Radiopharmacy Post-Handover Validation

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CMFT – A Snapshot

- Turnover is in excess of £600 M
- Employs over 10,000 staff
- 1200 beds across sites
- Comprises of the following

Manchester Royal Infirmary
Manchester Royal Eye Hospital
Saint Mary's Hospital
Royal Manchester Children's Hospital
University Dental Hospital
Trafford Hospitals (acquired 2012)

New Hospitals Development

- The £500 million PFI (Private Finance Initiative) project is the largest ever single investment in Manchester healthcare
- Completed 2009
- 5 year building period
- 4 teaching hospitals on to one site
- New development is the size of 66 football pitches!

New Manchester Hospitals
Private Finance Initiative (PFI) Scheme

- Private Finance Initiative (PFI) schemes
  - Public Private Partnership
  - Funding of public infrastructure projects e.g. hospitals with private capital

- Catalyst Healthcare
  - Manage PFI project/consortium
  - Raise money to build hospital in form of loans and bonds
  - Hospital pays monthly payment to Catalyst over 38 years for buildings and services

- Private Finance Consortium
  - Bovis Lend Lease (Construction)
  - Sodexo (Facilities Management; e.g cleaning, estates, AHU, portering etc)
  - Vita Lend Lease (lifecycle replacement of capital equipment)
  - HSBC (Finance)

New Manchester Hospitals PFI

- Bidding Process for PFI partner – July 2000
- Bidder awarded (Catalyst) – August 2002
  - Contract signed in 2004 following Department of Health and Treasury approval
    - Building work commenced
- New hospital handover in May 2009
- Nuclear Medicine moved in June 2009
- Radiopharmacy Unit moved in November 2009

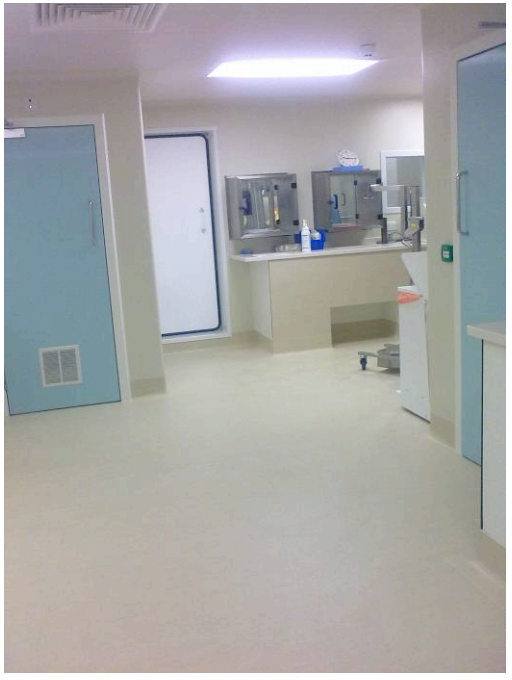
New Radiopharmacy Unit

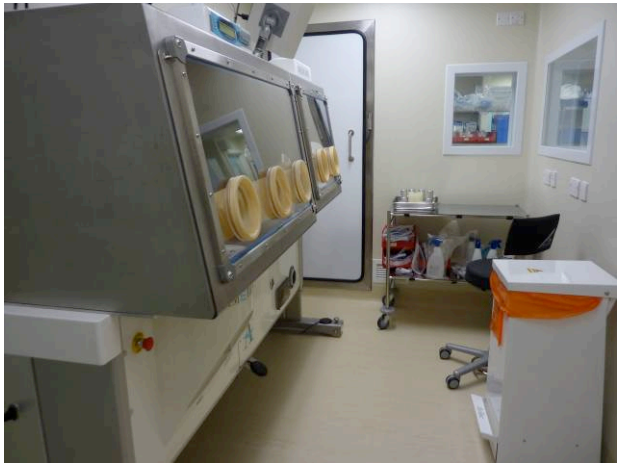
- Located within a large Nuclear Medicine Centre

- 3 EC GMP Grade B clean rooms each with separate change rooms
  - Technetium Suite
  - Blood Labelling Room
  - PET/Therapy/Clinical Trials Room
  - Large Process and Handling Area (Grade C) with change room

