

<b>Health Physics</b>	 <b>diamond</b>	<b>Doc No: TDI-HP-LR-0002</b> <b>Issue: 10.4</b> <b>Date: 29<sup>th</sup> October 2019</b> <b>Page: 1 of 21</b>
Author: RDoull	Reviewed by: SFaruk	Issued on: 2019



## Diamond Light Source

# Local Rules for the Protection of Persons from Ionising Radiations

## Beamlines & Experimental Hall Floor

These Local Rules are important for your safety and well-being. All Diamond Light Source personnel, users, visitors, and contractors must follow these Local Rules whilst working in the Diamond Controlled and Supervised Radiation Areas.

Disciplinary action will be taken against anyone found tampering with the Personnel Safety System or radiation shielding or deliberately failing to follow an effective search procedure.

These Local Rules will be reviewed biennially or whenever significant changes are required.

This issue of the Beamlines Local Rules supersedes all previous issues.

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**Document Approval:**

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## 1. Introduction

- 1.1 These Local Rules are a requirement of Regulation 18(1) of the Ionising Radiations Regulations (IRR) and they set out the key arrangements for restricting radiation exposure in and around the Diamond Beamlines and in the Experimental Hall area. They define the principles and working procedures to be adopted to ensure safe operation of the Diamond Light Source (DLS) beamlines. All Diamond Light Source staff, contractors and Users working in the Beamline Controlled or Supervised Radiation Areas must read these Local Rules as part of the radiation safety training before entering those areas covered by these Rules. All persons supervising contractors or guiding visitors in the Controlled or Supervised Radiation Areas must ensure that they are familiar with and obey the access conditions described in section 7.
- 1.2 Separate Local Rules (list of other local rules in 10.3) are available for the DLS Controlled Radiation Areas not covered by this document, and links to these documents will be found on the Health Physics page of the Diamond Intranet. Written procedures are provided where appropriate for all Supervised Radiation Areas not covered by this document.
- 1.3 These rules cover the Experimental Hall area, all beamline operation including the external beamline and any new beamline commissioning.
- 1.4 A glossary of Health Physics terms used in this document can be found on the Health Physics intranet page (FAQ section).

## 2. Radiation Safety Organisation and Responsibilities

- 2.1 The Chief Executive Officer (CEO) of DLS Ltd has overall responsibility for the health and safety of all staff, users, contractors and visitors at Diamond Light Source. The CEO may delegate authority for certain health and safety functions to other people, however, he may not delegate his responsibility. Safety responsibility then devolves down the management and supervisory chains. The name of the CEO is given in Appendix 1.
- 2.2 A Radiation Protection Adviser (RPA) has been appointed under Regulation 14 of the IRR. The RPA has been provided with appropriate terms of reference. DLS is obliged to consult the RPA on those matters which are specified in Regulation 14(1) and Schedule 4 of IRR. The RPA's name is listed in Appendix 1.

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- 2.3 In these Local Rules, the term ‘the Science Director’ refers to the Life Sciences Director for Life Science beamlines and the Physical Sciences Director for Physical Science beamlines. The appropriate Science Director will authorise each successive phase of the commissioning for the beamlines, having received appropriate confirmation of the functioning of the Personnel Safety System (PSS), the integrity of the shielding, and that all appropriate procedures are in place. Names of the Science Directors are given in Appendix 1.
- 2.4 The Health Physics (HP) Team Leader has responsibility for overseeing all aspects of radiation safety. For those matters specified in Regulation 14(1) and Schedule 4 of IRR, the Health Physics Team Leader must consult with the RPA. The name of the Health Physics Team Leader is given in Appendix 1.
- 2.5 Radiation Protection Supervisors (RPSs) have been appointed by the Science Director under Regulation 18(5) of the IRR. They are responsible for ensuring compliance with the Local Rules and have been given appropriate terms of reference. The Experimental Hall Coordinators have been appointed RPSs for the beamlines and their names and contact details are given in Appendix 1.
- 2.6 The Principal Personnel Safety Engineer (PPSE) is responsible for the design, commissioning, routine testing, and modification of the Beamlines PSS as described in Section 6 and [TDI-HP-GEN-REP-0013](#)<sup>1</sup>.
- 2.7 The Principal Beamline Scientist (PBS) has overall responsibility for the safe commissioning and operation of their beamline(s) and all associated equipment. This includes:
- Ensuring that the front end optics shutter is not opened at larger currents and higher magnetic field than the limits supplied by the RPA.
  - Ensuring that the procedures defined in the Local Rules and relevant Method Statements are followed.
  - Reviewing risk assessments submitted by Users.
  - Ensuring that all necessary safety equipment is supplied, including portable X-ray monitors at main entrances to all hutches.
  - Ensuring that any emergency exits are free from obstruction.
  - Before the start of each User’s beam time, ensuring that an effective search of the hutch can be performed and that all warning signs and lights are operational.
  - Ensuring that all Users have been given suitable training and are competent to work on the beamline.
- 2.8 The Experimental Hall Manager is responsible for all operational aspects of safety in the Experimental Hall area. The Experimental Hall Manager must be informed of the intention

