VOCs (actively pumped multisorbent Carbotrap tube). If the sample is an OVM 3500 organic vapor monitor sample, you have completed entering the information necessary to calculate a final concentration for the VOC in this sample, and you should continue with the next sample. However, if the sample is a QA/QC sample, proceed to section 7.6 to enter the rest of the information for this sample.

7.4.8 For pumped multisorbent Carbotrap tube samples only:

7.4.8.1 Tab to the "I-Flow" column and enter the Start Flow reading (cm^3/min) measured during air sampler setup and reported on the field form.

7.4.8.2 Tab to the "F-Flow" column, and enter the Stop Flow reading (cm^3/min) measured during air sampler take-down and reported on the field form.

7.4.8.3 For a QA/QC sample, proceed to section 7.6; otherwise proceed to the next sample.

7.5 Entering Data for PAH Air Samples

7.5.1 Open the Excel 97 results template corresponding to the environmental matrix for which you wish to enter results (e.g., Excel filename: "PAP.xlt," for entering results for Pesticide/PAH Combination Air Samples).

7.5.2 Position your cursor under the "Sample ID" column, and enter the sample identification number for the sample for which you wish to enter results. Tab the cursor past the "Compound" column to the "Raw Data" column. Enter the concentration of each of the target pesticides (µg/mL) for that sample, taken directly from the raw data calibration curve.

7.5.3 Tab to the "Raw ID" column and enter the raw data identification code listed on the raw data. For pesticides: "Visual identifier-analysis date", e.g. "PAH-071496" denotes active airborne PAH monitor, analyzed on July 14, 1996.

7.5.4 Tab to the "Det Limit" column and enter the detection limit (µg/mL) for each of the target pesticides for the analyses conducted on that day.

7.5.5 Tab to the "FB ID" column and enter the sample identification number of the appropriate field blank.

7.5.6 Tab to the "F Blank" column and enter the surrogate recovery-corrected concentration of each of the target pesticides (µg/mL) in the identified field blank.

7.5.7 Tab to the "Diln Fac" column and enter the dilution factor (unitless) by which the sample result for each of the target pesticides should be multiplied.

7.5.8 Tab to the "I-Flow" column and enter the Start Flow reading (L/min) measured during air sampler setup and reported on the field form.

7.5.9 Tab to the "F-Flow" column and enter the Stop Flow reading (L/min) measured during air sampler take down and reported on the field form.

7.5.10 For a QA/QC sample, proceed to section 7.6; otherwise proceed to the next sample.

7.6 Battelle Laboratory QA/QC Samples

7.6.1 If the sample is a laboratory QC sample, tab to the "QCC" column and enter the applicable 3-digit QC code:

QCC	Name
LD1	Laboratory Duplicate First Member
LD2	Laboratory Duplicate Second Member
AD1	Analytical Duplicate First Member
AD2	Analytical Duplicate Second Member
LSO	Laboratory Sample (Background for Pre-Preparation Spike)
LSF	Laboratory Pre-Preparation Spiked Sample
LPO	Laboratory Sample (Background for Post-Preparation Spike)
LPF	Laboratory Post-Preparation Spiked Sample
LFM	Laboratory Fortified Blank
LRB	Laboratory Reagent Blank
PSB	Pre-Shipment Blank
PSS	Pre-Shipment Spike
LRM	Laboratory Reference Material
FD1	Field Duplicate First Member
FD2	Field Duplicate Second Member
FMB	Field Method Blank
FMS	Field Method Spike
ALB	Arizona Lab Blank

7.6.2 Tab to the "QC Result" column and enter the applicable QC results:

QCC	QC Result
LD1	None (default)
LD2	Relative Percent Difference (%)
AD1	None (default)
AD2	Relative Percent Difference (%)
LSO	None (default)
LSF	Percent Recovery (%)
LPO	None (default)
LPF	Percent Recovery (%)
LFM	Percent Recovery (%)
LRB	None (default)
PSB	None (default)
PSS	Percent Recovery (%)
LRM	Percent Recovery (%)

FD1	None (default)
FD2	Relative Percent Difference (%)
FMB	None (default)
FMS	Percent Recovery (%)
ALB	None (default)

