The UK Nuclear Industry Guide To:

Changeroom Design, Operation and Maintenance

Nuclear Industry Safety Directors' Forum

This Nuclear Industry Guide was produced by the Industry Radiological Protection Co-ordination Group (IRPCG) and published on behalf of the Nuclear Industry Safety Directors' Forum (SDF)

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Revision History

Issue No.	Revision Date	Changes
1	July 2006	New document
2	August 2023	• Changes made throughout this Good Practice Guide to add clarity following a full review by the IRPCG • Further detail added on good practice for each of the different types of changerooms commonly used in the Nuclear Industry

It is recognised that – through the experience of using these Guides – there may be comments, questions and suggestions regarding its contents.

In the first instance, any such comments must be sent to the IRPCG secretary who can be contacted via the IRPCG website: www.irpcg.org

Foreword

Changerooms, in one form or another, are associated with many practices involving the use of ionising radiation. As well as providing access to, and egress from, radiologically designated areas they also have an important and integral role to play in preventing the spread of contamination. For this reason, it is important to ensure that the design, operation and maintenance of changerooms reflects, so far as is reasonably practicable, agreed good practice.

This document, now at issue 2, defines the good practice principles for the design, operation and maintenance of changerooms used by the nuclear industry in the United Kingdom for access to areas designated on the basis of a radioactive contamination hazard. All design, operation and maintenance of such changerooms must be underpinned by a suitable and sufficient risk assessment, and any deviations from the principles defined in this Good Practice Guide (GPG) should be justified within the risk assessment. The GPG is consistent with legislation and guidance listed in the References (page 55) and has been endorsed by the following organisations:

- Atomic Weapons Establishment (AWE);
- Defence Equipment & Support (DE&S);
- Devonport Royal Dockyard Ltd (DRDL);
- Dounreay;
- EDF;
- Low Level Waste Repository Ltd (LLWR);
- Magnox Ltd;
- Ministry of Defence (MoD);
- Rolls-Royce:
- Sellafield Ltd;
- URENCO;
- Westinghouse Ltd.

The IRPCG would like to take this opportunity to thank the members of the Technical Working Group that carried out the review of the 2006 edition of this document on behalf of the IRPCG.

Safety Directors' Forum

In a sector where safety, security and the protection of the environment is, and must always be the number one priority, the Safety Directors' Forum (SDF) plays a crucial role in bringing together senior level nuclear executives to:

- Promote learning;
- Agree strategy on key issues facing the industry;
- Provide a network within the industry (including with government and regulators) and external to the industry;
- Provide an industry input to new developments in the industry; and,
- To ensure that the industry stays on its path of continual improvement.

It also looks to identify key strategic challenges facing the industry in the fields of environment, health, safety, quality, safeguards and security (EHSQS&S) and resolve them, often through working with the UK regulators and Department for Business, Energy & Industrial Strategy (BEIS), both of whom SDF meets twice a year. The SDF members represent every part of the fuel cycle from fuel manufacture, through generation to reprocessing and waste treatment, including research, design, new build, decommissioning and care and maintenance. The Forum also has members who represent the Ministry of Defence nuclear operations, as well as "smaller licensees" such as universities and pharmaceutical companies. With over twenty-five members from every site licence company in the UK, every MoD authorised site and organisations which are planning to become site licensees the SDF represents a vast pool of knowledge and experience, which has made it a key consultee for Government and regulators on new legislation and regulation.

The Forum has a strong focus on improvement across the industry. It has in place a number of subject-specific sub-groups looking in detail at issues such as radiological protection, human performance, learning from experience and the implementation of the new regulatory framework for security (NORMS). Such sub groups have developed a number of GPGs which have been adopted by the industry. Further information on the GPGs can be found at http://www.nuclearinst.com/Publications.

Industry Radiological Protection Co-ordination Group

The Industry Radiological Protection Co-ordination Group (IRPCG) is the United Kingdom's Nuclear Industry forum that considers significant occupational radiological protection issues at a strategic level and provides a coherent approach as the industry develops. It is a sub-group of the Nuclear Industry's SDF and its members represent the majority of the Nuclear Industry's Radiation Protection Managers and Leaders. Their current topics of discussion include the Ionising Radiations Regulations 2017 implementation and Radiological Protection Training Standards. The group is also a significant forum for exchange of operating experience, lessons learned and best practice sharing.

The following companies and organisations are participating members of the IRPCG:

Disclaimer

This UK Nuclear Industry Good Practice Guide has been prepared on behalf of the Safety Directors Forum by a Technical Working Group. Statements and technical information contained in this Good Practice Guide are believed to be accurate at the time of writing. However, it may not be accurate, complete, up to date or applicable to the circumstances of any particular case. This Good Practice Guide is not a standard, specification or regulation, nor a Code of Practice and must not be read as such. We shall not be liable for any direct, indirect, special, punitive or consequential damages or loss whether in statute, contract, negligence or otherwise, arising out of or in connection with the use of information within this UK Nuclear Industry Good Practice Guide.

This Good Practice Guide is produced by the Nuclear Industry. It is not prescriptive, but offers guidance and in some cases a toolbox of methods and techniques that can be used to demonstrate compliance with regulatory requirements and approaches.

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1. Introduction

In May 1984 the United Kingdom Atomic Energy Authority (UKAEA) issued Atomic Energy Code of Practice No.1003 (AECP 1003)[1] as a design standard for radiological changeroom facilities. This standard, like many other AECPs, was adopted for use by most of the main nuclear site operators at that time and by related organisations, including UKAEA, British Nuclear Fuels plc (BNFL), AWE, National Nuclear Corporation Limited (NNC) and the Central Electricity Generating Board (CEGB).

During the late-1980s and early-1990s there were many organisational changes amongst the nuclear operators that had previously co-operated in the production and application of AECPs. Hence when AECP 1003 was reviewed and revised by UKAEA (then operating under the name AEA Technology) in 1993[2], the document was credited as being produced only for AEA Technology use, although it is understood to have been available for application by some of the previous users. Other users developed their own specific design standards, subject to commercial constraints, and evolution of these documents has inevitably resulted in some diversity of changeroom design standards.

In the late-1990s and early-2000s the Health and Safety Executive Nuclear Installations Inspectorate (NII) noted this lack of commonality and on occasion expressed concerns about particular aspects of changeroom design, construction or operation on certain nuclear sites. Consequently in 2002 the NII commissioned a report from an independent contractor reviewing good practice in the design and operation of nuclear changeroom facilities[3]. The intention of the review was to provide guidance suitable for use by all HSE staff involved in the inspection of changerooms giving access to radiological designated areas.

Nuclear site operators also recognised that not only were changeroom standards evolving, but that this could potentially give rise to significant differences between changerooms of different ages on the same site. Hence there was a requirement for an ongoing periodic review of changeroom standards, to ensure that consistent and adequate safety standards were maintained in all areas. This prompted an industry-wide review of changeroom practices concurrent with the NII review.

Following discussions between nuclear operators and the NII, a working group with input from the NII, was set up under the auspices of the Industry Radiological Protection Co-ordination Group (IRPCG). The objective of this group was to develop an agreed ‘Code of Practice’ on changeroom design, operation and maintenance for use by the nuclear industry in the United Kingdom. Issue 1 of the Code of Practice was published on behalf of the Safety Directors Forum in 2006.

In 2019 a new working group of the IRPCG reviewed the document, updating the content and also changing the intent from a Code of Practice to a Good Practice Guide, in line with other similar documents published on behalf of the Safety Directors Forum. The Changeroom Design, Operation and Maintenance Good Practice Guide, issue 2, is the agreed output of this working group, and was published on behalf of the Safety Directors Forum in September 2021.

2. Application

This Good Practice Guide is directly applicable to the design, operation and maintenance of new changerooms and those that are to be refurbished.

It is important at this point to note that a changeroom must be supported by a suitable and sufficient risk assessment, as required under The Management of Health and Safety at Work Regulations 1999 (MHSWR)[4] and The Ionising Radiations Regulations 2017 (IRR17)[5]. As individual sites and facilities will vary due to the nature of the site/hazard, the risk assessment may determine that a different approach to a practice or feature described within this document is appropriate to that changeroom. In such situations that approach can be justifiably adopted, however the other good practice features, as described in this document, should continue to be applied.

The effectiveness of existing changerooms should be periodically reviewed, for example as required by the MHSWR or if an adverse occurrence (such as unexpected levels of contamination on people leaving a changeroom) is identified. This Good Practice Guide will be of use to dutyholders and their advisors in such situations, although changes to existing changerooms for any reason will need to be justified and reasonable.

The issue of this Good Practice Guide is not intended to initiate wholesale review of existing changerooms where there is no driver to do so, such as those mentioned in the previous paragraph.

A suitable Radiation Protection Adviser (RPA) must be consulted during application of this Good Practice Guide and on risk assessments of changerooms, particularly if a different approach to a practice or feature described within this document is being considered.

3. Scope

This document details the systems, processes and features representing radiological protection good practice applied to all phases of the life of a new or newly refurbished changeroom. It is therefore relevant to design, construction, commissioning, operation and maintenance of such changerooms.

This document will be useful to all duty holders involved in the design, construction, commissioning, operation, maintenance and decommissioning of changerooms.

This Good Practice Guide focuses on access to areas designated on the basis of a contamination hazard (actual or potential); it does not provide guidance on access to areas designated on the basis of a radiation hazard.

3.1 What is a Changeroom?

For the purpose of this document a changeroom is a facility designed, constructed and operated to enable personnel to enter and leave potentially radioactively contaminated areas in a manner that confines, so far as reasonably practicable, the contamination inside the area and confirms, through radiological monitoring, that the personnel are not contaminated.

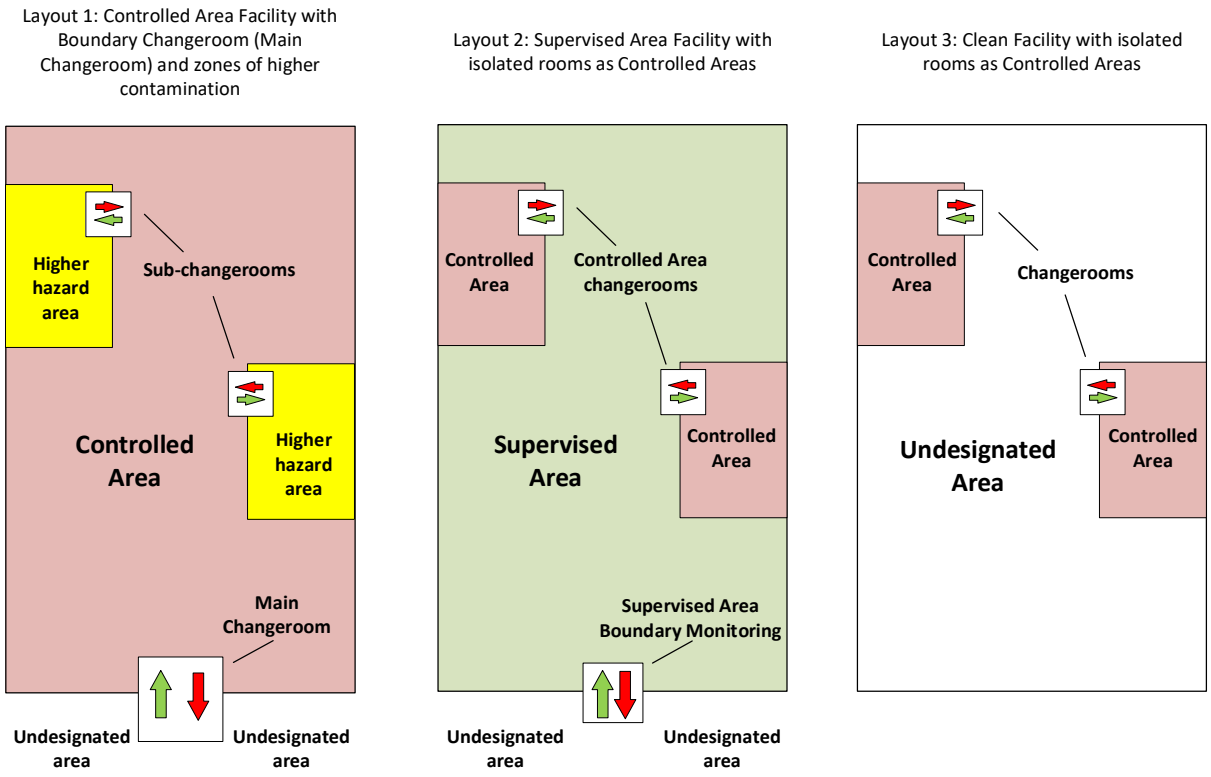
Changerooms are normally located at the boundary between two areas of different contamination designation (or classification). A changeroom consists of washing facilities, changing facilities and monitoring facilities, or a subset of these.

A changeroom is an integral part of the overall radiological designation/classification strategy for an area or facility. The type of changeroom required for a particular radiological boundary depends not only on the designation or classification of the area it provides access to, but also on the types/features of changerooms 'upstream' and 'downstream' of it.

Figure 1 provides an overview of three designated area layouts considered within this Guide. These layouts represent the situations normally encountered in the nuclear industry. The features of the different types of changeroom that support each layout are considered in detail in sections 6, 7 and 8.

A changeroom offers an ideal location to implement access control to radiologically designated areas, or zones of higher contamination within designated areas.

Figure 1: Designated areas and changeroom layouts



3.2 Health and Safety Legislation Compliance

This document has been generated with consideration of relevant health and safety legislation. Where appropriate legislation has been referenced, but the primary legislations that have an influence on this document are:

- The Management of Health and Safety at Work Regulations 1999 (MHSWR)[4].

- The Ionising Radiations Regulations 2017 (IRR17)[5]. In particular Regulations 8, 9 and 19 are the primary consideration.
- The Environmental Permitting (England and Wales) Regulations 2016 (EPR16)[6]
- The Environmental Authorisations (Scotland) Regulations 2018 (EA(S)R18)[7].
- The Workplace (Health, Safety and Welfare) Regulations 1992[8].
- The Health and Safety (Miscellaneous Amendments) Regulations 2002[9].
- The Provision and Use of Work Equipment Regulations 1998[10].
- The Personal Protective Equipment at Work Regulations 1992[11].
- The Personal Protective Equipment Regulations 2002[12].
- The Construction (Design and Management) Regulations 2015[13].

4. Management and Systems

4.1 Introduction

The intent of this section is to define good practice with respect to organisational arrangements and systems that should be in place to meet the relevant requirements of the primary legislation listed in section 3.2 (as the requirements apply to changerooms).

4.2 Management

Each changeroom should have a person identified as being responsible for its management, with clearly defined resource and operational responsibilities, including upkeep, maintenance and supervision. Responsibilities for the management and control of any changeroom should be explicit and unambiguous.

Permanent supervision of operations within the changeroom should not be necessary, as all staff using the facility should either be escorted or suitably qualified and experienced. Visitors should be escorted, and it is incumbent on the escort to ensure that their visitor adopts appropriate protocols. It is, however, essential that the condition of the changeroom and the practices adopted by personnel within the area are audited on a regular basis. This auditing will provide an opportunity to identify issues requiring attention, review any events and breakdowns in control, and identify improvements to be addressed by the changeroom manager.

4.3 Risk Assessment

Design, operation and maintenance of a changeroom must be supported by a suitable and sufficient risk assessment, as required under IRR17 and the MHSWR. Indeed, the risk assessment process

should be the starting point for the design of the overall contamination control process in a facility, of which the changeroom is but one control measure.

Risk assessment is fundamental to the safe design, operation and maintenance of changerooms. Direct outputs from the risk assessment process will contribute to all the following:

- Determination of the contamination control philosophy and the physical arrangements. This will include an assessment of the most appropriate split between on-facility controls/local monitoring and controls located at or within a Main changeroom.
- Appropriate area designation/classification for areas along the entrance/exit route(s).
- Contingency plans and emergency response arrangements, including non-radiological events, such as fire, electrical power failure or equipment breakdown.
- Specification of arrangements for personal contamination monitoring.
- Routes of access/egress and monitoring arrangements for items generated within the contamination area.
- Identification of a 'finger print' of unsealed radionuclides, that can be used by the RPA to specify the type and sensitivity of personal contamination monitoring equipment and suitable Personal Protective Equipment (PPE) for personnel working in the area.

