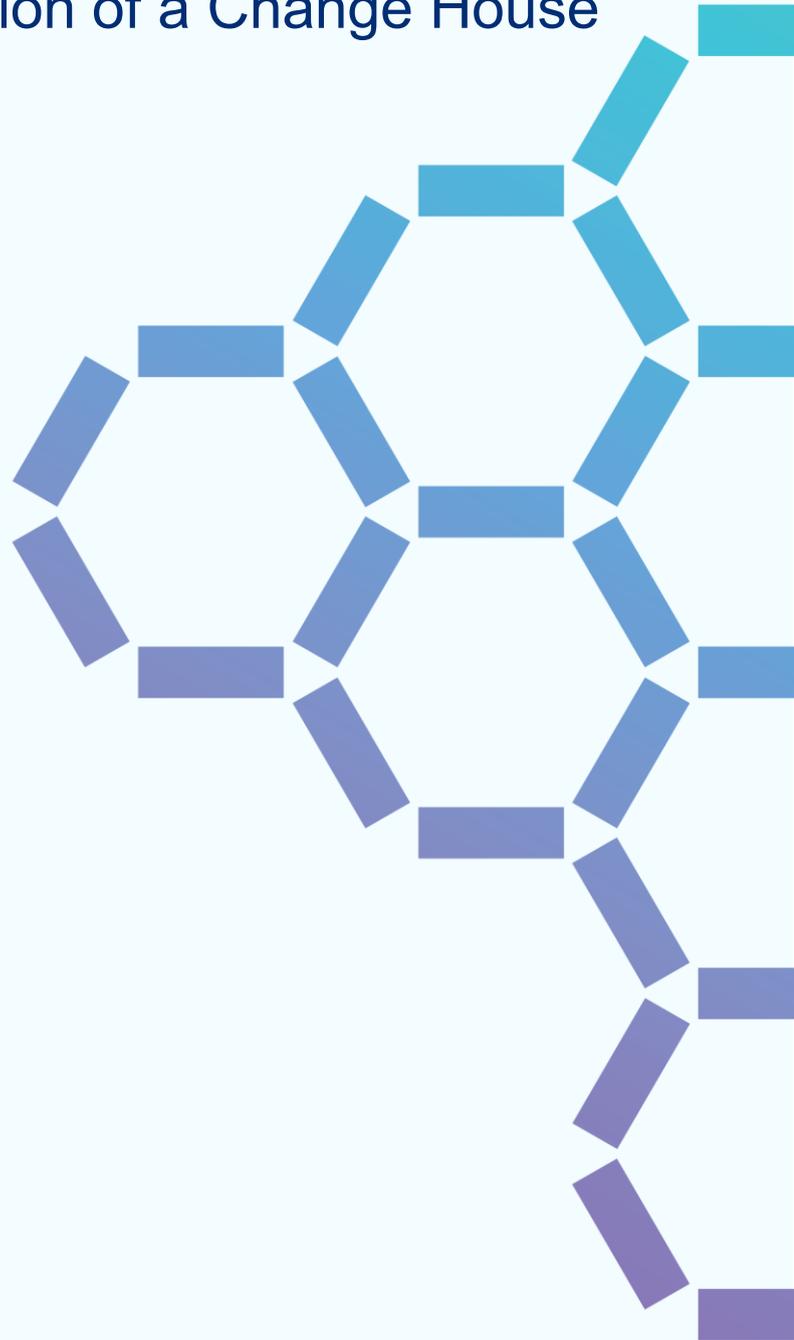


# Hydrofluoric Acid Guidance – Section K

## Layout & Operation of a Change House



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## Introduction

The Hydrofluoric Acid Sector Network of the Chemical Industries Association (CIA) has developed this Guidance. It is intended to identify best practice in the layout and running of a Change House facility on sites handling Hydrofluoric Acid where extensive use specialised Personal Protective Equipment (PPE) is used on a frequent basis. The Guidance is based upon many years of practical experience amongst member companies of the CIA HF Sector Network, and as such reflects the current best practice (at the time of publication).

