INNOVATION. QUALITY. GLOBAL REACH.

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Insights from IPA Best Practices Documents: Good Engineering Practices

THE TEAM

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PREFACE

This booklet provides comprehensive guidance on Clean Room Design Requirements for Sterile and OSD manufacturing plants. It serves as a valuable resource for business professionals, manufacturing experts, scientists, students, and technical consultants seeking insights into cleanroom design.

Authored by engineering experts with decades of experience and aligned with regulatory considerations, the guidance offers a practical approach to designing new or renovated facilities with technical precision and regulatory compliance. The goal is to achieve cost-effective adherence to existing regulations and guidelines.

The Baseline Engineering Guide, developed and owned by IPA, supports the pharmaceutical industry's shift towards a manufacturing model that emphasizes product and process understanding, risk-based approaches, and Quality by Design (QbD) principles. In this era of continuous improvement, the guide provides a crucial facility design baseline that ensures alignment with regulatory expectations, fostering both compliance and operational excellence.

Link to download Guidance document:
https://www.ipa-india.org/wp-content/uploads/2024/06/Guidance_on_Good_Engineering_Practices.pdf

CONCEPT REVIEWED

1. Guidance on Clean Room Design Requirement
2. Guidance on HVAC Design for OSD Plant
3. Guidance on HVAC Design for Sterile Plant
4. Guidance on BMS in Pharma
5. Guidance Document for Design, Installation and Testing of Purified Water System
6. Guidance on Compressed Air systems and Nitrogen
7. Guidance on Documents and Drawing Handling
8. Guidance on Equipment, System and Facility Life Cycle
9. Guidance on Pharma Maintenance Strategy
10. Guidance on GEMBA

1.GUIDANCE ON CLEAN ROOM DESGIN REQUIRMENT

- Facility Design Approaches
- Design Consideration for Architectural/Finishes Material In Different Grades Of Area
- Oral Solid Dosage Form Facility Design
- Utility System
- Control And Instrumentation
- Barriers and Isolator Technology

2.GUIDANCE ON HVAC DESIGN FOR OSD PLANT

Purpose: The purpose of this document is to provide guidance for HVAC Design for OSD Manufacturing Facility

- This procedure is applicable to provide design guidance for the following:
- Building and Facilities
- Process Equipment Consideration
- Heating, Ventilation and Air Conditioning (HVAC)
- Utility Systems
- Electrical Services
- Control and Instrumentation

- Procedure of HVAC Design
- Primary consideration: A) Product Protection and Avoidance of Cross Contamination
  B) Personnel Protection and Comfort
  C) Environmental Protection and Compliance with Local Statutory Pollution Norm

- Important topics
- AHU Grouping
- Pressure Gradient Philosophy
- Dust Extraction Philosophy
- Air changes Per Hour, Air flow pattern
- Qualification Strategy, Maintenance Strategy, etc.

2.GUIDANCE ON HVAC DESIGN FOR OSD PLANT

Cost consideration

- Capital cost
- HVAC system for sterile manufacturing are expensive
- The cost varies greatly and depends upon the decision made throughout the design stages.
- The main factors influencing capital cost: A) Size of aseptic processing area
  B) Simplicity of the design
  C) Use of isolators
  D) Standby Philosophy
  E) Integration of HVAC with other aspects
- Operating cost
- HVAC will affect the operating cost pf the manufacturing facility, particularly as 24hrs operation is required
- The main factors that influences the operation cost: A) ACPH
  B) Recovery period to suit operating nature of facility
  C) Optimum differential pressure
  D)Air filtration arrangement
  E) Use of re-circulation air or heat recovery use

3.GUIDANCE ON HVAC DESIGN FOR STERILE PLANT

Purpose: To provide guidance for cleanroom design for sterile plants

- Basis of design
- Allocation of Air Handling Unit/ AHU Zoning
- Airborne Particles Related to Environmental grade
- Room Pressurization
- Room air changes

- Containment features
- Filter Classification
- Internal Load
- Leakages through door gaps

4.GUIDANCE ON BMS IN PHARMA

Purpose: To serve as design guidance document for BMS purposed for the facilities in the pharmaceutical industry

Key Objective: is to provide guidelines for procuring BMS software in order in order create a manufacturing environment based on the clean room class requirement.

