Dealing with Radioactive Biological Samples in Laboratories

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Dealing with Radioactive Biological Samples

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Author Name/Title: J. Jones, D.Purfield

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Radioactive Biological Samples

Samples must be labelled as radioactive

Tissue samples must be kept in shielded containers

Reduce handling time and use forceps for handling as far as possible

If a sample is found to be leaking contact RPS or Lab manager to take charge of the incident

Consider discarding current specimen if another is easily obtainable, if not decontaminate as far as possible

Aqueous waste is discarded down designated sinks. The amount discarded must be recorded

Radioactive waste generated is disposed according to whether it is solid, OLW or aqueous waste

Radioactive waste to be discarded via the waste store (longer lived isotopes) must be placed in grey bags provided

Each bag must contain only one isotope and must be less than 2/3rds full

Each bag must be clearly labelled with unique i.d. waste label

Radioactive waste to be discarded via the waste store (longer lived isotopes) must be placed in grey bags provided

Aqueous waste is discarded down designated sinks. The amount discarded must be recorded

Solid / OLW

Radioactive waste to be discarded via the waste store (longer lived isotopes) must be placed in grey bags provided

Each bag must contain only one isotope and must be less than 2/3rds full

Each bag must be clearly labelled with unique i.d. waste label
Dealing with Radioactive Biological Samples in Laboratories

**Objective:** To ensure compliance with IRR99, EPR10 and Trust Radioactive Biological Samples Policy

**Place of action:** Laboratories

**General Note:** Regulation (IRR99) on the movement (within the site) of radioactive substances: A radioactive substance (a substance that contains one or more radionuclides whose activity cannot be disregarded for the purposes of radiation protection) to be moved (shall be) kept in a suitable receptacle, suitably labelled, while it is being moved.

A suitable receptacle will ensure effective restriction of exposure, prevention of dispersal and physical security. (ACOP)

Labelling (ACOP) needs to provide sufficient information for the safety of the person moving the receptacle, and indicate the nature and activity of the substances being moved.

The values tabulated in table 1 make the following assumptions:

- Dose limitation is that for a member of the public i.e. not a radiation worker.
- Samples are in containers.
- Remote handling devices e.g. forceps are not used.
- Number of samples handled is 5 per month.
- Total exposure time, in direct contact with the sample(s), does not exceed 1 hour.

**Table 1. Activities above which precautions additional to "Standard Precautions" may be necessary.**

<table>
<thead>
<tr>
<th>Radionuclide</th>
<th>Standard precaution level, single sample activity (kBq)</th>
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<tr>
<td>H-3</td>
<td>1,000,000</td>
</tr>
<tr>
<td>C-14</td>
<td>1,000</td>
</tr>
<tr>
<td>P-32</td>
<td>35</td>
</tr>
<tr>
<td>Cr-51</td>
<td>9,590</td>
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<tr>
<td>Co-57</td>
<td>1,000</td>
</tr>
<tr>
<td>Na-22</td>
<td>155</td>
</tr>
<tr>
<td>Fe-59</td>
<td>304</td>
</tr>
<tr>
<td>I-125</td>
<td>1,000</td>
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Values in table 1 from IRR99.
Interpretation of Table 1.
The activity limits listed are for a single sample. If 5 such samples at the activity limit are handled during 1 month the operator may achieve 1/12th of the annual dose limit for a non-radiation worker (50 mSv). If higher activity samples or more frequent sample handling occurs environmental or personal radiation dose monitoring may be needed.

Activities below those listed in table 1 can be disregarded for the purposes of radiation protection, provided that standard precautions are used and the assumptions, above, are not contravened.

Precautions additional to “Standard Precautions” include labelling, shielding, handling, storage, monitoring; and may be dependent on the results of risk assessment.

Risk assessment for each procedure must also include consideration of the following;
- If the activity of a sample cannot be directly measured, e.g. samples taken outside of normal office hours,
- if the taking of a sample cannot be deferred, due to clinical need,
- if multiple samples are required,

Action to be taken in the above circumstances should be included in written procedures, incorporated into contingency arrangements and included within local rules.

