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WMHT: 3426.1

Mr. A. W. Stromdahl
 Program Manager
 Lawrence Berkeley Laboratory
 University of California
 Berkeley, CA 94720

Dear Mr. Stromdahl:

We have completed our review of the draft letter report, "Geochemistry Research Planning for the Underground Storage of High-Level Nuclear Waste," which LBL transmitted in September 1982. This draft letter report was prepared under Task II of contract FIN No. B-3109, "Geochemistry Research Planning."

Our general comments on the subject report were sent to you on November 18, 1982. The specific comments made by the NRC staff are attached along with the earlier general comments. After resolution of the general and specific comments, the report will be ready for submittal to NRC as a final letter report.

The action taken by this letter is considered to be within the scope of the current contract (FIN B-3109). No change to costs or delivery of contracted products is authorized. Please notify me immediately if you believe this letter would result in changes to costs or delivery of contract products.

Sincerely,

"ORIGINAL SIGNED BY"

Julia A. Corrado, Project Manager
 High-Level Waste Technical
 Development Branch
 Division of Waste Management

Enclosure:
 As stated

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NRC STAFF COMMENTS ON LBL DRAFT LETTER REPORT
"GEOCHEMISTRY RESEARCH PLANNING FOR UNDERGROUND
STORAGE OF HIGH-LEVEL NUCLEAR WASTE"

GENERAL COMMENTS

1. Tables 2.1 and 2.2 are being used in both the subject letter report and the Task II formal report. In each report several approaches or breakdowns for understanding the geochemistry research problem are presented, and a separate logic is used to generate each table (for examples, see pages 10,11, 16-19). Table 2.1 summarizes the research needs as generated in the "Status ..." report. Table 2.2 extends and elaborates on those research needs, but is presented using a different rationale. It is important that both documents contain a clear description of the logic used to generate the summary tables.
2. It is difficult to understand the logic and therefore the soundness of the "Level of Effort" estimates in Table 2.2. Section 2.2.3 needs to define the rationale in terms of how the "approximate estimates" were made. Each element of Table 2.2. should include a reference to section 2.2.3.
3. The priorities used in Table 2.2 need clarification. For example, the rationale for the use of priority "A" is that the research is of top priority and is an essential matter requiring resolution before radioactive waste can be stored underground. This priority can change depending on the nature of site specific conditions where factors besides geochemistry might be able to compensate for uncertainties in retardation. Therefore, the definition of priority "A" should be revised to be less categorical and absolute.

Furthermore construction authorization in addition to waste emplacement is a key milestone. Although research cannot be expected to resolve all issues by the time of construction authorization, it should be apparent at construction authorization that significant progress on the issue has been achieved and the issue should be fully resolved before waste emplacement.

4. The use of "Link In," "Link Out" and "Existing Projects" at the bottom of Table 2.2 is not clear. A brief description is needed in the text. The text should be referenced in the table.

SPECIFIC COMMENTS

1. (Page 1, paragraph 1) The first sentence of the first paragraph should be revised to clearly indicate that this report is a document in which the conclusions depend on the assumptions and are therefore subject to change.
2. (Page 1, paragraph 2) The first sentence should be written more tightly. "Even a casual examination ... underground will show ..." to "An examination ... underground ... shows ..." The remainder of the paragraph is stated better on page 4 and should be deleted.

Finally, combine the remainder of paragraph 1 and 2 to produce a tightly written introductory paragraph. These paragraphs should be combined as follows:

"An examination of the problem of disposing of high-level radioactive waste underground shows that chemical processes strongly affect waste containment. This report develops a proposed plan for conducting geochemistry research to resolve problems related to the storage of high-level nuclear waste underground."

3. (Page 2, paragraph 2) Same as previous comment. The following changes are suggested:
 - a) Delete "complex" from the first sentence.
 - b) End the first sentence after the word "approach" (and delete the remainder of the sentence).
 - c) Sentence 2 should be rewritten as follows: "The remainder of Chapter 1.0 is devoted to describing our approach in terms of: (a) the ... waste isolation program (section 1.2), (b) approach ... planning (section 1.3), and (c) ... uncertainties (section 1.4).
4. (Page 3, paragraph 1, sentence 2) Same as 2. Delete "hoped", add "considered".
5. (Page 3, section 1.2.1, sentence 1) Same as previous comment. Delete "spelled out", add "defined".