<sup>1</sup> [http://diamvdocs13.diamond.ac.uk/TECHNICAL\\_DIVISION\\_\(TEC\)/Health\\_Physics\\_HP/General\\_\(GEN\)/Reports\\_\(REP\)/TDI-HP-GEN-REP-0013.pdf](http://diamvdocs13.diamond.ac.uk/TECHNICAL_DIVISION_(TEC)/Health_Physics_HP/General_(GEN)/Reports_(REP)/TDI-HP-GEN-REP-0013.pdf)

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to undertake hazardous operations within the DLS Experimental Areas, and has been authorised by the Science Director to halt any operation which they consider hazardous to personnel or equipment. The Experimental Hall Manager's name is given in Appendix 1.

### 3. Dose Investigation Level

- 3.1 If the dose recorded by any DLS employee exceeds 0.8 milliSieverts (mSv) for the first time in any calendar year, the Health Physics Team Leader will initiate a formal investigation to make sure that exposure is being restricted as far as is reasonably practicable. The RPA must be consulted about this investigation.
- 3.2 If there is evidence to suggest that the dose received by any DLS employee may reach the investigation level before the end of the calendar year, the Health Physics Team Leader will initiate a review of working conditions with the aim of restricting further exposure before the investigation level is reached.

### 4. Areas to Which These Rules Apply

- 4.1 These Local Rules apply within all the Controlled (beamline hutches) and Supervised Radiation Areas (all cabins next to the hutches and entire Experimental Hall area) listed in Appendix 2. The designation of each area is shown at each entrance into the area.

### 5. Shielding

- 5.1 The beamlines have been installed within interlocked shielded hutches. Some beamlines also make use of shielded transfer pipes between hutches. On some beamlines, the energy of the beam is sufficiently low that shielded hutches are not required. On these beamlines, the vacuum vessel forms the radiation shielding provided that the vacuum is maintained at the required pressure. These beamlines are under vacuum PSS. The PSS will close the beamline shutters if the pressure rises above a pre-determined level. The Health Physics Team will verify that the shielding is adequate by performing frequent radiation surveys. Once the equipment is operating normally, surveys will be performed on a 6 monthly basis. This period will be subject to review.

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5.2 All removable radiation shielding and beamline components which have a radiation safety function, e.g. shutters and bremsstrahlung collimators, are subject to configuration control using a radiation Permit to Work (PtW) based on the DLS PtW procedure [HAS-PRC-0021](#)<sup>2</sup>. All such shielding and components or its covers will be painted yellow or provided with suitable signs (Fig 1) to indicate that it is subject to configuration control, and that a radiation PtW issued by the RPS is required in order to disassemble the shielding or change or remove the components. The RPS will keep a register of all shielding and components which are subject to configuration control. User labyrinths are under PSS Fortress key control rather than configuration control – the beamline is disabled if the User labyrinth key is not in its key press.



Fig 1 Sample of warning sign for PtW.

- 5.3 **Any changes to radiation shielding or radiation safety critical components**, whether intended to be permanent or temporary or any kind of safety/ contingency exercise (SHE, Radiation, PSS etc.), must be carried out under a radiation PtW issued by the RPS.
- 5.4 **For temporary changes to radiation shielding which has been designed and constructed to fit only in the correct manner**, the RPS will visually confirm that the shielding has been returned to its original configuration before cancelling the permit. All other shielding must be surveyed by the Health Physics Team before the permit can be cancelled.
- 5.5 **Permanent changes to radiation shielding and radiation safety critical components, or installation of new shielding, must be approved in advance by the RPA.** The changes must be implemented under a radiation PtW issued by the RPS. The shielding or changed components must be surveyed by the Health Physics Team before the permit can be cancelled.
- 5.6 Where a survey is mandatory before a radiation PtW can be cancelled, it is permitted to open the shutter when machine running in its max current level specifically for the survey whilst the RPS and a member of the Health Physics Team are present.