- Other areas (not in clean room suite)
  - Radiopharmacy Quality Control Laboratory
  - Radiopharmacy Storage Area
  - Documentation Room
  - Radioactive Materials Receipt and Dispatch Room
  - Large Nuclear Medicine in-vitro laboratory
  - Staff offices

Radiopharmacy Clean Room Suite





CMFT Clean Rooms

4 GMP Clean Room Units

- Radiopharmacy Unit
  - MHRA Manufacturer's Specials Licence and MA(IMP)
- Pharmacy Aseptic Preparation Suite
  - Section 10 Unit
- Bone Marrow Transplant (Stem Cell)
  - Human Tissue Authority (HTA) Licensed
- Eye Bank (Corneal transplant service)
  - HTA licensed

Contractor for Cleanroom Suites

- Clean Room contractor appointed by PFI Consortium
  - No experience large pharmaceutical aseptic preparation or radiopharmacy clean room builds
  - Service users recommended specialist cleanroom contractors with track record in pharmaceutical cleanroom builds
  - No NHS pharmaceutical specialist expertise input into selection of the contractor
  - Company ceased operation shortly after build

User Requirement Specification

- Developed in March 2003
  - Planning for services 6 years ahead
    - Predicting clinical workload and future services
    - Increasing ^{99m}Tc workload
      - No ^{99}Mo supply problems predicted
      - Development of PET?
      - Clinical trials?
  - Future proofing
    - Cleanrooms built to Grade B specification
      - Currently operated at Grade C and D


AMERCARE
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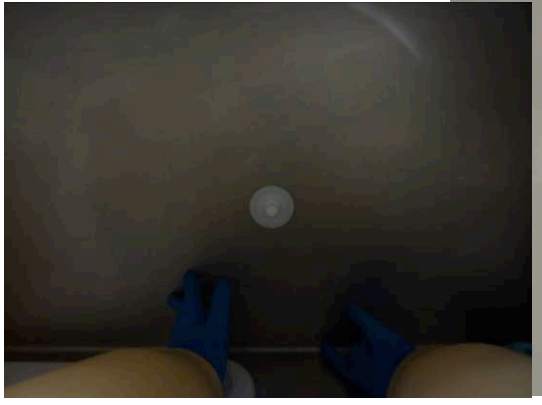
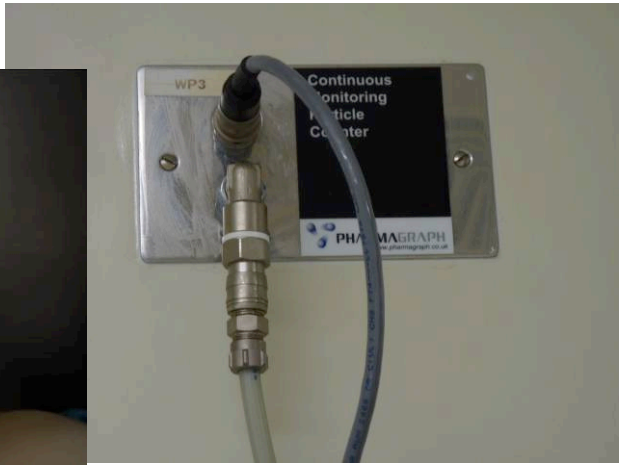
User Specification - changes

- Continuous particle monitoring
  - Installed in all Grade A and Grade B areas
  - Infrastructure in place in Grade C and D rooms
  - Very expensive to fit retrospectively





HEPA Filters: Filter Integrity Testing

- OQ carried out by recommended commissioning engineers
- HEPA H14 filters were fitted in all Grade B areas
  - Did not pass downstream penetration limits[1] (0.001%)
  - Met requirements for Grade C and D (0.01% penetration)
  - Negotiated for replacement by new ULPA U15 filters (<0.001% penetration) in Grade B areas

[1]Measurement of HEPA filter performance using the dispersed oil particle (DOP) aerosol test for leak detection in filter installations. NHS Pharmaceutical Quality Assurance Committee; April 2008

Benches – non-compliance

- Need to meet EC GMP requirements and Radiation Protection requirements

- User Specification stated: Solid Corian and coved to the wall at the back and lipped at the front
  - Trespa benching
    - more joins than Corian and was not supplied pre-formed with a coved back or lipped front
    - Coving at back and lipped front achieved by adding pieces with mastic!
    - Did not comply with EC GMP requirements and would not meet licensing requirements