It is recommended for use in conjunction with information from the supplier(s) of HF, and PPE suppliers. It is intended as a recommendation and not as a mandatory standard to which manufacturers and users of HF must adhere. As the title suggests, it provides Guidance on best practice for HF Change House facilities only. There will be variations in the applicability of this Guidance in its entirety, due to the operational and PPE requirement differences between different sites and processes. However, where there are variations then they should be locally risk assessed, and each site should adapt, develop and approve its own procedures as necessary, based on the Guidance.

The Guidance should not be used as a substitute for any applicable specific legislative requirements. Whilst all reasonable efforts have been made to ensure the accuracy of the contents and correspondence to legislative requirements at the time of publication, readers must refer to these themselves to ensure their compliance with current legal duties.

## Acronyms

HF	Hydrogen Fluoride, Hydrofluoric Acid
PPE	Personal Protective Equipment
PTW	Permit To Work

## K1 General Overview for a HF Change House

For HF Acid manufacturers and users' sites it is suggested that there is a dedicated Change House building, which provides operating and maintenance personnel working on the HF plant with facilities to don and doff the protective clothing required for HF-related tasks. The building should also accommodate equipment to neutralise, clean, dry, inspect / test, and store the protective clothing in accordance with the PPE supplier's recommendations, although the specific task of the cleaning can be undertaken at special facilities away from the Change House. Clear and controlled procedures for the handling of the potentially contaminated PPE must be in place and audited.

Where a Change House facility is provided there should be clear written procedures for its operation to ensure that HF contamination from the used PPE will not create a hazard within the Change House. Management of a Change House would normally be the responsibility of operations management, and they should ensure and maintain the discipline of all personnel involved to adhere to the procedures. Without such discipline the Change House can become an unsafe and untidy place. It is good practice to limit access to the HF Change House and plant to essential personnel only (i.e. only those required to work on the plant), and those individuals should be adequately trained on the specific procedures in line with the requirements of the following HF Guidance documents:

- CIA HF Network Guidance - Section A Training Requirements for HF Handling facilities
- CIA HF Network Guidance - Section B Personal Protective Equipment for Use at HF Handling Facilities
- CIA HF Network Guidance - Section I Emergency First Aid for HF Exposure

Where practical, controls should be in place to segregate the building into clean and contaminated areas in order to minimise the potential for HF burn related injuries as well as dedicated entrance/exit doors into/out of the building on both the clean and contaminated sides of the building. Personnel not wearing HF PPE should only use the clean door and likewise, those wearing potentially contaminated PPE should only use the door into the contaminated area.

A footbath containing a Sodium Bicarbonate solution should be provided at the entrance to the contaminated area from the plant area to allow footwear to be neutralised before re-entering the building, as well as baths for neutralising and rinsing gloves that may be contaminated prior to the wearer removing their PPE.

### K1.1 Change House Building Communication System

The Change House building should have secure established means of communication, e.g. telephone and radio, between it and other site locations such as control rooms and emergency services, as well as HF-specific First Aid kits and amenities to allow individuals to wash and shower.

### K1.2 Decontamination Procedures & Training

The individuals who undertake the decontamination of used PPE must be trained, as a minimum, to the same standard as those personnel who need to enter the HF unit, as well as in the specific written procedures for the handling, decontamination, cleaning, inspection, testing and storage of the contaminated PPE. When writing these procedures, the assistance and advice of the manufacturer of the PPE being used must be sought to ensure that the PPE is dealt with correctly to maintain the longevity and protective properties of the PPE.

## K2 Basis of Design for a Change House

**Note:** As well as the operation of such a facility, sites should also remember that there are many other requirements and assessments to be undertaken for the safe siting of occupied buildings – the CIA's *Guidance for the location and design of occupied buildings on chemical manufacturing sites*, developed by and available from the CIA, is the recognised industry standard for this.

The intention of this Guidance is to advise on what is considered to be best practice in ensuring the safety and wellbeing of all persons who need to use or work in a HF handling facility Change House. Many operations on a HF plant require PPE to be worn before tasks can be safely undertaken. The main purpose of the change facility is to allow personnel who need to wear special specific PPE to undertake tasks safely and correctly put on and remove HF-specific PPE. The design and layout of the building is a key element in ensuring the main purpose is achieved.

