STATE OF CALIFORNIA
REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL COAST REGION

STAFF REPORT FOR REGULAR MEETING OF JULY 14, 2011
Prepared on June 24, 2011

ITEM NUMBER: **9**

SUBJECT: **Waste Discharge Requirements for the Olin Aquifer Containment and Cleanup System, Santa Clara County (Order No. R3-2011-0209)**

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KEY INFORMATION

Facility Name	Olin Aquifer Containment and Cleanup System
Facility Owner:	Olin Corporation
Location:	425 Tennant Avenue, Morgan Hill, 95038
Discharge Type:	Industrial
Design Capacity:	1.1 million gallons per day
Treatment Type:	Perchlorate-specific ion exchange resin
Disposal Method:	Treated groundwater via injection wells; spent resin disposed at a landfill facility as nonhazardous waste
This Action:	**Adopt Order No. R3-2011-0209**

SUMMARY

Cleanup and Abatement Order (CAO) No. R3-2007-0077 requires Olin Corporation (hereafter "Olin" or "Discharger") to implement and complete all necessary investigations and remedial actions (hydraulic control and clean up) associated with the perchlorate plume related to the Olin facility located at 425 Tennant Avenue in Morgan Hill (Site). These Waste Discharge Requirements (Order) allow Olin to reinject treated groundwater as part of their cleanup strategy to remediate perchlorate in offsite groundwater, consistent with the CAO.

To address offsite perchlorate in groundwater, Olin plans to pump groundwater from offsite extraction wells and transport the extracted water back to the Olin Site for treatment. At the Site, Olin proposes to expand the current onsite aquifer containment and cleanup system (ACS). The treatment system will remove perchlorate from the groundwater to non-detectable levels using perchlorate-specific ion exchange resin. Olin will return the treated groundwater to the uppermost (shallow) aquifer through a series of onsite injection wells. System controls and monitoring required by this Order; a site-specific monitoring and reporting program (MRP); an Executive Officer-approved operations, maintenance and monitoring (OMM) plan; and CAO No. R3-2007-0077 ensure protection of beneficial uses and consistency with the "State Water Resources Control Board's (State Water Board) Resolution No. 68-16 Statement of Policy with Respect to Maintaining High Quality of Waters in California" (Resolution 68-16).

This Order covers operation of the onsite and offsite ACS by setting effluent limits (perchlorate, nitrate, and pH) for reinjection of treated groundwater. The ACS will treat perchlorate to non-detectable levels but nitrate concentrations may be higher in the reinjected groundwater relative to the current nitrate concentrations in the receiving water (shallow aquifer beneath the Site). The occurrence of nitrate is unrelated to Olin's former operations and without the elevated nitrate concentrations; the Central Coast Water Board would regulate the proposed reinjection of treated groundwater under the General Waiver instead of this Order. The proposed Order includes a MRP with a robust monitoring and reporting program for nitrate to identify changes in nitrate in the receiving water and throughout the area influenced by the offsite ACS recharge.

This proposed Order represents a major accomplishment for the Olin Cleanup Project. Olin will begin constructing the offsite groundwater treatment system to cleanup the remaining perchlorate in groundwater upon adoption of this Order.

PURPOSE

Operations at Olin's former flare manufacturing plant resulted in a release of perchlorate into the soil and groundwater beneath the Site. Olin has effectively controlled perchlorate migration at the Site boundary via successful onsite soil remediation and groundwater extraction and treatment; however, an offsite perchlorate groundwater plume still exists southeast of the Site. Currently, Olin provides replacement water in the form of wellhead treatment (e.g., ion exchange) or bottled water to users of domestic wells with perchlorate concentrations greater than the maximum contaminant level (MCL) of 6.0 micrograms per liter (µg/L). Currently, eight households served by five domestic wells receive bottled water and eight households are served water after wellhead treatment for perchlorate. One community water system in San Martin also has wellhead treatment for perchlorate. This Order is necessary for Olin to proceed with offsite aquifer cleanup and containment pursuant to CAO R3-2007-0077.

DISCUSSION

The Setting – The proposed ACS (extraction wells and conveyance pipelines) will be both within Santa Clara County and in the City of Morgan Hill (Figure 1 of the attached Order). The proposed ACS consists of offsite extraction wells, existing onsite extraction wells, and 5,700 feet of conveyance pipeline that connects the extraction wells to the groundwater treatment system. Approximately 60 percent of the pipeline is located within Santa Clara County rights-of-way and the remaining 40 percent of the pipeline is located within the City of Morgan Hill rights-of-way. Figure 2 of the attached Order is a schematic of the proposed ACS system, and provides a three-dimensional conceptual model of the hydrogeology, perchlorate plume, supply wells, extraction wells, and injection well system.

Groundwater Aquifers - Olin's extensive hydrogeological investigations show that there are three main aquifers in the Llagas Subbasin: 1) the shallow aquifer (surface to approximately 50 feet below ground surface [bgs]), 2) the intermediate aquifer (approximately 70 to 180 feet bgs), and 3) the deep aquifer (approximately 200 feet bgs to sub-alluvium). The intermediate and deep aquifers are further subdivided into three water-bearing units apiece (upper, middle, and lower). The sub-alluvium is a relatively impermeable zone, it is a slope debris deposit that overlies bedrock and forms the base of the water bearing zones because it contains a high percentage of clay making it less permeable than the overlying aquifers and aquitard units.

Perchlorate Distribution - Olin monitors groundwater beneath the Site and throughout the Llagas Subbasin, both upgradient (north and northeast) and downgradient (south, southeast, and east) of the Site pursuant to MRP No. R3-2008-0028. Historically, the perchlorate plume extended laterally and vertically south and southeast of the Site, with a length of 9.5 miles, width of 2,000 feet, and a depth to approximately 500 feet deep in some areas. However, over the past five years the plume extent and concentration have decreased due to Olin's onsite soil cleanup and continued operation of the onsite groundwater pump and treat system, offsite wellhead treatment systems, and natural attenuation processes (e.g., dispersion/dilution).

Olin divided the perchlorate plume into priority zones (Priority Zones A, B, and C) to establish appropriate clean up strategies for various parts of the plume. The Discharger defines Priority Zone A as the "plume core", characterized by groundwater containing perchlorate concentrations above 24.5 µg/L. Priority Zones B and C are defined as groundwater containing perchlorate at concentrations equal to and below 24.5 and greater than 11.0 µg/L, and equal to and below 11.0 and greater than 6.0 µg/L, respectively. Figures 3, 4, and 5 of the attached Order show the distribution of perchlorate in groundwater, for the intermediate, middle deep, and lower deep aquifers, respectively.

Nitrate Distribution – Nitrate concentrations are elevated (up to 270 mg/L) in portions of the Llagas Subbasin. The MCL for nitrate (i.e., state drinking water standard) is 45 mg/L nitrate as NO_3. Additionally, the concentration of nitrate varies considerably both laterally and vertically in the aquifers. For example, Figures 6 and 7 of the attached Order show the significant variability in the offsite nitrate distribution in the area from which Olin will extract groundwater to treat for perchlorate. Many studies attribute the elevated nitrate in the Llagas Subbasin to agricultural and other anthropogenic activities[1] and the Olin Site is not the source of nitrate in the area.

PROPOSED REQUIREMENTS IN ORDER

The proposed Order is consistent with other Central Coast Water Board requirements for comparable discharges within the Central Coast Region. This Order includes prohibitions and limitations that are designed to protect water quality for existing and anticipated beneficial uses of groundwater, to the maximum benefit of the people of the State.

Prohibitions and Effluent Limitations

Olin's ACS ion-exchange treatment system will remove perchlorate to non-detectable levels, however, this system will not remove nitrate. As Olin extracts offsite groundwater where nitrate concentrations are relatively elevated, these concentrations may be higher than the current nitrate concentrations in the receiving water (shallow aquifer beneath the Site). As a result, the following prohibitions are included in the proposed Order to ensure protection of beneficial uses during Olin's operation of the ACS.

Perchlorate: The Order prohibits incomplete treatment of ACS influent water for perchlorate prior to reinjection into the shallow aquifer. Treatment will remove perchlorate to non-detectable levels (typically below the laboratory method detection

[1] For example, Moran, J.E. et al., 2005. California GAMA Program: Sources and Transport of Nitrate in Shallow Groundwater in the Llagas Basin of Santa Clara County, California. July 2005.

limit of between 1.2 and 1.6 µg/L). This is achievable based on Olin's success in treating perchlorate to non-detectable levels over the past seven years while operating the existing onsite groundwater treatment and reinjection system.

In this Order, the effluent limit for perchlorate is based on monthly and quarterly averages. The monthly average is set at the laboratory practical quantitation limit of 4.0 µg/L, per US EPA Analytical Test Method 314.0. The practical quantitation limit represents a practical and routinely achievable limit that a laboratory can measure with greater than 99.9 percent confidence in the results. This monthly limit is set to account for potential exceedances of perchlorate due to analytical inaccuracies. However, the quarterly average is set so that Olin may not have more than one-third of the total number of samples collected at trace concentration of perchlorate between non-detectable levels (e.g., 1.6 µg/L) and the practical quantitation limit of 4.0 µg/L.