Benches – back edge upstand

Benches – bench edge corner

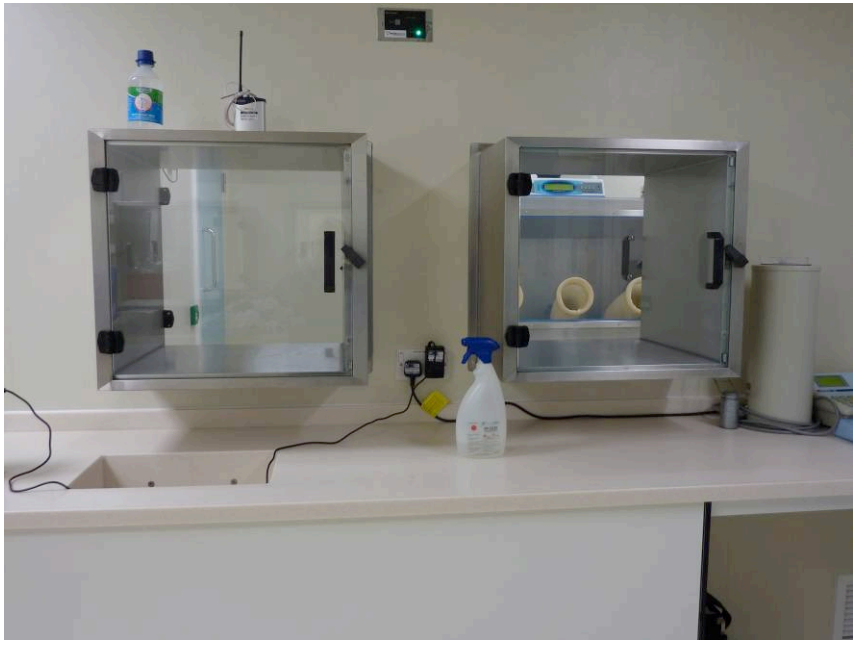
Benches - joins

Benches – under benches

Outcome - benches

- Several months delay to commissioning
- Joins between bench sections and bench and lip were difficult to decontaminate
- Trespa vs Corian
  - Trespa has more joins
    - higher risk for microbial and radioactive contamination
  - Trespa could not be supplied with pre-formed front lip or back upstand
  - Corian can be supplied preformed
    - Durable to disinfectants and easily cleaned
    - Less joins
- Agreed to refurbish benches with pre-formed Corian
  - Boxed in to provide continuous surface with flooring

Hatches



Hatches

Hatches - Generator Transfer

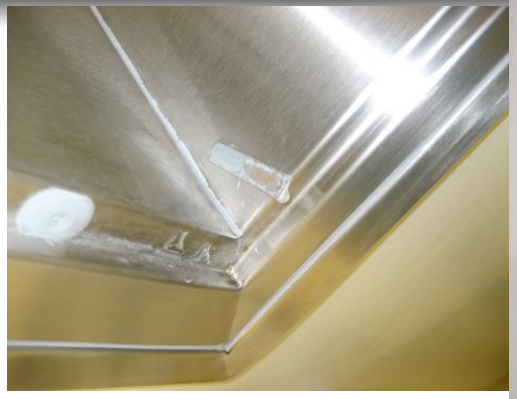
Hatches – problems

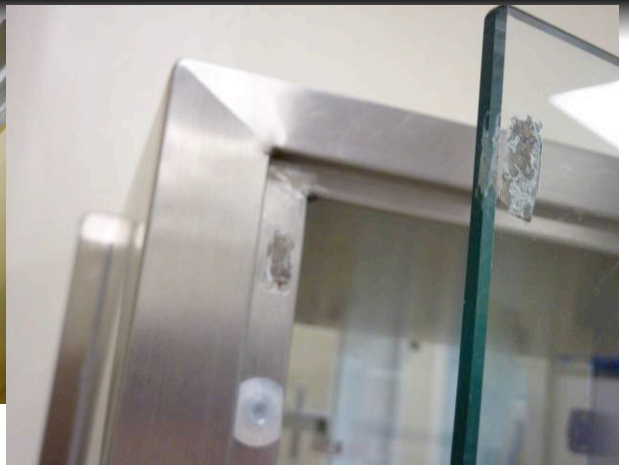
- Recommended manufacturer by Users
  - Not chosen by PFI consortium