4.3.1 Risk Assessment for New Build Changerooms

The risk assessment should include consideration of broad contamination control principles, such as application of the 'control at source' philosophy. This risk assessment will help identify the necessary contamination control arrangements, their physical location with regard to the potential source of contamination and the required degree of duplication of controls.

It is good practice to contain and control radioactive contamination as close as practicable to the point of origin. A changeroom forms part of the overall contamination control regime and therefore should be located as close as practicable to the source facility or facilities. The need for outside areas to be designated as controlled should be minimised so far as reasonably practicable. This said, on sites containing large numbers of facilities handling radioactive materials there may be some merit in co-ordinating arrangements in a Main changeroom to ensure consistency in procedures for users. Larger, well-used changerooms are more likely to justify adoption of good practice elements that may be expensive to implement, but this should be compared with the increased risk posed by the distance travelled from the source to the changeroom.

An important issue at this stage is the degree of 'nesting' of areas that may be subject to different control arrangements. For low-hazard, low-risk tasks a changeroom containing a single barrier with adjacent hand-washing facilities and monitoring equipment may be entirely appropriate. Facilities with a greater contamination hazard will have the potential to present a more significant challenge to a Main changeroom and to its associated contamination control measures. This risk should be controlled by the introduction of additional contamination control procedures local to the facility, supported by the use of sub-changerooms close to identified higher hazard areas, often located where additional personal protective equipment (PPE) should be worn. Local contamination control measures, for example 'frisking' with a contamination probe or use of an installed exit contamination monitor, will also be appropriate at the exit from a facility that is remote from the nearest Main changeroom.

In addition to the risk assessment addressing overall contamination control principles and arrangements, there should also be a comprehensive assessment of the hazards and risks relevant to the design and operation of the changeroom. This should include consideration of changeroom specific hazards and external hazards from supported facilities, for example:

- The chemical nature and physical form of radioactive contamination.
- The isotopic composition of materials likely to give rise to radioactive contamination.
- The quantity (activity) of radioactive material that could credibly be encountered.

4.4 Restriction of Exposure

ALARP (As Low As Reasonably Practicable) considerations should be applied to the design, operation, maintenance and decommissioning of changeroom facilities. As specified in 'Work with ionising radiation'[14], application of the ALARP principle involves consideration of the use of engineering controls/design features, systems of work, and personal protective equipment, in that order of priority.

Changeroom features influenced by the application of engineering controls include:

- Location of the changeroom itself (to avoid high radiation levels).
- Where appropriate and practicable, the demarcation by physical segregation of ingress and egress routes.
- The changerooms 'Lifecycle' considerations, such as its size in relation to the current work programme, future expansion in work programme and the reasonably foreseeable decommissioning requirements of supported plants.
- Ergonomic designs of the storage arrangements for clean and used PPE, which should also take into account the anticipated number of changeroom users during the different stages of the changeroom lifecycle.
- Use of physical barriers to demarcate potentially contaminated areas.
- Use of automated monitoring (for people and articles) and access control equipment to ensure appropriate controls at key points (where appropriate).
- Use of ventilation systems to control airborne activity.
- Surface coatings that are easy to decontaminate.

These aspects should be considered in greater detail within the design process (refer to sections 5-8).

Systems of work include operational controls such as:

- Radiological designation and classification of areas.
- Application of radiological monitoring regimes.
- Format and application of Local Rules.

- Adoption of maintenance and inspection regimes specific to the changeroom.
- Provision of information to changeroom users, such as instructions, notices and signs.

Use of contact clothing, including PPE that conforms to relevant test standards, is an integral part of changeroom arrangements, for example the use of coveralls or lab-coats, shoes/overshoes, hard hats, gloves and waterproof clothing, if required.

4.5 Radiological Surveys

Radiological conditions within changerooms should be kept under review in order to ensure safe operation and to detect any breakdowns in contamination control. All parts of the changeroom should be included in a schedule of routine radiological surveys, including any adjacent undesignated areas, to verify that the areas remain correctly designated and to detect breakdowns in controls, systems and procedures. This would demonstrate the effectiveness of contamination control procedures and the absence of significant radiological risk. It is important to recognise that surveys of changerooms are not a substitute for a suitable and sufficient monitoring programme of the radiological controls at source.

The frequency and type of survey should be determined in consultation between the changeroom manager and the relevant RPA. The risks and consequences of contamination events and the historic record of detection, such as recent survey records and contamination incidents, are factors to be considered as part of this consultation.

Any survey schedule should indicate not only the area to be monitored and the frequency of survey, but also how the monitoring is to be undertaken, what monitoring instruments are to be used and what action levels are to be applied.

As a general guide, the following bullet list will reflect the ranking of survey frequency requirements, with the top of the list requiring the most frequent monitoring:

- Contamination control barriers and adjacent floor areas.
- Controlled area footwear stored at the barrier.
- Other contact clothing used in controlled areas.
- ‘Works clothing’ worn in controlled areas.
- Installed personal contamination monitoring equipment.
- Remaining washing/monitoring areas.
- Clothing change areas and other nominally ‘clean’ areas.

Any requirement to monitor airborne activity levels should be determined initially from consideration of the risk assessment supporting the changeroom operation. It is possible, if a changeroom is to be used for re-entry operations in the event of a facility incident, that airborne activity monitoring will be required specifically to cover those operations even if not normally required for routine changeroom use. Appropriate incident monitoring facilities would therefore need to be available. The frequency of radiation and contamination surveys would also need to be increased during an incident.

4.6 Contingency Plans

The risk assessment of the changeroom, and risk assessment of the facility it supports, should identify credible radiation accident scenarios that can be used as the basis for contingency plans. Contingency plans specific to the changeroom facility will normally deal with reasonably foreseeable events, such as personal or surface contamination detected within the changeroom facility, possibly including the spill/spread of radioactive material. Consideration also needs to be given to the role of the changeroom as a means of access to/egress from other operational facilities.

The changeroom should be equipped to deal with all reasonably foreseeable events associated with its normal operation. Radiological events to be addressed would include significant personal contamination, possibly affecting several changeroom users. For changerooms with a large number of users, and particularly those serving areas with an elevated risk of contamination, there should be decontamination facilities readily available, such as showers in the radiologically designated area of the changeroom, or arrangements to transfer personnel to a remote facility.

It is good practice for contingency plans to include arrangements for retrospective monitoring of personnel and items that leave contamination-controlled areas following an unplanned evacuation from the changeroom, not using normal egress routes and arrangements.

4.7 Radioactive Clearance Criteria

To ensure compliance with IRR17, and the Environmental Permit issued under either EPR16 or EA(S)R18 (as appropriate), monitoring and radioactive clearance control measures must be applied to all items leaving potentially contaminated areas to ensure that they are either treated as a radioactive substance, or can be declared out of scope of regulation or conditionally exempt from further regulation [15]. It is good practice for clearance monitoring of such items to take place in a facility that is physically separated from the changeroom.

There will be some non-clothing items such as pens, notebooks, dosimetry, etc., for which equivalent procedures can be devised and included in the Local Rules. There needs to be, however, clear identification or definition of the types of materials and objects that are appropriate for self-monitoring clearance by the owner/user.

Waste minimisation is an important consideration and good practice is for this to be dealt with at source, by minimising the quantity of materials entering potentially contaminated areas. There should be justification for items entering a potentially contaminated area and quantities should be controlled. Limitations should be placed on the passage of items through changerooms. There is some overlap between this topic and that of security restrictions and access control (please refer to section 6.2.1).

Changeroom users and their personal clothing, which may include ‘works clothing’, will be cleared from potentially contaminated areas via a standard changeroom procedure. Arrangements for used contact clothing and PPE should be specified to ensure appropriate handling precautions and onward consignment procedures are in place.

Further guidance on clearance and radiological sentencing issues can be found in the IRPCG Good Practice Guide ‘Clearance and Radiological Sentencing: Principles, Process and Practices’ [15] and advice should be sought from a suitable Radioactive Waste Advisor (RWA).

5. Design Process and Considerations

5.1 Introduction and Fundamental Considerations

The intent of this section is to define good practice with respect to radiological protection considerations during changeroom design. For completeness it is important to state that the construction and fabric of the changeroom must, as a minimum, comply with the current Building Regulations Approved Documents and all relevant codes and standards. Consideration should also be given to the requirements of the Equality Act 2010 and British Standard (BS) 8300. These requirements should be addressed within the criteria of the design where possible or through an Access Management Strategy Document.

Welfare requirements, such as toilets, etc., are covered by the Workplace (Health, Safety and Welfare) Regulations 1992[8].

Additionally, waste minimisation issues and control adoption should be considered at the design stage, for implementation throughout the life of the changeroom.

5.2 Consultation

The designer of any changeroom should enter into consultation with the following interested parties during the design process:

- Employer (Changeroom Owner)
- Changeroom Manager
- RPA
- RWA
- Operational Health Physicist
- Changeroom staff
- Users
- Safety representative
- Safety adviser
- Fire officer
- Maintainer
- Human factors and ergonomics specialists, if available

The purpose of these consultations should be to ensure that there is a common understanding of the role of the changeroom and how it is to be used. Since the employer (Changeroom Owner) will have duties under health and safety legislation, it may be sensible for them to conduct the liaison and consultation on behalf of the designer. Early input from an RPA is important with regard to legal compliance and radiation protection matters. All relevant legislative requirements and good practice issues should be addressed. Critical information to be incorporated into the design specification

should include relevant summary details of the facilities supported by the changeroom and the operations carried out within those facilities.

Other key items of information required will include the number of users and patterns of usage, accommodation for changeroom support staff, ancillary functions of the changeroom, established practices in other changerooms on the same site and any known historic issues or information that may have a bearing on the future operation of the changeroom. Other parties who may need to be consulted and whose views may influence radiological protection arrangements include:

- Regulators
- Security personnel
- Emergency planner
- Medical advisers
- Clothing supply and laundry staff

5.3 Use

Close attention should be paid to the sequential procedures that users are expected to follow and to any ways in which the layout of changerooms can facilitate this process. The objective is total compliance with specified procedures, thereby minimising the potential for adverse events, such as a spread of contamination beyond the boundary of radiological designated areas. The physical layout of the changeroom should enable a smooth and logical progression through the various stages of the entry and exit procedure. This should be supported by information, instruction and training to enable changeroom users to understand exactly what they should do and why they should do it that way.

The procedures to be followed whilst crossing the boundary from a designated area into an undesignated area are of key importance in minimising the risk of spread of contamination and are addressed in section 6.2.9.

The number of monitoring instruments and other facilities such as hand wash sinks, and clothing/PPE storage provision, should be based upon the number of users and patterns of usage. Provision that is insufficient to cope with peak periods of use can contribute to poor contamination control behaviours by changeroom users.

5.4 Maintenance

Maintenance requirements should be identified during the design process. The maintenance requirements will necessitate input from specialist engineering personnel and from the RPA for those parts of the changeroom infrastructure that support contamination control and monitoring arrangements.

Maintenance activities should be optimised with other risks during the design process. For example, in a high contamination risk changeroom it may not be appropriate to have easily accessible pipe work that might become, or present, a contamination trap hazard, whilst for a lower contamination risk changeroom this may be the optimum layout to facilitate access.

Cleaning should be regarded as a key part of changeroom maintenance and an opportunity to identify any deterioration of surfaces or the accumulation of dust, etc. in unexpected locations.

A suitable audit and inspection regime should be devised and implemented by the changeroom manager, that ensures that the changeroom remains fit for purpose and that it is being adequately maintained.

5.5 Liquid Effluent Handling and Disposal

Liquid effluent should be discharged through an appropriate waste stream. Effluent from decontamination should be discharged via an appropriate active waste route. Effluent from hand washing, undertaken following monitoring, should be disposed of via a suitable waste route (dependent upon potential activity). This process may be subject to regulation in accordance with EPR16/EA(S)R18 and requires consultation with either the Environment Agency (EA) in England, National Resources Wales, or the Scottish Environment Protection Agency (SEPA). Advice should also be sought from a suitable RWA.

5.6 Variations from Identified Good Practice

There is no requirement to have separate male and female changerooms, unless there are specific privacy considerations. All changerooms should conform to the good practice detailed in this document or have a suitable and sufficient risk assessment in place that justifies the variance.

It is important to consider arrangements for any personnel covered by the Equality Act 2010 but, as these can be diverse, they are not discussed further here. It is, however, important that a suitable and sufficient risk assessment identifying that the radiological risk remains tolerable supports any non-compliance issues caused by these arrangements. The RPA should be consulted on the appropriateness of any deviations from the stated good practice in this document.

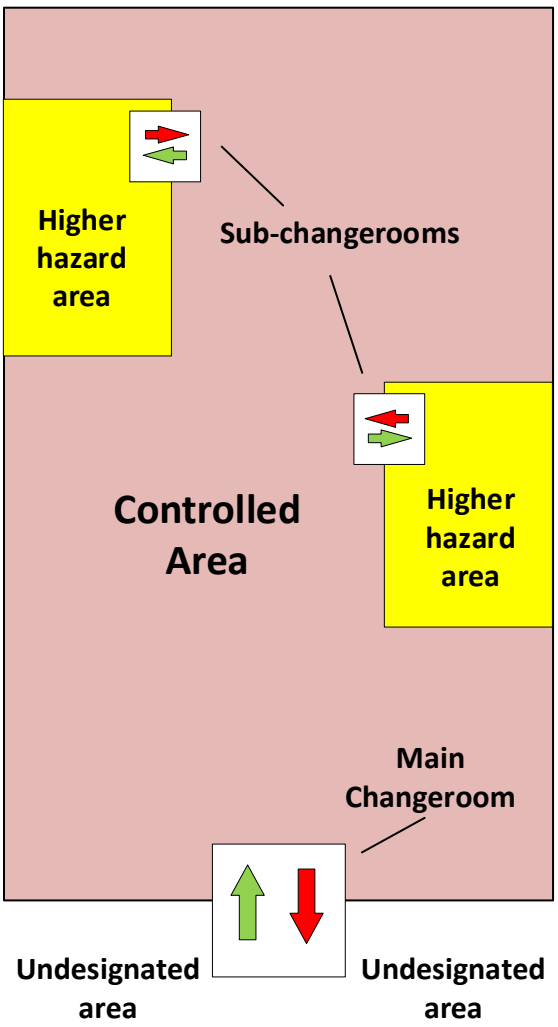
Any other variations from the good practice identified within this document should be justified, discussed with the RPA and/or RWA and supported by a suitable and sufficient risk assessment.

6. Controlled Area: Main Changeroom & Sub-Changerooms

6.1 Introduction

The intent of section 6 is to define good practice with respect to the features of changerooms associated with a controlled area facility. The 2 types of changeroom relevant to this plant layout are the Main changeroom and sub-changeroom, as shown in Figure 2 below.

Figure 2: Controlled area facility with boundary changeroom (Main changeroom) and zones of higher contamination



6.2 Main Changeroom

The Main changeroom should be the principal point of access into (and egress from) the controlled area. In general terms the constituent parts of a Main changeroom are:

- Areas where clothing or equipment to protect against radiological hazards is put on and taken off;
- An area in which personnel monitor and wash themselves; and
- An area for personnel to put on (or to take off) personal clothing and personal effects, as appropriate.

