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Office of the Auditor General

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Doug A. Ringler, CPA, CIA
Auditor General

February 17, 2016

The Honorable Jim Ananich
Senate Minority Leader
State Capitol, Room S-105
Lansing, Michigan

Dear Senator Ananich:

Enclosed are answers to the follow-up questions from your January 8, 2016 letter regarding our audit of the Office of Drinking Water and Municipal Assistance (ODWMA), Department of Environmental Quality (DEQ), specific to lead contamination in the City of Flint's drinking water. Also enclosed are two exhibits:

- Sample results for the two 6-month monitoring periods.
- Analysis of samples by zip code.

We appreciate the opportunity to assist you in answering questions regarding this topic. If you have further questions or a request for other services, please do not hesitate to contact our office.

Sincerely,

Doug Ringler
Auditor General

Enclosures



Auditor's Comment: For Questions 4, 6, 7, 8, 16, 17, 18, 33, 34, and 35, our review focused on DEQ's application of the Lead and Copper Rule (LCR) and operating practices related to oversight of the City of Flint Water Treatment Plant (Flint WTP) on LCR-related reporting. We did not review the application of laws, rules, and regulations by the Flint WTP because we were not able to independently verify the Flint WTP's actions. Doing so is outside of the Office of the Auditor General's constitutional and statutory authorities.

Q1: In the December 2014 Lead and Copper Report, what population was listed? Where was that population figure obtained? How many samples were listed as required?

A: For the 6-month monitoring period ended December 31, 2014, the population line in the Lead and Copper Report was left blank by the Flint WTP. However, DEQ informed us that the Flint WTP used the 2010 U.S. Census population of 102,400. The Lead and Copper Report included 100 sample items, which was the appropriate number based on LCR requirements for populations greater than 100,000.

Q2: What data should localities and the DEQ use to assess a water system's size?

A: Both the LCR and the Michigan Safe Drinking Water Act state that the size of a water system (also referred to as a water supply) is determined by the number of people the system "serves." The LCR and the Michigan Safe Drinking Water Act are silent as to how the number of people served should be determined. DEQ's operating practice is to work with each public water system to determine the population served, which could be obtained from various sources of city, State, or federal data.

Our audit report on ODWMA will contain recommendations related to ODWMA's operating practices for determining populations to be sampled.

Q3: How often or under what circumstances should a water system's population size be reevaluated? Are there any formal requirements under the LCR or other applicable law that dictate how population changes should be handled?

A: The LCR is silent on reevaluation of water system size. DEQ's operating practice is to work with the individual public water systems to determine the most accurate population. For the 6-month monitoring period ended December 31, 2014, the Flint WTP used the 2010 Census population of 102,400. For the second 6-month monitoring period ended June 30, 2015, the Flint WTP initially used the 2010 Census population of 102,400; however, during the monitoring period, DEQ became aware that the estimated 2014 U.S. Census population was 99,002 and reduced the required sample size from 100 to 60.

Q4: Were the City of Flint and DEQ in compliance with all laws, rules and regulations with respect to establishing the population size of Flint's community water supply and conducting sampling to test that water supply?

A: See Auditor's Comment preceding Question 1.

Neither the LCR nor the Michigan Safe Drinking Water Act mention allowable sources for determining population size. Therefore, it appears reasonable that the Flint WTP and DEQ used a third party source, such as the U.S. Census, to establish the population size for the Flint WTP. We are unaware of any other laws, rules, or regulations related to establishing population size.

Q5: Aside from the requirement to choose tier 1 sample sites, are there additional requirements for sample site selection? Must subsequent rounds of LCR testing be conducted at the same locations as prior rounds?

A: The only sample site selection criteria specified in the LCR is the use of tier 1 sample sites. The LCR requires that each water system complete a materials evaluation of its distribution system to identify a pool of targeted sampling sites. If a population does not have sufficient tier 1 sample sites, the LCR directs the water system to select tier 2 sites. Because of Flint's large population and the number of older residences, sufficient tier 1 sample sites existed in Flint; therefore, tier 2 or 3 selection was not necessary. The LCR has no additional requirements for sample site selection beyond the tier criteria.