- Poor quality
- Poorly fitted
- Interlocking system not robust
- Welding spots not cleaned and large gap between welded pieces
  - Short-term fix

- Hatches not durable and will need replacing
  - Shut-down and re-commissioning of Unit

Hatches -problems

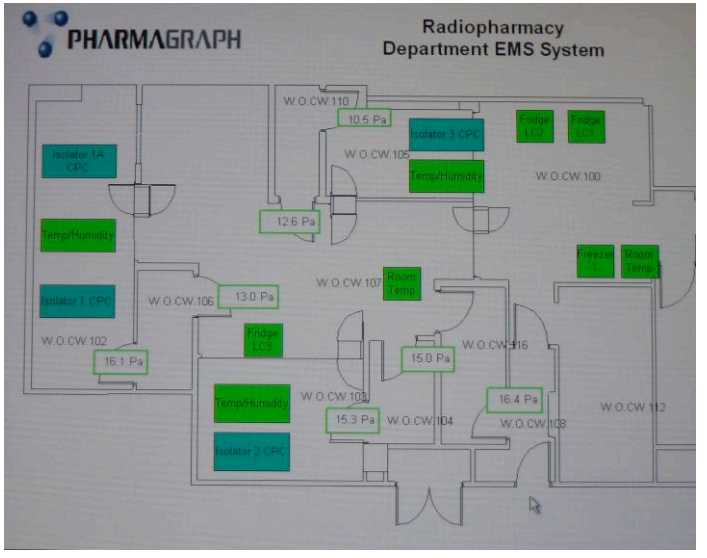




Pressure Differential Monitoring

- Magnehelic gauges and local Building Management Systems
  - Not GMP compliant
  - Not initially connected to Central BMS

- Environmental Monitoring System (EMS)
  - calibration certificates to UKAS standards
  - GMP compliant

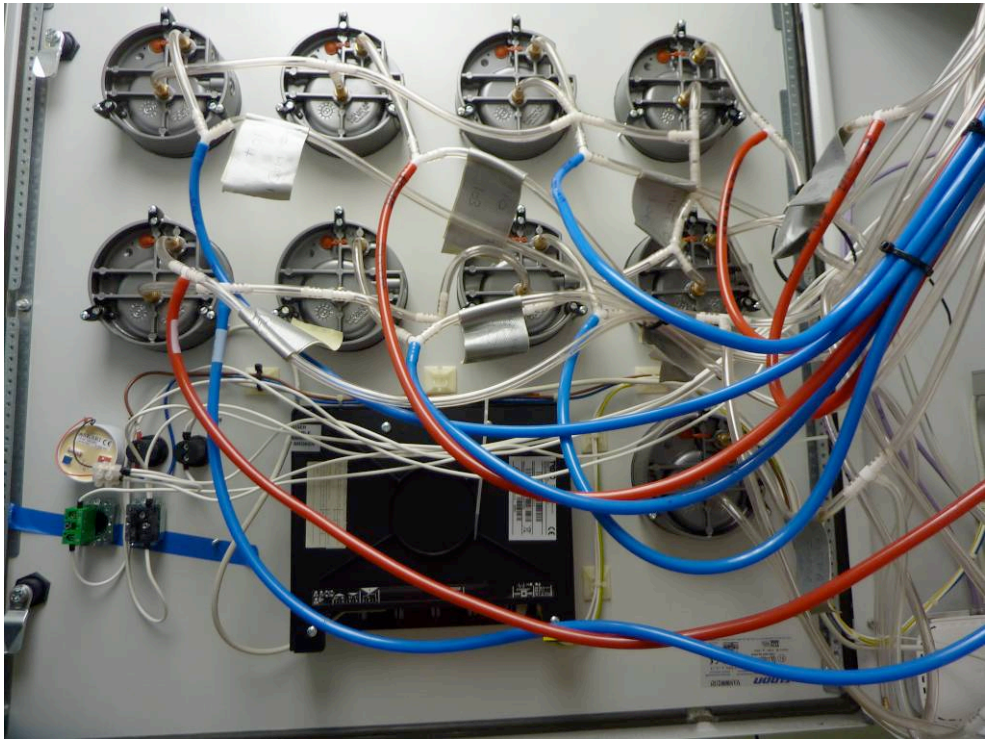


- Readings from both systems did not correlate!

