

HOUSING AND HANDLING OF RADIOACTIVE ANIMALS

PURPOSE

This procedure specifies conditions and methods for handling animals, bedding materials and excreta from experiments involving radioisotopes administered to animal subjects. This procedure addresses only the radiation protection aspects of such experiments; all other aspects of animal care are controlled by the Director of the Comparative Medicine Center (CMC).

POLICY

Animals may be housed in the CMC if they can be cared for by non-radiation workers without regard to radioactivity content. All other animals containing radioisotopes must be housed in designated radioisotope laboratories and cared for by workers trained in radiation safety. If alternative housing is required, a hazard evaluation and risk assessment must be performed, and the housing and handling protocols must be approved by the Radiation Safety Officer and Director of the Comparative Medicine Center.

DEFINITIONS

An **animal unit** is one large animal occupying a single cage or run, or a group of small animals housed in cages carried on a single rack or cart, or any comparable grouping of experimental animals.

A **combined reference quantity** is the sum of the fractions of individual isotopic reference quantities contained in one animal unit. Reference quantities for most commonly used radionuclides are listed in "RADIONUCLIDE CATEGORIES AND DATA" (RPR 10A).

INSTITUTIONAL ANIMAL CARE AND USE COMMITTEE (IACUC) ANIMAL RESEARCH PROTOCOL APPROVAL

All IACUC animal research protocols involving use of dispersible radioactive material have to be reviewed and approved by the Radiological

Health Department before final approval is given by the IACUC. The researcher is responsible for providing a copy of the proposed protocol to the department. Once approved, the researcher will give a copy of the letter of authorization to the IACUC.

ANIMALS REQUIRING RADIOLOGICAL CONTROL

Animals **must** be housed in designated radioisotope laboratories if they exceed either one of the following criteria:

1. external dose rate at one meter from one **animal unit** exceeds 0.2 mrem/hr, or
2. radioactivity that will be excreted from one **animal unit** exceeds one **combined reference quantity** per day.

Contaminated bedding material and animal carcasses must be treated as radioactive waste and handled as outlined in "RADIOISOTOPE ACQUISITION AND DISPOSITION" (RPR 13). Excreta may be put down the sewer provided that a record of the activity released to the sewer is kept as specified in RPR 13.

ANIMALS NOT REQUIRING RADIOLOGICAL CONTROL

Animals that meet the following criteria represent no hazard to the individuals that handle them, and require no special control of contamination or external exposure:

1. Animals that contain only nuclides that are present in such small quantities, or that are so tightly bound, that no more than one **combined reference quantity** is excreted per **animal unit** per day. A record that verifies this allowed release by calculation or measurement must be maintained.
2. The external dose rate from the animals may not exceed 0.2 mrem/hr at one meter from one **animal unit**.

Bedding material and carcasses of animals that do not require radiation controls for handling and housing must still be disposed of as radioactive waste (See RPR 13). The only exception to this requirement would be animals that contain only H-3 or C-14 at a concentration of less than 50 nanocuries per gram, averaged over the mass of the entire animal. These animals may be released directly to the CMC for disposal, provided that a record of the radionuclide concentration and disposition is reported (RPR 13).

An **animal unit** containing more than 10 **combined reference quantities** must be labeled with a CAUTION RADIOACTIVE MATERIAL sign on the cage, run, or cage rack even though the external dose rate is less than 0.2 mrem/hr at one meter.

CALCULATION OF EXTERNAL DOSE RATE

A calculation can be made prior to labeling an animal to estimate whether or not the 0.2 mrem/hr dose rate limit is likely to be exceeded. The dose rate in mrem/hr at one meter is the sum of the products of the activity of each isotope in millicuries (mCi) and the external dose rate constant (X), as found in "RADIONUCLIDE CATEGORIES AND DATA" (RPR 10A).

Dose rate (mrem/hr)

$$= \text{SUM } [A_i(\text{mCi}) \times X_i(\text{mrem/hr-mCi @ 1m})]$$

Example 1: A dog is labeled with 90 μCi of Sr-85, 85 μCi of Nb-95 and 90 μCi of Se-75; the dose rate at 1 meter would be:

$$\begin{aligned} \text{Dose rate} &= (0.09 \times 0.75) + (0.085 \times 0.48) \\ &+ (0.09 \times 0.86) = 0.19 \text{ mrem/hr} \end{aligned}$$

This would be an acceptable dose rate and, based on the external dose-rate criterion, the dog could be kept in the CMC. However, the excretion-rate criterion would also have to be satisfied.

Example 2: The dog is labeled with the same quantities of Sr-85 and Nb-95, but 300 μCi of Se-75. The dose rate at 1 meter would now be:

$$\begin{aligned} \text{Dose rate} &= (0.09 \times 0.75) + (0.085 \times 0.48) \\ &+ (0.3 \times 0.86) = 0.37 \text{ mrem/hr} \end{aligned}$$

The investigator should plan to keep this animal in a designated radioisotope laboratory at least until a measurement of the external exposure rate with an appropriate instrument demonstrated it to be less than 0.2 mrem/hr.

DETERMINATION OF DAILY EXCRETION RATE

The daily excretion rate of the administered radionuclides will depend on the elemental characteristics of the radionuclide, the chemical form, the method of administration, and the animal species. Frequently, a significant fraction of the material is excreted within the first day or two after administration. If the metabolic behavior of the administered material is not known in advance, the investigator should plan to keep the animals in a designated radioisotope laboratory for the first day or two and measure the activity excreted. When it can be demonstrated that the excretion rate has decreased to less than one **combined reference quantity** per day, and if the exposure rate is less than 0.2 mrem/hr at one meter, the animals could then be housed in the CMC without additional risk assessment by the Radiological Health Department.

If the metabolic behavior of the administered material is well known, calculations of expected excretion may be substituted for measurements. If the excretion even during the first day after administration will be less than one **combined reference quantity**, the animals may be housed immediately in the CMC.