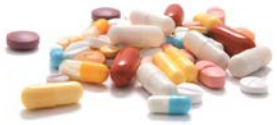


EXPERT
SANTÉ CANADA
MAPAQ

Cleanrooms, HVAC, Layouts
from Design to Validation
ISO-14644

PBE-Expert Inc – CANADA

Training Company Agreement CPMT #0059104

Qualified MAPAQ Consultant

At the measure 2 of the Levier Program

PBE, Training Company Agreement **CPMT** #0059104

Commission des partenaires du marché du travail
Québec

CERTIFICAT D'AGRÉMENT

Loi favorisant le développement et la reconnaissance des compétences de la main-d'oeuvre

Titulaire : PBE, PHARMA BIO EXPERT INC.

Numéro d'agrément : 0059104

NEQ : 1168916956

Catégorie d'agrément : Organisme formateur

Date de délivrance : 6 février 2018
Date d'échéance : 5 février 2020

CHAMPS PROFESSIONNELS

01 Administration et commerce
03 Alimentation, hôtellerie et tourisme
06 Chimie et biologie

Par : Isabelle Bergeur

Le 7 février 2018

La délivrance du certificat est valide en fonction des documents soumis à la Commission des partenaires du marché du travail.

Québec

Ministère du Travail, de l'Emploi et de la Solidarité sociale

EQ-6282 (06-2003)
ENT-0031 (12-2016)

Summary

1. Regulatory framework & requirements.
2. URS / Clean Rooms reminder.
3. Types of contaminants.
4. Clean Rooms Design
5. Dress code & means of prevention.
6. Room classifications vs standards & applications.
7. Types of segregation, flows, cascades.
8. Building elements and architectural finishes.
9. Design of HVAC systems, wet/dry formulation.
10. HVAC design for Injectable & Sterile products.
11. Design in presence of Highly Toxic products (HP/OEL2-6).
12. Design in presence of hazardous biological products (BSL1-3).
13. Design in presence of EXPLOSIVE & Flammable products (ATEX3).
14. Personal protection equipment.
15. OEL containment equipment.
16. Elements of Commissioning / Validation of Premises & HVAC .

HVAC in 9 points

1. What is an HVAC?
2. Benefits of an HVAC?
3. Why use an HVAC?
4. How does an HVAC work?
5. HVAC/AHU/FFU details
6. HVAC system types/formulation
7. Cooling / Expansion Group, GFH Filters
8. Monitoring & Follow-up, Integrity tests
9. Design Considerations

Layouts & clean rooms (ZAC) in 9 points

1. What is a Layout, a Clean Room?
2. Benefits of Layouts, Clean Rooms, PAL, MAL?
3. Why use a Layout, Clean Rooms, PAL, MAL?
4. How does a Clean Room work?
5. Layout & Clean Rooms, PAL, MAL design.
6. Room classification according to ISO-14644, and cGMP.
7. Types of segregation according to needs and processes.
8. Cleaning Cascade & Pressure Cascade.
9. Control and Monitoring of CEP.
10. Design considerations.

Regulatory Framework : Cleaning (cGMP)

Regulatory Framework : (BPF/cGMP)

World Health Organization (WHO)

- http://www.who.int/medicines/areas/quality_safety/quality_assurance/production/en/index.html

EU - EMEA

- http://ec.europa.eu/enterprise/pharmaceuticals/eudralex/vol4_en.htm

United States – FDA 21 CFRs

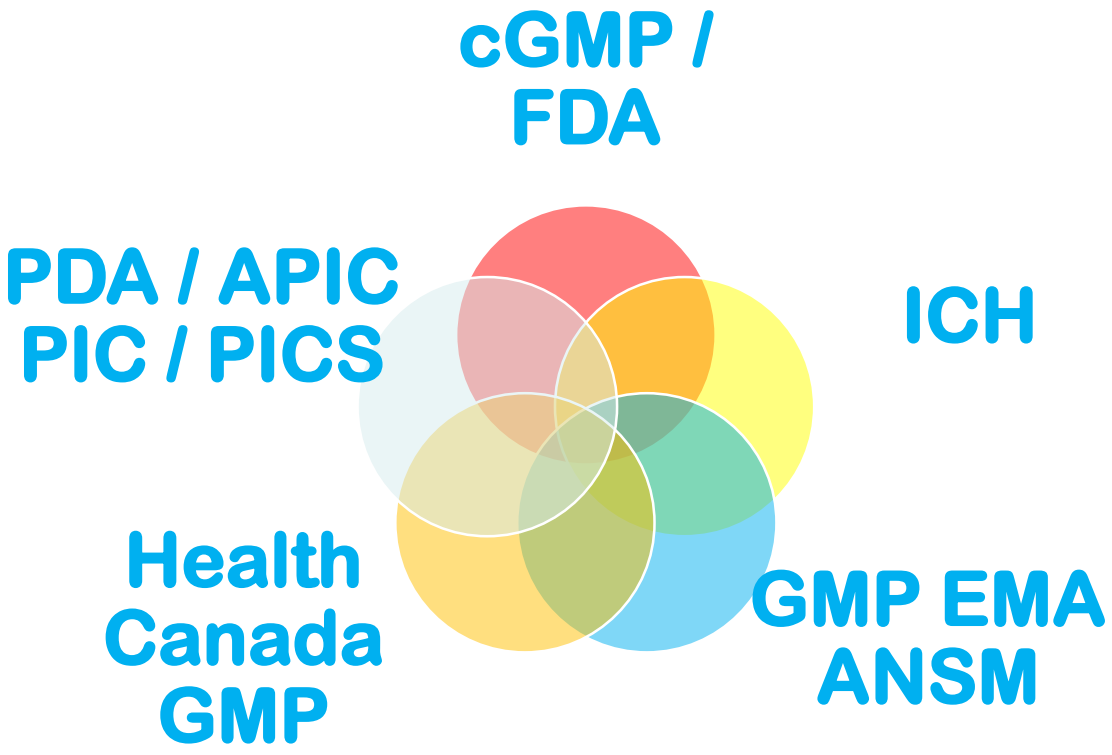
- http://www.fda.gov

Canada – Health Canada

- http://www.hc-sc.gc.ca/dhp-mps/compli-conform/gmp-bpf/index-eng.php
- ICH = International Conference on Harmonization

http://www.ich.org/products/guidelines/quality/quality-single/article/good-manufacturing-practice-guide-for-active-pharmaceutical-ingredients.html

Laws & Regulatory vs country ?



Normative requirements

- ✓ The European Pharmacopoeia (Ph.Eur.)
- ✓ The French Pharmacopoeia (Ph.F.)
- ✓ Pharmacopoeia Internationalis (Ph.I.)
- ✓ The British Pharmacopoeia (B.P.)
- ✓ The Canadian Formulary (C.F.)
- ✓ The National Formulary (N.F.)
- ✓ The Pharmaceutical Codex: Principles and Practices of Pharmaceuticals
- ✓ The United States Pharmacopoeia (U.S.P.)

