STANDARD OPERATING PROCEDURE

for

Performing Method Detection Limit Studies and Establishing Limits of Detection and Quantitation

SOP Code: ADM - MDL

Revision: 9

Effective Date: September 28, 2009

Approved by: ________________________ 9-8-09
Quality Assurance Director

______________________________ 9-9-09
President

© Columbia Analytical Services, Inc., 2009
1317 South 13th Avenue
Kelso, Washington 98626

Annual review of this SOP has been performed and the SOP still reflects current practice.

Initials: _____  Date: ______________
Initials: _____  Date: ______________
Initials: _____  Date: ______________

DOCUMENT CONTROL

NUMBER: _______________________
Initials: _____  Date: ___________
Standard Operating Procedure for Performing Method Detection Limit Studies and Establishing Limits of Detection and Quantitation

1.0 PURPOSE
This standard operating procedure (SOP) describes the procedure for the determination of method detection limits (MDLs) and limits of detection (LOD). The procedures for establishing the limits of quantitation are also included.

2.0 APPLICABILITY
2.1 The procedure described in this SOP is designed to be applicable to a wide variety of sample types ranging from reagent (blank) water or wastewater containing the analyte, to solids (such as soil) containing the analyte, to the analyte in a gaseous matrix. The MDL for an analytical procedure will vary as a function of sample matrix. This SOP requires a complete, specific, well-defined, and written analytical procedure (i.e., an SOP). It is essential that all sample-processing steps of the analytical procedure are included in the determination of the MDL; that is, all the steps that a sample is processed through, from sample preparation to analytical completion, must be included in the MDL determination. The MDL obtained by this procedure is used to judge the significance of a single measurement of a future sample. This SOP for the determination of MDLs was designed to be applicable to a broad variety of physical and chemical methods. To accomplish this, the procedure was made device or instrument-type independent.

2.2 The procedures described in this SOP are intended to meet the requirements of the NELAC 2003 Quality System standards and the Department of Defense Quality System Manual (4.1) with regards to limits of detection and limits of quantitation.

3.0 DEFINITIONS
3.1 Method Detection Limit (MDL)
3.1.1 The MDL is the minimum concentration of a substance or analyte that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix type containing the analyte.

3.1.2 The Calculated MDL (MDL_{C}) is the MDL as calculated in Section 6.1.11 and will typically contain two or more significant figures.

3.1.3 The Reported MDL (MDL_{R}) is the MDL that is used for reporting purposes. MDLs for organic analytes will be reported with two significant figures. MDLs for inorganic analytes will be reported with either one or two significant
figures depending upon the number of significant figures in the analytes’ method reporting limit.

3.2 Limit of Detection (LOD)

3.2.1 The Limit of Detection (LOD) is an estimate of the minimum amount of a substance that an analytical process can reliably detect. An LOD is analyte- and matrix-specific and is laboratory dependent.

3.2.2 For non-DOD applications LOD = MDL-R. For DOD the LOD is the spike concentration at which the initial detection limit and LOD verifications are successfully performed.

3.3 Limit of Quantitation (LOQ) - The Limit of Quantitation (LOQ) is the minimum level, concentration, or quantity of a target analyte that can be reported with a specific degree of confidence. The LOQ is equivalent to the method reporting limit (MRL).

3.4 Analytical Procedure - The Analytical Procedure is the written, step-by-step description of the operation by which samples are processed in order to obtain the concentration of an analyte in a sample.

3.5 Spike Level - The spike level is the known concentration of analyte that is added to a matrix for the determination of the MDL or LOD.

3.6 Interferences - Interferences are defined as systematic errors in the measured analytical signal of an established procedure caused by the presence of known or unknown species (interferent) that hinder an accurate analysis of the target analyte(s).

3.7 Matrix

3.7.1 When the matrix analyzed is aqueous (includes ground water, surface water, waste water, drinking water, etc.), analyte-free reagent water is to be used. When the matrix analyzed is solid (includes soil, sand, tissue, or other solid materials), analyte-free soil, sand, tissue, or a suitable material is to be used. When the matrix analyzed is gaseous (i.e., air or emissions), an analyte-free, inert gas (such as zero-grade air or ultrapure helium or nitrogen) is to be used.