7.6.3 Proceed to the next sample.

7.7 Completion of Data Entry, Archiving Data to Floppy Diskette

7.7.1 Print out a report of your results and proof the data entered.

7.7.2 After making any necessary changes, save the data in a file on the hard drive.

7.7.3 Save a copy of each modified database module on a floppy diskette or magnetic tape backup.

7.7.4 Label the diskette or magnetic tape backup with the filenames, and the date the backup was made.

7.8 Calculations

7.8.1 The human exposure concentration of a <u>metal in a dermal wipe</u> is expressed as:

$$(R - B_f) * D = \mu g$$

where:

	Default Value	Decimal Places
R = value obtained from raw data calibration curve (µg/mL)	none	3
B_f = field blank (µg/mL)	0.000	3
D = dilution factor (mL)	1.00	2

7.8.2 The human exposure concentration of a <u>metal in a surface wipe</u> is expressed as:

$$(R - B_f) * D * (1 / [(L / 100) * (W / 100)] = \mu g/m^2$$

where:

	Default Value	Decimal Places
R = value obtained from raw data calibration curve (µg/mL)	none	3
B_f = field blank (µg/mL)	0.000	3

D = dilution factor (mL)	1.00	2
L = length of area wiped (cm)	none	1
W = width of area wiped (cm)	none	1

7.8.3 The human exposure concentration of a metal in floor dust is expressed as:

$(R - B_f) * D * (1 / W) = \mu g/g$ fine dust

where:

	Default Value	Decimal Places
R = value obtained from raw data calibration curve (µg/mL)	none	3
B_f = field blank (µg/mL)	0.000	3
D = dilution factor (mL)	1.00	2
W = weight of the dust aliquot (g)	none	2

or:

$(R - B_f) * D * \{ 1 / [A * (W / W_T)] \} = \mu g/m^2$

where:

	Default Value	Decimal Places
R = value obtained from raw data calibration curve (µg/mL)	none	3
B_f = field blank (µg/mL)	0.000	3
D = dilution factor (mL)	1.00	2
A = area vacuumed (m^2)	2.00	2
W = weight of the dust aliquot (g)	none	2
W_T = weight of the total dust sample collected (g)	none	2

7.8.4 The human exposure concentration of a metal in foundation or yard soil is expressed as:

$(R - B_f) * D * (1 / W) = \mu g/g$

where:

	Default Value	Decimal Places
R = value obtained from raw data calibration curve (µg/mL)	none	3
B_f = field blank (µg/mL)	0.000	3
D = dilution factor (mL)	1.00	2
W = weight of the dried soil aliquot (g)	none	2

7.8.5 The human exposure concentration of a metal in a fixed site sample is expressed as:

$$[(R - B_f) * D] / \{ 0.001 * [T_s * 0.5 * (F_i + F_f)] \} = \mu g/m^3$$

where:

	Default Value	Decimal Places
R = value obtained from raw data calibration curve (µg/mL)	none	3
B_f = field blank (µg/mL)	0.000	3
D = dilution factor (mL)	1.00	2
T_s = actual pump run time (min)	none	1
F_i = start flow (L/min)	4.00	2
F_f = stop flow (L/min)	4.00	2

7.8.6 The human exposure concentration of a pesticide in a dermal wipe is expressed as:

$$\{ [R / (S / 100)] - B_f \} * D = \mu g$$

where:

	Default Value	Decimal Places
R = value obtained from raw data calibration curve (µg/mL)	none	3
S = surrogate recovery (%)	100	0
B_f = surrogate recovery-corrected field blank (µg/mL)	0.000	3
D = dilution factor (mL)	1.00	2

7.8.7 The human exposure concentration of a pesticide in floor dust is expressed as:

$$\{ [R / (S / 100)] - B_f \} * D * (1 / W) = \mu g/g \text{ fine dust}$$

where:

	Default Value	Decimal Places
R = value obtained from raw data calibration curve (µg/mL)	none	3
S = surrogate recovery (%)	100	0
B_f =surrogate recovery-corrected field blank (µg/mL)	0.000	3
D = dilution factor (mL)	1.00	2
W = weight of the dust aliquot (g)	none	2

or:

$$\{ [R / (S / 100)] - B_f \} * D * \{ 1 / [A * (W / W_T)] \} = \mu g/m^2$$

where:

	Default Value	Decimal Places
R = value obtained from raw data calibration curve (µg/mL)	none	3
S = surrogate recovery (%)	100	0
B_f = surrogate recovery-corrected field blank (µg/mL)	0.000	3
D = dilution factor (mL)	1.00	2
A = area vacuumed (m^2)	2.00	2
W = weight of the dust aliquot (g)	none	2
W_T = weight of the total dust sample collected (g)	none	2

7.8.8 The human exposure concentration of a pesticide in a fixed site air sample is expressed as:

$$(\{ [R / (S / 100)] - B_f \} * D) / \{ 0.001 * [T_s * 0.5 * (F_i + F_f)] \} = ng/m^3$$

where:

	Default Value	Decimal Places
R = value obtained from raw data calibration curve (ng/mL)	none	0
S = surrogate recovery (%)	100	0
B_f = surrogate recovery-corrected field blank (ng/mL)	0	0
D = dilution factor (mL)	1.0	1
T_s = actual pump run time (min)	none	1
F_i = start flow (L/min)	4.00	2
F_f = stop flow (L/min)	4.00	2

7.8.9 The human exposure concentration of a PAH in floor dust is expressed as:

$$[(R - B) * 0.001] * D * (1 / W) = \mu g/g \text{ fine dust}$$

where:

	Default Value	Decimal Places
R = value obtained from Quan report (ng/mL)	none	3
B = field blank value obtained from Quan report (ng/mL)	0.000	3
D = dilution factor (mL)	1.00	2
W = weight of the dust aliquot (g)	none	2

or:

$$[(R - B) * 0.001] * D * \{ 1 / [A * (W / W_T)] \} = \mu g/m^2$$

where:

	Default Value	Decimal Places
R = value obtained from Quan report (ng/mL)	none	3
B = field blank value obtained from Quan report (ng/mL)	0.000	3
D = dilution factor (mL)	1.00	2
A = area vacuumed (m^2)	2.00	2
W = weight of the dust aliquot (g)	none	2
W_T = weight of the total dust sample collected (g)	none	2

7.8.10 The human exposure concentration of a PAH in a fixed site air sample is expressed as:

$$(R-B) * D / \{ 0.001 * [T_s * 0.5 * (F_i + F_f)] \} = ng/m^3$$

where:

	Default Value	Decimal Places
R = value obtained from Quan report (ng/mL)	none	0
B = field blank value obtained from Quan report (ng/mL)	0	0
D = dilution factor (mL)	1.0	1
T_s = actual pump run time (min)	none	1
F_i = start flow (L/min)	4.00	2
F_f = stop flow (L/min)	4.00	2

7.8.11 The human exposure concentration of a volatile organic compound in a fixed site (passive OVM 3500 badge) air sample is expressed as:

$$(R - B_f) * 10^6 / K * C_r * T = \mu g/m^3$$

where:

	Default Value	Decimal Places
R = value obtained from raw data calibration curve (µg)	none	2
B_f = field blank (µg)	0.00	2
K = sampling rate for compound of interest (cm^3/min)	none	1
C_r = recovery coefficient for compound of interest (unitless)	1.00	2
T = time the OVM 3500 was exposed (min)	none	1

or:

$$[\{ (R - B_f) * 10^6 \} / K * C_r * T] * X = ppbv$$

where:

	Default Value	Decimal Places
R = value obtained from raw data calibration curve (µg)	none	2
B_f = field blank (µg)	0.00	2
K = sampling rate for compound of interest (cm^3/min)	none	1
C_r = recovery coefficient for compound of interest (unitless)	1.00	2
T = time the OVM 3500 was exposed (min)	none	1
X = conversion factor for compound of interest (ppbv/µg/m^3)	none	4

Compound	Sampling Rate (K)	Recovery Coefficient (C_r)	Conversion Factor (X)
Benzene	35.5	0.95	0.3130
m-Dichlorobenzene	27.8	0.87	0.1663
p-Dichlorobenzene	27.8	0.87	0.1663
Dichloromethane	37.9	0.97	0.2879
Ethylbenzene	27.3	0.96	0.2303
Styrene	26.8	0.82	0.2348
Tetrachloroethylene	31.1	0.95	0.1474
Toluene	31.4	1.00	0.2654
1,1,2-Trichloroethane	29.7	0.95	0.1833
Trichloroethylene	31.1	0.99	0.1861
m-/p-Xylene	27.3	0.97	0.2303
o-Xylene	27.3	0.97	0.2303

