UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

MAY 30 1979

MEMORANDUM FOR: Robert W. Reid, Chief
Operating Reactors Branch No. 4, DOR

FROM: Robert E. Jackson, Chief
Geosciences Branch, DSE

SUBJECT: VALLECITOS NUCLEAR CENTER (GETR) - QUESTIONS

We have completed our initial review of the report entitled, "Geologic Investigations, Phase II, General Electric Test Reactor, Vallecitos, California, February 1979," which was prepared by Earth Sciences Associates. The attached list includes questions from the U. S. Geological Survey, Dr. David B. Slemmons, and the staff. These questions should be forwarded to the licensee as soon as possbile in order to facilitate our review.

As you know, we have requested that the U. S. Geological Survey provide us with advice on the seismological aspects of the General Electric Test Reactor (GETR) site. Since they have only recently started this review, the attached list does not include any questions relating to this review element.

On April 27, 1979 we received an additional report entitled, "Probability Analysis of Surface Rupture Offset Beneath Reactor Building General Electric Test Reactor," prepared by EDAC, Inc. We have made a preliminary review of this report and would like to make several recommendations with respect to the final review of this document. The Geosciences Branch and its consultants will review those elements of this report which deal with the validity of the geologic data base and the geologic and seismological assumptions included in the probability analysis. Based on this review we will recommend whether or not these data allow for use of such an approach at this site. We recommend that you have the probability model and mathematics reviewed by experts in those areas. I would also like to note that this report and cover letter include considerations of probabilities of accident consequences which are of a policy nature and these elements should also be reviewed by experts in relevant areas.

Robert E. Jackson

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cc: See next page

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GENERAL ELECTRIC TEST REACTOR (GETR)

1. Inasmuch as the consultants maintain that the dislocations seen in the trenches are related to landsliding and not faulting, therefore, the relative stability of these so-called landslides is pertinent to GE's position on the safety of the reactor. The landslide stability analysis (ESA July 1978) was made before the information on trenches B and H was available. What new arcs of circles would be required to reflect the dislocations in these trenches? Are there any samples of comparable deformation reported in the literature? In particular, are there any precedents for recurrent landslide movement at a distance of 2000 feet from the base of the hill?

2. Inasmuch as the consultants admit (Landslide Analysis, ESA 1978, p. 5) that no detailed engineering investigations of the static and dynamic strength of the Livermore Gravels have been made, how can they affirm (p. 1) that the landslide that could affect GETR is stable under present geologic and climatic conditions?

3. Referring to figure 8 in the ESA February 1979 report, the movement of landslide blocks along the lines projected should result in bedding dips that are considerably steeper than those in undisturbed bedrock. Instead, the figure and attitudes in the field indicate that the dips are shallow. What is the explanation for this relationship?

4. Inasmuch as the consultants admit (ESA, 1979 p. IV-8) that there has been three feet of displacement of the stoneline in the last 10,000 years, and inasmuch as figure 9 shows multiple offsets that have no relation to any established geologic feature, what proof exists that this so-called landslide will not break directly beneath the reactor next and break with a displacement of several feet?

5. ESA asserts (ESA, 1979 p. IV-4) that the widespread occurrence of the buried paleosol exposed in the trenches indicates that no major disruption of the present topography has happened in the last 10,000 years. Yet, the consultants allege that thepostulated GETR landslide was significantly modified and the headscarp "pull away" structures largely eroded away during two "pluvial" episodes which occurred within the last 70,000 years (p. IV-2 thru IV-3). Substantial amounts of debris from the eroded landslide should have been shed westward across the GETR site during the period of alleged land-surface stability. Where is the debris?

6. (ESA, 1979, p. IV-2) ESA argues that fault movements in the GETR site area "can be reasonably explained as minor adjustments of the remnants of the slide complex in response to seismic shaking from large earthquakes on the Calaveras fault." When did large prehistoric earthquakes occur on

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the Calaveras fault zone, and how does their timing, location and size compare with the record of fault movements in the GETR site area?

7. (ESA, 1979) ESA implies on page III-20 that the faulting seen in trenches A-1 and A-2 could be part of a northwest-trending extension of the Williams fault. This continuation of the Williams fault would strike about N25W (ESA, 1979, fig. 3), extending through the pass on California Highway 84 east of the GETR. However, the faults seen in trenches A-1 and A-2 strike generally N65W to N80W, rather than N25W. Moreover, the alleged northwest-trending fault would have to cut Livermore Gravel Horizons near Highway 84 that ESA previously reported (ESA, 1978a, p. IV-15) are "unfaulted." How are these conflicting data compatible?

