



Public Health
England

Criteria in Considering Barrier Options in High-Containment

Heather Sheeley, Public Health England
Randy Kray, HOK

57th ABSA Conference in San Diego,



Public Health
England

Background

PHE are looking to replace ageing high containment facilities.

Working with designers.

Evaluation options.





Public Health
England

Barriers

Physical Barrier: to resist impact, hold up structure

Containment barrier; to seal around the containment envelope for fumigation and protect the environment.

The containment barrier -“envelope” internal surface.



Conventional Approach

While there is published guidance on design, layout and finishes of containment facilities there is little on construction materials most references especially in US are that of concrete and as such little else has been considered yet across the world there are different construction strategies.

Box with a box

Monolithic, smooth impervious surfaces, easy to clean and sealed penetrations



52 Performance Criteria

Functional Criteria: pertaining to the barrier's duties for security, containment, room fumigation and occupant's needs: anti-fungal, cleavability, chemical resistance, corrosion resistance, airtightness, impact resistance, force protection, acoustics, fire safety, appearance and structural capability

Operational Criteria: pertaining to the barrier's impact on operations and whole life costs: durability, maintainability, service flexibility, adaptability, sustainability.

Project Criteria: pertaining to the barrier's profile in terms of construction: budget: cost, timeline, constructability, commissioning, service integration, performance history



Six systems

**Reinforced
Concrete with
high performance
coating**

**Masonry with
plaster and high
performance
coating**

**Plasterboard with
high performance
coating**

**Mild steel with
high performance
coating**

**Glass reinforced
Panel**

**Stainless Steel
Panel**



Examples of tabulated data

PERFORMANCE CRITERIA MEASURES

Barrier Performance Criteria	Basis of Need	Item Ref	Name	Criteria
<i>A. Functional Criteria</i>				
1. Anti-Microbial	Should not support fungal and mould growth Should help control microbial growth	A1.1	Basic Material Consideration	Product review to confirm elements potentially exposed to contamination are not organic or capable of supporting microbial colonization
2. Cleanable	Make easy decontamination of barrier surfaces by validated methods	HSE ACDP - CL4 Table 2	Containment Measures	Surfaces impervious to water and easy to clean.
		HSE ACDP - CL4 216	Principal Requirements: Windows	Windows should be sealed and of non-opening design, and designed to avoid crevices or recesses that may be difficult to clean or seal.
		HSE ACDP - CL4 221	Principal Requirements: Walls	Walls must be smooth and easy to clean.
		URS-520.4.25.4.05	Facility Operational Principals - Fabrics and Finishes - Walls and Ceilings	All surfaces are required to be fully smooth washable and wipeable with chemical disinfectants including dilute sodium hypochlorite. All surfaces, corners and wall junctions should facilitate easy cleaning. The surfaces should harbour no crevices or fixtu
3. Chemical Resistance	Surfaces must not degrade over its full life cycle by contact with experimental and decontamination chemicals and gaseous agents	HSE ACDP - CL4 Table 2	Containment Measures	Surfaces resistant to acids, alkalis, solvents, disinfectants.
		HSE ACDP - CL4 221	Principal Requirements: Walls	Walls should be resistant to liquids and disinfectants in common use (including fumigants) in the laboratory.
		HSE ACDP - CL4 222	Principal Requirements: Walls	Materials should be resistant to the normally used disinfectants, detergents, acids, alkalis, solvents or other chemical preparations. Junctions of the walls with the ceiling and floor should be covered for easy decontamination.
		URS-520.4.10.02	Facility Operational Principals - Fumigation	All materials and finishes within areas requiring fumigation shall be compatible with frequent and regular fumigation at decontamination concentrations using Hydrogen Peroxide or Formaldehyde
		URS-520.4.25.4.05	Facility Operational Principals - Fabrics and Finishes - Walls and Ceilings	All surfaces are required to be fully smooth washable and wipeable with chemical disinfectants including dilute sodium hypochlorite. All surfaces, corners and wall junctions should facilitate easy cleaning. The surfaces should harbour no crevices or fixtu
		URS-520.4.25.4.15	Facility Operational Principals - Fabrics and Finishes - Walls and Ceilings	Containment area surfaces should have impervious chemically resistant finishes.
		ASTM D 1308-87	Test – Covered Spot Test – OpenSpot	Resistant to disinfectant gases and liquids and laboratory chemicals listed in Section 01640. Test resistance according to ASTM D1308-87 covered and open spot test. Acceptable resistance shall be minimal discoloration or change in gloss, no blistering, softening, swelling, or loss of adhesion.



