



*The American Association for Laboratory Accreditation*

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Compliance Report

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Laboratory Name:	A2LA Master Code:
Location:	Assmnt ID:
	Cert No.

Assessor Instructions: Review a representative sample of data packages to adequately cover the methods on the Scope of Accreditation, to determine compliance with the current DoD ELAP QSM. Appendix G requirements (attached). Record the results in the table below and enter relevant information in the A2LA test method review matrix (Form A312).

Data package ID	Compliant		Comment
	Y	N	



## **Appendix G – SW-846 LCS Control Limits**

DoD conducted a study to establish control limits for laboratory control samples (LCS) using data collected from DoD-approved environmental laboratories. LCS recoveries for all the analytes on the target analyte lists were pooled, and statistical analyses (such as outlier tests and analysis of variance) were performed on the data before generating the final LCS control limits (LCS-CLs). A complete description of the methodology and findings for Method 8270 can be found in the Laboratory Control Sample Pilot Study (DoD, 2000).

Environmental testing laboratories that perform work for DoD must utilize the DoD-specified LCS-CLs when assessing batch acceptance whenever they are available. This appendix presents the control limits generated by the LCS study and the methodology for applying the limits to LCS data. All analytes spiked in the LCS shall meet the DoD-generated LCS control limits. As described in Section D.1.1.2.1.e of NELAC Appendix D, a number of sporadic marginal exceedances are allowed. Depending on the length of the list of analytes, a specified small number of analytes may exceed the generated control limit. Upper and lower marginal exceedance (ME) limits, calculated at 4 standard deviations around the mean, are established to mark the boundaries of marginal exceedances. If more analytes exceed the LCS-CLs than are allowed, or if any one analyte exceeds the ME limits, then the LCS has failed.

### **DoD LCS Control Limits Policy**

- The laboratory shall use project-specific control limits based on data quality objectives (DQOs), if available. If not, DoD-generated LCS-CLs shall be used, if available. Otherwise, the laboratory's own in-house control limits shall be used.
- The LCS-CLs are based on the promulgated versions of SW-846 methods at the time of the study (2000). They should be used as a benchmark to evaluate acceptability even as methods are updated or alternative methods for the same class of compounds become available.
- The fact that the LCS-CLs are based on certain SW-846 methods should not limit the use of alternative analytical methods, if appropriate. If an alternative method is used, however, it should be capable of producing LCS recoveries that are at least as good as the DoD-generated LCS-CLs, unless project-specific DQOs allow less stringent criteria.
- The LCS study shows that preparatory methods may have a significant influence on a laboratory's ability to achieve certain LCS-CLs. If a laboratory is unable to achieve the LCS-CLs presented in this appendix, it should investigate the use of alternative preparatory methods as a means to improve precision and accuracy.

### **G.1 Generated LCS Control Limits**

As mentioned above, DoD compiled LCS data from multiple laboratories, performing statistical analyses on the data sets before generating control limits. The control limits were set at 3 standard deviations around the mean for all methods except 8151 (see below for further explanation). Limits were then rounded to the nearest 5 for ease of use. The ME limits were set at 4 standard deviations around the mean. The lower ME limit was then raised to 10% for those analytes in which 4 standard deviations falls below that level. Tables G -4 through G -19 at the end of this appendix present the mean or median, standard deviation, lower control limit, upper control limit, lower ME limit, and upper ME limit, as applicable, for each analyte in Methods 8260, 8270,



8151, 8310, 8330, 8081, 8082, 6010, and 7470/7471, for the water and solid matrices. The lower and upper ME limits are not presented for Methods 8151, 8082, and 7470/7471, since those methods have fewer than 11 analytes and are not capable of utilizing the sporadic marginal exceedance allowance. The analytes for Method 8270 are grouped by compound class.

The control limits for explosives Method 8330 in the water matrix were generated using data that were extracted with solid phase extraction (SPE) using acetonitrile only. Analysis of the data received from the LCS study showed that the extraction method produced recoveries with higher means and lower standard deviations than the salting out extraction method. This results in significantly narrower control limits. Since SPE/acetonitrile is less expensive, cumbersome, and time and labor intensive, the LCS control limits for Method 8330 in water were set with data using only that method. A limited amount of data were received that used SPE/acetonitrile, therefore, no outliers were removed during the statistical analysis. This ensures that a representative data set was used to generate the control limits (see Table G -12).

**Note:** Laboratories may use any extraction method they feel is appropriate; however, the LCS recoveries must fall within the LCS-CLs presented in Table G-12.

Control limits for chlorinated herbicides Method 8151 were generated using a non-parametric statistical approach. This is a different approach than for the other methods in the LCS study due to the large amount of intralaboratory variability in recoveries for all analytes in the method. The control limits for Method 8151, both solid and water matrices, were set at the 5<sup>th</sup> and 95<sup>th</sup> percentile of all data received in the study (no outliers were removed). Tables G -8 and G -9 present the median, lower control limit, and upper control limit for each analyte. LCS failure is assessed and corrective action applied the same way for all methods with control limits in this appendix (see Sections G.3 and G.4).

**Note:** These data represent the current capability of the SW-846 analytical and preparatory methods. Use of alternative preparatory procedures and/or improvements through PBMS is encouraged. Project-specific control limits can supersede these DoD limits.

If limits are not available for a project-specific analyte, the laboratory shall discuss with the client appropriate limits considering the project-specific DQOs.

Control limits for metals Method 6010, and mercury Method 7470/7471 were set at 80 – 120% even though generated limits were within these numbers. This reflects the allowable uncertainty in the calibration of the instrument. In one case the generated limit (silver in solid) was outside 80 – 120%, and therefore the generated limit was used.

## G.2 Marginal Exceedance

As described in Section D.1.1.2.1.e of NELAC Appendix D, a number of sporadic marginal exceedances of the LCS-CLs will be allowed. The number of exceedances is based on the total number of analytes spiked in the LCS. As the number of analytes in the LCS increases, more marginal exceedances are allowed. Table G-1 presents the allowable number of marginal exceedances for a given number of analytes in the LCS (as presented in NELAC Appendix D).

**Table G-1. Number of Marginal Exceedances**

Number of Analytes in LCS	Allowable Number of Marginal Exceedances of LCS-CLs
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> 90	5
71 – 90	4
51 – 70	3
31 – 50	2
11 – 30	1
< 11	0

A *marginal* exceedance is defined as beyond the LCS-CL but still within the marginal exceedance limits (set at 4 standard deviations around the mean). This outside boundary prevents a grossly out-of-control LCS from passing.