The building should have dedicated and segregated clean and contaminated areas, sometimes referred to as sweet (clean) and acid (contaminated) areas. The segregation between the two sides should be by a physical barrier, to remove the temptation for people to short-cut between the two sides, that still provides line-of-site. Recommended practice for this would be the use a physical barrier "pigeonholed" shelving unit (See **Appendix, Photograph 1**, for an example). This has the benefit of allowing viewing from either side into the other whilst also providing storage for personal footwear that needs to be taken off in the clean room and put back on in the contaminated room. The flooring should ideally be all on one level (no trip hazards) and made of smooth acid-resistant material, or tiling, that is easy to clean. All the in-service, cleaned and tested PPE should be on storage racks and rails in the clean side.

## K2.1 PPE Testing / Inspection & Storage Areas

There should be provision in the facility for air testing the gloves and Wellington boots to ensure they are leak-free by the intended wearer before they are used, as well as a facility to allow the Change House attendant to leak test the breathing airlines used on air-fed PPE clothing and hoods.

Either lockers or clothes pegs should be available for personal clothing and enough seating provided to allow the PPE to be put on comfortably and correctly. In order for the wearer to ensure that they have donned their PPE correctly it is deemed essential to have a full-length mirror in the clean side so they can check themselves.

## K2.2 Access & Egress

Where possible there should be a dedicated exit door from the clean side directly onto the plant area. This door should open outwards with a handle on the inner side only. This is to prevent the door being opened from the plant area that would allow persons wearing potentially contaminated PPE to re- enter the clean side of the building. Likewise, the contaminated area should also have a dedicated entrance door from the plant area. At this entrance door there should be a means of allowing persons entering the contaminated room to neutralise their footwear – ideally a metal or concrete bath on the floor containing a sodium bicarbonate solution. The bath can be outside or inside the building, but consideration of the external temperature conditions must be taken into account as during very cold spells the solution can freeze over and create slip hazards. Consideration of a means of replenishing the solution must also be included. Best practice is to have 2 ‘footbaths’ (which may effectively be sunken trays rather than full baths – see **Appendix 1 Photograph 5**) the first containing the neutralizing solution and the second clean water to remove traces of the solution from the first bath.

## K2.3 ‘Dirty Side’ Best Practice

On the inside of the contaminated room adjacent to the dirty entrance door there should be 2 wall mounted sinks to allow the wearers to neutralise and rinse their gloves as they enter the room to facilitate safe removal of their PPE. There should be adequate seating of an impervious material (easy to wash down in case of contamination) to allow the wearers to sit in order to safely and carefully remove contaminated clothing.

**Note: Personnel entering the dirty side of the Change House must not sit on the seating in contaminated PPE re potential for a burn once the PPE has been removed.**

There shall be clearly marked bins for the contaminated clothing to be placed in once removed and whilst waiting for cleaning. Cleaning should not be delayed beyond the PPE manufacturers’ recommendations as HF acid will permeate through the protective clothing.

There should be a means of contact with the plant’s main control building or emergency department in case emergency assistance is required. Ideally this should be hands-free to operate such as a speakerphone or press-to-activate radio. A fully equipped First Aid response kit (see HF Guidance I for advised contents) should be provided.

## K2.4 Decontamination & Cleaning

Depending upon the space available it may be that the decontamination and cleaning of the clothing is also carried out in the decontamination side of the Change House. Best practice would be that the decontamination and cleaning is carried out in a separate dedicated washroom (see Appendix Photograph 6 for an example). Regardless of the location of the PPE cleaning area, each PPE item will need to be neutralised in a bath of Sodium bicarbonate solution (5 – 6%W) by fully immersing and soaking for a while before being transferred into a bath of detergent for hand washing to remove residual dirt. The detergent used should comply with the PPE manufacturer’s recommendations. The temperature of the water should not exceed 30 degrees C and scouring washing powders and pads must not be used as these can damage the surface of the PPE material and increase its permeability.

Once cleaned the item is then next moved to either a rinse bath or shower to remove residual detergent and then drip dried before passing through a drying area (see **Appendix 1 Photograph 7** for an example). Thorough drying is required, and PPE must not be stored or reused until completely dry.

This is due to the hygroscopic nature of HF where any HF vapours would readily dissolve in water on the surface of the PPE resulting in PPE contamination which would not necessarily have happened if the PPE was dry.

