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16 March 2007

Ms. Ellen Fostersmith
Santa Clara Valley Water District
5750 Almaden Expressway
San Jose, CA 95118

Subject: **Response to Comments from City of Morgan Hill dated 28 February 2007**
Final Application: Treated Groundwater Recharge/Reinjection
Olin/Standard Fusee Site, Morgan Hill, California
Geosyntec Project: GR3918

Dear Ms. Fostersmith:

In a letter dated 28 February 2007, WorleyParsons Komex (WPK), on behalf of the City of Morgan Hill (CMH), provided comments to the Santa Clara Valley Water District (District) regarding Olin Corporation's (Olin's) Final Treated Groundwater Recharge/Reinjection (TGRR) Application for the Olin/Standard Fusee Site in Morgan Hill, California (the Site) dated 22 January 2007 (henceforth referred to as the Final TGRR Application). On behalf of Olin, Geosyntec Consultants (Geosyntec) has prepared this letter to address the WPK comments, which contain many factual errors and misinterpretations, and which we find to be unproductive. WPK's comments are included below in italics, followed by Olin's response.

WPK Comment 1: *Olin is only required to treat perchlorate in groundwater from the on-Site remediation system to a level of 6 ug/L, the public health goal (PHG). Olin has also filed numerous documents with the RWQCB contending that this level should be the defacto clean up level. Consequently, it is likely that Olin could reinject water treated only to this level, thereby introducing contamination to the Shallow Aquifer at levels substantially above any "reasonable" background level, which has yet to be established by Olin. This would result in the degradation of groundwater quality relative to background levels, in contradiction to the State Water Board's anti degradation policy (Resolution No. 68-16). This was noted by the Central Coast Regional Water Quality Control Board (RWQCB) in their February 28, 2006 letter to Olin (general waiver of waste discharge requirements), in which RWQCB stated "…injection of treated groundwater must not degrade the quality of the receiving water (i.e., contaminant concentrations in treated water cannot be higher than concentrations in the receiving water). These discharge conditions evolve from the California Water Code and the State anti-degradation policy." Therefore such activity by Olin should not be encouraged by SCVWD through providing TGRR compensation.*

Furthermore, Olin's treatment goal of 6 ug/L does not represent the best level of perchlorate treatment achievable with ion exchange, as required by SCVWD in that treatment for TGRR credit "… meets applicable Maximum Contaminant Levels or Best Available Technology Economically Achievable standards, whichever is lowest" (SCVWD, 1995).

As you know, the City's treatment systems successfully treat perchlorate contamination to below 2 ug/L. The ability to routinely treat groundwater to such levels was also noted by RWQCB in their February 28, 2006 letter to Olin, in which RWQCB concluded that "… it is our expectation that all extracted perchlorate-impacted groundwater will be treated to levels below detection for the perchlorate sampling analytical methods prior to injection." Note that this refers to the detection limit of the analytical method (typically 1.4 ug/L for EPA Method 314), not the reporting limit (typically 4 ug/L for EPA Method 314). Consequently, Olin's proposal to treat all groundwater for reinjection and TGRR credit only to 6 ug/L is inconsistent with existing regulatory requirements, as well as with the intention of the TGRR program.

Olin Response

WPK should be reminded that the perchlorate Ion Exchange Systems (IES) at both the Olin Site and the City of Morgan Hill municipal supply wells (e.g.,Tennant and Nordstrom wells) have all been designed by Siemens (formerly USFilter) with the same lead-lag design configuration, and all were designed to be capable of achieving the same treatment levels. As a result, the Olin and City of Morgan Hill systems all achieve the same perchlorate performance levels. With respect to treatment performance, the California Office of Environmental Health Hazard Assessment has not yet extablished a Maximim Contaminant Level (MCL), although they have promulgated a *draft* MCL of 6 µg/L. This draft MCL is also the California Department of Health Services Public Health Goal (PHG). While a background perchlorate concentration has not yet been formally established by the Water Board, an evaluation of estimated (j-flagged) perchlorate data recently developed by Olin and the City of Morgan Hill indicate the possibility of background perchlorate at concentrations of up to 4 µg/L. Execution of the Water District's "*Work Plan for the Perchlorate Source and Background Study of the Llagas Subbasin*" (June 2005) is intended to provide the information necessary to establish background perchlorate. Until a background perchlorate level can be established, the guiding treatment level for Olin's on-Site IES and On-Site Recharge System (ORS) is the PHG/draft MCL.