NELAC requires that the marginal exceedances be sporadic, i.e., random. As defined by DoD, if the same analyte exceeds the LCS-CLs repeatedly (e.g., two out of three consecutive LCS), that is an indication that the problem is systematic and something is wrong with the measurement system. The source of error should be located and the appropriate corrective action taken. Laboratories must monitor the application of the sporadic marginal exceedance allowance to the LCS results through QA channels to ensure random behavior. Effective implementation of the marginal exceedance allowance requires cooperation from the laboratory. If the laboratory fails to implement the policy properly, the privilege of using the marginal exceedance option will be revoked. Oversight and appropriate corrective action will be a focus of DoD laboratory assessments in the future.

### **G.3 LCS Failure**

Each LCS must be evaluated against the appropriate control limits and ME limits before being accepted. The laboratory shall use project-specific control limits, if available. If not, DoD generated LCS-CLs shall be used, if available (see Tables G-4 through G-19). Otherwise, the laboratory's own in-house control limits shall be used. First, the recoveries for the analytes spiked in the LCS should be compared with the LCS control limits. If a recovery is less than the lower control limit or greater than the upper control limit, that is an exceedance. The laboratory should note which analytes exceeded the control limits and make a comparison to the list of project-specific analytes of concern. If a project-specific analyte of concern exceeds its LCS-CLs, the LCS has failed. Next, the laboratory should add up the total number of exceedances for the LCS. Based on the number of analytes spiked in the LCS, the total number of exceedances should be compared with the allowable number from Table G-1. (The allowable number of marginal exceedances depends on the total number of analytes spiked in the LCS, even if DoD-generated control limits are not available for all analytes.) If a LCS has more than the allowable number of marginal exceedances, the LCS has failed. Finally, the recoveries for those analytes that exceeded the LCS-CLs should be compared with the ME limits from Tables G-4 to G-7, G-10 to G-15, or G-18 to G-19. If a single analyte exceeds its marginal exceedance limit, the LCS has failed. (This applies only to methods with greater than 10 analytes.)

In summary, failure of the LCS can occur several ways:

- Exceedance of a LCS-CL by any project-specific analyte of concern
- Marginal exceedance of the LCS-CLs by more than the allowable number of analytes
- Exceedance of the ME limits by one or more analytes

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Once a LCS has failed, corrective action is required, see section D.4.

## G.4 Corrective Action

If a sample fails based on any of the criteria in section G.3, corrective action is required. The corrective action requirement applies to all analytes that exceeded the LCS-CLs, even if one specific analyte's exceedance was not the trigger of LCS failure (see example below). All exceedances of the LCS-CLs, marginal or otherwise, are subject to corrective action.

### Example of Applying Corrective Action

- In a single LCS, anthracene has a recovery of 30%.
- The lower ME limit for anthracene is 45, therefore the LCS has failed.
- In the same LCS three other analytes exceeded their LCS-CLs but were within their ME limits.
- The LCS was spiked with 74 analytes; therefore, according to Table G-1, four marginal exceedances are allowed.
- The four total exceedances (anthracene plus the three other analytes) are within the allowable number for that analyte list size.

*Corrective action is triggered for the LCS because the anthracene recovery exceeded its ME limit, but it is required for all four analytes that exceeded the LCS-CLs.*

If a LCS fails, an attempt must be made to determine the source of error and find a solution. All the findings and corrective action should be documented. DoD requires that the analytes subject to corrective action in the LCS and all the samples in the batch be repped and reanalyzed or the batch rerun with a new LCS. The corrective action applied shall be based on professional judgment in the review of other QC measures (i.e., surrogates). If an analyte falls outside the LCS-CLs a second time or if there is not sufficient sample material available to be reanalyzed, then all the results in the associated batch for that analyte must be flagged with a Q (see DoD Gray Box 47). The recoveries of those analytes subject to corrective action must be documented in the case narrative, whether flagging is needed or not.

## G.5 Poor Performing Analytes

On the basis of results from the LCS study, DoD identified certain compounds that do not perform well with specific methods. These compounds produce low mean recoveries and high standard deviations, resulting in wide LCS control limits with particularly low lower control limits (sometimes negative values). The performance of these compounds reflects routine implementation of the method in many laboratories. DoD has defined a poor performing analyte as having a lower control limit of 10% or less. DoD does not feel it is appropriate to control batch acceptance on these compounds because there is a high level of uncertainty in their recovery. The data may be used; however, routine performance of the method on these compounds can result in being able to identify only a small percentage of the analyte.

The laboratory should include all target analytes in the calibration standard, including the poor performing analytes. If one of the poor performing analytes identified below is a project-specific analyte of concern *or* if it is detected in the project samples, the laboratory should contact the client (DoD), who will then work with the laboratory on an appropriate course of action. Ideally DoD and the laboratory would use an alternative method to test for the analyte (one that is known

to produce higher recoveries) or else modify the original method to optimize conditions for the poor performing analyte.

Poor performing analytes were only identified in SW-846 Methods 8270, 8151, and 8330. These analytes, along with the mean, standard deviation, lower control limit, upper control limit, lower ME limit, and upper ME limit (as generated by the LCS study) are presented in Table G-2.

**Table G-2. Poor Performing Analytes<sup>1</sup>**

Analyte	Mean/ Median	Standard Deviation	Lower Control Limit	Upper Control Limit	Lower ME Limit	Upper ME Limit
8270 Water:						
4-Nitrophenol	54	23	0	125	0	145
Benzoic acid	54	24	0	125	0	150
Phenol	55	19	0	115	0	135
Phenol-d <sub>5</sub> /d <sub>6</sub> (surrogate)	62	18	10	115	0	135
8270 Solid:						
3,3'Dichlorobenzidine	68	19	10	130	0	145
4-Chloroaniline	51	14	10	100	0	110
Benzoic acid	55	18	0	110	0	130
8151 Solid:						
Dinoseb	72		5	130		
8330 and 8330A Solid:						
Methyl-2,4,6-trinitrophenylnitramine (Tetryl)	80	23	10	150	0	172

**Note:** Lower limits calculated as negative values were raised to zero.

The LCS control limits generated by the study for the poor performing analytes are provided as a benchmark against which laboratories can measure the effectiveness of alternative methods or modifications to the current methods. Batch acceptance should not be evaluated using these limits. When choosing alternative or modified methods, laboratories should strive to raise the mean recoveries and lower the standard deviations in comparison with the performance of the analytes presented in Table G-2. The lower control limit generated for alternative or modified methods must be greater than 10% to be considered acceptable.

## G.6 Surrogates

The surrogate compounds for each method are added to all samples, standards, and blanks to assess the ability of the method to recover specific non-target analytes from a given matrix and to monitor sample-specific recovery. Control limits for these compounds were calculated in the same study as the other analytes on the target analyte lists. Below are the limits for some of the

<sup>1</sup>Control limits for Method 8151 were generated using non-parametric statistics; therefore, the median is presented without standard deviation (see section G.1 for further explanation). ME limits are not used for Method 8151 since the target analyte list has fewer than 11 analytes.



