University of Wisconsin·Madison

SAFETY IS OUR CONCERN...

SAFETY DEPARTMENT
317 N. Randall Avenue
MADISON, WISCONSIN 53715
608 262-8769 - 262-0667

November 11, 1985

U.S. Nuclear Regulatory Commission
Region III - Materials Licensing Section
Dr. William Adam - Personal
799 Roosevelt Road
Glen Ellyn, IL 60137

Bill:

Enclosed is an amendment to the University's broad scope license, 48-09843-18, for a specific field use of radionuclides. The amendment is for the use of small amounts of tritiated water involving Black-capped chickadees.

I believe that this amendment request includes all of the information as outlined in "Information Required to License Field Use of Byproduct Material". If you need additional information, please contact me as soon as possible. As you will notice that the research protocol dictates that this project be completed during the winter months.

Thank you for your time and assistance with this request.

Sincerely,

Sue Engelhardt

Sue Engelhardt
Radiation Safety Officer

Field Use Amendment

Use of tritiated water in the study of food requirements of Black-capped chickadees in wintertime.

Drs. William Karasov and Stanley Temple

Radionuclide: ^{3}H as doubly labelled water ($H^{3}HO-18$).

Amount: 0.240 mCi total in this study.

Research Protocol: Copy Attached.

Release of Material to the Environment: Due to the nature of this study and the metabolism of $^{3}H_2O$, most of the radionuclide will be lost to the environment as water vapor during respiration, in urine, and in fecal matter. The only portion of the ^{3}H that will be recovered will be that removed in the blood samples.

Estimate of dose to humans: copy of calculations attached.

Permission to use property: As is noted in the attached Research Protocol, Robert Rennebohm has agreed to the study and will submit a letter to this effect upon approval by the Nuclear Regulatory Commission. A copy of this letter will be sent to the NRC prior to commencing the study. Please note this is University Property set aside for research purposes.

Letter from State Health Authority: Letter from Lawrence McDonnell, Chief, Radiation Protection Section of Health and Social Services attached.

170.11(a)(9) EX 7C

FEE EXEMPT

RECEIVED BY LFMB
Date 11/18/85
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Action Compl.

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PROPOSAL TO USE TRITIATED WATER IN A FIELD STUDY

Principal investigators: Drs. William Karasov and Stanley Temple, Department of Wildlife Ecology, University of Wisconsin, Madison
Research assistant: Margaret Brittingham, Department of Wildlife Ecology, University of Wisconsin, Madison

Why this study is important. Approximately one fifth of all households in the United States feed birds during the winter. Relatively little is known of the impact of this large scale practice on native bird populations. As part of a larger project on this problem (Impact of winter bird-feeding on the population ecology of wild birds, S. Temple principal investigator), we are attempting to determine the percentage of a bird's energy and nutritional requirements which is obtained from feeders. We propose to use doubly labeled water (H^3HO-18) to measure the energy expenditure and hence food requirements of free-living Black-capped chickadees in wintertime. This will be the first measurement of field metabolic rate in a free-living bird under cold winter conditions.

Location of the study. We currently maintain bird feeding stations at several locations in southern Wisconsin where we capture, mark, release, and recapture birds. We consider the Potter Preserve in the Baraboo Hills area suitable for this study because it is owned and maintained by the University of Wisconsin Foundation as a research facility, and it is closed to the public. The permission of the director, Bob Rennebohm, has been secured, pending the proper permits.

Methods. The doubly labeled water method (Lifson and McClintock, J. Theor. Biol 12:46-74, 1966) allows an investigator to measure daily CO_2 production and hence energy metabolism in wild animals. Dr. Karasov has extensive experience with the method (c.f. Karasov, Oecologia 51:253-259, 1981). Twenty birds will be captured at the feeding station and brought into a building on the Potter Preserve grounds. Each bird will be injected with 12 microCuries of tritiated water intraperitoneally. Following equilibration (1 hour), 60 microliters of blood will be collected from the brachial vein in the wing. Then the birds will be released. Beginning the next day, and for the subsequent three days, we will recapture birds for the collection of another blood sample. Glass capillary tubes containing blood samples are flame sealed and transported to the University of Wisconsin-Madison. The blood samples will be distilled in Dr. Karasov's laboratory at the University, and the water counted for tritium using liquid scintillation techniques.

