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State of Washington

Addendum to Quality Assurance Project Plan

May Creek Landfill Groundwater Assessment Monitoring

November 2020

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Addendum to Quality Assurance Project Plan

May Creek Landfill Groundwater Assessment Monitoring

by Jacob Carnes

November 2020

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1.0 Table of Contents

The numbered headings in this document correspond to the headings used in the original QAPP. Only relevant sections are included; therefore, some numbered headings are missing and the text begins at 3.0.

3.0 Background

3.1 Introduction and problem statement

In February 2020, the Washington State Department of Ecology's (Ecology's) Environmental Assessment Program took over responsibility groundwater sampling at the May Creek Landfill. The approximately 10-acre site has operated as an unpermitted solid waste landfill in eastern King County since the 1990s. The site, also known as the Pillon Property, has a long history of investigations and citations by county and state regulatory agencies. Prior to Ecology's monitoring, EPA's Region IV Superfund Technical Assessment and Response Team (START) identified and removed hazardous wastes and materials, completing these activities in July 2019. Soil samples collected during removal activities indicated that the site soils were contaminated with petroleum hydrocarbons, dioxins, and metals (Woodke and Wing, 2019).

In July 2019, EPA also installed 7 monitoring wells and conducted one round of sampling to determine if the contaminated soil has resulted in contamination of the shallow groundwater. Groundwater samples collected by EPA and Ecology were analyzed for a wide range of contaminants detailed in the original QAPP (Carnes, 2020), including PCB aroclors. Ecology's Toxics Cleanup Program has requested high-resolution analysis of PCB congeners and dioxins/furans. Dioxins and furans are of concern in soil but are not expected to be detected in groundwater. However, there is potential for mobilization of dioxins due to co-solvency with petroleum products.

Table A1 lists the PCB congener analytes. Table A2 lists the dioxins/furans analytes. These additional analyses will be performed by SGS AXYS Analytical Services Ltd. (SGS AXYS) in Sidney, British Columbia, Canada.

3.2 Study area and surroundings

Seven monitoring wells are present at the May Creek Landfill (Figure 1). Well MW-01 is considered the hydrologically up-gradient well from the landfill. The other 6 wells, MW-02 - MW-07 are spaced across the site. Samples for PCB congener analysis will be collected from all 7 monitoring wells. Samples for dioxins/furans analysis will be collected from up-gradient well MW-01, and from wells MW-05 and MW-07, which are located in areas of the site where burning has apparently occurred.