- Required co-ordination between all contractors to resolve issue

Pressure differentials - Outcome

- Environmental Monitoring System
  - Correct and calibrated
- Magnehelic gauges had not been calibrated and were not fitted properly
- Tubing from Magnehelic gauges not fitted appropriately
  - Tubing partially collapsed/ kinked
  - Large number of tubing connectors not fitted correctly
    - Leakage



Critical Alarms and Isolator Extract fan

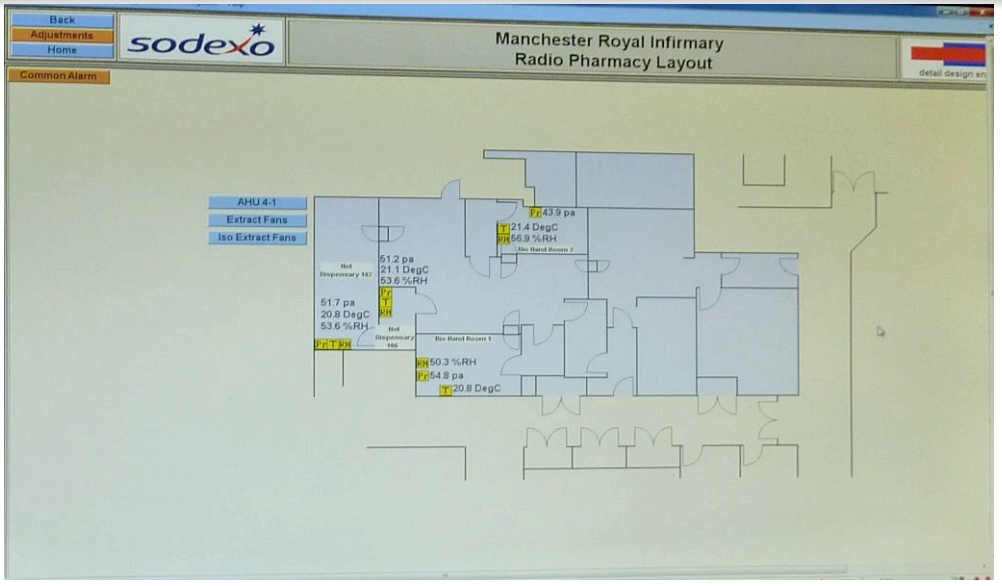
- Extract fan to technetium suite isolator failed
  - Discovered by Radiopharmacy team at 6.30 am!
  - No production run
  - Loss of patient services
  - Extract fan located on roof of building

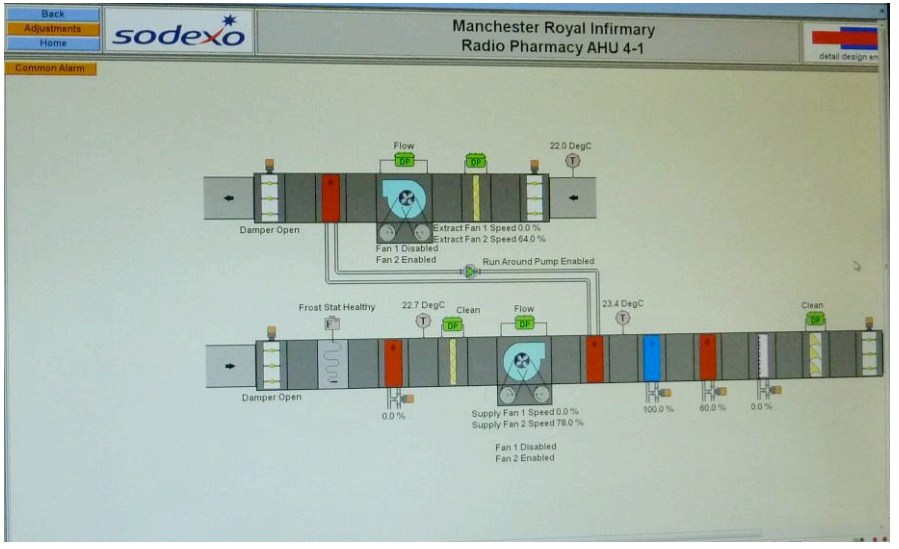
- Need to have back-up fan

- Critical alarms were not being monitored by central BMS system!