3.7.2 If the analysis is performed on a matrix for which there is not available an appropriate or similar, analyte-free matrix (such as, metals analysis on soil samples), the MDL analysis will be done as prescribed by the SOP for the analysis except the sample (weight) will be omitted; that is, the analysis will be done on all the reagents but without addition of any sample.
4.0 DISCUSSION

4.1 The MDL is a property of the analytical procedure, sample matrix, and measurement system (e.g., an instrument if one is used in the analytical procedure). The MDL is a statistic. It is an estimate that includes both the systematic and random errors that are an inherent part of the analytical procedure. The MDL for a given analyte will be unique for the sample’s matrix and may be different than the MDLs shown in published methods. The MDL actually achieved in a given analysis will vary depending on instrument sensitivity and matrix effects.

4.2 The relative uncertainty of an analytical measurement increases as the measured value approaches the MDL and at the MDL the uncertainty in the measured value may be 100% or greater.

4.3 The MDL procedure in this SOP is based upon the procedure described in 40 CFR Part 136, Appendix B (Reference 9.1).

5.0 RESPONSIBILITIES

5.1 It is the responsibility of the laboratory Quality Assurance Program Manager (QA PM), and department managers and supervisors, to schedule MDL determinations as necessary to meet the requirements of this SOP. It is the responsibility of the QA PM to track the status of MDLs, DOD LODs, laboratory LOQs, and their verifications in order to maintain compliance with this SOP and various accreditation programs.

5.2 Completed MDL determinations are to be reviewed by the department manager or supervisor, and approved by the QA PM before they are implemented. The QA PM is responsible for maintaining the MDL file described in Section 8.0.

6.0 PROCEDURE

6.1 Performing the MDL study

6.1.1 General requirements

6.1.1.1 MDLs are to be determined for each analyte and for each matrix. This SOP describes procedures for determining MDLs for the generic matrices aqueous, solid, and gaseous. MDLs for specific matrix types may be adapted from the procedures in this SOP.

Note: For aqueous MDL determinations, the default procedure for determining the MDL is the ‘spiked blank’ procedure. Sample matrix or sample-specific MDLs are performed only when required by project or program.
6.1.1.2 All sample processing steps in the analysis procedure shall be included in the determination of the MDL. MDLs shall be generated using all preparatory and cleanup procedures routinely used on samples.

6.1.1.3 For PCB Aroclors an MDL study is required for PCB Aroclors 1016 and 1260 only, unless required by accreditation program or project. However, MDL/LOD/LOQ verifications must be performed for all Aroclors being reported.

6.1.1.4 An MDL study is not required for any analyte for which spiking solutions or quality control samples are not available; e.g., temperature. Also, under NELAC and DOD programs, an MDL study is not required when results are not reported below the MRL/LOQ.

6.1.2 Frequency of MDL determination and verifications

6.1.2.1 An MDL study shall be performed initially; i.e., when the procedure is first put into production, and the LOD and LOQ established prior to sample analyses.

6.1.2.2 An MDL study shall be performed at the frequency specified in the applicable method or as specified by an accrediting authority. For example, some state accrediting programs may require annual MDL studies.

6.1.2.3 A new MDL determination is to be performed each time there is a change in the test method that affects how the test is performed, or when a change in instrumentation occurs that affects the sensitivity of the analysis.

6.1.2.4 MDL/LOD Verification – If an MDL study is not performed annually, an MDL/LOD verification shall be performed annually on every instrument used to perform a particular analysis. Note: This verification is required quarterly for DOD accredited tests.

6.1.3 Instruments - If more than one instrument is used for the same analytical procedure, the replicate samples should be analyzed on each instrument to ensure there is no instrument bias. Under some specific customer contracts and for some programs, instrument-specific MDLs may be required. There are two options for complying with this requirement:

- Analyze the replicate samples on each instrument used for the analytical procedure and calculate the MDL\(_\text{C}\) for each instrument. The MDL\(_\text{R}\) will be the largest of the several MDL\(_\text{C}\)’s; or
• Analyze the replicate samples on each instrument used for the analytical procedure and calculate a single MDL using all the values from each instrument. A minimum of five values is needed from each instrument. For example, if two instruments are used, there would be a minimum of two times five or ten values to be used to calculate the MDL. Make sure to use the appropriate Student’s t-statistic that corresponds to the number of values used to calculate the standard deviation.

Note: This option may not be acceptable under some specific customer contracts or for some programs, such as the DOD quality systems for environmental laboratories.