Clean Rooms: Regulations

GMP (Good Manufacturing Design) ed. 2002, Combined with the European standard

ISO 14644 (Clean rooms and associated controlled environments)

ISO 14698 « Control of bio-contamination, measurement methods, principles of data estimation and evaluation (interpretation) and methods of surface cleaning and disinfection »

ISO 13408 « Aseptic treatment of health care products »

ASHAE 1999 (Application) Clean Space chap. 15

ISPE, vol 3, chap. 4 à 9 et 11

ISPE, vol 6, chap. 6 et 13

IEST (Clean Room Considerations) RP cc0012.1

Codes & Standards Requirements

AABC : Associated Air Balance Council
ANSI : American National Standards Institute
ASHRAE : American Society of Heating Refrigerating and Air conditioning Engineers
ASME : American Society of Mechanical Engineer
CRN : Canadian Registration Number (Equipment Under Pressure)
CSA : Canadian Standard Association
NABC : National Air Balance Council
NEBB : National Environmental Balancing Bureau
NFPA : National Fire Protection Association
NEMA : National Electrical Manufacturers Association
OSHA : Occupational Health and Safety Administration
NIST : National Institute Of Standards and Technology
SMACNA : SMACNA Sheet Metal & Air Conditioning Contractors' National Association
ATEX : Explosive Atmosphere

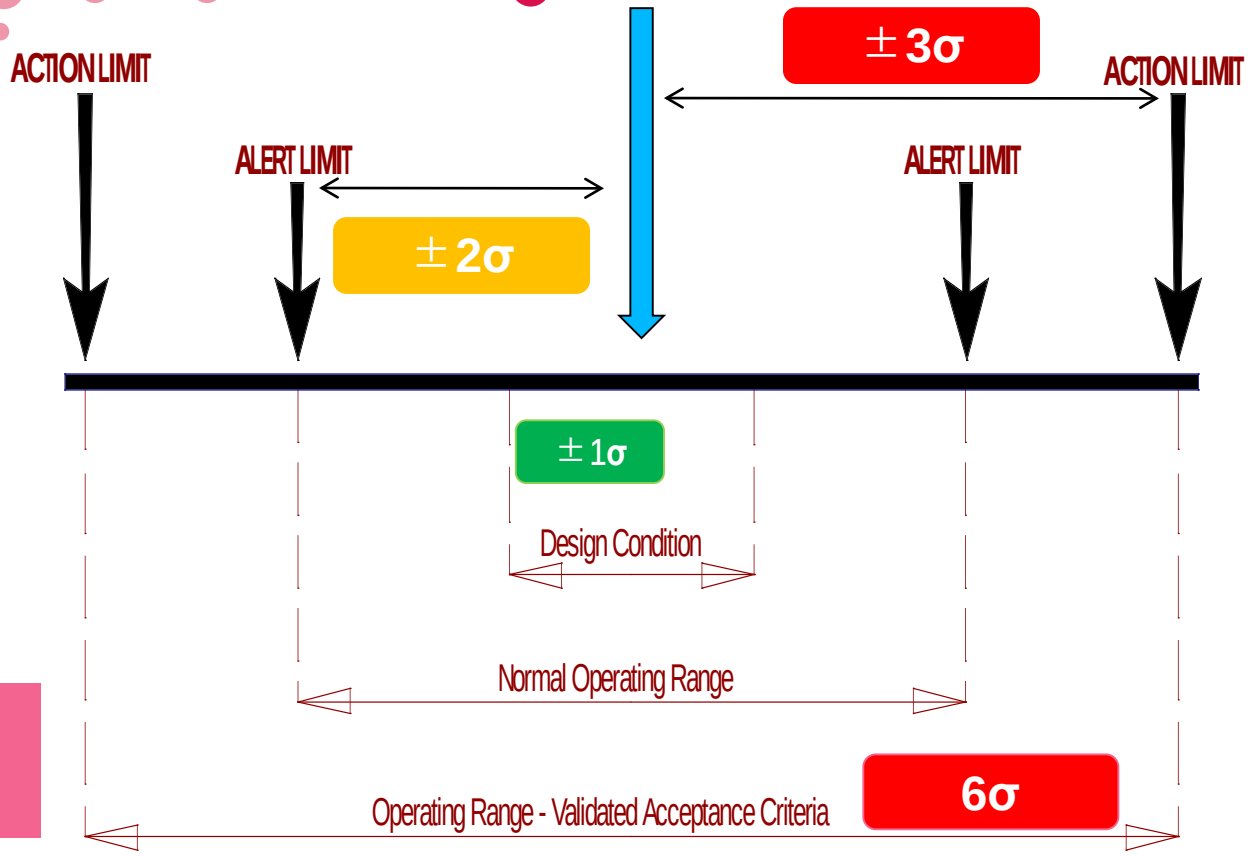
URS

User Requirements Specifications

URS : APPROACH TO DESIGN

- *Design conditions*
- *Normal operating ranges set to achievable limits*
- *Alert Points (2*Sigma)*
- *Action Points (3*Sigma)*
- *OOS results recorded*

Action Limit= mean +/- 3 sigma
Alert Limit= mean +/- 2 sigma
Sigma = std deviation/1,128




VURS
FURS
PURS
Product
Profit
Process
Partner
Performance
People
Plant
Project
8
11
1
13
1
25
20
21
PBE Expert Inc.
PBE
URS
cGMP certified

URS : 1- Performance Criteria :

1. Codes, standards and Regulatory Framework
2. Performance Criteria
3. Operation Specifications
4. Installation Specifications

e. Basic process flow diagrams.

f. Rational & References.