Title 40, Part 141, section 86 of the *Code of Federal Regulations (CFR)* states that subsequent rounds of LCR testing should be conducted at the same locations as prior rounds. If this is not possible, other tier 1 sites should be selected within reasonable proximity of the initial sample sites. The Flint WTP would be responsible for ensuring that the initial sample locations were used in subsequent rounds of testing. The Flint WTP reported on 13 repeat sample sites in the 6-month monitoring period ended June 30, 2015. DEQ informed us that, because these are voluntary samples, it is possible that residents received sample kits in both monitoring periods but did not complete the tests in the second round of 6-month monitoring ended June 30, 2015. Neither DEQ nor the Flint WTP has enforcement authority to ensure that residents submit the samples. The Flint WTP selects the sample sites for testing, distributes testing materials, and submits the water samples to State-owned laboratories for testing. DEQ does not monitor the Flint WTP for compliance with LCR requirements related to subsequent rounds of testing to ensure that the Flint WTP attempted to collect water from the same sample locations.

Our audit report on ODWMA will contain recommendations related to increasing the State's role in the certification of tier 1 sites.

Q6: Did Flint follow all requirements with sample site selection for both the initial round of testing and subsequent rounds of testing?

A: See Auditor's Comment preceding Question 1.

DEQ did not monitor the Flint WTP's compliance with requirements for sample site selection for the initial and subsequent rounds of testing aside from the certification at the end of each 6-month monitoring period.

Our audit report on ODWMA will contain recommendations related to monitoring sample site selection.

Q7: How did Flint choose sample sites for each round of testing?

A: See Auditor's Comment preceding Question 1.

DEQ did not monitor the Flint WTP's selection of sample sites aside from the certification at the end of each 6-month monitoring period.

Q8: What testing materials (e.g., water receptacles, instruction sheets, etc.) did Flint distribute to testing locations? How and why were those materials chosen? Were there any changes made in testing materials between rounds of testing? If so, what changes were made and why?

A: See Auditor's Comment preceding Question 1.

We are unaware of the materials distributed by the Flint WTP; however, DEQ stated that instructions and sample kits are distributed to the sample sites. DEQ's Web site contains an example of instructions that the Flint WTP can utilize. DEQ informed us that the State-owned laboratories would dictate the materials necessary for sample collection.

Our audit report on ODWMA will contain additional information related to water sampling instructions.

Q9: When you concluded that there is no reason to believe the DEQ willfully misrepresented information to the EPA, was that conclusion based entirely on evidence obtained through email exchanges? Was any additional evidence evaluated or any interviews conducted to support this conclusion? If so, what additional factors did you evaluate when coming to this conclusion?

A: Our conclusion was primarily based on our review of DEQ e-mail exchanges; however, we also conducted interviews with key ODWMA personnel. No definitive evidence of intentional misrepresentation to the U.S. Environmental Protection Agency (EPA) came to our attention.

Q10: For the water treatment industry, are there standard definitions for "corrosion control treatment" and "corrosion control program"? Among experts in the industry, are those terms widely understood to have different meanings?

A: Federal regulation 40 *CFR* 141.2 defines the corrosion control treatment requirements outlined in federal regulation 40 *CFR* 141.80. Optimal corrosion control treatment is defined as corrosion control treatment that minimizes the lead and copper concentrations at users' taps while ensuring that the treatment does not cause the water system to violate any national primary drinking water regulations.

After reviewing federal regulation 40 *CFR* 141.2, we determined that there is not a standard definition for "corrosion control program." Federal regulation 40 *CFR* 141.81 indicates the applicability of corrosion control treatment for small, medium, and large water systems and outlines the corrosion control treatment steps needed for a water system to determine that the system is optimized. Federal regulation 40 *CFR* 141.81(a)(1) indicates that large

systems shall complete the steps under federal regulation 40 *CFR* 141.81(b)(2) or 40 *CFR* 141.81(b)(3). Based on DEQ's interpretation, it followed federal regulation 40 *CFR* 141.81(b)(3), which states that a water system is deemed to be optimized if it submits results of tap water monitoring for two consecutive 6-month monitoring periods of less than 5 parts per billion (ppb).

In our meetings with DEQ personnel, there was no indication that they were trying to be deceptive in using the term "program" instead of "treatment."

Q11: What specific "key issues" "related to the Flint situation" were escalated up the chain of command?

Q12: Was each issue escalated in a timely fashion?

Q13: How was each issue handled by superiors once escalated?

A: In regard to Questions 11 through 13, our review of DEQ e-mails indicated that management (DEQ Director, DEQ Deputy Director, Field Operations Section Manager, and Lansing District Manager) was included on e-mails related to boil water advisories, monitoring period results, responses to inquiries, and press requests regarding water concerns. We cannot accurately speak to any meetings or discussions that may have arisen from these e-mails, the timeliness of management responses, or how the issue was handled because an audit trail does not always exist.