6.1.4 Estimation of the MDL - Use one of the following guides to help estimate the MDL.

6.1.4.1 The concentration value that corresponds to an instrument signal-to-noise ratio in the range of 2.5 to 5.

6.1.4.2 The concentration equivalent of three times the standard deviation of replicate instrumental measurements of the analyte in reagent water.

6.1.4.3 That region of the calibration curve where there is a significant change in sensitivity, i.e., a break in the slope of the calibration curve.

6.1.4.4 Instrumental limitations.

6.1.5 Aqueous Blank MDLs

6.1.5.1 Prepare reagent (blank) water that is as free of analyte as possible. Reagent or interference free water is defined as a water sample in which analyte and interferent concentrations are not detected at or above the MDL of each analyte of interest.

6.1.5.2 Prepare a minimum of 7 (preferably 8 to 12) analyte-spiked reagent water samples at a concentration that is 3 to 5 times the estimated MDL.

6.1.5.3 Analyze the analyte-spiked reagent water samples by processing them through the entire analytical procedure. Make all computations according to the directions prescribed in the analytical procedure with the final results reported in the same units as used for water samples. Proceed to calculation of the MDL.

6.1.6 Aqueous Sample MDLs
6.1.6.1 Analyze the aqueous sample by processing it through the **entire** analytical procedure.

6.1.6.2 Calculate the analyte concentration.

6.1.6.2.1 If the measured concentration of the analyte is in the recommended range of 3 to 5 times the estimated MDL, proceed to Section 6.1.6.3.

6.1.6.2.2 If the measured concentration of the analyte is less than the recommended 3 to 5 times the estimated MDL, add a known amount of analyte to bring the concentration of analyte between 3 to 5 times the estimated MDL and proceed to Section 6.1.6.3.

6.1.6.2.3 If the measured concentration of the analyte is greater than 5 times the estimated MDL, either obtain another sample with a lower concentration of analyte in the same matrix, or the sample may be used as is for determining the MDL if the analyte concentration does not exceed 10 times the MDL of the analyte in reagent water. The variance of the analytical procedure changes as the analyte concentration increases from the MDL; hence the MDL determined under these circumstances may not truly reflect method variance at lower analyte concentrations. Proceed to Section 6.1.6.3.

6.1.6.3 Prepare and analyze a minimum of 7 (preferably 8 to 12) aliquots of the aqueous sample by processing them through the **entire** analytical procedure. Make all computations according to the directions prescribed in the analytical procedure with the final results reported in the same units as used for water samples. Proceed to calculation of the MDL.

6.1.7 Solid Blank MDLs

6.1.7.1 Prepare a solid material (e.g., soil, sand, tissue, Na₂SO₄, Teflon chips, or other appropriate material) that is free of analyte.

6.1.7.2 Prepare a minimum of 7 (preferably 8 to 12) analyte-spiked solid samples at a concentration that is 3 to 5 times the estimated MDL. The same weight of analyte-spiked solid is substituted for the sample weight in the analytical procedure.

6.1.7.3 Analyze the analyte-spiked solid samples by processing them through the **entire** analytical procedure.
Make all computations according to the directions prescribed in the analytical procedure with the final results reported in the same units as used for solid samples. Proceed to calculation of the MDL.

6.1.8 Solid Sample MDLs

6.1.8.1 Analyze the solid sample by processing it through the entire analytical procedure.

6.1.8.2 Calculate the analyte concentration.

6.1.8.2.1 If the measured concentration of the analyte is in the recommended range of 3 to 5 times the estimated MDL, proceed to Section 6.1.8.3.

6.1.8.2.2 If the measured concentration of the analyte is less than the recommended 3 to 5 times the estimated MDL, add a known amount of analyte to bring the concentration of analyte between 3 to 5 times the estimated MDL and proceed to Section 6.1.8.3.

6.1.8.2.3 If the measured concentration of the analyte is greater than 5 times the estimated MDL, either obtain another sample with a lower concentration of analyte in the same matrix, or the sample may be used as is for determining the MDL if the analyte concentration does not exceed 10 times the MDL of the analyte in soil. The variance of the analytical procedure may change as the analyte concentration changes from the MDL; hence the MDL determined under these circumstances may not truly reflect method variance at lower analyte concentrations.

6.1.8.3 Prepare and analyze a minimum of 7 (preferably 8 to 12) aliquots of the soil sample by processing them through the entire analytical procedure. Make all computations according to the directions prescribed in the analytical procedure with the final results reported in the same units as used for solid samples. Proceed to calculation of the MDL.