7.8.12 The human exposure concentration of a volatile organic compound in a fixed site (pumped multisorbent Carbotrap tube) air sample is expressed as:

$$(R - B_f) / [(F_i + F_f) * 0.5 * T * 10^{-3}] = \mu g/m^3$$

where:

	Default Value	Decimal Places
R = value obtained from raw data calibration curve (ng)	none	0
B_f = field blank (ng)	0.00	0
F_i = start flow (cm^3/min)	5.0	1
F_f = stop flow (cm^3/min)	5.0	1
T = actual pump runtime (min)	none	1

or:

$$(R - B_f) / [(F_i + F_f) / 2 * T * 10^{-3}] * X = ppbv$$

where:

	Default Value	Decimal Places
R = value obtained from raw data calibration curve (ng)	none	0
B_f = field blank (ng)	0.00	0
F_i = start flow (cm^3/min)	5.0	1
F_f = stop flow (cm^3/min)	5.0	1
T = actual pump run time (min)	none	1
X = conversion factor for compound of interest (ppbv/$\mu g/m^3$)	none	4

Compound	Conversion Factor (X)
1,3-butadiene	0.4520
benzene	0.3130
trichloroethene	0.1861
toluene	0.2654
1,1-dichloroethene	0.2522
dichloromethane	0.2879
1,1-dichloroethane	0.2471
cis-1,2-dichloroethene	0.2522
trichloromethane	0.2048
1,2-dichloroethane	0.2471
1,1,1-trichloroethane	0.1833
carbon tetrachloride	0.1590
1,2-dichloropropane	0.2164
1,1,2-trichloroethane	0.1833
tetrachloroethene	0.1474
chlorobenzene	0.2172
ethylbenzene	0.2303
m+p-xylene	0.2303
styrene	0.2348
1,1,2,2-tetrachloroethane	0.1457
o-xylene	0.2303
m-dichlorobenzene	0.1663
p-dichlorobenzene	0.1663
o-dichlorobenzene	0.1663

7.8.13 Relative percent difference for LD2, AD2, and FD2 is expressed as:

$$\{ (| C_1 - C_2 |) / [(C_1 + C_2) / 2] \} * 100 = \text{Relative Percent Difference (\%)}$$

where:

C_1 = Analyte Conc (µg/mL) in:	C_2 = Analyte Conc (µg/mL) in:
LD1	LD2
AD1	AD2
FD1	FD2

7.8.14 Percent recovery of analytes in LSF, LPF, LFM, LRM and FMS QC samples is expressed as:

$[(C_1 - C_2) / C_{spk}] * 100 = \text{Recovery (\%)}$

where:

C_1 = Analyte Conc (µg/mL) in:	C_2 = Analyte Conc (µg/mL) in:	C_{spk} = Analyte Conc (µg/mL) in:
LSF	LSO	Fortification (spike)
LPF	LPO	Fortification (spike)
LFM	LRB	Fortification (spike)
LRM	LRB	Fortification (spike)
FMS	FMB	NIST or EMSL certification

7.9 Quality Control

7.9.1 All hard-coded computation performed within a given database module will be validated before entering the project results into the module.

7.9.2 Calculated fields will not be modifiable by the analyst or database technician.

7.9.3 Upon completing the entries into a given database module, a report will be printed out and hand-entered data will be proofread by a second party.

7.9.4 All magnetic storage media will be scanned for virus infection, using the most current version of VirusScan for Windows95 version 3.0 (or higher) prior to shipment.

7.9.5 All magnetic storage media will be shipped in anti-static, rigid diskette mailers.

8.0 Records

8.1 Records of all raw data used to compute pollutant concentrations in environmental matrices will be kept in the custody of the analyst for three years after completion of the study.

8.2 Identified and dated magnetic diskette backups of shipped database modules will be archived in read-only format by the database technician for three years after completion of the study. The archives will be stored at room temperature in a clean area, free from strong magnetic fields.