## 6. [Personnel Safety System \(PSS\)](#)

<sup>2</sup> <http://diamvdocs13.diamond.ac.uk/HEALTH AND SAFETY/Procedures/HAS-PRC-0021.docx>

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6.1 It is probable that any person left in a hutch whilst the beam is on would suffer serious detriment to their health. A PSS system is provided in all the hutches including the following safety features: (This is not an exhaustive list)

- Search carried out by trained staff and users, to ensure no one is remaining in the hutch
- Annunciators
- Warning sounds
- Lights
- Emergency 'beam off' buttons
- Door locks and interlocks

Correct use of the PSS by trained staff and users should prevent any one taking the beam in that hutch when people are present or entering the hutches whilst the beam is switched on. The procedures for design and modification of a PSS is described in [TDI-HP-GEN-REP-0013](#)<sup>3</sup>. This document should be considered as part of the Local Rules.

6.2 **Disciplinary action** will be taken against any person -

6.2.1 Tampering (i.e. altering or interfering in an unauthorised or improper manner) with any part of the PSS.

6.2.2 Deliberately not performing a search of any hutch in the correct manner.

6.3 Deliberately locking a person inside an interlocked hutch is forbidden except for the purpose of health physics radiation safety contingency exercise or checking the crash out mechanisms, the PSS (including emergency beam off buttons) and the rehearsal of the contingency plan detailed in appendix 4. These checks must be done under a radiation or PSS or both (radiation and PSS) PtW defined by the Principal Personnel Safety Engineer (PPSE) (and radiation PtW for contingency plan rehearsal) who will specify adequate hardware precautions to ensure that the beam cannot be activated in that hutch during the work or exercise.

6.4 The local RPSs are responsible for ensuring that an effective search pattern is maintained within the beamline hutches. Searchers must report to the RPS for the area any specific problems immediately for rectification.

6.5 Anybody noticing any fault or problem with the PSS for any beamline must not enter the hutch, and report to the Operations Shift Leader and PPSE as soon as possible.

<sup>3</sup> [http://diamvdocs13.diamond.ac.uk/TECHNICAL\\_DIVISION\\_\(TEC\)/Health\\_Physics\\_HP/General\\_\(GEN\)/Reports\\_\(REP\)/TDI-HP-GEN-REP-0013.pdf](http://diamvdocs13.diamond.ac.uk/TECHNICAL_DIVISION_(TEC)/Health_Physics_HP/General_(GEN)/Reports_(REP)/TDI-HP-GEN-REP-0013.pdf)



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6.6 Beamline users must not allow beam into the hutch if they are aware of or notice any fault or problem with the PSS which would compromise the effectiveness of the search in excluding people from the area and report to the Operations Shift Leader and PPSE as soon as possible.

**7. Access / Working Instructions**

7.1 All staff, Users and contractors entering the Controlled & Supervised Radiation Areas covered by these Local Rules are required to attend a Health Physics training session or **online refresher training every 2 years** dealing with the radiation hazards present around the beamlines and the contents of these Local Rules.

7.2 All staff, Users and contractors are required to obey all safety signs displayed at the doors of and inside the hutches.

7.3 General access to any commissioned, operational hutch is only permitted when the annunciator outside the door reads “Open” (Fig 2). Personnel not performing a search must not attempt to enter a hutch when it is in the process of being searched, shown as “Restricted” on the annunciator. Only those personnel trained in operation of the beamline may initiate an entry to the hutch once it has been searched, shown as “Standby” or “Beam on” on the annunciator. Entries under these conditions will ‘break the search’, returning the annunciator to “Open”, and another search will be required before operation can resume.



Fig 2 PSS annunciator displaying different stages in the beamline.

All entrances to hutches have an annunciator. Search door have the full annunciator as above. Service door may only have a smaller BEAM ON annunciator. Check the appropriate annunciator before opening a hutch door. The Beamline alarm panel message screen does not carry beam status information, so be sure to look for the appropriate annunciator.

Recent update

7.4 A portable X-ray radiation monitor will be located at each main entrance to all hutches. After breaking the search on an interlocked hutch, the first person entering the hutch must take this monitor with them, ensuring that it is switched on, and use it to check their work area.

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7.5 The IRR only allows two methods for access to a Controlled Radiation Area. Personnel must either be classified radiation workers, or must enter the area under the Written Arrangements (Appendix 3).

## 7.6 **Classified Workers**

7.6.1 All classified radiation workers employed by DLS are issued with personal dosimeters. These dosimeters should be worn for the period indicated on the dosimeter. Classified workers in the employment of another radiation employer who are visiting DLS (other than as outside workers) will have appropriate dosimetry issued by their employer. Classified workers must wear their dosimeters at any time that they enter any DLS Controlled or Supervised Radiation Areas (Fig 3). All classified workers employed by DLS will receive training in radiation safety before commencing work with radiation.