Receiving Water Limitations for Perchlorate – Current concentrations of perchlorate in the upper and intermediate aquifers below the Site are above 4.0 µg/L, so this Order does not propose a receiving water limitation for perchlorate because the current and proposed enforceable effluent limit is below receiving water perchlorate concentrations.

Nitrate: The proposed Order sets a monthly average nitrate effluent limit of 43 mg/L, and a quarterly average limit of 39 mg/L (the average of three monthly sample results). These effluent nitrate limits allow Olin to achieve capture of the offsite perchlorate plume with the proposed design of the ACS, which staff believes is reasonable. Based on staff's evaluation of Olin's calculations, the shallow aquifer in the area impacted by the reinjection of treated groundwater will be comprised of nearly 100 percent reinjected treated groundwater (Figure 8 of the attached Order) after ten years of reinjection. Therefore, the recharge of treated groundwater with these effluent nitrate limits could increase the nitrate concentrations in the receiving water (shallow aquifer) from approximately 24 mg/L up to 39 mg/L (provided no other nitrate sources are introduced to the aquifer) in the area affected by the reinjection (Figure 8).

Staff evaluated how treated groundwater reinjected into the shallow aquifer then moves and mixes throughout the intermediate aquifer (where nearly all domestic wells are screened) and the deep aquifer, and how the resultant nitrate concentrations in these aquifers may impact beneficial uses in the future. Despite the presence of a continuous aquitard between the shallow aquifer and intermediate aquifer in the vicinity of the Site, hydrogeologic data (e.g., downward head gradients, aquitard permeability, geochemical signatures) indicate that shallow aquifer water will mix with intermediate and deep aquifer water. Therefore, it is fairly certain that a portion of the treated groundwater reinjected into the shallow aquifer will also mix with intermediate and deep aquifer water. Based on predicted nitrate concentrations presented in Olin's Feasibility Study, staff estimates that reinjected water will constitute approximately 50 percent of the groundwater in the upper intermediate aquifer, 30 percent in the middle intermediate aquifer, and 10 percent in the lower intermediate aquifer after ten years of ACS operation. Therefore, based on these predictions, the average nitrate concentrations in the upper intermediate aquifer (in the vicinity of the Site) could increase from the current average of 33 mg/L up to 36 mg/L, after ten years of reinjection. These effects will diminish with distance from the Site due to groundwater mixing. In fact, for areas that are further downgradient from the Olin Site, the nitrate concentrations are more likely to improve because the current average nitrate concentration in the intermediate aquifer is significantly higher than 36 mg/L in some of these areas (e.g., Figure 7 of the attached

Order shows several wells (including domestic wells[2]) having nitrate concentrations between 36 and 84 mg/L). Staff determined that 24 domestic wells are located within the ACS recharge area. Olin's Feasibility Study predicts that half of the wells will experience an increase while half will experience a decrease in nitrate concentrations, with no MCL exceedance caused by the recharge.

Nitrate concentration increases caused by ACS reinjection in deeper aquifer units are expected to be significantly less than those observed in the intermediate due to the small percentage of reinjected water reaching these zones. The City of Morgan Hill's Tennant Well is the only known drinking water well within the ACS recharge area that pumps groundwater from deeper aquifer units. Staff estimates that ACS recharge could cause nitrate to increase in the Tennant Well by up to 2 mg/L. The current nitrate concentration in the Tennant Well is 28 mg/L so an increase to 30 mg/L is not significant with respect to the MCL and the City's cost of operating the Tennant Well. Because the quarterly effluent limit is 39 mg/L, treated groundwater reinjection will not cause nitrate exceedances of the MCL in any of the aquifer zones.

Receiving Water Limitations for Nitrate – The shallow aquifer is currently not used for domestic or municipal supply because it is too shallow for a typical properly constructed drinking water supply well. For these reasons, Central Coast Water Board staff does not recommend a receiving water limitation for the shallow aquifer.

Compliance with Anti-Degradation Policy: This Order finds that some degradation of the shallow aquifer is acceptable and consistent with State Water Board's Resolution 68-16 (also referred to as the Anti-Degradation Policy) because:

1) Perchlorate in groundwater will be removed to non-detect levels, from current concentrations that are significantly above the drinking water standard (6 µg/L).
2) Although nitrate concentrations may increase in some locations (and decrease in others), they would still remain significantly below the drinking water standard (45 mg/L) as a result of this discharge, thereby not causing any additional cost- or health-related impacts to current groundwater users.
3) The cleanup of perchlorate (the predominant constituent of concern from Olin's operations) is consistent with the Resolution 68-16, and this cleanup provides the maximum benefit to the people of the state because the cleanup will restore the beneficial use.

Even though the proposed Order's nitrate effluent limitation is protective of the beneficial uses of groundwater in the intermediate aquifer, the proposed Order includes a monitoring and reporting program with requirements to monitor perchlorate and nitrate from various monitoring/sentry wells in the shallow, intermediate, and deep aquifers so that increases in nitrate will be observed in these wells prior to reaching domestic and municipal wells, such that appropriate actions can be taken, as necessary. However, based on predicted values and observed effects of perchlorate migration through the aquifer systems, nitrate may increase in concentration by up to an average of 3 mg/L in the upper intermediate aquifer of the ACS recharge area, with some local areas experiencing a dilution of nitrate concentrations. Nevertheless, the monitoring/sentry wells provide a substantial backstop to ensure the ACS will operate in a manner fully protective of groundwater.

[2] For wells in this study area with known nitrate concentrations exceeding the MCL, Staff has notified well owners/users and provided public health reference material for them to make informed decisions about their drinking water. If additional wells are found to be above the MCL, staff will also notify those owners/users.

Provisions – This Order requires compliance with an Executive Officer-approved Monitoring and Reporting Program (MRP). This Order also requires that treatment system and reinjection operations are conducted in accordance with an Executive Officer-approved OMM plan. These two components will allow for monitoring and subsequent adjustment to system operation based on observed effects of the reinjection.

ENVIRONMENTAL SUMMARY

In accordance with the California Environmental Quality Act (CEQA) (Public Resources Code, Section 21000, et seq.) and the California Code of Regulations, the Central Coast Water Board is the lead agency for purposes of CEQA, and proposes adoption of Resolution No. R3-2011-0210 for approval of a Mitigated Negative Declaration, as supported by an Initial Environmental Study (IES) that addresses the ACS project. The Mitigated Negative Declaration and IES identified mitigation measures to address environmental impacts such as noise and air quality that may result from the ACS construction, primarily during pipeline installation. Significant adverse water quality impacts are not expected to result from the project (although significant water quality improvements are expected) and the IES did not identify additional water quality mitigation measures beyond existing project controls. The IES did not identify any significant direct or indirect adverse water quality impacts.

As indicated in the Mitigated Negative Declaration, the impact is less than significant because the project includes system controls and monitoring that will ensure treatment of perchlorate in groundwater to non-detectable levels, and facilitate blending of groundwater from the ACS extraction wells that reduces nitrate concentrations to below the limits set by this Order, thereby producing treated groundwater that is consistent with the maximum benefit of the people of the state in accordance with Resolution 68-16.

COMPLIANCE HISTORY

Olin has been responsive to Central Coast Water Board staff's information requests and directives. Olin has readily addressed issues that arise and has been diligent in solving complex issues. Additionally, Olin has met all original enforcement action compliance dates or extensions granted by the Executive Officer.

COMMENTS RECEIVED ON THE DRAFT ORDER

Central Coast Water Board staff distributed the draft Order No. R3-2011-0209 on April 20, 2011, to a list of interested persons and agencies that have been historically involved with the Olin cleanup project. During the Perchlorate Advisory Group Meetings (PCAG), Central Coast Water Board staff discussed CEQA and aspects of the draft Order. Central Coast Water Board staff also conducted teleconferences with several interested parties (including City of Morgan Hill, California Department of Public Health, Santa Clara Valley Water District, and Olin) to facilitate understanding and comments on this Order. After a 30-day public comment period, Central Coast Water Board staff received comments on the Order from six stakeholders; staff's responses are provided as Attachment 2.

PUBLIC COMMENTS AND STAFF RESPONSE

Central Coast Water Board staff received comments on proposed Waste Discharge Requirements Order No. R3-2011-0209 from the Perchlorate Community Advisory Group, Olin Corporation, City of Morgan Hill, Santa Clara Valley Water District, California Department of Public Health, and Clean Water Action. The comment letters are provided as Attachment 2 and are also available on GeoTracker at the following location:

http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=SL0608756247

The sections below provide the stakeholder comments (in italics) and Water Board staff responses to those comments following each stakeholder comment.

Perchlorate Community Advisory Group letter, dated June 4, 2011 Comments:

"The Perchlorate Community Advisory Group (PCAG) appreciates this opportunity to comment on the draft Waste Discharge Requirements (WDR) Order R3-2011-0209 for Olin Corporation's Aquifer Containment and Cleanup System for remediation of the perchlorate contamination in the Llagas Subbasin.

PCAG supports the adoption of the proposed WDR which supports reinjection of treated groundwater into the shallow aquifer beneath the Olin Site. PCAG does not support anything that would once again delay the perchlorate remediation process. For over two years, the members of PCAG have been reviewing/discussing information regarding nitrate problems in our area and possible affects of reinjection; we understand the pros & cons and find it to be the best possible solution. We know that thorough monitoring will be in place and regularly reviewed. All parties, including PCAG, will continue to review the findings of this monitoring and the WDR needs to stipulate that reinjection will be halted if the aquifer starts to push toward the level of the drinking water standard.

