

SAFETY PROTOCOL: C-14

Use of radioactive materials requires a safety protocol be submitted to the UNL Radiation Safety Committee (RSC) for approval. This is a safety protocol. To obtain RSC approval:

- Submit an Authorization for Radioactive Material Use request for review by the UNL RSC. Contact the UNL Radiation Safety Officer (RSO) for specific instructions.
- Agree to use this safety protocol or submit an alternative and equivalent procedure that you develop to meet your unique needs.

All radiation workers must be at least 18 years of age and have completed required radiation safety training. **Never handle radioactive material prior to the completion of radiation safety training.**

All research protocols involving radioactive material must be approved by the RSC.

Physical Data

- Half-life of C-14 = 5730 years.
- Beta particles are the primary radiation hazard.
- Beta particle maximum energy = 156 keV.
- The maximum beta range in air = 22 cm.

Radiation Protection Procedures

1. Special equipment or procedures
 - a. Use transfer pipettes, spill trays, and absorbent coverings to confine contamination.
 - b. Volatile chemical forms should be handled in a certified fume hood.
 - c. Use lab coats, safety glasses, and disposable gloves.
 - d. Replace gloves as needed.
 - e. Regularly monitor and promptly decontaminate gloves and work surfaces to maintain contamination and exposures As Low As Reasonably Achievable (ALARA).
 - f. Select gloves appropriate for chemicals handled.
2. Shielding requirements
 - a. None is needed at typical research quantities.
3. Surface contamination survey schedule

- a. A survey meter should be used to monitor work surfaces after use.
 - b. A removable contamination (swipe) survey utilizing a smear and appropriate counter must be performed each month in which radioactive material is used (including sewer disposal). The RSC may require a higher contamination survey frequency depending on the amount of material in process.
 - c. The action limit for cleanup of removable contamination is 1000 dpm/100 cm². Any indication above this limit on a swipe survey or above two times background with a survey instrument is considered to be contamination. Any accessible area found to be contaminated above this limit shall be decontaminated.
4. Bioassay requirements
 - a. None routinely required.
 5. Dosimetry
 - a. Typical research quantities of C-14 do not present a significant external exposure hazard since the low-energy betas emitted barely penetrate the outer dead layer of the skin.
 - b. The critical organ for uptake of many C-14 labeled carbonates is the bone. The critical organ for uptake of many other C-14 labeled compounds is the fat. Most C-14 labeled compounds are rapidly metabolized and the radionuclide is exhaled as carbon dioxide. Some compounds and their metabolites are eliminated via the urine. Biological half-lives vary from a few minutes to 35 days - 10 days being a conservative value for most compounds.
 - c. The annual limit of intake through ingestion is 2 mCi.

Waste Disposal

EHS procedures for disposal of hazardous and/or radioactive wastes are to be followed. C-14 waste can be combined with H-3 waste, but should be segregated from other radioactive waste.

Survey Meters

A survey meter is required to work with C-14. A thin window Geiger Mueller detector should be used to detect C-14.

Personnel Monitoring

Whole body and extremity dosimeters are not required for work with C-14 at typical research quantities.