UNIVERSITY OF CAMBRIDGE
DEPARTMENT VETERINARY MEDICINE

LOCAL RULES FOR THE POSSESSION AND USE OF RADIOISOTOPES FOR RESEARCH

1. *Status and scope*

These are local rules, required under the Ionising Radiations Regulations 1999. This set of rules provides the general principles and means of complying with the Management of the Health and Safety at Work Regulations 1999 for research work with radioisotopes. These rules are written to ensure that radiation doses to employees and others, resulting from the use of ionising radiations in specified work, are restricted to as low as is reasonably practicable (ALARP). Additionally, these rules refer to the arrangements to be observed in this Department to ensure that Best Available Techniques (BAT, see appendix 4) are employed to minimise the activity of disposed radioactive waste, minimise the volume of radioactive waste transferred to other premises, and, minimise the radiation effects of such disposals on the environment and on members of the public.

The following radioisotopes may be used in this Department: tritium (H-3), carbon-14 (C-14), phosphorus-32 (P-32), phosphorus-33 (P-33), sulphur-35 (S-35), chromium-51 (Cr-51), iodine-125 (I-125), rubidium-86 (Rb-86), calcium-45 (Ca-45), sodium-22 (Na-22), chlorine-36 (Cl-36), iodine-131 (I-131), gallium-67 (Ga-67).

- In accordance with the Regulations, the following are designated **Controlled Areas**:
  When risk assessments indicate the requirement:
  Room 301, Main Building (for P-32 and S-35 use only)
  Room 212, Main Building (for I-125 and Cr-51 use only, H-3 storage)
  Room 134A when Rb-86 stock aliquoting is in progress.

- In accordance with the Regulations, the following are designated **Supervised Areas**:
  When risk assessments indicate the requirement:
  Room 301, Main Building (for P-32 and S-35 use, H-3 storage)
  Room 212, Main Building (for I-125 and Cr-51 use, H-3 storage)
  Room 134A, Main Building (for Rb-86, Ca-45, Na-22 and Cl-36 use)

- The use of other isotopes or the designation of further areas as controlled or supervised may only be made by the RPS, in consultation with the University's RPA.

Date of first issue: December 1992. Date of revision: Sept 2012

These rules will be reviewed annually by the RPS (Section **2** below), and revised and re-issued whenever necessary.

2. *Personnel with responsibilities for radioisotopes in research*

Department:

Head of Department	Prof. D. Maskell	Ext 39868
Radiation Protection Supervisor (RPS) for open sources of ionising radiation for research purposes	Dr. B. Blacklaws	Ext 37609
Radiation Protection Supervisor (RPS) for department	Dr. M. Herrtage	Ext 37703
Safety Adviser, Laboratories	Dr. P. Mastroeni	Ext 65800
Senior Assistant	Mr. P. Grainge	Ext 37614
Senior Assistant's Assistant	Miss Betty Rayner	Ext 64080

University:

University Radiation Protection Adviser (RPA)	Mr. D.R. Plumb	Ext 39531
University Radiation Protection Officer (RPO)	Ms Lisabeth Yates	Ext 66354
University Assistant Safety Adviser	Dr L Hinton-Mead	Ext 39535

3. *Statement of Departmental Policy*

The Department of Veterinary Medicine, University of Cambridge, recognises its obligation to take all reasonably practicable steps to ensure the health, safety and welfare at work of all members of staff and to provide a safe working environment. Overall responsibility rests with the Head of Department, who delegates to the Safety Advisers organisation of the arrangements for safety in general. The organisation of arrangements in respect of the research use of radioisotopes is delegated to the Radiation Protection Supervisor (RPS), who is assisted by the Senior Assistant. These officers are named in Section **2**, above. The RPS is responsible for the supervision of all workers using radioisotopes for research. The arrangements for the possession and use of radioisotopes are given below.

