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TECHNICAL MEMORANDUM

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To: Linda Kiefer, U.S. Environmental Protection Agency (USEPA) and Dustin McNeil (CDPHE)

Cc: Sarah Teschner, Colleen Brisnehan, Steve Richtel, Dave Wilmoth, Tim Shangraw Paul Rosasco, Steven Fundingsland, Lyn Brill, Chris Carlson

From: Dan Griffiths and Lyn Brill (Parsons)

Subject: Statistical Analysis of Acetone Detections in Groundwater Samples 2016 through 2020

Statistical analyses were conducted on acetone detects in groundwater samples and associated quality assurance blanks (e.g., trip blanks, method blanks, and equipment blanks) collected during the last 5 years of groundwater sampling at Lowry Landfill. A five year time window of analytical data was selected to provide good statistical significance while keeping to recently collected data that reasonably represents near term site conditions. Acetone, as well as a number of other commonly used solvents, is a common laboratory contaminant and appears in environmental datasets as low concentration false positive detects (United States Environmental Protection Agency [USEPA], 2014). The identification of these false positive lab contaminant related detects is one of the primary purposes of the data validation process. Data quality assessment, or validation, is defined by USEPA as "*the process of evaluating the extent to which a dataset satisfies a projects objectives*" and data quality for "*projects such as long term groundwater monitoring may simply require that the data be of reasonable quality since data trends are well understood from previous monitoring events and groundwater contaminant concentrations typically don't change significantly over short time intervals*" (USEPA, 2014). Thus, the primary objectives of this exercise were to:

- Assess and document the validated acetone detection frequency in environmental groundwater samples and quality assurance samples (trip blanks, laboratory method blanks, and field equipment blanks) over the last five years (datasets from 2016, 2017, 2018, 2019, and 2020).
- Evaluate acetone detection frequency trends over time with respect to quality assurance improvements and bottle preservative product changes undertaken by the laboratory.

During the standard validation process ten percent of compliance samples are validated in accordance with the sitewide Groundwater Monitoring Plan, Revision 2 (EMSI/Parsons, 2018), approved by the USEPA on September 6, 2018. Due to inquiries about acetone detections, Parsons validated all groundwater acetone results from the last five years to determine the efficacy of the results. The acetone data collected from 2016 through 2020 was fully validated and "U" qualifiers were applied to indicate when a detect is associated with blank contamination and is therefore not a "true" detection at a concentration in excess of the reporting limit. The unqualified acetone detection frequency was determined in each yearly dataset. The number of samples collected and the number of samples of each type of blank are presented below. The unqualified acetone detection frequency in groundwater samples and frequency of detects in quality assurance samples are also presented by year in the table below.

During calendar years 2016, 2017, and 2018 the validated acetone detection frequency in groundwater samples was approximately nine to ten percent. This relatively high validated acetone detection frequency was mirrored in the quality assurance trip blanks, method blanks, and equipment blanks. Each blank is defined below.

- Method blanks are designed to measure laboratory-introduced contamination of environmental samples and verify that method interferences caused by airborne contaminants, solvents, reagents, glassware, or other sample processing hardware are measured. The method/reagent blank is processed through all procedures, materials, and labware used for sample preparation and analysis.
- The trip blank is used to indicate potential contamination by volatile organic compounds (VOCs) during sample shipping and handling. A trip blank consists of hydrochloric acid preserved laboratory reagent water (ASTM Type II or equivalent) in a 40-ml glass vial sealed with a Teflon® septum. The blank accompanies the sample bottles to the field and is placed in each cooler containing VOC samples returning to the laboratory for analysis.
- Equipment rinseate blanks consist of ASTM Type II water (or equivalent) poured into or pumped through a re-usable sampling device following decontamination and before sample collection. The rinseate is transferred to an appropriate pre-preserved VOC vial and transported to the laboratory for analysis.

During 2018 validated acetone detection frequencies in quality assurance trip blank and lab blank samples were higher than 2016 and 2017. An investigation was launched by the laboratory at the request of the WSDs. The laboratory determined that the VOC vials provided by the laboratory contained a preservative that was contaminated with acetone. The corrective action taken as a result of this investigative finding was to replace the sample bottle vendor. In addition, minor procedural changes to laboratory instrument decontamination procedures were implemented to improve laboratory performance and further reduce the frequency of acetone detects. Consequently, the validated acetone detection frequencies in environmental samples in 2019 (5%) and 2020 (1%) and in quality assurance samples were significantly lower than those between 2016 and 2018. In 2020, there was only one acetone detection (validated but not qualified) in 102 groundwater samples and only two acetone detections in 130 quality assurance samples.

