California Regional Water Quality Control Board
Central Coast Region

Terry Tamminen
Secretary for Environmental Protection

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Arnold Schwarzenegger
Governor

February 24, 2004

Mr. Richard W. McClure
Olin Corporation
Environmental Remediation Group
PO Box 248
Charleston, TN 37310-0248

Mr. Jay McLaughlin
President and CEO
Standard Fusee Corporation
PO Box 1047
Easton, MD 21601

Dear Mr. McClure and Mr. McLaughlin:

SLIC: 425 TENNANT AVENUE, MORGAN HILL; THIRD QUARTER GROUNDWATER MONITORING REPORT COMMENTS

Regional Board staff have reviewed the Third Quarter Groundwater Monitoring Report (Monitoring Report) submitted November 6, 2003 by Olin Corporation. For clarification and purposes of this letter, Olin Corporation and Standard Fusee Corporation are hereafter called "Discharger" when referred to collectively. The report outlines Olin's activities to comply with Revised Monitoring and Reporting Program No. 2001-161 (MRP No. 2001-161). Olin has also included proposed changes to MRP No. 2001-161 for intermediate zone sampling. In addition, we have received and considered Monitoring Report comments from the Santa Clara Valley Water District (SCVWD) and Cities of Morgan Hill and Gilroy. Based on our review, the Report is generally adequate. However, we have prepared the following comments to seek further clarification or request additional information:

1) **Page 6, 4.2.1 Representative MRP Wells** – The Report states that 45 representative MRP wells were identified within the proposed offsite monitoring area to "assess perchlorate trends, depth discrete perchlorate-containing groundwater zones, and seasonal variations in the sub-basin". Regional Board staff have previously discussed these 45 representative MRP wells with Olin officials at a November 21, 2003 meeting. At that meeting, we verbally notified Olin that well construction information along with other pertinent information is needed to justify using these wells for long term perchlorate plume monitoring. As we understand, Olin is going to submit a technical justification for the 45 Representative Offsite Monitoring Wells being utilized in the First Quarter 2004 Groundwater Monitoring Report, due April 30, 2004. Please be aware that any supply wells used must meet the minimum requirements for monitoring well construction and siting including but not limited to: total depth, well logs, screen length, screen location, access to measure groundwater elevations, and to ensure long term access to each well. If these data are

not available or should additional wells be necessary, then appropriately sited, constructed, and screened monitoring wells shall be installed.

This Monitoring Report section also states that additional wells have been identified and can be substituted for representative MRP wells should a representative MRP well not be accessible. For long term plume monitoring, it is essential to have long-term water quality data from designated monitoring points. For wells that meet the construction and siting requirements mentioned above, long term access agreements may need to be secured. Access to any well shall be as long as needed for plume monitoring.

2) **Page 6, 4.2.2 Wells with Perchlorate Concentrations Between 2 and 4 µg/l** – We request that Olin Corporation include a flag on tabulated results for wells with trace detections, [*Specifically, Tables 1 Onsite Perchlorate Results, Table 2 Offsite Perchlorate Results – Representative MRP Wells, Table 3 Offsite Perchlorate Results – 2 to 4 µg/l, Table 4 Offsite Water Quality Results – Tier 5 Wells*, and *Table 5 Offsite Water Quality Results – Additional Offsite Well Sampling*]. Although we understand Olin's concerns about data reported below 4 µg/l, we believe proper flagging or filtrating can be made to clarify the meaning of trace detections.

3) **Page 6, 4.2.3 Tier 5 Wells** – While Olin has made progress with sampling of the identified Tier 5 wells, we are not yet convinced that the plumes' lateral and vertical extent is fully characterized. Wells in this area shall continue to be tested and any wells proposed as monitoring points shall meet the same requirements outlined in the first bullet. Data gaps at the fringes of the plume must be filled. We believe it is very important to be confident of how perchlorate is migrating near the City of Gilroy Water Supply Wells Please keep us apprised of your efforts in this endeavor.

GENERAL COMPLIANCE WITH MRP No. 2001- 161

a) Monitoring and Reporting Program, Item 1, requires Olin to submit field-sampling data for each well sampled. The Report did not contain field data for offsite well sampling or a discussion on why the information was not included. Please include field-sampling data for offsite wells in future monitoring reports or submit technical justification for not collecting and reporting data.
b) Monitoring and Reporting Program, Item 4, requires Olin to submit groundwater potentiometric maps and flow directions for all aquifer intervals monitored. While onsite potentiometric maps were provided, offsite maps were not. Further, no explanation was submitted to why the maps were not included. Additionally, regional offsite flow directions were discussed but current data were not included. Please include this information if it is available for the 3rd quarter report and for future Monitoring Reports.
c) Construction data for the offsite wells sampled, including the 45 Representative MRP wells were not included. This information is required by Item 6 of MRP No. 2001-161. Please include this information in future Monitoring Reports.