Operation:

Biological samples (blood, urine, tissues or organs) obtained from patients who have recently received radioactive materials for the purposes of therapy or diagnosis are likely to be radioactive. In general, such samples will contain very low levels of radioactivity and consequently do not pose a significant risk to staff provided Standard Precautions and the Specimen Collection policy are adhered to (see section 1 below). Additional precautions are needed when taking or handling samples from patients who have recently received a therapeutic radionuclide administration and for excised organs and tissue samples (see section 4 below).

In all cases, the handling of radioactive biological samples should be performed with the aim of minimising risk. The minimisation of risk can generally be achieved by following trust policies on Standard Precautions and Specimen Collection. The scope of this policy only includes the handling of specimens once they have been taken from the patient and do not address any other issues that may be involved in collection of the samples. The period over which samples are required to be treated as radioactive will depend on the type of radioactive material administered, and guidelines on how long precautions need to be adopted after the radioactive administration will be advised by the departments responsible for their administration.

1. Infection control

1.1. Standard precautions

The trust has adopted a policy of Standard Precautions and all samples will be assessed to be of the same risk regardless of whether they are known to have an infection or not. All biological samples are regarded as hazardous, and the following guidelines should be followed:
Radiological Physics and Radiation Safety Group

- Ensure that the form is put in the pocket and not with the sample so it doesn’t get contaminated should there be a leak
- Using gloves ensure that the sample container / poly bag is securely sealed.
- All specimens must be regarded as potentially infective.
- All radioactive samples should be labelled with radioactive tape.

1.2. Specimen collection
Specimens must be labelled and collected in accordance with the Trust “Infection Control – Specimen Collection” policy.

That policy details arrangements for performing the following:
- Policy for specimen collection from wards
- Labelling of specimens.
- Movement of specimens from the wards to the laboratories

2. Radiation hazards
There are two kinds of hazard to be considered when dealing with all radioactive samples,

i) External radiation exposure:
Radiation doses arising from exposure to samples are likely to be small but it is important to assess each situation (organ/radionuclide) by performing adequate risk assessments (see section 5) and implementing the appropriate mitigating procedures.

Where practicable, radiation dose may be minimised by reducing the handling time and/or using forceps to increase the distance from the sample. If forceps are used, extra care must be taken not to drop the samples.

ii) Internal radiation exposure
This is possible via:

Open wounds
- Ensure that open wounds are covered, that protective clothing and gloves are worn

The mouth
- This is usually transferred from hands therefore ensure that gloves are worn and changed frequently and that hands are washed thoroughly before touching one’s skin.

Inhalation
- This is mainly from volatile radioactive material. As this is not significant for clinical samples, the risk is extremely low

3. Minimising Radiation Risk
The radiation risk, from the taking and handling of radioactive samples, is principally dependent on:
Dealing with Radioactive Biological Samples

a) **Amount of radioactivity within the sample**

The sample activity will reduce with both the physical decay of the radionuclide and excretion rate. The physical decay and its half-life is a fixed quantity. Excretion rate may vary with the health of the patient. In order to minimise risk samples should be taken, whenever possible, before the patient has radioactive material administered. Unless clinically urgent, once radioactive material has been administered sample taking should be delayed for as long as is practicable, to maximise physical decay and biological excretion.

b) **Sample volume and number of samples**

When clinically urgent samples are required the volume (ml) and number of samples should be minimised.

c) **The nature of radioactive emission from the radionuclide concerned**

Once administered the nature of the radiation emitted will not change however dose reduction can be optimised by using the most appropriate shielding and distance. Advice on this can be obtained from a radiation protection supervisor or medical physicist (RSG).

d) **The sample collection method and technique**

The sample collection method and technique selected should reduce the probability of leakage, spills and sprays. Collection time, shielding and use of distance should also be considered.

**3.1. Labelling of samples**

The relevant clinical details recorded on the label and the corresponding request form must state that the sample is radioactive and specify the radionuclide.

The requesting clinician should ensure that appropriately labelled samples along with the request forms are hand delivered to the testing laboratory - do not use the Airtube delivery system for radioactive samples. Details of which patients samples are deemed to be radioactive follow in section 4.

