

Facility Optimization from a Design Perspective

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Connecting a World of
Pharmaceutical Knowledge

Facility Design Influences

- Industry Trends
- Importance of Stakeholders in facility design
- Pipeline
- Process Development
- Design affects operations and operational costs



Industry Trends

- Traditional Paradigm
 - Fewer, bigger reactors are better to ensure supply
 - Stainless steel will be more efficient in the long run
 - Disposables are for clinical use only
 - Owning capacity is necessary for supply security
- New Paradigm
 - More, smaller reactors are more flexible for supply
 - Disposables offer multiple benefits of speed, cost, turnaround, and flexibility for commercial supply

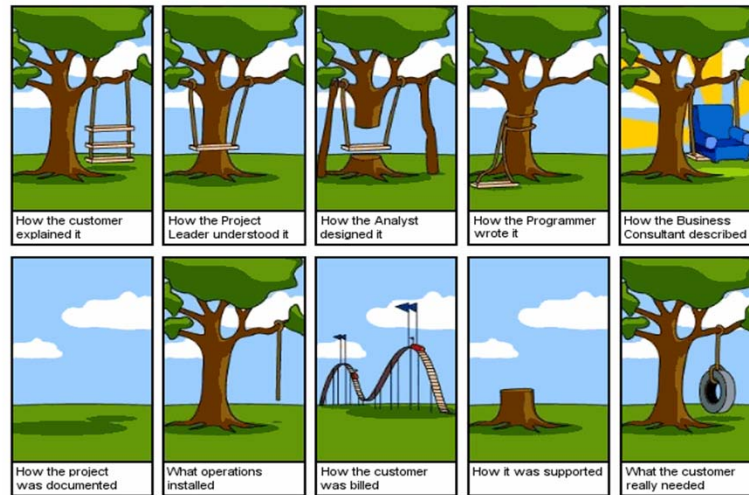


Industry Trends

- Experience from last 10 years:
 - Increased yields, product approval delays/failures
- Next decade
 - Focus on smaller/rare diseases
 - Biosimilars will fragment the supply for established products
 - By 2016, bioengineered vaccines and biologics will account for 23% of sales, up from 17% in 2009 (Source: EvaluatePharma, op. cit.)
- Need for smaller, more agile capacity



Stakeholder's Impact on Design



Stakeholder's Impact on Design

- Regulatory Affairs
 - Interpretation of cGMPs
- Quality (QA/QC)
 - Application of cGMPs
 - Product, Personnel Flows, etc...
- Facilities
 - Cleaning
 - Accessibility and ease of maintenance/calibration



Stakeholder's Impact on Design

- Manufacturing
 - Single or Multiple products?
 - What is the flow of the process, personnel, etc...?
 - Single or multiple access points?
- Materials
 - Ease and flow of material movement
 - Central or Local staging
 - Warehouse
 - Inside and outside of the processing areas



Stakeholder's Impact on Design

- It is critical that the Design Team have dedicated staff from each discipline
 - Part of their annual Objectives
- Stakeholders need to have decision making authority

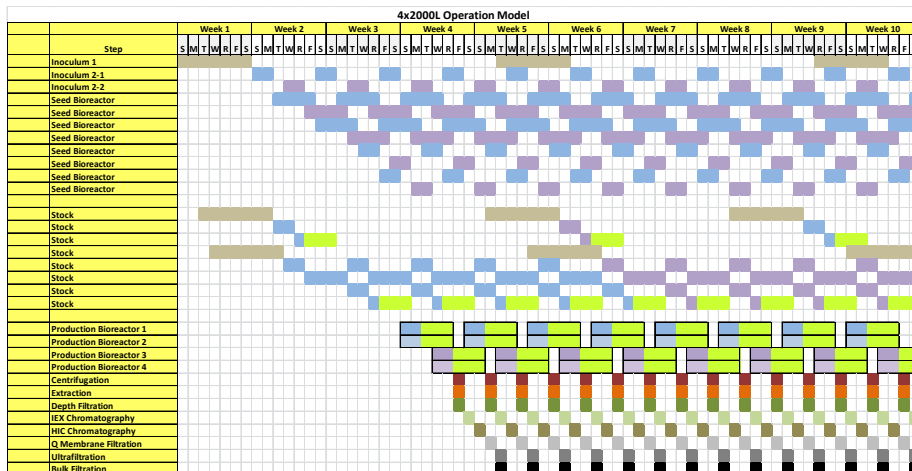


Pipeline

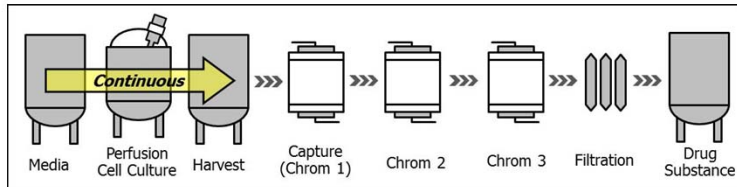
- What influences the multi-product strategy?
- HVAC Strategy
 - Segregation of specific MFG functions
- Flows
 - Personnel, Product, Materials, Waste, etc...
- Operation paradigm
 - Area Clearance practices
 - Stakeholder buy-in for multiple product line-clearance procedures