	Groundwater Samples			Quality Assurance Samples					
				Trip Blanks		Method Blanks		Equipment Blanks	
Year	Total # Samples	Validated Acetone Detects	Validated Detection Frequency	Trip Blanks	Acetone Detection Frequency	Method Blanks	Acetone Detection Frequency	Equipment Blanks	Acetone Detection Frequency
2016	99	10	10%	50	12%	52	6%	5	40%
2017	103	9	9%	59	17%	63	6%	6	50%
2018	302	28	9%	110	37%	128	8%	8	12%
2019	151	7	5%	90	4%	94	4%	5	0%
2020	102	1	1%	58	3%	70	0%	2	0%

Notes:

1) 2018 trip blank contamination was caused by acetone contamination in the hydrochloric acid bottle preservative. The lab took corrective action and changed to new supplier of acid preserved bottles.

2) Equipment blanks are performed when a well has no dedicated bailer or pump and decontaminated sampling equipment is used.

Within the entire 5-year dataset there were a total of 55 validated acetone detections in 757 groundwater samples, a detection frequency of 7.3% overall. The average detected acetone concentration across the entire dataset was 8.3 ug/L which is orders of magnitude lower than the groundwater performance standard of 1,600 ug/L. Based upon this low validated acetone detection frequency, particularly in recent years, it can be concluded that laboratory contamination of site samples is not a significant concern and that the Lowry Landfill analytical datasets are of high quality. It can be further concluded that the presence of an acetone source associated with Lowry Landfill is unlikely based upon the low acetone detection frequency, the low concentrations of the few validated acetone detects that are

present in the recent analytical datasets (Attachment A) and the lack of detection reproducibility at wells where acetone was detected.

It should be noted that the laboratory applies qualifiers to lab samples only during internal quality assurance review prior to the delivery of data and prior to data validation. During this quality assurance review the "b" flag that appears in the laboratory data may be added and is related to acetone detections in the method blanks only and does not reflect the contamination contributed by field blanks (trip and equipment blanks). The results of validation of the acetone detections reflect field blank contamination and revealed that a significant portion of the detections (up to 75%) were associated with this contamination. It should also be noted that a common lab contaminant will not be present in all samples. Common lab contaminants are prevalent but not universal.

References

EMSI/Parsons, 2018. Groundwater Monitoring Plan, Revision 2, Lowry Landfill Superfund Site, August 16.

USEPA, 2014. Laboratory Data Review for the Non-Chemist. October.