**Note: Drying room temperature should be controlled below the specific PPE manufacturing Guidance to prevent degradation of the PPE material.**

Ideally the individual baths will be placed adjacent to each other for ease of transferring the garments through the cleaning cycle. The personnel carrying out the cleaning tasks should wear eye protection, HF resistant gloves, Wellington boots and a full neck to ankle length Neoprene apron.

Once the cleaning cycle is complete each cleaned PPE item it must be visually inspected in accordance with manufacturer’s Guidance and if still fit for use transferred back into to the clean area for re-use. Items that fail the inspection should be discarded using local waste procedures, or if viable and safe to do so, put to one side for repair. Any repairs to PPE must be recorded.

**Note: Repairs to the HF PPE must only be carried out by personnel deemed competent by the specific HF PPE manufacturer’s repair Guidance. The specific HF PPE suppliers must carry out annual training and accreditation for personnel repairing the specific HF PPE.**

Clear signage must be appropriately displayed in and around the Change House to indicate hazards (i.e. Sodium Bicarbonate solution) and to indicate location of items such as First Aid kits etc. as well as specific exit and entry doors.

Provision should be made for washing, showering and toilet facilities located separately from both the clean and contaminated rooms.

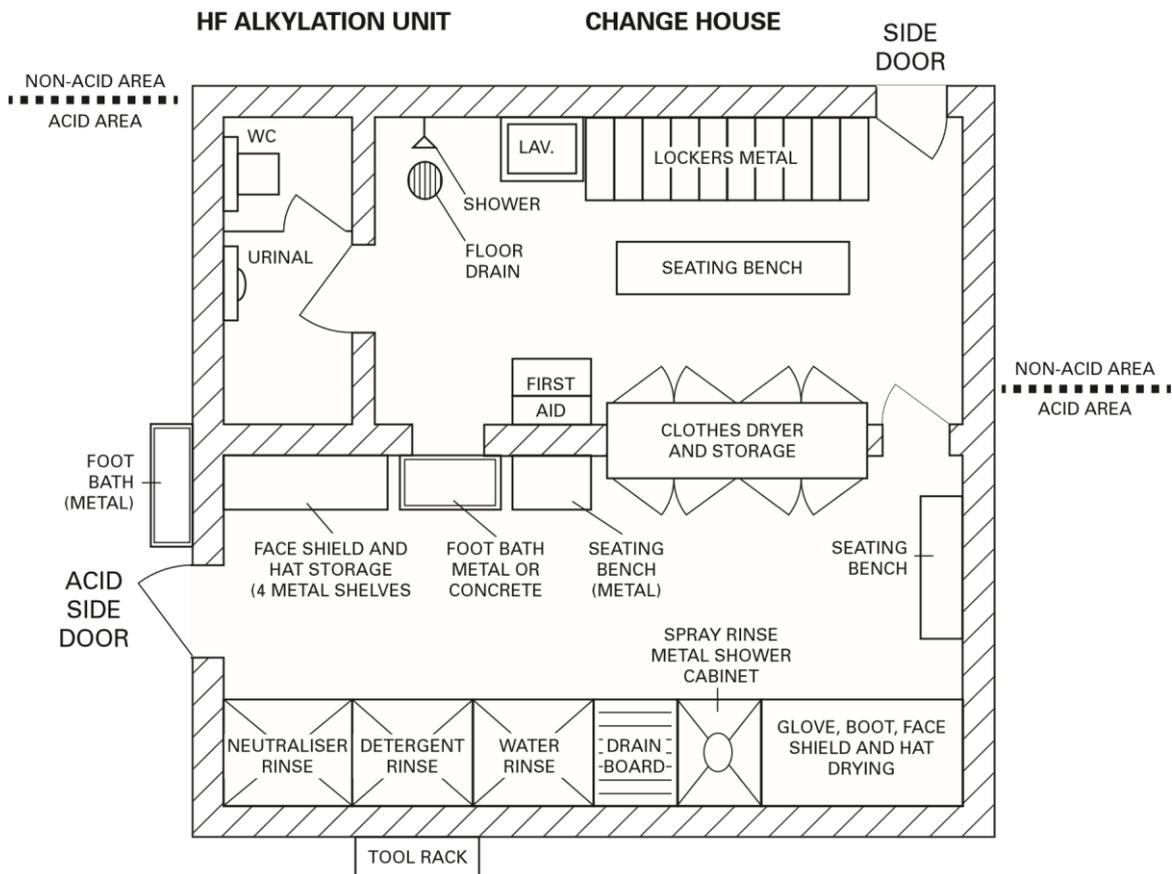


Figure 1. Example Layout of a Change House Facility

### K3 Using the Change House Facility

The intention is that, after acquiring the necessary work permit for the task to be undertaken from the work permit issuing location, persons entering the Change House in normal workwear will enter via a dedicated door directly into the clean area. Here they will select, or collect from the Change House attendant, the level of PPE as specified on the work permit. Whilst in the clean area they will visually inspect the PPE for holes, tears or rips paying particular attention to seams and zips. If any damage is identified the garments must be passed to the attendant or placed in dedicated repair bins. The selected gloves and Wellington boots should be tested with air whilst submerged in a water bath to detect any leaks (see **Appendix 1 Photographs 2, 3 & 4** for examples).

Once all the selected PPE items have been tested as fit to use then they can be donned in the correct manner – this should be covered in the unit-specific training induction. Personal items of clothing removed by the PPE wearer can be stored in lockers or on clothes pegs and normal footwear placed in the pigeonholes in the dividing wall.

**Note:** It is also advisable to have a clothing barrier between the user’s skin and the inside of the PPE.

Before leaving the clean side to go onto plant, the PPE wearer should check their clothing has been put on correctly by checking in the wall-mounted mirror. If the task to be undertaken is to be carried out by at least two workers, then they can assist each other with donning the PPE. In some classes of PPE, such as air-fed clothing or gas tight suits, this is essential. Entry to the plant area from the clean area will be via the dedicated exit door.