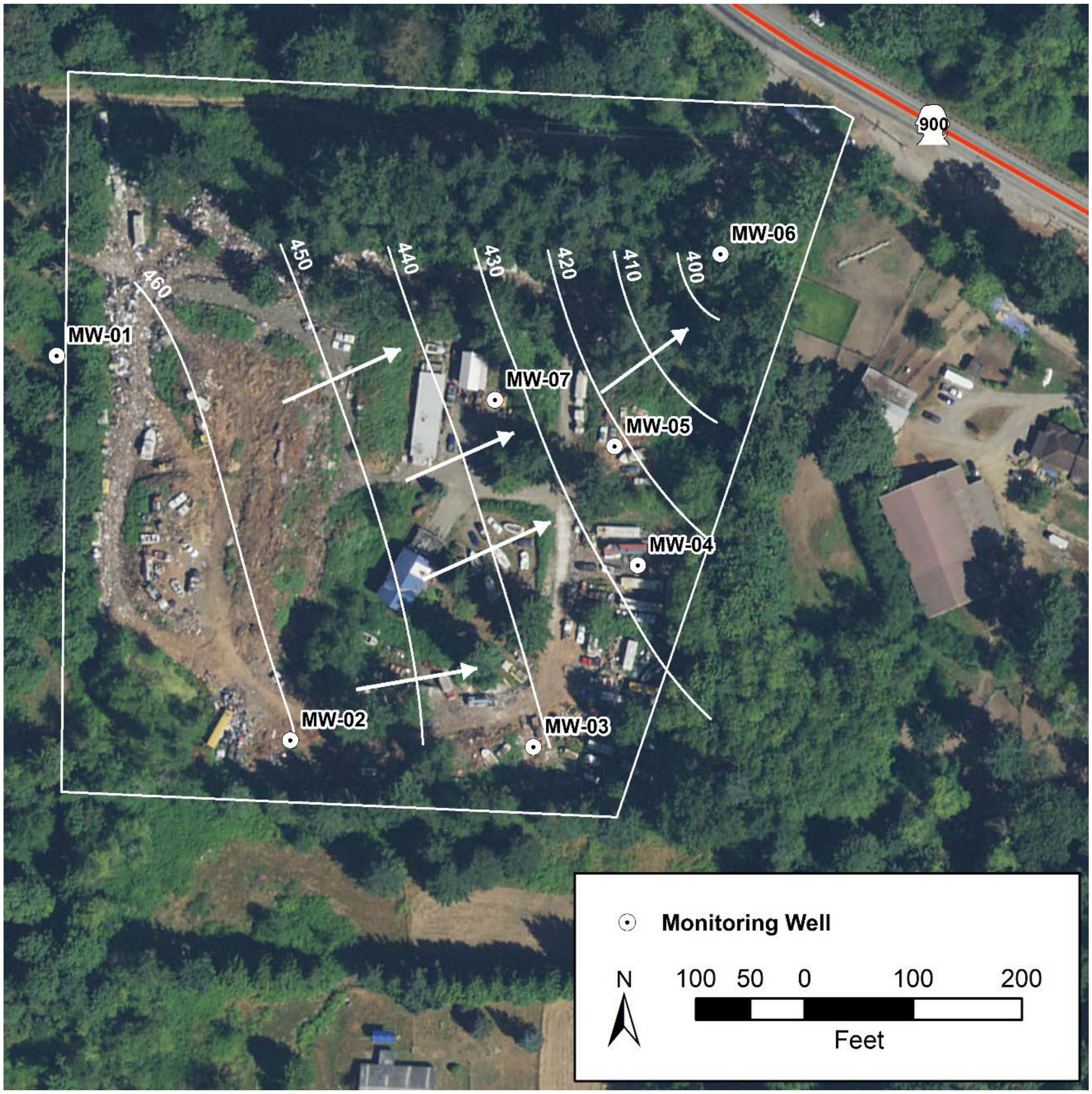

Figure 1. Map of monitoring well locations.

White lines are groundwater elevation contours in feet, created from February 2020 water level measurements. Groundwater flow direction is shown by white arrows.

5.5 Budget and funding

Table 1 presents the estimated analytical costs for a single round of PCB congeners and dioxins/furans analyses by EPA methods 1668C and 1613B, respectively. SGS AXYS will perform all analyses shown in Table 2. The per-round cost of sampling will change if analyses are added or removed during the course of this project.

Table 1. Project budget per round of sampling

Parameter	Number of Samples	Number of QA Samples	Total Number of Samples	Cost Per Sample	Lab Subtotal
PCBs	7	2	9	$895	$8,055
Dioxins/furans	3	2	5	$685	$3,425
Per-round Total					**$11,480**

6.0 Quality Objectives

6.2.1 Targets for precision, bias, and sensitivity

The MQOs for project results, expressed in terms of acceptable precision, bias, and sensitivity, are described in this section and summarized in Table 2 below. Analyte specific MQOs are included in the Appendix. Tables A1 and A2 list specific analytes by analytical method.

Table 2. Measurement quality objectives for laboratory analyses of water samples.