7.6.2 Classified workers have a duty of care to their dosimeter – information on use and care of dosimeters is provided to all workers when they become classified workers – see the DLS Health Physics leaflet “[Wear Your Dosimeter<sup>4</sup>](#)” available via the Health Physics pages of the Diamond Intranet.

## 7.7 **Non-classified Workers**

All non-classified workers must enter the Controlled Radiation Areas under the Written Arrangements (Appendix 3). Some workers at Diamond have been chosen to be part of a ‘control group’. They are issued with personal dosimeters on a quarterly basis. The purpose of this practice is to ensure that Diamond’s working areas have been correctly designated for radiation protection purposes. All workers in the ‘control group’ must wear their dosimeters at any time that they enter any DLS Controlled or Supervised Radiation Areas. The Written Arrangements still apply to these persons.

## 7.8 **Outside Workers**

7.8.1 Outside Workers are contractors providing a service to DLS, in DLS Controlled Radiation Areas, who have been designated as classified radiation workers by an employer other than DLS and who have a Radiation Passbook in their possession.

7.8.2 DLS employees who supervise potential outside workers must inform the Health Physics Team before the Outside Worker arrives at Diamond.

7.8.3 The Outside Worker must report initially to the Health Physics Team and present their Radiation Passbook. The Health Physics Team will retain the passbook whilst the Outside Worker is at DLS. The Outside Worker will be provided with dosimetry for the purpose of dose assessment.

<sup>4</sup> <http://intranet.diamond.ac.uk/dms/DiamondDocs/HealthPhysics/Wear-your-dosimetry/Wear%20your%20dosimetry.pdf>

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7.8.4 The DLS RPS and the contractor’s supervisor must ensure that the Outside Worker is wearing all appropriate dosimetry before permitting access to the Controlled Radiation Area. Written Arrangements are not needed and the Outside Worker is considered to have the same status in terms of access as a DLS Classified Worker to those Controlled Radiation Areas agreed upon in writing between DLS and the Outside Worker’s Employer.

7.8.5 At the end of the work, the Outside Worker must report to the Health Physics Team to allow a dose estimate to be entered into his or her Radiation Passbook. The Health Physics Team will forward the assessed dose to the Outside Worker’s employer as soon as possible. If it is known that Outside Workers will arrive or depart outside of normal working hours, the Health Physics Team will make special arrangements for the issue of dosimeters and entry of the dose estimate into the Outside Worker’s Radiation Passbook. These arrangements will be agreed with the Outside Worker’s employer.

## 8. Use of Radioactive Sources, Samples and X-ray Generators

- 8.1 Detailed procedures covering the use of sources at DLS are given in the document “Use of Radioactive Sources at Diamond”, [TDI-HP-PRC-0002](#)<sup>5</sup>. This document should be considered part of the Local Rules.
- 8.2 All radioactive sources and materials required by DLS staff must be purchased by the Health Physics Team. This may require application for an amendment to the Environmental Permit, which can take several months to be granted.
- 8.3 All persons intending to use DLS owned radioactive sources on the Diamond premises must provide copies of the method statements and risk assessments to the Health Physics Team Leader or Health Physicist at least 5 working days before the work is intended to start.
- 8.4 Users must not bring radioactive material to DLS without prior agreement from the Health Physics Team Leader or Health Physicist. Users intending to bring radioactive material to site must state this in their application for beam time. Radioactive material includes radioactive sources, experimental samples and Naturally Occurring Radioactive Materials (NORM). Copies of the risk assessments and method statements must be submitted to the Health Physics Team Leader at least 1 month before the sources are required on site. The Health Physics Team Leader or Health Physicist may refuse permission for certain radioactive materials to be brought onto site. Users wishing to work with any radioactive material on site, whether owned by their employer or by DLS, must provide a certificate from their employer indicating their competence to work with radioactive materials. Detailed procedures covering the use of user owned sources at DLS are given in the document “Procedures for the use of radioactive samples on the Diamond beamlines”, [TDI-HP-PRC-0006](#)<sup>6</sup>.