**Note:** On exiting the Change House, a final test should be carried out checking the seal of the gloves to the suit – this can be carried out by immersing the gloves & cuff seal into a clean water bath.

#### K3.1 Returning to The Change House & Removing PPE

When returning to the Change House entrance, this should be by the entrance door to the contaminated side only. It is good practice that when wearing air-fed clothing the wearers shower down in a dedicated shower outside the building before entering.

**Note:** After showering down, it is considered good practice to test the suit externals with pH indicator spray to confirm that the suit has

been de-contaminated.

The wearer will then step into the footbath(s) to neutralise their footwear before dipping their hands into the hand baths of neutralizing solution and rinse water. This will remove any residual contamination from the gloves to allow safe removal of the rest of the PPE.

The correct method of removing the PPE should be explicitly explained in the unit specific training induction. Extreme care and time must be taken to ensure that the person removing the PPE does not allow the PPE to come into contact with bare skin. By holding the inside of the removed PPE each item shall be placed either directly into the neutralizing solution bath or into the contaminated PPE holding bins.

Once individuals have removed their dirty PPE, they should go directly to the amenity area and thoroughly wash their hands, or shower if required, before returning to the clean area to put back on personal clothing. All individuals should then report back to the work permit issuing location to sign off the task they were undertaking.

The Change House is a potentially hazardous environment, and individuals should not use it as a place to congregate for breaks nor to consume food and beverages.

### **K3.2 Cleaning HF-Contaminated PPE**

All items of PPE that have been used MUST be considered as HF contaminated and MUST be processed through the decontamination and cleaning cycle. It is critical that all the PPE is correctly decontaminated, cleaned and inspected in line with proven written procedures to ensure the safety of all persons who need to wear the PPE. The personnel undertaking the cleaning tasks shall be trained to a very high standard in these procedures and be proven competent to carry out the cleaning. This training shall be recorded, and periodic scheduled refresher reviews should be provided, as detailed in Guidance Section A Training requirements.

The cleaning attendants must wear the specified PPE at all times when processing the worn PPE through the cleaning cycle. Care must also be taken to prevent skin coming into contact with the neutralising solutions as these in themselves can cause skin irritations / burns due to their alkaline properties.