8. The Livermore Gravels stratigraphic section in the Vallecitos-La Costa Ridge northeast of the GETR thins rapidly southward by several thousand feet toward California Highway 84. The abrupt change in section was explained previously (ESA, 1978b, p. 4-5) as a result of depositional thickening toward the north. With the discovery south of Highway 84 in the trenches of a major fault across which there is no stratigraphic continuity, how is the southward stratigraphic thinning in the Livermore Gravels now explained?

9. In the description of the modern solum in trenches B-1, B-2, and E (ESA, 1979, A-13 thru A-15), the soil is described as having A11, A12, A13, A2 (Ae), B1, and Bt horizon. The soil is developed in colluvium mantling a ...neline unconformity asserted to be at least 17,000-20,000 years o... The Bt horizon reportedly formed "in latest Pleistocene time" (p. A-15), between 10,000 (end of the Holocene) and 17,000-20,000 B.P. The albic horizon (A2 or A3 horizon), however supposedly developed after the Bt horizon, in the early Holocene(?), after 10,000 B.P. Radiocarbon ages (ESA, 1979, p. A-10) determined for carbon collected from the Bt, A2, and B1 horizons were all less than 4600 C-14 years. The true age (when corrected for modern carbon contamination) of these horizons is reported to be "greater than about 8000 years, and more likely in the range of 12,000-15,000 years" (Earth Sciences Associates, 1979, p. A-23). In a typical soil, humdified organic matter accumulates in the A1 horizons. In the A2 or Ae horizon, clay, iron, or aluminum is leached out by downward-percolating groundwater. In the B horizons, an alluvial concentration of silicate clays, iron, aluminum, or humus results from the downward movement of leachable ions and particulate matter from the A horizons. The growth of all horizons is simultaneous; the horizons are interrelated. With time, the horizons become better developed and grow to greater depths. At the GETR site, however, the Bt horiz... is supposed to have formed before the A2 horizon, like an accumulat... ...atigraphic sequence. This might be explained if the Bt horizon w... ...t of a buried soil profile, separated from the overlying A1 or A2 ...rizons. However, no erosional unconformity is described or recognized between the horizons; in figure A-7, they are inseparable. Moreover, the Bt horizon yielded radiocarbon ages indistinguishable from those determined on the A2 horizon. How are these discrepancies explained?

10. All radiocarbon ages obtained for samples from the colluvium atop the stoneline in trenches B-1 and B-2 were less than 5000 C-14 years. Without direct radiometric control, how can it be proved that the stoneline dates to isotope stage 2 (17,000-20,000 years ago), and that it is not time transgressive?

11. The establishment of the true age of the faulted soil horizons at the GETR site is of critical importance to defining the recency of faulting. Modern carbon contamination admittedly causes younger apparent C-14 ages. On page A-23, it is concluded that "(although) the amount of modern contamination in the GETR samples is conjuctural...the true age of these horizons is probably greater than about 8000 years; and more likely in the range of 12,000-15,000 years." How was this age correction calculated, and can it be proved that these horizons are really that old?

12. On page IV-10, ESA asserts that "(since) no offset of the Livermore Gravels did project beneath the reactor ... no faulting has occurred in the foundation area of the reactor for at least a million years." Units are unlabeled in the log of Trench B-1; separation of Livermore Gravels from younger alluvium and colluvium is impossible. Was Livermore Gravel seen in the area of trench B-1 adjacent to the reactor? What proof exists that the Livermore Gravels at the GETR site are 1,000,000 years in age?

13. ESA attempts to restrict the northeast-trending Las Positas fault to the southeast corner of Livermore Valley. In the only area where they have conducted field work near the Las Positas fault (at its southwest end), the ESA geologic map is practically identical to that of Herd (1977). Yet, ESA maintains that "field examination of the southern mapped trace of the Las Positas fault south of Arroyo del Valle confirmed Hall's (1958) interpretation that the Cierbo/Livermore Gravels contact in this area represent an onlap unconformity..." (p. III-3 and III-4). If these (ESA-Herd) maps are nearly identical, how has faulting been disproved?