RESPONSE TO MONITORING AND REPORTING PROGRAM REQUESTS

a) **Page 19, 7.2 Intermediate Zone Recommendations** – A number of wells are proposed to be added or deleted from the intermediate zone monitoring network. Please be aware that any supply wells used for monitoring must meet the minimum requirements for monitoring well construction and siting, including but not limited to: total depth, well logs, screen length, screen location, access to measure groundwater elevations, and long term access to each well. Regional Board staff will consider deleting or adding wells based on the information submitted in response to comments on section 4.2.1 Representative MRP Wells, above.

Pursuant to Section 13267 of the California Water Code, Olin is required to provide the above-requested information or technical justification for not including it, by April 30, 2004. Failure to submit adequate or complete information may subject you to a Regional Board enforcement action based on the original due date of the Third Quarter Monitoring Report. The Third Quarter Monitoring Report was originally due on October 30, 2003. The Regional Board requires Olin Corporation to submit the monitoring reports in accordance with Section 13267 of the Water Code to determine the concentrations and movement of the perchlorate plume in the vicinity of the Olin site. We require Olin Corporation to submit the information as the owner of the property, as one of the previous operators of a flare manufacturing facility that caused soil and groundwater perchlorate contamination at and in the vicinity of the Olin site at 425 Tennant Avenue, Morgan Hill, and as the Discharger representative.

Any person affected by this action of the Regional Board may petition the State Water Resources Control Board (State Board) to review the action in accordance with section 13320 of the California Water Code and Title 23, California Code of Regulations, Section 2050. The State Board must receive the petition within 30 days of the date of this order. Copies of the law and regulations applicable to filing petitions will be provided upon request.

We are enclosing copies of comments received from the SCVWD and the Cities of Morgan Hill and Gilroy. While you are not required to respond to these comments, we ask that you review and consider them. Finally, I want to acknowledge and express my appreciation to Olin for agreeing to provide hard and disk copies of technical reports to the SCVWD, Perchlorate Community Advisory Group and public library. We are firm believers that open communication is extremely important to the progress and public perception of the project. Should you have any questions, please contact **David Athey at (805) 542-4644** or Eric Gobler at (805) 549-3467.

Sincerely,

Roger W. Briggs
Executive Officer

Enclosures:

1) Cities of Morgan Hill and Gilroy via Komex letter dated November 6, 2003
2) SCVWD letter dated November 20, 2003

cc via E-mail:

Lori Okun
Office of the Chief Counsel
State Water Resources Control Board

Jim Ashcraft
City of Morgan Hill

Rich Chandler
Komex

Peter Forest
San Martin County Water

Steven L. Hoch
Hatch & Parent

Bill O'Braitis
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Santa Clara Valley Water District

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Elected Officials

U.S. Environmental Protection Agency

cc via U.S. Mail:

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ENVIRONMENT AND WATER RESOURCES

November 6, 2003
Project No.: 127-005

STATE OF CALIFORNIA
RECEIVED
NOV 10 2003
WATER QUALITY CONTROL

California Regional Water Quality Control Board,
Central Coast Region
895 Aero Vista Drive, Suite 101
San Luis Obispo, CA 93401
Attn: Mr. John Mijares

Re: Comments on "Third Quarter (July-September) 2003 Groundwater Monitoring Report, Oil/Standard Fusee Site, 425 Tennant Avenue, Morgan Hill, California"

Dear Mr. Mijares,

Komex has performed a review of the document entitled *Third Quarter (July-September) 2003 Groundwater Monitoring Report, Oil/Standard Fusee Site, 425 Tennant Avenue, Morgan Hill, California,* dated October 30, 2003, prepared by MACTEC Engineering and Consulting, Inc. (MACTEC) for the Olin Corporation (Olin). We are pleased to submit our comments on behalf of the Cities of Morgan Hill and Gilroy.

