



TOWN OF SHREWSBURY

SHREWSBURY, MASSACHUSETTS 01545-5398

Richard D. Carney Municipal Office Building

100 Maple Avenue

Shrewsbury, Massachusetts 01545-5398

March 8, 2019

To: Kevin Mizikar, Town Manager

From: Robert Tozeski, Superintendent Water & Sewer

Re: Hexavalent Chromium Mitigation Efforts

As part of required EPA testing for all water systems serving 10,000 or more people in the United States, the Shrewsbury Water Department conducted UCMR-2 (Unregulated Contaminants Monitoring Rule Round 2) testing in 2013-2014. As part of a wide range of substances tested, hexavalent chromium also known as Chromium-6 was included on the list. Our system registered results between 3-4 parts per billion (ppb) well under the EPA and MassDEP Departments standard of 100 ppb for total chromium which adds together trivalent chromium (Chromium-3) and hexavalent chromium (Chromium-6).

A report came out in 2015 by the Environmental Working Group (EWG) an environmental lobbying group out of Washington, DC headed by activist Ken Cook. This report using the EPA and State databases listed Danvers, Shrewsbury, and a third community on Cape Cod as the three highest in the State for hexavalent chromium. The Town through the Board of Selectmen took a proactive approach, which continues today to track down the source, to see what wells were affected, identify the feasibility of treatment methods and other alternatives.

I was asked by the Board to work with other parties to get the above information back to them. Since no New England laboratories are able to test for hexavalent chromium to the low levels that were required, we contacted the laboratory used by the EPA for the UCMR-2 testing, Eurofins in California to run our samples. We identified three wells, Home Farm 6-1, 6-3 and 6-4 out of eight wells as having low levels in their supplies. To

work on the source, we met with the adjacent business, Metso Inc., to inform them of the situation and they agreed to quickly begin sampling existing test wells onsite for hex chrome with the firm of Tetra Tech. We also involved MassDEP at this point through their Waste Site Cleanup Section of the work being conducted on the Metso property. In subsequent meeting MassDEP allocated funding to drill additional test wells on Bowditch Drive and Plantation Street in Worcester in an effort to clearly define a source of the contaminates. This work is ongoing and is continuing on this year.

The Town's goal in this endeavor was to identify the guilty party and incorporate offsite in situ treatment at their expense to intercept the plume before entering the Town of Shrewsbury property near our well sources. We also drilled four monitoring wells along our property boundary with Metso with two being shallow and two being deeper in depth to monitor the effect of hex chrome at different water depths as it impacts our property.

Since California is the only state to incorporate a hexavalent chromium level in the nation and are the leaders in remediation and treatment of this contaminate, various water districts, community water suppliers and personnel from Pacific Gas & Electric working on site for the Hinckley, CA plume were contacted. Through their invaluable assistance, the Town was able to get up to speed quickly on what methodologies were being used and the problems being encountered and new technologies starting to be used. With the majority of systems using an ion exchange process in which the units need to be regenerated with a salt brine compound, it was quickly apparent that the storing of salt onsite and amount of hazardous hexavalent chromium waste material classified as hazardous presented problems to the systems using them would not be a viable solution in Shrewsbury. We were very fortunate to be forwarded information from the California utility personnel about a new biological process for hex chrome removal being used originally for nitrate removal in the agricultural Central Valley of the State. Developed by Carollo Engineers and installed by AdEdge Technologies, they were having success in removing hex chrome and nitrate in single pass treatment method.

The Town developed a two prong strategy of minimizing usage of the two main wells with the highest levels affected and establish a new well away from the property on Sewell Street. This well would replace previous well source, Sewell #5, which was decommissioned for diminishing yield in a more favorable location. Concurrently, the biological treatment process was pilot tested onsite and showed favorable results but needed to be cut short due to monitoring well flow issues. For the upcoming FY 2020, the Town will be installing test wells to the north of the existing Treatment Plant to begin the process of establishing a replacement well to take place of the volume of Home Farm 6-1 and 6-3. With the new wells in place, we believe hexavalent chromium should be between 1-2 ppb and in all probability below 1ppm. The latest reading for finished water for hex chrome was 3.5 ppm on February 19, 2019. The Town continues to monitor hex chrome levels and evaluate available options for treatment and

mitigation. I have attached report information for offsite hex chrome source determination.

