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MEMORANDUM

TO: *RF* Ralph Ford-Schmid, WRS III: DOE Oversight

FROM: *SH* Scott Hopkins, Env. Spec. (C): SWQB/S&S

SUBJECT: ERA process and the LANL ERA proposal

DATE: October 30, 1996

First, I would like to tender my thanks for the opportunity to attend the Ecological Risk Assessment (ERA) workshop given by EPA last month. The workshop was the first opportunity I have had to glimpse the theoretical underpinnings of the ERA process.

Perhaps because my initial exposures to the ERA process have been from an external viewpoint, I entertain some degree of skepticism with regard to its ultimate validity. I do not mean to say that I believe that the ERA process is always doomed to failure, but rather that there is more than ample room for same, particularly in the long term.

The whole ERA concept is based on an interlocking network of assumption that is held together by faith, a little data, and yet more assumption. It may well be that the only real glue holding this whole house of cards together is the tendency of biotic systems to hold themselves together—despite our best intentions. To list a few of the assumptions a Risk Assessor must make:

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- We assume that we know how a system should function in health and how it will behave under our tender ministrations.
- We assume that we have sufficient data to describe accurately the stressors of a system.
- We assume that we have sufficient understanding of those stressors to manipulate them to the benefit of an impacted system.
- We assume that we know what the stressors to a system are.
- We assume that, despite the pressures of Politics, Economics and Expediency, our Risk Managers will make decisions based on the best available science and not PEE.
- We assume that the models we develop are appropriate.
- We assume that the languages of our electronic information handling systems can carry the type of information needed for the development of appropriate models.
- We assume to predict the reaction of one system to changes in another, related system.
- And we assume, finally, that we will do all of the above so well that our efforts will forestall a catastrophic system failure—in perpetuity.

We are dealing with complex adaptive systems when we attempt the manipulation of ecosystems, and since the best minds using the fastest computers have not gotten particularly far with the n-body orbital problem, I suspect we had better give the ecosystems under our care much of the credit for our successes when we undertake their management. Were it not for the adaptability of living systems we would get no further with them than we have with the n-body orbital puzzle.

Clearly, some standardized framework must be developed to organize our efforts in the remediation of ecologically destructive sites. In this respect the ERA process is a good start. It is just as clear, however, that the ERA process is still very much in its infancy, and must be entered into with a highly conservative stance. We risk not only the destruction of

habitats or, cumulatively, species; but we may well be held morally and legally responsible in the coming years for the damage we permit.

So then, my feeling is that to the extent a given system retains its resiliency the ERA process can be made to work—assuming, of course, that it is subject to revisitation: "No Further Action" (NFA) must be understood to mean "No Further Action Known To Be Required At Present", and assuming that as many assumptions are removed from the decision tree as possible. In addition, one very prevalent attitude needs to be dispelled: it seems to be a common perception that the function of the ERA process is solely the closure of a site. In as much as the "E" in ERA is derived from ecological and not economic or expedient, it follows that the primary goal of the process is not just the expeditious closure of a site, but closure with assurance of the protection of biotic integrity.

Comments specific to the Los Alamos Ecological Risk Assessment Approach:

In general the Los Alamos National Laboratory (LANL) Ecological Risk Assessment (ERA) proposal is comprehensive and exhaustive in its treatment of the not inconsiderable task of remediating contaminated sites on laboratory property. In particular, the emphasis on flexibility and exhaustive literature review, including reports from other agencies on similar multiple-contaminant, multiple-exposure route sites is commended. It should be noted that new data may render guidance obsolete, and slavish adherence to outmoded criteria may defeat the purpose of an ERA. Recent findings with respect to mercury are a good example of the above. Whether the requirements of RCRA or CERCLA are adopted for determination of the need for an ERA at a given Ecological Exposure Unit (EEU), it cannot be over-emphasized that the requirements of the State of New Mexico water quality standards must, without exception, be met.

Section II. Methodology

General: The exact status of an EEU subsequent to a finding of NFA needs to be clarified. Our knowledge in the field of ecotoxicology is very incomplete, and new information on threshold levels, modes of intoxication, and interactions between toxicants is being presented with virtually every new toxicological publication. It is therefore perfectly reasonable to predicate a scenario in which new data shows a previously NFA'd EEU to represent a palpable threat to some element of the biota of the site. LANL seems to have taken the position that once a finding of NFA has been reached there will be no revisitation of that site. This attitude does not fit well with biological reality, and verbiage should be included to define when, in the light of new data, consideration should be given to revisitation. This will be of particular concern should the screening assumptions be relaxed for a given EEU.

Paragraph three of page two states that "...the guidance presented in Appendix III have been verbally modified by EPA Region 6, and the instances in which this has happened are so indicated in the discussion." Only one reference to these verbal modifications is found. All guidance should be set out in text for review.

Task 1: The bottom of a drainage basin is, in many respects, the sum of its upper parts. Drainages and associated riparian corridors should be considered as continua as well as discrete EEUs.

The definition of "highly disturbed areas" needs clarification. The use of acute Toxicity Reference Values (TRV_a) as screening criteria at disturbed sites on a blanket basis is ecologically questionable. Assurance is required that surface water will be protected with respect to toxicants potentially released from both acute and sub-acute sites.