Parameter	**Calibration/ Verification** (% Recovery Limits)	**Ongoing Precision and Recovery** [a] (% Recovery Limits)	**Labelled Compound Recovery** [a] (% Recovery Limits)	**Reporting Limit** (pg/L)
PCB congeners	75 - 125	60 - 135	See Table A3	0.5 pg/L
Dioxins/furans	See Table A2	See Table A2	See Table A4	0.5 pg/L

[a] Acceptance criteria from EPA methods 1668C for PCBs (EPA, 2010), and 1613B for dioxins/furans (EPA, 2008)

In addition to the quality objectives above, relative percent difference (RPD) will be used to evaluate precision for field duplicate samples. The field duplicate RPD acceptance criteria for both PCB congeners (EPA method 1668C) and dioxins/furans (EPA method 1613B) is ≤ 30%. The smaller the RPD, the more precise the measurement process. Good precision is indicative of relative consistency and comparability between different samples.

7.0 Study Design

7.2.2 Field parameters and laboratory analytes to be measured

All field parameters originally listed in the QAPP (Carnes, 2020) will be measured prior to collecting samples. Samples will be collected for all laboratory analyses originally listed, except for PCB aroclors, which are being superseded by PCB congener analysis by method 1668C. Samples will be collected for these additional analyses to be completed by SGS AXYS Laboratories:

- PCBs congeners
- Dioxin/furans

8.0 Field Procedures

8.2 Measurement and sampling procedures

The only changes in sampling procedures necessary for the new analytical methods is the use of Teflon sample tubing, and platinum cured silicon tubing for the peristaltic pump head.

The samples for analysis by EPA methods 1668C and 1613B at SGS AXYS will be collected from the monitoring wells directly from the pump discharge line after they are fully purged at the same time as the samples to be analyzed by MEL. Samples will be stored with ice packs while being transferred to SGS AXYS using standard chain-of-custody procedure.

8.3 Containers, preservation methods, holding times

Table 3 shows the parameter, sample containers, preservation, and holding time required to meet project goals and objectives. Bottles will be provided by SGS AXYS. The provided bottles undergo batch quality control for acceptable background levels.

Table 3. Sample containers, preservation, and holding times.

Parameter	Matrix	Minimum Quantity Required	Container	Preservative	Holding Time
PCBs	Water	1 L	1 L amber glass bottle with Teflon lid.	Cool to ≤4°C	1 year
Dioxins/furans	Water	1 L	1 L amber glass bottle with Teflon lid.	Cool to ≤4°C	1 year

8.5 Sample ID

Manchester Environmental Lab will provide the field lead with work order numbers for all scheduled sampling dates. The work order number will be combined with a field ID number that is given by the field lead. This combination of work order number and field ID number constitute the sample ID. This information will be forwarded to SGS AXYS.

8.6 Chain of custody

Chain-of-custody procedures will be followed according to MEL protocol (Ecology, 2016b).

Once collected, samples will be properly labeled and stored in an ice-filled cooler inside the sampling vehicle. Samples will be transferred from Lacey, WA to MEL. MEL will ship the samples to SGS AXYS with chain-of-custody documentation.

9.0 Laboratory Procedures

9.1 Lab procedures table

The additional analyses for this project, along with the expected number of samples and an expected range of results are listed in Table 4. The Appendix contains full analyte lists for PCBs (Table A1) and dioxins/furans (Table A2)

Table 4. Laboratory measurement methods (laboratory).

Analyte Group	Sample Matrix	Samples (Number/ Arrival Date)	Expected Range of Results	Method Reporting Limit	Analytical (Instrumental) Method
PCBs	Water	9/quarterly	<0.5-10,000 pg/L	0.5 pg/L	EPA 1668C (EPA, 2010)
Dioxins/furans	Water	5/quarterly	<0.5-10,000 pg/L	0.5 pg/L	EPA 1613B (EPA, 2008)

9.2 Sample preparation methods

The laboratory will follow sample preparation procedures described in the analytical methods listed in Table 4.

9.4 Laboratories accredited for methods

SGS AXYS Laboratory will perform PCB and dioxins/furans analyses for the analytes listed in the Appendix.

10.0 Quality Control Procedures

The primary types of quality control samples to be used to evaluate and control the accuracy of laboratory analyses are check standards are listed in Table 5.