4. *Controlled and Supervised Areas*

- The following procedures will be contained in the system of work for these areas:
  1. Controlled Areas are kept locked. Rooms 301, 212 and 134A may be used as controlled or supervised areas. When in use, access is permitted only to those persons registered as users of the appropriate radioisotope (see Section **5** below) for the purpose of research procedures involving the radioisotope. These users must follow the written System of Work for the room.
  2. Film badges must be worn at all times (see Section **8a**(a) below).
  3. Procedures must be discussed with the RPS before work commences, to ensure that the minimum amount of isotope is used, distance from the source is maximised and exposure time is minimised (see Section **8d** below).
  4. Appropriate personal protection and shielding must be used, including laboratory coats, disposable gloves and eye protection where there is a risk of splashes (see Section **8b** below).
  5. Monitoring and decontamination of the person and the workplace must be carried out promptly (see Section **8a**(a),(c) below).
  6. Radioactive waste must be collected safely and disposed of promptly (see Sections **8c** and **9** below).
- Other areas designated for use of low levels of radioisotope:
  - When risk assessments do not indicate use as a controlled or supervised area: Room 212, Main Building (Cr-51 (< 500 MBq or 13 mCi), P-32 (< 1.7 MBq or 45 μCi), P-33, S-35, H-3, C-14, I-125 (<3.3 MBq or 100 μCi), Rb-86 (< 1.7 MBq or 45 μCi), Ca-45, Na-22 (< 1.7 MBq or 45 μCi) and Cl-36)
  - North and South Laboratories, Main Building (marked bays for P-32 (< 1.7 MBq or 45 μCi), S-35 and Cr-51 (< 500 MBq or 13 mCi) work only).
  - Tissue Culture Rooms, Main Building (for H-3, S-35 and Cr-51 (< 500 MBq or 13 mCi) use only)
  - Main Laboratory, Neurology Block (for P-32 (< 1.7 MBq or 45 μCi), P-33 and S-35 only)

5. *Registration of users*

- All persons in this Department using radioisotopes in research are required to register with the RPS, and must agree to abide by these Rules. You must state the isotopes with which you wish to work and types of work that will be carried out. Registration will be reviewed annually.

- It is the responsibility of senior members of staff to ensure the proper registration of anyone under their supervision who wishes to work with radioisotopes.
- Anyone starting work with radioisotopes, or wanting help or advice on working procedures or safety with radioisotopes must discuss these matters with the RPS. This must be done before work commences.
- Records of training of workers either by attendance at registration, induction courses, and practical training in the laboratory will be kept with the registration documents of the individuals.
- Pregnancy: The University provides guidance on safety issues relevant to female workers through the Maternity Policy and information leaflets. There is a possible risk to the foetus and where unsealed radioactive sources are used, the nursing infant. A risk assessment must be performed (the dose to the foetus must be less than 1 mSv throughout the pregnancy) and it is important that the worker informs the employer (Personnel Division, Occupational Health Service, supervisor or RPA as appropriate) **in writing** in accordance with the Maternity Policy if they discover they are pregnant or are breast feeding. The worker may wish to stop work with ionising radiation or have work re-scheduled or re-assigned and this matter will be discussed with the RPS and their research supervisor in the strictest confidence.

6. *Sources of information*

The main sources of information on the use of radioisotopes are the University booklet *Working Safely with Unsealed Radioactive Sources* online at http://www.admin.cam.ac.uk/cam-only/offices/safety/publications/hsd010r/index.html and HHSC Handbook No. 14 *Radiation Protection Handbook for Laboratory Workers* (September 1994). If you do not have access to a copy of one of these booklets, or if you have difficulties in obtaining the information you require, see the RPS.

7. *Ordering and Transport on and off site*

The Senior Assistant maintains records of all radioisotopes brought on to this site for research use (as listed in Section **1**, above), and ensures that the conditions of our Sub-Certificate are not infringed.