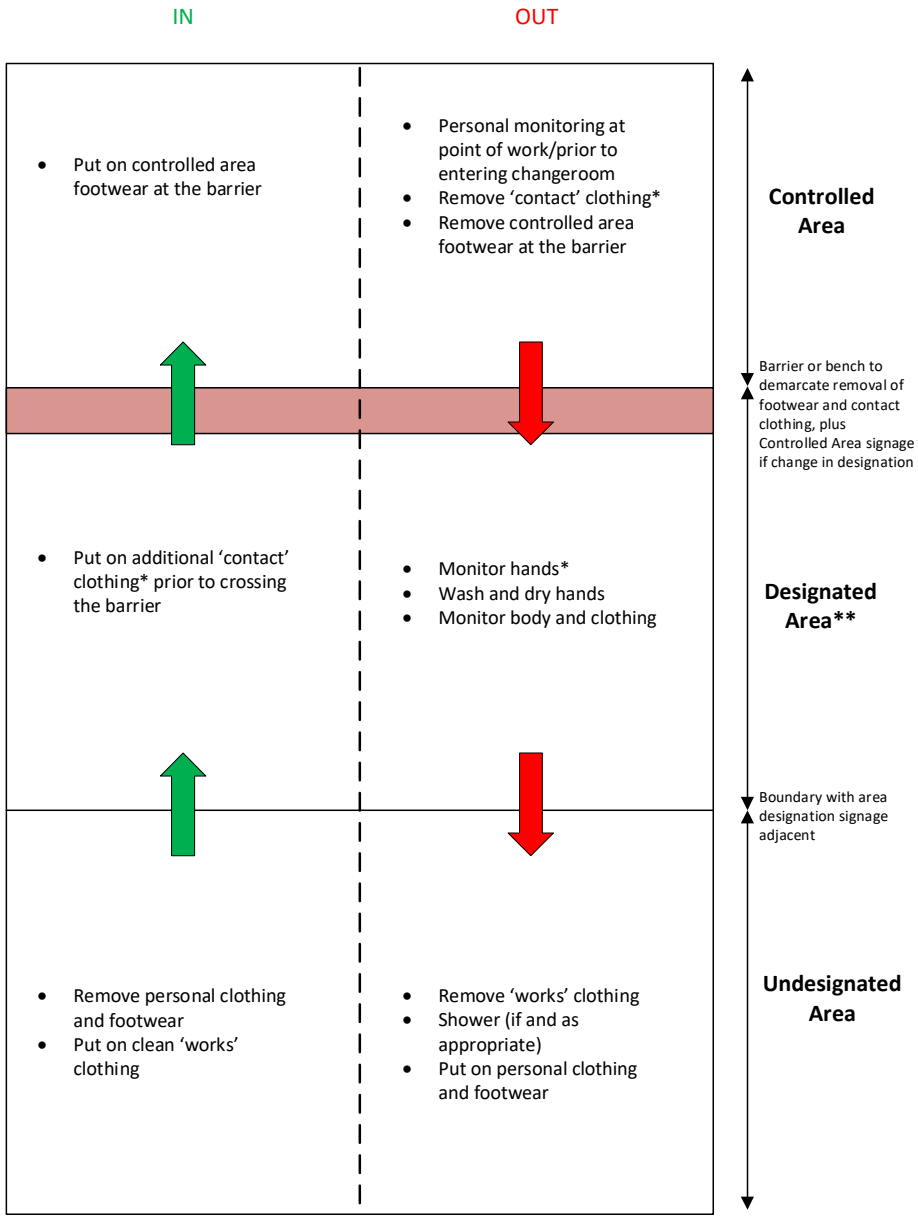
Normally these constituent parts should be located within a single facility, but this may not always be the case. Any deviations should be supported by a suitable and sufficient risk assessment that clearly justifies the adopted approach.

A Main changeroom serves as part of the overall contamination control arrangements associated with the controlled area. These arrangements enable demonstration of the adequacy and efficacy of contamination control.

A Main changeroom should not become contaminated and controls should be implemented downstream to ensure that all areas of the changeroom, and items brought into the changeroom, maintain this condition as far as reasonably practicable.

Figure 3 provides an overview of the sequence of steps involved in the good practice Main changeroom process. This figure also provides information that enables a better understanding of the functionality of the various sections of a Main changeroom.

Figure 3: Overview of Main changeroom process



*: if required by the risk assessment of the task/area
**: Controlled Area or Supervised Area, as determined by a risk assessment

Good practice for the radiological designation of areas in a Main changeroom (and the locations for carrying out personal monitoring) is as shown in Figure 3 above.

If the risk assessment of a changeroom determines that a different approach to designation is appropriate for control of contamination in that changeroom, then that can be adopted. The area between the barrier and the undesignated area boundary should be designated as appropriate to the nature of the controls/changeroom but should *at least* be designated as supervised. In such situations, the other good practice features as described in section 6.2 should continue to be applied.

Good practice for washing hands is that this should only be carried out after the hands have been monitored. This is to provide both confidence that upstream contamination control measures are adequate, and to help identify any breakdowns in those controls in order that learning can be gained and adjustments made. Monitoring should be undertaken as close as is reasonably practicable to the source (e.g. at the point of work), and as dictated within the risk assessment. In some facilities or for some tasks there may be a justifiable reason to wash hands before monitoring, such as due to other risks that are judged to be more significant to some operators. The risk assessment should demonstrate how an acceptable level of contamination control will be maintained if this sequence is to be used.

6.2.1 Access & Egress Control

Employers who designate controlled areas must restrict access to such areas, in a way that prevents unauthorised persons from entering. As such, Main changerooms are usually closely associated with access control arrangements, containing as they do the principal location for access and egress into controlled areas. Hence, in the design of new Main changeroom facilities, there should be close liaison between the designer and the employer to agree the extent to which access and egress control arrangements are incorporated into the changeroom design.

Access controls may include the installation of pass-reader identity security turnstiles or similar arrangements. Other security requirements may also apply to certain controlled areas, and it may be administratively convenient to co-locate additional security features within the changeroom layout. Modern electronic dosimetry systems, linked to turnstiles or similar infrastructure, can provide a convenient means of ensuring that persons entering a controlled area are subject to appropriate dosimetry arrangements and are approved to enter such an area.

Access control arrangements should ensure that persons entering controlled areas through the Main changeroom are either classified persons or entering the area in accordance with suitable written arrangements. All persons entering controlled areas should have received adequate information, instruction and training, and be subject to a suitable means of dose assessment or restriction. It is good practice to restrict the number of access points to a controlled area to the minimum that is necessary, with the ideal being one, and to ensure that access is appropriately controlled at all points.

Engineered devices (such as installed personal contamination monitors), should be used, where reasonably practicable, to prevent contaminated persons leaving the changeroom without decontamination and the initiation of an investigation into the circumstances. Most modern installed personal contamination monitoring equipment can identify a user from their issued dosimetry or a pass.

If a safe alternative evacuation point within the controlled area is not available, manual override of the access and egress control arrangement should be available to permit unrestricted exit in the event of an emergency. This must comply with all requirements of relevant fire safety legislation, on which the Fire Officer should be consulted. Contingency arrangements should be available to muster people who have left the controlled area in this way, and to ensure they are subject to personal contamination monitoring as soon as possible and as close to the controlled area boundary as reasonably practicable.

An alternative to the imposition of physical/mechanical interlocks is the application of supervision to the changeroom process. The rigour and effectiveness of supervisory control is difficult to quantify and is subject to human lapses, hence the adoption of interlocks is good practice. In summary, for higher hazard facilities good practice is the use of electronic interlock arrangements, whilst for lower hazard areas this may not necessarily be justified. Good practice for larger throughput Main changerooms is the use of electronic access control.

6.2.2 Ventilation and Airborne Activity Monitoring

Ventilation is a key consideration in a Main changeroom. The risk assessment will assist in the identification of credible radiological exposure scenarios from airborne radioactive contamination. The requirement is to ensure that there is minimal risk of committed effective doses in the changeroom. It should also be borne in mind, that as the changeroom is connected to a plant with a ventilation system, there may already be suitable ventilation available.

Ventilation can be one of the means by which people outside a contamination-controlled area are protected from the spread of contamination. A key principle of the ventilation system, therefore, should be to move potentially contaminated air from lower to higher risk areas. That is, from the undesignated area to the controlled area. The system should also prevent movement (back-migration) of air from the controlled area to the undesignated area. If there is a risk of significant committed effective doses within the Main changeroom, then equipment to monitor levels of airborne radioactivity that alarms if set levels are exceeded should be considered, as well as a ventilation system. Sometimes ventilation is necessary to maintain the effectiveness of alpha-in-air monitoring (which would otherwise be adversely affected by high levels of radon and its daughters) and reduce the radon hazard.

Any ventilation system should be designed in accordance with a relevant technical design standard addressing the ventilation of radioactive areas. Where practicable, there should be some indication of the operational status of the ventilation system sufficient to warn users if the system is operating below its design specification.

A consideration linked to the use of ventilation systems is the routing of air extracted from controlled areas and its eventual discharge into the environment. This process is subject to regulation in accordance with either EPR16 or EA(S)R18, and may require consultation with either the Environment Agency (EA) in England, Natural Resources Wales, or the Scottish Environment Protection Agency (SEPA). Advice should also be sought from a suitable RWA.

6.2.3 Personal Protective Equipment (PPE)

Issue of PPE

For this document, PPE refers to clothing (e.g. 'contact clothing'), footwear or equipment, including respiratory protective equipment (RPE), designed to protect the user against radiological or conventional safety hazards. The PPE required will be determined by the risk assessment of the controlled area supported by the Main changeroom.

All PPE should comply and be used in accordance with the Personal Protective Equipment at Work Regulations 1992[11] and the Personal Protective Equipment Regulations 2002[12].

Unused/ready-for-use PPE (including RPE) should be appropriately stored in a location that is easily accessible, but secure from unauthorised persons. Additionally, the issue of PPE should be controlled such that all persons using the equipment are suitably qualified and experienced persons (SQEP) in its use. The storage arrangements should protect the items from harmful effects such as physical damage, excessive heat, cold and moisture.

The Main changeroom should have appropriate storage facilities for the adequate supply of readily required PPE. It should, however, be noted that it is not the primary function of the changeroom to be a PPE storage and issue location. Certain operators may decide to adopt the changeroom for this purpose.

Storage and reuse of PPE

A key question that should be asked during the risk assessment is 'does the PPE need to be segregated?' For example, segregation of hard hats used only in undesignated areas from those used in the controlled area. If so, separate storage arrangements should be provided in the Main changeroom.

On exit from the controlled area supported by the Main changeroom, PPE intended for reuse should not be taken into the personal monitoring area of the changeroom unless it has been subjected to appropriate contamination monitoring. Unless and until monitored, it should remain on the 'facility' side of the boot barrier.

Storage arrangements will need to be provided in the appropriate area of the changeroom to enable this good practice to be met. Used contact clothing should be stored on hooks within a short distance of the boot barrier, with adequate adjacent space to reduce the risk of cross contamination from neighbouring clothing. Only one coverall/laboratory coat should be stored at the hook location. If hard hats are to be used in the controlled area supported by the Main changeroom, a sufficient number of hooks should be provided and only one hard hat should be stored at each hook location. Protective footwear should be stored in pigeonholes that are integrated into the boot barrier (on the appropriate side), or directly accessible from the boot barrier. Pigeonholes should be used exclusively for the storage of footwear.

The storage arrangements should facilitate contamination monitoring of the used PPE under a suitable survey schedule. The arrangements should also enable the wearer of the PPE to be quickly identified in the event that contamination is subsequently discovered on any PPE.

Single-use items of PPE do not require storage facilities but will require disposal facilities (bins). Identified routes for dealing with damaged reusable PPE or used contact clothing that needs to enter the cleaning cycle, should also be available (refer to section 6.7).

Respiratory Protective Equipment (RPE)

RPE intended for reuse should be safely stored in accordance with the manufacturer's instructions and in a way that prevents it becoming cross-contaminated. Further guidance on RPE storage can be found in HSE Publication HSG53 'The Selection, Use and Maintenance of Respiratory Protective Equipment: A Practical Guide' [16].

Storage of outdoor and personal items/clothing

Lockers should be provided in clothing change areas for secure storage of personal clothing and effects. Monitoring and clearance procedures for persons leaving the controlled area should be sufficiently robust that the provision of separate lockers for personal clothing and for used 'works clothing' is unnecessary.

Adjacent to external doors, a Main changeroom should incorporate facilities for the hanging and drying of outdoor clothing, including 'contact clothing' where appropriate. If outdoor clothing is to be worn in the controlled area supported by the Main changeroom, it should not be taken into the personal monitoring area of the changeroom after use unless it has been subjected to appropriate contamination monitoring

6.2.4 Information, Instruction and Signage

Local Rules, compliant with the requirements of IRR2017, must be posted at prominent locations within the Main changeroom, or at its entrance. The Local Rules should include access and egress procedures for the controlled area and, if deemed appropriate, the supervised area within the changeroom.

Clear signage should also be displayed in the changeroom that includes:

- The radiological designation of the area about to be entered. This signage should be located as close to each radiological boundary (i.e. controlled, supervised) as practicable.
- Sequence of steps to progress in and out of the changeroom.
- Key steps in the barrier procedure for entry into and exit from the controlled area. As a general guide on the expected content, examples from 2 nuclear sites in the UK are shown in Annex B.
- Use of monitoring equipment and actions in the event of an alarm or malfunction.
- PPE required.
- Contacts if assistance is required.

It is good practice to use pictorial signs, where feasible, as these are particularly useful in illustrating sequential procedures such as clothing divestment and barrier crossing. Specialised monitoring equipment is available that utilise synthesised voice messaging, to issue audible instructions to users. Alarm signals should be both audible and distinct, with users trained in their recognition. Specific signs detailing emergency arrangements may be appropriate in addition to the summary details incorporated into the Local Rules.

Training

It is also good practice for training in barrier procedures (that is dressing, undressing, washing and monitoring) to be included in induction training. Training of personnel should also include information on dosimetry requirements. It should be stated that dosimetry should not be left on contact clothing,

which could then undergo washing or be discarded. Refresher training should also be undertaken at intervals deemed appropriate.

6.2.5 Designated Area Delineation/Demarcation

Good practice for the designation of areas in a Main changeroom is as shown in Figure 3. The extent of the controlled area should be indicated by a physical barrier, which identifies a step change in the level of risk.

In a Main changeroom, where the controlled area incorporates the area where personal contamination monitoring and hand washing takes place, the boundary should be demarcated by a turnstile or other similar means (for people entering the changeroom from the undesignated area), and by the exit of the installed personal contamination monitoring equipment (for people exiting the changeroom to the undesignated area).

In a Main changeroom where the area for personal contamination monitoring and hand washing is designated as a supervised area, the controlled area boundary should, as a minimum, be demarcated by a boot barrier. In this situation, the supervised area to undesignated area boundary is demarcated by a turnstile and exit monitor, as described in the paragraph above.

Thus, the area between the boot barrier and the undesignated area boundary should be designated as appropriate to the nature of the controls/changeroom but it is good practice to *at least* be designated as supervised.

The combination of boundary demarcation and associated signs should indicate clearly and unambiguously the extent of the controlled area, and supervised area if used.

The boot barrier or bench should be used to indicate the point beyond which protective footwear (and contact clothing such as coverall or laboratory coat, if deemed necessary for the controlled area) should be worn. On exit from the controlled area supported by the changeroom, used footwear and contact clothing should not be taken into the personal monitoring area of the changeroom unless it has been subjected to appropriate contamination monitoring.

It will be important during training, etc. to distinguish between the purpose of the boot barrier and the extent of the radiologically designated areas in the Main changeroom.

If the Main changeroom forms part of an emergency exit, the boot barrier must comply with all requirements of relevant fire safety legislation, on which the Fire Officer should be consulted. The physical dimensions of the boot barrier should be such that a person could not credibly step over it without meaning to do so.

Any deviations to the above practices should be supported by a suitable and sufficient risk assessment that clearly justifies the adopted approach**.**

6.2.6 Materials of Construction

Main changerooms, in common with other areas associated with the handling and processing of radioactive material, should have engineered and administrative controls in place that ensure, so far as is reasonably practicable, that the surfaces do not become contaminated with radioactive materials. It is still reasonably foreseeable that a changeroom may become contaminated and require

decontamination. ISO 8690:1988[17] provides guidance on the methods for testing and assessing the ease of decontamination of radioactively contaminated surfaces. These principles are illustrated through their application to the role of a boot barrier, a key component of the changeroom furniture. Any boot barrier should be constructed:

- Of a material suitable to withstand the weight and structural stresses to be exerted on it, during reasonably foreseeable usage.
- So far as reasonably practicable with radial corners and edges to minimise the potential build-up of radioactive contamination.
- Coated in, or constructed of, a material that offers a continuous impermeable membrane that is resistant to damage, such as scratches breaching the membrane.
- Such that all surfaces are smooth, with no significant surface imperfection that may act as potential contamination traps. The membrane should, if damaged, not offer a porous surface to potential contamination.
- So that it is appropriately sealed to the building fabric, to restrict the migration of radioactive contamination. All surfaces of the barrier should be easily decontaminated and resistant to damage when cleaned utilising standard industrial cleaning chemicals.
- So that it offers no sharp or jagged edges that may pose a cutting or puncture hazard to personnel crossing or coming into contact with them. Joints and junctures should be minimised and appropriately sealed, to inhibit contamination migration.