The major benefits are:

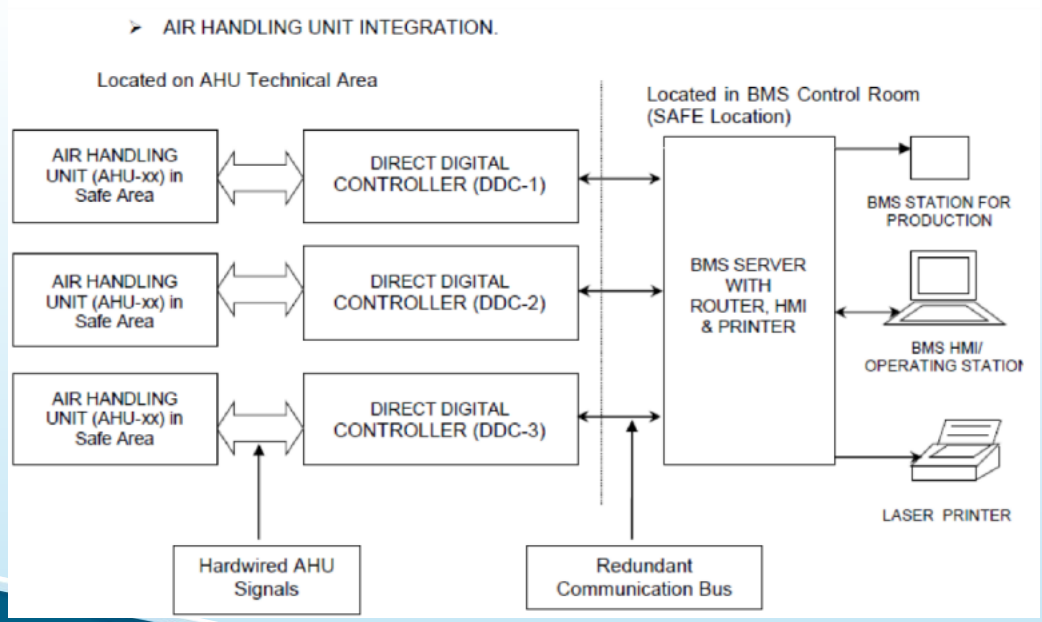
- Precision control with self-tuning adaptive technology.
- Centralized monitoring and control of networked systems.
- Optimized energy usage for process and product needs.
- User-friendly graphical interface for easy system management.
- Improved clean room performance by maintaining key environmental parameters (e.g., air handling, temperature, pressure, and filtration)

- Operational Requirements
- Capacity
- Process Requirement and control
- Functions

4.GUIDANCE ON BMS IN PHARMA

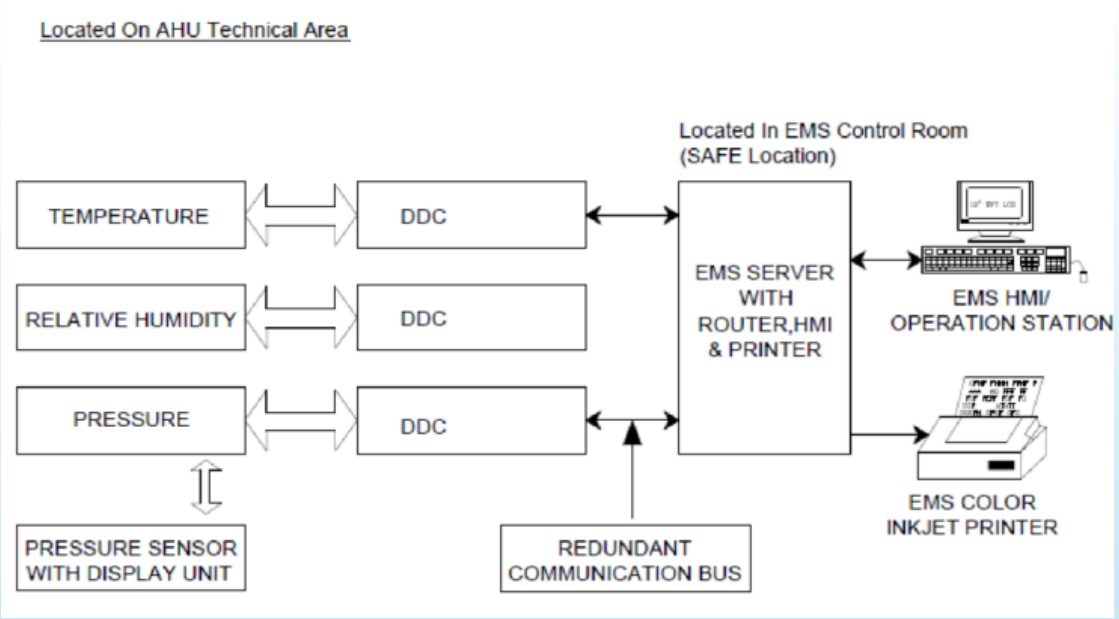
- BMS System block diagram
- The BMS is intended to seamlessly connect devices throughout the building regardless of subsystem type on the same network.