Examples of tabulated data

SAMPLE SYSTEM SCORING SUMMARY

Scoring Method:			Monolithic Concrete with Special Coating	Masonry Units with Special Coating	High Performance Lining with Special Coating	Mild Steel Panel with Special Coating	Fiberglass Reinforced Composite Panel	Stainless Steel Panel
<p>3. System exceeds project requirements</p> <p>2. System meets all project requirements</p> <p>1. System does not meet the higher requirement performance range but does not present a health or safety risk</p> <p>0. System does not meet project requirements</p>								
Barrier Performance Criteria	Name							
A. Functional Criteria								
1. Anti-Microbial	A1.1	Basic Material Consideration	2	2	2	2	3	2
2. Cleanability	HSE ACDP - CL4 Table 2	Containment Measures	2	2	2	2	2	2
	HSE ACDP - CL4 216	Principal Requirements: Windows	1	1	1	1	2	2
	HSE ACDP - CL4 221	Principal Requirements: Walls	2	2	2	2	2	2
	URS-520.4.25.4.05	Facility Operational Principals - Fabrics and Finishes - Walls and Ceilings	2	2	2	2	2	2
3. Chemical Resistance	HSE ACDP - CL4 Table 2	Containment Measures	2	2	2	2	2	2
	HSE ACDP - CL4 221	Principal Requirements: Walls	2	2	2	2	2	2
	HSE ACDP - CL4 222	Principal Requirements: Walls	2	2	2	2	2	2
	URS-520.4.10.02	Facility Operational Principals - Fumigation	2	2	2	2	2	2
	URS-520.4.25.4.05	Facility Operational Principals - Fabrics and Finishes - Walls and Ceilings	2	2	2	2	2	2
	URS-520.4.25.4.15	Facility Operational Principals - Fabrics and Finishes - Walls and Ceilings	2	2	2	2	2	2
4. Corrosion Resistant	A4.1	Historical Performance	2	2	2	0	2	2
5. Airtightness	HSE ACDP - CL4 220	Principal Requirements: Walls	3	1	1	2	3	3
	HSE ACDP - CL4 246	Principal Requirements: Disinfection	3	1	1	2	3	3
	HSE ACDP - CL4 248	Principal Requirements: Disinfection	3	1	1	2	3	3
	URS-520.4.06.3.	Facility Operational Principals - Sealability	3	1	1	2	3	3
	URS-520.4.06.4	Facility Operational Principals - Sealability	3	1	1	2	3	3



Examples of tabulated data

PERFORMANCE CRITERIA COMPARATIVE ANALYSIS

Sum of Scores System/Criteria	Scoring					TBC	Total Score
	0	1	2	3			
1. Monolithic Concrete with Special Coating		4	66	39			109
A. Functional Criteria		2	32	39			73
B. Operational Criteria		1	24				25
C. Project Criteria		1	10				11
2. Masonry Units with Special Coating		10	80				90
A. Functional Criteria		9	44				53
B. Operational Criteria			26				26
C. Project Criteria		1	10				11
3. High Performance Lining with Special Coating	0	18	58	3			79
A. Functional Criteria	0	10	40				50
B. Operational Criteria		6	12	3			21
C. Project Criteria	0	2	6				8
4. Mild Steel Panel with Special Coating	0	6	80		0		86
A. Functional Criteria	0	4	48		0		52
B. Operational Criteria		2	22				24
C. Project Criteria	0		10				10
5. Fiberglass Reinforced Composite Panel		3	54	60			117
A. Functional Criteria			40	33			73
B. Operational Criteria		1	12	18			31
C. Project Criteria		2	2	9			13
6. Stainless Steel Panel		1	68	42	0		111
A. Functional Criteria			42	27	0		69
B. Operational Criteria		1	20	6			27
C. Project Criteria			6	9			15

- Scoring Method:
- 3 System exceeds project requirements
 - 2 System meets all project requirements
 - 1 System does not meet the higher requirement performance range but does not present a health or safety risk
 - 0 System does not meet project requirements



Public Health
England

Weighting on Criteria

Absence of data

Subjectiveness vs professional judgement

Project risk tolerance

Advantages and disadvantages and performance summaries for each system tabulated and **debated**