6.1.9 Gaseous Blank MDLs

6.1.9.1 Using an appropriate sample container (e.g., Tedlar® bag or SUMMA® passivated canister) and appropriate analyte-free inert gas (such as zero-grade air or ultrapure nitrogen), prepare a minimum of 7 (preferably 8 to 12) analyte-spiked inert gas samples at a concentration that is 3 to 5 times the estimated MDL.
6.1.9.2 Analyze the analyte-spiked inert gas samples prepared in Section 6.8.1 by processing them through the entire analytical procedure. Make all computations according to the directions in the analytical procedure with the final results reported in the same units as used for air samples. Proceed calculation of the MDL.

6.1.10 Rejection of Replicate Sample Results

6.1.10.1 A replicate sample result may only be rejected if there is an assignable cause for not using that result. Assignable causes include, but are not limited to, replicate sample preparation error, instrument malfunction, bad injection or purge, and internal standard(s) missing or response uncharacteristically high or low. The cause for rejecting the replicate sample result must be documented in the MDL data package.

6.1.10.2 For multi-analyte analyses, if a replicate sample result is rejected for an assignable cause, results for all the analytes from that sample are to be rejected; that is, “picking and choosing” analyte results from a sample is not permitted.

6.1.11 Calculation of MDL<sub>C</sub>

6.1.11.1 Determine the standard deviation, <i>s</i>, of the replicate sample results.

\[
s = \sqrt{\frac{\sum_{i=1}^{n} (x_i - \bar{x})^2}{n - 1}}
\]

where \( \bar{x} = \frac{\sum_{i=1}^{n} x_i}{n} \)

Multiply the standard deviation obtained above times the appropriate one-sided 99% Student’s t-statistic, which is found in the following table.

\[\text{MDL}_{C} = s \times \{\text{appropriate Student’s t-statistic}\}\]
6.1.12 Determination of MDL$_R$

The Reported MDL (MDL$_R$) is the calculated MDL rounded up to the appropriate number of significant figures.

6.2 Evaluation of the Quality of the MDL Study

6.2.1 The quality of the MDL is evaluated using the following criteria.

6.2.1.1 Spike Level - The spike level is **too low** if the MDL$_C$ is greater than the spike level. The spike level is **too high** if the spike level is greater than ten times the MDL$_C$.

6.2.1.2 Percent Relative Standard Deviation (%RSD) - The %RSD should not exceed 35, where the %RSD is equal to the standard deviation ($s$) divided by the average of the spike recoveries times 100.

$$\%RSD = \left( \frac{s}{x} \right) 100$$

6.2.1.3 Percent Spike Recovery - The spike recovery should be what is typically obtained for that analyte from the analytical procedure; i.e., a 40% spike recovery for an analyte is too low if the method normally recovers 80% or more for that analyte.

<table>
<thead>
<tr>
<th>No. of Samples (n)</th>
<th>Student’s t-statistic</th>
<th>Degrees of Freedom (n - 1)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>3.143</td>
<td>6</td>
</tr>
<tr>
<td>8</td>
<td>2.998</td>
<td>7</td>
</tr>
<tr>
<td>9</td>
<td>2.896</td>
<td>8</td>
</tr>
<tr>
<td>10</td>
<td>2.821</td>
<td>9</td>
</tr>
<tr>
<td>11</td>
<td>2.764</td>
<td>10</td>
</tr>
<tr>
<td>12</td>
<td>2.718</td>
<td>11</td>
</tr>
<tr>
<td>13</td>
<td>2.681</td>
<td>12</td>
</tr>
<tr>
<td>14</td>
<td>2.650</td>
<td>13</td>
</tr>
<tr>
<td>15</td>
<td>2.624</td>
<td>14</td>
</tr>
<tr>
<td>16</td>
<td>2.602</td>
<td>15</td>
</tr>
<tr>
<td>17</td>
<td>2.583</td>
<td>16</td>
</tr>
<tr>
<td>18</td>
<td>2.567</td>
<td>17</td>
</tr>
<tr>
<td>19</td>
<td>2.552</td>
<td>18</td>
</tr>
<tr>
<td>20</td>
<td>2.539</td>
<td>19</td>
</tr>
<tr>
<td>21</td>
<td>2.528</td>
<td>20</td>
</tr>
</tbody>
</table>
6.2.1.4 At least one of the criteria in Sections 6.2.1.2 and 6.2.1.3 must be true. If the MDLC does not meet these criteria, then the study should be repeated, adjusting the spike level appropriately. Additionally, the MDLR needs to be verified as described in following sections.