Once again, thank you very much for this opportunity. PCAG members asked me to provide you with their position."

Staff's Response: Staff appreciates PCAG's input and support in adopting the proposed Waste Discharge Requirements (WDR). Staff agrees with PCAG that we need to move forward with perchlorate remediation of the offsite groundwater plume. This is a significant milestone in the history of this case and we are now at the stage of the project where offsite remediation of groundwater can begin by adoption of the proposed WDR.

Olin Corporation letter, dated May 20, 2011 Comments:

1) ***Page 2, paragraph 1 of Staff Report and Page 1, finding 3 of Draft WDR*** *– "The new Order rescinds enrollment into the General Waiver of Waste Discharge Requirements Resolution No. R3-2008-0010 in its entirety, including specific discharge allowances for soil and groundwater generated during well sampling, installation and testing activities. These routinely generated waste streams cannot normally be treated via the ACS because of elevated turbidity or occasional exceedance of other parameters. The General Waiver allows groundwater to be treated using a portable ion exchange and/or granular activated carbon system to ensure that it meets waste discharge requirements. With Water Board approval, treated groundwater is then*

discharged to the ground surface on-site or through the ACS. Likewise, with Water Board approval, soils that meet discharge requirements are reused onsite; those that do not are transferred to a proper disposal facility. We recommend adding the following sentence to the end of this paragraph:"

"Enrollment into the General Waiver will remain in place for soil and groundwater waste streams associated with remediation activities, including but not limited to well installation, testing, and monitoring activities."

Staff's Response: Staff made changes to the proposed WDR and staff report to clarify that the General Waiver is rescinded only for reinjection of treated groundwater associated with the groundwater aquifer containment and cleanup system upon startup of the offsite ACS. Staff also added the text suggested by Olin to clarify that the other discharges covered by the General Waiver still apply.

2) **General comment from Olin on nitrate treatment and in response to *Page 12, finding 33, second sentence and Page 14, Provision 1 of draft WDR*** – *"There are several locations in the Draft WDR where the Board has introduced references that treatment of nitrate by Olin may be required if WDRs cannot be achieved. It has been consistently documented by the Regional Board that the nitrate concentrations in the Llagas Subbasin are not connected with any Olin activities. Beyond treatment by blending, within the limitations imposed by existing water quality within the basin, treatment for nitrate is not a plan or requirement of this perchlorate remediation project under Cleanup and Abatement Order No. R3-2007-0077. Moreover, the ACS infrastructure is purposefully designed to monitor, control and adjust nitrate concentrations in the extracted and blended groundwater to ensure that nitrate levels in the recharge water remain below specified discharge requirements. Olin therefore requests that the references to potential nitrate treatment be removed from the final WDR."*

Staff's Response: Staff has removed the references in the WDR for Olin to consider potential nitrate treatment considering that the Water Board cannot specify how Olin will comply with the discharge limits set forth in the WDR. Staff suggested partial nitrate treatment in the WDR as a potential technology that Olin could use in the event that Olin can't meet the effluent discharge limits. Staff recognizes that Olin included "real time" nitrate analyzers in the ACS design that will allow for computer control and adjustment of blended proportions in response to nitrate concentrations in the extracted groundwater to ensure compliance with the effluent limits established in the proposed WDR. Additionally, Olin will frequently monitor and report the nitrate results from various monitoring wells, sentry wells, and domestic wells in accordance with the overall plume monitoring and reporting program. Staff will evaluate the monitoring results on a regular basis to ensure Olin is in compliance with the WDR and to compare nitrate concentration changes due to the reinjected groundwater with the predicted concentration changes for the various aquifers and well locations. Additionally, the estimated nitrate concentrations that Olin anticipates in the extracted groundwater are based on a conservative calculation of the mean concentration. For example, the blended nitrate concentrations in the extracted groundwater are estimated using 95 percent upper confidence level[3] (95% UCL) concentrations (as opposed to the mean[4] concentration) for the intermediate (IEW-1R) and deep aquifer extraction well (DEW-1).

[3] The 95% UCL is the value that when calculated for a random data set equals or exceeds the true mean 95% of the time.

[4] The mean is the sum of all the values divided by the number of values.

Olin estimates that the blended nitrate concentrations in the extracted groundwater will not exceed 38 milligrams per liter (mg/L). In the unlikely event that nitrate concentrations are higher than anticipated once the system starts up, Olin's contingency is to modify IEW-1R's design during ACS operation (e.g., isolating the lower portion of IEW-1R that has higher concentrations of nitrate but lower concentrations of perchlorate by using a packer device) to reduce the nitrate in the extracted water.

3) **General Comment from Olin regarding Impact of Reinjection on Tennant Well and in response to comments in draft WDR on Page 7, finding 15, tenth sentence; Page 9, finding 22, second paragraph; and Page 14, Ordering Paragraph B, point #2 (graph)** – *In the Draft WDR, the Water Board estimates that at the proposed quarterly and monthly nitrate discharge limits, on-Site reinjection of treated groundwater may have the potential to increase nitrate concentrations by up to 2 mg/L as nitrate. As noted in the attached comments, the method used to calculate the percent increase is incorrect and overestimates the potential effect of recharge on the nitrate concentration at the Tennant Well (which Olin earlier replaced by paying the cost of installing the higher capacity San Pedro Well in 2005). Applying the correct mathematical formula (described in the attached comments), the potential impact of on-Site reinjection on nitrate concentrations in the Tennant Well is estimated to be less than 0.5 mg/L, which is negligible compared to the temporal and spatial fluctuations of nitrate concentrations in the Llagas Subbasin.*

Staff's Response: Staff used conservative assumptions and calculations to estimate the nitrate increase in the Tennant Well. Staff "rounded up" the calculated nitrate increase in the Tennant well to 2 mg/L (see detailed calculation below). So, our conservative estimate is that nitrate in the Tennant Well will potentially increase from its current concentration of approximately 28 mg/L to 30 mg/L nitrate, which is within the temporal fluctuations (e.g., changes in nitrate concentrations due to seasonal changes in water table fluctuations, changes in spatial distribution of nitrate in groundwater, accuracy and precision of analytical analysis, etc.) of nitrate in the Tennant Well. Regardless, Olin's monitoring of nitrate concentrations in the shallow, intermediate, and deep aquifers in the vicinity of the Tennant Well will have sufficient spatial and temporal density to verify that actual nitrate concentrations are not different than the predicted changes of nitrate within each aquifer. Based on the concerns expressed in comments from other stakeholders, staff plans to modify MRP No. R3-2008-0028 before ACS startup (ACS startup scheduled for spring 2012) to ensure sufficient nitrate monitoring locations and frequency.

<u>Staff's Calculations for Estimated Increase in Nitrate from Tennant Well</u>:

Staff Assumptions:

- Nitrate in reinjected treated groundwater from the Olin Site will behave the same as perchlorate, with respect to transport in groundwater. This is a reasonable assumption because nitrate and perchlorate have similar chemical properties (e.g., behave similarly in groundwater).
- Staff used the difference between the perchlorate concentrations measured in the shallow aquifer and the Tennant Well to estimate a dilution factor for nitrate.
- Considering that perchlorate was likely discharged from a point source (smaller areal extent), and nitrate from the treated groundwater will be discharged via injection wells over a larger areal extent, staff conservatively reduced the calculated dilution factor by one half (resultant dilution factor of $1/10^{th}$) to account for the increased areal extent of the recharged treated groundwater.

- The calculation conservatively assumes that all of the perchlorate in the Tennant Well is from Olin's discharge and does not account for background sources of perchlorate.

Calculating dilution factor for nitrate using perchlorate data:
Representative source area of perchlorate in shallow aquifer: ..... 120 µg/L
Representative perchlorate concentration in the Tennant Well: ..... 6 µg/L
Resultant dilution factor:.....120/6 = 20
Dilution factor used in the calculation for nitrate: .....20 x ½ = 10