On 3 March 2006, discharge to the Butterfield Flood Control Ditch was discontinued, and in its place, treated groundwater from the IES was recharged to the shallow (A zone) aquifer via three injection wells, which comprise the ORS. As discussed in Section 3.2.2 of the Final TGRR Application, the effluent sample port (SV-300) data are representative of the quality of the injected water. To supplement the effluent analytical data provided in Table 3-3a of the Final TGRR Application, perchlorate concentrations from SV-300 reported to the method detection limit (MDL) are provided below.

Date	Perchlorate (µg/L)
09-Mar-06	<1.2
30-Mar-06	<1.2
03-May-06	<1.2
01-Jun-06	<1.2
30-Jun-06	<1.2
31-Jul-06	<1.2
30-Aug-06	<0.80
27-Sept-06	<1.2
30-Oct-06	<1.2
30-Nov-06	<1.2

Legend:
< - Non-detect; associated value is the MDL

Based on the data presented above, we offer the following conclusions:

- The treated water recharged by the injection wells does not degrade the quality of the receiving waters, as WPK erroneously contends. The concentrations of perchlorate in the recharge water have consistently been less than the 1.4 µg/L MDL cited by WPK, and the perchlorate concentration in groundwater samples from well MW-013A have consistently also been non-detect (less than 2.0 µg/L).

- The lead-lag configuration of the on-Site IES is operating as designed (i.e., removing perchlorate to a concentration of less than 2 µg/L, as stated in the Section 3.2.1 of the Final TGRR Application). In this respect, the WPK comment is misleading and unproductive, since WPK is aware that the City and Olin systems are both designed by Siemens to achieve the same performance standards.

- Since startup of the ORS, water recharged by the injection wells has been treated by the on-Site IES to levels below detection, and beginning with the First Quarter of 2007, perchlorate concentrations will be reported to the MDL in the Quarterly Performance Monitoring Reports submitted by MACTEC Engineering & Consulting, Inc. to the Central Coast Water Board (Water Board) (with copies provided to the District).

WPK Comment 2: *Figures 4-1, 4-2, 4-5, and 4-6 of the Application show Shallow Aquifer capture zones for the injection and extraction remediation system for different points in time. In all four time periods represented by these figures, there is incomplete capture of the injected water to the west of extraction*

well EW-002A. This is shown by the flow lines that pass by the extraction wells to the west, and are not captured. This incomplete capture raises two issues:

a. A loss of recharged water that is not recovered by the intended extraction well; and

b. Recharged water with potentially elevated perchlorate concentrations will remain in the shallow aquifer after remediation. These elevated concentrations may result from either reinjection of the treated water at levels approaching the public health goal, as discussed in point 1 above, or by recontamination of the reinjected water by passing through residual contamination in the shallow aquifer. This second concern is discussed in more detail in point 3, below. In either case, the requirement of the TGRR permit, "…that the quality and the groundwater be protected to the maximum feasible extent" (SCVWD, 1995) is not met, and therefore the Olin application should be considered unacceptable.

Olin Response

WPK should be directed to more closely review the District's *"Treated Groundwater Recharge/Reinjection Project Fact Sheet"* (Fact Sheet) (District, 1995) for the TGRR Application, which clearly states, "Demonstrate substantial recapture of recharged water by the sponsor's contaminated water extraction system when recharge is conducted within or near plume of contamination to prevent possible spreading of the plume. The demonstration shall be made under the direction of an appropriate California-registered geologist or engineer." Per the Fact Sheet, 100% recapture of the treated water is not required to be eligible for TGRR enrollment. Figures 4-1, 4-2, 4-5, and 4-6 of the Final TGRR Application clearly illustrate that substantial recapture is achieved through operation of the groundwater extraction system (GES). The capture zones shown in the cited figures were developed and approved by a California-registered geologist. Thus, item (a) identified by WPK is not an issue that affects Project eligibility.