Another key changeroom structure of particular importance to contamination control is the floor surface, which should be smooth with sealed joints to prevent ingress of contamination and with an upward curving lip in corners and along edges. Floor surfaces should, however, provide sufficient grip when wet or dry to mitigate against the risk of slipping.

6.2.7 Used PPE and Clothing

Containers used for the collection of used contact clothing that needs to enter the cleaning cycle should be designed to facilitate easy monitoring and processing. The use of readily identifiable receptacles, such as colour-coded, is good practice. All such receptacles should be marked externally to indicate their contents or intended use and should be lined with bags designed for the receipt and onward handling of their contents. The receptacles should be included on the routine survey schedule, along with any contents. Use of these containers to store PPE or clothing found to be contaminated should be prohibited. Local procedures should require that any such items are dealt with promptly on discovery of the contamination.

Changeroom working instructions will normally include arrangements for the monitoring and handling of all types of laundry.

6.2.8 Communications

Main changerooms should be equipped with communication systems accessible from each main area. Communication points should be provided in the area where personal monitoring equipment is located and should be a sufficient distance from radiological boundaries so as to discourage reaching

over the boundary. At each communication point, key contacts should be posted to enable assistance to be summoned if required.

6.2.9 Personal Contamination Control

Fundamental contamination control arrangements are those associated with the barrier procedure for personnel access to and from the controlled area. The good practice barrier area layout for a Main changeroom involves a single boot barrier, with personal clothing and shoe storage in the undesignated area of the changeroom and contact clothing/controlled area footwear left after use on the facility side of the boot barrier (as shown in Annex A).

The arrangements should aim to further reduce the risk of transferring contamination beyond the boundary of the radiologically designated area and into undesignated areas. Monitoring and washing facilities should be located in the radiologically designated area of the changeroom. After physically crossing the boot barrier, and up to the point where personal contamination monitoring is completed, there remains a risk of a transfer of contamination into the monitoring and washing area. Therefore, the radiological conditions within the designated area of the Main changeroom should be routinely monitored to minimise any associated doses received by persons working in, or passing through, the area.

As shown in Figure 3, the controlled area exit monitoring process is to firstly carry out contamination monitoring of the hands. This monitoring should be undertaken as close as is reasonably practicable to the source, and as dictated within the risk assessment of the task or work area. Hand monitoring may be repeated on arrival at the Main changeroom (prior to washing) if there is a risk of contamination while on-route to the changeroom through the controlled area. The risk assessment that supports the Main changeroom should determine this requirement. The key point is that only after monitoring has confirmed that the hands are free from contamination should they be washed within the Main changeroom. Lastly, a full personal contamination monitoring check should be carried out before proceeding to the undesignated area of the Main changeroom.

All instances of personal contamination should be reported immediately. This is to ensure that the cause can be investigated and so that appropriate decontamination arrangements can be implemented. This arrangement is of benefit to the contaminated person and other personnel if the contamination is identified early and appropriately controlled.

6.2.10 Personal Decontamination Facilities

Decontamination facilities should be available for persons found to be contaminated either in, or on the approach to, Main changerooms. Decontamination should only be conducted by, or under the guidance of suitably trained personnel. Use of such facilities should be supervised, and arrangements for access posted. If decontamination facilities are not readily available, alternative arrangements should be identified in local instructions and included in Local Rules.

The precise nature of decontamination facilities will be determined from the outputs of the risk assessment and will be agreed between local management and the RPA. Detailed arrangements may be influenced by the facilities that the changeroom supports and the type and quantity of radioactive contamination that may be presented at the changeroom. Facilities handling small quantities of radioactive materials in known configurations may require little more than a single washbasin, some soap or other detergents and a cloth or other means of application. Abrasive or

corrosive decontamination agents should not be readily accessible and should only be used by personnel trained in their use.

Main changerooms serving more substantial facilities, with an associated risk of widespread personal contamination and perhaps with a larger number of users, may warrant dedicated shower facilities for supported decontamination following unplanned events. The showers should be supported by a suitable and sufficient risk assessment and housed within an enclosure constructed to limit the spread of radioactive contamination. Ideally the water supply to such a shower should be thermostatically controlled, and the waste should go through an active route. Additionally, suitable monitoring and maintenance of the system should be implemented.

Drying and monitoring facilities should be provided locally, together with replacement clothing for use after decontamination. Appropriate storage should be provided for any cleaning or decontamination agents and personnel should be trained in their use. Decontamination procedures should be specified which minimise the risk of inducing or aggravating any damage to the skin that may result in the bodily ingestion of radioactive contamination.

Where decontamination is carried out in a facility remote from the Main changeroom, clean protective clothing and materials suitable to cover contaminated areas should be provided locally to facilitate the transfer of contaminated persons to that facility.

Effluent from decontamination practices should be treated as potentially radioactive waste and dealt with appropriately through an active route for which advice should be sought from a suitable RWA.

If personal decontamination is to be conducted in the Main changeroom, it is good practice to install modesty facilities.

6.2.11 Washing/Drying Facilities

Hand washing and drying facilities should be located as close as practicable to the main contamination control/boot barrier area in the Main changeroom.

Good practice for washing hands is that this should only be carried out after the hands have been monitored. This monitoring should be undertaken as close as is reasonably practicable to the source, and as dictated within the risk assessment of the task or work area. Hand monitoring may be repeated on arrival at the Main changeroom (prior to washing) if there is a risk of contamination while on-route to the changeroom through the controlled area. The risk assessment that supports the Main changeroom should determine this requirement.

In some facilities or for some tasks there may be a justifiable reason to wash hands before monitoring. The risk assessment should demonstrate how an acceptable level of contamination control will be maintained if this sequence is to be used.

For most purposes an adequate degree of radiological control can be ensured through the provision and use of hand washbasins, with running warm water. Washbasins should be capable of operation without using the hands and ideally the water supply should be thermostatically controlled.

Associated soap dispensing facilities that minimise the risk of cross-contamination should be used.

Provided that prior personal monitoring arrangements are in place to control the risk of discharging radioactive material through this route, liquid effluent from hand washbasins can be disposed of via a suitable waste route. It is good practice to place warning signs on these discharge points, to identify that “NO other liquid” should be disposed through this route.

This process is subject to regulation in accordance with either EPR16, or EA(S)R18, and may require consultation with either the Environment Agency (EA) in England, Natural Resources Wales, or the Scottish Environment Protection Agency (SEPA). Advice should also be sought from a suitable RWA.

Hot-air hand dryers and/or disposable paper towels are considered good practice, from a radiological protection standpoint, for drying hands. Decisions on the location of the hot-air hand dryers should take due cognisance of any potential for re-suspending contamination on the potentially contaminated side of the boot barrier. They should also be located at a sufficient distance from contamination monitoring equipment, to ensure that any alarm on the monitoring equipment can be clearly heard.

Contingency arrangements should be in place to support a power supply or equipment failure in the Main changeroom, such as a supply of disposable paper towels, or wet wipes in the case of water supply failure. Where alpha contamination of hands is a possibility, it is important that the hands are dried effectively before employing any subsequent monitoring techniques carried out after washing, e.g. use of exit monitors.

6.2.12 Personal Contamination Monitoring Facilities

Purpose

Monitoring serves the dual purpose of identifying contamination above defined control levels and providing an indication of a breakdown of either facility-based, or changeroom-specific controls (such as cross-contamination).

It is important to recognise that personal monitoring in changerooms is not a substitute for a suitable and sufficient monitoring programme of the radiological controls at source.

Pre-changeroom monitoring

Where comprehensive on-facility monitoring is impracticable, or greater control is required before entering the changeroom, it is good practice to include a monitoring stage as part of the Main changeroom entry procedure. Such a requirement should be identified from the risk assessment for the changeroom and consideration of the credible range of hazards associated with facilities supported by that changeroom. This monitoring should focus on the detection of personal contamination associated with facility operations and might be as simple as using a frisking probe. The monitoring arrangements should be set up to give an alarm signal above a pre-defined contamination alarm level. Local arrangements must include a means of summoning assistance in the event of an alarm, and the recording of relevant details.

In some situations where exposure through contamination by high-activity beta/gamma particulate activity is a significant risk, it may be appropriate to install exit-type ‘walk-through’ monitoring equipment to automate the pre-changeroom monitoring process. Alarm signals and the appropriate response would need to be incorporated into local instructions and user training.

Boundary monitoring

All Main changerooms supporting areas designated for a contamination hazard, should incorporate a means of personal contamination monitoring before exiting the radiologically designated area. Personal contamination monitoring equipment should be located adjacent to any hand washbasins that persons who are leaving the designated area are required to use. The final stage of monitoring, using installed personal contamination monitors (exit monitors), denotes the boundary between the designated area and the undesignated area. It should not be possible for any person to enter the designated area of a Main changeroom and leave again to the undesignated area without monitoring.

Equipment specification and use

The detailed technical specification of contamination monitoring equipment used in Main changerooms should be derived from the risk assessment and from detailed consideration of the credible range of radiological hazards associated with the facilities supported by the changeroom.

Each Main changeroom should have a defined exit monitoring regime with associated instructions and user training. The use of installed personal contamination monitoring equipment set up to ensure operation in a pre-determined monitor/user configuration is considered good practice where that configuration ensures an acceptable standard of monitoring. Monitoring regimes should be suitable for monitoring of the body and limbs, and capable of detecting significant quantities of any radionuclide that may pose a credible contamination risk in areas supported by the changeroom. The determination of a significant quantity of any radionuclide should include consideration of clearance and exemption requirements [15], as well as normal radiological protection issues such as radiation doses and application of the ALARP principle. The presence of radionuclides that are not detectable by available changeroom monitoring equipment may be inferred from measurements of other radionuclides, where there is a reasonably constant radionuclide mix ('fingerprint') and relevant detection thresholds provide an appropriate level of radiation protection.

Alarm levels should be derived for all types of monitoring equipment used in the Main changeroom and for all anticipated modes of use. Further guidance can be found in the IRPCG Good Practice Guide 'The Selection of Alarm Levels for Personnel Exit Monitors' [18].

There should be a written statement of alarm levels for each type of monitoring equipment used in the Main changeroom including, where practicable, the derivation of those alarm levels. Additionally, there should be a written record indicating the reasoning behind the use of the selected combination of instruments in the exit monitoring process. This should include formal consideration of the radionuclides likely to be encountered and how their presence is to be determined, whether measured directly or inferred from measurements of other radionuclides.

Exit monitors, fitted with proximity alarms to ensure minimal separation between the monitored surface and the detector, are examples of such equipment. They may also be linked with access control facilities to prohibit the exit of contaminated personnel.

Floor-to-ceiling systems are also available that can restrict the passing of inanimate objects across to the undesignated side. It is worth noting that installed fixed-configuration monitoring equipment has significant limitations when it comes to the monitoring of alpha or low-energy beta contamination on clothing. A consistently small clothing-detector separation is often not practicable and hence such equipment should normally be used in conjunction with a hand-held contamination monitor such as a frisking probe (wall-mounted or stand-alone). The principal drawback of hand-held equipment is that its efficacy is entirely dependent on user skill and diligence. Wall-mounted clocks should be installed to provide a method of tracking monitoring time during self-frisking. This, together with setting of appropriate standards during training, provides a method of encouraging fastidious monitoring.

Within a large, permanent, high-throughput Main changeroom it may be appropriate to use a combination of frisking probe to monitor body/clothing surfaces, followed by an automated exit monitor to detect hand and foot contamination. Generic guidance on the selection monitoring instrument combinations, based on technical and cost considerations, is as detailed below:

Significant Radiation hazard	Main changeroom monitoring arrangement		
	Exit Monitor	Hand & Foot/Hand Monitor	Frisking Probe
Alpha, beta and gamma	✓	*	✓
Beta and gamma	✓	*	✓
Alpha only	X	✓	✓
Low energy beta	X	X	✦

✓ Recommended
* Contingency
X Not recommended
✦ Only if designed for use with low energy radiation

The necessary quantity of monitoring equipment should be determined through consideration of likely peak throughput of persons exiting the Main changeroom. Some allowance should be made for typical rates of equipment non-availability associated with faults or routine calibration/ maintenance. Special consideration may need to be given to emergencies when the need for urgent evacuation of personnel may justify a non-standard exit monitoring procedure, or the introduction of supplementary monitoring capabilities brought in from outside the changeroom.

The instructions to users of changeroom monitoring equipment should include specific arrangements for the recording of all alarms, other significant radiological findings and any unusual events, including equipment malfunctions. The training of changeroom users should emphasise the positive benefits of investigating all such events.

Low levels of contamination may build-up over time on monitoring equipment and this may increase detection thresholds and the number of missed contamination incidents on devices that do their own background radiation correction. Most modern installed personal contamination monitors will raise an alarm when the background becomes too high. Foils/windows should be cleaned or replaced when they become significantly contaminated to reduce risks of contamination spread, so far as is reasonably practicable.

Maintenance, testing and calibration

All monitoring equipment should be subject to an appropriate testing and calibration regime. This regime should be derived after consultation with the RPA and the qualified person who oversees the testing and calibration of monitoring equipment. Further guidance can be found in the NPL Measurement Good Practice Guide No. 29 'The Examination, Testing and Calibration of Installed Radiation Protection Instruments'[19].

6.2.13 Toilets

It is good practice to locate toilet facilities only in areas after final contamination monitoring. Toilets should not be located within potentially contaminated areas. This ensures that any persons using the toilets after leaving potentially contaminated areas have monitored themselves and ascertained that they are free from detectable personal contamination.

6.2.14 Dosimetry Facilities

It is not the primary function of a Main changeroom to support the issue and storage of personal dosimetry. Operators may decide that the changeroom is a suitable location for this and if this is so, they should have adequate provision for the storage of personal external dosimetry and issue/return/temporary storage of personal air samplers (PAS), as appropriate. Any passive external dosimetry such as TLD badges stored within the changeroom should be stored in a location where the ambient dose rate is at or is close to normal background levels. Any dosemeter storage location should be such that the risk of damage or interference from environmental factors is negligible. For example, dosemeters should not be stored under pipework which might leak or result in falling condensate. If dosimetry is to leave the controlled area, appropriate monitoring should be undertaken prior to its release.

Main changerooms used for the issue of PAS, for the assessment of potential intakes of radioactive materials, should be designed to avoid cross-contamination of the PAS. Arrangements for the issue, storage and handling of PAS should therefore be organised to avoid contact with potentially contaminated surfaces.

Internal dosimetry assessment regimes may require the provision of excreta samples (urine or faeces) by changeroom users either on a scheduled routine basis or as a one-off exercise in response to a suspected intake or potential exposure event. These samples should be provided in a clean area following final monitoring from the designated area, where there is no significant risk of environmental contamination to minimise potential cross-contamination of excreta samples. Local procedures for the provision of excreta samples should require the washing of hands both before and after sample provision to further minimise the risk of cross-contamination.

6.2.15 Emergency Response

It is not the primary function of a Main changeroom to act as an emergency response centre, but it may well be ideally located and suited to fulfil such a role. Thus, the use of the Main changeroom in an emergency response role is discussed here in general, rather than in any specific detail.

The changeroom may have a significant role to play in the response to an event in a facility it serves, and this role would need to be addressed in the changeroom's emergency response arrangements. Facility- or site-specific emergency arrangements affecting the changeroom might include its use as a mustering point for evacuated personnel, for the triaging of those potentially affected by an on-facility event or as a control point for recovery operations. Hence, there needs to be co-operation between the changeroom and facility management to integrate the respective emergency plans. One possible consequence of such considerations is that the changeroom may need to be equipped to act as a control point in the event of an emergency requiring evacuation of adjacent facilities.