NHEXAS DWM G283317-21DATA									7/10/97
		(ug/mL)		(ug/mL)		(ug/mL)			
Sample ID	Compound	Raw Data	Raw ID	Det Limit	FB ID	F Blank	Diln Fac	QCC	QC Result
	barium								
0	cadmium		0		0		0		
0	chromium		0		0		0		
0	copper		0		0		0		
0	manganese		0		0		0		
0	nickel		0		0		0		
0	lead		0		0		0		
0	selenium		0		0		0		
0	vanadium		0		0		0		
0	zinc		0		0		0		

Figure 1. Example of an Excel97 spreadsheet template for dermal wipe metals analytical results entry.

Access 97 Visual Basic Import Macro for Importing Dermal Wipe Metals Data

```
Option Compare Database
Option Explicit

'------------------------------------------------------------
' DWM_Import_Macro
'------------------------------------------------------------
Function DWM_Import_Macro()
On Error GoTo DWM_Import_Macro_Err

   ' Import metals data for sample 1
   DoCmd.TransferSpreadsheet acImport, 5, "DWM Results", "c:\1NHXTRACK\im\import.xls",
True, "dwmp1"
   ' Import metals data for sample 2
   DoCmd.TransferSpreadsheet acImport, 5, "DWM Results", "c:\1NHXTRACK\im\import.xls",
True, "dwmp2"
   ' Import metals data for sample 3
   DoCmd.TransferSpreadsheet acImport, 5, "DWM Results", "c:\1NHXTRACK\im\import.xls",
True, "dwmp3"
   ' Import metals data for sample 4
   DoCmd.TransferSpreadsheet acImport, 5, "DWM Results", "c:\1NHXTRACK\im\import.xls",
True, "dwmp4"
   ' Import metals data for sample 5
   DoCmd.TransferSpreadsheet acImport, 5, "DWM Results", "c:\1NHXTRACK\im\import.xls",
True, "dwmp5"
   ' Import metals data for sample 6
   DoCmd.TransferSpreadsheet acImport, 5, "DWM Results", "c:\1NHXTRACK\im\import.xls",
True, "dwmp6"
   ' Import metals data for sample 7
   DoCmd.TransferSpreadsheet acImport, 5, "DWM Results", "c:\1NHXTRACK\im\import.xls",
True, "dwmp7"
   ' Import metals data for sample 8
   DoCmd.TransferSpreadsheet acImport, 5, "DWM Results", "c:\1NHXTRACK\im\import.xls",
True, "dwmp8"
   ' Import metals data for sample 9
```

Figure 2. Example of Access 97 Visual Basic import macro for importing dermal wipe metals data for each of ten elements analyzed using inductively couple plasma atomic emission spectroscopy (ICP/AES) for ten individual samples from given analysis date into corresponding database table.

```
   DoCmd.TransferSpreadsheet acImport, 5, "DWM Results", "c:\1NHXTRACK\im\import.xls",
True, "dwmp9"
   ' Import metals data for sample 10
   DoCmd.TransferSpreadsheet acImport, 5, "DWM Results", "c:\1NHXTRACK\im\import.xls",
True, "dwmp10"

DWM_Import_Macro_Exit:
   Exit Function

DWM_Import_Macro_Err:
   MsgBox Error$
   Resume DWM_Import_Macro_Exit

End Function
```

Figure 2. (continued).

Excel 97 Visual Basic import macro for importing pesticide data into NHEXAS spreadsheet templates

```
' Standards Macro
' Macro recorded 12/31/96 by ASATD1
'
' Keyboard Shortcut: Ctrl+s
'
Sub Standards()
    ActiveCell.Select
    Selection.Copy
    Windows("GCMSDstd.xlt").Activate
    Selection.PasteSpecial Paste:=xlValues, Operation:=xlNone, _
        SkipBlanks:=False, Transpose:=False
    Windows("410RERUN.xls").Activate
    ActiveWindow.WindowState = xlNormal
    ActiveCell.Offset(0, 1).Range("A1").Select
    Application.CutCopyMode = False
    Selection.Copy
    Windows("GCMSDstd.xlt").Activate
    ActiveCell.Offset(0, 3).Range("A1").Select
    Selection.PasteSpecial Paste:=xlValues, Operation:=xlNone, _
        SkipBlanks:=False, Transpose:=False
    Windows("410RERUN.xls").Activate
    ActiveWindow.WindowState = xlNormal
    ActiveCell.Offset(0, 1).Range("A1").Select
    Application.CutCopyMode = False
    Selection.Copy
    Windows("GCMSDstd.xlt").Activate
    ActiveCell.Offset(0, 2).Range("A1").Select
    Selection.PasteSpecial Paste:=xlValues, Operation:=xlNone, _
        SkipBlanks:=False, Transpose:=False
    Windows("410RERUN.xls").Activate
    ActiveWindow.WindowState = xlNormal
    ActiveCell.Offset(0, 1).Range("A1").Select
    Application.CutCopyMode = False
    Selection.Copy
    Windows("GCMSDstd.xlt").Activate
```