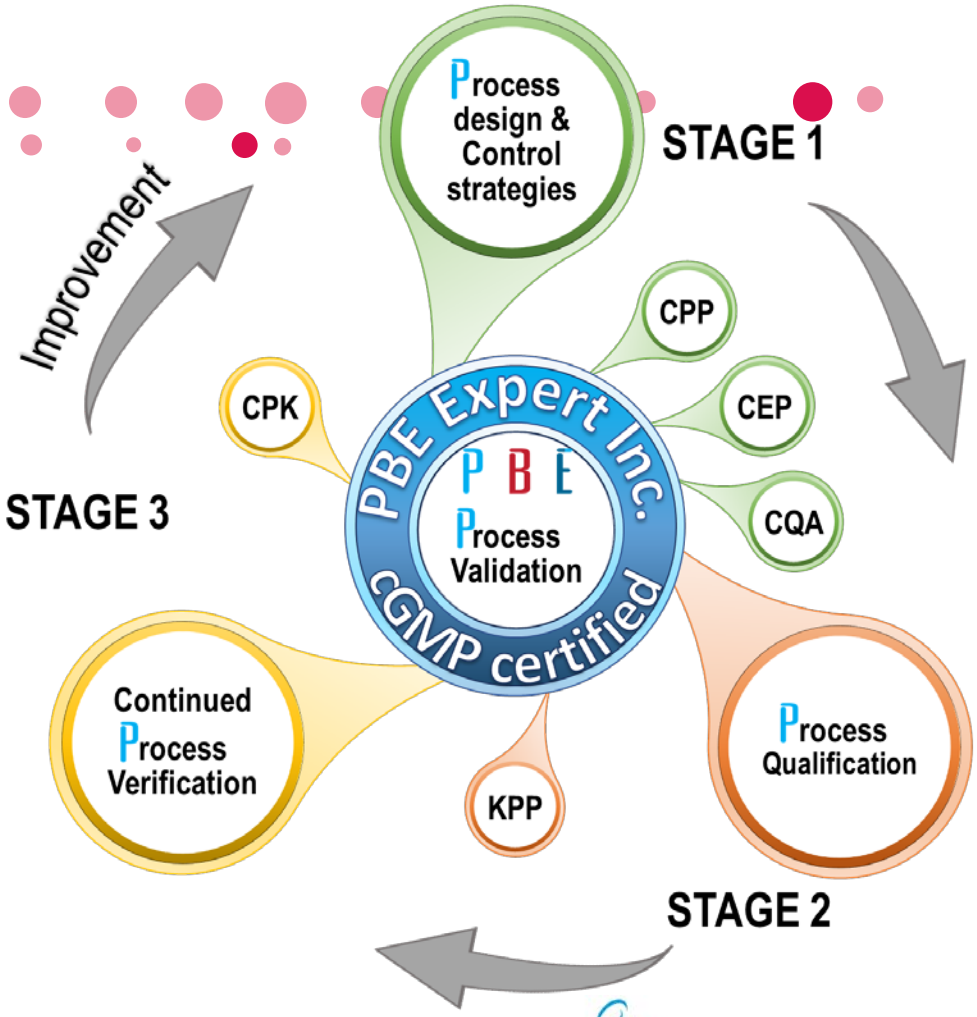
g. Tests to be planned.

h. Execution in :

   a. IQ/OQ/PQ qualification

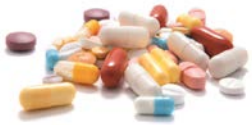
   b. and/or Commissioning: FAT, SAT.

URS : LIFE CYCLE APPROACH – PROCESS VALIDATION



10 Golden Rules?

Golden Rule #1	Get the facility 1-_____ right from the start
Golden Rule #2	2-_____ processes
Golden Rule #3	Write good 3-_____ and follow them
Golden Rule #4	4-_____ who does what
Golden Rule #5	Keep good 5-_____
Golden Rule #6	6-_____ and develop staff
Golden Rule #7	Practice good 7-_____
Golden Rule #8	8-_____ facilities and equipment
Golden Rule #9	Build 9-_____ during design into the whole product lifecycle (APR, PV, QBD)
Golden Rule #10	Perform regular 10-_____



10 Golden Rules?

PREMISES in which a lot ora production batch of a drug / medicine is:

MANUFACTURED → PACKED → LABELLED → STORED

are

DESIGNED → BUILT → ? → ?

5.0 Regulations – Premises C.02.004 Interpretation

3. Prevent Cross Contamination (CC)

3.1 **TO BE SEALED?** To allow Cleaning and prevent CC

3.3 Joints between walls, ceilings and floors are **SEALED**

FL._____ WA._____ CE._____ DO._____ WI._____ JO._____

WATCH OUT FOR SUSPENDED CEILINGS!

5.0 Regulations– Premises C.02.004 Interpretation

3.1 → To enable **Cleaning**

3.2 → **AVOID** surfaces where foreign substances may accumulate and free of sharp edges.

- Horizontal surfaces
- Acute & sharp angles
- Not washable
- Non-drainable
- Rough

- FLOOR
- WALL
- CEILING
- DOORS
- WINDOWS

→ **Surfaces are hard, smooth (NO SOFT WALL)**

5.0 Regulations– Premises C.02.004 Interpretation

3.4 DESIGN PREMISES & CLEANABLE SURFACES

PI._____

LI._____ EQUIPMENT

VE._____ HOLES

OTHER IT._____

5.0 Regulations– Premises C.02.004 Interpretation

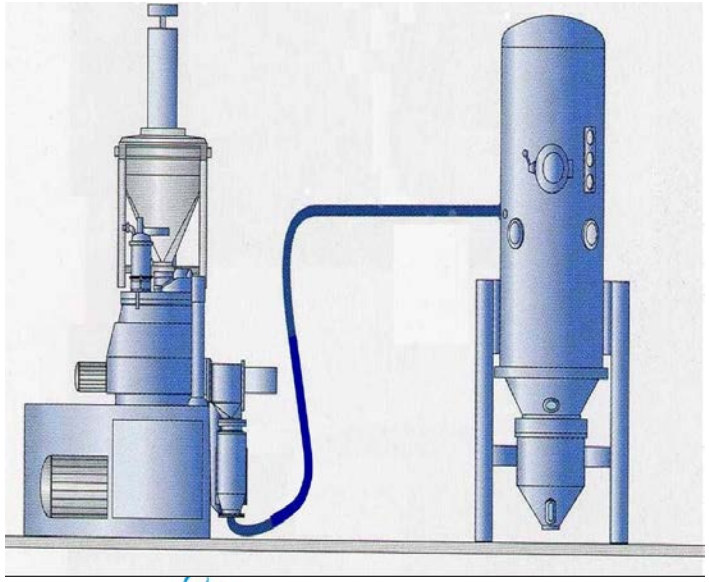
1- ► while **controling dust**,

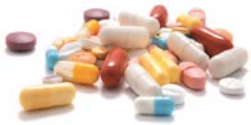
Three golden rules to apply :

a. **CE**

b. **CT**

c. **LEV**





5.0 Regulations– Premises C.02.004 Interpretation

2.5 → **HAZARDOUS** production activities,

→ are **isolated** & confined.

OEL, HP 2 @ 6 Products | BSL 2 @ 4 Products | ATEX 1 @ 3 Products | Flammable Products | Radioactive Products

PHYSICAL	MECHANICAL	CLOTHING	PROCEDURE
• Dedicated premises	• 1.	• 1.	• 1.
• Dedicated access	• 2.	• 2.	• 2.
• Controled access	• 3.	• 3.	• 3.
• PAL / door interlock	• 4.	• 4.	• 4.
• MAL / door interlock	• 5.	• 5.	• 5.
• Corridors			
• Cascade			

Types of contaminant & cleaning Systems

Sources of contaminant

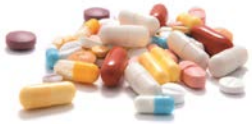
4.1.11 Materials and products should be protected from contamination and cross-contamination during all stages of manufacture (see also section 5.5 for cross-contamination control).