The use of CCTV or similar equipment to give a picture of emergency response arrangements in the vicinity of the boot barrier and the washing/monitoring facilities could be beneficial to persons directing emergency recovery operations from a remote location. The CCTV monitors should only be operational during an emergency response (or emergency exercise) and be located and operated such that the personal privacy of members of the emergency response teams is not compromised.

6.2.16 First Aid

Similarly, it is not the primary function of a Main changeroom to act as a First Aid point, but in certain circumstances it may lend itself to being used for this function. If a changeroom is to be utilised for this role it would need to be clearly justified by a suitable and sufficient risk assessment, to ensure that other hazards are not exacerbated to enable this functionality.

It is clearly inappropriate, under normal situations, to use the Main changeroom as anything more than a First Aid post and the treatment of wounds, etc., is better serviced elsewhere.

6.3 Sub-Changeroom

Higher contamination hazard facilities will have the potential to present a significant challenge to the Main changeroom, its associated contamination control measures and areas on-route to the changeroom. Typically, higher contamination hazard areas have a radiological classification greater than that of the general controlled area facility, for example a classification of ‘Medium’ level risk under most UK nuclear industry area classification schemes.

As described in section 4.3.1, the increased contamination risk should be controlled by the introduction of additional contamination control procedures local to the facility, supported by the use of sub-changerooms close to identified higher hazard areas, located where additional PPE is to be put on. The sub-changeroom should be the principal point of access into (and egress from) the higher hazard area.

Note that good practice for access to very high contamination hazard areas (such as those that require use of RPE with an independent or self-contained breathing air supply) is not covered in this Guide. For access to these areas a dedicated entry facility is normally used.

At the sub-changeroom personnel will don dedicated specific PPE before entry into the higher hazard area, by crossing a barrier. These items of PPE should be removed prior to returning across the sub-changeroom barrier. In certain operations, personnel may require the assistance of an undresser to ensure safe egress. If this is likely in a sub-changeroom, its design should take this requirement into account.

Local contamination control measures, for example independent monitoring by a Health Physics surveyor, self ‘frisking’ with a contamination probe, or the use of an installed exit contamination monitor, will also be appropriate prior to exit from a sub-changeroom.

There is a need for physical restriction to prevent inadvertent access to areas having particularly high levels of contamination. This may include a combination of lockout arrangements to a sub-changeroom and positioning of physical barriers within the sub-changeroom to prevent unauthorised access.

There is an increased risk of contamination within a sub-changeroom compared to a Main changeroom. However, the objective should be that a sub-changeroom should not become contaminated, and controls should be implemented within the higher hazard area to ensure that all areas of the sub-changeroom, and items brought into the changeroom, maintain this condition as far as reasonably practicable.

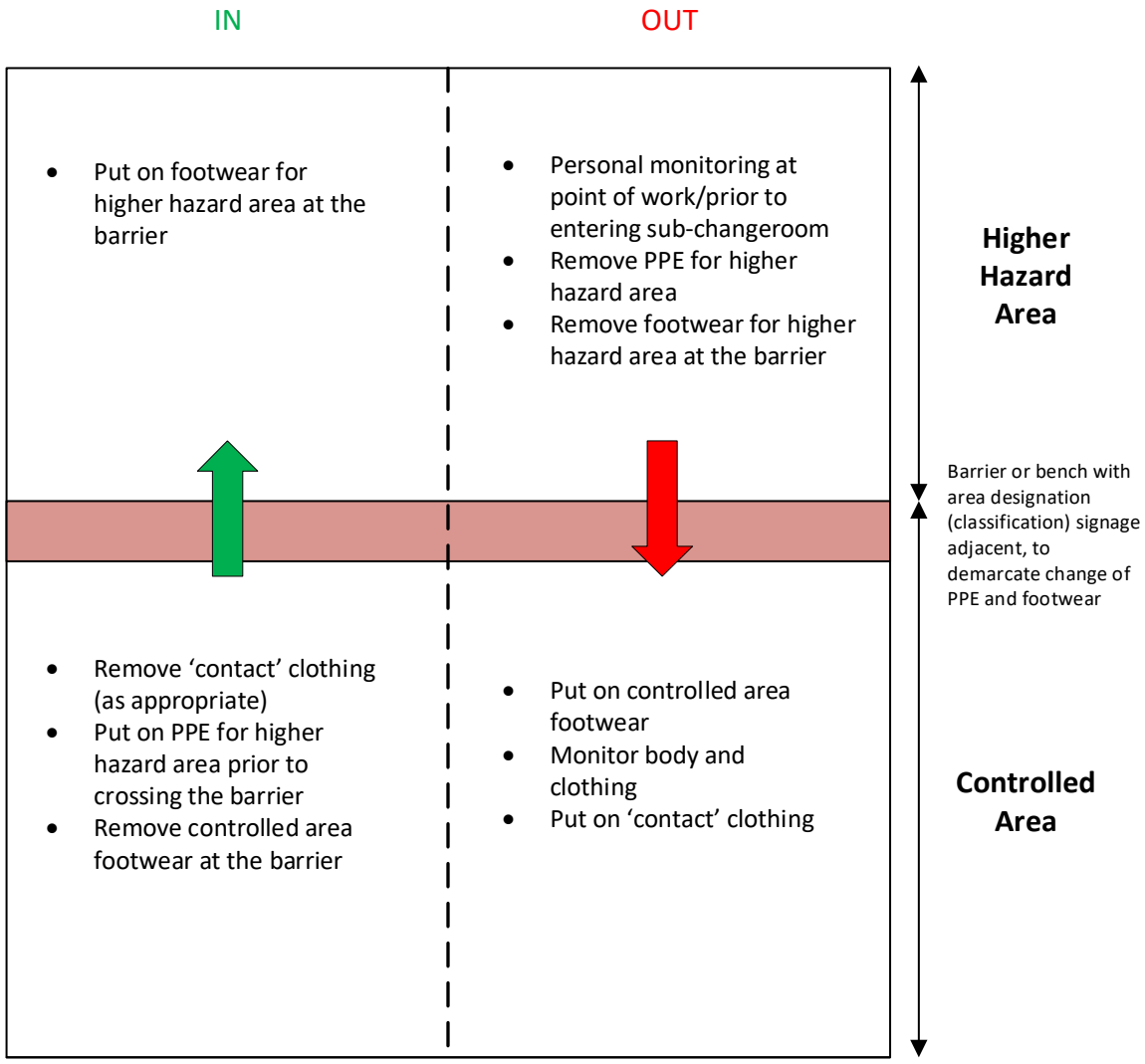
A risk assessment for the operation of this type of changeroom is particularly important due to the enhanced contamination risk.

In general terms the constituent parts of a sub-changeroom are:

- Areas where PPE to protect against radiological hazards is put on and taken off; and
- An area in which personnel monitor themselves.

Figure 4 provides an overview of the sequence of steps involved in the good practice sub-changeroom process.

Figure 4: Overview of sub-changeroom process



6.3.1 Good Practice Considerations for a Sub-Changeroom

Feature	Good Practice considerations
Location and Size of the Sub-Changeroom	• Located as close to identified higher hazard area as reasonably practicable. • Sufficient space should be provided in each area of the sub-changeroom for anticipated periods of peak use. Provision that is insufficient to cope with peak periods of use can contribute to poor contamination control behaviours by changeroom users. Consider how many additional people may be present to support an entry, for example a Health Physics surveyor, tally person, or undresser. • May be kept as an 'empty shell' and temporarily fitted with equipment as and when used.
Access & Egress Control	• Sub-changeroom should be inaccessible/locked off when not in use. • Access limited to trained and authorised personnel.
Ventilation and Airborne Activity Monitoring	• Ventilation is a key consideration in a sub-changeroom. The increased contamination risk in the sub-changeroom means that ventilation is required. • If there is a risk of significant committed effective doses within the sub-changeroom, then equipment to monitor levels of airborne radioactivity that alarms if set levels are exceeded should be provided. Consideration should be given to positioning monitoring equipment on both sides of the barrier. The number and positioning of monitoring equipment should take into account the areas where airborne contamination is likely to be generated and air flows within the sub-changeroom (including the effect on air flows when doors into the sub-changeroom are closed/open).
PPE	• Follow good practice in section 6.2.3. • On exit from the higher hazard area supported by the sub-changeroom, PPE intended for reuse should not be taken across the barrier in the sub-changeroom unless it has been subjected to appropriate contamination monitoring. Unless and until monitored, it should remain in the higher hazard area of the sub-changeroom. • When not being worn, protective footwear should be stored in pigeonholes that are integrated into the barrier (on the appropriate side), or directly accessible from the barrier. Pigeonholes should be used exclusively for the storage of footwear. Protective footwear should not be stored on the floor in front of the barrier (on either side) as this will create a tripping hazard. • In sub-changerooms where personnel put on PPE alone/unassisted, a mirror should be installed in the dressing area if it is important for the wearer to be able to see that the PPE has been correctly donned (e.g. RPE) before entry to the work area.
Information, Instruction and Signage	• Follow good practice in section 6.2.4.
Controlled Area Delineation/ Demarcation	• The extent of the higher hazard area should be indicated by a physical barrier, which identifies a step change in the level of risk and the point beyond which PPE should be worn. Good practice is to use a boot barrier or bench. The top of the barrier should have the same radiological classification as the area in which clean PPE

Feature	Good Practice considerations
	is put on before crossing the barrier. • The combination of boundary demarcation (barrier) and associated signs should indicate clearly and unambiguously the extent of the higher hazard area. • It will be important during training, etc. to define the purpose of the boot barrier in a sub-changeroom. • If the sub-changeroom forms part of an emergency exit, the barrier must comply with all requirements of relevant fire safety legislation, on which the Fire Officer should be consulted. The physical dimensions of the barrier should be such that a person could not credibly step over it without meaning to do so.
Materials of Construction	• Follow good practice in section 6.2.6.
Used PPE	• Bins and containers used for the collection of used PPE for disposal or that needs to enter the cleaning cycle should be designed to facilitate easy monitoring and processing. The use of readily identifiable receptacles, such as colour-coded, is good practice. • All such receptacles should be marked externally to indicate their contents or intended use and should be lined with bags designed for the receipt and onward handling of their contents. The receptacles should be included on the routine survey schedule, along with any contents.
Communications	• Sub-changerooms should be equipped with communication systems accessible from each main area. Communication points should be provided in the area where personal monitoring equipment is located. There should be sufficient distance between the barrier and the communication point in the dressing/monitoring area, so as to discourage reaching over from the higher hazard area to the lower hazard area. At each communication point, key contacts should be posted to enable assistance to be summoned if required.
Personal Contamination Control	• Fundamental contamination control arrangements in the sub-changeroom are those associated with the barrier procedure for personnel access to and from the higher hazard area. The good practice barrier area layout for a sub-changeroom involves a single boot barrier, with PPE/higher hazard area footwear stored after use in the higher hazard area of the sub-changeroom (as shown in Annex C). • The arrangements should aim to further reduce the risk of transferring contamination beyond the boundary of the higher hazard area and into the general controlled area of the facility. After physically crossing the barrier, and up to the point where personal contamination monitoring is completed, there remains a risk of a transfer of contamination into the dressing/monitoring area. Therefore, the radiological conditions within all areas of the sub-changeroom should be routinely monitored to minimise any associated doses received by persons working in, or passing through, the area. • Touch points in the sub-changeroom such as door handles, bin lid handles, barrier top and communication equipment are susceptible to contamination. Where these are unavoidable, they should be

Feature	Good Practice considerations
	regularly cleaned, and included on the routine survey schedule. • Personal contamination monitoring should be carried out prior to exiting the sub-changeroom. • All instances of personal contamination should be reported immediately. This is to ensure that the cause can be investigated and so that appropriate decontamination arrangements can be implemented. This arrangement is of benefit to the contaminated person and other personnel if the contamination is identified early and appropriately controlled.
Personal Decontamination Facilities	• These would not normally be expected in sub-changerooms. Decontamination facilities would normally be provided within a central location for a controlled area facility, such as in or adjacent to the Main changeroom (refer to section 6.2.10). Detailed arrangements for the transfer of a contaminated person to the facility will be necessary, including appropriate contamination control measures. • If deemed to be necessary in a sub-changeroom, the precise nature of decontamination facilities will be determined from the outputs of the risk assessment and will be agreed between local management and the RPA.
Washing/Drying Facilities	• These would not normally be expected in sub-changerooms. If deemed to be necessary, the precise nature of washing/drying facilities will be determined from the outputs of the risk assessment and will be agreed between local management and the RPA.
Personal Contamination Monitoring Facilities	• Follow good practice in section 6.2.12. Particular issues of relevance to the sub-changeroom are detailed below. • The sub-changeroom should contain equipment for carrying out personal contamination monitoring following work in the higher hazard area it supports. As a minimum, monitoring equipment should be situated in the lower hazard area of the sub-changeroom (for use after crossing the barrier on exit from the area), but additionally equipment may be situated in the higher hazard area of the sub-changeroom (for carrying out contamination monitoring prior to removing PPE) if deemed to be necessary in the risk assessment. • The detailed technical specification of contamination monitoring equipment used in the sub-changeroom should be derived from the risk assessment and from detailed consideration of the credible range of radiological hazards associated with the area supported by the sub-changeroom. • It is normally sufficient to equip the sub-changeroom with a frisking probe for body/clothing surface monitoring. A hand monitor or hand & foot monitor may also be deemed necessary following an assessment of the potential for personal contamination. • Each sub-changeroom should have a defined exit monitoring regime with associated instructions and user training. • Personal contamination monitoring on either or both sides of the barrier could instead be carried out independently by a Health Physics surveyor if deemed necessary by the risk assessment of the task or work area.
Dosimetry Facilities	• These would not normally be expected in a sub-changeroom. If

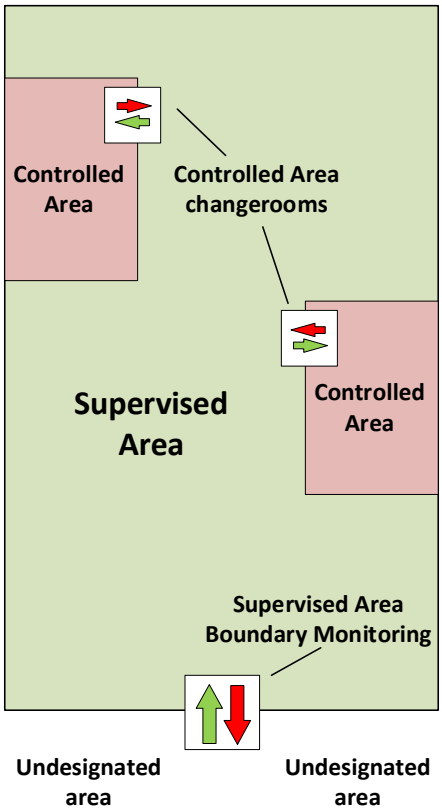
Feature	Good Practice considerations
	deemed to be necessary, the precise nature of washing/drying facilities will be determined from the outputs of the risk assessment and will be agreed between local management and the RPA.
Emergency Response	• The sub-changeroom may have a significant role to play in the response to an event in the higher hazard area it supports. This should be identified in the risk assessment of the facility and addressed in the facility's emergency response arrangements. One example of such a role is that the sub-changeroom may need to be capable of being modified/equipped to act as a re-entry point to the area following an event.
First Aid	• Follow good practice in section 6.2.16.

7. Supervised Area: Boundary Monitoring & Changerooms to Controlled Areas within

7.1 Introduction

The intent of section 7 is to define good practice with respect to the features of changerooms associated with a supervised area facility containing isolated controlled areas within it. The two types of changeroom relevant to this plant layout are the supervised area to undesignated area boundary and the controlled area changeroom, as shown in Figure 5 below.

Figure 5: Supervised area facility with isolated rooms as controlled areas



The principal difference between this plant layout and the one dealt with in section 6 is that this layout is used when there is greater confidence that contamination levels in the general area of the facility will remain below the level at which controlled area designation is required.