10.1 Table of field and laboratory quality control

Table 5. Quality control samples, types, and frequency.

Parameter	Field Equipment Blanks	Field Replicates	Ongoing Precision and Recovery	Method Blanks[a]
PCBs	1	1/10 samples	1/batch	1/batch
Dioxins/ Furans	1	1/10 samples	1/batch	1/batch

[a] A batch is defined as up to 20 samples analyzed together.

Each type of QC sample listed above will have MQOs associated with it that will be used to evaluate the quality and usability of the results (Section 6.2, Appendix). Equipment blanks will be collected to indicate whether samples are potentially contaminated by sampling equipment. Field replicates will provide insight to the relative consistency and comparability between different samples.

13.0 Data Verification

13.3 Validation requirements

A Level IV data package will be requested for supplemental parameter data. A contracted data validation firm will conduct a review equivalent to an EPA Level IV, and following guidance included in an Ecology technical memo currently in preparation (Era-Miller, 2020). When a result is flagged as an estimated maximum possible concentration (EMPC), the result will assigned a qualifier of NJ (there is evidence that the analyte is present in the sample. reported result for the tentatively identified analyte is an estimate). For use in investigative studies, EMPC results will be reported as an estimated concentration and qualified NJ. However, if data from this project are used as a future basis for a regulatory decision on the data, EMPC results must be manually assigned a qualifier of U (Analyte was not detected at or above the reported result), and a concentration of zero.

The vendor for data validation will be selected after the data arrives. The data validator will prepare a memo of the data validation results, including an overall assessment of data quality and usability, an evaluation of MQOs, and evaluation of instrument quality control and performance.

15.0 References

Carnes, J., 2020. Quality Assurance Project Plan: May Creek Landfill Groundwater Assessment Monitoring. Washington State Dept. of Ecology, Olympia, WA. Publication 20-03-115. https://fortress.wa.gov/ecy/publications/summarypages/2003115.html

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EPA, 2014. R10 Data Validation and Review guidelines for Polychlorinated Dibenzo-p-Dioxin and Polychlorinated Dibenzofuran data (PCDD/PCDF) Using Method 1613B, and SW846 Method 8290A. EPA-910-R-14-003. United States Environmental Protection Agency, Region 10 Office of Environmental Assessment. Seattle, WA. https://nepis.epa.gov/Exe/ZyPDF.cgi/P100JJP7.PDF?Dockey=P100JJP7.PDF

Era-Miller, Brandee, 2020 (In preparation). Technical Memo: Polychlorinated Biphenyl (PCB) Groundwater Sampling Guidance for the Lower Duwamish River. Washington State Department of Ecology. Olympia, WA.

16.0 Appendix. Analyte lists and acceptance criteria for PCBs and dioxins/furans

Table A1. Analyte list for PCB congeners by EPA method 1668C (EPA, 2010), with reporting and quantification limits.

Analyte	Reporting Limit (pg/L)	Limit of Quantification (pg/L)
CL1-PCB-1	0.5	30
CL1-PCB-2	0.5	30
CL1-PCB-3	0.5	30
CL2-PCB-4	0.5	30
CL2-PCB-5	0.5	30
CL2-PCB-6	0.5	30
CL2-PCB-7	0.5	146
CL2-PCB-8	0.5	35
CL2-PCB-9	0.5	30
CL2-PCB-10	0.5	30
CL2-PCB-11	0.5	160
CL2-PCB-12/13	0.5	30
CL2-PCB-14	0.5	30
CL2-PCB-15	0.5	30
CL3-PCB-16	0.5	30
CL3-PCB-17	0.5	30
CL3-PCB-19	0.5	30
CL3-PCB-21/33	0.5	30
CL3-PCB-22	0.5	30
CL3-PCB-23	0.5	30
CL3-PCB-24	0.5	30
CL3-PCB-25	0.5	30
CL3-PCB-26/29	0.5	30
CL3-PCB-27	0.5	30
CL3-PCB-28/20	0.5	34
CL3-PCB-30/18	0.5	35
CL3-PCB-31	0.5	30
CL3-PCB-32	0.5	30
CL3-PCB-34	0.5	30
CL3-PCB-35	0.5	30
CL3-PCB-36	0.5	30
CL3-PCB-37	0.5	30
CL3-PCB-38	0.5	30
CL3-PCB-39	0.5	30
CL4-PCB-41/40/71	0.5	30
CL4-PCB-42	0.5	30
CL4-PCB-43	0.5	30
CL4-PCB-44/47/65	0.5	74