We can give an example of an escalation that occurred: when the total coliform violation occurred in August 2014, an analyst in the Lansing district office notified DEQ management and the Flint WTP within 3 days of being informed of the violation that a boil water advisory was needed per *Michigan Compiled Law* requirements.

Q14: Did anyone in the DEQ express concern when 90th percentile lead results rose from 6 ppb in December 2014 to 11 ppb in June of 2015? Was this increase in lead level escalated to the attention of management? What actions, if any, were taken in response?

A: In an August 17, 2015 letter to the Flint WTP, DEQ requested that the Flint WTP determine a plan for optimizing corrosion control within 6 months in accordance with LCR-required time frames. DEQ went beyond LCR requirements by requesting that the Flint WTP begin adding phosphate treatment as soon as possible to address the ongoing concerns by customers regarding lead levels.

Our audit report on ODWMA will contain observations related to the potential for analysis of results beyond the 90th percentile.

See Exhibit #1 for sample results from the two 6-month monitoring periods.

Q15: At what point must DEQ staff alert local officials about drinking water issues in a municipality? Did anyone in the DEQ alert any Flint officials outside the Flint WTP (local, state, or federal) about potential lead or other water quality issues?

A: The LCR does not require DEQ to notify local officials when the 90th percentile results are below the action level of 15 ppb.

We are unaware of any notification of Flint officials outside the Flint WTP about potential lead or water quality issues. DEQ does inform the EPA on a quarterly basis of all lead sampling results. DEQ indicated that it provided the first round of 6-month monitoring ended December 31, 2014 to the EPA on March 25, 2015. It supplied the second round of 6-month monitoring ended June 30, 2015 to the EPA on November 24, 2015.

- Q16: Who at the Flint WTP was responsible for negotiating with the Detroit Water and Sewerage Department (DWSD) to maintain DWSD as Flint's water supplier?**
- Q17: Was the primary negotiator given final authority to accept or reject potential deals with the DWSD? If not, who had this final authority?**
- Q18: What were the primary objectives of the person or persons negotiating with the DWSD? For Flint, what terms were necessary in order to continue using the DWSD as a water supplier?**

A: See Auditor's Comment preceding Question 1.

In regard to Questions 16 through 18, DEQ indicated that the responsibility for negotiating with the DWSD was between the City of Flint, the Flint WTP, and DWSD. DEQ was utilized in an advisory capacity only during the initial conversations on switching water sources from DWSD to Karegnondi Water Authority (KWA).

- Q19: Since the promulgation of the LCR, has any Michigan locality switched to a new water source using a new water system? Specifically, have any other localities made changes analogous to Flint's switch from DWSD water to processing water from the Flint River in the Flint WTP? If so, how did DEQ apply the LCR in those cases? Were localities required to use some corrosion control treatment from the outset of the change?**

A: Since the promulgation of the LCR, there have not been any large water systems that switched to a new water source using a new water treatment plant.

However, we identified two examples of small and medium water systems that switched to a new water source: Benton Harbor (prior to the Flint water switch) and Bay City (after the Flint water switch). Requirements for small and medium water systems are different from large system requirements. A key difference is the point at which a system is considered optimized, which determines when corrosion control treatment is needed. Small and medium water systems are considered to have optimized corrosion control if the 90th percentile results of two 6-month monitoring periods show lead levels of 15 ppb or less. Large water systems are considered to have optimized corrosion control if the 90th percentile results of two 6-month monitoring periods show lead levels of 5 ppb or less.

- Q20: Did DEQ staffers mistakenly apply LCR standards for a smaller water system, or did DEQ staffers believe that the LCR allowed a phase-in window during which corrosion control treatment was unnecessary? Why has the DEQ given two different explanations?**

A: The LCR provides different rules and regulations for small, medium, and large water systems. The size of the system is based on the number of individuals

served by the water system. DEQ did not apply the standards of a small or medium water system. DEQ believed that it was appropriately applying the standards of a large water system with a change in water source using a new water treatment plant. DEQ executed a plan assuming that performing the two 6-month monitoring samples was the appropriate application of the LCR. This determination was later clarified by the EPA in the November 3, 2015 letter, which indicated that there were multiple possible interpretations of corrosion control requirements and that corrosion control should be maintained for future applications.