The subject document is herein referred to as the Third Quarter 2003 Report, and the former Olin facility at 425 Tennant Avenue in Morgan Hill is herein referred to as the Site. The Third Quarter 2003 Report was submitted by Olin to the California Regional Water Quality Control Board, Central Coast Region (Regional Board) to comply with the Region Board's Monitoring and Reporting Program No. 2001-161. The Third Quarter 2003 Report presents evaluations of on-Site and off-Site hydrogeology, the results of recent sampling of on-Site and off-Site wells for concentrations of perchlorate in groundwater, and interpretations of the extent of the perchlorate plume.

Our review of this document should in no way be considered a validation of the document contents or any portion of the document, including findings, interpretation, conclusions or opinions expressed therein. If we do not provide comments, corrections or questions for a respective sentence, paragraph or section, this should not be construed as agreement with the information presented within that respective sentence, paragraph or section.

GENERAL COMMENTS

Our review of the Third Quarter 2003 Report indicates the following:

- On-Site groundwater elevation data is dismissed as unreliable if it does not indicate a southerly groundwater flow direction;
- The interpretation of off-Site hydrogeology is based on unreliable information and is greatly over-simplified;
- Sampling results do not support statements that there are on-Site and off-Site clay units that may limit lateral or vertical migration; and
- A statement that perchlorate has not been detected in off-Site wells southeast of the Site that are screened in the "deep zone" is false.

These comments, as well as other comments related to the investigation, are discussed in greater detail below.

SPECIFIC COMMENTS

On-Site Groundwater Flow

The Third Quarter 2003 Report presents information that indicates that the direction of groundwater flow beneath the Site is highly variable. Figures 5 through 8 and Figure 10 indicate that groundwater in discrete zones may flow east and north from the Site. The Third Quarter 2003 Report suggests that the inferred groundwater flow directions may be attributed to geologic variability, discrete monitoring points, local pumping, and precipitation. This raises many troubling issues about interpretations of Site hydrogeology and the value of any groundwater elevation data collected from the discrete monitoring points.

Olin has maintained that groundwater beneath and near the Site can only flow toward the south or southeast. This is based on regional information published by the U.S. Geological Survey, the California Department of Water Resources, and the Santa Clara Valley Water District. The southerly groundwater flow direction indicated in reports from these agencies; however, is based on groundwater elevations in water supply wells that typically have long screens extending across multiple hydrostratigraphic zones. Komex has previously stated that hydrogeology beneath the Site is more complex than depicted by Olin and their consultants, and that in a complex hydrogeologic environment groundwater in discrete zones may not flow in the same direction as the regional flow direction. Information presented in the Third Quarter 2003 indicates that this is the case.

Interpretation of Off- Site Hydrogeology

The interpretation of off-Site hydrogeology presented in the Third Quarter 2003 Report is based on Well Driller Logs. These logs are usually prepared by persons with little or no geologic training, no discrete depth soil samples are collected during a typical water well supply installation, and soils are typically not logged according to any accepted classification scheme. For these reasons Well Driller Logs are of limited value in assessing hydrogeology to the degree required in an environmental investigation such as is needed here. It appears that Olin is attempting to use unreliable information to avoid the installation of a basin-wide groundwater monitoring well network, which will be necessary to understand the extent of contamination and develop a plan for basin-wide remediation.

The geologic cross-sections presented in Figures 17a through 17e classify all subsurface materials as either silts and clays, or sands and gravels. It is highly unlikely that the Well Driller Logs on which these cross-sections are based were so simplistic; therefore, it is apparent that in addition to the inherent inaccuracy of the Well Driller Logs as discussed above, there has been a substantial amount of reclassification of soil types. There could potentially be bias in reclassifying soil types in order to make complex data fit into a simple hydrogeologic framework. And in fact, the interpretation of off-Site hydrogeology is exactly the same as earlier interpretations of on-Site hydrogeology, with a "shallow zone" from 0 to 50 feet bgs, an "intermediate zone" from 100 to 200 feet bgs, and a "deep zone" at depths greater than 200 feet. Even assuming that cross-sections accurately depict subsurface conditions, it is still not clear from the cross-sections that there are a "shallow zone," an "intermediate zone," and a "deep zone." This classification appears to be arbitrary.

Fine-Grained Units Limiting Migration

The Third Quarter 2003 Report states the following: "The presence of clay units in the shallow zone around the Site are expected to limit groundwater migration in the shallow zone from the Site." And in discussing off-Site contamination "The underlying clay units appear to restrict the perchlorate to the intermediate zone." It is obvious given the extent of the plume of perchlorate-impacted groundwater in the Llagas Sub-basin that clay units are not effective in preventing either lateral or vertical perchlorate migration.