Analyte	Reporting Limit (pg/L)	Limit of Quantification (pg/L)
CL4-PCB-45/51	0.5	30
CL4-PCB-46	0.5	30
CL4-PCB-48	0.5	30
CL4-PCB-50/53	0.5	30
CL4-PCB-52	0.5	51
CL4-PCB-54	0.5	30
CL4-PCB-55	0.5	30
CL4-PCB-56	0.5	30
CL4-PCB-57	0.5	30
CL4-PCB-58	0.5	30
CL4-PCB-59/62/75	0.5	30
CL4-PCB-60	0.5	30
CL4-PCB-61/70/74/76	0.5	49
CL4-PCB-63	0.5	30
CL4-PCB-64	0.5	30
CL4-PCB-66	0.5	30
CL4-PCB-67	0.5	30
CL4-PCB-68	0.5	30
CL4-PCB-69/49	0.5	30
CL4-PCB-72	0.5	30
CL4-PCB-73	0.5	30
CL4-PCB-77	0.5	30
CL4-PCB-78	0.5	30
CL4-PCB-79	0.5	30
CL4-PCB-80	0.5	30
CL4-PCB-81	0.5	30
CL5-PCB-82	0.5	30
CL5-PCB-83/99	0.5	30
CL5-PCB-84	0.5	30
CL5-PCB-88/91	0.5	30
CL5-PCB-89	0.5	30
CL5-PCB-92	0.5	30
CL5-PCB-94	0.5	30
CL5-PCB-95/100/93/102/98	0.5	30
CL5-PCB-96	0.5	30
CL5-PCB-103	0.5	30
CL5-PCB-104	0.5	30
CL5-PCB-105	0.5	30
CL5-PCB-106	0.5	30
CL5-PCB-108/124	0.5	30
CL5-PCB-109/119/86/97/125/87	0.5	30
CL5-PCB-107	0.5	30
CL5-PCB-110/115	0.5	30
CL5-PCB-111	0.5	30

Analyte	Reporting Limit (pg/L)	Limit of Quantification (pg/L)
CL5-PCB-112	0.5	30
CL5-PCB-113/90/101	0.5	30
CL5-PCB-114	0.5	30
CL5-PCB-117/116/85	0.5	30
CL5-PCB-118	0.5	63
CL5-PCB-120	0.5	30
CL5-PCB-121	0.5	30
CL5-PCB-122	0.5	30
CL5-PCB-123	0.5	30
CL5-PCB-126	0.5	30
CL5-PCB-127	0.5	30
CL6-PCB-128/166	0.5	30
CL6-PCB-130	0.5	59
CL6-PCB-131	0.5	30
CL6-PCB-132	0.5	30
CL6-PCB-133	0.5	30
CL6-PCB-134/143	0.5	30
CL6-PCB-136	0.5	30
CL6-PCB-137	0.5	30
CL6-PCB-138/163/129/160	0.5	30
CL6-PCB-139/140	0.5	30
CL6-PCB-141	0.5	30
CL6-PCB-142	0.5	30
CL6-PCB-144	0.5	30
CL6-PCB-145	0.5	30
CL6-PCB-146	0.5	30
CL6-PCB-147/149	0.5	30
CL6-PCB-148	0.5	30
CL6-PCB-150	0.5	30
CL6-PCB-151/135/154	0.5	30
CL6-PCB-152	0.5	30
CL6-PCB-153/168	0.5	60
CL6-PCB-155	0.5	30
CL6-PCB-156/157	0.5	30
CL6-PCB-158	0.5	30
CL6-PCB-159	0.5	30
CL6-PCB-161	0.5	30
CL6-PCB-162	0.5	30
CL6-PCB-164	0.5	30
CL6-PCB-165	0.5	30
CL6-PCB-167	0.5	34
CL6-PCB-169	0.5	30
CL7-PCB-170	0.5	30
CL7-PCB-171/173	0.5	34