Examples of tabulated data

SYSTEM SCORING SUMMARY

Scoring Method:			Monolithic Concrete with Special Coating	Masonry Units with Special Coating	High Performance Lining with Special Coating	Mild Steel Panel with Special Coating	Fiberglass Reinforced Composite Panel	Stainless Steel Panel
<p>3. System exceeds project requirements</p> <p>2. System meets all project requirements</p> <p>1. System does not meet the higher requirement performance range but does not present a health or safety risk</p> <p>0. System does not meet project requirements</p>								
Barrier Performance Criteria	Name							
A. Functional Criteria								
1. Anti-Microbial	A1.1	Basic Material Consideration	2	2	2	2	3	2
2. Cleanability	HSE ACDP - CL4 Table 2	Containment Measures	2	2	2	2	2	2
	HSE ACDP - CL4 216	Principal Requirements: Windows	1	1	1	1	2	2
	HSE ACDP - CL4 221	Principal Requirements: Walls	2	2	2	2	2	2
	URS-520.4.25.4.05	Facility Operational Principals - Fabrics and Finishes - Walls and Ceilings	2	2	2	2	2	2
3. Chemical Resistance	HSE ACDP - CL4 Table 2	Containment Measures	2	2	2	2	2	2
	HSE ACDP - CL4 221	Principal Requirements: Walls	2	2	2	2	2	2
	HSE ACDP - CL4 222	Principal Requirements: Walls	2	2	2	2	2	2
	URS-520.4.10.02	Facility Operational Principals - Fumigation	2	2	2	2	2	2
	URS-520.4.25.4.05	Facility Operational Principals - Fabrics and Finishes - Walls and Ceilings	2	2	2	2	2	2
	URS-520.4.25.4.15	Facility Operational Principals - Fabrics and Finishes - Walls and Ceilings	2	2	2	2	2	2
4. Corrosion Resistant	A4.1	Historical Performance	2	2	2	0	2	2
5. Airtightness	HSE ACDP - CL4 220	Principal Requirements: Walls	3	1	1	2	3	3
	HSE ACDP - CL4 246	Principal Requirements: Disinfection	3	1	1	2	3	3
	HSE ACDP - CL4 248	Principal Requirements: Disinfection	3	1	1	2	3	3
	URS-520.4.06.3.	Facility Operational Principals - Sealability	3	1	1	2	3	3
	URS-520.4.06.4	Facility Operational Principals - Sealability	3	1	1	2	3	3



Examples of tabulated data

SYSTEM SCORING SUMMARY

Scoring Method:			Monolithic Concrete with Special Coating	Masonry Units with Special Coating	High Performance Lining with Special Coating	Mild Steel Panel with Special Coating	Fiberglass Reinforced Composite Panel	Stainless Steel Panel
<p>3. System exceeds project requirements</p> <p>2. System meets all project requirements</p> <p>1. System does not meet the higher requirement performance range but does not present a health or safety risk</p> <p>0. System does not meet project requirements</p>								
Barrier Performance Criteria	Name							
A. Functional Criteria								
1. Anti-Microbial	A1.1	Basic Material Consideration	2	2	2	2	3	2
2. Cleanability	HSE ACDP - CL4 Table 2	Containment Measures	2	2	2	2	2	2
	HSE ACDP - CL4 216	Principal Requirements: Windows	1	1	1	1	2	2
	HSE ACDP - CL4 221	Principal Requirements: Walls	2	2	2	2	2	2
	URS-520.4.25.4.05	Facility Operational Principals - Fabrics and Finishes - Walls and Ceilings	2	2	2	2	2	2
3. Chemical Resistance	HSE ACDP - CL4 Table 2	Containment Measures	2	2	2	2	2	2
	HSE ACDP - CL4 221	Principal Requirements: Walls	2	2	2	2	2	2
	HSE ACDP - CL4 222	Principal Requirements: Walls	2	2	2	2	2	2
	URS-520.4.10.02	Facility Operational Principals - Fumigation	2	2	2	2	2	2
	URS-520.4.25.4.05	Facility Operational Principals - Fabrics and Finishes - Walls and Ceilings	2	2	2	2	2	2
	URS-520.4.25.4.15	Facility Operational Principals - Fabrics and Finishes - Walls and Ceilings	2	2	2	2	2	2
4. Corrosion Resistant	A4.1	Historical Performance	2	2	2	0	2	2
5. Airtightness	HSE ACDP - CL4 220	Principal Requirements: Walls	3	1	1	2	3	3
	HSE ACDP - CL4 246	Principal Requirements: Disinfection	3	1	1	2	3	3
	HSE ACDP - CL4 248	Principal Requirements: Disinfection	3	1	1	2	3	3
	URS-520.4.06.3.	Facility Operational Principals - Sealability	3	1	1	2	3	3
	URS-520.4.06.4	Facility Operational Principals - Sealability	3	1	1	2	3	3



Conclusions 1 – choosing a system

No one system presents an unequivocal advantage

Greater performance increased cost – so value for money

Two options were then determined, for this project, R /Concrete and masonry





Conclusion 2 – was the exercise useful?

Helped inform decision that may have been against the flow

Established risk understanding and therefore control in the project

Reduced the commercial risk especially around integration

Defendable design that had to balance many factors such as flexibility, reliability, usability, maintainability etc.

Appreciation of other systems and where and when they could be used.



Delivery is
proof of the
pudding!



Acknowledgements

Randy Kray & Chirag Mistry, Shem Sacewicz, HOK, and Anthony Fuller, WYG

ARUP (London)

PHE Science Hub team