7.0 QUALITY ASSURANCE/QUALITY CONTROL REQUIREMENTS

7.1 Matrices - MDLs shall be generated for all applicable matrices.

7.2 Preparatory and clean-up procedures - MDLs shall be generated for all preparatory and clean-up procedures routinely used on samples.

7.3 Analysis of MDL study replicates

7.3.1 No fewer then 7 replicate samples can be used; 8 to 12 replicate samples is preferred.

7.3.2 The replicate samples do not have to all be analyzed in the same analytical batch on the same day. In fact, it is preferred to spread out the replicate samples among several analytical batches analyzed on several days to increase the contribution of the day-to-day variability. For drinking water compliance tests, sample preparation and analyses for the MDL calculation should be made over a period of at least three days to include day-to-day variation as an additional source of error.

7.4 Review and Approval - Completed MDL determinations are to be reviewed by the supervisor of the analysis. The QA PM will review and approve the MDL determination before it is implemented.

7.5 MDL/LOD verification, non-DOD analyses (annually)

7.5.1 The MDL/LOD verification is required for NELAC accredited tests for which results will be reported below the lower end of the calibration range (i.e. below the MRL/LOQ).

7.5.2 Following the completion of MDL study, verify the validity of the MDLR by confirming the qualitative identification of the analyte in a MDL/LOD verification QC sample in each applicable matrix. The verification sample should contain the analyte at approximately 2 - 3 times the MDLR for single analyte tests and 1 - 4 times the MDLR for multiple analyte tests. This verification must be performed on every instrument that is used for the analysis of samples and reporting of data.
7.5.3 The verification sample is processed through the entire analytical process. The verification shall be acceptable if it produces a response that is at least three times above the instrument’s noise level and can be qualitatively identified (ion abundance, 2nd column confirmed, retention time, pattern recognition, etc.). If the MDL verification check fails, the cause is to be determined and documented, and additional MDL verification checks shall be performed at a higher level to set a higher MDL, or a new MDL study shall be performed and the verification repeated.

7.5.4 Once the verification is completed, the MDL is then used for data evaluation and reporting.

7.6 LOD verification – DoD accredited analyses (quarterly)

7.6.1 The LOD verification is required for DOD accredited tests for which results will be reported below the lower end of the calibration range (i.e. below the LOQ).

7.6.2 Following the completion of MDL study, determine the LOD by confirming the qualitative identification of the analyte in a LOD verification QC sample in each applicable matrix. The verification sample should contain the analyte at approximately 2 - 3 times the MDL for single analyte tests and 1 - 4 times the MDL for multiple analyte tests. This verification must be performed on every instrument that is used for the analysis of samples and reporting of data.

7.6.3 The verification sample is processed through the entire analytical process. The verification shall be acceptable if it produces a response that is at least three times above the instrument’s noise level and can be qualitatively identified (ion abundance, 2nd column confirmed, retention time, pattern recognition, etc.). If the LOD verification check fails, the cause is to be determined and documented, and additional LOD verification checks (two are required) shall be performed at a higher level to set a higher LOD, or a new MDL study shall be performed and the LOD verification repeated.

7.6.4 Once the verification is completed, the concentration of the LOD verification sample establishes the LOD for data evaluation and reporting. The MDL is not used for reporting for DOD projects unless project-specified.

7.7 Determining and verifying the limit of quantitation, non-DOD analyses (annually)

7.7.1 The LOQ (MRL) is initially set by identifying the lowest concentration point on the calibration curve, putting that concentration through the sample calculation formulae using the sample weights, volumes, dilutions, etc used to calculate sample results.

7.7.2 The LOQ/MRL must be at a level above the MDL.
7.7.3 The LOQ (MRL) is then confirmed by performing an LOQ verification by successfully analyzing a QC sample containing the analyte at 1-2 times the claimed LOQ. This must be done in each applicable matrix. The verification is acceptable if the following conditions are met:

- The analyte is qualitatively verified as per LOD verification.
- The recovery of each analyte is within the established criteria, or project DQOs, for accuracy.

If the LOQ verification check fails, the cause is to be determined and documented, and additional LOQ verification checks shall be performed at a higher level to set a higher LOQ, or a new MDL study shall be performed and the LOQ verification repeated.