Q21: How did the DEQ find out that one site was a business and that another had a point-of-entry treatment device to filter contaminants? Was this information sought for any samples that were below the lead action level (and therefore would not have had the effect of depressing the 90th percentile calculation)?

A: In the second round of 6-month monitoring ended June 30, 2015, the Flint WTP submitted a cover letter identifying 69 sample sites and sample results for 71 sites. DEQ noticed the inconsistency and contacted the Flint WTP at which time DEQ determined that one site was a business and one site had a point-of-entry treatment device. DEQ determined that these two sites were appropriate to exclude. This decision was made without consideration for the lead scores of the two locations.

DEQ does not normally verify that the sample sites selected by the Flint WTP met tier 1 criteria. DEQ relies on the certification, submitted by the Flint WTP at the end of each 6-month monitoring period, that the samples submitted are valid tier 1 sites. However, once DEQ learned that there was a possibility that all sites were not tier 1, it formally requested, in a letter dated November 9, 2015, that Flint validate that the sample population sites met the tier 1 requirements.

Our audit report on ODWMA will have recommendations that address sample site certification and reevaluation of the 90th percentile calculation.

Q22: Did the DEQ put their rationale for dropping those two samples in writing? Can that information be readily accessed by the public?

A: According to the LCR, the State may invalidate a water sample if it determines that the sample was taken from a site that did not meet the appropriate site selection criteria. An invalidated sample item does not count in the determination of 90th percentile lead levels or toward the minimum monitoring requirements. The LCR states that, to invalidate a sample, the decision and rationale must be documented in writing. However, the LCR does not indicate the extent of the documentation or if it should be made available to the public. DEQ personnel documented on the laboratory results for the two sites in question that the sites were invalid because one was a business and one used a point-of-entry device.

Q23: The LCR and related Michigan rules require the establishment of a sampling pool. Given that no sampling pool was established, is the invalidation of samples under 40 CFR 141.86(a) proper?

A: The intention of the sample site pool is to ensure that only appropriate tier 1 sites are included. Because the two excluded sites did not meet tier 1

criteria, removing the items was appropriate and necessary for compliance with the LCR.

Q24: According to Michigan's guidance on LCR implementation, given that Flint WTP did not properly identify a sample pool by tier preferences, is invalidation based on the existence of a POE device proper?

A: Although a sample pool was not formally established prior to the two rounds of 6-month monitoring, the intention of a sample site pool is to ensure that only tier 1 (highest risk for lead contamination) samples are included and sites that are not representative of water system customer are excluded, such as sites with point-of-entry or point-of-use devices. It is appropriate and necessary for compliance with the LCR to invalidate such samples from the 90th percentile calculation to ensure that the results are representative of the Flint WTP customers who are at highest risk for lead contamination.

Q25: Although federal rules allow for invalidating samples with POE or POU devices, the purpose of those rules is to prevent artificially low test results. Given that the sample rejected because of a POE device had a lead level of 104 ppb, was invalidation proper?

A: The goal of the testing is to provide lead results representative of the Flint WTP water customers who are at highest risk for lead contamination. Therefore, including results that are artificially low or high would misrepresent the lead levels of Flint WTP high-risk customers. This 90th percentile score is used, if needed, by the WTP for determining a corrosion control optimization plan.

DEQ informed us that the Flint WTP and the EPA investigated the results of the sample site with the point-of-entry device and determined that the lead level of 104 ppb was unique to that residence because of a long lead service line. Neighboring residences were tested and found not to have high lead levels. The City of Flint worked with the EPA to replace the water lines of that residence.

Our audit report on ODWMA includes observations regarding improvements to the LCR regarding the 90th percentile calculations.

Q26: How did Flint decide to include the preflush instruction in their methodology? What factors did they consider? What was their objective?

A: DEQ established an example of sampling instructions for WTPs to use when collecting samples. The instruction to flush the tap the night before first draw was not unique to the Flint WTP and was used throughout the State. The instructions stated: "Flush the COLD water for at least 5 minutes. Let the water sit for at least 6 hours **before** you plan to collect the sample. . . . DO NOT use this faucet again until it is sampled." DEQ indicated that it had implemented the flush procedure to ensure that water was not overly stagnant, which would not be representative of a customer's normal daily water usage.