Note: ***contaminants*** *may result from :*

1. ***Inappropriate PREMISES*** *(e.g.* ***poor design****,* ***layout*** or ***finishing***),
2. ***Poor CLEANING procedures***,
3. *Contaminants brought* in ***by PERSONNEL***,
4. ***Poor HVAC system***.

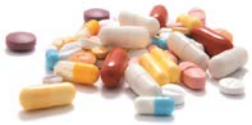
Sources of contaminant

Viable Biological Contaminants	**Bioburden** Bacterial Load
Viable Biological Contaminants	**Endotoxin**
Non-viable Particles	**External Particles**
Non-viable Particles	**Chemical Particles**



Contaminant reduction processes

Sterile Filtration	Reduce
SIP / SOP Sterilization	Reduce
Depyro, Thermal/Chemical Treatment	Remove
Cleaning, CIP Final rince / WFI	Reduce



Objectives of protection

External Contaminants	Respect	
External Contaminants	Ensure	
External Contaminants	To Eliminate via	

Objectives of protection

Internal Contaminants	**To Control via**	
Internal Contaminants	**To Eliminate via**	
Toxic Contaminants	**To Confine via**	

Cleanroom design

Room Design Elements (GMP)

1. Room classification
2. Controlled environmental parameters
3. Selection of construction materials, equipment and aeraulic circuits
4. Selection of cleaning mode for equipment, systems and premises,
5. Flow slope adoption and drainability
6. Choice of internal surface finishes compatible with the process
7. Choice of connection types
8. Selection of sterilization, sanitization, fumigation mode

Prevention technologies in clean rooms (GMP)

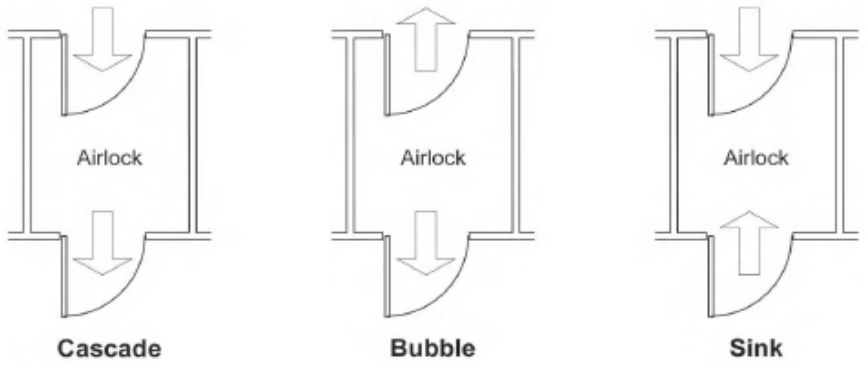
1. Process identification.
2. Description of critical process parameters.
3. Air quality % process:
   a. Classification of the rooms where the equipment is installed.
   b. Definition of the types of clothing compatible with the asepsis or protection level.
   c. Quality of air coming into contact with the product.
   d. Quality of surfaces coming into contact with the product.

Prevention technologies in clean rooms (GMP)
Segregation and flow :

a. Primary Segregation:

a. Design and physical & mechanical segregation:
b. Personal material SAS,
c. Corridors,
d. Access cards & interlock,
e. Dedicated rooms,
f. HVAC,
g. Protection systems,
h. Clean Utilities

Figure 8.6: Airlock Configurations



b. Secondary Segregation :

a. Control procedures to reduce the risk of contamination and cross-contamination

Prevention technologies in clean rooms (GMP) Segregation and flow

1. Definition of GMP, aseptic, sterility level:
   - **GMP, aseptic design, sterile, etc.**
2. Definition of containment level:
   - **BSL 1 to 4.**
3. Definition of the level of protection:
   - **HP 1 to 6, BiBo vs Non BiBo.**
   - **ATEX 1 to 3.**
4. Process type & equipment definition (Open/**Closed**).
5. **Mono vs Multi-product** (Operation by campaign).
6. Definition of the type of **clothing** & **signaling**.

Prevention technologies in clean rooms (GMP)

1. Dress code
2. Classified rooms
3. Physical / mechanical segregation
4. HVAC Systems
5. Procedures
6. Cleaning & Disinfection

Dress code & means of prevention

GMP dress code

Classe	D (ISO8)	C (ISO7)	B (ISO5)
Hat			
Beard-Cover			
Sterile Gloves			
Frock			
Hood			
Mask			
Shoe-Cover			
Jacket			
Trousers and Coveralls			
Boots			

Room classifications vs standards & applications

Cleanrooms Classification (Viable) EMA-ANSM 04/12/2013

Agence nationale de sécurité du médicament et des produits de santé

Recommended microbiological contamination limits (a)				
Class	Air Sample ufc/m^3	Petri Dish (D=90mm) ufc/4heures (b)	Contact Agar (D=55mm) ufc/plaque	Glove Prints (5 fingers) ufc/glove
A	<1	<1	<1	<1
B	10	5	5	5
C	100	50	25	-
D	200	100	50	-

BPF/**ANSM**, p60, &20. **Appropriate ALERT and ACTION thresholds should be defined for particulate and microbiological monitoring results.**. If these limits are exceeded, operational procedures must impose corrective measures.

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Cleanrooms Classification Viable Count cGMP FDA

U.S. Food and Drug Administration

TABLE 1- Air Classifications[a]

Clean Area Classification (0.5 um particles/ft^3)	ISO Designation[b]	$\geq$ 0.5 µm particles/m^3	Microbiological Active Air Action Levels[c] (cfu/m^3)	Microbiological Settling Plates Action Levels[c,d] (diam. 90mm; cfu/4 hours)
100	5	3,520	1[e]	1[e]
1000	6	35,200	7	3
10,000	7	352,000	10	5
100,000	8	3,520,000	100	50

a- All classifications based on data measured in the vicinity of exposed materials/articles during periods of activity.
b- ISO 14644-1 designations provide uniform particle concentration values for cleanrooms in multiple industries. An ISO 5 particle concentration is equal to Class 100 and approximately equals EU Grade A.
c- Values represent recommended levels of environmental quality. You may find it appropriate to establish alternate microbiological action levels due to the nature of the operation or method of analysis.
d- The additional use of settling plates is optional.
e- Samples from Class 100 (ISO 5) environments should normally yield no microbiological contaminants.

