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GOVERNOR

STATE OF MICHIGAN
DEPARTMENT OF ENVIRONMENTAL QUALITY
JACKSON DISTRICT OFFICE



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VIA ELECTRONIC AND US MAIL

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Dear Sirs:

SUBJECT: Gelman Sciences, Inc. Remedial Action
Evergreen System Review, dated May 10, 2007

The Department of Environmental Quality (DEQ) has completed its review of the Evergreen System Review (ESR) report. Pall Life Sciences, Inc. (PLS) submitted this report in response to the DEQ's previous requests for technical analysis to support PLS's request to remove the minimum extraction rates for the Evergreen System extraction wells. The enclosed Interoffice Communication from Mr. Rick Mandle, dated July 13, 2007, provides the technical support for the comments and requests in this letter.

The ESR outlines two issues: 1) the pumping rates for wells LB-1 and LB-3 and, 2) the inability of well AE-3 to maintain the minimum pumping rate. Proposed solutions to both issues are presented in the report. For the reasons stated below, and as discussed by Mr. Mandle, the DEQ does not believe the model or the current field data supports PLS's description or assessment of the issues. Additional information and analysis is needed before the issues, especially the complex geology in the Evergreen area can be sufficiently understood and appropriate solutions can be proposed and approved.

The ESR states that 1,4-dioxane concentrations in upgradient portions of the Unit D₂¹ plume are generally declining, and suggests that concentrations in the Evergreen Subdivision area are not going down, or are increasing in some cases, because the presumed excessive pumping from the Evergreen System extraction wells is pulling in contaminated groundwater from the Unit E plume. We do not believe that PLS has presented sufficient data to support its premise that the concentrations of 1,4-dioxane in portions of the Unit D₂ aquifer that are upgradient of the Evergreen Subdivision are declining. First, concentrations of 1,4-dioxane in monitoring well MW-17, which is believed to be on the southern edge of the Unit D₂ plume, upgradient of the Evergreen Subdivision, have increased from 36 parts per billion (ppb) in August 2001 to 565 ppb in April 2007. Second, another monitoring well, MW-94s, is about 1,600 feet further upgradient of MW-17, and is believed to be close to the center of the Unit D₂ plume at Wagner Road. Concentrations of 1,4-dioxane in MW-94s have declined somewhat since it was installed (2,810 ppb in January 2005 to 2,588 ppb in April 2007); however, these data show that high concentrations of 1,4-dioxane are continuing to migrate toward the Evergreen Subdivision. Third, some of this contamination was previously removed by operation of the north horizontal

¹ The term "Unit D₂" in this letter corresponds to the term "Unit D" used by Mr. Mandle, consistent with the nomenclature used in PLS's groundwater model.

wells; however, these wells have not been used since this pipeline was converted to a transmission line in 2005. Based on this information, we do not believe it can be concluded that stable or increasing levels of contamination must be coming from a source other than the upgradient Unit D₂ plume. We also do not believe that there are measurements of groundwater level elevations that show the potential for Unit E contaminated groundwater south of the Evergreen Subdivision to move either laterally or vertically into the Unit D₂ aquifer or toward the Evergreen System wells.

As outlined in detail by Mr. Mandle, there are deficiencies in the construction and calibration of the model PLS relied upon for this analysis. The deficiencies include the model representation of the degree of hydraulic connection between the Unit D₂ and Unit E aquifer and the model boundary conditions. The PLS model assumes there is no connection between the water-bearing layers that represent the Unit D₂ and Unit E aquifers, while at the same time asserting that pumping from the Evergreen extraction wells are pulling in contaminated groundwater from the Unit E aquifer. Evidence that this assumption is not applicable include the fact that soil boring GSI-96-01, installed in the southwestern area of the Evergreen Subdivision, showed there is no confining unit that hydraulically separates the Unit D₂ from the Unit E aquifer in this area. In addition, the stratigraphy in the central and eastern area of the Evergreen Subdivision, proximal to the LB and AE extraction wells, has not been vertically profiled to depths sufficient to conclude that there is no hydraulic connection between the Unit D₂ and Unit E aquifers in this area.

The assumption that there is no hydraulic connection between the Unit D₂ and Unit E aquifers results in the model calculating a larger capture zone than likely exists and that, contrary to PLS's hypothesis, all contamination being captured is coming from the Unit D₂ aquifer. PLS's consultant did not revise the model to reflect the greater degree of connection that geologic data collected since 2002 suggest. The model boundary conditions force the model to simulate a direction of groundwater and contamination movement that has not been verified by field data.

LB-1 and LB-3 Extraction Rates

PLS believes, as stated in the ESR, that the extraction rates for wells LB-1 and LB-3 are too high, and are causing the deeper Unit E plume to migrate upward to the overlying Unit D₂ aquifer and northward from the area south of the Evergreen Subdivision, toward the Evergreen extraction wells. PLS also expresses a concern that the groundwater flow direction in the Maple and Dexter Roads area is being altered by pumping from the Evergreen System, causing contamination in the Unit E plume to migrate closer to the northern boundary of the Prohibition Zone. Other concerns are energy use and wear on the transmission pipeline, which the DEQ did not consider in this evaluation, as they do not directly relate to the adequacy of the remedial action.

Thus, PLS proposes decreasing the extraction rates from LB-1 and LB-3 by 25 percent initially, and by as much as 50 percent after a three-month review of the 25 percent reduction. This proposal is based on simulations using a groundwater-flow model and the extent of groundwater contamination as depicted by maps prepared for PLS by its consultant.