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surrogates of Methods 8260, 8270, 8081, and 8082, based on 3 standard deviations around the mean (Table G-3). Sufficient data were not received for those analytes during the LCS study to perform statistically significant analyses. No ME limits are presented as marginal exceedances are not acceptable for surrogate spikes.

*Note:* DoD prefers the use of those surrogates not identified as poor performing analytes in Table G-2 above.

**Table G-3. Surrogates**

Analyte	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit
8260 Water:				
1,2-Dichloroethane-d <sub>4</sub>	95	8	70	120
4-Bromofluorobenzene	98	7	75	120
Dibromofluoromethane	100	5	85	115
Toluene-d <sub>8</sub>	102	6	85	120
8260 Solid:				
4-Bromofluorobenzene	101	6	85	120
Toluene-d <sub>8</sub>	100	5	85	115
8270 Water:				
2-Fluorobiphenyl	79	10	50	110
Terphenyl-d <sub>14</sub>	92	14	50	135
2,4,6-Tribromophenol	82	13	40	125
2-Fluorophenol	63	14	20	110
Nitrobenzene-d <sub>5</sub>	76	11	40	110
8270 Solid:				
2-Fluorobiphenyl	72	10	45	105
Terphenyl-d <sub>14</sub>	78	15	30	125
2,4,6-Tribromophenol	80	15	35	125
2-Fluorophenol	70	11	35	105
Phenol-d <sub>5</sub> /d <sub>6</sub>	71	10	40	100
Nitrobenzene-d <sub>5</sub>	69	10	35	100
8081 Water:				
Decachlorobiphenyl	83	17	30	135
TCMX	81	19	25	140
8081 Solid:				
Decachlorobiphenyl	94	13	55	130
TCMX	97	9	70	125
8082 Water:				
Decachlorobiphenyl	88	15	40	135
8082 Solid:				
Decachlorobiphenyl	91	11	60	125



### G.7 In-House LCS Control Limits

The acceptability of LCS results within any preparatory batch shall be based on project-specified limits or the following DoD-specified LCS control limits, if project-specific limits are not available. If DoD limits are not available, the laboratory must use its in-house limits for batch acceptance.

DoD strongly believes that it is important for laboratories to maintain their own in-house LCS limits. These in-house limits must be consistent with (i.e., within) the DoD limits (project-specific, if available; otherwise the following LCS-CLs). The laboratory in-house limits shall be calculated from the laboratory’s historical LCS data in accordance with a documented procedure (e.g., SOP) that is consistent with good laboratory practice. That document must describe the process for establishing and maintaining LCS limits and the use of control charts.

The laboratory in-house limits are to be used for several purposes:

- Laboratories are expected to utilize their in-house limits as part of their quality control system, and to evaluate trends and monitor and improve performance.
- When a laboratory’s in-house limits are outside the DoD control limits (upper and/or lower), they must report their in-house limits in the laboratory report (see Appendix E) even if the LCS associated with the batch fell within the DoD limits. Using this information, DoD will be able to determine how laboratory performance affects the quality of the environmental data.
- DoD may review the laboratory in-house limits and associated trends, as reflected in control charts, to determine whether the laboratory’s overall performance is acceptable. If deemed unacceptable, this can allow DoD to decide not to use the laboratory again until substantial improvement has occurred.

**Table G-4. LCS Control Limits for Volatile Organic Compounds SW-846 Method 8260 Water Matrix<sup>2</sup>**

Analyte	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit	Lower ME Limit	Upper ME Limit
1,1,1,2-Tetrachloroethane	105	8	80	130	75	135
1,1,1-Trichloroethane	100	11	65	130	55	145
1,1,2,2-Tetrachloroethane	96	11	65	130	55	140
1,1,2-Trichloroethane	100	8	75	125	65	135
1,1-Dichloroethane	101	11	70	135	60	145
1,1-Dichloroethene	99	10	70	130	55	140
1,1-Dichloropropene	102	10	75	130	65	140
1,2,3-Trichlorobenzene	99	14	55	140	45	155

<sup>2</sup> A number of sporadic marginal exceedances of the control limits are allowed, depending on the number of analytes spiked in the LCS. Refer to section G.2 and Table G-1 for guidance on the appropriate application of control and ME limits. LCS control limits are not available for Total Xylene. Xylene may be reported on a project-specific basis as a total number; however, for the purposes of the DoD QSM, it will be analyzed and reported as m,p-Xylene and o-Xylene. Additional limits for poor performing compounds can be found in section G.5 and for surrogate compounds in section G.6.



**Table G-4. LCS Control Limits for Volatile Organic Compounds SW-846 Method 8260 Water Matrix<sup>2</sup>**

Analyte	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit	Lower ME	Upper ME
1,2,3-Trichloropropane	98	9	75	125	65	130
1,2,4-Trichlorobenzene	100	11	65	135	55	145
1,2,4-Trimethylbenzene	103	10	75	130	65	140
1,2-Dibromo-3-chloropropane	91	14	50	130	35	145
1,2-Dibromoethane	100	7	80	120	75	125
1,2-Dichlorobenzene	96	9	70	120	60	130
1,2-Dichloroethane	100	10	70	130	60	140
1,2-Dichloropropane	100	8	75	125	65	135
1,3,5-Trimethylbenzene	102	10	75	130	65	140
1,3-Dichlorobenzene	100	8	75	125	65	130
1,3-Dichloropropane	100	9	75	125	65	135
1,4-Dichlorobenzene	99	8	75	125	65	130
2,2-Dichloropropane	103	11	70	135	60	150
2-Butanone	91	20	30	150	10	170



**Table G-4. LCS Control Limits for Volatile Organic Compounds SW-846 Method  
8260 Water Matrix<sup>2</sup> (continued)**