Critical Alarms

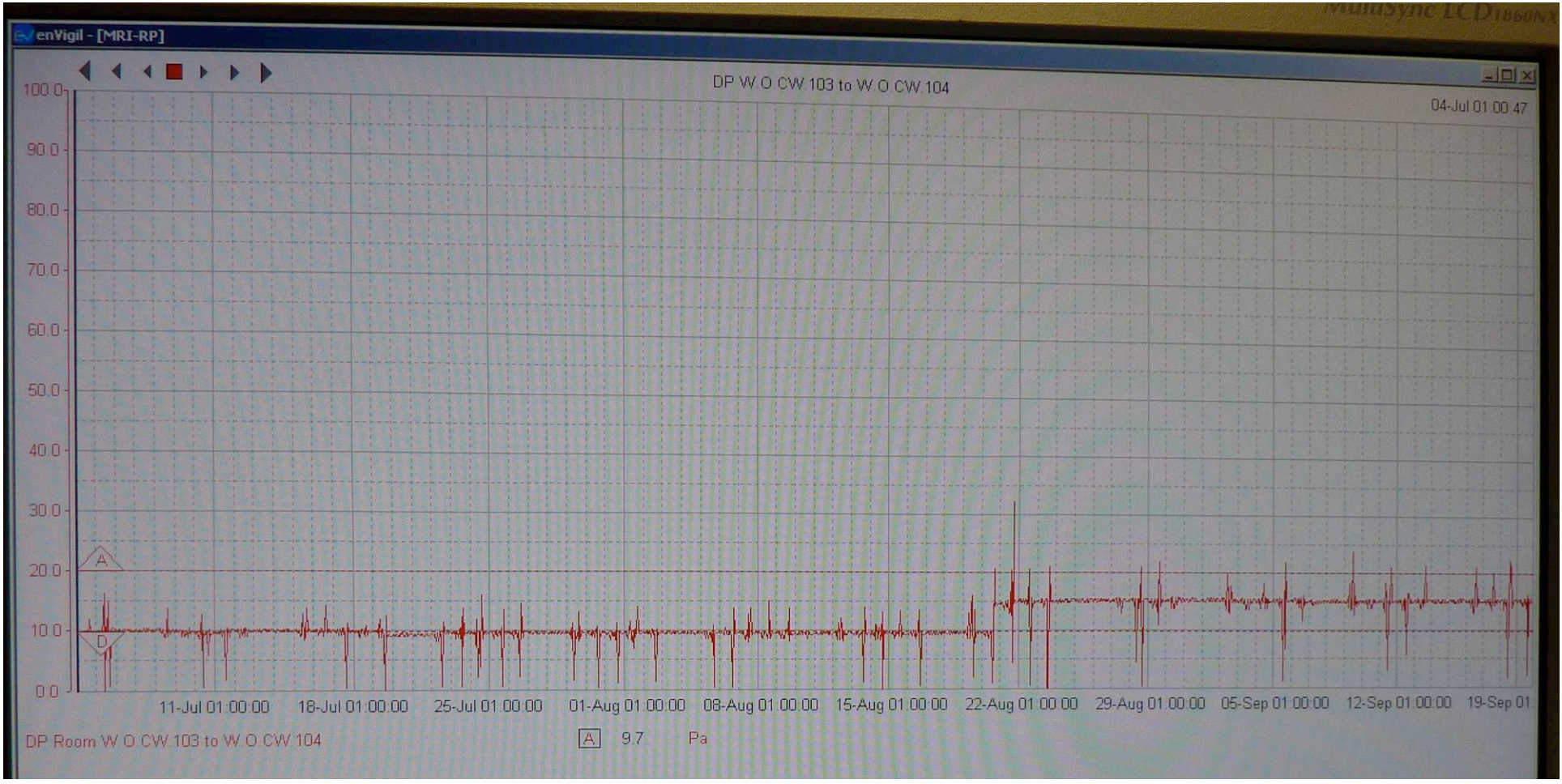
- Critical alarms for all 4 GMP cleanroom units not being monitored on central BMS system
- New IT network and software installed for remote monitoring
  - Links local BMS in each unit to central BMS
- Critical alarms now monitored remotely 24/7 by facilities management
- Local audible alarm