- All orders for radioisotopes for research must be made through the Senior Assistant on the pro-forma paper order form. Please ensure that quantities are given in MBq. He will return a CUFS order form to the requestor which must be FAXed or the order phoned through. A hard copy of the order must always be kept. In the absence of the Senior Assistant, the RPS may authorize ordering of radioisotopes, however where this is for their own or their groups use this order must be authorized by the Radiation Protection Supervisor (RPS) for the department.
- Only stores personnel with registered signatures (or the Senior Assistant and RPS) may sign for delivery of radioisotope from suppliers. The stores personnel will hold the radioisotope securely until it is collected by the Senior Assistant (or RPS or Paul Tonks if the Senior Assistant is not available).
- A unique identification number (UIN, the order number) will be assigned by the Senior Assistant to each consignment of radioisotope as it arrives on this site.
- The Senior Assistant will retain the consignment until it is collected by the user.
- When the consignment is collected, the Senior Assistant will supply a stock sheet and a label for the pot bearing the UIN, which must be attached to the stock pot by the user at the earliest opportunity. Stock pots must be **stored securely in locked rooms / refridgerators / freezers / cupboards**. The stock sheet must be stored in the group's recognised radioactivity record folder.
- 'Gifts' and other non-conventional transfers of radioactive substances must be authorized by the RPS and documented into the Department systems as above.
- There are difficulties in making transfers of radioisotopes between this site and other sites. Any such transfers, for any purpose, must be discussed with the RPS beforehand who can advise on the

statutory requirements for the transport of radioactive substances, the type of packaging, labeling and documentation that will be required.

8. *General working procedures*

a. *Monitoring*

a) *Personal:* All users of controlled or supervised areas are required to wear film badges, which are obtained by arrangement with the Senior Assistant. After each work session, you must monitor yourself in the same manner as described below (c) for work areas and the results recorded. Wash, then monitor again if contamination is found.

- P-32, Rb-86, Na-22, Cl-36. If you intend to use P-32/Rb-86/Na-22 in quantities greater than 40 MBq (approx. 1 mCi), wrist and/or finger badges should be worn.
- Film badges are not required for individuals working only with low energy beta emitters (C-14, P-33, S-35, Ca-45) outside supervised or controlled areas or individuals working solely with H-3.
- Film badges are changed at the beginning of the month, it is the user's responsibility to ensure that their badges are changed even if they are not in the laboratory at this time.
- The University has, in accordance with Regulation 8(7) of the Ionising Radiations Regulations 1999, set formal investigation levels for a whole body dose of 2 mSv and/or an extremity dose of 150 mSv in any calender year. If these dose levels are exceeded or are thought to have been exceeded, the Safety Office and RPA will be informed and a formal investigation will be initiated.

b) *Storage areas:* These must be monitored regularly in the manner described below (c) for work areas. Note also:

- H-3. Storage in freezers results in the isotope collecting in ice deposits. Such freezers must be defrosted as necessary, and checked thoroughly for contamination, as described for work areas in (c), below.
- P-32, Cr-51, I-125, Rb-86, Na-22, Cl-36. Monitor the storage area for leakage of radiation, and shield the source as necessary.

c) *Work areas:* These must be monitored before and after each work session, as follows:

- Contamination monitor with beta probe for P-32, Na-22 and Rb-86 (and C-14, S-35, Cl-36, Ca-45 if used in amounts of greater than 40 MBq (approx. 1 mCi)).
- Contamination monitor with gamma probe for Cr-51, I-125, Na-22.
- It is the responsibility of each user to ensure that access to a suitable contamination monitor is available before undertaking radioisotope work (see **Appendix 1**).
- Monitoring for H-3, (and ideally for Ca-45 and C-14) cannot be accomplished in this way because of the low energy of the isotope. You must monitor by swabbing, and counting the swabs by liquid scintillation.
- The results of all monitoring must be recorded in a suitable book to show the date, area monitored, by whom, isotope in use, monitor used (or method used for H-3 and others) and the result of monitoring. If contamination is found, the method of decontamination and final reading must also be recorded. You must also check your hands/feet/person for contamination at the end of work and record the readings as above. Inspectors from HSE and from the Environmental Agency will expect to see such records.
- The RPS will make spot checks from time to time to ensure that effective monitoring is being carried out.

b. ***Shielding***

The use of control measures such as screens, boxes and blocks (relevant to the ionising radiation source) are examples of good laboratory practice and must always be used when working with radioactive sources.