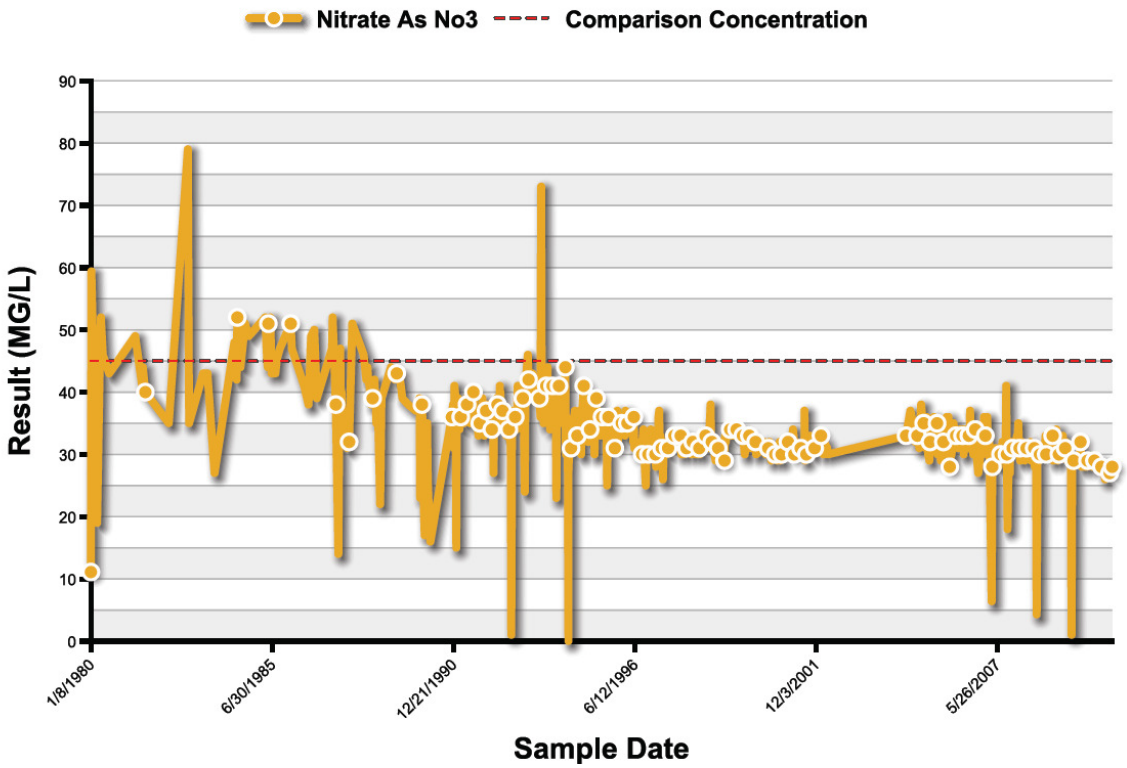
Calculating anticipated increase in nitrate in Tennant Well:
Current average concentration of nitrate in the shallow aquifer:.....24 mg/L
Estimated maximum long-term nitrate discharge concentration: .....38 mg/L
Resultant maximum shallow aquifer nitrate concentrations (100% discharge): .....38 mg/L
Change in shallow aquifer nitrate concentration over 10 years:..... 38-24 = 14 mg/L
Resultant change in Tennant Well concentration: ..... 14/10 (dilution factor) = 1.4 mg/L
Rounded up to the nearest integer:.....**2 mg/L**

4) ***General comment regarding Quarterly and Monthly Nitrate Limits and in response to Page 14, Ordering paragraph B, point #2 (graph) of proposed WDR*** – *"As illustrated by existing data, nitrate concentrations within the Llagas Subbasin fluctuate temporarily [sic] and spatially. As an example, the nitrate concentrations at MW-64 in the shallow and upper intermediate aquifer have varied by 225% and 50%, respectively, over the past 6 or 7 years. In addition, the proposed recharge is shown to have a negligible impact at the replaced Tennant well. Given these factors, the quarterly and monthly nitrate discharge requirements should be adjusted to 40 mg/L and 45 mg/L, respectively. These limits are protective of beneficial use, would allow maximum system operational flexibility, and maintain compliance with State Board Resolution 68-16.* "

Staff's Response: Staff is aware of the inherent spatial and temporal variance in the nitrate concentrations within the Llagas Subbasin, as reported in Olin's characterization and groundwater monitoring reports, as well as from other groundwater work in the basin. However, staff does not concur with Olin's request to increase the quarterly and monthly nitrate discharge effluent limits to 40 and 45 mg/L, respectively. Based on the information presented in Olin's feasibility studies, the limits proposed in the WDR are achievable and reasonable. Olin estimates that the blended nitrate concentration in the extracted groundwater will be 38 mg/L. The estimated nitrate concentration of 38 mg/L is based on conservative estimates (as described in our response to comment number 2 above) and Olin will be able to implement a contingency by altering the design of IEW-1R to reduce blended nitrate concentrations in the extracted groundwater.

In addition, the monthly limit of 43 mg/L, rather than 45 mg/L (the MCL) requested by Olin, allows for a buffer between the nitrate concentration reported by the analyzer (e.g., accuracy of the in-line nitrate analyzer is +/- 2%) and the actual concentration of nitrate in the effluent. It also creates a margin of safety that decreases the likelihood that the levels of nitrates in the effluent will exceed the MCL. Staff also anticipates that the average influent/effluent nitrate concentrations will decline as remediation progresses over time. Staff anticipates that the discharge will approach the average nitrate concentration (33 mg/L) in the upper intermediate aquifer as determined from monitoring well data in the area of Olin's groundwater extraction.. Nitrate concentrations in this portion of the Llagas Subbasin are also expected to continue to decline as a result of ongoing changes in land use from irrigated agriculture to residential land uses,

and as the District continues to introduce low-nitrate water via their percolations ponds to the Llagas Subbasin. Evidence of decreasing nitrate concentration trends are also shown by Tennant Well results. Nitrate concentrations in the Tennant Well show a long-term decline over the past 25 years from over 50 mg/L in 1985 to approximately 28-34 mg/L over the last couple of years (see graph below for the Tennant Well).



Source: Geotracker GAMA Website

5) ***Page 3, Perchlorate Distribution, first paragraph, second sentence of staff report:*** *"The correct direction is 'southeast' not 'southwest'."*

Staff's Response: Staff corrected the Staff Report accordingly.

6) ***Page 3, Perchlorate Distribution, first paragraph, last sentence of staff report and Page 6, finding 14, third sentence of the draft WDR:*** *"The Water Board attributes the perchlorate plume decrease to only the "natural attenuation" processes. While natural attenuation is one of the factors responsible for perchlorate reductions, the Water Board fails to mention other factors acknowledged elsewhere in the Cleanup and Abatement Order #R3-2007-0077 (CAO), Draft Staff Report and the Draft WDR. For example, in the CAO and several areas of the Draft Staff Report and the Draft WDR, the Water Board acknowledges the beneficial impact of the on-site groundwater treatment system, but fails to attribute source control for reducing perchlorate distribution in the Basin (CAO, paragraph 8.b). Likewise, the Water Board acknowledges Olin's installation of the domestic and community IX systems (e.g.: the West San Martin Water Works and San Martin County Water District) in the basin, but fails to acknowledge the beneficial impact of these treatment systems to reduce perchlorate (CAO, paragraph 8.a). Finally, the Water Board failed to mention the substantial benefit of our in-situ and ex-situ, enhanced bioremediation efforts for on-site soils and omitted their October 26, 2006*

acknowledgement regarding successful completion of on-site remediation activities (CAO, paragraph c.). These efforts should be acknowledged as they represent several documented factors responsible for the significant reduction in perchlorate distribution."

Staff's Response: The proposed WDR focuses on regulating the effluent concentrations from the ACS treatment that will be discharged to land rather than the overall perchlorate cleanup. Staff agrees that Olin has been very successful in their soil and onsite groundwater remediation efforts. Therefore, staff incorporated a discussion of Olin's cleanup efforts in the staff report and proposed WDR.

7) ***Page 3, Perchlorate Distribution, second paragraph, third sentence of staff report and Page 6, finding 14, second paragraph, third sentence of the draft WDR:*** *"Priority Zone C (PZC) is incorrectly defined; PZC perchlorate concentrations are between 11.0 µg/L and those >6.0 µg/L (greater than is omitted in the draft staff report). According to the California Office of Environmental Health Hazard Assessment, a perchlorate concentration equal to 6 µg/L is safe as below the MCL."*

Staff's Response: Staff corrected the staff report accordingly.

8) ***Page 4, Prohibitions and Effluent Limitations, first paragraph, second sentence of the staff report and Page 6, finding 14, second paragraph, third sentence of draft WDR:*** *"'(typically 'between' 1.2 and 1.6 µg/L)' should be 'typically below 1.2 to 1.6 µg/L'. Paragraph #8 of the Draft Waste Discharge Requirements provides a better definition of the MDL."*

Staff's Response: Staff concurs with Olin's proposed changes and staff revised the language in the proposed WDR to clarify that the method detection limit is typically below 1.2 to 1.6 µg/L.

9) ***Page 4, Prohibitions and Effluent Limitations, second paragraph, second sentence:*** *"If the Water Board documents a particular practical quantitation limit (e.g.: 4 µg/L), it is recommended that they also specify the EPA test method, in this case Method 314.0."*

Staff's Response: Staff added reference to US EPA Test Method 314.0.

10) ***Page 5, first paragraph (partial), first complete sentence****: "It is more accurate to state that simulations indicate that after 10 years of ACS operation, reinjected water in the vicinity of the Site will constitute 50 percent of groundwater in the upper intermediate, 30 percent in the middle intermediate, and 10 percent in the lower intermediate aquifer zones. Recommend revising as suggested*."

Staff's Response: Staff concurs and changed the text accordingly.

11) ***Page 5, Receiving Water Limitation for nitrate section, second paragraph, second sentence****: "Suggest inserting "i.e. to above the MCL solely from mixing with reinjected treated groundwater" after "significantly" since nitrate increases may occur due to other (anthropogenic) sources. The revised sentence would be:*
'Therefore, this Order prevents Olin's discharge from causing nitrate to increase above the MCL solely caused by mixing with reinjected treated groundwater, in the intermediate and deep aquifers.'"

Staff's Response: Staff added clarification that the receiving water limitation applies to increases resulting solely from mixing of reinjected treated water with receiving groundwater.

