

STANDARD OPERATING PROCEDURE

Procedure:	Working with tritium 3H radioactive isotope
School/Department:	School of Molecular Bioscience
SOP prepared by:	Larissa Belov and Nick Coleman
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Section 1 – Personal Protective Equipment

1. Lab coat or lab gown
2. Nitrile or latex gloves
3. Proper enclosed shoes
4. Perspex shield
5. Radiation dosimeter / badge

Section 2 – Potential Hazards + Safety precautions

1. 3H isotopes emit beta radiation particles. These have moderate penetrative power, and travel a maximum of 6 mm in air and 6×10^{-3} mm in water.
2. Chronic exposure to radiation from [3H] may result in mutagenic effects (DNA damage, cancer, birth defects).
3. Do not work with radioisotopes if you are pregnant or trying to get pregnant – the developing baby is more susceptible to DNA damage than an adult, and you may be pregnant with the most sensitive early stage embryo before you know for sure.
4. The 3H half-life is 12.35 years, so any waste will be fairly long-lived. Use the minimum amount of isotope possible to minimise the amount of waste.
5. Glass or plastic provides adequate shielding, if the barrier is properly deployed (between your body and the radiation source).
6. A problematic safety issue with this isotope is that 3H cannot be easily monitored during use. A Geiger counter will not detect the presence of tritium. The only way to monitor contamination of work area is to wipe the area with a piece of moist tissue paper and use a scintillation counter to measure radioactivity (**wipe test**).
7. Contamination on the skin could lead to the absorption of tritium into the body. Other routes of exposure include inhalation and ingestion, so never eat or drink while working with radioisotopes, and always wash your hands afterwards. If isotopes are swallowed or inhaled, seek medical advice.
8. Long hair must be tied back.
9. Workers with pre-existing medical conditions (e.g. allergy, immunocompromised state, chemical sensitivity) and workers who are pregnant or expecting pregnancy must consult with their supervisor AND medical specialist AND the university's WHS services before performing this procedure. If there are any serious concerns expressed by any of these individuals, this task must not be performed.

Section 3 - Procedure

1. Know the location of spill kits, eyewashes, safety showers before starting work.
2. Read and understand the Risk Assessment for Working with Radioisotopes. If anything is unclear or if you are unsure of the risks, consult your supervisor before starting any hands-on work.
3. Worker must wear appropriate PPE (gloves, lab coat).
4. If 3H work is to be done in a general laboratory, clearly delineate the area designated for this work with Radioactive Hazard tape and signs, alert all workers in the area that you are doing radioactive work, and let them know the isotope, and the risks and risk controls. Clean up thoroughly when all the [3H] work is completed.
5. Place Radioactive Hazard stickers or tape on all freezers, refrigerators, containers and bins where radioactive material is located.
6. Cover the work area with bench coat and replace this regularly.
7. Work behind a Perspex shield where possible

8. Complex procedures should be tested with a full non-radioactive run-through first.
9. Avoid cross-contamination of other parts of the laboratory or equipment by changing gloves regularly.
10. Discard contaminated gloves and other contaminated non-sharp material into designated radioactive waste bins that are clearly labelled with Radioactive Hazard tape and signs.
11. Discard contaminated sharps into dedicated sharps waste containers that are clearly labelled with Radioactive Hazard tape.
12. Discard contaminated liquid waste into dedicated, clearly labelled, radioactive waste containers, preferably contained inside an external secondary Perspex box.
13. All equipment handled while working with 3H isotope must be wiped down with 10% Decon or 70% alcohol. The wipes must be discarded as radioactive solid waste.
14. Any equipment that may come directly in contact with low levels of 3H isotope (e.g., gel tanks or blotting tanks) must be soaked in 10% Decon 90 and washed thoroughly. These should be labelled with Radioactive Hazard tape and dedicated to 3H isotope work.
15. Ensure that any biological hazards in the waste are neutralised before disposal (eg with Viraclean (1/10 dilution) or freshly prepared bleach (1%))
16. Hands should be thoroughly washed before leaving the area.

Disposal / Spills / Incidents

1. All spills must be cleaned up immediately and thoroughly. Use a wad of folded tissue paper or paper towelling, soaked in Decon 90, held in forceps, to decontaminate surfaces. The wipes must be discarded as radioactive solid waste.
2. Use the **wipe test** based on scintillation counting (above) to ensure that all radioactive material has been removed.
3. Radioactive waste must be disposed of into dedicated liquid or solid waste containers. Each isotope has its own container. Do not mix isotopes unless this is unavoidable.
4. Accumulated solid radioactive waste (if estimated to be at levels **<100 Bq/g**), can be disposed of, but still must be handled as hazardous waste (consult the school waste disposal officer).
5. Liquid waste containing detectable radioactivity must be collected and handled as hazardous waste. (consult the school waste disposal officer). Do not put down the sink. This liquid waste can be disposed **if the activity is <100 Bq/g**.
6. Any waste at levels >100 Bq/g should be transported to the Hazardous Chemicals Room on Level 2 (SMB). This waste MUST be accompanied by appropriate paperwork (name, room number, isotope type, any other hazardous chemicals present, radioactivity per gram, and total volume). Forms are available on the SMB website that detail the information required.
7. All large spills of radioactive material should be reported to your supervisor, the room custodian, and via an online incident report.
8. All incidents and injuries should be reported to your supervisor, and via an online incident report. Near misses (hazardous situations not leading to an incident) should also be reported.
9. All radioactive waste bags need to be labelled with lab name, the date of disposal and relative amount of radioactivity it contains (high or low).

Section 5 – Repairs / Certification / Validation

N/A

Section 6 – Relevant Material safety data sheets

Manufacturer's safe handling guide for 3H; MSDS for [3H]cAMP, [3H]retinoic acid, [3H]retinol

Section 7 - References

SMB Risk Assessment for "Using radioactive isotopes".

Print names and enter signatures and dates to certify that the persons named in this section have been consulted/trained in relation to the development and implementation of this Standard Operating Procedure. WHS Representative (WHS Committee) certifies that consultation has taken place.

Name Authorising (Printed): DIANNE FISHER.....

WHS Committee Representative Name (Printed): MARKUS HOFER

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