- P-32. This isotope emits high-energy beta-radiation, and therefore needs careful attention to shielding. Secondary X-rays (bremsstrahlung) are produced by absorption of the beta-particles. Absorption by high density materials yields X-rays, but even those from low density materials (e.g. aluminium, perspex) may need shielding with lead if quantities greater than 400 MBq are used. Always work behind 1 cm perspex screens in Room 301. Beta boxes, blocks and pipette shields should be used at all times. Unshielded tubes containing concentrated solutions of P-32 must never be handled with the hands.
- I-125. The gamma-radiation emitted by this isotope must be shielded with lead. Always work behind leaded perspex screens in Room 212.
- Rb-86. This isotope emits high-energy beta-radiation which is not attenuated by perspex shields but needs 0.5 cm lead. Work behind leaded perspex screens to stop splashes. Unshielded tubes containing concentrated solutions of Rb-86 must never be handled with the hands.
- Na-22. This isotope emits both beta and gamma-radiation and must be shielded with lead. Always work behind leaded perspex screens. Unshielded tubes containing concentrated solutions of Na-22 must never be handled with the hands.
- Cl-36. This isotope emits beta-radiation. Always work behind perspex screens.

c. ***Storage and Disposal***

- Radioisotopes may only be stored in areas notified to, and approved by, the RPS. All laboratories (or cupboards, refridgerators and freezers within rooms) that contain radioisotopes **must be locked**. All rooms so used, and all cupboards, refrigerators and freezers within the rooms that contain radioisotopes must be labelled as *Radioactive*. All containers used must be labelled as *Radioactive*, giving the isotope, the quantity of radioactivity, and the owner and date of storage.
- Freezers used to store H-3 must be defrosted and monitored for contamination as necessary (see Section **8a**(b), above).
- Radioactive waste must be placed in properly shielded containers during any procedure. Disposal of waste must take place routinely, in accordance with the rules set out in Section **9**.
- Radioactive waste must be logged on the appropriate waste form (temporary bag or sink) at the point of disposal in MBq.

d. ***Handling***

- You must read the precautionary information in the booklets mentioned above (Section **6**), and give careful thought to shielding and monitoring.
- Work may only be carried out in designated areas that have been notified to, and approved by, the RPS.
- Remember that you must label all radioactive containers, surfaces, equipment, etc., and all rooms in which radioactivity is handled.
- Never eat, drink or smoke in a radioactive area.
- Never pipette radioactive solutions by mouth.
- You should wear proper protective clothing at all times, and wash thoroughly after each work session.
- The handling of I-125 carries particular risks as the isotope may become volatile. Quantities exceeding 10 MBq (approx. 0.3 mCi) must be handled in the exhaust chamber in Room 212. Do not freeze or acidify solutions containing this isotope.
- Counting facilities are available in Main Building, Room 212. Please keep this room tidy, and remove counted vials as soon as possible. Only biodegradable liquid scintillants may be used. See the RPS if you need advice.

e. ***Movement of radioactive substances within the Department***

When moving radioactive substances within the Department, users must in the first instance seek advice from the RPS to ensure all reasonable precautions are taken to prevent accidents, limit consequences of any spill and to avoid unnecessary exposure of themselves and others. Work should be planned so that open containers with significant amounts of radiation are not carried about. Stock solutions in vials should be carried in the manufacturer's protective holder with the lid sealed. Suitable containment should be provided for other liquids eg containers in outer containers with absorbent material to soak up any leakage of liquids and should be suitably labeled.

f. ***Security***

When not directly supervised by personnel, **all sources** (including experimental work, waste and stocks) must be in secure (locked) cupboards, fridge/freezers or laboratories.