Analyte	Reporting Limit (pg/L)	Limit of Quantification (pg/L)
CL7-PCB-172	0.5	30
CL7-PCB-174	0.5	30
CL7-PCB-175	0.5	30
CL7-PCB-176	0.5	30
CL7-PCB-177	0.5	30
CL7-PCB-178	0.5	39
CL7-PCB-179	0.5	30
CL7-PCB-180/193	0.5	45
CL7-PCB-181	0.5	30
CL7-PCB-182	0.5	30
CL7-PCB-183/185	0.5	30
CL7-PCB-184	0.5	30
CL7-PCB-186	0.5	30
CL7-PCB-187	0.5	42
CL7-PCB-188	0.5	30
CL7-PCB-189	0.5	30
CL7-PCB-190	0.5	30
CL7-PCB-191	0.5	30
CL7-PCB-192	0.5	30
CL8-PCB-194	0.5	30
CL8-PCB-195	0.5	30
CL8-PCB-196	0.5	30
CL8-PCB-197/200	0.5	30
CL8-PCB-198/199	0.5	30
CL8-PCB-201	0.5	30
CL8-PCB-202	0.5	30
CL8-PCB-203	0.5	30
CL8-PCB-204	0.5	30
CL8-PCB-205	0.5	30
CL9-PCB-206	0.5	36
CL9-PCB-207	0.5	30
CL9-PCB-208	0.5	30
CL10-PCB-209	0.5	30

Table A2. Analyte list for dioxins/furans by EPA method 1613B, with associated reporting and quantification limits, and limits on acceptance criteria (EPA, 2008).

Analyte	Reporting Limit (pg/L)	Limit of Quantification (pg/L)	Ongoing Precision and Recovery Limits (%)	Calibration/ Verification Limits (%)
2,3,7,8-TCDD	0.5	8	67-158	78-129
2,3,7,8-TCDF	0.5	5	75-158	84-120
1,2,3,7,8-PeCDD	0.5	25	70-142	78-130
1,2,3,7,8-PeCDF	0.5	25	80-132	82-120
2,3,4,7,8-PeCDF	0.5	25	68-160	82-122
1,2,3,4,7,8-HxCDD	0.5	25	70-164	78-128
1,2,3,6,7,8-HxCDD	0.5	25	76-134	78-128
1,2,3,7,8,9-HXCDD	0.5	25	64-162	82-122
1,2,3,4,7,8-HxCDF	0.5	25	72-137	90-112
1,2,3,6,7,8-HxCDF	0.5	25	84-130	88-114
1,2,3,7,8,9-HxCDF	0.5	25	78-130	90-112
2,3,4,6,7,8-HxCDF	0.5	25	70-158	88-114
1,2,3,4,6,7,8-HpCDD	0.5	25	70-138	86-116
1,2,3,4,6,7,8-HpCDF	0.5	25	82-122	90-110
1,2,3,4,7,8,9-HpCDF	0.5	25	78-138	86-116
OCDD	0.5	50	78-144	79-126
OCDF	0.5	50	63-170	63-159

Table A3. Acceptance criteria for PCB labelled compound recovery by EPA method 1668C (EPA, 2010).