Task 2: Special consideration must be given to EEUs containing substances known to exhibit biomagnification.

A program of random sampling should be in place to determine the frequency of occurrence of contaminants not previously suspected at a given EEU. If the occurrence of a particular toxin at unexpected sites is high, or if it is found that contaminants commonly occur at unsuspected locations, allowances will have to be made in the screening process to account for the new findings. Dioxins and furans are not listed in the preliminary COPEC list. Is it known that these, or other contaminants, do not occur at any of the EEUs?

The practice of ashing samples for analysis of mercury, or any other volatile substance prior to analysis must stop.

Task 3: Fungi should be included in the consideration of foodwebs, both as mediators of nutrient and energy flow and as food items for deer, bear, squirrels etc.

Task 4: The tendency of mercury to volatilize should not be overlooked. Similarly, the tendency of mercury to collect in wetlands, where it may be subject to methylation and later release should be addressed.

Task 5: Consideration should be given to mycorrhizal fungi in the selection of ecological receptors. Some fungi, mycorrhizals among them, are known to accumulate metals, and so may become important links in exposure pathways. As virtually all woody plants are now known to have mycorrhizal associates, knowledge of the state of health of the mycorrhizal community is pertinent to the restoration of ecological integrity at any given EEU.

In the selection of receptors it should be kept in mind that top predators are the ultimate biological sinks for toxins, and that their dietary preferences vary. Appropriate dietary pathways need to be determined for each predator. Owls are particularly easy to assess in this respect in that they produce an exact record of their recent meals in their pellets, and dietary exposure can be verified by trapping and analyzing prey species.

While not exactly a surface water concern, it should be obvious that damage to T&E species at an EEU is not going to go over well with the Fish & Wildlife Service. LANL should conduct an exhaustive literature review with respect to relevant T&E species and contaminants at EEUs.

Task 6: Literature reviews need to concentrate on the most recent data available.

The ERA needs to address radionuclides at all relevant EEUs because biota may be more sensitive, or more heavily exposed, than humans.

Task 7: The use of 50% soil in the calculation of diet is inappropriate in the estimation of risk posed by materials

subject to biomagnification, and probably elsewhere as well. The use of the geometric mean of the NOAEL and the LOAEL is insufficiently protective. Both LOAELs and NOAELs are typically generated by highly focused, relatively short term, laboratory studies on caged animals. A study monitoring liver pathology after a three month exposure to one contaminant cannot be expected to address reproductive success rates after five years, or much of anything else, when the hazard under investigation consists of lifetime exposures to multiple contaminants. The use of Ambient Water Quality Criteria (AWQC) for biomagnifiers, e.g. mercury, selenium, or PCBs, is not protective.

Task 8: Use of acute criteria for "highly disturbed sites" may be insufficiently protective. Owls in particular are seen hunting along disturbed areas like highway rights of way, and can be expected to utilize similar areas on LANL property. Bats are seen to prey on insects attracted to lights. Each "highly disturbed site" should be evaluated with such considerations in mind and relevant criteria applied on an individual basis. Some definition should be applied to the term "highly disturbed site" to avoid confusion.

Task 9: Again, use of 50% for the dietary soil fraction is inappropriate where biomagnifiers are concerned.

Task 10: No comments.

Task 11: When an EEU is evaluated using less than maximally conservative screening assumptions, and the Hazard Quotient returned is ≤ 0.3 , that EEU should be reserved from NFA and placed in a new category of sites (No Immediate Action NIA?) that will be periodically revisited (five year or ten year cycle?) as new data is obtained pertinent to the contaminants and wildlife at that EEU. This is suggested because of the lag time, often several years or more, between the inception of guidelines and

their eventual finalization. New information developed in the interim may not be considered in said guidelines and may render them obsolete e.g., the data now under investigation by EPA indicating that certain chlorinated hydrocarbons may act as hormone analogs. A course of action used at the Rocky Mountain Arsenal (RMA) to deal with sites that the various stakeholders could not agree on might be modified for use in this situation as well (Richard Roy, RMA/USF&WS, Sept., 1996, pers. com.). During the RMA risk assessment process it was found necessary to establish a special committee to deal with problem EEUs. The committee consisted solely of technical personnel representing the various stakeholders. Lawyers, managers and politicians were specifically excluded, and the findings of the committee were binding. Decisions on action at these sites was referred to the committee for delayed and detailed attention while less problematical sites were dealt with. Obviously, some time frame for eventual closure would have to be set, though this might vary according to the type or degree of contamination at specific EEUs.

Tasks 12, 13: What is the mechanism for determining uncertainties and data gaps? This process needs to be monitored carefully. Process iteration is a highly useful tool, but if data requirements are overlooked, or uncertainty underestimated then no amount of iteration will produce a relevant outcome.

Task 14: A multi-metric approach to ecosystem assessment is highly recommended. In addition it is recommended that some method of integration, similar to the EPA's Rapid Bio-Assessment Protocols, be adopted and that it be adhered to rigorously.

Task 15: No comment.