9. ***Disposal***

Any work giving rise to radioactive waste is subject to legislation the Environmental Permitting Regulations 2010 (EPR10) (previously under the Radioactive Substances Act 1993) which is enforced by the Environment Agency. The Senior Assistant maintains records of the disposal from this site of all radioactive materials used for research, and ensures that the conditions of our Sub-Certificate are not infringed. Therefore, the Senior Assistant should be consulted in the first instance before you dispose of radioactive materials. Users are <u>individually</u> responsible for their own radioactive waste and its safe disposal. All disposals must be recorded, and a summary supplied to the Senior Assistant monthly, on request. See section 7: Working Safely with unsealed radioactive sources. Waste may only be accumulated in laboratories for up to 2 weeks (but should be disposed of daily if you cannot make it secure or it presents an exposure problem to yourself or others).

- Heavily contaminated waste must be placed in **heavy duty** plastic sacks with the **radioactive trefoil sign** in barrels in the Waste Cage (near South entrance to the Coombs building). Each radionuclide has a separate barrel. Each package that you put in a barrel must bear an official label (orange), which are available from the Senior Assistant or his assistant, which shows the research group, the isotope and the approximate activity. The sacks are available from Stores.
- Used scintillation vials must be placed in **heavy duty** plastic sacks with the **radioactive trefoil sign** as above and the bag label must indicate "ORGANIC LIQUID", as well as the other details and placed in a **red bin** in the Waste Cage. This bin has a 20 kg limit and the seal is one-time seal so do not close until authorized by the RPS. Disposals of scintillation vials must be entered separately in your disposal returns.
- Biodegradable scintillants must be used. Any other contaminated organic liquid waste may only be disposed of by special arrangement with the University Radiation Officer.
- For each package a transport form must be completed. The forms are available in the folder inside the main building by the exit to the Cage (back door), and completed forms must be placed back into this folder. The senior assistant's assistant arranges monthly collection of waste from the Waste Cage and requires transport forms for this pick-up.
- All waste must be transported to the Waste Cage in sealed sacks in suitable containers to reduce exposure to personnel (both directly disposing of waste and others indirectly exposed) eg 1 cm Perspex boxes for P-32 or autoclave dixies for Cr-51.
- Dose rates on the outside of packages must be less than 5 uSv/h (usually 200 MBq total isotope but I-125, Cr-51 50 MBq total). Consider I-125/131, Rb-86, Na-22 and P-32 especially, where small but heavily contaminated items in the waste may be best put in a primary container (small box or steel tube) before being put in the waste bag. You MUST NOT use lead packaging in waste destined for burial or incineration.

- Contaminated carcasses, and similar biological material, may be disposed of by removal from the site for incineration by an authorized contractor for incineration elsewhere. Such disposals must be approved in advance and arranged by the RPS on each occasion.
- Liquid waste may be flushed down approved sinks with copious amounts of water. These sinks are labeled. With initial dilution, disposals should not exceed 100 Bq/ml (1 MBq (27 uCi)/10 litres).
- To ensure that we do not exceed the limits of our license (see Appendix 4), **maximum daily sink disposal limits** are:

	H-3	C-14	Other
sink, room 301:			9.5 MBq
sink, fumehood South Main Laboratory			2.0 MBq
sink, room 212:	20 MBq	0.6 MBq	9.0 MBq
sink, room 134A			11.0 MBq
sink, main laboratory Neurology			0.5 MBq

  Only the indicated radioisotopes may be disposed down each sink. Larger disposals may only be carried out by prior arrangement (in writing) with the RPS.
- Further guidance is given in *Working Safely with Unsealed Radioactive Sources (2002).*

10. *Accidents*

Any accident involving radioactive materials, or the discovery of any unexpected contamination, must be reported at once to the RPS (or if unavailable, to the Senior Assistant or the Safety Adviser). Serious occurrences should immediately be reported to the University Radiation Protection Officer (Mr. D.R. Plumb, Ext 39531).