Sincerely yours,

A handwritten signature in dark ink, appearing to read "Robert Tozeski". The signature is written in a cursive, slightly slanted style.

Robert Tozeski
Superintendent Water & Sewer

RT/mb



June 25, 2018

Commonwealth of Massachusetts
Department of Environmental Protection
Bureau of Waste Site Cleanup
8 New Bond Street
Worcester, MA 01608

**Re: Response to Comments Regarding Downgradient Property Status Opinion
44 Bowditch Drive
Shrewsbury, Massachusetts
RTN 2-20057**

Dear Sir/Madam:

In December 2016 Release Tracking Number (RTN) 2-20057 was issued to the Metso Flow Control (Metso) property at 44 Bowditch Drive (the Site) for a potential condition of Substantial Release Migration (SRM). The potential SRM condition was related to the detection of hexavalent chromium in groundwater samples collected from monitoring wells on the Site in November 2016, and the historic detection of hexavalent chromium in water samples from the Town of Shrewsbury municipal water supply wells (Home Farm Well Field). After further assessment of groundwater conditions on the Site, supplemented by a review of historic testing results for properties located in the Site area and an evaluation of the results of testing conducted in 2017 on upgradient properties by contractors (Green Environmental (Green) and Environmental Strategies & Management, Inc. (ES&M)) working on behalf of the Massachusetts Department of Environmental Protection (MassDEP), it was determined there was no evidence of an on-site release of hexavalent chromium at Metso. Based on historic documents that indicated there was at least one known upgradient, off-site source of hexavalent chromium, the former Garrepy Plating (Garrepy) property at 722 Plantation Street, and review of the criteria in the Massachusetts Contingency Plan (MCP) (310 CMR 40.0183(2)), it was determined the Site was eligible for Downgradient Property Status. On February 14, 2018, Tetra Tech, Inc. (Tetra Tech) submitted a Downgradient Property Status Opinion (DPSO) to MassDEP on behalf of Metso for RTN 2-20057.

On June 6, 2018, GZA GeoEnvironmental, Inc. (GZA) submitted the attached letter, dated June 1, 2018, to MassDEP responding to the DPSO submitted by Tetra Tech. In the letter GZA states, "it is our opinion that the identification of the former Garrepy Plating facility as a source of the contamination at 44 Bowditch Drive is in error." The conclusions in the GZA letter are based primarily on two lines of evidence, the direction of groundwater flow on the properties in the area and contaminant distribution. The letter also suggests there is no evidence of a significant release of hexavalent chromium on the former Garrepy property, and the hexavalent chromium detected in groundwater on and near the Site originates from releases on other properties, but does not suggest there is a source of hexavalent chromium on the Metso property. Based upon the flaws noted below, we disagree with the conclusions reached by GZA.

Groundwater Flow Direction

The available information regarding the overall, regional direction of groundwater flow is sufficient to demonstrate that Metso is a downgradient receptor of hexavalent chromium released upgradient from the Site, but it is not adequate to support the conclusions reached by GZA in the response letter. In its DPSO response, a basis for GZA's argument that the Garrepy property is not the source of the hexavalent chromium detected at the Site is that the groundwater flow direction on the Garrepy property is to the east-northeast, toward Poor Farm Brook, and not toward the Site. GZA also states that the direction of groundwater flow at 705 Plantation Street (the former Goddard Valve property) and on properties in the area of Bowditch Drive is to the east, based on groundwater elevations calculated by Tetra Tech, Green Environmental and ES&M, and takes the position that the easterly direction of groundwater flow indicates the source of hexavalent chromium is in the vicinity of the 700 Plantation Street or 705 Plantation Street properties.