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Building Elements & Architectural Finishes

Building Elements & Architectural Finishes

Physical Make-up/Room Finish

Parameter	Minimum Requirements	Classification Levels A/B	C	D	E
Ceiling	• Drywall with epoxy, plastic polyester (at least two coats) • To be smooth and cleaning agent resistant	R R	R R	R R	R R
Walls	• Plastic, epoxy coated plaster, drywall, or panel systems so as to provide and maintain a smooth acid and cleaning agent resistant surface.	R	R	R	R
Floors	• Coved, seamless • Coving, such that no dust collecting ridges are found • Floors in areas where operations discharge water liquid product waste onto floor must be sloped to a drain and sealed to facilitate cleaning	R R N/A	R R N/A	R R N/A	R R N/A
Windows	• Required for monitoring purposes and communication • Must be flush, no ledges • If ledges present, must be slanted	R R N/A	R R N/A	N/A NR R	N/A NR R
Doors	• Framing to be flush (hardware should be stainless or equivalent).Any hardware should have a minimum of protrusions • Weather stripping may be required for differentials (non-shedding or particulate producing) • No panic bars are allowed	R R R	R R R	R R R	NR NR NR
Lighting	• Shadowless and uniform intensity at 100 to 150 foot candles at work surface • 70 to 100 foot candles at work station • Light fixtures should be sealed to prevent air leaks. Flush mounted are preferred	R N/A R	R N/A R	N/A R NR	N/A R NR
Electrical Design	• Electrical panels, distribution equipment, panels, and starters/related components that do not have to be used for daily operation in the cleanroom should be installed in unclassified areas. • Conduits entering the cleanroom should have seal fittings attached to them just ahead of the entrance point.This prevents outside air and vermin from coming into a cleanroom through race ways of electrical components. • Light switches should be installed outside cleanrooms • If present, all switches and receptacles should have gasket weather proof SS/anodized aluminum covers, and located high enough above the floor as possible, out of reach of hose-down-cleaning activities	R R R R	R R R R	R R NR NR	R R NR NR
General	• No protrusions, ledges, or exposed piping are allowed • Access doors in walls and ceilings should be limited • No drains • Those drains, if present, should be designed with atmospheric break, or check valve to prevent back flow.(trap seal primer is required) • Process' drains and "sanitary" drains should be separated with a running trap • Cross connections between "process and sanitary" systems should be avoided • All process pipe lines or service lines whose contents come in contact with product or product contact surface (such as steam and compressed air) should be sloped back to the source, or to a planned low point drain outside of controlled area.	R R R R N/A N/A R	R R R R N/A N/A R	NR NR NR NR R R R	NR NR NR NR R R R

Continued

Building Elements & Architectural Finishes

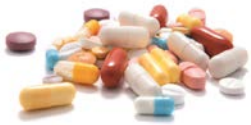
- ✓ Suspended ceiling?
- ✓ Is this acceptable:
  1. D class Production premises
  2. D class Corridor & SAS
  3. D class Washing Area
  4. Warehouse CNC

Design of HVAC / AHU AIR TREATMENT CENTRALS

HVAC Design Elements

Different types of clean room models in the pharmaceutical industry:

- **H**_____ Ventilation.
- Tu_____ Flow.
- **Un**_____ # **La**_____ Flow.
- Air F_____ rate (recirculation, Risk analysis% cross conta).
- Air inlet Qu_____.
- Particles Co_____.
- Premises **Dim**_____.
- HVAC Ef_____ (contamination removal efficiency).



URS & HVAC prerequisites?

1• Classified ZACs vs Protection Level (I @ IIIa vs IIIb)

2• Total Volume Flow & TCA.

3• Type of flow (**T**_____ **vs L** _____) & (**U** _____ **vs M** _____).

4• **A**_____ **Rate** vs **r**_____ **Time**

5• **P**_____ & **c**_____ **Cascade**

6• _____**range** & _____

7• _____ counts VNV

8• Flow of _____, _____, **PSO,** _____ …

9• Type of **a**_____ and **p**_____

URS & HVAC prerequisites?

10• W_____ & P_____ Conditions

11• Number of P_____ inside the room

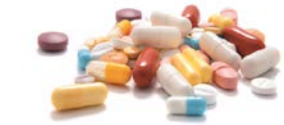
12• Filtration type (Cascade: _____, _____, _____)

13• C_____ filtration vs T_____ (T_____, P_____ & N_____ of filters).

14• Air D_____ in the room vs b_____ air, q_____air and l_____ (leakage check : Input – Output).

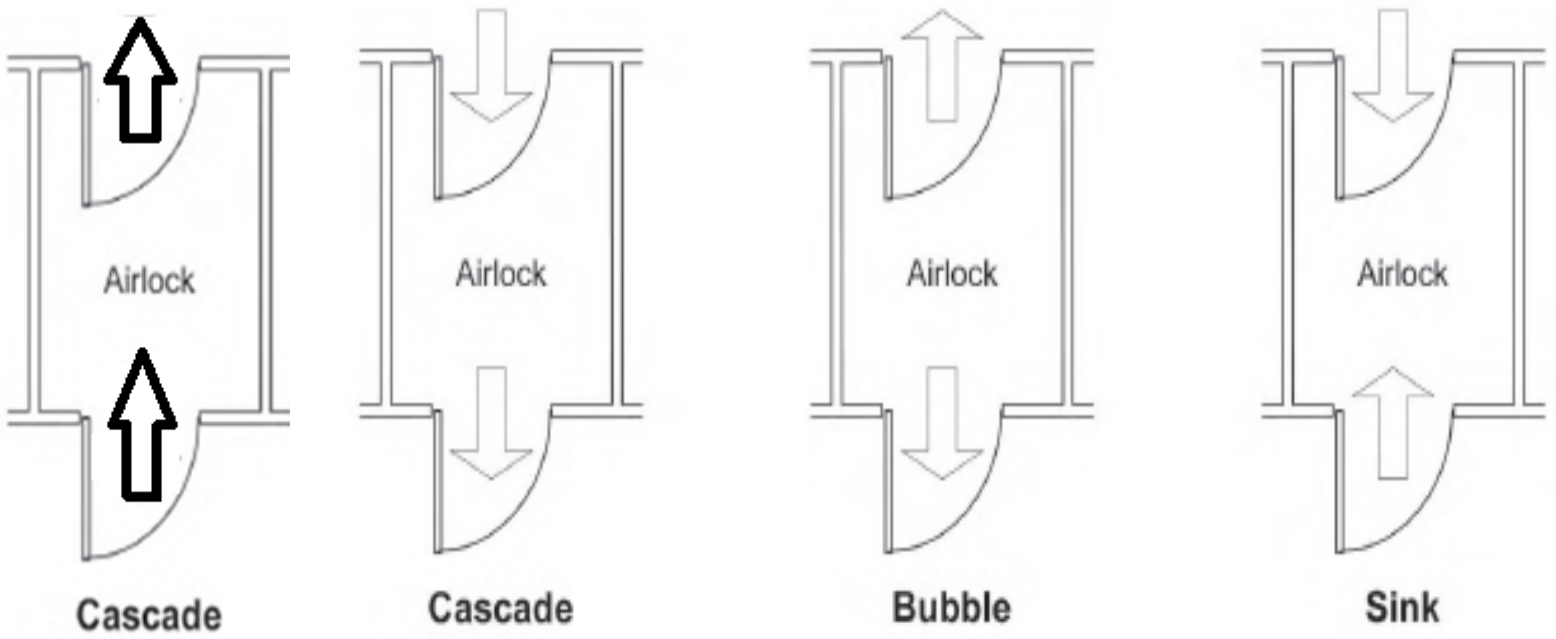
15• System with direct E_____ vs C_____ water/air, cooling T_____.