Analyte	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit	Lower ME Limit	Upper ME Limit
2-Chlorotoluene	100	9	75	125	65	135
2-Hexanone	92	12	55	130	45	140
4-Chlorotoluene	101	9	75	130	65	135
4-Methyl-2-pentanone	96	13	60	135	45	145
Acetone	91	17	40	140	20	160
Benzene	102	7	80	120	75	130
Bromobenzene	100	8	75	125	70	130
Bromochloromethane	97	11	65	130	55	140
Bromodichloromethane	98	8	75	120	70	130
Bromoform	99	10	70	130	60	140
Bromomethane	88	19	30	145	10	165
Carbon disulfide	100	21	35	160	15	185
Carbon tetrachloride	102	12	65	140	55	150
Chlorobenzene	102	7	80	120	75	130
Chlorodibromomethane	96	13	60	135	45	145
Chloroethane	99	12	60	135	50	145
Chloroform	100	12	65	135	50	150
Chloromethane	83	15	40	125	25	140
cis-1,2-Dichloroethene	99	9	70	125	60	135
cis-1,3-Dichloropropene	100	10	70	130	60	140
Dibromomethane	101	8	75	125	65	135
Dichlorodifluoromethane	93	21	30	155	10	175
Ethylbenzene	100	9	75	125	65	135
Hexachlorobutadiene	97	15	50	140	35	160
Isopropylbenzene	101	9	75	125	65	135
m,p-Xylene	102	9	75	130	65	135
Methyl tert-butyl ether	94	10	65	125	55	135
Methylene chloride	96	14	55	140	40	155
Naphthalene	96	14	55	140	40	150
n-Butylbenzene	103	11	70	135	55	150
n-Propylbenzene	101	9	70	130	65	140
o-Xylene	100	7	80	120	75	130
p-Isopropyltoluene	102	10	75	130	65	140
sec-Butylbenzene	100	9	70	125	65	135
Styrene	100	11	65	135	55	145



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tert-Butylbenzene	99	10	70	130	60	140
Tetrachloroethene	96	18	45	150	25	165
Toluene	100	7	75	120	70	130
trans-1,2-Dichloroethene	99	13	60	140	45	150
trans-1,3-Dichloropropene	98	15	55	140	40	155
Trichloroethene	99	9	70	125	60	135
Trichlorofluoromethane	103	15	60	145	45	160
Vinyl chloride	99	16	50	145	35	165

**Table G-5. LCS Control Limits for Volatile Organic Compounds SW-846 Method 8260 Solid Matrix<sup>3</sup>**

Analyte	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit	Lower ME Limit	Upper ME Limit
1,1,1,2-Tetrachloroethane	100	9	75	125	65	135
1,1,1-Trichloroethane	101	11	70	135	55	145
1,1,2,2-Tetrachloroethane	93	13	55	130	40	145
1,1,2-Trichloroethane	95	11	60	125	50	140
1,1-Dichloroethane	99	9	75	125	65	135
1,1-Dichloroethene	100	12	65	135	55	150
1,1-Dichloropropene	102	11	70	135	60	145
1,2,3-Trichlorobenzene	97	12	60	135	50	145
1,2,3-Trichloropropane	97	11	65	130	50	140
1,2,4-Trichlorobenzene	98	11	65	130	55	140
1,2,4-Trimethylbenzene	100	12	65	135	55	145
1,2-Dibromo-3-chloropropane	87	16	40	135	25	150
1,2-Dibromoethane	97	9	70	125	60	135
1,2-Dichlorobenzene	97	7	75	120	65	125
1,2-Dichloroethane	104	11	70	135	60	145
1,2-Dichloropropane	95	8	70	120	65	125
1,3,5-Trimethylbenzene	99	11	65	135	55	145
1,3-Dichlorobenzene	98	9	70	125	65	135
1,3-Dichloropropane	100	8	75	125	70	130
1,4-Dichlorobenzene	98	9	70	125	65	135

<sup>3</sup> A number of sporadic marginal exceedances of the control limits are allowed, depending on the number of analytes spiked in the LCS. Refer to section G.2 and Table G-1 for guidance on the appropriate application of control and ME limits. LCS control limits are not available for Methyl tert-butyl ether and Total Xylene. Sufficient data to perform statistically significant analyses were not received for MTBE during the LCS study. Xylene may be reported on a project-specific basis as a total number; however, for the purposes of the DoD QSM, it will be analyzed and reported as m,p-Xylene and o-Xylene. Additional limits for poor performing compounds can be found in section G.5 and for surrogate compounds in section G.6.



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2,2-Dichloropropane	101	11	65	135	55	145
2-Butanone	94	22	30	160	10	180
2-Chlorotoluene	98	10	70	130	60	140
2-Hexanone	97	16	45	145	30	160
4-Chlorotoluene	100	9	75	125	65	135
4-Methyl-2-pentanone	97	17	45	145	30	165
Acetone	88	23	20	160	10	180
Benzene	99	9	75	125	65	135
Bromobenzene <sup>4</sup>	93	9	65	120	55	130
Bromochloromethane	99	9	70	125	60	135
Bromodichloromethane	100	9	70	130	60	135
Bromoform	96	13	55	135	45	150
Bromomethane	95	21	30	160	10	180
Carbon disulfide	103	19	45	160	30	180
Carbon tetrachloride	100	11	65	135	55	145
Chlorobenzene	99	8	75	125	65	130
Chlorodibromomethane	98	11	65	130	55	140
Chloroethane	98	20	40	155	20	175

<sup>4</sup> Provisional limits – outlier analyses during the LCS study resulted in LCS-CLs generated with data from fewer than four laboratories. Limits may be adjusted in the future as additional data become available.



**Table G-5. LCS Control Limits for Volatile Organic Compounds SW-846 Method  
8260 Solid Matrix<sup>3</sup> (continued)**

Analyte	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit	Lower ME Limit	Upper ME Limit
Chloroform	98	9	70	125	65	135
Chloromethane	90	13	50	130	40	140
cis-1,2-Dichloroethene	96	10	65	125	55	135
cis-1,3-Dichloropropene	99	9	70	125	65	135
Dibromomethane	100	9	75	130	65	135
Dichlorodifluoromethane <sup>4</sup>	85	17	35	135	15	155
Ethylbenzene	101	9	75	125	65	135
Hexachlorobutadiene	98	15	55	140	40	155
Isopropylbenzene	103	9	75	130	70	140
m,p-Xylene	102	8	80	125	70	135
Methylene chloride	97	14	55	140	40	155
Naphthalene	84	14	40	125	25	140
n-Butylbenzene	101	12	65	140	50	150
n-Propylbenzene	99	12	65	135	50	145
o-Xylene	101	8	75	125	70	135
p-Isopropyltoluene	104	10	75	135	65	140
sec-Butylbenzene	97	11	65	130	50	145
Styrene	101	9	75	125	65	135
tert-Butylbenzene	99	11	65	130	55	145
Tetrachloroethene	103	12	65	140	55	150
Toluene	99	9	70	125	60	135
trans-1,2-Dichloroethene	100	11	65	135	55	145
trans-1,3-Dichloropropene	96	10	65	125	55	140
Trichloroethene	101	8	75	125	70	130
Trichlorofluoromethane	106	27	25	185	10	215
Vinyl chloride	92	11	60	125	45	140



**Table G-6. LCS Control Limits for Semivolatile Organic Compounds SW-846 Method 8270 Water Matrix<sup>5</sup>**

Analyte	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit	Lower ME Limit	Upper ME Limit
<b><u>Polynuclear Aromatics</u></b>						
2-Methylnaphthalene	75.0	9.5	45	105	35	115
Acenaphthene	77.6	10.1	45	110	35	120
Acenaphthylene	78.5	9.4	50	105	40	115
Anthracene	83.0	9.7	55	110	45	120
Benz[a]anthracene	82.7	8.9	55	110	45	120
Benzo[a]pyrene	81.3	9.5	55	110	45	120

<sup>5</sup> A number of sporadic marginal exceedances of the control limits are allowed depending on the number of analytes spiked in the LCS. Refer to section G.2 and Table G-1 for guidance on the appropriate application of control and ME limits. LCS control limits are not available for Benzidine, 2,6-Dichlorophenol, and N-nitrosopyrrolidine. Sufficient data to perform statistically significant analyses were not received for those analytes during the LCS study. Additional limits for poor performing compounds can be found in section G.5.



