Battelle
Pacific Northwest Laboratories
Battelle Boulevard
P.O. Box 999
Richland, Washington 99352
Telephone (509)
372-6096

September 15, 1995

To: Recipients of PNL-10605, *Hanford Site Long-Term Surface Barrier Development Program: Fiscal Year 1994 Highlights*

From: Document Authors

You recently received a copy of the document *Hanford Site Long-Term Surface Barrier Development Program: FY 1994 Highlights*, by K.L. Petersen, S.O. Link, and G.W. Gee. Page A.6 from Appendix A is missing in your copy of that document. Please remove the existing page A.5 and tape in the new page A.5/A.6. We apologize for this inconvenience. Thank you.

Errata for K.L. Petersen, S.O. Link, and G.W. Gee, *Hanford Site Long-Term Surface Barrier Development Program: Fiscal Year 1994 Highlights*, PNL-10605, Pacific Northwest Laboratory, Richland, Washington.

Replacement pages - Appendix A

Page A.6 from Appendix A of this document is missing from your copy. Please replace the existing page A.5 with the attached page A.5/A.6.

be about 80,00 gallons of water per acre per year. If this liquid contacts soluble contaminates, leachate with migration potential results. A good surface barrier will greatly minimize this potential.

4. Although good estimates of the number of acres of surface barriers required at Hanford are not available, a ball-park figure is 1,000 to 10,000 acres. Typical RCRA caps cost about $50K to $300K per acre. The prototype barrier constructed at Hanford is on the order of $300K per acre. The total cost range is $50M to $30B. A realistic figure is a minimum of several billion dollars.

5. As operable units are closed, Hanford will face an immediate need for surface barriers. If DOE wants to begin closing out operable units within the next few years, it must have surface barrier technology ready to go. You are not, at this point, close to being ready to implement surface barriers on a massive scale.

6. For the sake of discussion, let's just assume that Hanford will spend $5B over the next 20 years on surface barriers. The cost could easily go up or down 1, 2, or even $3B, depending on the final designs, components, thicknesses, etc. Once the surface barriers (graded to reflect the nature of underlying wastes) are selected, the same design will probably be repeated over and over. Hanford has an opportunity to spend several million dollars over the next several years to think through the surface barrier design, select and test the most cost-effective options, and then implement those options. This type of R&D could lead to a 10 to 10,000 fold return on investment.

PARALLELS TO EPA

I have worked closely with EPA over the past 15 years and somewhat closely with DOE over the same period (especially the last 2 years). DOE is in danger of repeating EPA's mistakes in terms of surface barriers. The main points are:

Mistakes that EPA made	Mistakes that DOE could make
1. Underestimated the value of containment. The initial goal of full restoration of sites to pristine conditions turned out to be technically and economically impossible. EPA is now relying more on "containment" and "risk management," but these approaches are not well developed or verified.	1. DOE has not put enough resources into containment technology and is likely to be in the position of needing technologies that are not yet proven or, in some cases, not available. The result is that, unless the situation is rectified, surface barriers will be selected that in many cases will not work. The cost to fix the problems could be enormous.
2. Let their in-house containment capability slip. The result is that the expertise that EPA needs is largely gone, except for one or two key people. The quality of regulations and oversight has suffered.	2. The Hanford group has people who have worked for several years or more on surface barriers. The DOE will need this expertise. A continuing commitment is needed to maintain a core group.

3. Underestimated the degree of difficulty in designing effective landfill caps. The result is regulations and guidelines that will lead to inadequate designs. What seemed like a simple problem (landfill caps) has turned out to be a challenging technical problem.

3. It would be easy for DOE to assume that the surface barrier is a well-established, off-the-shelf technology. Nothing could be further from the truth, particularly for long-term containment at arid sites. If existing design approaches are used, there is great risk that they will not work.

RECOMMENDATIONS

Most of the issues addressed herein are not unique to Hanford but cut across all the DOE facilities that require remediation. Hanford's need for surface barriers is significantly greater than that of any other DOE facility. The level of knowledge and experience among the key group of scientists and engineers at Hanford, in terms of surface barriers, is probably greater than that of any other DOE facility. It seems logical that Hanford should be DOE's leader in surface barrier technology.

My recommendations are:

1. Continue to fund the prototype barrier work at Hanford (including the tests on Hanford soil at Hill AFB, Utah). This work is absolutely crucial. Cuts in this effort would constitute a classic case of "penny wise, pound foolish."

2. Develop over the next 3 years detailed designs for "graded barriers," with different levels of sophistication, risk reduction, and cost, for different levels of subsurface hazard. The goal should be surface barrier designs that are "ready to go" with field construction by September, 1997. If this is accomplished, I venture a guess that the 1994-97 R&D funds expended for this effort would prove to be among the most cost effective R&D investments ever made at Hanford.

3. Formulate a "Surface Barrier Strategic Planning Team," composed of surface barriers experts from Hanford, end users at Hanford, experts and key end users from other DOE facilities, and perhaps others, to help in planning and coordinating the work.

4. Identify the key barrier people at Hanford and continue to involve them in the work. The technical expertise is a very valuable resource whose loss could be extremely costly.

Thank you for the opportunity to share my thoughts with your. Please do not hesitate to call (512-471-4730) if you have any questions or comments.

Sincerely,

David E. Daniel
L. B. (Preach) Meaders Professor
of Civil Engineering

DED:jb