August 17, 1977

Dr. James L. Liverman
Assistant Administrator
for Environment and Safety
U. S. Energy Research and
Development Administration
Washington, D. C. 20545

Dear Dr. Liverman:

In response to your request of August 11, 1977, plans for the cleanup of Enewetak Atoll were reviewed at a meeting at the Nevada Operations Office, August 15-17, 1977. A list of participants in the review is attached.

Prior to the meeting, the reviewers were provided copies of documents relative to the development of cleanup criteria and preparation of the EIS. Supplementing these were briefings by Joe Deal, Tommy McCraw, Roger Ray, and members of the Staff of the Defense Nuclear Agency. Mr. Stevens reviewed the Environmental Impact Statement and Major General Shedd and Colonel Hemler described operational plans for soil cleanup and crater disposal. In addition, Mr. M. Gates, Manager of the Nevada Operations Office, met with the reviewers and discussed points he raised in his letter to you.

The reviewers addressed two primary issues:

The criteria for cleanup of the islands contaminated with plutonium.

The plan for disposal of plutonium contaminated soil and other radioactivity contaminated debris in the Cactus Crater.

Several other related issues were addressed during the discussion.

I. Summary of the Reviewers' conclusions

There was unanimous agreement that the criteria for cleanup of the islands contaminated with plutonium are reasonable in the light of present knowledge and their application does not pose an unacceptable health risk.

Although the reviewers identified alternatives that may be preferable, there was unanimous agreement that the planned emplacement of plutonium contaminated soil and debris in concrete in the Cactus Crater does not impose unacceptable environmental and health risks.

II. Review of Plans for Cleanup of Enewetak Atoll

A. Criteria for removal of contaminated soil

The reviewers considered the criteria for the relocation of approximately 10 Ci of plutonium from dispersed locations in the terrestrial environment to a central location in the Cactus Crater on Runit Island.

The reviewers concurred with the 40 pCi Pu/g soil value adopted in the Environmental Impact Statement as a minimal action level and with 400 pCi/g as the mandatory cleanup level. Using the assumptions in the EIS the reviewers estimated that the lung dose resulting from lifetime inhalation of air containing an equivalent concentration (100 μg soil/m^3 air or 4 fCi Pu/m^3) would be approximately 0.01 rem/year, or 1 mrad/year, assuming a quality factor of 10. This compares with the proposed EPA federal guidance value of 1 mrad/year to the lung from transuranic elements in the environment. The reviewers believe that lung doses from inhaled plutonium will be considerably less than this for persons living and working on the Atoll because of the small land area which minimizes buildup of plutonium concentrations in the air and because of the conservative assumptions used in estimating dose; e.g., all contaminated soil was considered respirable, the concentration of soil in air was maintained constantly at the 100 μg/m^3 level, etc.

The reviewers recommend that more specific guidance for application of the criteria at plutonium levels between 40 and 400 pCi/g be developed for the Task Group Commander.

The Environmental Impact Statement indicates that ^{90}Sr and ^{137}Cs in the soil and the uptake by plants is the major problem which will limit the occupancy and utilization of certain islands of the Atoll. Certain soil amendments that have been shown to significantly decrease the uptake of these radionuclides may be useful for hastening the rehabilitation of the Atoll.

B. Disposal of plutonium-contaminated soil and debris in the Cactus Crater

In examining the question of disposal of contaminated soil and debris, the reviewers considered potential human health effects, future maintenance and monitoring requirements, retrievability, potential restrictions on access to Runit Island, implications and risk of reopening the Environmental Impact Statement, costs, quantities of debris, and engineering problems. Weighed against these considerations the reviewers agreed that the planned emplacement of concrete-encased plutonium-contaminated soil and debris in the Cactus Crater would not in itself impose unacceptable human health risks. The method could result in the gradual release of this plutonium to the marine environment; this would be in addition to the 1500 Ci already in the lagoon sediment. However, for the worst case in which 10 Ci Pu is added to the Crater below the water level, the local lagoon water plutonium concentration would not increase more than by a factor of two. This could lead to an increased dose of a few mrem per year to a person who obtained all of his food from the local marine environment.

Several alternate disposal schemes, while not significantly influencing the health risk prospects, might be preferable. While it may be inadvisable to change disposal plans at this late date, the reviewers believe you should be aware of the possible advantages of other methods.

