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**Comments on  
May 15, 1995, Operable Unit 1 Feasibility Study  
and May/June 1995 Proposed Plan  
Moffett Field, California**

Dear Messrs. Chuck and Gill and Ms. Adams:

Harding Lawson Associates (HLA) is sending this letter on behalf of our client, Schlumberger Technology Corporation. This letter presents comments on the May 15, 1995, Operable Unit 1 Feasibility Study (OU1 FS) and the related May/June 1995 Proposed Plan for cleanup of OU1 at Moffett Federal Airfield (Moffett Field, formerly Naval Air Station Moffett Field), California. OU1 consists of Navy-designated Site 1, the so-called Runway Landfill, and Navy-designated Site 2, the so-called Golf Course Landfill.

**EXECUTIVE SUMMARY**

We have concluded that the interpretations and conclusions presented in the OU1 FS and repeated in the Proposed Plan are inadequately supported and that these documents contain errors, omissions, and misrepresentations that must be corrected before the documents can fairly represent either the nature and extent of contamination at the two landfills, or appropriate and cost-effective site cleanup alternatives.

On the basis of our review, we recommend that the May 15, 1995, OU1 FS and the May/June 1995 Proposed Plan be rejected or withdrawn, and that deficiencies in site characterization and remedial planning be remedied before those two documents are revised and reissued. In our opinion, this is the simplest and most straightforward way of addressing the many problems that have been

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identified and of creating an easily understood administrative record that fairly represents both the remedial investigation/feasibility study (RI/FS) and the final remedial selection. There does not appear to be any technical reason why this approach would significantly delay the actual field implementation of remedial actions.

Contrary to this recommendation, we understand that U.S. Environmental Protection Agency (EPA) and California Department of Toxic Substances Control (DTSC) staff would prefer to accept the OU1 FS in its present form and attempt to remedy deficiencies through an additional specially established, review, comment, and revision process inserted between the end of the current formal FS/Proposed Plan public comment period and creation of the draft Record of Decision (ROD). It is our understanding that this preference is motivated by a desire to maintain the current Moffett Field RI/FS schedule and allow listing of the OU1 FS as "complete". Unless this represents preferential treatment for the Navy, it appears that this approach will establish a new precedent for approval of significantly flawed Superfund deliverables that will be applicable to many similar public and private Superfund sites.

Successfully implementing such a deviation from established Superfund protocols will require establishing an enforceable framework for ongoing public review and comment and an enforceable mechanism for continued revision of the Proposed Plan as fundamental data gaps are filled and additional required analyses are performed. We understand that the agencies' proposed approach will result in some key data gaps, such as gaps in required groundwater characterization, not being filled until after the ROD is completed. This will require an enforceable and meaningful mechanism for community input even after the ROD is completed. At this time, we do not understand how this can be accomplished consistent with the basic Superfund principle that community input is cut off after completion of the ROD.

#### **CONCURRENCE WITH COMMENTS OF OTHERS**

HLA has reviewed comments, concerns, and issues submitted by other individuals and groups, including:

- The August 28, 1995, comments of the Technical, Historical, and Educational (RAB) Committee of the Moffett Field Restoration Advisory Board (RAB), a community input forum established for Moffett Field Cleanups,
- The June 14, 1995, comments from the City of Sunnyvale Department of Public Works,
- The June 4, June 12, and August 7, 1995, comments of the Cost Committee of the RAB,
- The August 10, 1995, outline of recommendations for closing Moffett Field Landfills, submitted by community member Cynthia Sievers at the August 10, 1995, RAB meeting.

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On the basis of our review of the listed documents, we have concluded that our comments and concerns are all raised in one or more of those documents. Copies of each of these documents are attached for reference. Rather than restate all of these previously submitted comments, we simply confirm here that we concur with the factual issues and questions raised by the earlier commentators. We believe that all of these issues and questions need to be adequately addressed before the OU1 FS and the Proposed Plan will be adequate, and we note that adequately addressing some of these issues and questions will require additional data collection, technical analyses, and/or document revision.

#### **EXAMPLES OF FS AND/OR PROPOSED PLAN PROBLEMS**

In the following sections, we present examples of some of the more significant kinds of problems identified in the OU1 FS and the Proposed Plan. The following examples are not exhaustive. Instead, these examples are intended to clarify and demonstrate the type and significance of identified problems. The previous comment submissions by others listed above should be consulted for a fuller accounting of comments, concerns, and issues that require substantive response.