The use of the groundwater flow directions depicted on the figure attached to the June 1, 2018 letter as the basis for the conclusion that Garrepy is not the source of the elevated concentrations of hexavalent chromium detected in the area of Bowditch Drive and on the Site is flawed for the following reasons:

- The groundwater flow directions identified on the Garrepy and 705 Plantation Street properties are based on historic measurements of groundwater elevations on those relatively small parcels at different times, so the directions of groundwater flow are indicative of localized conditions and do not consider the overall, regional direction of groundwater flow or changes in the flow direction as groundwater migrates from those parcels to downgradient properties.
- The groundwater elevations measured by Tetra Tech, Green Environmental and ES&M reflect water levels measured at single points in time, and do not characterize seasonally variability in groundwater elevations or flow directions or the influence of pumping the Town of Shrewsbury wells on groundwater elevations and flow directions.

As stated above, the available information on regional groundwater flow direction sufficiently demonstrates that Metso is a downgradient receptor of hexavalent chromium released upgradient from the Site. That data is not, however, adequate to support GZA's conclusions in its response letter. For GZA to be able to use the direction of groundwater flow as the basis for its conclusion that the Garrepy property is not the source of the hexavalent chromium impacts identified in groundwater monitoring wells located along Bowditch Drive and on the Site it would need to perform a comprehensive assessment of the regional direction of groundwater flow, including an evaluation of seasonal variability and the influence of pumping the Town of Shrewsbury wells.

In addition, the groundwater flow directions identified by GZA are based on water levels measured in monitoring wells screened in overburden rather than in bedrock.

An assessment of groundwater conditions in bedrock at the Garrepy property, combined with an evaluation of groundwater flow and contaminant transport in bedrock at locations downgradient from that property, must be performed before it could be concluded that releases originating at Garrepy are not the source of the hexavalent chromium detected in the area of Bowditch Drive and the Site. As has been shown by the testing completed to date, the depth to bedrock is relatively shallow on the Garrepy property. In the area of Plantation Street, the bedrock surface slopes steeply to the east moving from Plantation Street toward the Site, and unconsolidated deposits greater than 180 to 200 feet thick are present near the western boundary of the Site. In addition, the presence of generally north-south trending bedrock structural features in the Site area, including normal faults and thrust faults, have likely created north-south trending fractures which act as preferred pathways for groundwater flow and contaminant transport in bedrock. Based on those conditions, a reasonable conceptual model is that releases of hexavalent chromium in the area of Plantation Street impacted overburden groundwater and migrated vertically into bedrock. The contaminated groundwater in bedrock then migrates to the east and south along bedrock fractures, and the contaminated groundwater

discharges into the overburden along the steeply sloping bedrock surface located west of the Site and east of Plantation Street. The conceptual model is supported by the slight upward gradients identified by ES&M in the well couplets (EMS-1S/1D, GRN-101S/101D and GRN 201S/201D), indicating that groundwater flow is from bedrock to overburden along the steeply sloping bedrock surface, and explains how hexavalent chromium impacted groundwater can be transported from Garrepy to the Site.

We concur with GZA's position that additional assessment would be appropriate to evaluate whether releases of hexavalent chromium at other properties is contributing to the groundwater conditions identified on and upgradient from the Site.

Contaminant Distribution

With respect to contaminant distribution, GZA states that the highest concentrations of hexavalent chromium were reported for groundwater samples collected downgradient of 700 Plantation Street and cross-gradient to the Garrepy property. However, as discussed above, further evaluation of the direction of groundwater flow, including the assessment of groundwater flow and contaminant transport in bedrock, is needed before such a definitive conclusion could be drawn regarding the absence of a connection between Garrepy and the monitoring wells containing the highest concentrations of hexavalent chromium.