12) ***Page 3, continued finding 7, last paragraph, last sentence:*** *"The extracted groundwater volume (4,210,000 gallons) is incorrect. This volume represents the Forth (sic) Quarterly 2010 extraction total, not the system total. The correct extracted volume from 2004 through 2010 is 266,974,000 gallons."*

Staff's Response: Staff made the correction to the proposed WDR.

13) ***Page 4, finding 9, second paragraph, third sentence:*** *"The Water Board's characterization of a topographic high as an "alluvial fan" is incorrect. As described in the 2007 Llagas Subbasin Characterization report, (MACTEC, 2007), we suggest this sentence be revised to:*
'The Llagas Subbasin's northern boundary consists of a groundwater divide that is believed to coincide with the topographic high near where the Coyote Creek emerges from the eastern foothills.'"

Staff's Response: Staff made the suggested change to the language.

14) ***Page 5, continued finding 10, point #3 and last sentence:*** *"The cited maximum depth of the deep aquifer is incorrect. As indicated in our Annual Characterization reports, maximum depth increases southeast of the Site, but exceeds 500 feet bgs."*

Staff's Response: Comment noted and staff revised the text in the proposed WDR to clarify that the maximum depth of the deep aquifer exceeds 500 feet in some areas.

15) ***Page 6, finding 14, second sentence:*** *"The correct direction is 'southeast'".*

Staff's Response: Correction made.

16) ***Page 10, finding 22, first full paragraph, last sentence****: "This sentence cites the ACS' beneficial effects; however, the statement about reduction in nitrate loading to the land is not related to Olin, and should be clarified."*

Staff's Response: Staff changed the sentence to clarify that nitrate concentrations will decline due to surrounding land use changes.

17) ***Page 10, finding 23 and Page 14, Ordering paragraph C, point #3****: "This paragraph, stating that Olin is prohibited from "causing nitrate to increase significantly," is ambiguous as there are no quantitative criteria expressed. Given the seasonal fluctuations and spatial variations of nitrate concentrations in the different aquifers, it will be difficult to evaluate this criterion. This paragraph should be deleted; it is unnecessary given that compliance with the Waste Discharge Requirements is directly established by compliance with specific permit limits."*

Staff's Response: Staff agrees that the paragraph is ambiguous; based on Olin's comment and comments from other stakeholders; therefore, staff removed the paragraph. Before ACS startup, staff will implement modifications to the current monitoring program (MRP No. R3-2008-0028) to ensure that a monitoring program is in place to evaluate nitrate concentrations in all aquifer zones, domestic wells within the

area influenced by the recharged water, and the Tennant Well. Any increases in nitrate concentrations above those predicted by Olin (considering natural variability in the data) will result in a trigger of the following actions: 1) evaluate potential sources of increase (i.e., change in background concentrations, change in groundwater flow regime or land use, reevaluate calculations used to determine predicted nitrate concentrations in the various aquifers), 2) increased monitoring, if necessary, 3) staff will notify the City of Morgan Hill and nearby domestic well users if increasing trends are observed beyond what is predicted in the feasibility study, or 4) if concentrations change beyond what is predicted to occur and they are attributed to Olin discharge, the ACS system will either be modified or shutdown.

18) ***Page 11, finding 27****: "Olin generally agrees with the Water Board's analysis regarding State Water Board Resolution 68-16 (anti-degradation). The permitted discharge is a part of an overall ACS system that removes perchlorate and restores beneficial uses of the aquifers affected by perchlorate while at the same time maintaining nitrate concentrations that are (i) consistent with the maximum benefit to the People, (ii) will not unreasonable affect present and anticipated beneficial uses, and (iii) will not result in water quality less than that prescribed in State policies."*

Staff's Response: Comment noted.

19) ***Page 12, finding 31, second sentence****: "Because of the verb tense, this paragraph seems to imply that characterization is not yet complete. As acknowledged in the Water Board's June 30, 2010 letter, basin characterization has been completed sufficient to proceed with remediation. We suggest that the verb tense be changed to past tense."*

Staff's Response: Staff added a sentence to clarify that basin characterization is sufficiently complete to proceed with remediation.

20) ***Page 14, Ordering paragraph B, point #2 (graph****): "'Nitrate' should be specified as 'Nitrate (as NO3)'"*

Staff's Response: Staff concurs and made the recommended change.

21) ***Page 14, Ordering paragraph B, point #2 (graph), footnote #2:*** *"The Water Board's requirement to "minimize nitrate in the effluent while maximizing perchlorate" is ambiguous. The statement should be worded to better reflect planned operation as follows:*
'The discharger shall operate the ACS to establish containment of perchlorate and, if necessary, adjust extraction rates to achieve the specified discharge requirements.'"

Staff's Response: Comment noted and staff removed the wording from footnote #2 of Ordering Paragraph B.2 in the proposed WDR.

22) ***Page 14, Ordering paragraph C, point #1:*** *"This goal is stated incorrectly. The goal of the ACS is to establish perchlorate containment in the designated aquifers, treat groundwater to achieve the specified perchlorate discharge limits, and recharge treated groundwater in a manner that is compliant with the discharge specifications."*

Staff's Response: Comment noted and staff removed the wording from Ordering Paragraph C.1 in the proposed WDR.

City of Morgan Hill letter, dated May 20, 2011 Comments

1) *"Nitrate concentration levels resulting from the proposed action would potentially cause Morgan Hill drinking water supply to exceed drinking water safety standards for nitrate. Board staff projects that the City's Tennant Well aquifers would see an increase of nitrate concentration to a projected 36 mg/L. Department of Public Health mandates the shut down of the City's well operation if nitrate concentration level in its well water reaches 40 mg/L at anytime."*

Staff's Response: As a point of clarification, staff conservatively estimated an average nitrate increase in the upper intermediate aquifer of 3 mg/L (a nitrate increase from 33 mg/L to 36 mg/L) due to the ACS recharge over a ten year period. With dilution causing a diminishing effect of ACS recharge in the middle and lower intermediate and deep aquifers. The City of Morgan Hill's (City) Tennant Well produces water from the lower intermediate and deep aquifers, where the anticipated effect of the ACS recharge will be less. In addition, as per California Department of Public Health's (CDPH) letter, comment no. 2 on the proposed WDR (provided below): "*Tennant Well is equipped with an online nitrate analyzer that is programmed to shutdown the facility should the nitrate reach or exceed 40 mg/L.*" Simple mixing equations indicate that it is impossible for Olin's ACS recharge to cause an increase of the current nitrate concentration in the Tennant Well from 28 mg/L to 40 mg/L. A conservative estimate of the maximum expected increase in Tennant well is 2 mg/L (nitrate increase from 28 mg/L to 30 mg/L). Nevertheless, the proposed MRP requires Olin to conduct monitoring for nitrate in aquifers above the Tennant Well screen intervals to monitor the change in nitrate over time. Furthermore, based on our discussions during the May 10, 2011 conference call between the City, Central Coast Water Board staff, and CDPH, CDPH made it clear that it only mandates shutdown of a well when it reaches the MCL for nitrate; operation of a well with nitrate at 40 mg/L is acceptable provided that nitrate concentrations are not showing an increasing trend or highly variable nitrate concentrations.

2) *"The proposed Order that 'the discharge shall not cause a significant increase in nitrate concentrations.' would not meet the requirement of State Water Board Resolution 68-16 requiring the 'best practicable treatment and control of discharge' The City proposes a defined 'significance level' so that Olin must cease reinjection operations any time the concentration in the intermediate and deep aquifer reaches 34 mg/L in order to investigate the potential impact on drinking water supplies and methods to reduce nitrate levels."*

Staff's Response: In the case of Olin's ACS, the best practicable treatment and control is ion-exchange for perchlorate and blending for nitrate. Staff does not concur with the City that the receiving water limit be 34 mg/L for the following reasons:1) portions of the intermediate aquifer already exceed 34 mg/L in the ACS recharge area, which is not a reasonable criteria for the aquifer in general, 2) a conservative estimate of nitrate concentration increase in the Tennant Well caused by ACS recharge is less than 2 mg/L (assuming an effluent of 39 mg/L), and 3) The MRP has a monitoring program to verify assumptions that the increase in Tennant Well is negligible compared to CDPH required actions and recent variability in nitrate concentrations. Olin did not cause elevated nitrate conditions in the area. Please see staff's response to the District's comment no.3 regarding "significance levels" and required actions.

3) *"Proposed Action Would Degrade Drinking Water Supply Nitrate Levels to the Edge of Water Safety Threshold Standards."*

Staff's Response: Staff respectfully disagrees; staff's conservative estimate is that nitrate may increase by up to 2 mg/L in the Tennant Well in response to the ACS recharge if the effluent concentration is 39 mg/L. The effluent concentration will likely be lower than 39 mg/L so staff anticipates that the increase in nitrate in the Tennant Well will be less than 2 mg/L. Even with an increase in the Tennant Well nitrate concentration of up to 2 mg/L, a change of 2 mg/L is within the variation of the nitrate concentrations in the Tennant Well. Additionally, an increase of 2 mg/L of nitrate would not require any corrective actions, changes in monitoring requirements, or additional expenditures on behalf of the City, as the Tennant Well's current nitrate concentration is approximately 28 mg/L. The amount of time for the predicted nitrate increase to occur in the Tennant Well is likely to be several years (as the upper most portion of the Tennant Well screen is 190 feet below ground surface) and the monitoring network will be designed to allow Olin to monitor and staff to evaluate nitrate changes before they reach the Tennant Well.