- BMS Control Block Diagram



- EMS for HVAC
- This system shall carry out the monitoring, control and recording of various parameters.

- EMS Control Block Diagram



4.GUIDANCE ON BMS IN PHARMA

- Hardware
- System Network Controller
- Controllers and Field Devices
- Sensors and Field Devices and Selection Approach
- DDC Panel
- Server and Database

- Application software: Client web browser GUI
- Communication Standards and Network Standards
- Power failure/ Recovery
- Time Synchronization
- Alarms and Warnings
- Alarm Management
- More 14 parameters are covered

- Documentation: Installation, operation, and maintenance instruction documentation for the system shall be developed.
- Incidence Management: All post go-live malfunctions shall be logged in the incident log. The details shall be documented and these malfunctions shall be categorized as: A)Software issue
  B) Training issue
  C) Procedural issue

5.GUIDANCEDOCUMENT FOR DESIGN, INSTALLATION AND TESTING OF PURIFIED WATER SYSTEM

- Purpose: To provide general guidance for designing of water system for pharmaceutical use

- Regulated water qualities
- non portable water
- Portable water
- Purified water
- Water for injection

- Water for pharmaceutical use
- purified water
- Water for injection

- International regulations
- Water quality and analytics methods

5.GUIDANCE ON DOCUMENT FOR DESIGN, INSTALLATION AND TESTING OF PURIFIED WATER SYSTEM

- International regulations and guidelines
- Identifying purities
- Raw water management
- Primary Filtration
- Softener system
- Ultra filtration
- CSRO system
- Purified water generation system
- Sanitization cycle
- SOP
- Procedure for testing purified water conductivity

6.GUIDANCE ON COMPRESSED AIR SYSTEMS AND NITROGEN

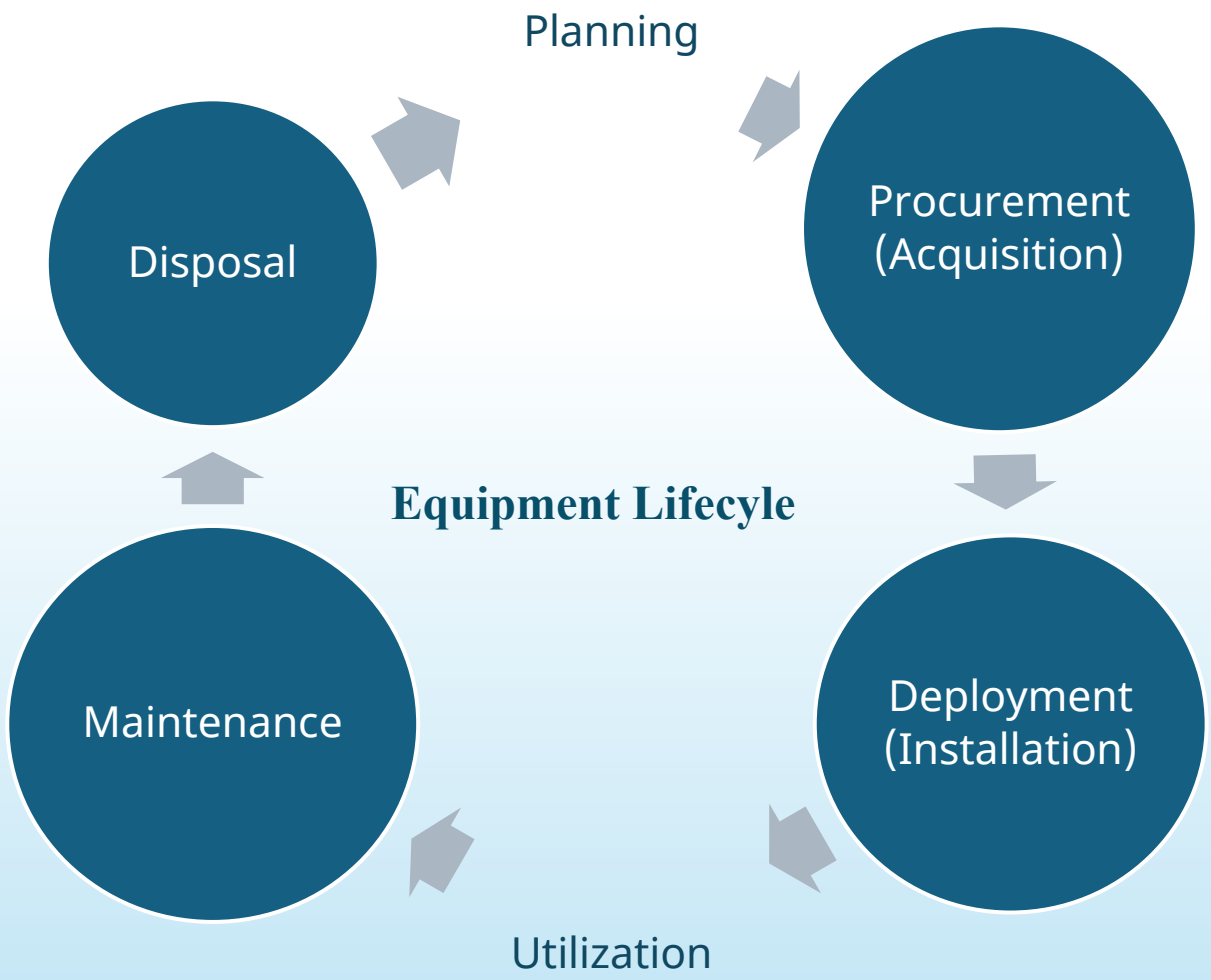
- Arrangement of supply side components
- Equipment selection
- Air treatment
- Compressed air filters
- Air receivers
- Traps and drains
- Design of nitrogen system