**Table G-6. LCS Control Limits for Semivolatile Organic Compounds SW-846  
Method 8270 Water Matrix<sup>5</sup> (continued)**

Analyte	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit	Lower ME Limit	Upper ME Limit
Benzo[b]fluoranthene	81.8	12.1	45	120	35	130
Benzo[k]fluoranthene	84.6	13.2	45	125	30	135
Benzo[g,h,i]perylene	80.5	14.1	40	125	25	135
Chrysene	82.1	8.9	55	110	45	120
Dibenz[a,h]anthracene	84.7	14.1	40	125	30	140
Fluoranthene	85.2	10.4	55	115	45	125
Fluorene	80.6	10.3	50	110	40	120
Indeno[1,2,3-cd]pyrene	84.3	13.6	45	125	30	140
Naphthalene	70.8	10.5	40	100	30	115
Phenanthrene	84.0	11.0	50	115	40	130
Pyrene	88.6	13.2	50	130	35	140
<b>Phenolic/Acidic</b>						
2,4,5-Trichlorophenol	79.7	10.3	50	110	40	120
2,4,6-Trichlorophenol	80.7	10.7	50	115	40	125
2,4-Dichlorophenol	76.3	9.6	50	105	40	115
2,4-Dimethylphenol	68.8	13.5	30	110	15	125
2,4-Dinitrophenol	75.8	20.6	15	140	10	160
2-Chlorophenol	71.3	11.4	35	105	25	115
2-Methylphenol	73.3	11.7	40	110	25	120
2-Nitrophenol	75.8	12.4	40	115	25	125
3-Methylphenol/4-Methylphenol	71.3	13.0	30	110	20	125
4,6-Dinitro-2-methylphenol	84.9	15.0	40	130	25	145
4-Chloro-3-methylphenol	78.6	10.7	45	110	35	120
Pentachlorophenol	77.6	13.3	40	115	25	130
<b>Basic</b>						
3,3'-Dichlorobenzidine	65.2	15.3	20	110	10	125
4-Chloroaniline	62.2	15.6	15	110	10	125
<b>Phthalate Esters</b>						
Bis(2-ethylhexyl) phthalate	84.2	14.0	40	125	30	140
Butyl benzyl phthalate	81.1	11.7	45	115	35	130
Di-n-butyl phthalate	84.8	10.3	55	115	45	125
Di-n-octyl phthalate	87.4	16.6	35	135	20	155
Diethyl phthalate	79.2	12.9	40	120	30	130
Dimethyl phthalate	75.9	16.9	25	125	10	145



<b><u>Nitrosoamines</u></b>						
N-Nitrosodi-n-propylamine	80.9	15.7	35	130	20	145
N-Nitrosodimethylamine	67.9	14.1	25	110	10	125
N-Nitrosodiphenylamine	79.6	10.6	50	110	35	120
<b><u>Chlorinated Aliphatics</u></b>						
Bis(2-chlorethoxy)methane	76.2	10.2	45	105	35	115
Bis(2-chloroethyl) ether	73.3	12.3	35	110	25	120
Bis(2-chloroisopropyl) ether	78.2	17.5	25	130	10	150
Hexachlorobutadiene	65.2	12.6	25	105	15	115
Hexachloroethane	60.9	11.1	30	100	15	105

**Table G-6. LCS Control Limits for Semivolatile Organic Compounds SW-846  
Method 8270 Water Matrix<sup>5</sup> (continued)**

Analyte	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit	Lower ME Limit	Upper ME Limit
<b><u>Halogenated Aromatics</u></b>						
1,2,4-Trichlorobenzene	71.7	11.6	35	105	25	120
1,2-Dichlorobenzene	67.3	11.4	35	100	20	115
1,3-Dichlorobenzene	64.8	10.9	30	100	20	110
1,4-Dichlorobenzene	64.8	10.9	30	100	20	110
2-Chloronaphthalene	76.5	9.3	50	105	40	115
4-Bromophenyl phenyl ether	82.9	10.2	50	115	40	125
4-Chlorophenyl phenyl ether	80.6	10.3	50	110	40	120
Hexachlorobenzene	82.3	10.0	50	110	40	120
<b><u>Nitroaromatics</u></b>						
2,4-Dinitrotoluene	84.3	11.2	50	120	40	130
2,6-Dinitrotoluene	82.7	11.3	50	115	35	130
2-Nitroaniline	81.8	11.2	50	115	35	125
3-Nitroaniline	72.6	17.7	20	125	10	145
4-Nitroaniline	77.2	13.7	35	120	20	130
Nitrobenzene	76.8	10.8	45	110	35	120
<b><u>Neutral Aromatics</u></b>						
Carbazole	82.5	11.4	50	115	35	130
Dibenzofuran	80.3	8.8	55	105	45	115
<b><u>Others</u></b>						
1,2-Diphenylhydrazine	84.8	9.4	55	115	45	120
Benzyl alcohol	71.0	13.8	30	110	15	125



Isophorone	81.0	10.5	50	110	40	125
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**Table G-7. LCS Control Limits for Semivolatile Organic Compounds  
SW-846 Method 8270 Solid Matrix<sup>6</sup>**

Analyte	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit	Lower ME Limit	Upper ME Limit
<b>Polynuclear Aromatics</b>						
2-Methylnaphthalene	77.3	10.0	45	105	35	115
Acenaphthene	77.3	10.3	45	110	35	120
Acenaphthylene	75.7	10.4	45	105	35	115
Anthracene	79.9	9.0	55	105	45	115
Benz[a]anthracene	81.6	9.8	50	110	40	120
Benzo[a]pyrene	80.7	10.3	50	110	40	120
Benzo[b]fluoranthene	79.7	11.4	45	115	35	125
Benzo[k]fluoranthene	83.8	12.9	45	125	30	135
Benzo[g,h,i]perylene	81.8	14.7	40	125	25	140
Chrysene	82.6	9.9	55	110	45	120