As discussed in more detail by Mr. Mandle, the DEQ does not believe that the groundwater model is appropriately constructed or calibrated and thus it cannot support PLS's proposal. In addition, the DEQ does not believe that the lateral and vertical extents of the groundwater contamination or groundwater-flow directions in the Evergreen Subdivision area have been properly characterized. For these reasons, the DEQ cannot approve any reduction in the extraction rates at this time, as it would be premature to do so until more information is provided to support such a change.

In addition to determining groundwater-flow directions and the extent of 1,4-dioxane, additional monitoring wells will be needed to monitor the performance of the Evergreen System and to help understand the relationship between the Unit D₂ plume and the Unit E plume. The monitoring well(s) proposed in the ESR, and in more detail in PLS's June 29, 2007 submittal, will provide some information, but will not be adequate by itself to address all of the DEQ's concerns.

Allison Extraction Wells Cannot Maintain a Sustainable Flow

PLS attributes problems maintaining flow from AE-3 to falling water levels and to low transmissivity in the Allison Street area. We do not dispute that these problems have had an effect on the operation of AE-3, and on AE-1 before that. However, we do not believe PLS has demonstrated that these chronic problems require that all extraction downgradient of LB-1 and LB-3 be abandoned.

The fact is that for almost nine years PLS has operated either AE-1 or AE-3 at, or near, the minimum extraction rate, with limited shutdowns related to these chronic problems. As shown by the hydrographs of Evergreen-area monitoring wells submitted by PLS on May 17, 2007, water levels have stabilized since 2003. Rehabilitation of both of these wells has been effective in allowing the extraction wells to resume operating at the minimum rate, suggesting that the lower water table does not prohibit it from maintaining the minimum extraction rate.

Section V.A.1.(a) of the Consent Judgment requires PLS to: "...intercept and contain the leading edge of the plume of groundwater contamination detected in the vicinity of the Evergreen Subdivision area." Unless, and until, PLS can demonstrate that it is not technically feasible to capture the plume at this location, the DEQ will not consider any amendment to this section of the Consent Judgment.

The ESR indicates that the groundwater model was used to evaluate the installation of an extraction well on Center Street, one block west of Allison, but did not include that analysis for our review. In any event, prior to considering that option, the DEQ will require that PLS evaluate the installation of two separate extraction wells on Allison, as previously suggested by the DEQ. The installation of two extraction wells would limit the chronic problems experienced in the past in two ways. First, it would allow each well to be operated at a significantly lower extraction rate, thereby reducing the velocity of groundwater entering the well and reducing the amount of mineral precipitation that promotes well fouling. Second, it would allow each well to be rehabilitated separately, allowing one well to remain in operation during rehabilitation. This analysis should include at least two test borings to collect information on the ability of the formation to support the extraction wells. If PLS decides to use the groundwater-flow model for any hydraulic capture analysis, deficiencies in the model, as noted by Mr. Mandle, must be addressed prior to its use.

Conclusion

The DEQ is willing to consider changes to operation of the Evergreen System if PLS submits additional information to support such changes. Such information would include additional plume and groundwater-flow direction data, and may include a re-submittal of the groundwater model that has been revised to incorporate Mr. Mandle's comments. Regardless of PLS's intentions in that regard, the DEQ believes additional performance monitoring wells are needed to assess the operation and extent of capture of the Evergreen System and that additional investigation is needed to better understand the connections between the Unit D₂ and Unit E aquifers.

We received PLS's June 29, 2007 submittal of the Evergreen System Work Plan for Well Installation and Capture Zone Monitoring Background on July 5, 2007. That submittal includes more detail on how PLS proposes to use the data to be collected in evaluating the capture zone for the Evergreen System. We have not completed our review of that portion of the submittal; however, we have reviewed the sections on *Monitoring Well Installation* and *Well Boring/Well Installation Methods* and request that PLS proceed with installation of the monitoring well(s). Boring and analytical data should be provided to the DEQ for review prior to any decisions regarding the number and depth of wells to be installed. We will respond to the remainder of the submittal upon completion of our review.

In addition, at least one additional boring/monitoring well cluster is needed west of Dupont Circle. The concentration of 1,4-dioxane in the former residential well at 465 Dupont Circle is steadily increasing (671 ppb in May 2007). The source of this contamination, at a depth that is more consistent with the Unit E plume, is still not understood. The GSI-96-01 boring near the intersection of Valley and Rose shows there is a connection between the Unit D₂ and Unit E aquifers in this area; however, no vertical profiling data were collected during the completion of that boring. The requested boring/monitoring well cluster will help to better characterize the relationship between the Unit D₂ and Unit E aquifers in this area, and can help ensure that current and future response actions are adequate. Please submit a work plan for installation of the requested boring/monitoring well cluster by August 10, 2007. This and the previously discussed monitoring well cluster should be installed by September 28, 2007. Depending on the results of these two borings/monitoring well clusters, additional investigation may be needed.

In summary, we believe the complex geology in the Evergreen Subdivision area, witnessed by both historical and more recent hydrogeological information, requires that additional data be collected and evaluated before any significant changes to the operation of the Evergreen System can be made. The DEQ shares PLS's desire to reinterpret the site conceptual model as new data are gathered and used to determine the need for any changes or additions to the remedial systems. The DEQ is willing to meet with PLS to discuss the issues addressed in this letter in more detail. Please contact me if you have questions or would like to discuss these matters in more detail.

Sincerely,

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SK/KJ

Enclosure

cc: Mr. Richard Mandle, DEQ
cc/enc: Ms. Celeste Gill, Department of Attorney General
Mr. Mitchell Adelman, DEQ/Gelman File
Mr. James Cogger, DEQ