Detection of Perchlorate in Off-Site "Deep Zone"

The Third Quarter 2003 Report states the following: "...Fences 17a through 17e show that perchlorate has not been detected in samples collected from offsite wells located southeast of the Site that are screened in the deep zone." In fact, if the classification of "deep zone" zone wells includes wells screened at depths greater than 200 feet bgs, there are numerous "deep zone" wells that have yielded samples with detectable perchlorate. If the classification of "deep zone" zone wells includes wells screened at depths greater than 300 feet bgs, there are still "deep zone" wells that have yielded samples with detectable perchlorate including the West San Martin Waterworks Well (over 400 feet bgs), Well 10S04E18B0017, and Well 10S04E29C001. Many of the wells shown in the cross-sections do not have the screen interval illustrated. If the depth of the screen interval of these wells is not known then they cannot be used to evaluate the vertical extent of contamination.

When evaluating the vertical extent of perchlorate contamination using domestic water wells it must be remembered that a well may draw water from anywhere within the filter pack zone, not just the screen interval; therefore the total depth of the well needs to be considered. In addition, as shown in the figures presented in the Third Quarter 2003 Report there are apparently an insufficient number of "deep zone" wells in the Llagas Sub-Basin to evaluate the vertical extent of perchlorate contamination. For all of the reasons cited above the installation of a basin-wide groundwater monitoring well network will be necessary.

CLOSING

The information presented in the Third Quarter 2003 Report highlights the need for the prompt completion of several tasks that our clients have been requesting, including investigation of the presence of perchlorate in groundwater northeast of the Site, installation

of a basin-wide network of monitoring wells, and development of a plan for basin-wide groundwater remediation.

Komex is pleased to provide our comments to the Regional Board. If you have any questions or need additional information please call Rich Chandler at (805) 787-0307 x244.

Sincerely,
KOMEX

Rich Chandler, R.G.
Senior Geologist

cc: Mr. Steve Hoch, Hatch and Parent
Mr. Jim Ashcraft, City of Morgan Hill
Mr. Rick Smelser, City of Gilroy

November 20, 2003

Mr. A. John Mijares, Water Resources Control Engineer
Central Coast Regional Water Quality Control Board
895 Aerovista Place, Suite 101
San Luis Obispo, CA 93401

Subject: Comments on Third Quarter (July–August) 2003 Groundwater Monitoring Report
Olin/Standard Fusee Site, 425 Tennant Avenue, Morgan Hill, California

Dear Mr. Mijares:

The Santa Clara Valley Water District appreciates the opportunity to issue the following comments on the above referenced report.

The District appreciates your efforts to provide an electronic copy of the 3rd Quarter Monitoring Report to the District, however transferring the report to stakeholders is a burden for both sender and recipient. While the 3rd Quarter Monitoring report was issued to RWQCB on 10/30, we finally received the last transmittal of a missing Appendix today. Olin Corporation and their consultants did not provide the 3rd Quarter Monitoring Report directly to the Santa Clara Valley Water District, the City of Morgan Hill, the City of Gilroy, or the County of Santa Clara Environmental Health Department. By furnishing hard copy and electronic copy of the report to the RWQCB only, stakeholders experienced a significant delay in obtaining and evaluating important and time-critical information. We have requested that RWQCB require Olin issue reports directly to the District, the Cities and the County on three separate occasions: at the elected officials meeting held at SCVWD's offices in April, at the Regional Board meeting in Salinas, and in a letter from Walt Wadlow to Roger Briggs sent several months ago. Subsequent to issuing these requests, the situation has worsened. Whereas we previously received reports a week or two later than RWQCB, we now receive none. We recommend the following steps be taken to remedy this situation:

RWQCB should order Olin to resume direct transmittal of all regulatory compliance, monitoring, and design reports and correspondence to the Santa Clara Valley Water District, the Santa Clara County Department of Environmental Health, the City of Gilroy, and the City of Morgan Hill. These submittals should include:

a) complete hard copy reports, with figures originally rendered in color provided in color;
b) electronic copies of reports on CD, as PDF files or similar public domain format
c) Electronic Data Deliverables to facilitate analysis by RWQCB, SCVWD, the Cities and County, or their consultants.

In addition, the affected residents of San Martin have on several occasions requested that a library repository be established to allow their viewing of hard copy reports. Due to the continuing need to provide current and detailed information to the affected communities, we hereby request that RWQCB cause Olin to establish repository of case documents at a location accessible to south County residents.