This has several benefits compared to the plant layout in section 6, including:

- The general area can be designated as a supervised area for contamination
- Controlled areas occupy a smaller footprint within the facility
- Less time spent monitoring the general area than if it were a controlled area
- Supports greater focus on contamination control in the controlled areas, and at the boundaries between the supervised area and the controlled areas
- Lower contamination risk at the boundary from the supervised area to the undesignated area
- Access and egress to the supervised area is more straightforward and a Main changeroom is not necessary

These benefits are reflected in the good practice layouts and processes in both types of changeroom described in this section.

7.2 Supervised Area Boundary Monitoring

The supervised area boundary should be the principal point of access into (and egress from) the supervised area. In general terms the constituent parts of the supervised area boundary changeroom are:

- An area in which personnel monitor themselves; and
- An area for personnel to put on/take off works clothing and footwear, if necessary
- *Washing/drying facilities should be provided in this changeroom if not provided within the controlled area changerooms downstream.*

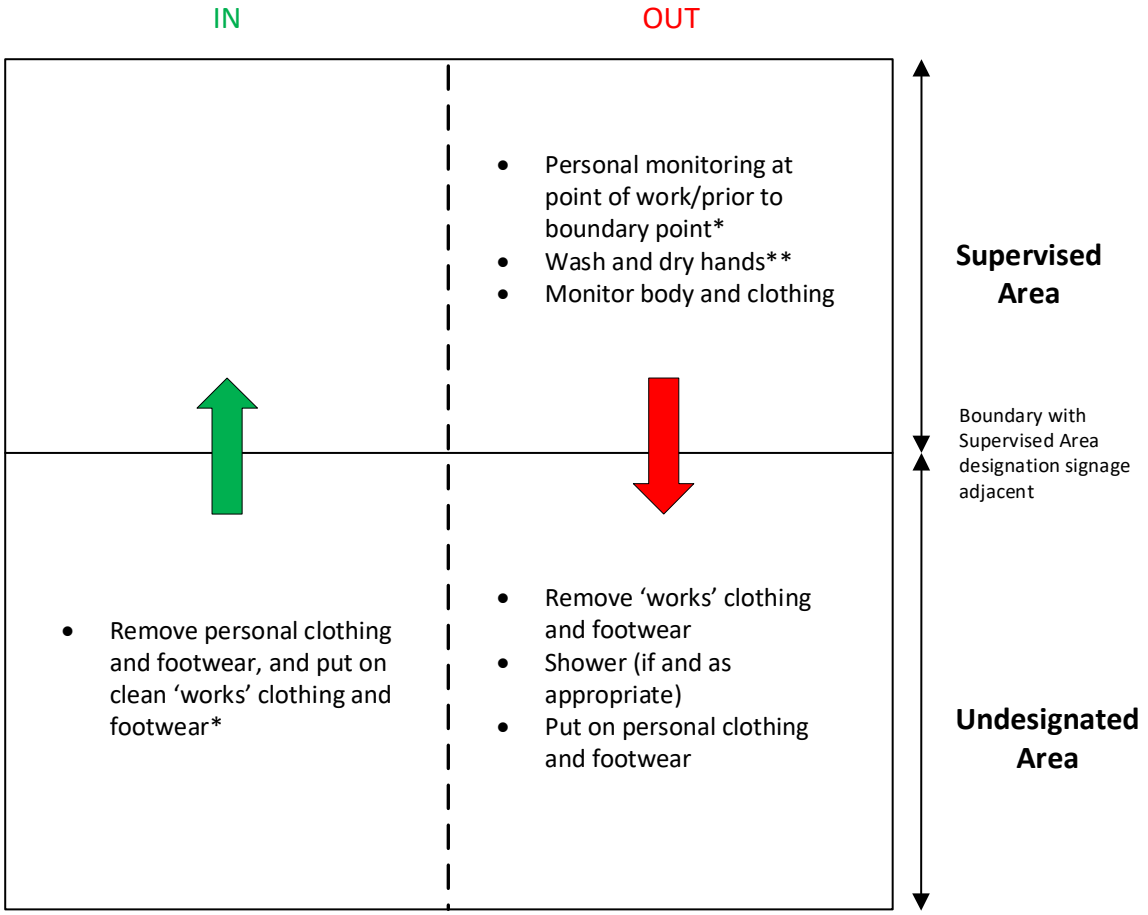
Areas for personnel to put on and take off clothing or equipment to protect against radiological hazards are not required in this type of changeroom.

Normally these constituent parts should be located within a single facility, but this may not always be the case.

A supervised area boundary changeroom should not become contaminated and controls should be implemented downstream to ensure that all areas of the changeroom, and items brought into the changeroom, maintain this condition as far as reasonably practicable.

Figure 6 provides an overview of the sequence of steps involved in the good practice supervised area boundary changeroom process.

Figure 6: Overview of supervised area boundary monitoring process



*: if required by the risk assessment of the supervised area (note: a change into works clothing is required if entry to the controlled area is to take place)
**: if not carried out at controlled area boundary (see figure 7)

7.2.1 Good Practice Considerations for Supervised Area Boundary Monitoring

Feature	Good Practice considerations
Location and Size of the Changeroom	• Located as close as reasonably practicable to the supervised area it supports. • Sufficient space should be provided in each area of the changeroom for anticipated periods of peak use.
Access & Egress Control	• Apply good practice principles in section 6.2.1, noting that since this layout contains isolated rooms as controlled areas it may be more efficient and effective to control access centrally within this changeroom.
Ventilation and Airborne Activity Monitoring	• Ventilation is not a key consideration in this type of changeroom, however the risk assessment of the supervised area the changeroom supports may require ventilation of the area. If this is the case, ventilation of the changeroom may be justified. • There should not be a risk of significant committed effective

Feature	Good Practice considerations
	doses within the changeroom, therefore equipment to monitor levels of airborne radioactivity is not required.
PPE	• PPE should not be a requirement of the supervised area the changeroom supports, therefore this feature is not applicable (note that the specification/use of 'works clothing' within the supervised area is not PPE).
Information, Instruction and Signage	• Follow good practice in section 6.2.4.
Supervised Area Delineation/ Demarcation	• For people entering the changeroom from the undesignated area, as a minimum the supervised area boundary should be demarcated by clear marking and signage. Alternatively, depending on the access control requirements above, the boundary may be designated by physical means such as a turnstile. • For people exiting the changeroom to the undesignated area the boundary should be demarcated by the exit of the installed personal contamination monitoring equipment (exit monitor). • The combination of boundary demarcation and associated signs should indicate clearly and unambiguously the extent of the supervised area.
Materials of Construction	• Follow good practice in section 6.2.6.
Used PPE	• PPE should not be a requirement of the supervised area the changeroom supports, therefore this feature is not applicable.
Communications	• The changeroom should be equipped with a communication system in the area where personal monitoring is carried out. At each communication point, key contacts should be posted to enable assistance to be summoned if required.
Personal Contamination Control	• Fundamental contamination control arrangements for this plant layout are those associated with the controlled area changeroom, covered in section 7.3. • Good practice contamination control arrangements in the supervised area boundary changeroom are limited to personal contamination monitoring on exit to the undesignated area. The objective of this monitoring is to further reduce the risk of transferring contamination beyond the boundary of the supervised area and into the undesignated area. The arrangements may be extended to incorporate hand washing, as described below.
Personal Decontamination Facilities	• Apply good practice principles in section 6.2.10, noting that it may be more efficient and effective to provide a centralised decontamination facility in or adjacent to this changeroom.
Washing/Drying Facilities	• Washing/drying facilities should be provided in this changeroom if not provided within the controlled area changerooms downstream, noting that it may be more efficient and effective to provide the facilities centrally within this changeroom. • If washing facilities are required, follow good practice in section 6.2.11.
Personal Contamination Monitoring Facilities	• Follow good practice in section 6.2.12. Particular issues of relevance to the supervised area boundary changeroom are detailed below.

Feature	Good Practice considerations
	• Installed personal contamination monitoring equipment (exit monitors) should be situated in the supervised area of the changeroom, to be used by all personnel exiting the area. This completes the controlled area exit monitoring process. • A frisking probe for body/clothing surface monitoring may also be provided in the same location, if deemed necessary against the risk of personal contamination occurring within the supervised area. • The changeroom should have a defined exit monitoring regime with associated instructions and user training. • The detailed technical specification of contamination monitoring equipment used in the changeroom should be derived from the risk assessment and from detailed consideration of the credible range of radiological hazards associated with the area supported by the changeroom.
Toilets	• Follow good practice in section 6.2.13. Locate toilet facilities only in areas that follow final contamination monitoring.
Dosimetry Facilities	• Apply good practice principles in section 6.2.14, noting that it may be more efficient and effective to provide centralised dosimetry facilities in this changeroom.
Emergency Response	• Follow good practice in section 6.2.15.
First Aid	• Follow good practice in section 6.2.16.

7.3 Controlled Area Changeroom within a Supervised Area

This changeroom is a key part of the overall radiological designation/classification strategy for the supervised area facility, as it contains the boundary of the controlled area it supports. This changeroom has a greater challenge to (and therefore should have a greater focus on) contamination control than the supervised area boundary changeroom discussed in section 7.2.

Since it contains the controlled area boundary the good practice features of a Main changeroom will apply in this changeroom, albeit on a smaller scale. Alternatively, as discussed in section 7.2 there may be justification for some of the features, such as access/egress control and washing facilities, to be situated at the supervised area boundary changeroom to centralise the arrangements and avoid unjustified and expensive duplication.

The controlled area changeroom may be used to provide direct access to rooms/zones of higher contamination hazard, for example a classification of ‘Medium’ level risk. If this is to be carried out, then consideration should be given to also applying each of the good practice considerations for a sub-changeroom contained in section 6.3. A risk assessment for the operation of this type of changeroom is particularly important due to the increased contamination risk.

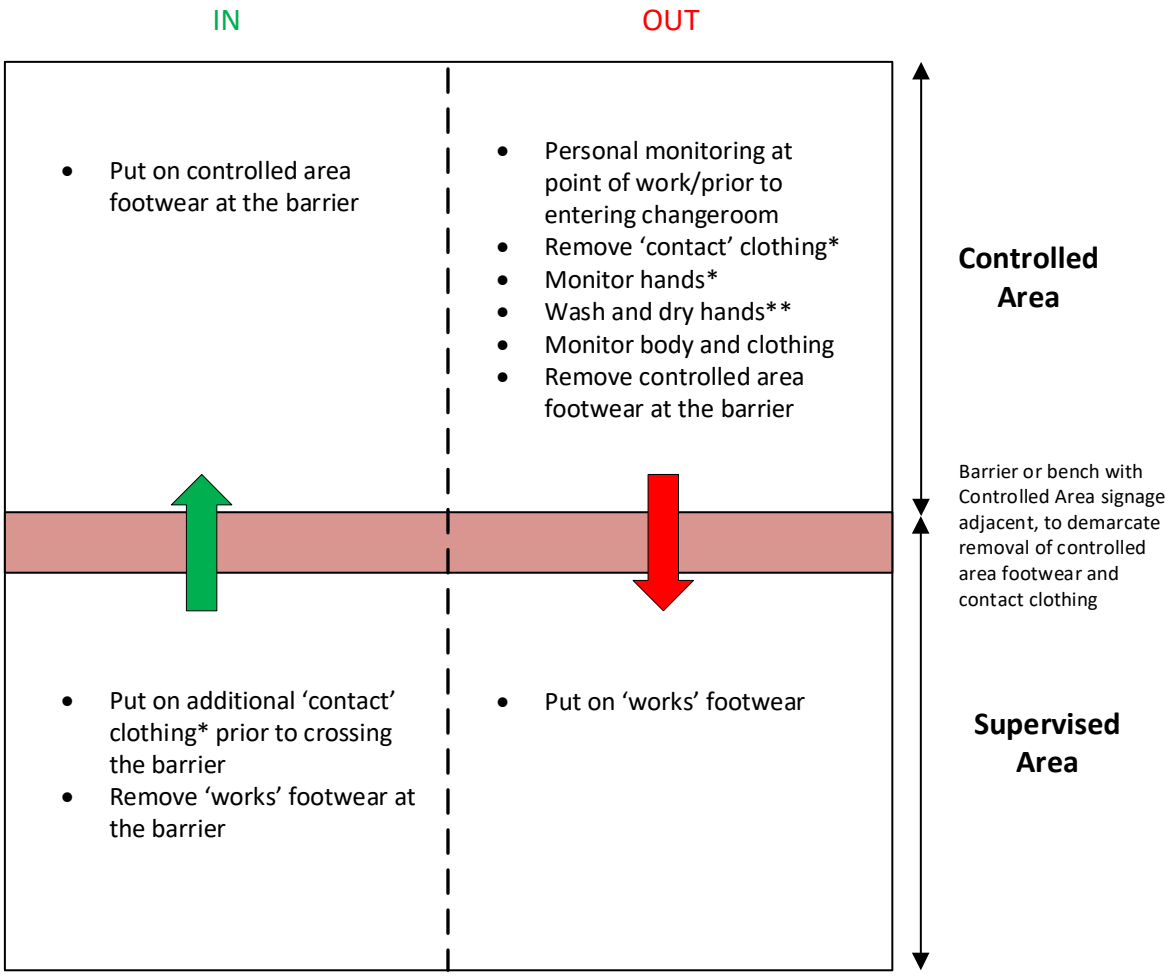
In general terms the constituent parts of a controlled area changeroom are:

- Areas where clothing or equipment to protect against radiological hazards is put on and taken off; and
- An area in which personnel monitor themselves.
- *Washing/drying facilities must be provided in this changeroom if not provided at the supervised area boundary upstream.*

A controlled area changeroom should not become contaminated, and controls should be implemented downstream to ensure that all areas of the changeroom, and items brought into the changeroom, maintain this condition as far as reasonably practicable.

Figure 7 provides an overview of the sequence of steps involved in the good-practice controlled area changeroom within a supervised area.

Figure 7: Overview of controlled area changeroom within a supervised area



*: if required by the risk assessment of the task/area
**: if not to be carried out at supervised area boundary (see figure 6)

7.3.1 Good Practice Considerations for a Controlled Area Changeroom within a Supervised Area

Feature	Good Practice considerations
Location and Size of the Changeroom	• Located as close as reasonably practicable to the controlled area it supports. • Sufficient space should be provided in each area of the changeroom for anticipated periods of peak use. • May be kept as an 'empty shell' and temporarily fitted with equipment as and when used.
Access & Egress Control	• Apply good practice principles in section 6.2.1, noting that it may be more efficient and effective to control access centrally within the supervised area boundary changeroom. • Locked off when not in use.
Ventilation and Airborne Activity Monitoring	• Follow good practice in section 6.2.2.
PPE	• Follow good practice in section 6.2.3. • On exit from the controlled area supported by the changeroom, PPE intended for reuse should not be taken across the barrier in the changeroom unless it has been subjected to appropriate contamination monitoring. Unless and until monitored, it should remain in the controlled area of the changeroom.
Information, Instruction and Signage	• Follow good practice in section 6.2.4.
Controlled Area Delineation/ Demarcation	• The extent of the controlled area should be indicated by a physical barrier, which identifies a step change in the level of risk and the point beyond which PPE should be worn. Good practice is to use a boot barrier or bench. The top of the barrier should have the same radiological classification as the supervised area. • The combination of boundary demarcation (barrier) and associated signs should indicate clearly and unambiguously the extent of the controlled area. • It will be important during training, etc. to define the purpose of the boot barrier. • If the changeroom forms part of an emergency exit, the barrier must comply with all requirements of relevant fire safety legislation, on which the Fire Officer should be consulted. The physical dimensions of the barrier should be such that a person could not credibly step over it without meaning to do so.
Materials of Construction	• Follow good practice in section 6.2.6.
Used PPE	• Follow good practice in section 6.2.7.
Communications	• The changeroom should be equipped with a communication system in the area where personal monitoring is carried out. At each communication point, key contacts should be posted to enable assistance to be summoned if required.
Personal Contamination Control	• The good practice barrier area layout for a controlled area changeroom involves a single boot barrier, with contact clothing/controlled area footwear stored after use in the controlled area of the changeroom.