<sup>5</sup> [http://diamvdocs13.diamond.ac.uk/TECHNICAL DIVISION \(TEC\)/Health Physics HP/Procedures \(PRC\)/TDI-HP-PRC-0002.pdf](http://diamvdocs13.diamond.ac.uk/TECHNICAL DIVISION (TEC)/Health Physics HP/Procedures (PRC)/TDI-HP-PRC-0002.pdf)

<sup>6</sup> [http://diamvdocs13.diamond.ac.uk/TECHNICAL DIVISION \(TEC\)/Health Physics HP/Procedures \(PRC\)/TDI-HP-PRC-0006.pdf](http://diamvdocs13.diamond.ac.uk/TECHNICAL DIVISION (TEC)/Health Physics HP/Procedures (PRC)/TDI-HP-PRC-0006.pdf)

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- 8.5 No radioactive material or source, including activated components, may leave the DLS site without prior approval of the Health Physics Team Leader or Health Physicist.
- 8.6 If the person responsible for a source knows or suspects it is missing or damaged, they should immediately inform the RPS, Experimental Hall Manager, and the Health Physics Team.
- 8.7 If any person intends to install or use X-ray generators on any beamlines, they must seek advice from the RPA in advance. They will need to obtain approval for the shielding and interlock systems, showing that they are not susceptible to being circumvented. X-ray generators used at Diamond must comply with the Generic Prior Authorisation for the Use of Electrical Equipment Intended to Produce X-rays, issued by the HSE.

## 9. Incidents, Accidents and Contingency Plans

- 9.1 The possibility of accidents and incidents involving ionising radiation or failure of the search system is small but cannot be eliminated totally.
- 9.2 Any person finding themselves to be locked in a searched hutch should walk towards the nearest door avoiding crossing the X-ray beam if possible, and pressing the nearest emergency beam off button en route or pressing the emergency door release. They must then report to the Operations Shift Leader in the Control Room. The Operations Shift Leader will inform a Science Director who will decide what form of investigation, if any, will be conducted.
- 9.3 A contingency plan (Appendix 4) has been written to cover reasonably foreseeable accidents involving persons being exposed to radiation. Health Physics will perform contingency plan rehearsal at suitable intervals to comply with IRR [Reg-13(2)c] with coordinate support & response from PSS, SHE, EHC and OPS.
- 9.4 Any person hearing the fire alarm sounding must follow DLS FIRE AND EMERGENCY ARRANGEMENTS ([HAS-PRC-0011](#))<sup>7</sup>

## 10. General

### 10.1 Radiography

All DLS staff who intend to bring radiography contractors onto the Diamond site must inform the Health Physics Team Leader or Health Physicist (who will inform the Experimental Hall Manager and the RPS) at least 5 working days before the work is intended to start.

### 10.2 Other Local rules –

<sup>7</sup> <http://diamvdocs13.diamond.ac.uk/HEALTH AND SAFETY/Procedures/HAS-PRC-0011.docx>

<b>Health Physics</b>	 The logo for Diamond Light Source, featuring a yellow sunburst icon to the left of the word "diamond" in a blue, lowercase, sans-serif font.	<b>Doc No: TDI-HP-LR-0002</b> <b>Issue: 10.4</b> <b>Date: 29<sup>th</sup> October 2019</b> <b>Page: 13 of 21</b>
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- 10.2.1 Accelerator local rules (TDI-HP-LR-0001)
- 10.2.2 RF Test Facility (TDI-HP-LR-0003)
- 10.2.3 Radio-chemical Laboratory (TDI-HP-LR-0006)
- 10.2.4 Detector Laboratory (Lab 29/ DR G43) (TDI-HP-LR-0004)