We have the following specific comments:

Monitoring Wells are needed: The January 24th Monitoring and Reporting Program was issued in response to the discovery of widespread perchlorate contamination, reported in sampling results by Olin and the Santa Clara Valley Water District. In order to characterize the extent of impacted domestic wells, the District provided Olin with data for 1,100 wells. Olin's consultants screened these wells for attributes that would serve as interim monitoring wells until the extent of perchlorate exposure to private well owners could be established. 45 wells were chosen for longer term use. Mactec has labeled these 45 wells "Representative MRP Wells". We concurred with the selection of these 45 wells for interim monitoring at our January 7th meeting with RWQCB in Morgan Hill, however, we do not consider these private wells to be suitable for characterization of perchlorate distribution or for longer term monitoring. These wells are 'representative' only in the sense that they provide a representative sampling of the types, depths, screen lengths, and uses of wells in the basin. The use of private wells to characterize where drinking water tainted with perchlorate was being consumed was appropriate under the circumstances. In view of the logistical difficulty in establishing a properly designed monitoring network while the extent of the plume was still being defined, it was also appropriate to select a group of private wells for repeat monitoring to establish seasonal trends in perchlorate concentrations.

At this point in time, a great deal more is known about the extent of perchlorate occurrence in private wells. It would therefore be appropriate to begin the process of designing and installing a network of monitoring wells capable of yielding depth discrete perchlorate concentrations and water level measurements. Continued use of private production wells is not appropriate for characterizing the extent of contamination because private wells were not designed for monitoring purposes. Private wells are inappropriate for characterizing perchlorate occurrence over the longer term, due to their long well screens, multiple screened intervals, poor construction and sealing, and active pumping. Continued use of private wells for longer term monitoring will only serve to tell the individual well owner the quality of water in their well, and will not reveal the nature of perchlorate distribution in the Llagas basin aquifers. We contend that only depth-discrete monitoring wells separately completed in multiple zones will yield meaningful data that will contribute to managing and remediating perchlorate contamination of the Llagas basin.

Off-site water level measurements are needed: Olin has not complied with the January 24th Monitoring and Reporting Program requirement for collecting and reporting water levels in off-site wells. While all elements of the MRP should be carried out, water level measurements from active private wells would not be very effective in advancing our knowledge of basin flow on the higher resolution, local scale needed for characterizing perchlorate occurrence. Instead of pursuing water level measurements in private wells, a network of several dozen multi-level monitoring wells should be installed to allow collection of data that will yield meaningful interpretations of flow patterns affecting perchlorate distribution. Knowledge of groundwater flow gradients obtained by measuring properly designed and installed monitoring wells will allow a more informed determination of contaminant migration patterns and the completeness of private well sampling for exposure assessment. The benefits of installing monitoring wells for long term evaluation of groundwater flow patterns and perchlorate distribution include:

- Understanding of vertical gradients controlling perchlorate distribution at depth
- Understanding completeness of private well exposure assessment (private well sampling) through seasonal monitoring of flow gradients

- Understanding longer term trends in perchlorate occurrence to facilitate plume management and aquifer restoration.

We recommend that the MRP be revised to require that proper monitoring wells be designed and installed following generally accepted practices in the near term. We encourage RWQCB to consider requiring a full transition to proper monitoring wells by the 3rd quarter of 2004.

District will install Llagas Basin Monitoring Wells. The Santa Clara Valley Water District has obtained grant funding from the California Department of Water Resources to install nine monitoring wells in eight locations in the Coyote and Llagas basins. The purpose of the wells is to provide the District with detailed data for water supply management and water quality monitoring, primarily for nitrate. Data from these wells will be made available to the Central Coast Regional Water Quality Control Board once they have been installed, developed, and monitored. We are prepared to meet with RWQCB to discuss opportunities for avoiding redundancy in Olin's monitoring infrastructure as we move forward with securing monitoring well sites.

Potentially affected well owners should be contacted. Olin indicates that 33 Tier 5 private well owners did not respond to their request for testing. Olin should continue attempting to contact these well owners, including visiting the properties on which the wells reside, until they have obtained permission or a refusal from each of the well owners. Private well owners have a right to know whether their well has been impacted. We encourage RWQCB to require that Olin make a concerted effort to reach these well owners and obtain their permission or refusal for well sampling.