Item (b) implies that operation of the recharge system may result in elevated perchlorate concentrations remaining in the aquifer due to incomplete capture. The first mechanism described in the comments relies on the elevated perchlorate concentrations (greater than 1.4 µg/L but less than 4 µg/L) being a result of perchlorate remaining in the injected water after treatment. Olin's response to WPK Comment 1 clearly indicates that perchlorate is not present in the water that is being injected and that is the subject of the TGRR application. The second mechanism describes a process wherein residual perchlorate in the aquifer contaminates the recharged water and then the water bypasses the extraction wells. There are several factors that make this mechanism extremely improbable. First, the recharged water is injected well upgradient of the perchlorate plume in an area of the Site that has been repeatedly shown to be clean. If one evaluates the flow paths depicted in the cited figures, it is clear that the water that bypasses the extraction wells follows a path that does not encounter the on-Site area still containing perchlorate. As such, there is no potential for the small percentage of water that bypasses the GES to accumulate

perchlorate via passage through impacted areas. Second, the recharge water that does pass through areas where residual perchlorate remains is completely captured by the GES. As required by the criteria listed in the Fact Sheet, the Olin Project satisfies the requirements stated by the District to protect groundwater to the "maximum feasible extent."

WPK Comment 3: *The treated water is injected by Olin into a contaminated portion of the Shallow Aquifer, and therefore it is highly likely that the reinjected water will be recontaminated by residual perchlorate within the Shallow Aquifer materials, or from perchlorate mass residing in the Shallow Aquitard zone underlying the aquifer. The Application states that the travel time between the injection and extraction wells is 130 days, based on a Darcy's Law calculation of flow between the injection and extraction locations. Another way to view this travel time estimate is that in 130 days, the Shallow Aquifer groundwater between the injection and extraction wells would be displaced by the treated injection water, that is, one pore volume of Shallow Aquifer groundwater would be displaced. Between the start of injection in March 2005 and the end of September 2006, the period of injection corresponds to nearly two pore volumes of displacement by treated injection water. In spite of this degree of flushing, the Application shows that concentrations of perchlorate up to 1,700 ug/L persist within the Shallow Aquifer between the injection wells and the extraction wells (e.g., well MW-15, 1700 ug/L, 3rd quarter 2006). Despite the fact that nearly two pore volumes of treated water have been injected, concentrations of perchlorate in the Shallow Aquifer remain high, in excess of 20 ug/L at the influent to the extraction wells, confirming the recontamination of the treated injection water within the Shallow Aquifer, between the injection and recharge wells. Clearly, groundwater with over 20 ug/L perchlorate is of virtually no beneficial use, and therefore is not worthy of consideration in the TGRR program. The TGGR program is only for projects that "…treat and recharge or reinject groundwater for beneficial uses…" (SCVWD, 1995). This application does not qualify.*

Olin Response

There are three factual errors in Comment 3 from WPK:

1. WPK contends that "treated water is injected by Olin into a contaminated portion of the shallow aquifer". This is incorrect and unproductive. The treated groundwater is injected via three injection wells located in the northern portion of the Site near well MW-013A. As shown in Table 3-5 of the Final TGRR Application, the concentration of perchlorate in groundwater samples from the receiving waters (represented by monitoring well MW-013A) have consistently been non-detect (less than 2.0 µg/L). Therefore, Olin is not injecting (and has not injected) treated water into a contaminated portion of the shallow aquifer.

2. The WPK statement *"…concentrations of perchlorate in the Shallow Aquifer remain high, in excess of 20 µg/L at the influent to the extraction wells, confirming the recontamination of the*

treated injection water within the Shallow Aquifer, between the injection and recharge wells" is erroneous and misleading in several ways. First, as is clearly shown in Figure 2-3 of the Final TGRR Application, the concentrations of perchlorate in shallow aquifer extraction wells EW-001A and EW-002A during the Third Quarter of 2006 (the data presented in the Final TGRR Application) were 6.1 and 15 µg/L, respectively. Second, as shown in Figure 1 (attached), the concentrations of perchlorate at the shallow aquifer extraction wells EW-001A and EW-002A have shown dramatic declines (from 36 µg/L to 3.7 J µg/L at EW-001A; from 100 µg/L to 9.1 µg/L at EW-002A) since startup of the recharge system in early March 2006. These trends clearly refute WPK's contention of recontamination of the treated injection water within the shallow aquifer, and in fact underscore how quickly perchlorate is being removed from the shallow aquifer by the extraction and treatment system. It is also worth noting that the concentrations of perchlorate at EW-001A and EW-002A have declined from historic highs of 52 µg/L and 230 µg/L, respectively, further highlighting the success of the site soil and groundwater remediation systems.