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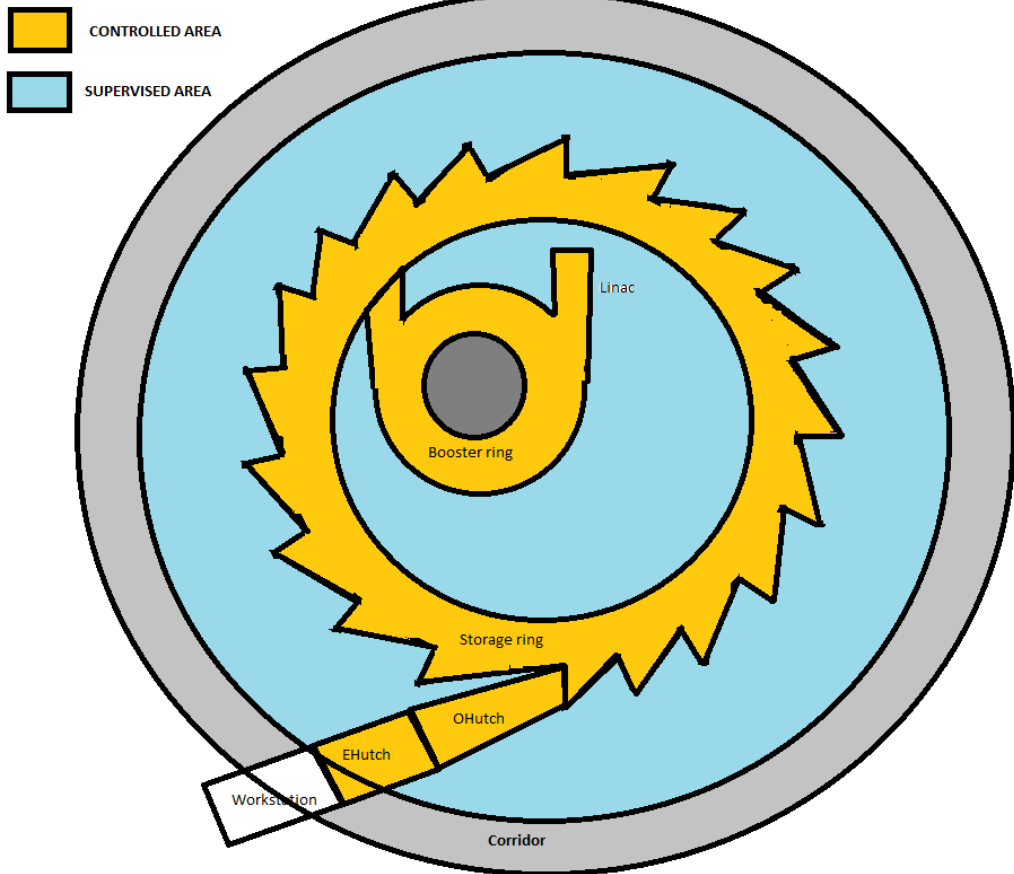
## Appendix 1 – Names of Nominated People

Position	Name	Tel Ext.
Chief Executive Officer	Andrew Harrison	8811
Science Director (Physical Sciences)	Laurent Chapon	8984
Science Director (Life Sciences)	Professor David Stuart	8877
RPA & HP Team Leader Health Physicist	Richard Doull Sanjeev Faruk	8269 8875 8605 (HP Team)
Experimental Hall Manager		TBC
Principal Personnel Safety Engineer	Martin Wilson	8049
<b>**RPSs:</b> All Experimental Hall Coordinators (EHCs) as listed below have been appointed RPSs:		
	EHC General Number	8787
	Edward Cassidy	8738
	Leslie Clinker	8737
	Alistair Donaldson	8751
	Nicholas Gorringer	8732
	Douglas Scott	8724
	Nathan Sear	8733
	Paul Symes	8731
Operations Shift Leader	Control Room	8899 (01235 778899 from a mobile phone)

**\*\*Note – At least one RPS required to be present/ available in the working hours on weekdays to fulfil the requirement of IRR, Reg – 18(5), ACOP para-350.”**

**Appendix 2 – Designation of Areas**

Designation	Area
Controlled Radiation Area	All commissioned beamline hutches which are shielded and protected by a Personnel Safety System. (Including beamline hutches in the I13 & I14 external building)
Supervised Radiation Area	Experimental area floor bounded by the outer circulation corridor.
Not designated	All other areas.



**Fig 3: Layout of controlled and supervised area in synchrotron ring.**

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[Appendix 3 – Written Arrangements for access to the DLS Controlled Radiation Areas by Non-classified Persons](#)

**1. Area**

These Written Arrangements apply to work within the beamline hutches and any other temporary Controlled Radiation Areas.

**2. Application**

These Written Arrangements apply to ALL people entering the above areas who are not designated as Classified Workers under Regulation 19(3)c of the IRR.

**3. Summary of Hazards**

**3.1 Optics hutches (Controlled Area):**

When the accelerators are operating and shutters open, the Optics hutches will take synchrotron radiation and bremsstrahlung. The synchrotron radiation is a high intensity beam with energy in the tens of keV range, whereas the bremsstrahlung is lower intensity but more penetrating, having an energy spectrum up to 3 GeV. Prior to taking beam, the hutches will be searched and locked by trained DLS staff. The Optics hutches are shielded with lead. Sensitive gamma radiation monitors (Fig 4) which continuously monitor and record dose rate are installed on the outer wall of the Optics hutch, opposite the first scattering element.



**Fig 4: Installed Radiation monitor.**

**3.2 Experiments Hutches (Controlled Area):**

When the accelerators are operating and shutters open, the majority of Experiments hutches will take synchrotron radiation only, the bremsstrahlung having been stopped in the Optics hutch. The radiation will be scattered within the hutch. Prior to taking beam, the hutches will be searched and locked by trained DLS staff or Users. The Experiments hutches are shielded with lead, concrete or steel. The Experiments hutches on beamlines which are capable of taking bremsstrahlung are shielded as Optics hutches.