**Table G-7. LCS Control Limits for Semivolatile Organic Compounds  
SW-846 Method 8270 Solid Matrix<sup>6</sup> (continued)**

Analyte	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit	Lower ME Limit	Upper ME Limit
Dibenz[a,h]anthracene	82.9	13.9	40	125	25	140
Fluoranthene	83.9	10.1	55	115	45	125
Fluorene	78.3	9.8	50	110	40	115
Indeno[1,2,3-cd]pyrene	79.7	13.8	40	120	25	135
Naphthalene	73.4	11.1	40	105	30	120
Phenanthrene	80.1	10.0	50	110	40	120
Pyrene	84.4	12.8	45	125	35	135
<b>Phenolic/Acidic</b>						
2,4,5-Trichlorophenol	80.1	10.4	50	110	40	120
2,4,6-Trichlorophenol	76.3	11.0	45	110	30	120
2,4-Dichlorophenol	77.2	10.9	45	110	35	120

<sup>6</sup> A number of sporadic marginal exceedances (ME) of the control limits are allowed, depending on the number of analytes spiked in the LCS. Refer to section G.2 and Table G-1 for guidance on the appropriate application of control and ME limits. LCS control limits are not available for Benzidine, 2,6-Dichlorophenol, 1,2-Diphenylhydrazine, and N-nitrosopyrrolidine. Sufficient data to perform statistically significant analyses were not received for those analytes during the LCS study. Additional limits for poor performing compounds can be found in section G.5.



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2,4-Dimethylphenol	67.3	11.9	30	105	20	115
2,4-Dinitrophenol	72.6	20.0	15	130	10	150
2-Chlorophenol	74.7	10.3	45	105	35	115
2-Methylphenol	71.7	10.6	40	105	30	115
2-Nitrophenol	76.2	11.5	40	110	30	120
3-Methylphenol/4-Methylphenol	73.9	10.9	40	105	30	120
4,6-Dinitro-2-methylphenol	83.1	18.0	30	135	10	155
4-Chloro-3-methylphenol	79.5	11.1	45	115	35	125
4-Nitrophenol	77.0	20.2	15	140	10	160
Pentachlorophenol	71.9	15.6	25	120	10	135
Phenol	69.7	10.2	40	100	30	110
<b>Phthalate Esters</b>						
Bis(2-ethylhexyl) phthalate	87.4	13.3	45	125	35	140
Butyl benzyl phthalate	86.4	12.3	50	125	35	135
Di-n-butyl phthalate	83.2	9.1	55	110	45	120
Di-n-octyl phthalate	86.4	15.2	40	130	25	145
Diethyl phthalate	82.2	10.6	50	115	40	125
Dimethyl phthalate	79.6	10.2	50	110	40	120
<b>Nitrosoamines</b>						
N-Nitrosodi-n-propylamine	76.8	12.3	40	115	30	125
N-Nitrosodimethylamine	66.1	15.9	20	115	10	130
N-Nitrosodiphenylamine	82.4	11.1	50	115	40	125
<b>Chlorinated Aliphatics</b>						
Bis(2-chlorethoxy)methane	75.5	10.9	45	110	30	120
Bis(2-chloroethyl) ether	71.1	11.2	40	105	25	115
Bis(2-chloroisopropyl) ether	68.4	15.7	20	115	10	130
Hexachlorobutadiene	78.2	12.9	40	115	25	130
Hexachloroethane	71.9	12.6	35	110	20	120
<b>Halogenated Aromatics</b>						
1,2,4-Trichlorobenzene	77.4	11.2	45	110	30	120
1,2-Dichlorobenzene	70.9	8.7	45	100	35	105
1,3-Dichlorobenzene	69.7	10.3	40	100	30	110
1,4-Dichlorobenzene	69.0	11.4	35	105	25	115

Table G-7. LCS Control Limits for Semivolatile Organic Compounds  
SW-846 Method 8270 Solid Matrix (continued)

Analyte	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit	Lower ME Limit	Upper ME Limit
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2-Chloronaphthalene	75.2	9.9	45	105	35	115
4-Bromophenyl phenyl ether	81.7	11.8	45	115	35	130
4-Chlorophenyl phenyl ether	79.6	10.7	45	110	35	120
Hexachlorobenzene	82.5	11.7	45	120	35	130
<b><u>Nitroaromatics</u></b>						
2,4-Dinitrotoluene	82.0	11.4	50	115	35	130
2,6-Dinitrotoluene	80.2	10.7	50	110	35	125
2-Nitroaniline	81.0	12.2	45	120	30	130
3-Nitroaniline	68.8	13.8	25	110	15	125
4-Nitroaniline	73.6	13.1	35	115	20	125
Nitrobenzene	77.2	11.9	40	115	30	125
<b><u>Neutral Aromatics</u></b>						
Carbazole	80.4	12.3	45	115	30	130
Dibenzofuran	77.1	8.8	50	105	40	110
<b><u>Others</u></b>						
Benzyl alcohol	70.9	17.4	20	125	10	140
Isophorone	77.0	11.4	45	110	30	125

**Table G-8. LCS Control Limits for Chlorinated Herbicides SW-846 Method 8151 Water Matrix<sup>7</sup>**

Analyte	Median	Lower Control Limit	Upper Control Limit
2,4-D	88	35	115
2,4-DB	99	45	130
2,4,5-T	83	35	110
2,4,5-TP (Silvex)	87	50	115
Dalapon	62	40	110
Dicamba	86	60	110
Dichloroprop	91	70	120
Dinoseb	65	20	100
MCPA	93	60	145

<sup>7</sup> LCS control limits were generated using non-parametric statistics (see section G.1 for further explanation). LCS control limits are not available for MCPP. Sufficient data to perform statistically significant analyses were not received for the analyte during the LCS study.