Feature	Good Practice considerations
	• The controlled area arrangements should aim to further reduce the risk of transferring contamination beyond the controlled area boundary and into the supervised area of the facility. After physically crossing the barrier, and up to the point where personal contamination monitoring is completed, there remains a risk of a transfer of contamination into the supervised area. Therefore, the radiological conditions within all areas of the changeroom should be routinely monitored to minimise any associated doses received by persons working in, or passing through, the area. • Personal contamination monitoring should be carried out prior to exiting the changeroom.
Personal Decontamination Facilities	• Apply good practice principles in section 6.2.10, noting that it may be more efficient and effective to provide a centralised decontamination facility in or adjacent to the supervised area boundary changeroom. • Detailed arrangements for the transfer of a contaminated person to the facility will be necessary, including appropriate contamination control measures.
Washing/Drying Facilities	• Washing/drying facilities should be provided in this changeroom if not provided within the supervised area boundary changeroom upstream. • If washing facilities are required, follow good practice in section 6.2.11.
Personal Contamination Monitoring Facilities	• Follow good practice in section 6.2.12. Particular issues of relevance to the controlled area changeroom are detailed below. • It is normally sufficient to equip the changeroom with a frisking probe for body/clothing surface monitoring. This should be located on supervised area side of the barrier, for use after crossing the barrier on exit from the controlled area. A hand monitor or hand & foot monitor may also be deemed necessary following an assessment of the potential for personal contamination. • Installed personal contamination monitoring equipment (exit monitors) should be situated in the supervised area boundary changeroom to complete the controlled area exit monitoring process. • The changeroom should have a defined exit monitoring regime with associated instructions and user training. • The detailed technical specification of contamination monitoring equipment used in the changeroom should be derived from the risk assessment and from detailed consideration of the credible range of radiological hazards associated with the area supported by the changeroom.
Toilets	• Follow good practice in section 6.2.13. Locate toilet facilities only in areas that follow final contamination monitoring.
Dosimetry Facilities	• Apply good practice principles in section 6.2.14, noting that it may be more efficient and effective to provide centralised dosimetry facilities in the supervised area boundary changeroom.
Emergency Response	• Follow good practice in section 6.2.15.

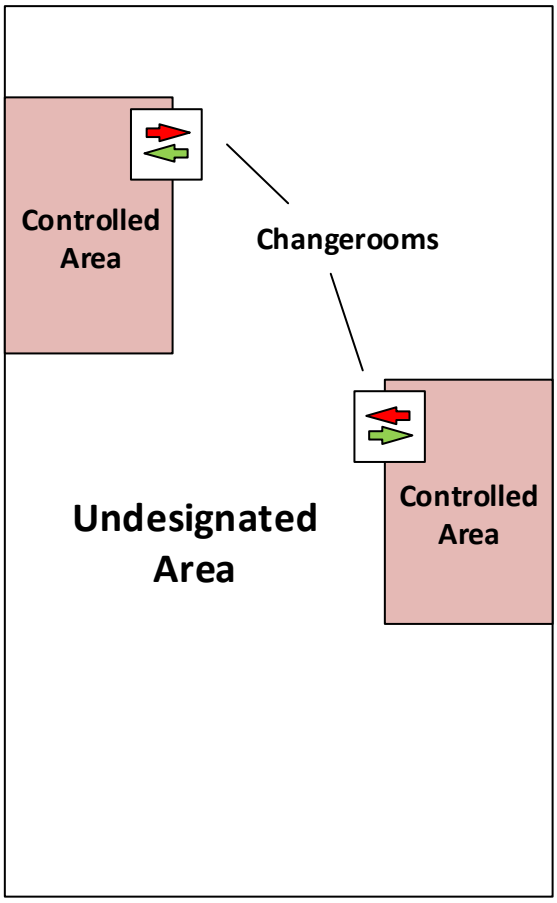
Feature	Good Practice considerations
First Aid	• Follow good practice in section 6.2.16.

8. Undesignated Area: Changerooms to Controlled Areas within

8.1 Introduction

The intent of section 8 is to define good practice with respect to the features of changerooms associated with a clean (undesignated) facility containing isolated controlled areas within it. The changeroom relevant to this plant layout is a controlled area changeroom, as shown in Figure 8 below.

Figure 8: Clean (undesignated) facility with isolated rooms as controlled areas



The principal difference between this plant layout and the ones dealt with in sections 6 and 7 is that this layout is used when there is confidence that contamination levels in the general area of the facility will remain below the level at which any radiological designation is required.

The main benefits compared to the plant layout in section 7 is that there are no radiological restrictions or controls required for access to the general area of the facility, and that it supports complete focus

on contamination control in the controlled areas and at the controlled area boundary in the changeroom.

8.2 Controlled Area Changeroom within an Undesignated Area

Since it contains the controlled area boundary the good practice features of a Main changeroom will apply in this changeroom, albeit on a smaller scale. However, as with the changeroom discussed in section 7.3, there may be justification for a small number of the features to be situated at a central location in the facility to avoid unjustified and expensive duplication.

As with the changeroom discussed in section 7.3, this type of changeroom may be also kept as an 'empty shell' and temporarily fitted with equipment as and when used. This type of changeroom should also be locked off when not in use.

The controlled area changeroom may be used to provide direct access to rooms/zones of higher contamination hazard, e.g. a classification of 'Medium' level risk. If this is to be carried out, then consideration should be given to also applying each of the good practice considerations for a sub-changeroom contained in section 6.3. A risk assessment for the operation of this type of changeroom is particularly important due to the increased contamination risk.

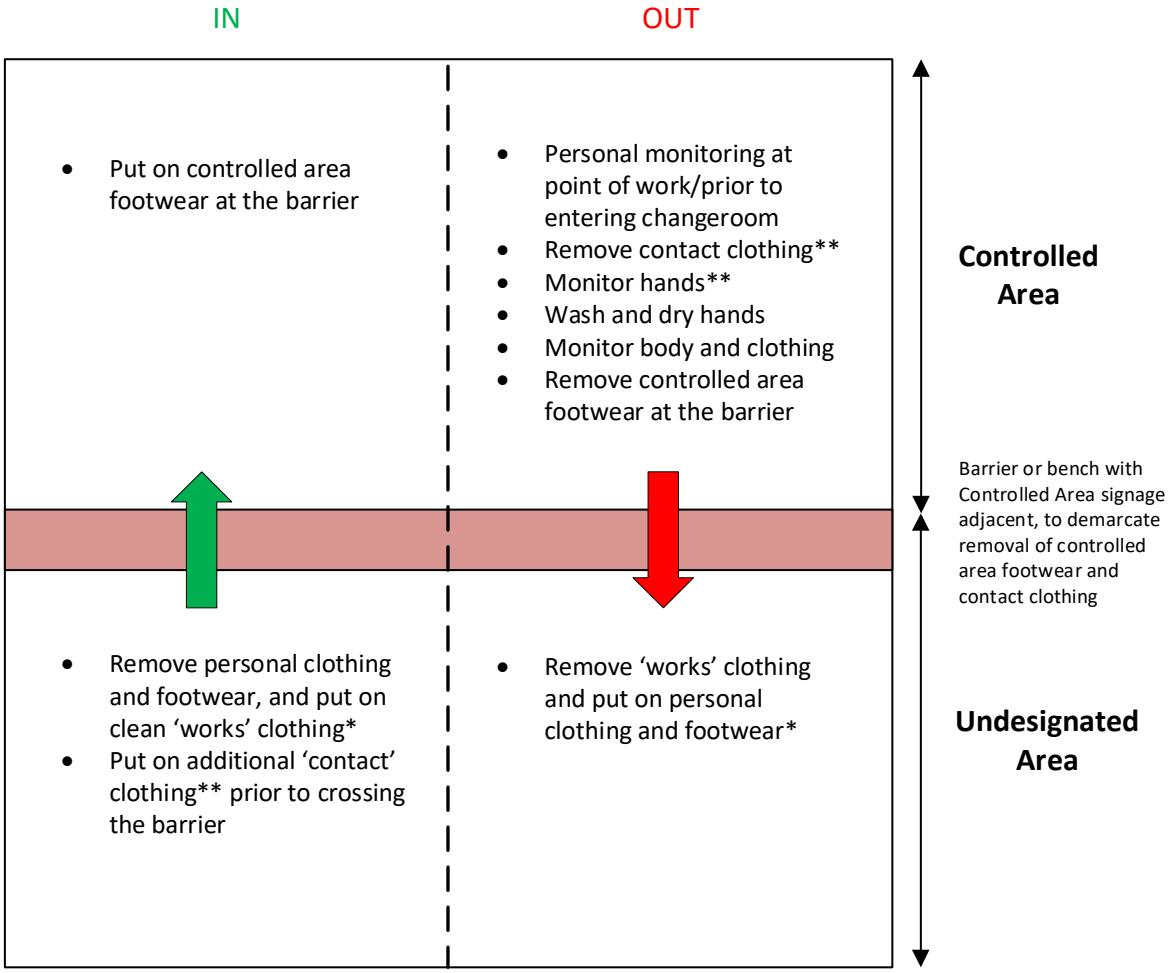
In general terms the constituent parts of a controlled area changeroom are:

- Areas where clothing or equipment to protect against radiological hazards is put on and taken off; and
- An area in which personnel monitor and wash themselves.
- *An area for personnel to put on/take off works clothing should be provided in this changeroom if not provided at a central location in the facility.*

A controlled area changeroom should not become contaminated, and controls should be implemented downstream to ensure that all areas of the changeroom, and items brought into the changeroom, maintain this condition as far as reasonably practicable.

Figure 9 provides an overview of the sequence of steps involved in the good-practice controlled area changeroom within an undesignated area.

Figure 9: Overview of controlled area changeroom within an undesignated area



*: if not done at a central location in the undesignated area
**if required by the risk assessment of the task/area

8.2.1 Good Practice Considerations for a Controlled Area Changeroom within an Undesignated Area

Good practice for this changeroom is as described in section 7.3.1, with the following key differences:

- Controlled area access and egress control should be localised to the changeroom rather than co-ordinated centrally within the undesignated area.
- Washing/drying facilities should be provided within the changeroom rather than co-ordinated centrally within the undesignated area.
- Personal contamination monitoring in the changeroom should include final exit monitoring prior to leaving the changeroom. If it is not reasonably practicable to provide installed exit monitors in the changeroom, adequate control and supervision must be in place to ensure the correct standard of exit monitoring is completed prior to leaving the changeroom.

9. Establishing a Temporary Changeroom

A risk assessment for the specification and operation of any temporary changeroom is particularly important due to the enhanced contamination risk above the normal use of that room or area.

In general, the same layout, process and good practice features of a permanent changeroom will apply to the equivalent temporary changeroom. However, the non-permanent nature of a temporary changeroom, combined with what is usually a relatively low rate of usage, means the case for implementing the same level of technology as found in the permanent changeroom is not as strong. This needs to be optimised with the ALARP considerations, ensuring that adequate arrangements are instigated for the hazards and the risk associated with its operation.

In particular, additional control and supervision will be necessary to ensure that:

- The temporary changeroom is confirmed to meet acceptable standards before authority is given to bring it into use, and
- The correct standard of contamination control is followed during its operation, and
- Appropriate contamination controls are in place and followed during its removal.

Matters that may require additional consideration within the risk assessment are as follows:

i. Suitability for the intended number of personnel
ii. The arrangements for clothing and personal storage (which may include the use of nearby facilities, remote from the changeroom)
iii. Electrical supply to support the provision of lighting, instrumentation & temperature-controlled water for hand washing
iv. The substitution of electrical hand dryers with paper towels
v. Management of liquid discharges
vi. Provision of telecommunications
vii. Airflow management to support the correct cascaded control of potentially contaminated air
viii. Suitability for supporting decontamination procedures if applicable
ix. Appointment of personnel i.e. changeroom manager and Radiation Protection Supervisor
x. Fabric of the changeroom so as to support effective cleaning
xi. Frequency of area monitoring

In considering the above elements it may be expected that the normal provisions for a dedicated changeroom cannot be automatically or reasonably provided for. Alternative arrangements will need to be considered in managing the hazards that may be reasonable only on a short-term basis only.

10. Summary of Key Points

- A changeroom should not become contaminated and controls should be implemented downstream to ensure that it maintains this condition.
- There should be an identified manager for each changeroom, with clearly defined resource and operational responsibilities, including upkeep, maintenance and supervision. Responsibilities for the management and control of any changeroom should be explicit and unambiguous.
- A changeroom must be supported by a risk assessment, as required under IRR17 and MHSWR. The risk assessment may determine that a different approach to a practice or feature described within this document is appropriate to that changeroom. In such situations that approach can be justifiably adopted.
- A suitable RPA must be consulted during application of this Good Practice Guide and on risk assessments of changerooms, particularly if a different approach to a practice or feature described within this document is being considered.
- The changeroom should be equipped to deal with all reasonably foreseeable events associated with its normal operation.
- The designer of any changeroom should ensure that there is consultation with interested parties during the design process. It may be sensible for the employer to conduct this liaison and consultation on behalf of the designer.
- Liquid effluent should be discharged via an appropriate waste stream. Effluent from decontamination should be discharged via an appropriate active waste route, whilst waste from hand washing undertaken following monitoring, should be disposed of via a suitable waste route. Advice should be sought from a suitable RWA.
- It is good practice for clearance monitoring to take place in a facility that is physically separated from the changeroom. There will be some non-clothing items such as pens, small notebooks, etc., for which equivalent procedures adopted in the changeroom can be devised and included in the Local Rules.
- If a changeroom supports or is within a contamination-controlled area, ventilation is a key consideration. The ventilation system should move potentially contaminated air from lower to higher risk areas, that is from the non-controlled area to the controlled area, or the higher hazard area in the case of a sub-changeroom. The requirement is to ensure that there is minimal risk of committed effective doses in the changeroom.
- PPE (including RPE) should be appropriately stored in a location that is easily accessible, but secure from unauthorised persons.
- It is good practice to locate toilet facilities only in areas after final contamination monitoring. Toilets should not be located within potentially contaminated areas. This ensures that any persons using the toilets after leaving potentially contaminated areas have monitored themselves and ascertained that they are free from detectable personal contamination.
- Fundamental contamination control arrangements are those associated with the barrier procedure for personnel access to and from the controlled area, or higher hazard area in the case of a sub-changeroom.
- Monitoring, washing and drying facilities in a Main changeroom should be located as close as

practicable to the boot barrier area.

- Only after monitoring has confirmed that the hands are free from contamination should they be washed within the Main changeroom. The risk assessment should determine where this monitoring is to be carried out.
- Personal monitoring serves the dual purpose of identifying radioactive contamination above defined control levels and providing an indication of a breakdown of either facility-based, or changeroom-specific controls (such as cross-contamination).
- Radiological conditions within changerooms must be kept under review in order to ensure safe operation and to detect any breakdowns in contamination control.
- It is important to recognise that radiological surveys and personal monitoring in changerooms are not a substitute for a suitable and sufficient monitoring programme of the radiological controls at source.
- It is good practice to contain and control radioactive contamination as close as possible to the point of origin. Changerooms form part of the overall contamination control regime and therefore should be located as close as practicable to the source facility or facilities.

11. Glossary

Contact clothing	Clothing worn in a controlled area where there is a risk of contamination, such as coveralls, lab coats and protective footwear.
Controlled area	An area designated by the employer in accordance with regulations 17(1) of IRR17.
Contingency plan	Pre-planned arrangements for dealing with radiation accidents.
Exit monitor/installed personal contamination monitoring equipment	Installed monitoring equipment set up to ensure operation in a pre-determined monitor/user configuration, that may also be linked with access control facilities to prohibit the exit of contaminated personnel.
Radiation accident	An event as defined by regulation 2(1) of IRR17.
Supervised area	An area designated by the employer in accordance with regulations 17(3) of IRR17.
Works clothing	Clothing, that is not ‘contact clothing’ worn for personal hygiene reasons.