- Evacuate the contaminated area of all non-essential personnel, and mark it clearly.
- Attempt to contain the radioactivity, and to monitor the area, so far as is possible without risk to health.
- With guidance from an appropriate Officer, commence decontamination, as follows:
  - Always decontaminate personnel first
  - Remove contaminated clothing and store as for radioactive waste and wash contaminated skin, etc
  - Any contaminated personnel must be decontaminated near to the site of the accident (unless seriously injured) to prevent the spread of contamination.
  - Contaminated surfaces should be decontaminated from the edge inwards, monitoring each treated area before proceeding to the next.
- Medical checks can be provided for any personnel exposed to radioactive hazards.

11. *Records*

a. *To be kept by the user*

- Each user (or group of users) must maintain records of acquisition, storage, use and disposal of radioisotopes, on a stock sheet bearing the unique identification number (UIN) of the consignment of isotope. In this Department the UIN is the purchase order number. When a consignment has been fully used up and the disposal entered on the monthly returns, the stock sheet must be returned to the RPS.
- Records of acquisition and disposal, and the balance on hand at the end of each month, must be kept for each radioisotope.
- Users must record the disposal of waste into sinks and temporary waste bags on the forms provided. This is in addition to the record on the stock sheet. Disposal logs must be returned to the RPS when full.

- Records must be kept in MBq.
- Users must also keep a log book of monitoring of work and storage areas for contamination.
- These records are in addition to those held by the Senior Assistant.

b. ***Other records***

- The Senior Assistant maintains records of all radioisotopes brought on to this site for research use, and of their disposal from this site, and ensures that the conditions of our Sub-Certificates are not infringed. At the beginning of each month, returns are sent to the University Health and Safety Division with records of new stock acquisitions, remaining stocks and disposals. Returns from individual groups to the senior assistant must be made promptly for collation into the Departmental return.
- The Senior Assistant and RPS keep records of film badge or extremity monitor doses. Users will be informed if doses are registered.
- Certificates of examination, testing and calibration of contamination and dose rate monitors are held by the RPS, who is responsible for ensuring that all monitors are tested in accordance with the Regulations.

12. *Prior Risk Assessment*

All work using radioactive substances must be risk assessed in advance and the relevant forms lodged with the RPS. All users of radioactivity must ensure that the relevant assessments for the work have been carried out (check with their research supervisor). These are to ensure that exposure to workers and other people is restricted as far as reasonably practicable and therefore will involve statement of what measures will be taken to avoid exposure eg shielding used. There are University Risk Assessment forms to help with this which may be found on Shared Items/Departmental Safety/Ionising Radiation/Risk Assessment Forms folder. If you want to take these onto your own file space you must copy the folder first so a copy is always available on Shared items. Guidance notes may be found in University booklet *Working Safely with Unsealed Radioactive Sources* online at http://www.admin.cam.ac.uk/cam-only/offices/safety/publications/hsd010r/index.html. Within the shared items folder there are also worked examples and tables of dose rates with different isotopes. The dose constraint set by the University in accordance with Regulation 8 (3) of the Ionising Radiation Regulations 1999 is whole body dose 2 mSv per year. Risk assessments leading to predicted higher doses must be discussed with the RPS and the Safety Office.