GZA also notes that the hexavalent chromium concentration reported for a groundwater sample collected from monitoring well MW-2, located on the west side of the 25 Bowditch Drive property, was up to 160 micrograms per liter ($\mu\text{g/l}$), lower than concentrations reported in downgradient monitoring wells. However, samples collected from that well in 1990 and 2006 contained chromium concentrations of 480 $\mu\text{g/l}$ and 442 $\mu\text{g/l}$, respectively. While those samples were not analyzed for chromium speciation, groundwater samples analyzed by Tetra Tech for total chromium and hexavalent chromium have shown that most of the chromium in groundwater is hexavalent chromium. Therefore, it is likely the hexavalent chromium concentrations in the area of MW-2 have historically been higher than those detected in recent samples, and the concentrations may fluctuate seasonally.

Relative to sources on the Garrepy property, GZA states that laboratory analysis of soil samples collected in September 2004 indicated chromium concentrations in soil of up to 459 milligrams per kilogram (mg/kg), suggesting the absence of a significant source on that property. Other sampling events, along with reported observations of visually contaminated soil in areas beneath the former Garrepy plating vats, indicate releases to soil more significant have occurred at the property than that referenced in the GZA letter.

During testing done by Ransom Environmental, Inc. (Ransom) on the Garrepy property in 2000 chromium concentrations up to 16,000 mg/kg were reported for soil samples collected under the building. During testing done in June 2002 by Roy F. Weston (Weston) on behalf of the US Environmental Protection Agency (USEPA), screening of soil using an x-ray fluorescence (XRF) instrument identified chromium concentrations up to 109,230 mg/kg under the building and up to 8,640 mg/kg in an unpaved area east of the building. Soil testing done in September 2003 by MACTEC Engineering and Consulting, Inc. (MACTEC) detected chromium concentrations in soil up to 6,000 mg/kg .

The DPSO response letter notes that the highest concentration of hexavalent chromium in groundwater on the Garrepy property was 11 $\mu\text{g/l}$, below the MCP Method 1 GW1 standard. Based on historic reports, the sample was collected in July 2003 by MACTEC from monitoring well MW-3. However, Table 8 of the August 2006 Response Action Outcome (RAO) Statement prepared by GZA indicates the highest hexavalent chromium concentration was actually 16 $\mu\text{g/l}$, reported for the sample collected in July 2003 from MW-7. Both samples were collected approximately two weeks after the wells were drilled, with no subsequent sampling conducted to evaluate potential fluctuations in hexavalent chromium concentrations over time or to assess whether the original samples were influenced by the use of potable water during drilling. Definitive

conclusions regarding groundwater conditions on the Garrepy property cannot be drawn using data from a single round of groundwater sampling.

Conclusions

Based on the information discussed above, we disagree with the conclusion reached by GZA that the Garrepy property is not a source of the hexavalent chromium detected in monitoring wells located on the Site. While we cannot rule out other sources having contributed to the hexavalent chromium impacts to groundwater, and we support further assessment by MassDEP or others to evaluate whether there are other sources of hexavalent chromium upgradient from the Site, we continue to believe that the overwhelming bulk of data obtained to date supports the conclusion that releases of hexavalent chromium related to the operations of the former Garrepy Plating are a significant source of the impacts detected on and directly upgradient from the Site.

Very truly yours,



Raymond C. Johnson, PG, LSP
Senior Vice President

Attachment – June 1, 2018 GZA DPS Response Letter

C: Robert Tozeski, Shrewsbury Water & Sewer Superintendent

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249 Vanderbilt Avenue
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www.gza.com



June 1 2018
File No. 01.0173635.00

Commonwealth of Massachusetts
Department of Environmental Protection
Bureau of Waste Site Cleanup
8 New Bond Street
Worcester, MA 01608

Re: Response to DPS Filed by Metso, Inc.
Shrewsbury, Massachusetts
Release Tracking Number (RTN) 2-20057

Dear Sir/Madam:

On behalf of our client, 722 Plantation Street LLC, GZA GeoEnvironmental, Inc. (GZA) has prepared this response to the Downgradient Property Status (DPS) Opinion submittal filed by Tetra Tech on behalf of Metso Flow Control (Metso). In its DPS, Tetra Tech identified the former Garrepy Plating facility at 722 Plantation Street as "a significant source of the chromium observed in the groundwater at the Metso Site" at 44 Bowditch Street. However, based on our review of readily available groundwater data at several other nearby disposal sites, it is our opinion that the identification of the former Garrepy Plating facility as a source of the contamination at 44 Bowditch Drive is in error.