3. WPK cites a perchlorate concentration of 1700 µg/L at well MW-015 in the Third Quarter of 2006 and uses this single data point, in ignorance of Site hydrogeology, overall trends at this well, and results from surrounding wells, as the basis to suggest that the TGRR application does not qualify. It is important to realize that well MW-015 is screened from only 10 to 25 ft bgs within materials that are less transmissive than the underlying materials, where most of the groundwater flow occurs. Furthermore, well MW-015 is dry for a significant portion of the year. While an "average travel time" between the injection and extraction wells was provided in our TGRR application (at the District's request), the reality is that the travel time in the upper portion of the shallow aquifer is likely to be slower (based on geologic information) than in the lower portion of the shallow aquifer where the more transmissive materials exist. While it is convenient for WPK to use an "average travel time" but a "depth-specific concentration" to develop a negative conclusion, it is technically inappropriate and misleading. To responsibly develop this case, a travel time specific to the MW-015 depth interval should have been used. Perhaps most disturbing is that fact that WPK appears to ignore the coincidental timeframe data for well MW-016, co-located with MW-015, screened in the deeper, more transmissive shallow aquifer materials. During the same time interval cited by WPK, the perchlorate concentration at MW-016 declined from 160 µg/L to <2 µg/L. Historically, the perchlorate concentration at well MW-016 was as high as 1500 µg/L. These data, in association with the understood hydrogeological conceptual model for the Site, indicate that groundwater conditions in the Site groundwater are rapidly improving.

   Despite the transmissivity/travel time differences within the shallow aquifer materials, the perchlorate concentration at well MW-015 has beneficially declined from 2600 µg/L since startup

of the recharge system to 530 µg/L during the First Quarter of 2007. This suggests that the shallower interval is also cleaning up, albeit on a slightly slower pace than the deeper A zone materials, as would be expected based on transmissivity differences and the fact that the well is dry for a significant portion of the year.

WPK Comment 4: *Half of the performance monitoring wells identified in the Application are outside the path that recharged waters would travel, as represented by the pathlines between injection and extraction wells shown in the Application. The wells outside of the recharge path include MW-1, 3, 12A, 13A, 13A, and PM-1A, 2A, and 3AR. These wells will provide no information on the progress of remediation, and little information on the quality of water recharged by the injection wells, which is the focus of the Application. The remaining monitoring wells within the flow path of the recharged water are improperly positioned, with only one performance monitoring well location (i.e., well MW-16) located in the path of the recharged water between injection wells INJ-002 and INJ-003 and the corresponding extraction well EW-001A, with the exception of two monitoring wells located immediately adjacent to the injection or extraction wells. Consequently, there is no way of verifying the quality of the much of the recharged water in the Shallow Aquifer, for which the Application is applying for TGRR credit.*

Olin Response

In their criticism of the current groundwater monitoring system, WPK misstates the purpose of the monitoring wells when they comment that the wells *"will provide no information on the progress of remediation …."* The "progress of remediation" is regularly evaluated by the Water Board. While remediation progress is critical to the Water Board, Olin and key stakeholders, it is not relevant to the TGRR credit.

WPK is also incorrect when they state that *"there is no way of verifying the quality of much of the recharged water in the Shallow Aquifer…."* The "quality of water recharged by the injection wells" is explicitly monitored at the effluent sampling port (SV-300) prior to injection into the subsurface. Thus, the existing groundwater monitoring system is not used to verify the quality of the injected water.

The primary purpose of the groundwater monitoring program for the TGRR credit is for monitoring water levels both inside and outside the injection and extraction areas to obtain a reliable estimate of the potentiometric surface and thereby to evaluate: (i) the area of recapture based on Site data, and (ii) the potential impacts of the ORS on the effectiveness of hydraulic containment by the on-Site GES. In this respect, the groundwater monitoring program provides adequate and sufficient data demonstrating significant recapture of injected water and hydraulic containment by the on-Site GES.

We trust that this letter addresses the comments from WPK's 28 February 2007 letter. We strongly believe that this project meets the intent and requirements of the District's TGRR program, and we look forward to working with the District to move this application process to completion. Please feel free to contact Mr. Rick McClure at Olin (423.336.4576) if you have any questions with the information contained in this letter response.

