State of New Mexico
ENVIRONMENT DEPARTMENT
DOE OVERSIGHT BUREAU
P.O. Box 1663, MS/J-993
Los Alamos, New Mexico 87545

GARY E. JOHNSON
GOVERNOR

MARK E. WEIDLER
SECRETARY

LANL General

February 18, 1997

Mat Johansen, DOE AIP POC
U. S. Department of Energy
Los Alamos Area Office, MS A316
Los Alamos, NM 87544

RE: Comments on Draft "Limits for Radiation and Radioisotopes in Ecological Systems at Los Alamos National Laboratory" (Ecorisk Rad Strawman), Los Alamos National Laboratory, October 3, 1996

Dear Mr. Johansen:

The DOE Oversight Bureau (DOE OB) has reviewed the subject document. The attached comments are provided for the purpose of communicating the results of the review. They are not provided or intended for the purpose of representing the regulatory position of the New Mexico Environment Department (NMED).

If there are any questions regarding this review, please contact me at (505) 672-0448 or Ralph Ford-Schmid of the DOE OB Technical Support staff at (505) 827-1536.

Sincerely,

Stephen Yanicak

Steve Yanicak, LANL POC
Department of Energy Oversight Bureau

SY:RFS:rfs

attachment

cc w/attachment:
J. Parker, NMED DOE OB
B. Garcia, NMED HRMB
S. Hoines, NMED HRMB
G. Saums, NMED SWQB
T. Taylor, DOE LAAO, MS A316
J. Jansen, LANL EM/ER, MS M992

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Comments on Draft "Limits for Radiation and Radioisotopes in Ecological Systems at Los Alamos National Laboratory" (Ecorisk Rad Strawman), Los Alamos National Laboratory, October 3, 1997

Comments are referenced to statements made in the document, which are shown in italics.

1. *If human radiation dose estimates are protective, no added analysis need be carried out.*

The statement above is based on the 1977 recommendations of the International Commission on Radiological Protection (ICRP) and the International Atomic Energy Agency (IAEA, 1992). The IAEA indicates that the 1977 recommendation is a qualified assumption: "The ICRP clearly regards the assumption [if man is adequately protected then other living things are also likely to be sufficiently protected] to be qualified rather than absolute." The Ecorisk Rad Strawman lists four qualifiers or exceptions to the use of human radiation dose estimates in evaluating environmental health.

The Strawman proposes that the use of human radiation dose estimates in evaluating environmental health may not be appropriate when:

- *human access is restricted but access by biota is not restricted*
- *unique exposure pathways exist for biota*
- *Threatened and Endangered Species are present*
- *other stressors are significant, i.e., exceed Tolerance Level Values*

At first view, these exceptions seem reasonable and necessary; however, closer inspection shows that one or more of the exceptions exist at virtually every site. That is, biota often have access to sites where human access is restricted; unique exposure pathways generally exist for biota; there are threatened and endangered species present in the Los Alamos area; and other stressors often exist (although they may not be significant or exceed Tolerance Level Values).

Therefore it would seem, since the exceptions are so common, that a human health risk assessment would not be adequately protective of biota. If we presume that *in most cases*, man is adequately protected then other living things are also likely to be protected, or by extension, that human radiation dose estimates can be used to evaluate environmental health, the question becomes: when are human radiation dose estimates *not adequate* to evaluate environmental health? Conversely, in what cases can an Effective Dose Equivalent of less than 10 mrem/yr be used to make a determination that further analysis is not needed?

Comment:

A conservative human health risk assessment, used to evaluate protection of biota should assume human access is not restricted, and should be based as a minimum on the following assumptions:

1) humans reside on the site for an extended period of time

3) humans ingest and contact available water (surface water or alluvial water)

3) humans ingest and contact soils and sediments

4) humans inhale vapors and particulates

5) humans consume produce grown on the site

The total dose estimate should include external exposures from gamma emitters in the soil and from contact with water and soil/sediments as well as internal exposures from ingestion of water, ingestion and inhalation of soils/sediments and inhalation of vapors/particulates, and ingestion of produce grown on the site. Available water (surface water from stormwater runoff, or shallow perched alluvium or perched intermediate aquifers) should be used so that the human health dose estimate more closely matches potential exposures to biota. The use of municipal or deep aquifer water in the ingestion pathway should not be used in a conservative human health risk assessment used to evaluate protection of biota.

A human health risk screen that incorporates the above exposure assumptions and demonstrates a dose less than 0.1 of the Effective Dose Equivalent (EDE) at point of Maximum Probable Exposure, or 10 mrem/yr, is probably protective of biota.

Further discussion of the Rad Strawman and of how the exceptions affect the application of human dose estimates to environmental evaluations is given below.

2. *A. Exceptions*

- *human access is restricted but access by biota is not restricted*

Comment:

The use of human access restrictions were discussed in the previous section. Access by biota should not be considered restricted unless the site is inside a building or covered by asphalt (parking lot).