6. (Page 3, section 1.2.1, sentence 2) The "primary objective" appears to be a quote. If it is a quotation, quotation marks should be used.
7. (Page 3, section 1.2.1, sentence 3) Same as previous comment.
8. (Page 4, first complete paragraph) This paragraph is vague. In the first sentence it appears that the word "must" should be "were". In the third sentence the use of "DOE" is not necessary, and "paper studies" should be in quotes. The fourth sentence is more clearly stated on page 5 and should be deleted from page 4.
9. (Page 4, paragraph 3, sentence 4) The use of the work "complex" overemphasizes the nature of the geochemistry that must be understood. Delete the word "complex".
10. (Page 5, first complete sentence) For the purpose of clarification, this sentence should be rewritten as follows: "... demonstrated in the field and laboratory to ..."
11. (Page 6, second complete paragraph) This paragraph is not tightly written. Suggested rewording follows:
 - a) Delete "is a system" from sentence one. Add "uses a systems approach."
 - b) Delete "also" from sentence two
 - c) Delete "in" from sentence three. Add "for the purpose of."
 - d) Add the word "the" after the word "one."
12. (Page 7, list, No. 5) Same as the previous comment. The fifth item in the list should be rewritten as follows: (5) "near field, and"
13. (Page 7, third complete sentence) This sentence is not clearly written. A suggested rewriting would be "... by the emplacement of the waste either mechanically (by rock breakage), thermally (by heat generated by the waste), or chemically (by grouts or other chemically reactive constituents used to modify the host rock in anticipation ...)."
14. (Page 9, paragraph 1) This paragraph has not been clearly written. A suggested rewriting would be:

- a) Sentence two - Delete "to avoid ... presented in"
Rewrite - "Figure 1.1 shows the logical sequence of actions suggested by the foregoing authors ..."
 - b) Start new paragraph with sentence 3 ("the main ... ") and add the word "report" after "this" ("i.e., ... this report and ...")
15. (Figure 1.1) The use of the dashed line in the diagram is not clear. This line should be annotated or deleted.
16. (Page 10, paragraph 3) This paragraph rambles. A suggested rewriting would include at least the following.
- a) Sentence 1 - "For reasons already discussed, this ... involved."
 - b) Sentence 2 should be broken into two sentences.

The first sentence would end after "employed" ("Nevertheless ... employed.")

The third sentence should start "As Varanini ..."
17. (Page 11, first paragraph continued from page 10) The following word changes are suggested:
- a) line 1 - change "oversee" to "overcome".
 - b) line 2 - change "required" to "suggested".
 - c) line 6 (list item 3) - it appears that this should read "computer simulations" not "simulations" (see title page 12, 1.2.2.3).
18. (Page 11, section 1.2.2.1) Title "Problem definition" does not reflect title in prior list.
19. (Page 12, section 1.2.2.4) Sentence 1 is not clearly written. Suggested word changes are as follows: Delete "to verify the correctness of geochemical concepts." Insert "... to verify that the geochemical concepts are correct ..."

20. (Page 13, sentence 3) Same as previous comment. Suggested word changes are as follows: "Therefore, both laboratory experiments and field tests should be considered, ..."
21. (Page 13, section 1.2.2.6, sentence 1) - "The process of site characterization could continue beyond the preparation of an environmental impact statement." This sentence should be deleted.
22. (Page 13, section 1.2.2.6) Sentence 2. This sentence is an overly broad generalization. The sentence should be rewritten (e.g., "An adequate characterization ..." or "Characterization ...")
23. (Page 14, paragraph 1, sentence 1) Sentence 1 sounds as if we are constrained by the conclusion that HLW can be isolated. This sentence should be rewritten so that the opposite conclusion could be reached.
24. (Page 18, line 15 and 16) It is possible that the "complete list of all projects" is not complete. The sentence should be rewritten as follows; "This was accomplished by compiling a list of projects funded as of _____" (state appropriate fiscal year here).
25. (Page 19, last paragraph, last sentence) This sentence is not tightly written. This sentence should be rewritten (e.g., "An example ... migration." "Strontium - 90 would ...")
26. (Page 21, sentence 1) This sentence is not tightly written. At a minimum the sentence should list the three areas of uncertainties.
27. (Page 22, last sentence) The last part of this sentence "and through discussions with DOE" is beyond the scope of the document and should be deleted.
28. (Page 26, Recommendation 2) It is not clear whether the recommendation is being limited to carboxylic acid complexes. Consider adding "and other organic complexing agents."
29. Table 2.2 must be proof-read. See page 36.
30. (Page 98, section 2.2.4, sentence 2) The milestone in 1987 is going to be construction authorization, not licensing. This sentence should be changed to reflect this.

31. (Page 99, first complete paragraph, sentence 1) It is not clear from table 2.2. that "the present research coverage is uneven and incomplete." This paragraph should be rewritten to explain this conclusion.
32. (Page 100, first complete paragraph, sentence 3) This is not tightly written. The sentence should be rewritten so that it is clear that while the "present program does not address the effort necessary to characterize specific sites", it does address the effort required for site characterization (see page 13 "site selection and characterization")
33. (Page 100, last paragraph, sentence 1) This sentence is somewhat inaccurate. The study of analogues is likely to be pursued in the context of "field tests." This paragraph should be rewritten to reflect this.
34. (Page 105 - 109) these pages are unclear without tables 2.1 and 2.2 properly described. An appropriate description should be included.
35. (Page 110, first sentence) Sentence 1 suggests that there are no alternatives to the manpower requirements. This sentence should be changed (e.g., "Figure 2.3 is a example illustrating manpower....")
36. (Page 116, line 3) The estimate of 30.0M and 33.5M is not consistent with the numbers from Table 2.3 of 32-38M (page 122). These numbers should be clarified.
37. (Page 122, item 9) Post closure monitoring is not required by the rule (10CFR60). The lack of a requirement should be included in this sentence.
38. (Page 129, line 3) Same as comment 36.