Labelled Compound	Congener Number [1]	Labelled Compound percent recovery limits (%)
$^{13}C_{12}$-2-MoCB	1L	5-145
$^{13}C_{12}$-4-MoCB	3L	5-145
$^{13}C_{12}$-2,2'-DiCB	4L	5-145
$^{13}C_{12}$-4,4'-DiCB	15L	5-145
$^{13}C_{12}$-2,2',6-TrCB	19L	5-145
$^{13}C_{12}$-3,4,4'-TrCB	37L	5-145
$^{13}C_{12}$-2,2',6,6'-TeCB	54L	5-145
$^{13}C_{12}$-3,3',4,4'-TeCB	77L	10-145
$^{13}C_{12}$-3,4,4',5-TeCB	81L	10-145
$^{13}C_{12}$-2,2',4,6,6'-PeCB	104L	10-145
$^{13}C_{12}$-2,3,3',4,4'-PeCB	105L	10-145
$^{13}C_{12}$-2,3,4,4',5-PeCB	114L	10-145
$^{13}C_{12}$-2,3',4,4',5-PeCB	118L	10-145
$^{13}C_{12}$-2',3,4,4',5-PeCB	123L	10-145
$^{13}C_{12}$-3,3',4,4',5-PeCB	126L	10-145
$^{13}C_{12}$-2,2',4,4',6,6'-HxCB	155L	10-145
$^{13}C_{12}$-2,3,3',4,4',5-HxCB [2]	156L	10-145
$^{13}C_{12}$-2,3,3',4,4',5'-HxCB [2]	157L	10-145
$^{13}C_{12}$-2,3',4,4',5,5'-HxCB	167L	10-145
$^{13}C_{12}$-3,3',4,4',5,5'-HxCB	169L	10-145
$^{13}C_{12}$-2,2',3,3',4,4',5-HpCB	170L	10-145
$^{13}C_{12}$-2,2',3,4,4',5,5'-HpCB	180L	10-145
$^{13}C_{12}$-2,2',3,4',5,6,6'-HpCB	188L	10-145
$^{13}C_{12}$-2,3,3',4,4',5,5'-HpCB	189L	10-145
$^{13}C_{12}$-2,2',3,3',5,5',6,6'-OcCB	202L	10-145
$^{13}C_{12}$-2,3,3',4,4',5,5',6-OcCB	205L	10-145
$^{13}C_{12}$-2,2',3,3',4,4',5,5',6-NoCB	206L	10-145
$^{13}C_{12}$-2,2',3,3',4,5,5',6,6'-NoCB	208L	10-145
$^{13}C_{12}$-2,2',3,3',4,4',5,5',6,6'-DeCB	209L	10-145

[1] Suffix "L" indicates labelled compound.
[2] PCBs 156 and 157 are tested as the sum of two concentrations

Table A4. Acceptance criteria for dioxins/furans labelled compound recovery by EPA method 1613B (EPA, 2008).

Labelled Compound	Recovery Limits (%)
$^{13}C_{12}$-2,3,7,8-TCDD	25-164
$^{13}C_{12}$-2,3,7,8-TCDF	24-169
$^{13}C_{12}$-1,2,3,7,8-PeCDD	25-181
$^{13}C_{12}$-1,2,3,7,8-PeCDF	24-185
$^{13}C_{12}$-2,3,4,7,8-PeCDF	21-178
$^{13}C_{12}$-1,2,3,4,7,8-HxCDD	32-141
$^{13}C_{12}$-1,2,3,6,7,8-HxCDD	28-130
$^{13}C_{12}$-1,2,3,4,7,8-HxCDF	26-152
$^{13}C_{12}$-1,2,3,6,7,8-HxCDF	26-123
$^{13}C_{12}$-1,2,3,7,8,9-HxCDF	29-147
$^{13}C_{12}$-2,3,4,6,7,8-HxCDF	28-136
$^{13}C_{12}$-1,2,3,4,6,7,8-HpCDD	23-140
$^{13}C_{12}$-1,2,3,4,6,7,8-HpCDF	28-143
$^{13}C_{12}$-1,2,3,4,7,8,9-HpCDF	26-138
$^{13}C_{12}$-OCDD	17-157
$^{37}Cl_{4}$-2,3,7,8-TCDD	35-197