- *unique exposure pathways exist for biota*

Comment:

Unique (that is, different that for human) pathways almost always exist for biota. An example may be a high external exposure to a burrowing rodent. Besides unique pathways, other considerations, such as the bioaccumulation of radionuclides or other chemicals may be unique to biota. Transfer coefficients for important species found in each Ecological Exposure Unit (EEU) should be researched and developed to accommodate unique exposure pathways.

For example, the uptake and bioconcentration of Sr-90 by Chamisa (*Chrysothamnus nauseosus*) (Fresquez, 1995) and the resulting dose to herbivorous browsers should be assessed. Another example would be the dose to hummingbirds through particulate and pollen consumption. Though data may not be available for hummingbirds, there is information on tritium concentrations in bees and honey at LANL (Fresquez, 1994).

- *Threatened and/or Endangered Species are present*

The presence of threatened or endangered species habitat, regardless of occupancy status, will require additional assessment (not necessarily a baseline risk assessment).

- *other stressors are significant*

This is an important issue, as radioactive contamination is not the only stressor at many sites at LANL. The issue of multiple chemical stressors and radiation exposure is generally not addressed in an ecological risk assessment.

It may be possible to address the problem of multiple stressors in this way. A Hazard Quotient (HQ) may be defined as the ratio of exposure or dose to a Toxicity Reference Value (TRV). It may be possible to define a Hazard Index (HI) for toxics as the sum of the HQs for toxic chemicals, a HI for carcinogens as the sum of the HQs for carcinogenic chemicals, and a HI for radionuclides as the sum of the HQs for radionuclides. The HIs for toxics, carcinogens, and radionuclides may then be evaluated as part of the risk screening process. Since information on synergistic effects is often not available, a conservative approach might be to consider that the HIs are additive.

Besides the issue of multiple chemical stressors, bioconcentration factors, if known, should be incorporated into the exposure pathway assessment.

3. *Dose limit to be applied for evaluations carried out for the exceptions are:*

0.1 rad/day for aquatic and terrestrial animals for a representative member of the population; 1 rad/day for plants for a representative member of the population

Dose limits to be applied for screening purposes should be 0.1 rad/day for plants and aquatic and terrestrial animals. Depending on the radionuclide, the assessment of dose should incorporate a quality factor of 20 to account for alpha particle effective dose. The Hazard Quotient for radionuclides is then the sum of the exposure to dose limit ratios for each radionuclide.

The human health based dose limits are more conservative than the 0.1 rad/day dose limit. For screening purposes, the human health based dose limits could also be used instead of the 0.1 rad/day dose limit.

4. *The limits apply to non-industrial parts of the Laboratory where habitat is available for biota.*

The limits should apply to all parts of the Laboratory, except where there is no habitat available for biota such as in buildings or under roads and parking lots.

5. *The "representative member of the population" will be based on adult members of the population.*

The "representative member of the population" should be based on the most susceptible member of the population (EPA, 1996). If adults are chosen as the "representative member of the population", all reproductive members of the population, including adults and sub-adults, should be included in the assessment.

General Comments:

1. EPA guidance (EPA, 1996) recommends that conservative assumptions should be used for screening purposes. This would maximize exposure parameters such as

- Area Use Factor (100%)
- Bioavailability (100%)
- Body weight and food ingestion rate (minimum body weight to maximum ingestion rate
- Dietary composition (100% of diet consists of the most contaminated dietary component). The highest dose and/or concentration found at an EEU should be used to represent the average dose to biota.

2. For screening purposes, the maximum exposed individual should be considered.

3. If a risk screen shows a Hazard Index greater than one, then a baseline risk assessment should be conducted. A site conceptual model should be developed as part of the baseline risk assessment process. Exposure parameters may be adjusted within the baseline risk assessment process, but not in the risk screening process.

REFERENCES

Fresquez, 1994. P.R. Fresquez, D. R. Armstrong, and J.G.Salazar, "Tritium Concentrations in Bees and Honey at Los Alamos National Laboratory," Los Alamos National Laboratory report LA-12872-MS (1994)

Fresquez, 1995. P.R. Fresquez, T.S. Foxx, and L. Naranjo, "Strontium Concentrations in Chamisa (*Chrysothamnus nauseosus*) Schrub Plants Growing in a Former Liquid Waste Disposal Area in Bayo Canyon", Los Alamos National Laboratory report LA-13050-MS

(1995)

IAEA, 1992. "Effects of Ionizing Radiation on Plants and Animals at Levels Implied by Current Radiation Protection Standards," International Atomic Energy Agency, Technical Report Series No. 332 (1992)

U.S. EPA, 1996. "Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments". U.S. Environmental Protection Agency Environmental Response Team, Edison, NJ., June 3, 1996, Internal U.S. EPA Review Draft