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### 3.3 Radioactive sources:

The radioactive sources permitted for use on the beamlines are limited to those covered by DLS's Environmental Permit. An appropriate Risk Assessment will be completed prior to the use of any radioactive source on a beamline and a copy submitted to the RPA, giving a minimum of 5 working days' notice. Users require to use Radio-chemical Lab will also need to follow the Radio-chemical Lab local rules [TDI-HP-LR-0006](#)<sup>8</sup>.

## 4. [Access Conditions](#)

### 4.1 General

4.1.1 Access to any hutch is only permitted when the annunciator outside the door reads "**Open**". Personnel must not attempt to enter a hutch when it is in the process of being or has been searched, shown as "**Restricted**" or "**Standby**" respectively on the annunciator.

4.1.2 A portable X-ray monitor is located at each main entrance to all hutches. The first person to enter the hutch after it has taken beam must take this monitor with them, ensuring that it is switched on.

### 4.2 DLS Employees

All DLS staff, Users or contractors who "work" or accompany visitors in the hutches are expected to attend a training course in Beamlines and Experimental Hall radiation safety. This will explain the requirement of:

- The Local Rules
- Permits to Work
- Shielding
- The meaning of any signs in use
- Emergency Procedures
- Access

### 4.3 Visitors

4.3.1 Visitors are defined in document '[HAS-PRC-0032 Access Management for Diamond Controlled Premises](#)'.

4.3.2 All visitors must be accompanied at all times by a member of DLS staff who has; attended the Health Physics radiation safety training session, is fully aware of the

<sup>8</sup> [http://diamvdocs13.diamond.ac.uk/TECHNICAL%20DIVISION%20\(TEC\)/Health%20Physics%20HP/Local%20Rules%20\(LR\)/TDI-HP-LR-0006.pdf](http://diamvdocs13.diamond.ac.uk/TECHNICAL%20DIVISION%20(TEC)/Health%20Physics%20HP/Local%20Rules%20(LR)/TDI-HP-LR-0006.pdf)

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work in progress in the area and the contingency plan detailed in Appendix 4 of this document.

4.3.3 In Supervised Radiation Areas the maximum number of visitors is 10 per Suitably Qualified and Experienced DLS staff. Maximum number of visitors in a tour group is 12 depending on the profile of the group, tour groups of more than 10 visitors must be accompanied by at least 2 Suitably Qualified and Experienced Persons. Authorisation must be obtained from the appropriate person in charge of that area. The host (DLS staff) is responsible for ensuring the evacuation of the visitors in the event of a fire.

4.3.4 In Controlled Radiation Areas the maximum number of visitors is 6 per Suitably Qualified and Experienced Person. Maximum number of visitors in a tour group is 12, tour groups of more than 6 visitors must be accompanied by at least 2 Suitably Qualified and Experienced DLS staff. Authorisation must be obtained from the appropriate person in charge of that area. The host (DLS staff) is responsible for ensuring the evacuation of the visitors in the event of a fire.

4.3.5 Visitors must obey all safety signs displayed at the door, inside the hutches and all instructions given by the guide.

#### 4.4 Contractors.

All contractors who “work” on the beamlines are expected to attend Beamlines and Experimental Hall radiation safety training or receive instruction (Toolbox talk if working less than 5 days) in radiation safety. This will explain the requirement of:

- Requirements of the Local Rules
- Permits to Work
- Shielding
- The meaning of any signs in use
- Emergency Procedures
- Access

#### 4.5 Special Cases

4.5.1 Female employees and visitors: The external radiation hazards around the hutches are expected to be low (less than 0.5  $\mu\text{Sv/h}$ ), so it is not considered necessary to introduce further work restrictions for female workers or visitors who may be pregnant. This must however, be confirmed by risk assessment. Any female employee who declares herself to be pregnant will be offered a personal dosimeter on a monthly basis for the term of the pregnancy. A user who declares herself pregnant will be issued with a dosimeter for the duration of her time on the beamline. There are no significant contamination hazards around the hutches, so it is not considered necessary to introduce additional restrictions for female workers

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or visitors who may be breastfeeding (although there could be other reasons). They are advised to–

- Wear Dosimeter (ask HP for the Dosimeter)
- Do not enter the hutch first to do the radiation checks with radiation monitor (ask another trained member of staff to do it)
- No work/ manipulation / handling with radioactive source or induced materials.