As pointed out by the THE Committee, comments on the OU1 FS and Proposed Plan can be divided into five general categories: (1) Issues related to the adequacy of the site investigations, (2) Issues related to Navy assumptions about current conditions, (3) Issues related to Navy assumptions about future conditions, (4) Issues related to design assumptions, and (5) Issues related to regulatory compliance and financial security.

#### **Examples Related to the Adequacy of Site Characterization**

It does not appear that the available data adequately support some of the key assumptions and interpretations that underlie the cleanup alternatives presented in the OU1 FS and Proposed Plan. In particular, the Navy's assumptions are poorly supported or contradicted by available information in the following areas:

- **Pistol Range Lead.** The Navy apparently assumes that there are no potential risks associated with expected lead contamination at the pistol firing range at Site 1. The OU1 FS does not contain any information on lead contamination at the pistol firing range, even though lead contamination has been identified as an environmental problem at other firing ranges. This omission should be remedied so that the OU1 FS presents a more complete picture of potential threats associated with Site 1. Failure to have an adequate assessment of potential lead contamination in Site 1 surface soils could materially delay or force changes to plans to cap the landfill.

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- **Hazardous Landfill Contents.** The possible extent of hazardous waste disposal in the landfills has been unnecessarily and inappropriately understated by changes in language between the OU1 remedial investigation (RI) report and the OU1 FS. The OU1 RI report contains concise text that identifies and gives the estimated quantities of hazardous wastes that have probably been disposed in the two OU1 landfills. It is clear from the OU1 RI and from earlier Navy documents, such as the Navy's 1984 Initial Assessment Study, that the identities of wastes named in the RI report can be taken as reasonably well established, with more uncertainty associated with the estimated quantities of each waste disposed.

However, the OU1 FS changes the RI report language to indicate that the identities of wastes are more uncertain and to omit all indications of the substantial quantities of wastes estimated to have been disposed. For example, the RI report estimated that the equivalent of 2,000 55-gallon drums of one group of solvents might have been disposed in the Site 1 landfill. Even if the estimate was too large by a factor of 2, the resulting quantity of solvent, the equivalent of 1,000 drums, merits mention in the OU1 FS. There is no apparent rationale for this change.

Restoring the OU1 RI report waste estimates would not lengthen the OU1 FS noticeably, and is necessary to establish an appropriate frame of reference for judging the effect of potential landfill contents on the development and assessment of remedial alternatives. In particular, this information is important to balance characterizations of Navy landfill contents as probably not materially different from the contents of nearby municipal landfills. Actually, on the basis of the OU1 RI report waste estimates, it seems likely that the proportion of hazardous waste in the Navy landfills is significantly higher than in nearby municipal landfills.

- **Leachate Paths.** The text of the FS is equivocal and confusing on the subject of leachate generation and migration within the landfills. However, there are two lines of evidence that leachate must be more or less continuously generated in the landfills and discharged into underlying groundwater. It appears that the largest area of leachate discharge may be under the northern part of the Site 1 landfill, with smaller areas of potential discharge at other locations around the two landfills. The actual quality of this leachate appears to be largely unknown, because there are only five leachate monitoring wells for the entire 12-acre Site 1 landfill and three leachate wells in the 5-acre Site 2 landfill. At Site 1, one of the leachate wells is located more than 400 feet from its nearest neighbor.

The lines of evidence for leachate movement are simple and direct. First, leachate elevation data from the Site 1 landfill shows that there is a piezometric gradient established in the leachate. This is shown on OU1 FS Figure 12, which shows a gradient of 0.006 between Wells W1-10 and W1-11. This is a steeper gradient than is established in much of the local groundwater, and indicates that there is active flow taking place in the refuse. Figure 12

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also indicates that the leachate flow originates in the landfill and must be leaving the landfill. There does not appear to be any other credible explanation for the leachate piezometric data.

The second line of evidence that leachate is both flowing within and leaving the landfills is the detection of chemicals in surrounding groundwater. In light of the locations of the landfills, regional groundwater flow trends, and other considerations, the groundwater chemical data near the landfills indicate that the landfills are leaking. The sporadic nature of the detections appears more likely the result of poor placement of wells with respect to the most likely contaminant flow pathways, than an indication of only intermittent leakage or other sources of chemicals. This is discussed further in the next section.