Sincerely,

Leslie M. Griffin, PE
Project Manager

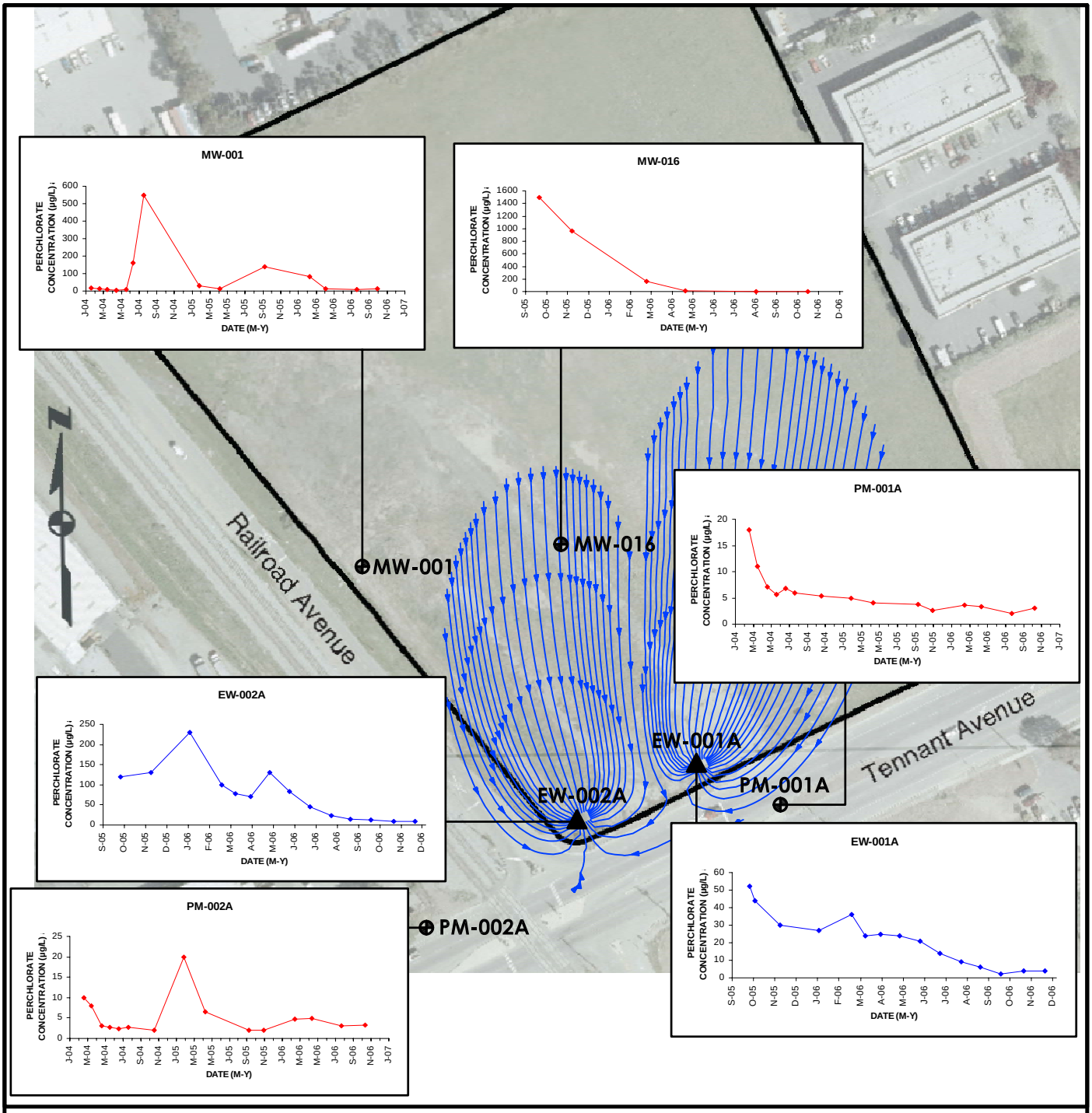
John D. Gallinatti, CHg
Associate Hydrogeologist

Evan E. Cox, MSc
Principal In Charge

Attachment: Figure 1: Perchlorate Concentration Declines in Shallow Aquifer Groundwater Since Startup of On-Site Groundwater Treatment System

Copies to: Mr. Behzad Ahmadi, Santa Clara Valley Water District
Mr. James Ashcraft, City of Morgan Hill
Mr. Hector Hernandez, Central Coast Water Board
Mr. Eric Lacy, State Department of Health Services
Mr. Rick McClure, Olin
Mr. David Share, Olin

FIGURES



Site boundary

A zone monitoring well

groundwater extraction well

Extraction well pathline

Time interval between arrows is 30 days

0 100 200

scale (ft)

Perchlorate Concentration Declines in Shallow Aquifer Groundwater Since Startup of On-Site Groundwater Treatment System
Olin/Standard Fusee Site, Morgan Hill, California

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Kennesaw, Georgia | March 2007

Figure 1

Note: Monitoring well MW-016 and extraction wells EW-001A and EW-002A were not sampled prior to September 2005.