16• Dispersion control and control of highly active contaminants and impact on personnel, the environment



Means of prevention / Physical segregation / Pressure cascade / PAL & MAL

Figure 8.6: Airlock Configurations



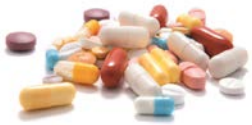
FS mo	?
FS mu	
FS Eff	
CR	
HP	
INJ	
BSL2	
HP+ INJ	

A

B

C

D



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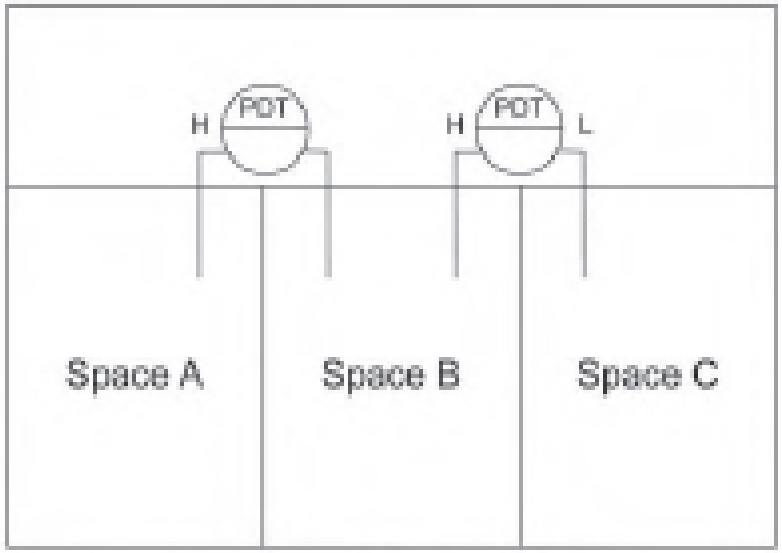
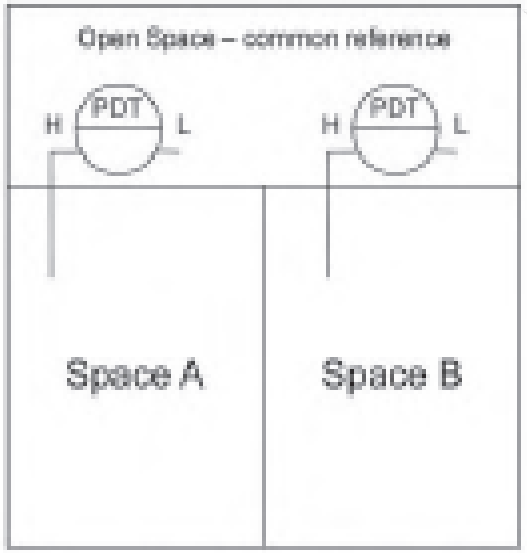
DIFFERENTIAL PRESSURE CASCADES

Differential pressure measurement configuration

Figure 8.10: DP Sensor Locations

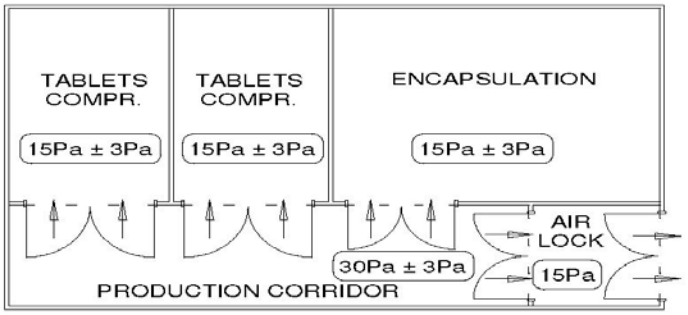


Room-to-Room Monitoring

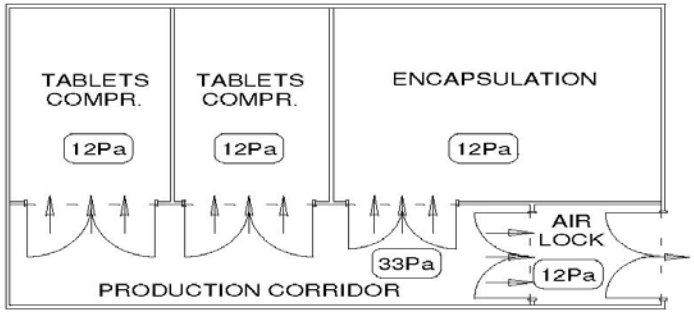


Common Reference Monitoring

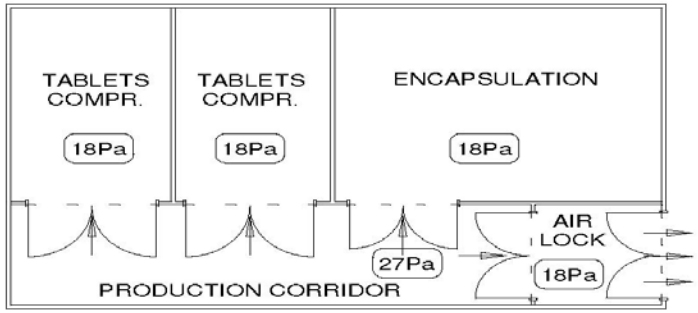
Prevention means / Differential pressure cascade



DESIGN CONDITION



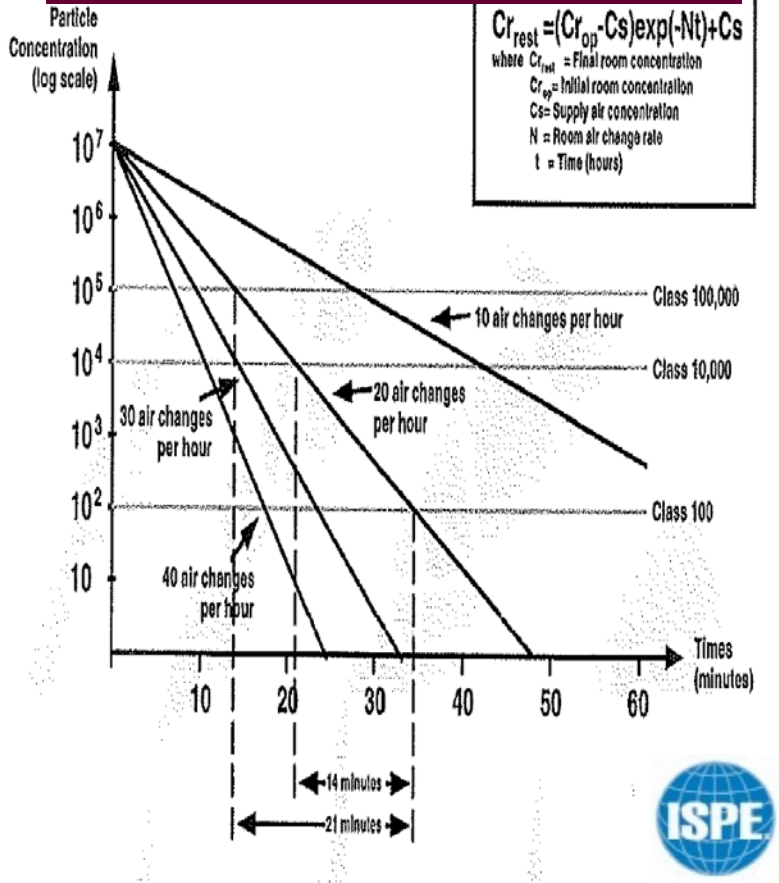
MAXIMUM DIFFERENTIAL



MINIMUM DIFFERENTIAL

Air quality recovery time: ISPE, ISO-14644-3 (B12)