4.5.2 Young Persons on work experience: Young people aged between the ages of 16 and 18 are allowed to work as trainees in radiation areas subject to a risk assessment being performed by the person responsible for the visit and an annual dose limit of 0.3 milliSieverts (mSv).

## 5. Dose Estimation

5.1 Dose estimation will be derived from:

- Diamond Synchrotron Light Source. Report of the Design Specification. chapter E6
- [TDI-HP-GEN-PRO-0003](http://diamvdocs13.diamond.ac.uk/TECHNICAL%20DIVISION%20(TEC)/Health%20Physics%20HP/General%20(GEN)/Proposals%20(PRO)/TDI-HP-GEN-PRO-0003.pdf)<sup>9</sup> Implementation of the Radiation Safety Legislation at Diamond
- Installed radiation monitoring
- Personal monitoring of classified workers and DLS control group
- Radiation Surveys
- Induced activity surveys

5.2 The shielding around Diamond has been designed to ensure that no person working outside of the shielding at DLS should receive a dose in excess of 1 mSv in a 2000 hour working year.

## 6. Records

The Approved Dosimetry Service contracted by DLS keeps all dose records.

## 7. Contingencies

All persons working in the hutches must be aware of the contingency plans for dealing with emergencies, detailed in Appendix 4 of this document.

<sup>9</sup> [http://diamvdocs13.diamond.ac.uk/TECHNICAL DIVISION \(TEC\)/Health Physics HP/General \(GEN\)/Proposals \(PRO\)/TDI-HP-GEN-PRO-0003.pdf](http://diamvdocs13.diamond.ac.uk/TECHNICAL%20DIVISION%20(TEC)/Health%20Physics%20HP/General%20(GEN)/Proposals%20(PRO)/TDI-HP-GEN-PRO-0003.pdf)

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## Appendix 4 – Contingency Plan for Persons Exposed to Radiation within a Hutch

The Operations Shift Leader on duty is responsible for activating and applying the emergency plan. This plan addresses the situation where someone has received or it is thought possible to have received, an over-exposure to radiation by being within a hutch whilst that beamline's shutter has been open. Any person who knows or suspects that they or another person has been over-exposed to radiation should contact the Operations Shift Leader (8899) in the Control Room immediately. A contingency flow chart (TDI-HP-LR-0007) is available in all hutch entrances for a quick guide of the following actions.

1. If a beamline '**Emergency beam off**' button (Fig 5) has not already been pressed, press one immediately. Emergency beam off button must be pressed on the concerned hutch unless all other hutches were searched and locked to take the beam (i.e. if the EH1 is locked and taking beam while EH2 is not searched and open. Pressing EH2 emergency beam off button will not stop the beam in EH1.)
2. **Call** operation shift leader (8899) in the control room and explain the incident and ask for, if required, summon assistance, a Diamond First Aider or the Ambulance service.
3. **Disable** the beamline by **removing** the beamline PSS key. Do not issue the key again until authorised in writing by the Science Director in conjunction with the RPA.
4. **Take whatever immediate action is needed to sustain life.** There should be no radiation hazard within the hutch although other hutches may still be taking beam. This should be confirmed using a switched on portable radiation monitor.
5. **Do not leave** the casualty unattended unless it is absolutely necessary to do so.
6. **Collect** dosimeter, if wearing, and record as much information as possible about the incident from the person concerned, and anyone else present. Stay with the casualty and try to comfort until emergency responder arrives.



Fig 5 Emergency Beam off button.

**Following sections is for information only. Emergency controller and other responsible group dealing with the incident will take following actions accordingly –**

7. If the emergency services have been called, ensure that the responders are met and escorted to the casualty.
8. A member of staff may accompany the casualty to hospital, during office hours this could be preferably be the RPS. JR is the nearest A&E and has radiation emergency procedure in place. Out of office hours the EHCs (who are all trained as RPSs) should ring JR via switch board (01865 741841) to alert emergency physicist/ RPA regarding the incident and seek their assistance.
9. Inform the Science Director, Human Resources (HR) and the Health Physics Team Leader, as soon as possible. HP team leader or RPA may communicate with Oxford University Hospitals (OUH) RPA or emergency physicist via switch board (01865 741841) if required.
10. Collect any dosimeters worn by the affected persons.

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11. If the injuries are serious, arrange for Human Resources Group to inform both the casualty's employer (if not a staff member) and the casualty's next of kin.

This contingency plan is intended to cover only the emergency phase of the incident. The plan will end when the Operations Shift Leader has formally declared the situation safe and is satisfied that in the short term a repetition of the incident is not possible. The Science Director(s) will then decide if an inquiry should be established to investigate the incident.