The following is a summary of the procedure suggested for neutralising and washing used HF PPE:

- For persons wearing air fed clothing it is best practice to wash it down before entering the Change House by standing under a decontamination shower outside the Change House for a few minutes. Good practice to test the suit externals with Ph indicator spray to confirm de-contamination;
- Before entering the Change House, the footwear is neutralised in a footbath filled with a sodium bicarbonate solution;
- When entering the Change House, the PPE wearer should neutralise and rinse their gloves in the baths provided;
- Gloves should be removed after removing headwear;
- The used PPE should be carefully removed as per detailed unit-specific induction training, avoiding contact between the external potentially contaminated surface and bare skin;
- After removal, the used PPE should be immersed in the neutralizing bath, to ensure all parts have been in contact with the solution. A commonly used neutralising solution is 5- 6%W sodium bicarbonate dissolved in water;
- After neutralisation the solution should be allowed to drain off the clothing before passing the item into the detergent bath to remove dirt etc. The cleaning should be done by hand using soft cleaning cloths only;
- Once cleaned the items should then be rinsed clear of any residual detergent fluid either in a rinse bath or a spray rinse cabinet, before allowing to drip dry;
- Once drip dry all items can be placed in a drying cabinet;
- Once each clothing item is dry it should be visually inspected in line with the PPE manufacturer's guidelines before being returned to the proper storage area ready for the next use. Any defective PPE will be removed from service for either repair, if viable and safe to do, or be permanently discarded.

## K4 Role of Change House Attendant

Best practice would be for each Change House location to have a dedicated Change House Attendant, but it is also recognised that at some locations the individuals working on the unit are trained in cleaning their own PPE. However, to ensure the safe and optimum running of such a facility, certain essential tasks need to be undertaken on a very frequent basis and individuals who undertake these tasks must be trained to a very high standard. (See section K5 for training requirements).

The following are the suggested key duties of a Change House attendant:

- Neutralise, wash and dry the used PPE;
- Check the pH of the neutralizing baths, including the footbaths;
- Check and maintain the inventory of essential PPE including breathing airlines. Where necessary carry out repairs to damaged PPE in accordance with PPE manufactures guidelines and training;
- Clean the Change House floors on a daily basis;
- Clean amenity facilities on a daily basis;
- Check the operation of cleaning equipment such as rinse cabinets and dryers and report faults;
- Check the First Aid equipment in the Change House and replenish when necessary;
- Check operation of telephone/radio on a daily basis and report any faults;
- Maintain the general order and cleanliness of Change House facilities.

Change house attendants should display high personal standards of hygiene and be disciplined in following and adhering to procedures, to set an example and to ensure the safety of everyone who uses the Change House facility.

## K5 Training

### K5.1 General Requirements

All personnel who need to work on a HF handling facility / unit should be instructed in the nature of HF acid, so they know how to recognise the liquid or vapour properties of the acid, how the acid could affect them, how to use the safety equipment, and how to recognise and what to do if they come into contact with the acid. One effective way to achieve this is to make an induction film of the procedures that are required to be followed. The induction film should ideally be made at the actual site location and should be specific to local procedures.

The film should be seen by all personnel entering the HF facility and should be followed by a questionnaire or simple test to check the understanding of the material shown in the induction. It is also considered to be good practice to the donning and removal steps; this should include hands-on training and physically putting on and removing a suit in front of trained personnel. If a person has passed the HF specific safety induction, a record of their name should be made and a dated sticker handed to them, or an HF Unit Pass issued indicating when refresher training is required. This sticker or HF Unit Pass should be shown when applying for a permit to work on the HF facility. No person should be permitted access to a HF handling facility without the permission from the facilities operating team. Refer to **HF Guidance documents A, B & I** for details of the minimum level of knowledge & training required.

All training given should be recorded in appropriate registers and refresher training given at a maximum two-year interval.

### K5.2 Change House Attendant Training

Change House Attendants, or those undertaking PPE decontamination activities, **MUST** also be trained in the correct methods for progressing specialised PPE through the neutralising and cleaning cycle. The procedures written for these tasks should be done taking into consideration advice from the PPE manufacturer. Best practice would be to ask the PPE manufacturer to assist in the training of these individuals, especially if they are also to undertake repairs to the garments. A key area of this training is for the Change House Attendant to be competent in identifying when the permeability of the PPE fabric has become degraded – in which case the garment should be removed from service (i.e. when it is at the end of its life).

## K6 Auditing

In order to ensure that relevant procedures and safety standards are maintained regular auditing of the Change House, the PPE itself, and the management systems is imperative. Periodic auditing will confirm that the systems are working correctly and are being followed.