4) *"Though the City supports the treatment of perchlorate, the City has raised with Board Staff concerns that the proposed treatment system would transport water from areas with high nitrate concentrations to the City's Tennant Well area where the nitrate concentration is lower. Indeed, the Board staff report indicates that "effluent nitrate limits could increase the nitrate concentrations in the receiving water (shallow aquifer) from approximately 24 mg/L up to 39 mg/L.' More concerning to the City is that "the average nitrate concentrations in the upper intermediate aquifer (the vicinity of the Site) could increase from the current average on 3 mg/L up to 36 mg/L, after ten years of reinjection.'"*

Staff's Response: We understand the City's concern; however, as discussed above, dilution of the effluent as it mixes with progressively deeper aquifers will protect the Tennant Well from experiencing a significant increase in nitrate resulting from the ACS recharge. Please see staff's response to the District's second comment as it is a related comment pertaining to the State's Anti-Degradation Policy.

5) *"The proposed action pushes nitrate concentration levels at the City's Tennant Well perilously close to the level where the City would have to shut down its well operation. As discussed above, the City is obligated to shut-down the Tennant Well in the event nitrate levels are greater than or equal to 40 mg/L To meet this requirement, nitrate levels at Tennant Well are closely monitored; measured by an on-line analyzer, checked daily by a certified operator and samples sent to a certified laboratory weekly. The City's on-line nitrate analyzer at Tennant Well shows nitrate levels in decline, There is a 9% decrease in the annual average nitrate level measured at Tennant Well by this instrument from May 2005 to May 2011. Consistent with the on-line nitrate analyzer, the weekly samples analyzed by the laboratory also show a downward trend in the level of nitrate as observed in the resulting water quality reports. Whereas 2005 returned two samples in February that reached 38 mg/L and 37 mg/L, laboratory analyst of Tennant Well nitrate levels in 2011 have not returned a single sample above 29 mg/L".*

"Overwhelming evidence supports the City's claims that nitrate levels in the vicinity of Tennant Well are in decline. This is a benefit to the community. Olin's plan reverses the trend of declining nitrate levels in the vicinity and increasing the nitrate threat to Tennant Well."

Staff's Response: Based on our discussions during the May 10, 2011 conference call between the City, Central Coast Water Board staff, and CDPH, CDPH made it clear that it only mandates shutdown of a well when it reaches the MCL for nitrate; operation of a well with nitrate at 40 mg/L is acceptable provided that nitrate concentrations are not showing an increasing trend or highly variable concentrations. As clarified by CDPH's comment no. 2 provided below: "*Provided that the anticipated increase holds true, the Department considers the impact to City of Morgan Hill's Tennant Well to be non-significant. Furthermore, Tennant Well is equipped with an online nitrate analyzer that is programmed to shutdown the facility should the nitrate reach or exceed 40 mg/L. However, increases in nitrate concentration in Tennant Well above 36 mg/L and trending upward may warrant modified operation of the potable water source, which will negatively impact the City of Morgan Hill."* Staff agrees that nitrate concentrations in the Tennant Well are in a state of long-term decline, which is very promising and further supports staff's contention that nitrate increases in the Tennant Well should not reach above 30 mg/L, given 28 mg/L holds as the background concentration for nitrate. The decreasing trends may indicate that concentrations in the Llagas Subbasin are decreasing therefore the ACS effluent should experience similar declines after startup of the system. If these basin-wide decreasing trends covered in the City's comment continue, the predicted nitrate effluent value is a conservative estimate over the life of the ACS system, and therefore the overall nitrate increase imparted to the Tennant Well will be less than 2 mg/L. Additionally, as the ACS system operates the perchlorate concentrations will also decline in the Tennant Well.

6) *"Proposed Order Should Define What Constitutes "Significant Increase in Nitrate" That Would Trigger Protective Actions*

Given the clear degradation of water quality in nitrate levels, the proposed action treads on the borderline of the State Water Board Resolution 68-16:

"Any activity which produces or may produce a waste or increased volume or concentration of waste and which discharges or proposes to discharge to existing high quality waters will be required to meet waste discharge requirements which will result in best practicable treatment and control of the discharge necessary to assure that (a) a pollution or nuisance will not occur and (b) the highest water quality consistent with maximum benefit of the people of the State will be maintained"

The City does not believe that that proposed Order is the "best practicable treatment and control of the discharge. With regard to the level of degradation in the receiving water, the proposed Order only provides that:

"The discharge shall not cause a significant increase in nitrate concentrations in the intermediate and deep aquifer monitoring wells located within the ACS recharge area"

Given that Board staff projects nitrate concentrations of the injected water and increased concentration in the aquifer would come perilously close to drinking water safety thresholds, the proposed Order is unduly vague and does not propose the "best practicable treatment and control".

The City requests that Board clearly define what constitutes a "significant increase" in the nitrate level to the intermediate and deep aquifers. The City suggests an increase to 34 mg/L of nitrate in these aquifers (on a quarterly average basis) would be considered significant due to the contamination risks to the ground water and in particular the city owned Tennant Well. At this significant level, Olin should be required to cease

reinjection of the treated water and cooperate with the Board and the City to undertake investigation as to ways to ensure that nitrate concentration does not exceed drinking water standards, including examination of potential other sources of nitrate.

The suggested limit of 34 mg/L would provide the City with a 12% buffer between the operating restriction of the Tennant Well (40 mg/L) imposed by the Department of Public Health and the projected increased nitrate levels (36 mg/L) contributed by Olin's proposed operations.

The suggested limit is also reasonable in light of the permitted effluent concentration in the proposed Order. The proposed order limits Olin re-injected effluent to 39 mg/L on a quarterly average basis and 43 mg/L on a monthly average basis. The City notes that 39 mg/L is only 1 mg/L below the concentration at which the City would have to shut down its well operations and 43 mg/L would cause the City to shut down its wells.

City understands that Board staff projects that the effluent concentration would be diluted when it blends with receiving water at the intermediate and deep aquifer levels (where the drinking water resides). However, these are only projections predicated upon assumptions that may or may not prove to be true. The City, faced with a strict order to SHUT DOWN its well operations cannot gamble with such projections and assumptions. The City is reasonable in requesting that there is a defined level of nitrate concentration in the aquifer itself (34 mg/L) that would trigger Olin and the Board to take cooperative action with the City to remedy nitrate contamination so that it stays below the drinking water safety standard threshold."

Staff's Response: Staff does not concur with the City's proposed effluent limit of 34 mg/L. As stated above, the quarterly effluent limit for nitrate is set at 39 mg/L. Conservative predictions estimate the ACS recharge nitrate concentration at a maximum of 38 mg/L, and monitoring of surrounding wells upgradient of the extraction points suggests this effluent nitrate concentration may be closer to 33 mg/L after the ACS reaches steady-state operation. Reinjected groundwater will travel downward and laterally through hundreds of feet of saturated silt, sand, and gravel in the shallow, intermediate, and deep aquifers and the confining units prior to reaching the Tennant Well screen. If we assume the ACS recharge nitrate concentration is at 38 mg/L (as a maximum) and staff conservatively estimated the dilution factor for nitrate based on the dilution observed for perchlorate (see calculation in response to Olin's third comment above), the Tennant Well will still only increase from its current nitrate concentration of 28 mg/L to 30 mg/L. This example demonstrates that the effluent limit of 39 mg/L provides appropriate and adequate protection for the Tennant Well. The MRP will also require monitoring at locations between the injection point and the Tennant Well (and other drinking water wells) to verify effects of the ACS recharge. In addition, an effluent limit of 34 mg/L does not allow for the best practicable treatment and control using blending because the intermediate and deep aquifers already contain nitrate at or above 34 mg/L, making blending to that level impractical. Before ACS startup, the Executive Officer will modify the MRP to increase monitoring locations and frequency of sampling for nitrate.

Santa Clara Valley Water District letter, dated May 20, 2011 Comments:

1) *The Santa Clara Valley Water District (District) supports the Regional Water Quality Control Board's (Water Board's) efforts to expedite Olin's ACS.*

Staff's Response: Comment noted; staff appreciates the District's support of our efforts.

2) ***Nitrate Effluent Limitations***
"The District is concerned about the nitrate effluent limitations of 39 parts per million (ppm; quarterly average) to 43 ppm (monthly average) as this water is to be re-injected into the shallow groundwater, which is of higher quality. The current shallow zone nitrate concentrations in the immediate vicinity of the Site range from 10 to 27 ppm. The reinjection of the treated groundwater at rates of 500 to 1,000 gallons per minute (gpm) may result in significant impact on the shallow groundwater quality. Although the District acknowledges the benefit of reducing perchlorate in the intermediate and deep aquifers, this should not be achieved by degrading water quality in the shallow zone, which is hydraulically connected to deeper zones currently pumped for beneficial use. The District believes that additional actions can be required to lessen this impact, including lowering the effluent limitation for nitrate and monitoring to assess the significance of impacts to the shallow groundwater and to the domestic well owners in the ACS recharge zone."