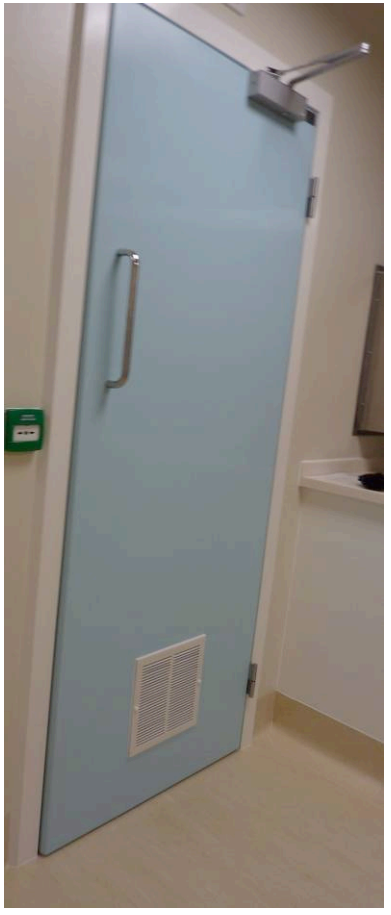
Clean Room Doors and Pressure Differential Monitoring

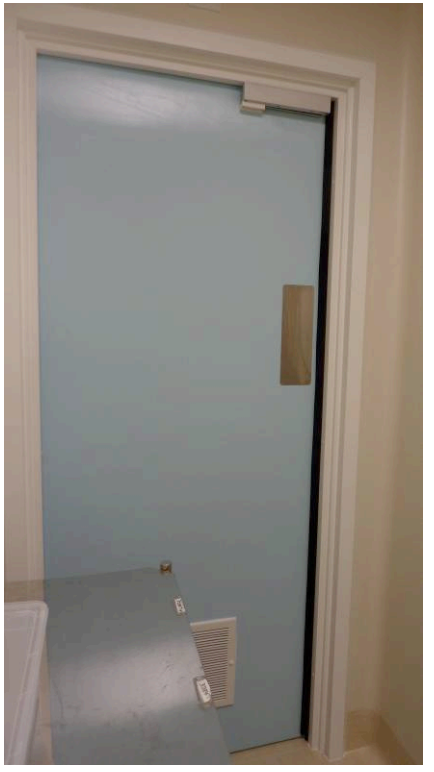
- Pressure differentials set on EC GMP minimum standards
  - 10 Pa (clean to clean)
  - 15 Pa (clean to dirty)
- Frequent alarms on EMS system as minimum standard breached
  - Needed to look at long-term solution
- Agreed that differential pressures should be set 5 pa higher than minimum standard
- Difficult to achieve for all pressures
  - Investigated door structures


enVigil - [MRI-RP]
DP W O CW 103 to W O CW 104
04-Jul 01:00:47
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
A
D
11-Jul 01:00:00
18-Jul 01:00:00
25-Jul 01:00:00
01-Aug 01:00:00
08-Aug 01:00:00
15-Aug 01:00:00
22-Aug 01:00:00
29-Aug 01:00:00
05-Sep 01:00:00
12-Sep 01:00:00
19-Sep 01
DP Room W O CW 103 to W O CW 104
A 9.7 Pa

Clean room doors/frames

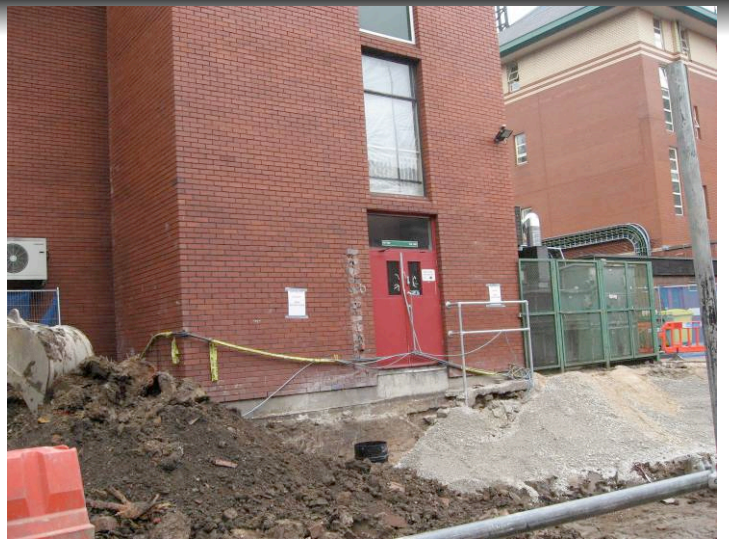
- Investigation found
  - Twisted doors within frame
    - Short-term – one or two doors can be replaced to achieve required pressure differentials
- Many doors – poorly fitted
  - Twisted frames
  - Would require shut down to rectify