Figure 3. Example of Excel 97 Visual Basic import macro for importing pesticide data into NHEXAS spreadsheet templates.

```
ActiveCell.Offset(0, 2).Range("A1").Select
  Selection.PasteSpecial Paste:=xlValues, Operation:=xlNone, _
    SkipBlanks:=False, Transpose:=False
  Windows("410RERUN.xls").Activate
  ActiveWindow.WindowState = xlNormal
  ActiveCell.Offset(0, 1).Range("A1").Select
  Application.CutCopyMode = False
  Selection.Copy
  Windows("GCMSDstd.xlt").Activate
  ActiveCell.Offset(0, 2).Range("A1").Select
  Selection.PasteSpecial Paste:=xlValues, Operation:=xlNone, _
    SkipBlanks:=False, Transpose:=False
  Windows("410RERUN.xls").Activate
  ActiveWindow.WindowState = xlNormal
  ActiveCell.Offset(0, 1).Range("A1").Select
  Application.CutCopyMode = False
  Selection.Copy
  Windows("GCMSDstd.xlt").Activate
  ActiveWindow.SmallScroll ToRight:=2
  ActiveCell.Offset(0, 2).Range("A1").Select
  Selection.PasteSpecial Paste:=xlValues, Operation:=xlNone, _
    SkipBlanks:=False, Transpose:=False
  Windows("410RERUN.xls").Activate
  ActiveWindow.WindowState = xlNormal
  ActiveWindow.SmallScroll ToRight:=3
  ActiveCell.Offset(0, 1).Range("A1:L1").Select
  Application.CutCopyMode = False
  Selection.Copy
  Windows("GCMSDstd.xlt").Activate
  ActiveWindow.ScrollColumn = 1
  ActiveCell.Offset(7, -11).Range("A1").Select
  Selection.PasteSpecial Paste:=xlValues, Operation:=xlNone, _
    SkipBlanks:=False, Transpose:=False
  Windows("410RERUN.xls").Activate
  ActiveWindow.WindowState = xlNormal
  ActiveCell.Offset(9, 12).Range("A1:A5").Select
  ActiveWindow.ScrollColumn = 2
  ActiveCell.Offset(-8, -18).Range("A1").Select
End Sub
```

Figure 3. (continued).

Table 1. Environmental matrices and their corresponding Excel template file and Access data entry form names.

Environmental Matrix	Excel Template Filename	Access Data Entry Form Name
Dermal Wipe Metals	DWM.xlt	DWM Results
Dermal Wipe Pesticides	DWP.xlt	DWP Results
Floor Dust Metals	FDM.xlt	FDM Results
Floor Dust Pesticides	FDP.xlt	FDP Results
Floor Dust PAH	FDH.xlt	FDH Results
Fixed Filter Metals	FFM.xlt	FFM Results
Foundation Soil Metals	FSM.xlt	FSM Results
Organic Vapor Monitor	OVM.xlt	OVM Results
Active airborne PAH Monitor	PAH.xlt	PAH Results
Sill Wipe Metals	SWM.xlt	SWM Results
Volatile Organic Compounds	V2C.xlt	V2C Results
Volatile Organic Compounds	V3C.xlt	V3C Results
Yard Soil Metals	YSM.xlt	YSM Results
Yard Soil PAH	YSH.xlt	YSH Results
Pesticide Combo Air	PCA.xlt	PCA Results
PAH Combo Air	PAP.xlt	PAP Results