- Q27: A number of industry experts argue that preflushing deceptively lowers lead levels. Did Flint WTP or the DEQ consider this when deciding to use or allow Flint's sampling methodology?**
- A: We did not identify any e-mails or discussions that caused us to believe that DEQ was attempting to be deceptive by establishing the requirement for flushing the tap the night before first draw.
- An argument could be made that the guidance for flushing the tap the night before a draw helped to ensure that overstagnation did not occur.
- Q28: What do industry best practices dictate with respect to preflushing for LCR sampling purposes?**
- A: We are not aware of any industry best practices with respect to flushing. However, we identified at least eight other states that included the requirement to flush in their instructions to residents.
- Q29: There are a number of clusters of sampling sites on the map in both 2014 and 2015. (The cluster sites are even closer to one another than Exhibit #1 demonstrates because of the size of the dots used on the map.) Are such clusters methodologically appropriate? Why did Flint choose to cluster its sample sites? Did anyone at the DEQ notice site clustering? What discussions and actions ensued as a result?**
- A: The only requirement for sample selection is that a site meet the requirement of being a tier 1 sample site. Flint has sufficient tier 1 sample locations available; therefore, the remaining requirements for sampling tier 2 and tier 3 sites were not applicable. Clusters can be appropriate as high-risk residences could be located in the same neighborhood.
- DEQ did not map the sample sites noted in Exhibits #1 and #2 of our December 23, 2015 response to your questions. Therefore, DEQ did not identify site-clustering or have any discussions on the appropriateness of the clustering.
- Q30: Was every address listed as a sample site verified as a legitimate house address?**
- A: DEQ does not validate that each sample site is a legitimate house address. DEQ relies on the Flint WTP's confirmation that all sample sites are valid tier 1 sites.
- Q31: Approximately 14 sample site locations were repeated in 2014 and 2015. Does the LCR require repeated sampling of site locations? If so, why were so many 2014 sample sites not tested in 2015?**
- A: See answer to Question 5.
- Q32: Did the DEQ or Flint WTP map sampling sites in order to ensure appropriate testing coverage of the city? What were the discussions with regard to these maps?**
- A: See answer to Question 29.

Q33: The number of samples at 5 ppb or higher increased between 2014 and 2015, despite the fact that fewer overall samples were collected in 2015. Was there any discussion within the DEQ or Flint WTP about this increase? Was anyone in either office alarmed?

A: DEQ did not perform a review of individual residences over 5 ppb. DEQ indicated that the Flint WTP notifies all residents of the results of their lead testing regardless of whether the results exceed 5 ppb. See Auditor's Comment preceding Question 1 regarding any discussions that the Flint WTP may have had.

When the second round of 6-month samples ended June 30, 2015 were available, DEQ determined that there was a need for corrosion control treatment and began drafting the letter to the Flint WTP to require it to establish a plan to optimize corrosion control.

Q34: Did the DEQ or Flint WTP attempt to map lead level results in order to determine patterns of high lead levels? If so, were concerns expressed about any areas with particularly high lead levels? Were any potential action items discussed?

A: DEQ did not map lead level results to determine patterns of high lead levels. DEQ is not aware of any mapping of lead level results by the Flint WTP. See Auditor's Comment preceding Question 1.

Q35: Presumably Flint WTP attempted to gather samples from a number of homes throughout the city that were nonresponsive. Analysis of total attempts, responses and non-responses by zip code might also be helpful. Would such an analysis be possible?

A: DEQ does not obtain this information as part of the LCR monitoring. Therefore, this information, if maintained, would be located at the Flint WTP. See Auditor's Comment preceding Question 1.

Q36: A side-by-side analysis of samples by zip code in July - December 2014 versus January - June 2015 might be helpful. Would such an analysis be possible?

A: Yes. See Exhibit #2.

Q37: What events precipitated DWSD offering to waive the reconnection fee in January 2015?

Q38: Why did Flint's Emergency Manager at the time reject the offer?

A: Our review of DEQ e-mails and other documentation did not provide any insight into Questions 37 and 38.

Q39: What events precipitated the July 21, 2015 conference call between the EPA and DEQ?

A: A June 30, 2015 e-mail from the EPA Region 5 Water Division director to the ODWMA director referred to discussions that occurred during a semi-annual call on June 10 with EPA Region 5 staff regarding DEQ's implementation of the LCR and the status of Flint. That e-mail indicated that

the Region was concerned about the lead situation in Flint and suggested additional assistance could be provided to Flint's Advisory Committee. The EPA Region 5 Water Division director noted that Flint was finishing its second set of 6-month monitoring and stated that she had scheduled a call with the ODWMA director on July 21 to discuss the situation in more detail. The e-mail also indicated that the EPA had collected samples in Flint and was preparing a report summarizing the visits and findings.