14. What is the character of the Verona fault and what is its relation to other faults and folds of the southwestern part of the Livermore Valley depression. Include in this discussion a consideration of the possibility that the Verona fault zone is a detachment structure and known faults (at B-1, B-2, H, Maguire Peak, etc.) may be separate structures in a complex decoupled or detached zone of related faults and folds that may not have a direct connection. If the Verona fault is a detachment structure is the true basement displacement the cumulative offsets less drag? Discuss reasons why the Williams fault and the Verona fault are not scissors faults as was suggested in ESA July 1978 report IV-18. This would explain the lack of surface expression along the California Highway 84 roadcuts.

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15. Based on the character of the Verona fault zone as determined by your response to question 14, and assuming surface displacements, what is the maximum probable earthquake that could occur on the Verona fault?

16. Provide further clarification on the characteristics at depth of the faults that have been located in the trenches at the site. Estimate at what depth the fault mapped in the H trench passes beneath the GETR site and whether or not these faults connect at depth.

17. The statement is made in the ESA February 1979 report p. IV-5 indicating that one line of evidence supporting a landslide origin of the shears is that basement rock in the Livermore Valley to the east is lower than it is beneath the site, or on the west side of the fault zone. Provide a discussion of all evidence that demonstrates that basement rock is lower east of the fault zone than west of it.

18. In the ESA February 1979 report it is concluded that the shear offsets exposed in trenches are the result of 3 separate displacements of about 1 meter each in the last 70,000 years. Based on the data available, could the total cumulative movement on all of the shears be related to larger offsets on a single fault plane at depth where they connect. Discuss in detail and provide the basis for your reponse.

19. The structure shown within the southernmost part of geologic section of the ESA February, 1979 report (Figure No. 7) is interpreted to be that of a syncline and an anticline in the Briones Sandstone. A note on the drawing indicates that those structures are based on a projection of surface outcrops. Are the outcrops of Briones sandstone, which led to the structural interpretation illustrated here, of sufficient quality and proper distribution to rule out faulting as an alternative interpretation to folding?

20. As stated in your February 28, 1979 submittal, it is the considered opinion of GE and its consultants that the most probable origin (of the shear like structures in trenches B-1, B-2, B-3, H, H-1 and H-3) is large-scale landsliding. The staff and its consultants believe that the date of last movement along these shears could be younger than the 10,000 years B.P. reported in your landslide stability analysis (ESA July 1978). There is general agreement that multiple movements have taken place on these shears since the last 70,000 to 125,000 up to less than 10,000 years ago.

The potential for landslide is reviewed at sites where the existence of historic landslides or topographic relief or geology indicate such a condition may be present at the site. The staff requires geologic mapping, core borings as well as complete geotechnical analysis of any landslide potential. Clearly the GETR site falls into this category. Your July, 1978 report, Landslide Stability is a cursory treatment of this potential hazard.

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It is the staff's position that there is a potential landslide hazard at the GETR site. A detailed investigation and complete geotechnical analysis must be performed to demonstrate the stability of the hillside deposits. At the present time, the documentation regarding the landslide potential at the GETR site does not meet the requirements of Appendix A to 10 CFR 100.

21. It is strongly inferred on pp. III-12-14 of the ESA 1979 report that evidence for a northeast-southwest trending Las Positas fault is questionable. On p. III-15 the referenced Wright, Harding, and Yadon abstract acknowledges the presence of this fault although a subsidence origin is argued. Please explain this apparent discrepancy.

22. The discussion of faults in the Livermore Valley in the ESA February 1979 report (P. LLL-4) neglects to discuss the fact that the Corral Hollow-Carnegie fault system and Tesla faults have substantial component of reverse movements. In addition the Ramp thrust fault is not discussed. Please provide a complete description of the direction of net slip and the amount of displacement on all faults in the Livermore Valley.

23. Referring to p. III-21 in the ESA report, reference is made to a "minor oblique slip component" of movement. Please provide the location at which this movement was observed along with the amount of oblique slip which was measured. Please provide a tabulation of all measurements or estimates of oblique slip which have been made during these investigation including the locations at which these observations were made.

24. It is noted on p. III-24, that, "expressions of the "B-2" shear were not observed in any of the remaining trenches located northeast and northwest of Trench B-215," Based on a lower sun angle aerial overflight it appears that these trenches could be located northeast of the actual strike of a linear feature in this area. Has an attempt been made to review available aerial photography to see if these trenches were properly located?

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