Auditing should be considered at a number of differing levels, e.g. frequent audits from within the work group and less frequent, external auditing by non-facility personnel. Additionally, the PPE manufacturer should undertake annual inspection of all of the in-service PPE to ensure that it is fit for purpose. All audits and actions generated should be fully documented with individual actions and responsibilities clearly identified and followed up.

## Appendix 1 Example Pictures of a Change House Facility



1. General layout showing an example of a 'pigeonhole' barrier between clean and dirty sides of the Change House



2. Typical glove tester to detect any leaks



3. Typical air-fed glove tester in use



4. Typical boot tester in use



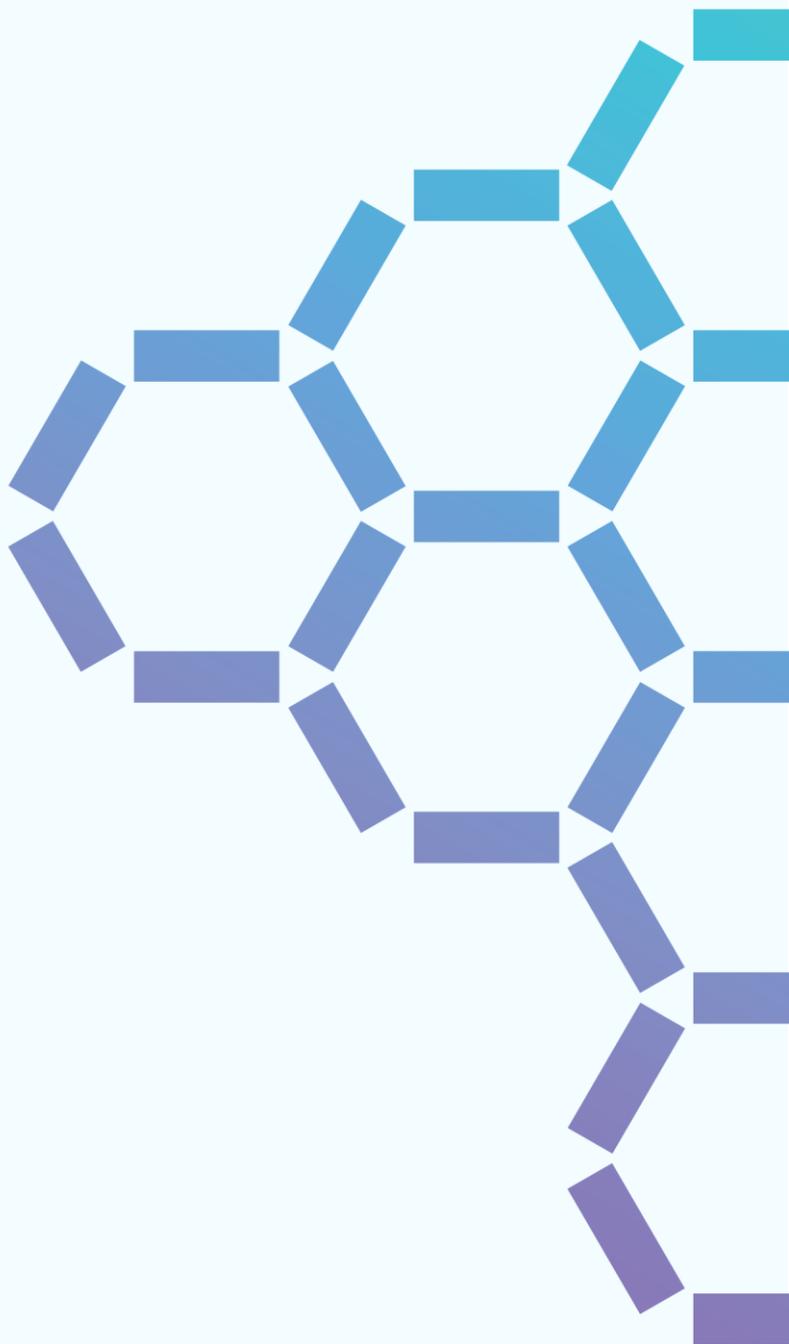
5. Footwear neutralisation bath



6. Neutralisation bath for decontaminating PPE



7. Drying room for decontaminated PPE



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