7.GUIDANCE ON DOCUMENTS AND DRAWING HANDLING

Topics covered

- Specific uses of documents
- Master formula record
- Batch manufacturing record
- Batch packaging record
- Standard Operating Procedures
- Equipment cleaning and use record
- Records of raw materials
- Master production instructions
- Batch production records
- Laboratory control records
- Batch production record review
- Document required as per regulatory guideline
- GMP guideline
- Development and Implementation in documentation

8.GUIDANCE ON EQUIPTEMENT, SYSTEM AND FACILITY LIFE CYCLE



8.GUIDANCE ON EQUIPTEMENT, SYSTEM AND FACILITY LIFE CYCLE

Replacement of Equipment	Life cycle of equipment documents	Stages of Equipment qualification	Preventive Maintenance	Importance of AMC
• Technology Obsolescence • Energy Efficiency • Maintenance Cost • Compliance And Regulations • Environmental impact, etc	• Objectives of equipment qualification	• Stages • Critical equipment • Non critical Equipment	• Three categories: primary, secondary and ancillary • Minor check • Major check • Registration and PM check list	• Reasons for oversight • How to address this issue • Software: EAM and CMMS

9.GUIDANCE ON PHARMA MAINTENANCE STRATEGY

- Maintenance process
  - TPM
  - Scheduled maintenance
  - Unscheduled maintenance
  - RCM
- Maintenance Planning
  - Maintenance Management Plan
  - Total Productive Maintenance
  - Autonomous Maintenance
  - Scheduled Maintenance
  - Unscheduled Maintenance
- RCM
  - Measures of Reality
  - Calculation of MTBF, MTTF and MTTR
- Annual Turn Around
  - Plant turnaround philosophy
  - Management process
- Planning and scheduling of maintenance
  - Facts about plan
  - Who plan the work?
  - Planning process
- SOP
  - Applicable regulatory requirements
  - Identification of equipment, building or utility

10.GUIDANCE ON GEMBA

GEMBA, meaning "the actual place," refers to where value is created in business, specifically the factory floor in manufacturing. In a pharmaceutical plant, GEMBA encompasses process areas, warehouses, technical service floors, water systems, QC labs, and sampling areas.
GEMBA Walks involve visiting these locations to observe processes and identify waste and improvement opportunities. This practice is key to lean management. The goal is to understand the value stream and its problems rather than just reviewing results.

Insights from GEMBA Walks in the Pharmaceutical Industry

GEMBA Walks provide management and senior leaders with valuable insights into:

- The effectiveness of validation and qualification systems in meeting regulatory requirements.
- The robustness of facility and machine maintenance programs aligned with regulatory and global engineering standards.
- The efficiency of CAPA (Corrective and Preventive Action) and change management systems.
- The adequacy of training systems in compliance with regulatory standards.
- The effectiveness of safety systems in line with global industrial safety standards.

By evaluating these areas, organizations can identify opportunities for improvement, driving continuous and incremental enhancements that lead to long-term success.

References

- USFDA - Sterile Drugs Products Produced by Aseptic Processing, Sep-2004, Sec. IV, Building and facilities.
- Annex 1, EU Manufacture Sterile Medicinal Products Guidelines - November 25, 2008
- WHO GMP Guidelines Annex 6
- PIC/S PI032-02 Annex 1 Guideline Interpretations

THANK YOU