Attachment A

Validated Acetone Detects in Groundwater

2016 - 2020

ATTACHMENT A
SUMMARY OF VALIDATED ACETONE DETECTS 2016 THROUGH 2020

Sample Date	Well ID	Parameter Name	Result	Final Qualifier	Units	Reporting Limit	Method Detection Limit	Lab Flag	Validation Flag	MB	TB	EB
4/19/2016	MW74-WD	Acetone	3.5	J	ug/L	10	1.9	J		ND	ND	
4/27/2016	NEPZ-101	Acetone	3.8	J	ug/L	10	1.9	J	J	ND	ND	ND
5/3/2016	MW135-WD	Acetone	3.7	J	ug/L	10	1.9	J	J	ND	ND	
5/4/2016	NEPZ-103	Acetone	1.9	J	ug/L	10	1.9	J	J	ND	ND	ND
5/12/2016	MW108-WD	Acetone	6.6	J	ug/L	10	1.9	J		ND	ND	
5/12/2016	MW60-WD	Acetone	5.6	J	ug/L	10	1.9	J		ND	ND	
5/12/2016	U-518R-WD	Acetone	6.2	J	ug/L	10	1.9	J		ND	ND	
11/3/2016	B-326-WD	Acetone	3.1	J	ug/L	10	1.9	J		ND	ND	
11/8/2016	MW23-UPPER-C	Acetone	2.3	J	ug/L	10	1.9	J		ND	ND	
12/27/2016	MNA-01	Acetone	9.8	J	ug/L	40	7.6	J		ND	ND	
4/24/2017	MW77-WD	Acetone	4.0	J	ug/L	10	1.9	J	J	ND	ND	
4/27/2017	GW-106	Acetone	4.4	J	ug/L	10	1.9	J		ND	ND	
4/27/2017	U-518R-WD	Acetone	2.8	J	ug/L	10	1.9	J		ND	ND	
5/23/2017	MW101-WD	Acetone	2.3	J	ug/L	10	1.9	J	J	ND	ND	
7/24/2017	MW90-UD	Acetone	4.0	J	ug/L	10	1.9	J		ND	ND	
7/24/2017	MW91-UD	Acetone	4.5	J	ug/L	10	1.9	J		ND	ND	
10/19/2017	U-518R-WD	Acetone	3.7	J	ug/L	10	1.9	J	J	ND	ND	
10/26/2017	MW77-WD	Acetone	2.2	J	ug/L	10	1.9	J		ND	ND	
10/31/2017	B-326-WD	Acetone	7.4	J	ug/L	10	1.9	J		ND	ND	
3/19/2018	MW176-DEN	Acetone	3.8	J	ug/L	10	1.9	J		ND	ND	
4/19/2018	MW176-DEN	Acetone	30		ug/L	10	1.9			ND	ND	
4/23/2018	BM-15N6	Acetone	4.6	J	ug/L	10	1.9	J		ND	ND	
4/23/2018	MW60-WD	Acetone	2.0	J	ug/L	10	1.9	J		ND	ND	
5/10/2018	MW105-WD	Acetone	2.9	J	ug/L	10	1.9	J		ND	ND	
5/10/2018	MW62-WDR	Acetone	3.6	J	ug/L	10	1.9	J		ND	ND	
6/26/2018	B-311	Acetone	14		ug/L	10	1.9			ND	ND	
6/27/2018	PTP-25	Acetone	3.7	J	ug/L	10	1.9	J		ND	ND	
7/27/2018	PTP-26	Acetone	3.0	J	ug/L	10	1.9	J		ND	ND	
8/6/2018	B-313-UD	Acetone	5.6	J	ug/L	10	1.9	J		ND	ND	
8/21/2018	GW-108A	Acetone	3.1	J	ug/L	10	1.9	J *		ND	ND	
9/12/2018	MW76-WD	Acetone	4.9	J	ug/L	10	1.9	J		ND	ND	
9/21/2018	PTP-11	Acetone	11		ug/L	10	1.9			ND	ND	
9/24/2018	MW104-WD	Acetone	8.4	J	ug/L	10	1.9	J		ND	ND	
9/24/2018	MW108-WD	Acetone	5.5	J	ug/L	10	1.9	J		ND	ND	
9/24/2018	MW115-WD	Acetone	7.7	J	ug/L	10	1.9	J		ND	ND	
9/24/2018	PM-6X-UD	Acetone	5.6	J	ug/L	10	1.9	J		ND	ND	
10/10/2018	MW120-WD	Acetone	2.4	J	ug/L	10	1.9	J		ND	ND	
10/10/2018	MW141-WD	Acetone	5.5	J	ug/L	10	1.9	J		ND	ND	
10/10/2018	MW144-WD	Acetone	4.2	J	ug/L	10	1.9	J		ND	ND	
10/15/2018	MW105-WD	Acetone	4.1	J	ug/L	10	1.9	J		ND	ND	
10/16/2018	PM-6X	Acetone	2.1	J	ug/L	10	1.9	J		ND	ND	
10/26/2018	BM-11I-100N	Acetone	2.1	J	ug/L	10	1.9	J		ND	ND	
10/30/2018	B-317	Acetone	7.3	J	ug/L	10	1.9	J		ND	ND	
11/2/2018	MW46-WD	Acetone	6.3	J	ug/L	10	1.9	J		ND	ND	
11/6/2018	PM-10I	Acetone	7.0	J	ug/L	10	1.9	J		ND	ND	
11/30/2018	B-317	Acetone	10		ug/L	10	1.9			ND	ND	
11/30/2018	PTP-25	Acetone	5.2	J	ug/L	10	1.9	J	J	ND	ND	
2/7/2019	B-317	Acetone	7.8	J	ug/L	10	1.9	J		ND	ND	
2/19/2019	MW178-UDEN	Acetone	2.0	J	ug/L	10	1.9	J	J	ND	ND	
5/2/2019	MW176-UDEN	Acetone	12		ug/L	10	1.9			ND	ND	
5/15/2019	B-317	Acetone	3.3	J	ug/L	10	1.9	J		ND	ND	
5/17/2019	MW170-EW-1	Acetone	4.1	J	ug/L	10	1.9	J		ND	ND	
12/17/2019	GW-106	Acetone	270		ug/L	10	1.9			ND	ND	

ATTACHMENT A
SUMMARY OF VALIDATED ACETONE DETECTS 2016 THROUGH 2020

Sample Date	Well ID	Parameter Name	Result	Final Qualifier	Units	Reporting Limit	Method Detection Limit	Lab Flag	Validation Flag	MB	TB	EB
12/17/2019	MW62-WDR	Acetone	95		ug/L	10	1.9			ND	ND	
6/1/2020	GW-109	Acetone	3.0	J	ug/L	10	1.9	J		ND	ND	

Notes:

1) MB = Method blank

1) TB = Trip blank

1) EQB = Equipment blank

4) J-flag indicates that acetone was detected at a concentration above the method detection limit but below the reporting limit and as a result the detected concentration is estimated.