In preparing this response to the Metso DPS, GZA reviewed the following documents, most of which are available through MassDEP's on-line database:

1. GZA's previous reports on the 722 Plantation Street site;
2. The January 1998 H&A report on the 705 Plantation Street (Goddard Valve) site;
3. The June 2017 Green Environmental (Green) report on the 25-28 Bowditch Drive area prepared on behalf of MassDEP;
4. The November 2017 ES&M Environmental & Engineering Solutions (ES&M) report on 700-722 Plantation Street and 25 Bowditch Drive prepared on behalf of MassDEP;
5. The December 2017 Tetra Tech DPS filed for 44 Bowditch Drive; and
6. MassDEP on-line files, Sanborn insurance maps, and other historical data sources relevant to upgradient properties along Plantation Street, Lincoln Street, and Boylston Street.

GZA relied on the site history, chemical data, and groundwater flow presented in these reports as the basis for our opinion. Relevant portions of this information are discussed below. Figure 1 shows locations of current monitoring wells, hexavalent chromium concentrations, and groundwater flow directions at vicinity disposal sites.



GZA (722 Plantation Street – the former Garrepy Plating)

In 2004, GZA conducted site assessment activities which ultimately supported the filing of a Class B-2 Response Action Outcome (RAO) Statement for RTNs 2-0629 and 2-13541 for Poor Farm Brook Development, the property owner. In September 2004, eleven borings were advanced onsite, including nine soil borings inside the Site building and two borings along the exterior (northern wall) of the building. Laboratory analysis identified chromium in the soil samples at concentrations up to 459 mg/kg; however, the highest reported concentration of hexavalent chromium in groundwater was 11 ppb, below the Method 1 GW-1 standard. In addition, the direction of groundwater flow was found to be east-northeasterly, toward the abutting Poor Farm Brook.

Haley & Aldrich (705 Plantation Street- Goddard Valve)

The contaminants of concern at the Goddard Site are volatile organic compounds (VOCs), primarily (TCE); groundwater samples were not analyzed for chromium. The groundwater flow direction at this site was determined by H&A to be easterly.

Green Environmental (near 25 and 28 Bowditch Drive)

Green was contracted by MassDEP to perform well installation and groundwater sampling to assess the presence of hexavalent chromium in the groundwater along Bowditch Drive in Shrewsbury and Worcester. On May 18, 2017, Green installed five wells (two couplet wells: GRN-101S/D and GRN-201S/D, and one shallow well: GRN-103) along Bowditch Drive. On June 8, 2017, Green gauged, surveyed and collected groundwater samples from the newly installed wells. The highest hexavalent chromium concentrations were found in GRN-103, GRN-201S and GRN-201D. Based on the survey and groundwater elevation calculations, the groundwater flow direction was shown to be easterly.

ES&M Investigation

ES&M was contracted by MassDEP to conduct a site assessment to investigate the source of hexavalent chromium in the Town of Shrewsbury public water supply wells (located to the east of 44 Bowditch Drive) and in monitoring wells located upgradient of the well field. In September 2017, one well couplet (ESM-1S and ESM-1D) and three additional monitoring wells (ESM-2, -3 and -4) were installed to assess hexavalent chromium concentration distribution. In addition, in October 2017, ES&M conducted gauging, groundwater monitoring, sampling, and surveying of wells ESM-1D, ESM-1S, ESM-2, ESM-3, ESM-4, MW-1, MW-2, GRN-101S, GRN-101D, GRN-201D, GRN-201S, and GRN-103.

