STATE OF MICHIGAN
DEPARTMENT OF ENVIRONMENTAL QUALITY
JACKSON DISTRICT OFFICE

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November 7, 2003

VIA ELECTRONIC MAIL

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Mr. Michael L. Caldwell
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Dear Sirs:

SUBJECT: Gelman Sciences, Inc. (GSI) Remedial Action
Work Plan for Testing of *In Situ* Oxidation, October 17, 2003

We have received the above referenced work plan. Our review of the work plan is not yet complete. We had requested that Pall Life Sciences (PLS) delay implementation of the work plan until the Department of Environmental Quality's (DEQ) comments could be provided and considered. We understand that the work plan was initiated last week, ahead of the schedule proposed in the work plan. However, we are providing this preliminary response to give PLS the opportunity to postpone further testing until some fundamental issues are resolved.

There are serious flaws with the work plan that lead us to believe that the test will not provide enough information to determine if any of these methods are feasible and could be proposed as a preferred option for remediation of the contamination in the Unit E Aquifer. In addition, conducting the pilot tests without a good understanding of expected outcomes, based upon sound scientific principles, may result in unintended consequences.

1. Due to numerous variables inherent in performing such a test in a complex geological system, the test should be preceded by bench scale testing where variables can be independently controlled and analyzed. This is especially important for the Stage C test where PLS proposes using ozone and hydrogen peroxide together in order to avoid bromate formation. We are not aware that these two chemicals have been used together before for *in situ* chemical oxidation treatment (ISCO) of 1,4-dioxane in a confined aquifer. Without bench scale testing, it seems unlikely that PLS will be able to determine in the field, the optimal mixture of the two chemicals needed to produce the desired effect, i.e. destruction of 1,4-dioxane without the formation of bromate. Without such bench scale tests, it will be difficult to determine the reasons for variations observed during testing. Bench scale testing should also provide information on the potential for gas production to determine whether there will be a need to vent gases if this technology is applied in a confined aquifer for long-term remediation.

2. The work plan should include references to document the body of science that was used to design the test.

3. There should be an explanation of why the three proposed areas were selected for the three separate tests, and how each area compares to the Unit E aquifer on which a large-scale implementation of one or more of these methods is contemplated.

4. The testing should include predictions of the expected responses based on results of the bench scale tests, along with adequate physical and chemical monitoring to test the predictions.

5. The expected chemical reactions between the oxidants, groundwater and soil components should be itemized. For example: 1) what is the effect of the oxidants on metals and organics in groundwater and soils? 2) what intermediate products and end products are expected to be formed? 3) what is the expected longevity of these products?

6. The expected radius of influence should be stated for each test. A monitoring system capable of assessing the effectiveness of the injection and range of influence needs to be properly designed and implemented in the field.

7. Due to the reactive nature of these oxidants, the type of material of which the delivery equipment is made, including the well casing and screen, should be carefully researched and specified.

8. The screen length for the new monitoring wells should be specified.

9. The proposed monitoring is inadequate. Vertical sampling of the aquifer will be needed to evaluate the results, and additional monitoring locations upgradient and side gradient of the injection point may also be necessary.

10. The Stage A test should include: 1) the basis for using a 12% solution of hydrogen peroxide; 2) the frequency of hydrogen peroxide dosing and total dosing; 3) the reason for possibly having to lower the pH, and how this will be determined.

11. The Stage B test should include: 1) the solubility limit of ozone in water at the expected temperature; 2) procedures for determining the injected gas mass.

12. Potential releases of ozone, and possibly other gasses, to the environment may require an air permit from the DEQ.

13. The duration of the testing is unlikely to provide enough information to design a safe and effective remedial system.

In summary, we do not wish to dissuade PLS from investigating innovative remedial alternatives that have a reasonable chance of effectively addressing the problems associated with your facility. We acknowledge that *in situ* chemical oxidation is a potentially viable technology for your facility. It is important to ensure that the work PLS does toward these ends is scientifically sound and is performed in a safe manner. After you have had an opportunity to review our comments, we believe it would be useful to meet to discuss these issues before giving you any additional comments. Please contact me to advise us whether you intend to move forward with the pilot tests or wait until we resolve the issues outlined above.

Sincerely,

Sybil Kolon
Environmental Quality Analyst
Gelman Sciences Project Coordinator
Remediation and Redevelopment Division
517-780-7937

SK/KL

cc: Ms. Mary Ann Bartlett, Pall Corp.
Mr. Robert Reichel, DAG
Mr. Mitchell Adelman, DEQ/GSI File
Mr. Leonard Lipinski, DEQ