FLEXIBILITY BY DESIGN

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TRENDS – A LITTLE QUIZ
Trends

Multi product - flexible facilities

Hybrid facilities
2- 8 times 15K SS
2- 8 times 2K SUS
SS and SUS

Closed processing

Robotics

Modular design

Local manufacturing (and development) in emerging markets
Trends – continuous

Tech Transfer
Continuous processing
Control Strategy
Devices
Environmental impact
ADC’s

Level 1
Real-time automatic control + Flexible process parameters to respond to the variability in the input material attributes

Level 2
Reduced end product testing + Flexible critical material attributes and critical process parameters within design space

Level 3
End product testing + tightly constrained material attributes and process parameters
The New Pharma Reality…
The future "long tail" of therapeutic areas

Orphan drugs catch fire in big pharma
PM360 July 2015

The new pharma reality...

Last century product distribution

Today's product distribution

Focus on manufacturing Speed

Focus on change-over speed
FACILITY CONSIDERATIONS

Product Supply Options

1. Get all product produced at CMO’s

2. Co-invest in construction of new facilities together with a CMO

3. Build own facility covering all or a portion of the expected demand
Facility design
Distribution of demand for different batch sizes

Normal distribution

Facility design
Distribution of demand for different batch sizes

Product demand
Batch size
Facility design
Distribution of demand for different batch sizes – API product

Orphan drug               Insulin

Facility design
Distribution of demand for different batch sizes – Final drug product

Luxemburg               USA
Build in flexibility

Process level flexibility
Suite configuration flexibility
Operations flexibility
Site and integration flexibility
Investment flexibility

BASIC PROJECT CONSIDERATIONS
What comes first
– Facility consideration

- Layout
- Classification
- Segregation
- HVAC

- Equipment
- Process
- Closed / open
- SS / SUS

Infrastructure
- Organisation – People and processes
- Procedures – SOP's, gowning, planning
- Flow – People, Raw Mat, Waste
- Automation, training

Connecting Pharmaceutical Knowledge ispe.org
Why are we here – Purpose

From a ‘ME’ to ‘WE’ culture and approach

**Internal**
- Decentralized organisation, focusing on local organisation business targets and on overall goals
- Hierarchy in main and support functions lacking understanding of overall targets
- Results based on individual performance – One person, one group, one function, one site, one company
- Data handling as an individual or limited group effort
- Physical and non-transparent facility borders between functions
- Focus on individual operator deviations / errors

**External**
- Limited integration with the local community, ‘self-sufficient’ and closed image
- Minimal involvement of suppliers

**Internal**
- One organisation with holistic focus, with local centres of excellence supporting the whole organisation
- Seamless collaboration between main and support functions to support common goals
- Results based on a collaborative approach
- Collaboration / interaction between people from different Groups, functions, sites, companies
- Data handling/processing based on sparring and knowledge sharing, local and global
- Transparent and seamless transmission between functions to support integration
- Focus on avoiding errors and proactive risk management from a holistic and system perspective

**External**
- High level of integration and interaction with the local community, open and involving image
- Transform suppliers to strategic partners
FACILITY DESIGN
**Building Typology**
Flexible design for future expansion

1. Basic production process structure.
2. – 6. Support functions.
   - Administration, Main gowning, etc.
   - Receive / Dispatch.
   - Laboratories.
   - Utility – black / clean.
   - Hazardous support
TECHNOLOGY INNOVATION AND EVOLUTION

Robotics

- Mitigate cross contamination risk
- Mitigate human errors
- Sustainable commercial manufacturing (cost)
Compounding of potent drugs

Future drugs are becoming more toxic and potent and batch sizes are getting smaller. This increase the need for keeping the operator away from the product.

Robot density – 2015 (all industries)

Source: IFR World Robotics 2016

Collaborative robots – Cobots are the new black!

Cobots
• Can work in close proximity with people – no fence

Force limited
• Built-in force torque sensors that detect impact and abnormal forces, which stops the robot when overloaded

Ideas for use:
• Part assembly or pack of medicinal kits
• Small batch sizes
Mobile Autonomous Robots

Autonomous
Self-driving and navigating

No ‘wiring’ needed
Uses sonar and laser for detection (SLAM*)

Ideas for use:
Ideal for material transport

*SLAM: Simultaneous Localisation and Mapping

MODULAR APPROACH
Modular – different definitions

Modular – Copy / Paste
• On-site construction, where same type of rooms are build as copies – same size and configuration

Modular – off site construction of building elements – LEGO concept
• A method of construction that utilizes off-site pre-engineered, pre-fabricated structures which are reassembled on-site.
• Up to 100% of the building and the equipment are already completed and pre-tested at the factory prior to shipping

Modular – PODular
• Full clean-room facilities built in a POD, including HVAC, air locks etc., which is build and qualified off-site. The POD’s are then shipped to the site for the pharmaceutical production and connected to the stick built part of the facility

Modular thinking
Modular thinking

Layout – 3D
Modular thinking

- Façade - Adapted to local rules and building traditions.
- Technical support modules – HVAC etc.
- Technical distribution modules.
- Process area – Process and Support building modules.
- Foundations – for building modules and Technical distribution (water, drains, waste etc.)

Modular Engineering

Modular Engineering let the process structure and functionality be the guiding principles in the modularization – not physical or construction considerations.

In this way each module has a distinct function and clear interfaces to the surroundings.

When it comes to the physical implementation of the Process Module the solutions are flexible: Pre-Assembled Units (PAU), skids or super-skids, building modules or stick built.

The key is that we think, engineer, construct, qualify and document in a modular structure.

Plants

Process Module

Units

Equipment Module

Components
CONCLUSION
Future – Possibilities

Multi product flexible facilities

Prepared for future expansions and new products

Optimal use of SUS, Continuous Processing and other “new” technologies

Lower area classification – few airlocks – larger suits

“Modular” facility designs

Yes – the robots are coming

Flexibility – standardisation – simplification

Open Mind Regarding Technology Choice

Think big, but take small steps at the time
THANK YOU

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