The highest concentrations of hexavalent chromium were found along Bowditch Drive in GRN-103, GRN-201S and GRN-201D. The hexavalent chromium concentrations in ESM-1S, ESM-1D, and the most upgradient well ESM-2 were very low (3.2 ppb, <3.0 ppb, and 0.36 ppb respectively); ESM-3 was not sampled due to lack of water. MW-2, which is located to the north of GRN-103, GRN-201S and GRN-201D, had a hexavalent chromium concentration of 160 ppb. ESM-4 showed a very low (0.37 ppb) concentration of hexavalent chromium. In addition, GR-103 (1,300 ppb) GR-201S (990 ppb) and GR-201D (1,900) were also sampled.

ES&M noted that the monitoring data from the couplet wells indicated a slight upward vertical gradient between the deep and the shallow overburden aquifers, indicating that groundwater is likely flowing from the deep aquifer to the shallow aquifer as groundwater flows to the east. Note that the absence of groundwater analytical data from ESM-3 represents a data gap directly upgradient of the wells with the highest concentrations of hexavalent chromium.



ES&M concluded, "Finally, we believe additional research is warranted regarding past and current usage of properties along Plantation Street, particularly 700 Plantation Street which is upgradient of the highest concentrations of hexavalent chromium."

Tetra Tech DPS

The Tetra Tech DPS filed for 44 Bowditch Street concluded that groundwater impacted by chromium originated from release(s) at upgradient properties. They determined the direction of groundwater flow to be southeasterly based on measurements made by Tetra Tech and MassDEP's contractors and information contained in multiple reports prepared by other consultants for properties in the Site area.

FINDINGS

In its DPS, Tetra Tech identified the former Garrepy Plating facility at 722 Plantation Street as "a significant source of the chromium observed in the groundwater at the Metso Site" at 44 Bowditch Street. Based on our review of the available data, it is our opinion that the identification of the former Garrepy Plating facility as the source of the contamination at 44 Bowditch Street is in error. This opinion is based on two lines of evidence, as described below.

Groundwater Flow Direction

After reviewing the groundwater flow data from the numerous above sources, it appears that the dominant groundwater flow is easterly in the vicinity of 44 Bowditch Drive. However, the groundwater flow direction at the former Garrepy Plating site, which is northwest of 44 Bowditch Drive, is east-northeasterly, with groundwater from Garrepy Plating flowing directly to the nearby Poor Farm Brook. In short, groundwater from the former Garrepy Plating Site does not flow toward the area of 44 Bowditch at which elevated hexavalent chromium levels have been detected.

Contaminant Distribution

The highest hexavalent chromium concentrations outside of the 44 Bowditch Drive property were observed in monitoring wells GRN-103, GRN-201S and GRN-201D, all located due west (upgradient) of that property; east (downgradient) of the 700 Plantation Street property; and southeast (crossgradient) of the 722 Plantation Street property. It is possible that the source of the contamination is west of 700 Plantation Street, but as noted above, no data were available for well ESM-3, the well directly upgradient of 700 Plantation Street. In the absence of that data, it is GZA's opinion that the most likely upgradient source is in the vicinity of 700 or 705 Plantation Street or upgradient of those properties. We concur with ES&M that additional testing should be conducted in the vicinity of these two properties.

It should also be noted that the monitoring wells between 44 Bowditch Street and the former Garrepy Plating site (MW-1, MW-2, and the GRN-101 couplet) all have considerably lower levels of hexavalent chrome (ND to 160 ppb) than the concentrations reported at 44 Bowditch Drive (up to 1,200 ppb). In addition, wells immediately downgradient of 722 Plantation (ESM-1S, ESM-1D, and MW-1) have low chromium concentrations. This again indicates that the former Garrepy Plating site is not the source of the hexavalent chromium reported at 44 Bowditch Drive.



If you have any questions or need further information, please contact Larry Feldman at 781-2789-3807.

Yours truly,

GZA GEOENVIRONMENTAL, INC.

A handwritten signature in blue ink that reads "Lawrence Feldman".

Lawrence Feldman, Ph.D., LSP
Senior Principal

A handwritten signature in blue ink that reads "David E. Leone".

David E. Leone
Consultant/Reviewer

Attachment: Figure 1