$$Cr_{Rest} = (Cr_{Initial} - C_S) \exp(-N.t) + C_S$$



Recovery Time (mn)	ISO8/D @ ISO7/C	ISO7/C @ ISO 5/A	ISO8/D @ ISO 5/A
ACR10			
ACR20			
ACR30			
ACR40			
ACR60			
ACR120			
ACR240			

DIFFERENTIAL PRESSURE CASCADES

HVAC Design vs Protection & Classification Level

Level	Condition	Example of area
Level 1	**General**	Area with normal housekeeping and maintenance where there is no potential for product contamination, e.g. warehousing.
Level 2	**Protected**	Area in which steps are taken to protect the pharmaceutical starting material or product from direct or indirect contamination or degradation, e.g. secondary packing, **warehousing**, first stage change rooms.
Level 3	**Controlled**	Area in which specific environmental conditions are defined, controlled and monitored to prevent contamination or degradation of the pharmaceutical starting material or product, e.g. where product, starting materials and components are exposed to the room environment; plus equipment wash and storage areas for equipment product contact parts.

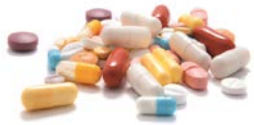
HVAC Design vs Protection & Classification Level

TABLE 6-1 – Suggested minimum design values (see text for details/exceptions)

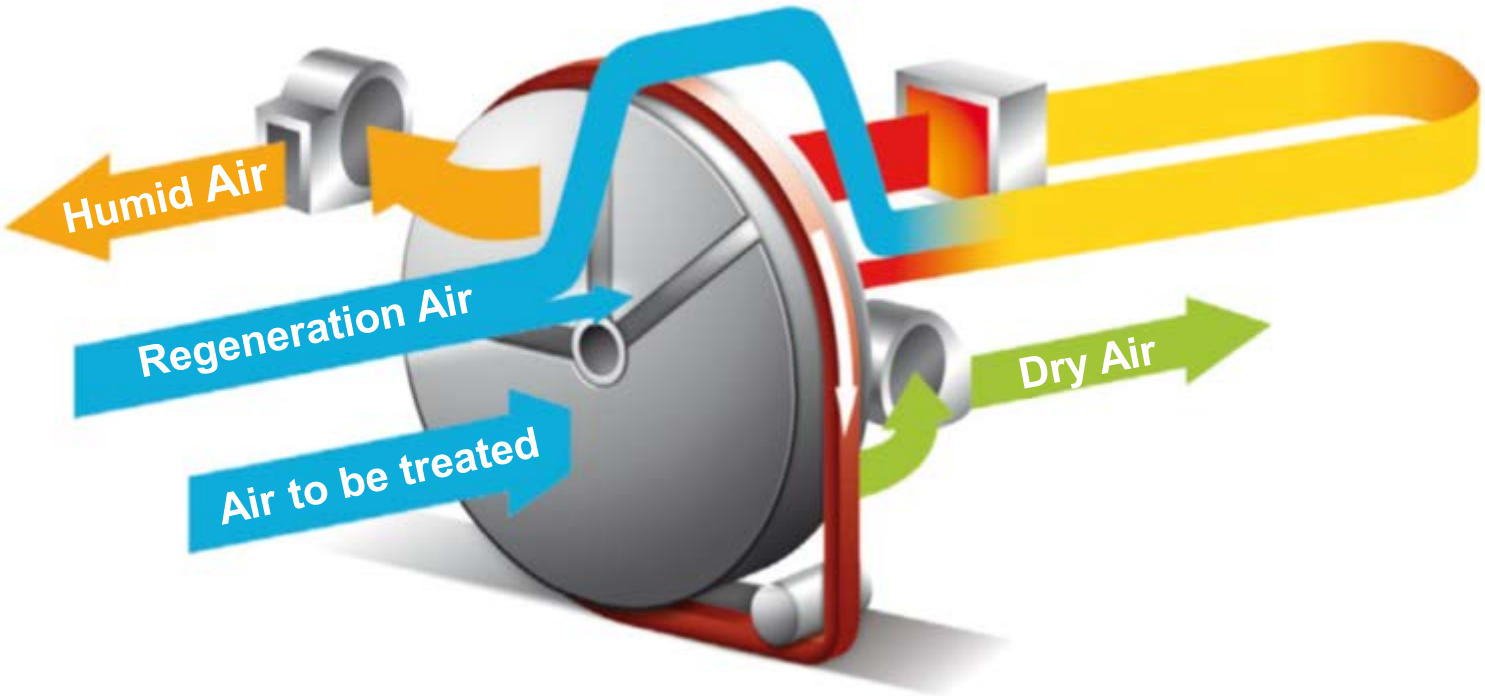
CONTROLLED VARIABLE	LEVEL I	LEVEL II	LEVEL IIIa Non - aseptic	LEVEL IIIb Aseptic
Temperature	60-105F (10-40.6°C)	Product reqmt	Product reqmt	Product reqmt
RH	20-60% recomm	Product reqmt	Product reqmt	Product reqmt
Room classification	none → 60%	none	none	Class 10,000 EC Grade B
Supply air filter	30% ASHRAE	30% ASHRAE*	85% ASHRAE*	HEPA 99.97%
Room air changes	Codes & NFPA	Codes & NFPA	Codes & NFPA	20 (Unidirectional flow ** at product)
Differential Pressure	none	protect the product	controlled airflow	0.05 or 0.06 inch wg (12.5 or 15 Pascal) positive
Differential Pressure (potent)	none	negative	negative or positive to anteroom	Pressure buffer at 0.05 or 0.06 inch wg (12.5 or 15 Pascal)
Outdoor air	code & ASHRAE62	code & ASHRAE62	code & ASHRAE62	As required for pressurization §
Duct material	galvanized steel, aluminum	galvanized steel, aluminum	galvanized steel, aluminum	Stainless steel, plastic, or cleanable equivalent where exposed to room
Duct leakage	This is an economic decision, follow SMACNA standards			
Validation	none	Product req.◆	Product req.◆	Product req.◆ + air changes + HEPA**

*	For once through air. Recirculated air may require additional treatment
**	Pinhole scanned 99.99% HEPA filtration of air in direct contact with product, air class 100 or better at product, unidirectional flow at nominal 90 ft/min (0.46m/s). EC Grade A. See ASHRAE Applications, ISO/IES or forthcoming ISPE Guide on aseptic production facilities.
§	It is assumed that the volume of makeup air for pressurization will provide more outdoor air than required by ASHRAE 62.
◆	Sensors / indicators / alarms / recorders for Critical Product Parameters

For details of American Society of Heating, Refrigeration, and Air Conditioning Engineering (ASHRAE) and Sheet Metal & Air Conditioning Contractors' National Association (SMACNA) standards see Chapter 12 *References*.