**Table G-9. LCS Control Limits for Chlorinated Herbicides SW-846 Method 8151 Solid Matrix<sup>8</sup>**

Analyte	Median	Lower Control Limit	Upper Control Limit
2,4-D	88	35	145
2,4-DB	108	50	155
2,4,5-T	86	45	135
2,4,5-TP (Silvex)	90	45	125
Dicamba	90	55	110
Dichloroprop	99	75	140

**Table G-10. LCS Control Limits for Polynuclear Aromatic Hydrocarbons SW-846 Method 8310 Water Matrix<sup>9</sup>**

Analyte	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit	Lower ME Limit	Upper ME Limit
Acenaphthene	70	11	35	105	25	115
Acenaphthylene	74	13	35	115	20	125
Anthracene	77	12	40	110	30	125
Benz[a]anthracene	81	11	50	110	40	125
Benzo[a]pyrene	79	11	45	115	35	125
Benzo[b]fluoranthene	82	10	50	110	40	125
Benzo[k]fluoranthene	79	10	50	110	40	120
Benzo[g,h,i]perylene	77	14	35	120	20	135
Chrysene	83	11	50	115	40	125
Dibenz[a,h]anthracene	64	15	20	110	10	125
Fluoranthene	82	11	50	115	35	125
Fluorene	69	11	35	105	25	115
Indeno[1,2,3-cd]pyrene	80	11	45	110	35	125
Naphthalene	68	12	35	105	20	115
Phenanthrene	80	13	40	120	25	135
Pyrene	80	9	50	110	45	115

<sup>8</sup> LCS control limits were generated using non-parametric statistics (see section G.1 for further explanation). LCS control limits are not available for Dalapon, MCPA, and MCPP. Sufficient data to perform statistically significant analyses were not received for those analytes during the LCS study. Additional limits for poor performing compounds can be found in section G.5.

<sup>9</sup> A number of sporadic marginal exceedances of the control limits are allowed, depending on the number of analytes spiked in the LCS. Refer to section G.2 and Table G-1 for guidance on the appropriate application of control and ME limits.



**Table G-11. LCS Control Limits for Polynuclear Aromatic Hydrocarbons SW-846 Method 8310 Solid Matrix<sup>10</sup>**

Analyte	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit	Lower ME Limit	Upper ME Limit
Acenaphthene	71	12	35	110	20	120
Acenaphthylene	73	13	35	115	20	125
Anthracene	86	13	45	125	35	140
Benz[a]anthracene	78	9	50	105	40	115
Benzo[a]pyrene	86	15	40	135	25	150
Benzo[b]fluoranthene	89	11	55	120	45	130
Benzo[k]fluoranthene	84	12	50	120	35	135
Benzo[g,h,i]perylene <sup>11</sup>	85	10	55	115	45	125
Chrysene	87	11	55	120	45	130
Dibenz[a,h]anthracene	81	11	45	115	35	125
Fluoranthene	88	16	40	135	25	150
Fluorene	76	10	45	105	35	115
Indeno[1,2,3-cd]pyrene	95	13	55	135	45	145
Naphthalene	80	11	50	110	40	120
Phenanthrene	91	12	55	125	45	135
Pyrene	82	11	50	115	40	125

**Table G-12. LCS Control Limits for Explosives SW-846 Methods 8330 and 8330A Water Matrix<sup>12</sup>**

Analyte	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit	Lower ME Limit	Upper ME Limit
1,3,5-Trinitrobenzene	102	13	65	140	50	150
1,3-Dinitrobenzene	103	18	45	160	30	175
2,4-Dinitrotoluene	98	12	60	135	50	145
2,6-Dinitrotoluene	99	13	60	135	50	150
2,4,6-Trinitrotoluene (TNT)	98	15	50	145	35	160

<sup>10</sup> A number of sporadic marginal exceedances of the control limits are allowed, depending on the number of analytes spiked in the LCS. Refer to section G.2 and Table G-1 for guidance on the appropriate application of control and ME limits.

<sup>11</sup> Provisional limits – outlier analyses during the LCS study resulted in LCS-CLs generated with data from fewer than four laboratories. Limits may be adjusted in the future as additional data become available.

<sup>12</sup> A number of sporadic marginal exceedances of the control limits are allowed, depending on the number of analytes spiked in the LCS. Refer to section G.2 and Table G-1 for guidance on the appropriate application of control and ME limits. LCS control limits were generated using solid phase extraction with acetonitrile only, without removing outliers from the data set (see section G.1 for further explanation).



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Analyte	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit	Lower ME Limit	Upper ME Limit
2-Amino-4,6-dinitrotoluene <sup>13</sup>	101	17	50	155	35	170
2-Nitrotoluene	88	15	45	135	30	150
3-Nitrotoluene	90	14	50	130	35	145
4-Amino-2,6-dinitrotoluene <sup>13</sup>	104	16	55	155	40	170
4-Nitrotoluene	90	14	50	130	35	145
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	106	18	50	160	35	180
Methyl-2,4,6-trinitrophenylnitramine (Tetryl) <sup>13</sup>	98	25	20	175	10	200
Nitrobenzene	94	15	50	140	35	155
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	99	6	80	115	75	120

Table G-13. LCS Control Limits for Explosives SW-846 Methods 8330 and 8330A Solid Matrix<sup>14</sup>

Analyte	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit	Lower ME Limit	Upper ME Limit
1,3,5-Trinitrobenzene	99	9	75	125	65	135
1,3-Dinitrobenzene	102	8	80	125	70	135
2,4-Dinitrotoluene	102	7	80	125	75	130
2,6-Dinitrotoluene	100	7	80	120	70	130
2,4,6-Trinitrotoluene (TNT)	99	14	55	140	45	155
2-Amino-4,6-dinitrotoluene	102	7	80	125	75	130
2-Nitrotoluene	101	7	80	125	70	130
3-Nitrotoluene	100	7	75	120	70	130
4-Amino-2,6-dinitrotoluene	101	7	80	125	75	130
4-Nitrotoluene	101	8	75	125	70	135
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	103	10	70	135	65	145
Nitrobenzene	100	8	75	125	70	130

<sup>13</sup> Provisional limits – outlier analyses during the LCS study resulted in LCS-CLs generated with data from fewer than four laboratories. Limits may be adjusted in the future as additional data become available.

<sup>14</sup> A number of sporadic marginal exceedances of the control limits are allowed, depending on the number of analytes spiked in the LCS. Refer to section G.2 and Table G-1 for guidance on the appropriate application of control and ME limits. Additional limits for poor performing compounds can be found in section G.5.



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Analyte	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit	Lower ME Limit	Upper ME Limit
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	100	9	75	125	65	135

**Table G-14. LCS Control Limits for Organochlorine Pesticides SW-846 Method 8081 Water Matrix<sup>15</sup>**

Analyte	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit	Lower ME Limit	Upper ME Limit
4,4'-DDD	88	20	25	150	10	170
4,4'-DDE	87	18	35	140	15	160
4,4'-DDT	92	15	45	140	30	155
Aldrin	83	19	25	140	10	155
alpha-BHC	94	11	60	130	50	140
alpha-Chlordane	93	10	65	125	55	135
beta-BHC	96	10	65	125	55	135
delta-BHC	91	15	45	135	30	150
Dieldrin	95	11	60	130	50	140
Endosulfan I <sup>16</sup>	80	10	50	110	40	120
Endosulfan II	79	17	30	130	10	150
Endosulfan sulfate	96	14	55	135	40	150
Endrin	95	13	55	135	45	145
Endrin aldehyde	96	14	55	135	40	150
Endrin ketone	102	8	75	125	70	135
gamma-BHC	82	18	25	135	10	155
gamma-Chlordane	94	11	60	125	50	135
Heptachlor	87	15	40	130	30	145
Heptachlor epoxide	96	11	60	130	50	140
Methoxychlor	103	16	55	150	40	165

<sup>15</sup> A number of sporadic marginal exceedances of the control limits are allowed, depending on the number of analytes spiked in the LCS. Refer to section G.2 and Table G-1 for guidance on the appropriate application of control and ME limits. LCS control limits are not available for Hexachlorobenzene and Toxaphane. Sufficient data to perform statistically significant analyses were not received for those analytes during the LCS study. Additional limits for surrogate compounds can be found in section G.6.