APPENDIX 1. *Contamination Monitors*

Isotope	*Monitor/probe*	*Serial No*	*Group*	*Ref*
C-14, S-35	Mini-monitor Series 900/E	026070	Field	147
	NE Ratemeter RM6/BP4/4	1073/4544		159
	Mini-monitor Series 900/EP15	45954	Gibson	278
	Mini-monitor Series 900/EL	025990	Franklin	311
	Mini-monitor Series 900/EP15	216	Maskell	408
P-32	Mini-monitor Series 900/44A	031381/1972	Holmes	129
	Mini-monitor Series 900/E	026070	Field	147
	NE Ratemeter RM6/BP4/4	1073/4544		159
	Mini-monitor Series 900/EP15	45954	Gibson	278
	Mini-monitor Series 900/EL	025990	Franklin	311
	Mini-monitor Series 900/SL	049289	Gibson	312
	Mini-monitor Series 900/44A	033468/2162	Lachmann	392
	Mini-monitor Series 900/44A	042838/3026	Lachmann	393
	Mini-monitor Series 900/EP15	216	Maskell	408
Rb-86, Ca-45 Cl-36, Na-22	Mini-monitor Series 900/EP15	034591	Gibson	522
Cr-51, I-125	Mini-monitor Series 900/44A	031381/1972	Holmes	129
	NE Ratemeter RM6/GP7/4	1073/503		159
	Mini-monitor Series 900/44A	033468/2162	Lachmann	392
	Mini-monitor Series 900/44A	042838/3026	Lachmann	393

APPENDIX 2. *Research Groups and persons responsible for overseeing Group records*

Main Building: Blacklaws, Bujdoso, Gibson, Sargan, Tiley (combined ordering and records overseen by Dr B Blacklaws, RPS)
Neurology Block: Franklin, Skelly (Dr C Zhao)

Temporarily suspended

APPENDIX 3. *Local Sub-Certificate Limits for Holding and Disposal*

Holding (MBq)

H-3	250	Na-22	100
C-14	50	Cr-51	200
P-32	200	I-125	40
Rb-86	400	mTc-99	100 GBq
Others	contact safety office		

Disposal per month (MBq)

Burial

H-3/C-14		100
Other beta/gamma emitters	($t_{1/2} \leq 100$d)	300
	($t_{1/2} \geq 100$d)	20

Max storage 2 months

Drains

H-3	200
C-14	20
Other beta/gamma emitters	500

Scintillant (Biodegradable)

H-3/C-14	10
Other beta/gamma emitters	20

Max storage 6 months. Red bin

Gaseous	none
Incineration	none

APPENDIX 4. *Best Available Techniques*

All work with radiation within the department is expected to use Best Available Techniques (BAT) to reduce waste disposal. This does not mean increasing dose to workers or public (ALARP must still apply). A document explaining this is available from the Safety Office website (http://www.admin.cam.ac.uk/cam-only/offices/safety/publications/hsd035r/index.html).

It is expected that the user shall use ***BAT*** to:

(a) minimise the activity in all disposals of radioactive waste;

(b) where authorised, minimise the volume of radioactive waste disposed of by transfer to other premises;

(c) dispose of radioactive waste at times, in a form, and in a manner so as to minimise the radiological effects on the environment and members of the public.

This must include

- **JUSTIFICATION** for particular uses of radioactive substances, and minimisation of the quantities used and waste generated (activity and volume). Consultation with suitable Radiation Protection Advisers should occur as part of this process.
- **DECISION MAKING –** from design of a process, to final disposal, the principle of reducing disposals to that which is the minimum possible (without incurring excessive cost), should be observed and demonstrable. Can waste be abated or decay storage used? Senior departmental management must be involved in the decision making process, and therefore need to be aware of the regulatory needs of EPR and BAT.
- **OPERATIONAL PROCEDURES** - including minimisation of contamination, carrying out monitoring, and, record keeping. Methods of measuring or estimating waste must be robust and reliable. Maintenance of plant and facilities to be appropriate.
- **APPROPRIATE FACILITIES** for work and waste accumulation/disposal within the department including abatement facilities, and decay storage if appropriate.
- **STAFF TRAINING** in management of radioactive substances, particularly waste generation and disposal.
- **REVIEW –** Processes and management arrangements must be considered periodically to ensure that they remain BAT in the light of developments in the work. For instance, are there possibilities of further abatement of discharges, and other continuing improvements to a process?