Caveats to presented groundwater flow gradients should be supported by data. Mactec has listed three categories of factors to which inferred local gradients can be attributed. Without assertively stating which of these factors are at play, or supporting such assertions with data, Mactec has concluded that a long tradition of regional-scale mapping showing a southerly flow in the Llagas Basin is sufficient basis to conclude that groundwater flows to the south beneath the site. We believe Mactec could have better supported their assertions with data presented in a single table.

The following table examines Mactec's assertions in greater detail than was presented in the Third Quarter Monitoring Report. Lithologies and water level changes that are different from others in the same set used to determine gradients are called out in bold type.

Interval	Wells	Lithology	Water Level delta	Comments
I 46 – 49.5	MW-SW-007-SA1 MW-SW-008-SA1 MW-SW-009-SA1 MW-SW-010-SA1 MW-SW-011-SA1	**lean clay w/sand** clayey sand w/gravel clayey sand w/gravel clayey sand w/gravel clayey sand w/gravel	7.97 7.96 7.86 **10.28** **9.6**	4 of 5 lithologies similar; like water level changes occur in different lithology types. Pump test response in SW-011 differs from 007 and 008. Max/min monitored zone = 4'
II 89 - 99	MW-SW-007-SA2 MW-SW-008-SA2 MW-SW-010-SA2 MW-SW-011-SA2	**larger gravels** clayey sand sandy clay w/gravel lean clay w/sand	**11.28** 12.3 12.12 12.11	Coarse grained interval has smaller water level decrease than finer grained intervals. Max/min monitored zone = 10' 7, 8 & 11 each have unique response to pump test.

III 134 – 142	MW-SW-007-SA3 MW-SW-008-SA3 MW-SW-010-SA3 MW-SW-011-SA3	**well-graded gravel w/sand** clayey sand w/gravel clayey sand w/gravel lean clay w/sand	12.32 12.72 12.05 12.15	Coarse grained interval has similar water level change to finer grained intervals. Max/min monitored zone = 8'
IV 175 – 195	MW-SW-007-SA4 MW-SW-008-SA4 MW-SW-009-SA4	**Gravel** clayey sand w/gravel clayey sand w/gravel	~~13.63~~ ~~13.16~~ ~~14.93~~	Max/min monitored zone = 20'. The vertical separation in screened intervals is too large for interpretation of flow directions.
V 200 – 210	MW-SW-004A MW-SW-005A MW-SW-006A	**well-graded gravel w/sand** clayey sand clayey gravel w/sand	~~4.29~~ ~~12.86~~ ~~15.43~~	A large difference in water level change corresponds to lithologic differences. Suggests this interval may not be useful for interpreting flow directions Max/min monitored zone = 10'
VI 335 – 341	MW-SW-004C MW-SW-005C MW-SW-006C	**well-graded gravel w/sand** clayey sand clayey sand	32.29 30.12 33.02	Lithology of screened zones differs significantly. Max/min monitored zone = 6'

Mactec presents three categories of factors that may bias the interpreted gradients:

a) Geologic Variability – screens may be in different or discontinuous hydrostratigraphic units, such that if two screens are in a sand and a third in a clay, the interpreted gradient would not accurately reflect true flow directions.
b) Discrete Monitoring Points - data obtained from 3-foot screens reflect micro-scale conditions that are not applicable on a site-wide basis.
c) Transient Hydrologic Conditions - monitored zones may be responding to off-site pumping.

We agree with Mactec's point on geologic variability, but their report does not state which monitored intervals should not be used due to geologic variability. Differing lithology does not always mean that monitored portions of an aquifer are hydraulically isolated. The best indicator that monitored points are in hydraulic communication is similarity of hydraulic response to seasonal changes, or a hydraulic stress such as pumping a nearby well. Using the Roman Numerals to identify each zone, the following additional interpretation of Mactec's data may help to determine which data could be used to interpret gradients:

I. Two of the five wells in this zone showed larger changes in water level from Q2 to Q3. Of the three wells that showed similar water level changes, one is completed in a different lithology. If the gradient is determined from only those wells that showed a similar hydraulic response, the gradient is fairly flat: about **0.004 due South** in Q2, and about **0.0036 due South** in Q3.