- **Groundwater Paths.** The OU1 FS cleanup alternatives rely on the assumption that there is no significant impact of the landfills on underlying groundwater, especially at Site 1. Unfortunately, insufficient data have been collected to support this assumption. In the most dramatic example, Figure 13 of the OU1 FS indicates that most groundwater flow in the first aquifer under the Site 1 landfill probably passes under a narrow portion of the landfill's southern edge. No monitoring wells have ever been installed in this area. The nearest existing wells, Wells W1-14 and W1-15, are approximately 500 feet apart, with the apparent groundwater flowpath passing between them. Comparison of Figures 12 and 13, including consideration of downward vertical gradients between leachate in the apparent leachate-discharge area and the underlying A1-aquifer near Well W1-17, indicates that leachate from large uninvestigated areas of Site 1 leaks into the A1-aquifer and then flows to the south between wells W1-14 and W1-15 where permeable peat layers have been found. There are no data from critical locations to determine the nature of leachate entering the groundwater and leaving the landfill area.

Unfortunately, this lack of data is compounded by the limited data from the next-deeper A2-aquifer. There is only one A2-aquifer monitoring well near Site 1 and it is horizontally upgradient of the landfill so that it cannot monitor chemicals leaving the landfill area in the A2-aquifer. Comparison of available data from the A1-aquifer and the A2-aquifer near Site 1 indicates that there are downward gradients from the A1-aquifer into the deeper A2-aquifer at some times. Therefore, a potential for further downward migration of leachate from Site 1 exists, but this cannot be adequately assessed with the existing monitoring well network.

- **Landfill Boundary.** The existing networks of soil borings and monitoring well borings surrounding the landfills are too widely spaced to provide accurate assessment of landfill boundaries. For example, spacings of 400 feet or more between borings outside the landfill boundaries are found at both landfills.

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No trenching has been performed to accurately assess the landfill boundaries, even though trenching is commonly used to sharpen the definition of landfill boundaries and often reveals that boundaries estimated by air photo review, geophysical surveys, drilling, and ground surface observations are incorrect. Inaccurate estimates of the landfill boundaries will have a significant effect on cleanup costs and could cause incomplete capping when actual cleanup begins.

- **Landfill Depth and Underlying Soil Type.** The depth of refuse in the landfills and the nature and extent of underlying soil types have only been approximately determined. The existing level of exploratory drilling in the landfills is insufficient to justify the Navy's critical assumption that the landfills are completely underlain by low permeability clays. For example, a roughly square part of Site 1, comprising approximately 4 acres, or approximately one-third of the entire landfill, has not been drilled at all. This is an area roughly equal to 32 standard suburban residential lots and substantially bigger than several major industrial Superfund sites in the Santa Clara Valley. This low level of investigation is insufficient to support the Navy's assumption of a continuous clay under the landfills.

Furthermore, the OU1 FS text indicates that landfill refuse was placed as much as 21 feet below sea level. Cross sections presented in the OU1 FS indicate that refuse placed at that depth would have been placed in direct contact with A1-aquifer sands and would not have been separated from those sands by clays. However, contrary to the text, the OU1 FS cross sections only portray refuse placed to depths of approximately 13 feet below sea level, substantially underrepresenting the reported depth of refuse.

The substantial possibility that refuse is in direct contact with higher-permeability aquifer materials further discredits the Navy's remedial design assumption that there is no movement of leachate into groundwater.

#### **Examples Related to Assumptions About Current Conditions**

- **Low Permeabilities of Underlying Soils.** The FS understates the measured permeability of some underlying soil samples by factors of up to approximately 10. The OU1 RI report contains two concise tables that list the laboratory-measured permeabilities of soil samples from Site 1 and 2. Rather than reproducing those tables in the OU1 FS, or realistically summarizing the data, the OU1 FS lumps the measurements into oversimplified categories, reported in a relatively obscure computer-style notation. This lumping process implies that some samples were much less permeable than actually indicated by their tests. For example, correlating the OU1 FS text to the RI report data tables indicates that the measured permeabilities of soil samples WO1-12(A1)MD2 and WO1-06(A1)MD5 are understated in the OU1 FS by factors of 9.8 and 8.7, respectively. This understatement promotes unrealistic assumptions about the general permeability of the underlying soils.

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- **Leakage from the Landfills.** As described in earlier sections, the alternatives evaluated in the OU1 FS and the Proposed Plan are based on the unrealistic assumption that the OU1 landfills are not leaking. In fact, available data indicate that both Site 1 and Site 2 are leaking, but there are insufficient data to realistically assess the magnitude of the resulting environmental impact. The remedial alternatives evaluated for OU1 must specifically address this leakage issue.

#### **Examples Related to Assumptions About Future Conditions**

The third area of concern involves assumptions about future conditions. Navy consultants have stated that the proposed cleanup alternatives depend on the continued operation of the Moffett Field underground drainage system. However, it is not clear how the continued operation of this system will be assured, especially if the base reverts to local ownership. There appears to be no plan or commitment to keep this system operating. If the system were to accidentally stop operating, or be deliberately shut down to promote wetlands restoration or some other goal, the landfills probably would be flooded and possibly subject to tidal action. Provision for the operation of the drains in perpetuity should be an explicit part of the alternatives presented in the OU1 FS and Proposed Plan.