Possible hazards. The possible hazards resulting from this study are probably negligible. Although the study will be done on free-living animals, we have good control over our system. For example, we currently recapture 50% of our birds and have several options for improving our success for this particular study. The Potter Preserve is large (400 acres = 2/3 square mile) relative to the distance most of the birds move away from the feeder (ca. 700 feet). The tritiated water which is lost by the birds will be primarily in the form of water vapor in the atmosphere. Water in the excreta will evaporate also. The biological half-life of tritium in the birds will be less than 1 day. Should any predator consume one of the birds, tritium will similarly "washout" in a few days.

Regarding the human hazard present in the study, the maximum permissible body burden for tritium is 1000 microCuries, more than four times the total amount to be used, 240 microCuries.

ESTIMATED DOSE TO HUMANS

The dose to humans from this study should be totally non-existent. The release of 0.24 mCi of ^{3}H is inconsequential when compared to the naturally produced environmental equilibrium concentration of ^{3}H, estimated to be 69 Megacuries (Ref. 1).

The estimated dose from the 69 Megacuries of environmental ^{3}H is 6.9×10^{-4} millirem per year per person. The dose from an additional 0.24 mCi of ^{3}H, used in this study, would increase the annual dose due to ^{3}H in the environment by 1.0×10^{-14} per year (Ref. 2).

The above estimate of dose to humans assumes that the ^{3}H used in the study is all released to the atmosphere as triatiated water and is mixed uniformally. The other estimate of the dose to humans would be if someone would ingest the entire population of radiolabelled birds immediately after the injection of the ^{3}H. In this case the dose to the individual would be approximately 17 mRem, assuming an effective half-life of 12 days (Ref. 3) and an S-Factor of 1.7×10^{-7} (Ref. 4).

Since the food value of these birds is very low, along with the short half-life of the ^{3}H in these birds; the 17 mRem dose seems to be an extremely high estimate.

REFERENCES

1. Moghissi, A. A., & Carter M.W. Environmental Tritium. Tritium. Messenger Graphics, 1975.

2. Cohen, J. J., & Higgens, G. H. The Socioeconomic Impact of Low-Level Tritium Releases to the Environment. Tritium. Messenger Graphics, 1975.

3. ICRP Report Number 10. Report of Committee IV on Evaluation of Radiation Doses to Body Tissue from Internal Contamination due to Occupational Exposure. Pergamon Press, 1968.

4. Medical Internal Radiation Dosimetry Pamphlet Number 11. "S," Absorbed Dose per Unit Cumulated Activity for Selected Radionuclides and Organs. Society of Nuclear Medicine, 1975.

State of Wisconsin \ DEPARTMENT OF HEALTH AND SOCIAL SERVICES

DIVISION OF HEALTH
MAIL ADDRESS:
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November 8, 1985

Michael Baumann
Senior Health Physicist
Safety Department
University of Wisconsin-Madison
317 N. Randall Avenue
Madison WI 53715

Dear Mr. Baumann:

I have reviewed the proposal by Dr. Karasav and others to use tritiated water in a field study of the daily energy requirements of black capped chickadees during winter time. While there appears to be no particular problems involving human uptake of the tritium to be used in this study, I do have some concerns regarding the proposal.

The last paragraph of the proposal notes that the maximum body burden for tritum is 1,000 microcuries, while only 240 microcuries of tritium will be used in the entire field study. The 1,000 microcurie value is that body burden which will produce a dose to the whole body of 5 Rem, which is an occupational exposure limit. While the argument used in the last paragraph is valid and conservative when applied to occupational exposure, it is not clear that non-occupational exposure as a result of the field study has been considered.

I would suggest that non-occupational exposures be considered with respect to human uptake. The argument could be made that the maximum body burden used for non-occupational exposure should be 1/10 of the occupational exposure limit or 100 microcuries. This value would then be less than the 240 microcuries proposed for use in the study. I would suggest that an attempt be made to show that uncaptured birds would not produce a threat to the public due to indirect uptake.

In conclusion I do not object to this proposal so long as it meets with all of the appropriate NRC regulations and a plan to account for uncaptured birds is included.

Sincerely,

Lawrence J. McDonnell, Chief
Section of Radiation Protection

LJM:KOB:sm

CONTROL NO. 80127