II. One well, 007, is completed in gravel, whereas the other three are completed in finer grained material. The water level changes in the three wells completed in fine-grained materials are similar, whereas the water level change in the well completed in gravel is smaller. If the gradient is determined from only those wells showing a similar hydraulic response, the gradient is approximately **0.009 to the east-northeast** in Q2, and **0.001 to the northeast** in Q3. The vertical separation of the zones monitored in the three selected wells (008, 010, and 011) is 10 feet, which could affect the accuracy of gradient interpretations. The differing responses of monitored zones to pumping measured in the aquifer test further suggests this set of monitoring points may not be ideal for interpreting hydraulic gradient.

III. The same pairings of lithology and water level changes seen in **II** are seen again here, suggesting the gradients should be calculated from wells 008, 010, and 011. The gradient from these three wells alone in Q2 is approximately **0.0014 to the southeast** in Q2, and 0.0016 **due east** in Q3.

IV. The vertical separation of monitored zones in this set is 20 feet, which is probably too great to provide meaningful interpretation of flow gradients.

V. Significant lithologic differences are mirrored by substantial differences in water level change, suggesting that this interval would not yield accurate interpretations of flow gradients.

VI. In the deepest zone, significant lithologic differences exist, though the changes in water levels among these three wells appear similar. The report erroneously states that the monitored interval is 313 ft to 341 ft; our records indicate the correct interval is 335 to 341 feet. Because water level changes are similar in spite of a large lithologic contrast, this zone may be suitable for interpreting gradients. The gradient in Q2 is approximately **0.0033 ft due north**, and **0.003 to the south-southwest** in Q3.

I – VI. The report alludes to the influence of off-site pumping, though the specific location and amount of pumping that would cause a reversal from the expected regional southerly gradient is not provided. The regional southerly gradient is interpreted from a network of predominantly deeper production wells, whose screened intervals may exceed 100 feet. Local variation beneath the site is not unexpected.

This review reveals a high degree of uncertainty in the use of the BarCad system for interpreting site flow gradients, and a high degree of variability in interpreted flow directions among those sets of monitoring points that appear suitable for gradient interpretation. Nevertheless, determining vertical and horizontal gradients is critical for understanding site hydrogeology and controls over groundwater flow conditions governing perchlorate migration.

Uncertainty has also prevailed in the interpretation of perchlorate concentrations in the lower zone, which at one point revealed a concentration greater than 300 ppb, a result which was later dismissed. Subsequent monitoring has shown repeated low-level detections in deep zone monitored points, and the testing of the Tennant well performed by Komex Inc. has revealed perchlorate occurrence in the lower zone along the gravel pack and likely within the formation itself.

Conventional short-screen, deep zone, multi-level monitoring well pairs are needed for determining site gradients. In view of the lingering uncertainty and ambiguous interpretations of data from the BarCad wells, we are prepared to accept Mactec's assertions that the monitoring infrastructure is not reliable for providing basic data for the site. We therefore recommend that conventional monitoring wells with short screen lengths be drilled to replace the BarCad wells. Locations should be selected to allow monitoring of the C zone below the locations where the greatest perchlorate concentrations have been found in soil and underlying groundwater. Screens should be set in each of the zones selected for monitoring in the BarCad wells, and should not exceed 10 feet, however, existing geologic data should be used to increase the likelihood that the monitored zones are in hydraulic communication.

Fence diagrams provide an over-simplified interpretation. Almost all wells in the fence diagrams discussed in Sections 6.1 to 6.3 are shown screened across multiple intervals. Perchlorate concentrations detected in these wells are linked to a specific zone even though there are multiple screened zones in the monitored wells. It is not possible to determine the actual concentrations in specific zones in these cases. Mactec's methodology for assigning depths to the concentrations was not provided, and we know of no means of reliably distributing a single concentration measured from a well's discharge to discrete depth zones. This presentation gives the impression that vertical characterization of the plume has been accomplished, when none has actually been completed off-site.

The lithology of the basin has been classified into a binary system, coarse-grained and fine-grained. This approach over simplifies the basin and leads to large assumptions on the lateral continuity of sedimentary lenses, when the data demonstrate a high degree of textural heterogeneity and discontinuity of units. An improvement to this effort would be the identification of sedimentary facies. Installation of carefully logged monitoring wells and collection and interpretation of geophysical logs will permit an appropriate hydrostratigraphic classification scheme and interpretation of basin hydrogeology.

Use of active, private wells with long well screens is unacceptable for plume characterization. As this case transitions from public response action to monitor private wells and establish an exposure assessment baseline to plume characterization, proper monitoring wells are essential. The proposed use of the initial network of private wells is not adequate for this purpose. Long screen zones and active pumping prevent an assessment of perchlorate distribution due to dilution with uncontaminated water. Understanding where the perchlorate is most concentrated will allow some form of plume management and aquifer restoration to begin.