Ocean dumping was considered to be the preferred solution by most of the reviewers. While the quantities of soil and debris are high (75,000-225,000 yds^3), the plutonium inventory is estimated to be only in the order of 20 Ci, an insignificant amount to dump into the Pacific Ocean compared to that which is already present in the ocean from weapons test fallout. Presently 3-4 Ci is transported from the waters of the lagoon to the open ocean each year. We understand that EPA interprets PL 92-532 to effectively prohibit ocean dumping by the U.S. However, the U.S. has contributed technical guidance and is signatory to the international agreement on the dumping of radionuclides in the ocean under the London Convention which "allows" dumping of much larger quantities than 20 Ci of plutonium. Advantages of deep ocean dumping include the removal of the plutonium completely from the Atoll environment and the elimination of the need for any future monitoring and maintenance. However, the EIS would probably have to be reopened and an oceanographic survey performed.

Lagoon dumping as an acceptable alternate to ocean dumping minimizes international ramifications. Since soil would be slowly dispensed to the lagoon during the cleanup and only a small fraction of the bound plutonium will be remobilized, the actual impact on the lagoon water concentration will be slight. It can be demonstrated by computation that less than 0.01% of the plutonium would be remobilized to the solution phase during disposal to the lagoon. The majority of material would settle to the floor of the lagoon. Concentrations of plutonium in aquatic organisms might increase, but since the residence time for sea water in the lagoon is about 150 days, the concentrations would shortly be reduced to ambient levels. Again, the EIS would have to be reopened and permits obtained from the EPA, other Federal agencies and the Trust Territory.

Terrestrial disposal on Runit Island with a concrete cover would have the least immediate impact on the local marine environment in that remobilization of the radionuclides from the soil to the groundwater and eventually to the lagoon is minimized. This method would maximize potential occupational exposures during the cleanup operation.

Terrestrial disposal by covering the existing contaminated areas on Runit with contaminated soil removed from other islands, but without concrete cover, was also considered. This would reduce the average surface levels of plutonium on Runit, but might require quarantine. Both terrestrial disposal methods would allow retrieval of the plutonium. Both would require reopening of the EIS.

Other methods for disposal of plutonium were proposed. One interesting possibility is the application of mining and milling techniques to separate plutonium from the soil of Enewetak Atoll. The reviewers were not aware of this having been explored. While such a technique could not be available for application to Enewetak Atoll, it might be useful at other sites in the future.

C. Future ERDA Commitments at Enewetak Atoll

According to the Environmental Impact Statement, ERDA is committed to long-term monitoring the the Enewetak Atoll.

Planning for this responsibility appears to be incomplete. The reviewers offer the following suggestions:

1. The environmental monitoring program should be as inconspicuous as possible and should be aimed at estimating radiation doses to the inhabitants of the Atoll.

2. Any activities carried out by individuals other than the Enewetakese should be conducted only if it is ascertained that the activity has minimal impact on the inhabitants.

3. During the next three years a study of resuspension of plutonium from soils in circumstances typical of those that will occur when the islands are reinhabited should be conducted. It is emphasized that this should not be a study of resuspension associated with cleanup activity per se. Information applicable to the Enewetak people will be invaluable in improving estimates of radiation dose to human beings returning to the islands and will assist in reaching decisions about future use of specific islands.

4. The EPA regards the crater disposal method as temporary storage. Under this view, maintenance of the concrete structure may be required. The Defense Nuclear Agency regards this method as permanent disposal which would imply no maintenance. This could lead to uncertainties of responsibility for future activities at the crater site.

5. A programmatic effort must be initiated to communicate to the Enewetak people the nature of the risks to which they will be exposed. The potential risks associated with living and visiting the various islands must be made comprehensible to the people from their perspective to insure their understanding the need for restricted access to Runit, etc.

D. Concern for incomplete cleanup

The reviewers were concerned that the cleanup program, as defined in the EIS, could be terminated before completion if the funds and other resources appropriated for the effort proved to be insufficient due to underestimates of the magnitude of the amount of soil that has to be removed.

In conclusion it should be emphasized that only the adequacy of the criteria and disposal methods were reviewed and that the operational plans for assuring implementations of the criteria were not examined in detail.

Sincerely,

William J. Bair, Chairman

APPENDIX

PARTICIPANTS IN REVIEW OF ENEWETAK CLEAN-UP CRITERIA AND DISPOSAL

NEVADA OPERATIONS OFFICE, LAS VEGAS, NEVADA

August 15-18, 1977

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