7.7.4 Once the verification is completed, the LOQ/MRL is then used for data evaluation and reporting.

Note: The LOQ verification is not required in the following cases:

- For ‘non-spikable’ tests or for tests where QC samples are not available or appropriate, or
- If during routine analysis the accuracy and precision is evaluated at the LOQ/MRL (i.e. batch QC LCS is run at the LOQ/MRL).

7.8 Determining and verifying the limit of quantitation – DOD accredited analyses (quarterly)

7.8.1 The LOQ is initially set by identifying the lowest concentration point on the calibration curve (or higher), putting that concentration through the sample calculation formulae using the sample weights, volumes, dilutions, etc used to calculate sample results.

7.8.2 The LOQ must be at a level at least 3 times the DOD LOD earlier established.

7.8.3 The LOQ is then confirmed by performing an LOQ verification by successfully analyzing a QC sample containing the analyte at 1-2 times the claimed LOQ. This must be done in each applicable matrix. The verification is acceptable if the following conditions are met:

- The analyte is qualitatively verified as per LOD verification.
• The recovery of each analyte is within the established criteria, or project DQOs, for accuracy. Initially, the criteria will be the laboratory’s statistical LCS limits for the test. As LOQ verification points are accumulated, they will be used to establish limits for subsequent verifications.
• Using from 2 to 4 LOQ verification points, the ongoing %RSD is calculated to demonstrate the precision at the LOQ.

If the LOQ verification check fails, the cause is to be determined and documented, and additional LOQ verification checks shall be performed at a higher level to set a higher LOQ, or a new LOD established and the LOQ verification repeated.

7.8.4 Once the verification is completed, the LOQ is then used for data evaluation and reporting.

Note: The LOQ verification is not required for ‘non-spikable’ tests or for test where QC samples are not available or appropriate. Also, the LOQ verification is not required if during routine analysis the accuracy and precision is evaluated at the LOQ/MRL (i.e. batch QC LCS is run at the LOQ/MRL).

8.0 RECORDS

8.1 The data for the MDL determination is summarized in an Excel spreadsheet or similar format (e.g. Stealth or LIMS outputs). The spreadsheet contains programmed cells to automatically calculate the data once individual analysis results are entered. In addition to the summarized data, the spreadsheet will contain approval lines and all applicable header information to identify the MDL study.

8.2 The summary and the reference to the location of the raw data are to be filed in a readily available file of MDLs, either hardcopy or electronically. This file is to be located both in the department performing the analytical procedure and in a centralized location for MDLs from the entire laboratory.

9.0 REFERENCES


9.2 SOP for Significant Figures, ADM-SIGFIG


9.5 National Environmental Laboratory Accreditation Conference (NELAC), 2003 Quality Systems Standard, Section 5.5.9.2.a)4); Appendix C, Section C.3.1.; and Appendix D, Section D.1.2.1.

9.6 *Department of Defense Quality Systems Manual for Environmental Laboratories* (DoD QSM), Final Version 3, January 2006, Appendices C and D; Final Version 4.1, April 2009, Appendices C and D.


10.0 CHANGES FROM PREVIOUS REVISION

Title page Revised title.
All pages Removed footnotes, revised numbering to follow standard Word template
All pages Moved some sections, minor wording/format changes for improved readability
Section 1.0 Revised to add LOQ
Section 2.0 Removed redundant previous last paragraph, added new 2nd paragraph.
Section 3.2 Revised to clarify new DOD LOD definition
Section 3.3 Revised to add MRL line from prior 3.1.2
Section 4.0 Revised and removed last paragraph. Removed redundant section 4.3.
Section 5.0 Revised to add/clarify responsibilities
Section 6.1.1 Added ‘default’ note for aqueous MDLs
Section 6.1.2 Moved from previous 6.13 for improved flow
Section 6.1.3 Revised
Section 6.2 Removed non-DoD vs DOD MDL evaluations.
Section 6.2.1 Revised, delete last sentence
Section 6.2.3 Revised and moved part of procedure to more applicable Section 7
Section 6.12.5 Revised and moved part of procedure to more applicable Section 7
Section 6.14 Revised and moved part of procedure to more applicable Section 7
Section 7 Rearranged to improve flow/readability. NOTE: Several significant changes
Section 7.5 Revised to add non-DOD vs DOD details.
Section 7.6 Revised to add non-DOD vs DOD details.
Section 7.7 New section
Section 8.0 Revised
Section 9.0 Removed ADM-BATCH reference, updated EPA and DOD references
Figure 1 Removed
Appendix A Removed