Staff's Response: Staff concurs with the District that the shallow aquifer (water bearing zone) within the ACS recharge area has lower nitrate concentrations than the proposed effluent limit for nitrate. However, as discussed in the proposed WDR and staff report, the proposed reinjection and associated effluent limits are consistent with the Anti-Degradation Policy, despite some anticipated increases in nitrate concentrations in the shallow, intermediate, and potentially the deep aquifers within the ACS recharge areas over the next ten years. It is important to note that Olin did not cause nitrate to be present in the aquifer. The proposed reinjection and effluent limits provide the maximum benefit of the people of the state because the ACS will remove perchlorate and restore the currently-impaired beneficial use of the drinking water aquifer with only minimal impacts on nitrate concentrations. The proposed effluent limits for nitrate will allow for some increase in nitrate concentration, but with the quarterly effluent limit of 39 mg/L and the monthly effluent limit of 43 mg/L, the shallow aquifer will never exceed the drinking water standard for nitrate (45 mg/L) as a result of the proposed reinjection. The ACS system is projected to have a flow rate of 530 gpm (higher rates not proposed by Olin at this time) and a maximum nitrate concentration of 38 mg/L, as compared to the current calculated average (upper confidence interval) of 24 mg/L in the shallow aquifer and an average of 33 mg/L in the upper intermediate aquifer (note that maximum detected concentrations in the ACS recharge zone are 68 mg/L in the shallow and 110 mg/L in the intermediate aquifer – in these locations, the proposed discharge will dilute existing nitrate concentrations). Staff anticipates an increase of nitrate in the recharge area of the shallow and upper intermediate aquifer to 38 mg/L and 36 mg/L, respectively, after ten years of ACS operation. Since the effluent limit is set at 39 mg/L it is impossible for there to be an increase in nitrate above the drinking water standard of 45 mg/L due to reinjection of treated groundwater. Therefore, the beneficial use remains protected. Additionally, the shallow aquifer currently is not used for drinking water because it is too shallow for a typical properly sealed domestic or municipal well. Therefore, the predicted maximum increase of 3 mg/L nitrate in the upper intermediate aquifer, while cleaning up perchlorate to below drinking water standard of 6 µg/L, is consistent with the maximum benefit of the people of the State.

As for lowering the effluent limit, staff does not concur with the District. The effluent limit is protective of beneficial uses and reasonable. The effluent limit as currently proposed allows Olin to operate the ACS system under the variable nitrate concentrations found in the ACS recharge area and without further delay. Also, Olin will be able to modify the producing screen intervals of the intermediate extraction well, IEW-1R, to reduce the blended nitrate concentration in the effluent, if necessary, to ensure the blended nitrate concentrations do not exceed 39 mg/L.

However, based on the District's comments, staff reviewed the current nitrate monitoring program included in the current MRP No. R3-2008-0028. Staff identified some data gaps relative to monitoring both the extent of the anticipated ACS recharge zone and the need for some additional monitoring to evaluate changes in nitrate concentrations in the vicinity of domestic well users. The Executive Officer will revise the MRP before ACS startup (first quarter 2012) and add additional monitoring locations, including monitoring of additional domestic wells and increasing the frequency of monitoring from semiannual to quarterly at locations near the injection wells. The revised MRP will ensure that staff can detect any changes in nitrate concentrations to confirm the predicted nitrate concentrations once reinjection of the treated groundwater begins.

Both the District's letter and the City of Morgan Hill's letter bring up the issue that the proposed treatment system would transport water from areas with high nitrate concentrations to an area where the nitrate concentration is lower. However, this situation is not unique to Olin's proposed remediation project. A similar transfer of poorer quality water to higher quality shallow groundwater is apparently currently underway in some locations by other wells, including the City's well and water distribution system. For example, the City's Tennant Well has a reported average concentration of 28 mg/L of nitrate (as NO_3). This water is delivered north into the City's distribution system. The average delivered water in the City is 25.1 mg/L nitrate as NO_3 with concentrations as high as 32 mg/L.[5] In an urban system, a significant percentage of delivered water does not end up in the sewer system. Outdoor uses lead to some recharge of groundwater under the area of use. Some of these areas of use, particularly where shallow water is also influenced by the District's imported water (having nearly no nitrate), have much lower nitrate concentrations in shallow water. The well identified as "Morgan Hill 101829 09S/03E-23L05 M SAN PEDRO 462" is very shallow and has very low nitrate[6] while another shallow well in the same report, MH 101665 has a fairly low nitrate concentration of 13.7 mg/L nitrate as NO_3. Consequently, Morgan Hill's system is transporting water from areas with higher nitrate concentrations to some areas where the nitrate concentration is lower. The same situation appears to be true in parts of nearby San Martin (immediately south of Morgan Hill and the Olin Site) with wells drawing higher nitrate water and recharging some areas with lower nitrate (e.g., deeper wells have significant nitrate concentrations while well 101856 has a screen starting at the shallow depth of 50 feet below ground surface and has a nitrate concentration of only 0.4 mg/L as NO_3 [ibid]). Consequently, Olin's remediation system will be similar to some other existing water transfer systems in the area regarding nitrate concentrations.

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[5] 2010 Report to Consumers on Water Quality -Consumer Confidence Report, City of Morgan Hill

[6] Lawrence Livermore National Laboratories, California GAMA Program: Sources and transport of nitrate in shallow groundwater in the Llagas Basin of Santa Clara County, California, July, 2005: http://www.swrcb.ca.gov/gama/docs/llagas_nitrate_shallow_gw2005_llnl.pdf

3) *"Olin's reinjection has the potential to adversely impact the 23 domestic wells located in the ACS recharge zone. Nitrate analysis should be required for the domestic wells located in the ACS recharge zone. Should this monitoring indicate statistically significant nitrate increases in the domestic wells, Olin should be required to assess the cause and evaluate options to minimize the increase it is attributed to the reinjection. If Olin's reinjection results in any domestic wells in the ACS exceeding the MCL for nitrate, Olin should be required to provide an alternative water supply for the well users."*

Staff's Response: As presented in Addendum 3 to the Plume Migration Control Feasibility Study (Geosyntec, 2010) and as shown in Figure 9 of the proposed WDR, approximately 24 domestic wells are located within the ACS recharge zone in the intermediate aquifer. Nitrate data is available for eight of the 24 domestic wells and for several of Olin's monitoring wells in the ACS recharge zone. Out of those eight wells, five have had nitrate concentrations above the MCL, with a maximum detected concentration of 76 mg/L. Staff estimated typical nitrate concentrations at the other domestic wells to be between 12 and 60 mg/L, using the nitrate contour map (Figure 7 of the proposed WDR). Based on the map, three additional domestic wells likely have nitrate concentrations above the MCL (i.e., 30% of the domestic wells in the ACS recharge zone likely have experienced nitrate concentrations above the MCL).[7] Based on staff's calculations, nitrate will likely increase in one-half of the domestic wells and the remainder will likely decline in nitrate concentrations. The average change in nitrate concentration estimated for the 24 wells is approximately 2 mg/L. Of the wells predicted to have a nitrate increase due to mixing with ACS recharge, the maximum is an increase to 33.5 mg/L in one well. The ACS recharge will benefit wells that currently have nitrate concentrations greater than what staff anticipates Olin will introduce via the ACS recharge in the intermediate aquifer for approximately half of the 24 domestic wells in the ACS recharge area.

4) *"Addendum 3 to the Plume Migration Control Feasibility Study (Geosyntec, 2010) included pumping from well DEW-2 to provide containment for the lower deep aquifer and to reduce the nitrate concentrations in the blended groundwater entering the treatment system. The current plan does not include pumping from well DEW-2, instead relying on the proposed Gradient Driven Remediation (GDR). While the District will be commenting on the GDR concept separately, the District recommends that well DEW-2 be incorporated into the current plan to meet its initial goals."*

Staff's Response: Staff is currently evaluating Olin's GDR pilot study work plan[8] for cleaning up the lower deep aquifer. Staff is unaware of any domestic wells that are screened in the lower deep aquifer but some City of Morgan Hill municipal supply wells have a portion of their screen in this portion of the deep aquifer. Staff's main objective for remediation of perchlorate in the lower deep aquifer is to prevent potential northeast

[7] For wells in this study area with known nitrate concentrations exceeding the MCL, Staff has notified well owners/users and provided public health reference material for them to make informed decisions about their drinking water. If additional wells are found to be above the MCL, staff will notify those owners/users as well.

[8] Olin's hydraulic investigations have determined that a strong downward gradient exists between the intermediate and upper/middle deep aquifers and the lower deep aquifer. The Gradient Driven Remediation (GDR) wells will take advantage of the strong downward hydraulic gradients to induce flow from the intermediate aquifer (no perchlorate) into the lower deep aquifer zone (elevated perchlorate) to improve groundwater quality of the lower zone without negatively impacting either zone. GDR requires no pumping, thus it is a green solution that could create potentially significant reductions in greenhouse gas emissions and will not require energy to operate.

migration of perchlorate towards City of Morgan Hill's municipal supply wells (the wells that are located east and northeast of the Olin Site). Staff will review this new technology for remediation of the lower deep aquifer but GDR requirements and conditions are not included in this proposed WDR. Prior to our review of the GDR concept, staff will not require well DEW-2 to be incorporated in the ACS because other contingencies (e.g., modification of IEW-1R) are available to ensure that the nitrate concentrations will meet the WDR effluent limits.