<sup>16</sup> Provisional limits – outlier analyses during the LCS study resulted in LCS-CLs generated with data from fewer than four laboratories. Limits may be adjusted in the future as additional data becomes available.



**Table G-15. LCS Control Limits for Organochlorine Pesticides SW-846 Method 8081  
Solid Matrix<sup>17</sup>**

Analyte	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit	Lower ME Limit	Upper ME Limit
4,4'-DDD	81	18	30	135	10	155
4,4'-DDE	97	10	70	125	60	135
4,4'-DDT	92	16	45	140	30	155
Aldrin	93	16	45	140	30	155
alpha-BHC	93	10	60	125	50	135
alpha-Chlordane	92	10	65	120	55	130
beta-BHC	95	11	60	125	50	135
delta-BHC	94	12	55	130	45	145
Dieldrin	96	10	65	125	55	135
Endosulfan I	74	20	15	135	10	155
Endosulfan II	89	17	35	140	20	160
Endosulfan sulfate	99	12	60	135	50	145
Endrin	97	12	60	135	50	145
Endrin aldehyde	92	18	35	145	20	165
Endrin ketone	100	11	65	135	55	145
gamma-BHC	91	11	60	125	50	135
gamma-Chlordane	96	10	65	125	55	135
Heptachlor	96	15	50	140	35	155
Heptachlor epoxide	98	11	65	130	55	140
Methoxychlor	100	14	55	145	45	155

**Table G-16. LCS Control Limits for Polychlorinated Biphenyls SW-846 Method 8082 Water  
Matrix<sup>18</sup>**

Analyte	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit
Aroclor 1016	85	20	25	145
Aroclor 1260	87	19	30	145

<sup>17</sup> A number of sporadic marginal exceedances of the control limits are allowed, depending on the number of analytes spiked in the LCS. Refer to section G.2 and Table G-1 for guidance on the appropriate application of control and ME limits. LCS control limits are not available for Hexachlorobenzene, Hexachlorocyclopentadiene, and Toxaphane. Sufficient data to perform statistically significant analyses were not received for those analytes during the LCS study. Additional limits for surrogate compounds can be found in section G.6.

<sup>18</sup> LCS control limits are not available for Aroclors 1221, 1232, 1242, 1248, 1262, and 1268. Sufficient data to perform statistically significant analyses were not received for those analytes during the LCS study. Additional limits for surrogate compounds can be found in section G.6.



**Table G-17. LCS Control Limits for Polychlorinated Biphenyls SW-846 Method 8082 Solid Matrix<sup>18</sup>**

Analyte	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit
Aroclor 1016	90	16	40	140
Aroclor 1260	96	12	60	130

**Table G-18. LCS Control Limits for Metals SW-846  
Methods 6010 and 7470 Water Matrix<sup>19</sup>**

Analyte	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit	Lower ME Limit	Upper ME Limit
Aluminum	97	5	80	120	80	120
Antimony	98	4	80	120	80	120
Arsenic	98	4	80	120	80	120
Barium	99	4	80	120	80	120
Beryllium	99	4	80	120	80	120
Cadmium	100	4	80	120	80	120
Calcium	98	4	80	120	80	120
Chromium	100	4	80	120	80	120
Cobalt	99	3	80	120	80	120
Copper	99	3	80	120	80	120
Iron	102	4	80	120	80	120
Lead	99	4	80	120	80	120
Magnesium	98	4	80	120	80	120
Manganese	100	4	80	120	80	120
Mercury	100	5	80	120	No ME	No ME
Molybdenum	95	5	80	120	75	120
Nickel	100	4	80	120	80	120
Potassium	98	4	80	120	80	120
Selenium	98	6	80	120	75	120
Silver	97	5	80	120	75	120
Sodium	99	4	80	120	80	120
Thallium	97	4	80	120	80	120
Vanadium	99	4	80	120	80	120

<sup>19</sup> The as-generated limits have been adjusted to reflect Method requirements and acceptable calibration uncertainty. A number of sporadic marginal exceedances of the control limits are allowed for Method 6010, depending on the number of analytes spiked in the LCS. Refer to section G.2 and Table G-1 for guidance on the appropriate application of control and ME limits.



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**Table G-18. LCS Control Limits for Metals SW-846  
Methods 6010 and 7470 Water Matrix<sup>19</sup>**


Analyte	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit	Lower ME Limit	Upper ME Limit
Zinc	100	4	80	120	80	120



**Table G-19. LCS Control Limits for Metals SW-846 Methods 6010 and 7471 Solid Matrix<sup>20</sup>**

Analyte	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit	Lower ME Limit	Upper ME Limit
Aluminum	95	5	80	120	75	120
Antimony	96	5	80	120	75	120
Arsenic	95	4	80	120	80	120
Barium	98	3	80	120	80	120
Beryllium	99	4	80	120	80	120
Cadmium	97	4	80	120	80	120
Calcium	97	4	80	120	80	120
Chromium	99	5	80	120	80	120
Cobalt	98	4	80	120	80	120
Copper	97	3	80	120	80	120
Iron	100	4	80	120	80	120
Lead	95	4	80	120	80	120
Magnesium	96	3	80	120	80	120
Manganese	97	4	80	120	80	120
Mercury	100	6	80	120	No ME	No ME
Molybdenum	96	5	80	120	75	120
Nickel	97	4	80	120	80	120
Potassium	96	4	80	120	80	120
Selenium	93	4	80	120	75	120
Silver	96	7	75	120	70	125
Sodium	96	4	80	120	80	120
Thallium	94	4	80	120	80	120
Vanadium	99	3	80	120	80	120
Zinc	95	5	80	120	75	120

<sup>20</sup> The as-generated limits have been adjusted to reflect Method requirements and acceptable calibration uncertainty. A number of sporadic marginal exceedances of the control limits are allowed for Method 6010, depending on the number of analytes spiked in the LCS. Refer to section G.2 and Table G-1 for guidance on the appropriate application of control and ME limits.

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