Air dehydration



Influence of HVAC components on the cleanliness of classified cleanrooms

Equipment	Temperature	Humidity RH%	Prussure Static/Room	Air Flow(AHU)	Air cleanliness
AHU / FFU					
Blow & Return Fan					
Direct Extraction Fan					
Heating Battery					
Battery & Cooling Unit					
Air Filter					
Humidifier					
Dehumidifier					
Aeraulic Network					
Register & Component					
Air Diffusers Grilles Recovery					
UV Lights					

22 CHECKS TO PLACE?
On 60

SANTÉ CANADA
MAPAQ

EXPERT

HOURLY AIR CHANGE RATE - ACR

CRITICAL EQUIPMENT IN AN HVAC UNIT

ENERGY SAVING & HQ SUBSIDY, ...

HEPA FILTERS & INTEGRITY TESTS

ISO-14644 & FREQUENCY TESTS

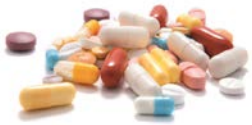
BIMODULAR CLEAN ROOMS

UDAF vs LAMINAR FLUX

UDAF vs LAMINAR FLUX

WHO_TRS-93[illegible] p[illegible]

Minimum requirement	UDAF	Laminar Flux
1- HEPA filter		
2- Integraty Test		
3- Speed		
4- Unidirectional flow		
5- Particle class		
6- Particle count continuous monitoring		
7- Operators under		
8- Differential Pressure		
9- Protection		



DUAL REDUNDANCY, WHEN IS IT REQUIRED?

CAPTURING SYSTEMS AT THE SOURCE? LOCAL VS. CENTRAL

FLOW TYPES FILTER/DIFFUSER POSITION

CASE STUDY #1: Wet & Dry Forms.

CASE STUDY#2: Injectables & Steriles.

CASE STUDY #3: Highly Toxic Products– OEL 2-6

CASE STUDY #4: Biological Products BSL2-3

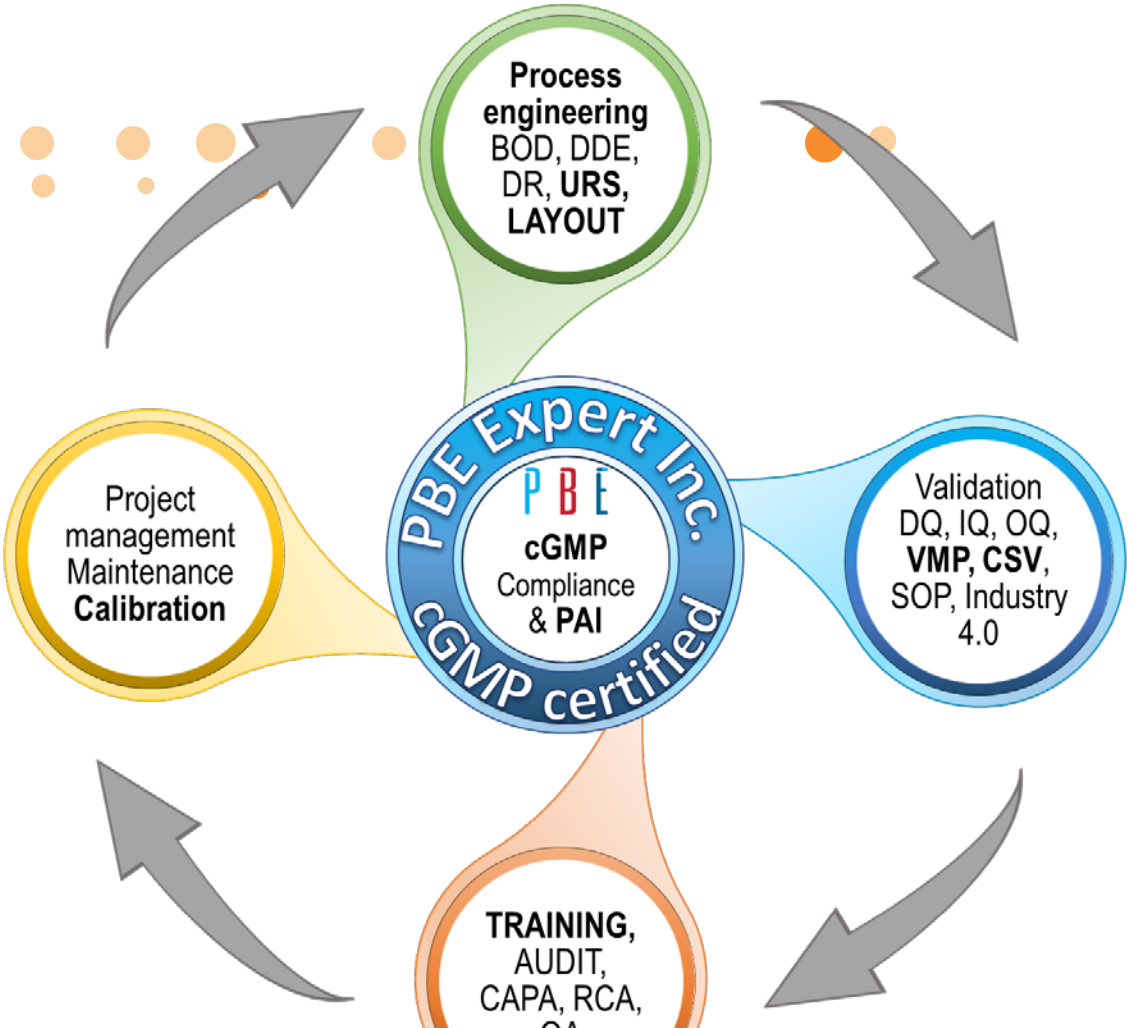
CASE STUDY #5: Explosives products & Flammable Solvents. ATEX 1-3

Staff protection equipment

OEL Containment Equipment

Commissioning / Premises Validation & HVAC

Part 7 – Quiz - Evaluation



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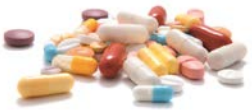

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