12. References

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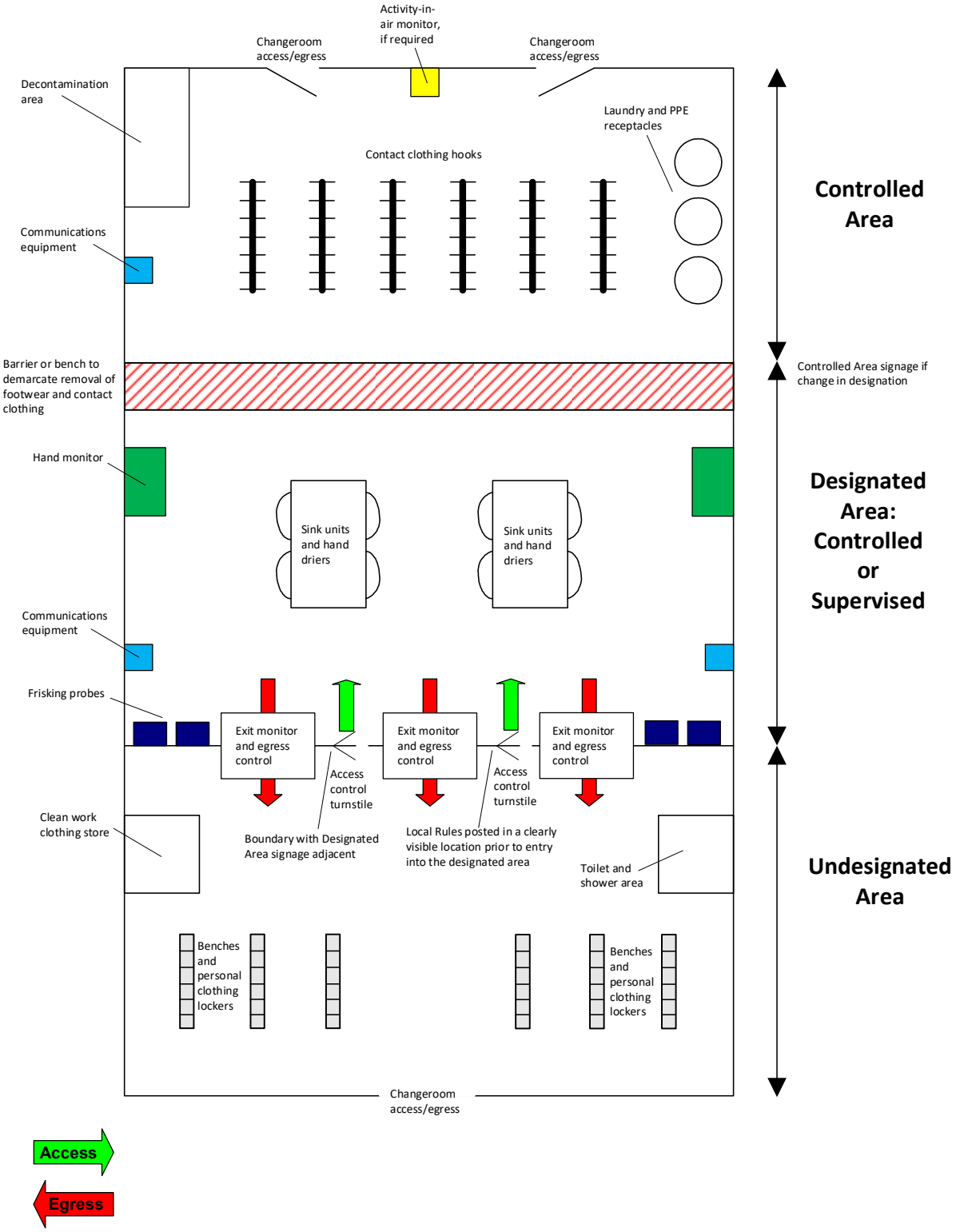
[18] The Selection of Alarm Levels for Personnel Exit Monitors, Operational Monitoring Good Practice Guide, Industry Radiological Protection Coordination Group, Interim Issue, December 2009

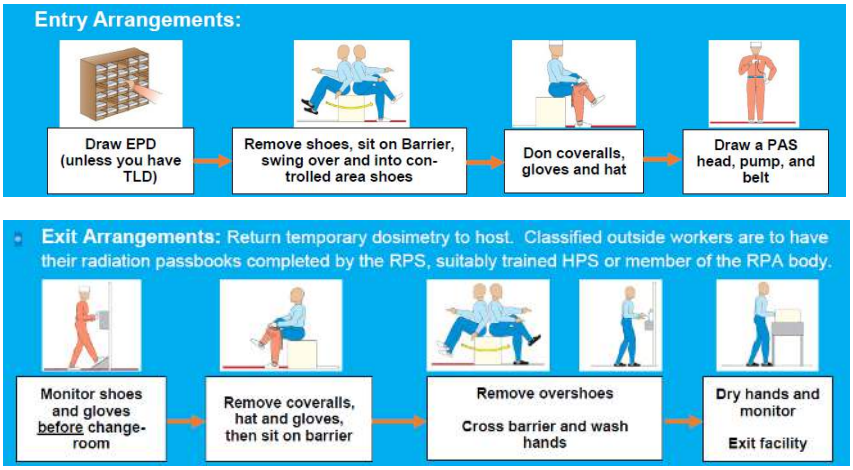
[19] National Physical Laboratory Measurement Good Practice Guide No. 29 - The Examination, Testing and Calibration of Installed Radiation Protection Instruments, Stationery Office, 2001, ISSN 1368-6550.

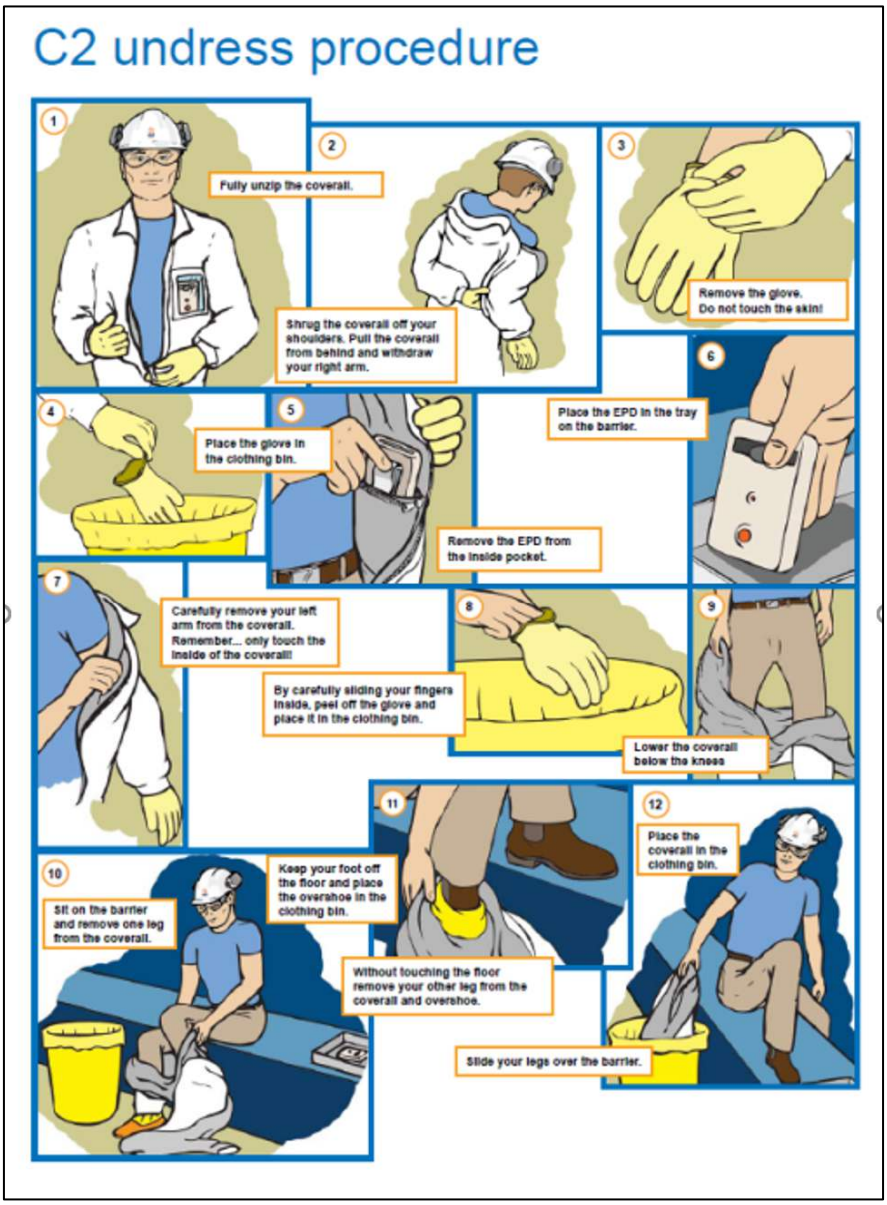
Annex A (Example Good Practice Main Changeroom)



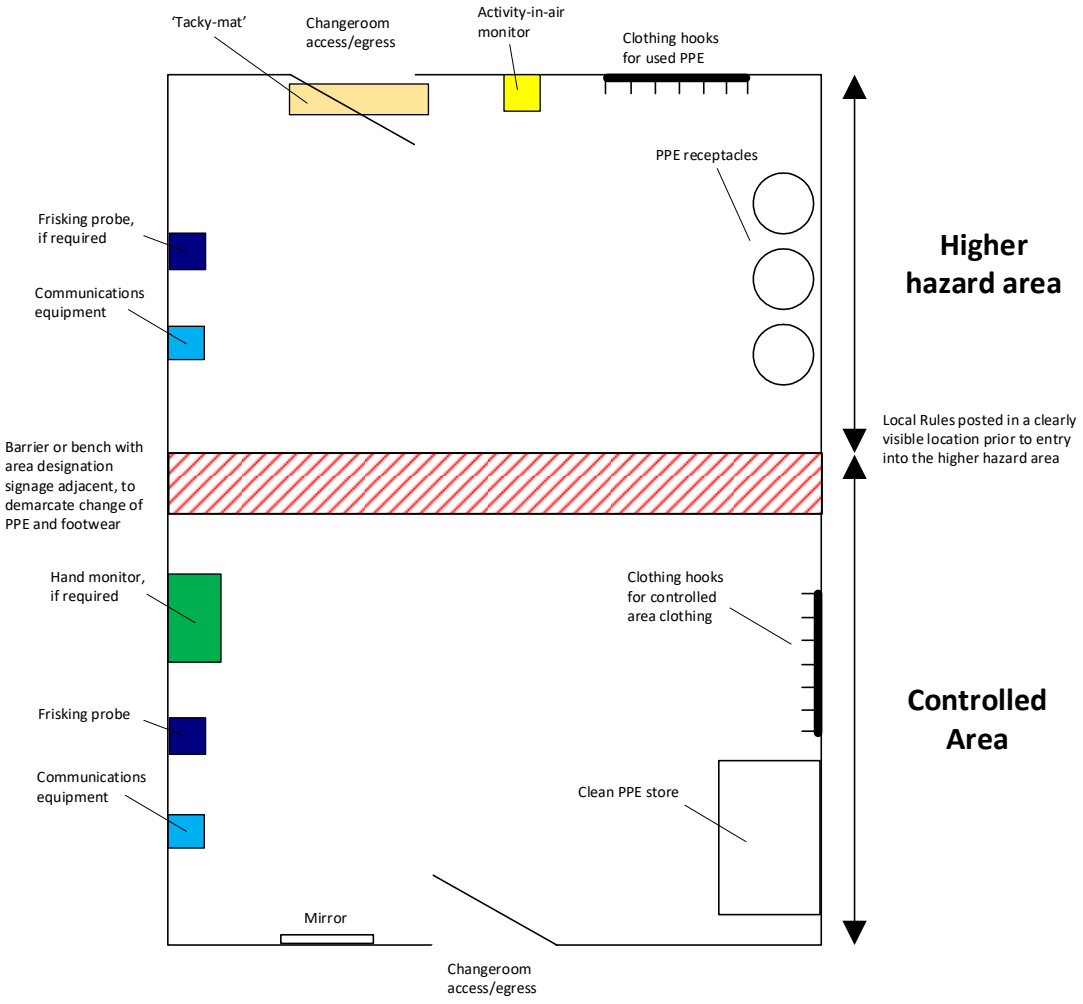
This layout is for illustrative purposes only and does not imply that this is the only acceptable layout.

Annex B (Examples of Barrier Procedure Signage)



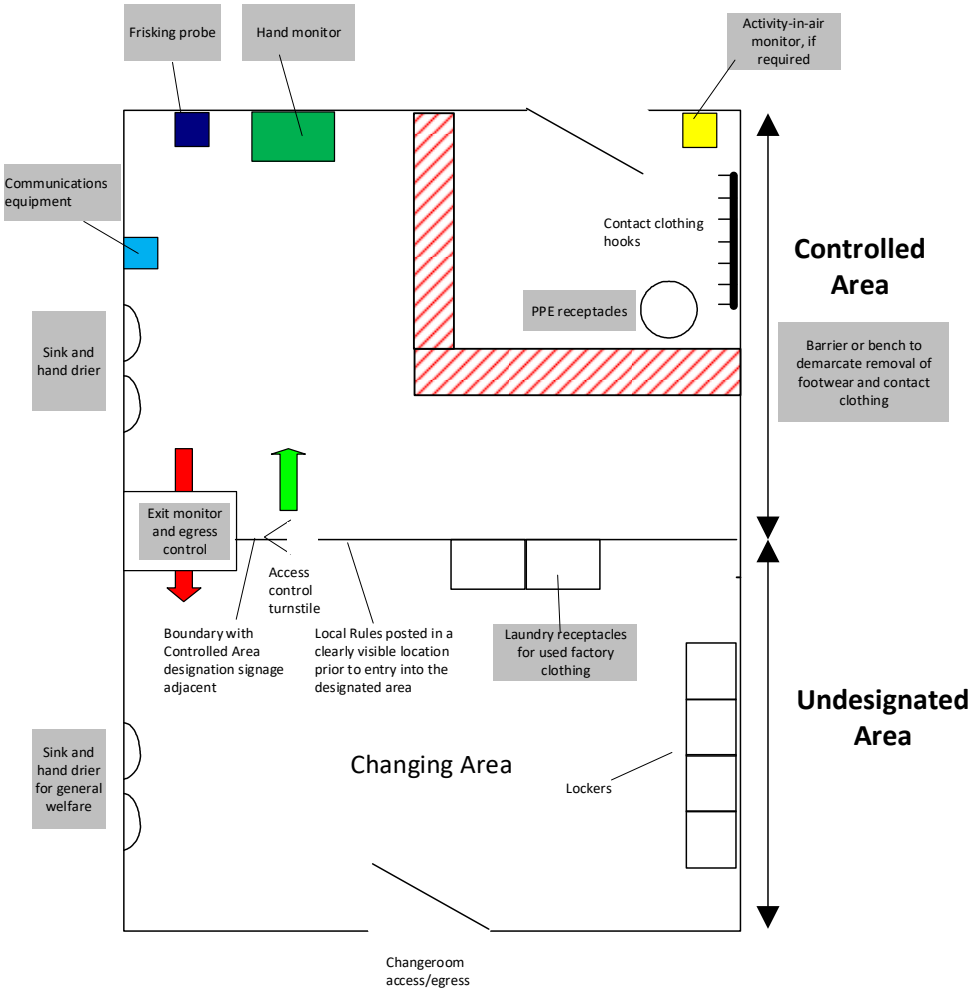


Annex C (Example Good Practice Sub-Changeroom)



This layout is for illustrative purposes only and does not imply that this is the only acceptable layout.

Annex D (Example Good Practice Controlled Area Changeroom)



The shaded boxes indicate equipment that could either be permanently installed/present, or temporarily fitted in situations where this type of changeroom is kept as an 'empty shell' and fitted with equipment as and when the changeroom is used. Additionally, the risk assessment for a temporary changeroom should consider whether alternative control measures to those illustrated above are justified for the rate of usage of that changeroom.

This layout is for illustrative purposes only and does not imply that this is the only acceptable layout.