Capacity Problems

- Skilled staffing levels need to be considered
  - Skilled staff providing existing service
  - Staff also required to be involved in performance qualification and transition etc
    - Difficult to recruit staff with relevant NHS pharmaceutical specialist expertise
- Nuclear Medicine moved June 2009
  - Radiopharmacy still operated from old building until November 2009
  - Pressure to move out of old Unit as space needed for new research facilities
    - Funding at risk for research laboratories
    - Not acceptable to move into sub standard facility
- Existing Unit and new Nuclear Medicine Department in different areas of hospital
  - Transport of radiopharmaceuticals across the site
  - Limited patient workload



Lifecycle and Maintenance Agreements

- Not everything owned by Hospital!
- Equipment classified into 5 groups

	Group A	Group B	Group C	Group DB	Group D
Supply	PFI	HOSPITAL	HOSPITAL	HOSPITAL	HOSPITAL
Installation/ Commissioning	PFI	PFI	HOSPITAL	PFI	HOSPITAL
Lifecycle	PFI	HOSPITAL	HOSPITAL	HOSPITAL	HOSPITAL
Maintenance	PFI	PFI	PFI	HOSPITAL	HOSPITAL

Maintenance Agreements for Equipment

Group A equipment

- e.g. Pharmaceutical isolators, AHU, EMS system

- Service User – Professional responsibility
  - Hospital holds Manufacturer's Specials and MA(IMP) Licences or has Section 10 responsibility

- PFI consortium – financial/contractual responsibility
  - Access to service reports, service agreements, amending maintenance agreements and directly controlling problems that arise can be difficult for service user
  - Should Hospital and Facilities Management/PFI both be named on maintenance agreement?

Lifecycle

- Lifecycle of Group A equipment (managed by PFI not hospital)
  - Not yet defined for specific equipment e.g. isolators, particle counters
    - Still under discussion
  - Financial burden if transferred to Hospital (Group D) responsibility
    - Facilities infrastructure managed by PFI

Upgrading Facilities

- Facilities and equipment will not last for 38 years!
  - Replace isolators (every 8-10 years?)
    - No access panels to remove from Unit
  - Hatches
    - Replacement will require shutdown
  - Flooring
    - Some minor repairs may be risk managed without requirement for shut-down
    - More intrusive work will require a shut-down
  - Regulatory changes
  - New clinical services

Upgrading Facilities - Planning

- Need to have a planned co-ordinated approach to allow minimum number shut-down periods
  - Shutdowns may be 6 months or greater
  - Re-commissioning

- Impact on patient services
  - May not be able to outsource service – or outsourcing is very limited
    - Units working to full capacity
    - Loss of Nuclear Medicine clinical services
    - Clinical management of patients
    - Increase in patient waiting times for investigations
    - Loss of income for hospitals

Upgrading Facilities – Temporary arrangements

- Temporary facilities ?
  - Expense
    - Excess of £1m
    - Planning permission
    - Licensing
    - Co-ordinated approach with all other hospital GMP units?
  - Staffing
    - Requires increased capacity

Summary

- Selection of specialist cleanroom contractor
  - Assessment of their experience with pharmacy and radiopharmacy cleanrooms
  - NHS pharmaceutical expertise input into the process
- EC GMP standards
  - Building to minimum standards will lead to problems
- Staffing Capacity
  - Needs planning
  - Adequate resourcing
- Lifecycle /Maintenance contracts
  - How managed by hospital and PFI consortium
- Refurbishment and Upgrading Facilities
  - Impact on patient services