**3.2. Sample packaging**

Extra care must be taken to minimise any risk of leakage to avoid causing radioactive contamination at any stage in the sample’s journey. Standard Precautions (mentioned in section 1) must be followed.
3.3. Leaking samples

Any obviously leaking package must be separated immediately (using gloves) and the radiation protection supervisor (RPS) or a senior member of the laboratory staff contacted to take charge of the incident.

Care must be exercised to avoid clerical error on re-labelling if there is a leak. If the request form is contaminated but readable, it should be carefully dried/wiped with a disposable paper towel. It should then be placed into a plastic cover and photocopied. The original may then be disposed into the orange plastic waste bags if it is found to be inactive. Otherwise seek advice from RSG.

Any spillage onto the sample receipt bench area during unpacking should be decontaminated following local procedures or Radiation Local Rules. Contaminated packing materials and paper towelling used in decontamination must be dealt with as detailed in local procedures or Radiation Local Rules. The surrounding area should then be monitored in accordance with local procedures or Radiation Local Rules.

If any receiving departments do not have local procedures for work with radioactive material the Radiation Safety Group (RSG) should be contacted to provide advice.

4. Radioactive Samples

*Radionuclide therapy patients*

Regarding in-patients who have had a therapeutic administration, samples must only be taken if clinically urgent. These samples can be relatively radioactive depending on when they were taken. All such samples should be labelled as radioactive with radioactive tape and be hand-delivered to the lab.

*Diagnostic nuclear medicine patients*

Due to the type and level of radioactivity administered to these patients, most samples from these patients will not come within the scope of this policy as they are unlikely to cause significant radiation dose or risks from contamination. For patient groups that do come within the scope of this policy, such as patients undergoing sentinel node biopsy, specific policies and procedures have been developed. In the event of any other large sample or tissue collection is taken on a nuclear medicine patient advice should be sought from Nuclear Medicine physics staff.

*Administration of sealed radionuclide sources*

Radioactivity may concentrate in particular organs and tissues following administration of unsealed sources of radionuclides. Such samples should be assumed to have concentrated radioactivity. For patients undergoing brachytherapy, radioactive sources may be administered to a particular organ or tissue. Monitoring for radioactive contamination should be carried out before and after work with organs and tissue samples, in accordance with local procedures or Radiation Local Rules (see Section 5). The hazards are the same as those stated in section 2, i.e. external radiation and internal radiation.
exposure. However, the risk arising from external radiation is higher and therefore additional precautions need to be taken.

5. **Radiation Local Rules and radiation risk assessments**

Local rules must be available for all Radiation Controlled Areas.

It is recommended that Local Rules are also made available in those areas where there is a potential for an increased radiation risk to staff and members of the public, including examination rooms or theatres where radioactive samples are obtained from patients and laboratories where samples are examined or stored.

The basis for each area’s local rules are on-going risk assessments and audits that should be performed by senior staff and/or the RPS. A Medical Physicist or the Radiation Protection Adviser (RPA) may assist or advise.

The Local Rules and radiation risk assessments must be reviewed regularly and whenever new procedures or changes in procedure are implemented.

For advice on radiation safety including radiation risk assessments and Radiation Local Rules see Section 7.

6. **Radioactive waste**

Radioactive waste materials must be disposed in accordance with the Environmental Permitting Regulations 2010. Departmental Radiation Local Rules provide detailed information on radioactive waste disposal. Further advice can be sought from the departmental RPS or the RSG.

7. **Advice on radiation safety**

Radiation safety advice, including the preparation of Local Rules and guidance on radiation risk assessments, can be obtained from the Radiation Safety Group.

Contact details:

| Radiation Safety Group (RSG)             | 35679 |
| Radiation Protection Adviser (RPA)     | 33759 |
| Nuclear Medicine Physicist             | 33095 |
8. References

- Pathology Users Handbook, GEN MP 001 001.

- The Haematology Handbook, RFHNST,
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- Infection control – Standard precautions, RFHNHST, July 2008,
  http://freenet/guidelines/775_Standard%20Precautions%20Final.doc

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- The Environmental Permitting Regulations 2010, HMSO 2010.