#### **Examples Related to Design Assumptions**

The Navy did not assess an alternative incorporating a synthetic membrane as a water barrier in a landfill cap. Extensive experience with the design and installation of such membranes in landfill caps indicates that they can deliver superior performance at lower cost than entirely soil based caps. Furthermore, regulatory agencies have often indicated a preference for caps including such membranes for landfill closures. Failure to consider such a cap may have resulted in an unrealistic assessment of the cost-benefit ratios of alternative cap designs.

With respect to minimum standard design requirements, the OU1 FS states that typical maximum allowable permeabilities for landfill closure caps are  $1 \times 10^{-6}$  centimeters per second (cm/sec). In fact, for hazardous waste landfills in California two other criteria must be met. First, the barrier layer of a hazardous waste landfill cap must have a maximum permeability of  $1 \times 10^{-7}$  cm/sec, ten times lower than stated in the OU1 FS. Second, the cap must have a permeability lower than the permeability of the underlying soils, to avoid the so-called "bathtub" effect (which appears to prevail at Site 1 now). In light of the large quantities of hazardous waste that were likely disposed in the OU1 landfills, the OU1 FS appears to adopt an unconservative approach to specifying the landfill caps.

In addition, the OU1 FS has adopted an unrealistic Alternative 3 cap design such that the HELP infiltration modeling performed for the OU1 FS predicts essentially no difference in performance between the Alternative 2 cap and the Alternative 3 cap. Specifically, the Alternative 3 cap design

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incorporates a so-called drainage layer that is only five times more permeable than the layer it is supposed to drain and does not meet EPA recommendations. It also incorporates a so-called low permeability layer that is too permeable to meet the requirements for a hazardous waste closure cap and is much more permeable than many of the samples of soil underlying the landfills.

In light of these apparently arbitrary and unrealistic hypothetical material specifications, it is not surprising that the modeling did not predict a meaningful difference in cap performance. It does appear likely that both OU1 landfill cap designs would create a bathtub effect in the landfills if the Navy's assumptions are correct and the landfills are underlain by continuous clay layers with permeabilities as low as  $1 \times 10^{-9}$  cm/sec.

Both proposed caps are predicted to allow between 5 and 10 percent of total annual precipitation to enter the landfills and continue to create leachate. No information is available on the permeability of the existing surface soils overlying refuse at the two landfills, so there is no basis to assess whether either of the proposed caps would provide any improvement over the existing unsatisfactory situation.

#### **Examples Related to Regulatory Compliance and Financial Security Issues**

We are concerned with the following regulatory compliance and financial security issues. First, the proposed Alternative 2 landfill cap (the "loamy soil" cap) and the Alternative 3 landfill cap (the "multilayer" cap) do not meet established standards for hazardous waste landfill closure caps, but are not adequately labeled as nonstandard and therefore requiring special regulatory review.

Second, we are concerned that the Navy has made a number of statements recently that suggest that it will not or cannot provide for assured continued funding to support the future operation, monitoring, and maintenance of the landfill cleanups. This is especially troubling in light of the importance of the continued operation of the Moffett Field drain system, the possibility that the landfill closures could require future remedial actions to address cap maintenance or groundwater impacts, and the growing probability that the base will move into local ownership. In light of current funding trends in Congress, it is unreasonable to expect the local community to rely on hypothetical future appropriations to address such contingencies, or for that matter, routine ongoing operations such as monitoring. Adequate funding should be provided and secured now to address reasonable future routine and contingent costs.

#### **CONCLUSION**

On the basis of our review, we recommend that the May 15, 1995, OU1 FS the May/June 1995 Proposed Plan be rejected or withdrawn, and that deficiencies in site characterization and remedial planning be remedied before those documents are revised and reissued. There is not now an adequate basis to determine whether any of the alternatives described in the OU1 FS will prove

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acceptable as final remedial actions or whether new alternatives will prove more appropriate when an adequate FS has been completed.

We appreciate the opportunity to provide these comments and look forward to continuing to work constructively with the Navy, the concerned regulatory agencies, and other concerned citizens to promote a timely and cost-effective resolution to the issues raised here.

If you have questions please call me at (415) 844-3280.

Very truly yours,

**HARDING LAWSON ASSOCIATES**



James G. McClure, Ph.D., P.E.  
Principal Engineer

Attachments: Comments by others, as listed in the text

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