5) *Beneficial Use of Shallow Groundwater (Page 11, Number 27)*
"This section states, "Although nitrate concentrations will increase locally in the shallow aquifer (that does not currently have a beneficial use) ... ' While the shallow aquifer is not currently being used as a source of drinking water, the District believes that this statement is inaccurate and recommends modifying this statement to read, "Although nitrate concentrations will increase locally in the shallow aquifer (that is not currently being used as·a source of drinking water)~ .."

Staff's Response: The comment is correct and staff made the correction to the WDR as recommended.

6) *Effluent Monitoring (Item 25)*
"Item 25 states that the Operation, Maintenance, and Monitoring (OMM) plan requires monthly sampling for perchlorate and nitrate. This frequency of sampling is sufficient once the system is up and running and reached a steady state. However, during initial operations, conditions may be much more dynamic. The District recommends that more frequent sampling be required during the start-up period until steady-state conditions can be demonstrated."

Staff's Response: Staff is still in the process of reviewing the OMM. Olin will conduct more frequent sampling during the start-up phase to ensure that discharge limits for perchlorate and nitrate are met. Additionally, Olin will monitor nitrate real-time using in-line instruments and Olin will also collect samples for laboratory analysis to check the calibration of the in-line instruments.

7) *Monitoring and Reporting (Provision 2)*
"A groundwater contour map should be required in each quarterly monitoring report in order to evaluate mounding in the injection area and capture in the intermediate and deep aquifers."

Staff's Response: The current MRP requires Olin to generate groundwater contour maps on a semiannual basis. However, during start up and until steady-state (approximate) conditions are established, the Executive Officer may require more frequent submittal of groundwater contour maps.

Comments from the California Department of Public Health – May 13, 2011

1) *"The Draft Order identifies only the City of Morgan Hill as potentially impacted by the ACS. It should be noted that there are other public water systems, including two small community water systems and three transient, non-community water systems, within the vicinity of the ACS (as bordered by Tennant Avenue, Santa Teresa Blvd, Cox Avenue. in San Martin, and Highway 101) that may be impacted by the ACS. One of the systems currently has treatment for nitrate; therefore, any increase in nitrate levels to the source*

may affect nitrate treatment operations. These other systems should also be considered when assessing potential impacts due to the ACS."

Staff's Response: Staff concurs and will ensure that the MRP has appropriate monitoring locations to evaluate potential impacts of the ACS recharge on small community water systems. Staff determined that Cox Avenue is a significant distance south of the ACS recharge area (over one mile) so that the ACS recharge is unlikely to have an effect on wells located near Cox Avenue.

2) *"Item 2 of the Discharge Specifications (page 14) indicates that the effluent discharge limits for nitrate is 43 mg/L for the monthly average and 39 mg/L for the quarterly average. Based on these discharge limits, it is anticipated that the corresponding increase in nitrate at Tennant Well will be up to 2 mg/L resulting in an estimated increase in the Tennant Well nitrate concentrations from 28 mg/L to 30 mg/L. Provided that the anticipated increase holds true, the Department considers the impact to City of Morgan Hill's Tennant Well to be non-significant. Furthermore, Tennant Well is equipped with an online nitrate analyzer that is programmed to shutdown the facility should the nitrate reach or exceed 40 mg/L. However, increases in nitrate concentration in Tennant Well above 36 mg/L and trending upward may warrant modified operation of the potable water source, which will negatively impact the City of Morgan Hill."*

Staff's Response: Comment noted. As we have responded to similar comments from other interested persons, staff will modify the MRP to ensure that monitoring of the receiving water is capable of verifying that the anticipated increase in nitrate is a conservative estimate such that the nitrate increase in the Tennant Well resulting from ACS recharge is in the range anticipated as described above.

3) *"Item 25 of the Draft Order (page 10) states that "an Executive Officer-approved [operations, maintenance and monitoring] (OMM) plan is in place that requires monthly effluent sample collection and laboratory analyses for perchlorate and nitrate, and instantaneous monitoring for nitrate in the treatment stream using in-line analyzers. Instantaneous monitoring of nitrate allows for timely system adjustments and potential shutdowns, if necessary." Shutdown and alarm functions consistent with the effluent discharge limits and programmed into the in-line analyzer should be included in the operations and reliability of the ACS and should be specified in the OMM. Furthermore, action items should be specified in the event that a shutdown or alarm is triggered."*

Staff's Response: Staff concurs. The OMM must require immediate shutdown and alarm if nitrate analyzers measure concentrations that exceed 43 mg/L, with commensurate written notification to the Water Board. Action items include checks on calibration of in-line sensors (i.e., sending water samples to a certified laboratory), change in blending proportions to reduce nitrate, as necessary, or implementing the contingency plan.

4) *"Item 1 of Receiving Water (Groundwater) Limitations (page 14) states that "the goal of the proposed ACS is to blend concentrations of nitrate from offsite extraction wells as close to the present receiving water concentrations for nitrate as economically and technically possible." Blending operations should be specified in the Executive Officer approved operations, maintenance, and monitoring (OMM) plan and should include action items when the nitrate concentrations of the effluent discharge exceed those specified in the Draft Order."*

Staff's Response: Staff concurs and will ensure that the blending operations and action items associated with meeting the effluent limits in the proposed WDR are included in the OMM plan.

Clean Water Action Comments – May 19, 2011

"Thank you for this opportunity to comment on the draft Waste Discharge Requirements (WDR) Order R3-2011-0209 for Olin Corporation's Aquifer Containment and Cleanup System employed to address the perchlorate contamination in the Llagas Subbasin. Clean Water Action (CWA) generally supports adoption of this WDR related to the reinjection of treated groundwater to the shallow aquifer beneath the Olin Site.

CWA is a national citizens' organization working for clean, safe, and affordable water, and prevention of health-threatening pollution. We have approximately 85,000 members in California, including in the perchlorate affected areas of Morgan Hill, San Martin, and Gilroy.

As an active participant in meetings of the Perchlorate Community Advisory Group since 2003, CWA has closely followed the efforts to characterize the perchlorate contamination in the Llagas Subbasin and identify the most effective strategies to cleanup the perchlorate plume. There is no doubt that these efforts have come a long way since the problem became public and we applaud Regional Board Staff's diligence and transparency as the impacted community works with them to ensure that remediation advances in a timely manner.

We agree with Staff's assessment that this WDR is a major step forward in actually removing the perchlorate from the local drinking water supply. While we believe it serves the greater good of the community, we are concerned that reinjection of the perchlorate treated water into the groundwater will potentially increase nitrate concentrations in both the shallow and intermediate aquifers. This is particularly of concern given that local nitrate levels, though variable throughout the Subbasin, do in some cases already exceed the nitrate drinking water standard of 45 mg/L. We appreciate that the Order appropriately sets a quarterly effluent discharge limit of 39 mg/L of nitrate as NO3 (Item #22) to provide a margin of safety, and prohibits nitrate levels to increase significantly in all aquifers currently used for domestic and municipal supply (Item #23). However, we are concerned that these measures alone do not accurately monitor or adequately protect the aquifers against degradation.

As part of our support for the WDR, therefore, CWA asks that a robust monitoring program be established to monitor trends in the nitrate levels of the aquifers, with a particular focus on the drinking water wells influenced by the recharge of the perchlorate treated water. Of course, because nitrate is unrelated to Olin's operations, it will be regulated under a separate WDR (R2-2008-0010). To ensure optimum coordination and protection, we urge the Board to explicitly include a stipulation in this WDR revoking the discharge waiver for nitrates containing water if the trend in nitrate levels indicates that degradation of the aquifers threatens to cause exceedences of the drinking water standard.

Again, we commend Regional Board Staff for their dedication to working with the local impacted community, as well as the responsible party, to ensure an effective perchlorate cleanup program. Because moving forward with the perchlorate treatment program is essential in protecting the health and safety of the community, we urge the Board to

adopt this WDR. CWA certainly recognizes that it is not uncommon that efforts to address one water contaminant can conflict with concerns about other pollutants. Our recommendations above are therefore made in the spirit of strengthening the proposed WDR and we appreciate your consideration of them."

Staff's Response: Staff members appreciate Clean Water Action's recognition of the Water Board's diligent and transparent efforts in working with the community in getting perchlorate cleaned up in a timely manner. As our above comment responses indicate, staff concur that the nitrate monitoring requirements for the receiving water need to be robust enough to ensure protection of all the beneficial users of the groundwater. Therefore, staff will modify MRP No. R3-2008-0028 to include additional monitoring locations and more frequent monitoring to verify the extent of the ACS recharge zone and ensure that projected increases in nitrate caused by ACS will be protective of beneficial users.

CONCLUSION

This Order establishes effluent limits for treated groundwater from Olin's ACS and finds that this discharge complies with the State Water Board Resolution 68-16 (often called the Anti-Degradation Policy)..

Adoption of this Order will allow Olin to initiate construction of the offsite groundwater treatment system that will cleanup groundwater downgradient from the Site. Residents in this area have been impacted by the discharge of perchlorate into their drinking water for decades, and this Order will start the final major phase of the cleanup.

RECOMMENDATION

Adopt Order No. R3-2011-0209 for the ACS project.

ATTACHMENTS

1. Draft WDR Order No. R3-2011-0209
2. Comment Letters

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