Choosing to continue using private wells delays RWQCB's ability to appreciate the magnitude and extent of the problem in sufficient detail to order appropriate remedial actions. RWQBC must therefore require the installation of industry standard monitoring infrastructure, i.e., short-screen, multi-level monitoring wells capable of reliably providing depth discrete perchlorate concentrations and accurate water level measurements for interpretation of groundwater flow patterns.

It is too soon to begin eliminating private wells from the current monitoring network. The Q3 report proposes elimination of a number of wells from the monitoring program because they appear to be redundant. We assert that no wells should be dropped from the program until they are replaced with industry standard conventional groundwater monitoring wells. The seasonality of data is poorly understood at this point. Continuing to collect data for at least two full hydrologic years should provide sufficient baseline to understand variability in perchlorate concentrations in long-screen active private wells. This data will be useful in designing treatment systems for private wells, and in establishing extraction systems for plume management and aquifer restoration.

Adequacy of Tier 5 wells to determine southerly extent of perchlorate contamination has not been established. On Page 18, Mactec asserts that the Tier 5 wells are sufficient to determine the southerly extent of perchlorate contamination. The southerly extent has not been identified as yet. Mactec could assist RWQCB's appreciation of the pattern of perchlorate occurrence at the southern end of the area investigated thus far by presenting perchlorate detections less than 4 ppb. Whereas the "green dots surrounding red dots" picture appears to be improving, rendering the map with yellow dots for perchlorate detections less than four would better inform RWQCB of the geographic extent of perchlorate occurrence identified thus far.

The Q3 report notes a few instance in which wells that previously had detections less than 4 have now shown concentrations greater than 4. The large changes in perchlorate concentrations seen in some wells warrants plotting the data down to the laboratory reporting limit. This will improve RWQCB's ability to see where perchlorate has been found.

In summary, we make the following recommendations:

a) RWQCB should cause Olin to provide the District, the Cities of Gilroy and Morgan Hill, and the County of Santa Clara (the stakeholder parties) with hard copy and electronic copies of all submittals.
b) RWQCB should cause Olin to provide Electronic data deliverables, i.e. relational database files and/or spreadsheet files of data collected in compliance with the MRP, future orders, and existing and future RWQCB 13267 letters, to RWQCB and the stakeholder parties.
c) RWQCB should cause Olin to install a network of off-site monitoring wells constructed to industry standards, capable of yielding useful information on perchlorate occurrence in depth discrete zones.
d) RWQCB should encourage Olin to work with the District on placing monitoring wells to avoid redundancy in placing costly monitoring infrastructure.
e) RWQCB should not accept a "no response" status for Tier 5 wells at the southerly limits to the investigated area. RWQCB should only accept sampling results or a signed refusal to permit well sampling. RWQCB should independently notify wellowners to ensure that they're given every opportunity to have their well tested. The District stands ready to assist RWQCB and Mactec with verified addresses and other contact info.
f) RWQCB should cause Olin to install conventional deep depth-discrete monitoring wells beneath the site to allow interpretation of vertical and horizontal gradients in multiple zones, and to permit reliable determination of perchlorate occurrence at depth.
g) RWQCB should not accept private wells as a means of characterizing perchlorate concentrations at depth. RWQCB should require the installation of properly designed monitoring wells capable of yielding depth discrete perchlorate data.
h) RWQCB should require continued monitoring of private wells for two full hydrologic years while Olin installs a network of monitoring wells to allow design data collection for plume management and aquifer restoration extraction systems. No wells should be dropped from the program at this point in time.
i) RWQCB should cause Olin to present their data in a manner allowing full interpretation of perchlorate occurrence in private wells, i.e., presenting detections less than 4 ppb to indicate where perchlorate has been found.

Sincerely,

Thomas K.G. Mohr, California Certified Hydrogeologist No. 98
Solvents and Toxics Cleanup Liaison, Groundwater Cleanup Oversight Program

cc: Mr. Jim Ashcraft, Public Works Director, City of Morgan Hill
Mr. Rick Smelser, City Engineer, City of Gilroy
Ms. Suzanne Muzzio, Santa Clara County Environmental Health
Mr. Bill O'Braitis, Mactec Inc.
Mr. Rich Chandler, KOMEX Inc.
Mr. Rick McClure, Olin Corporation