July 2014 through December 2014

Total sample items: 100

Number of samples with 5 ppb or greater: 17 (17%)

Number of samples with 15 ppb or greater: 2 (2%)

90th percentile sample number: 90

90th percentile lead level: 6

January 2015 through June 2015

Total sample items: 69

Number of samples with 5 ppb or greater: 28 (41%)

Number of samples with 15 ppb or greater: 6 (9%)

90th percentile sample number: 62

90th percentile lead level: 11

Sample Number	Lead Count ppb
1 - 37	0
38 - 49	1
50 - 67	2
68 - 73	3
74 - 83	4
84	5
85	5
86	5
87	5
88	5
89	5
90	6
91	6
92	6
93	7
94	8
95	9
96	9
97	10
98	10
99	23
100	37

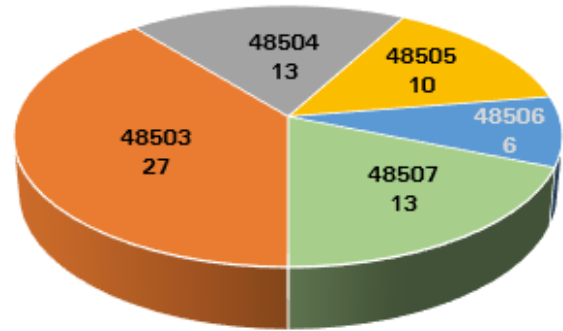
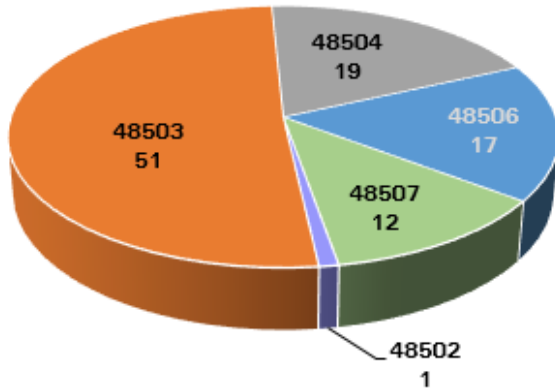
Sample Number	Lead Count ppb
1 - 13	0
14 - 17	1
18 - 28	2
29 - 39	3
40 - 41	4
42	5
43	5
44	5
45	5
46	5
47	5
48	5
49	5
50	6
51	6
52	6
53	6
54	7
55	7
56	7
57	8
58	8
59	9
60	10
61	10
62	11
63	13
64	18
65	21
66	22
67	29
68	42
69	42

Source: The Office of the Auditor General prepared this exhibit using data obtained from DEQ.



July 2014 through December 2014

January 2015 through June 2015



	Number of Samples Taken						
	48502	48503	48504	48505	48506	48507	48532
July 2014	0	0	0	0	0	0	0
August 2014	0	0	0	0	0	0	0
September 2014	0	0	0	0	0	0	0
October 2014	0	0	0	0	0	0	0
November 2014	0	1	1	0	2	2	0
December 2014	1	50	18	0	15	10	0
	<u>1</u>	<u>51</u>	<u>19</u>	<u>0</u>	<u>17</u>	<u>12</u>	<u>0</u>
January 2015	0	0	0	0	0	0	0
February 2015	0	0	3 (1)	0	0	0	0
March 2015	0	8	0	2	0	3	0
April 2015	0	2	0	1	0	3	0
May 2015	0	1	0	6	0	3	0
June 2015	0	16 (4)	10 (2)	1	6 (3)	4 (3)	0
	<u>0</u>	<u>27</u>	<u>13</u>	<u>10</u>	<u>6</u>	<u>13</u>	<u>0</u>
Total	<u>1</u>	<u>78</u>	<u>32</u>	<u>10</u>	<u>23</u>	<u>25</u>	<u>0</u>

Note: Numbers in parentheses indicate the number of repeat samples (13 total). In our December 23, 2015 letter to you, Exhibit #1 identified 5 samples taken in 2014 and 2015 (repeat samples) for zip code 48503. However, we have since determined that one of the sample locations was sampled twice in the same sample period (March 2015 and May 2015) and should not have been counted as a sample taken in 2014.

Source: The Office of the Auditor General prepared this exhibit using data obtained from DEQ.