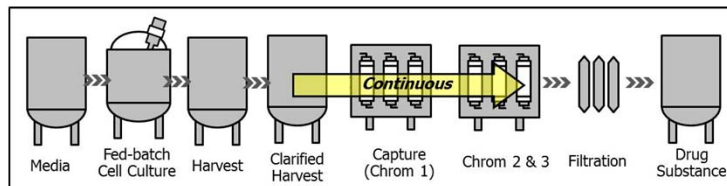
Pipeline



Continuous Processing



Example 1: Continuous upstream (perfusion), batch downstream

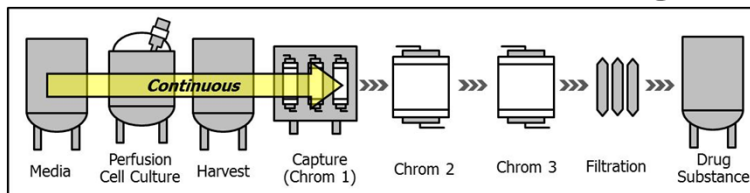


Example 2: Batch upstream, continuous downstream

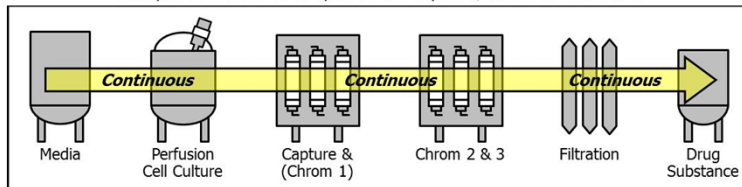


[International Symposium on Continuous Manufacturing of Pharmaceuticals](#)
Konstantin B. Konstantinov, Charles L. Cooney, May 20-21, 2014

Continuous Processing



Example 3: Continuous upstream + capture, batch downstream



Example 4: Continuous upstream and downstream



[International Symposium on Continuous Manufacturing of Pharmaceuticals](#)
Konstantin B. Konstantinov, Charles L. Cooney, May 20-21, 2014

New Technologies

- Continuous DSP
 - Direct processing of harvest material
 - Eliminates large tanks, reduces facility footprint
 - More complex operation



Continuous Process

- Continuous or fully continuous?
- Either will have a dramatic effect on facility design
 - Footprint
 - Infrastructure...
- Risk profile(s) will be different
 - Solutions to mitigate risk
 - Acceptance of Risk(s)
- Prior to implementation...
 - ... stakeholder understanding is critical



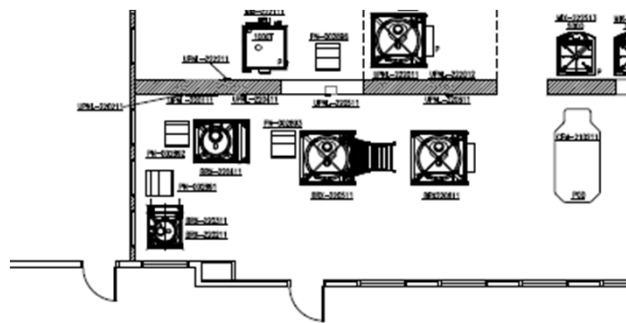
New Technology Enables....

- Single-use technology enable simpler, more flexible facility
 - Reduced infrastructure demand
 - WFI systems can be smaller
 - Clean in Place not required
 - Clean steam distribution not required
 - Portability
 - Limited distribution piping
 - Primarily WFI
 - Clean steam if autoclave or special requirements are necessary
 - “Process piping” is flexible tubing!



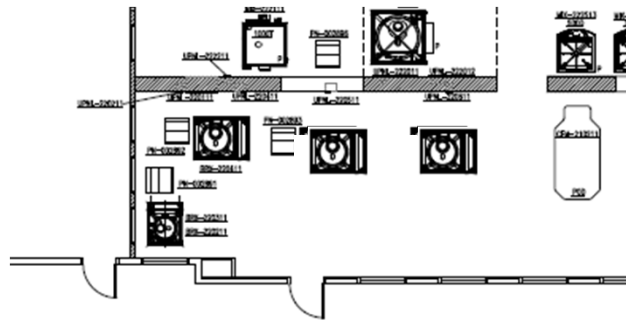
Flexibility

- Single use bioreactors can be changed easily
 - Use 500L in same space as 2000L



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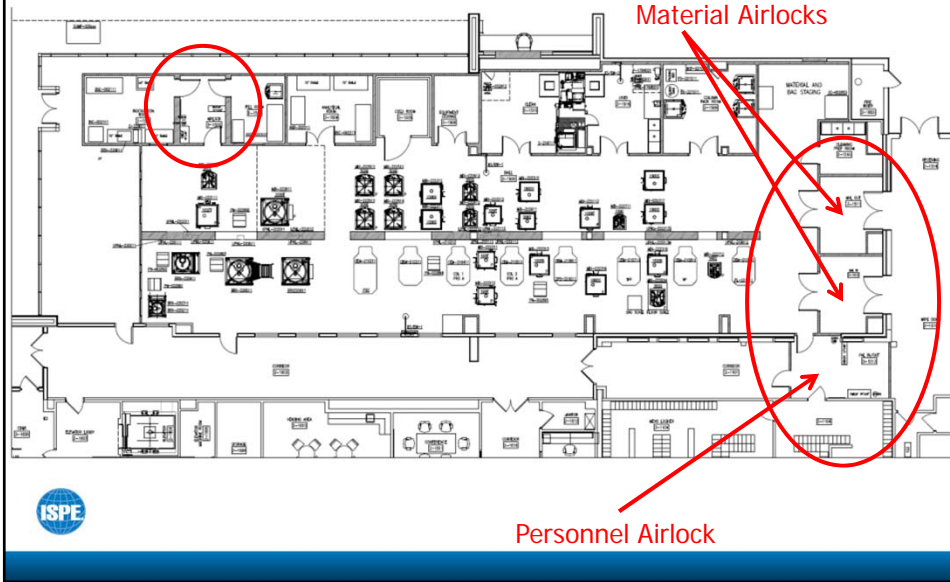


Operations Effect on Design

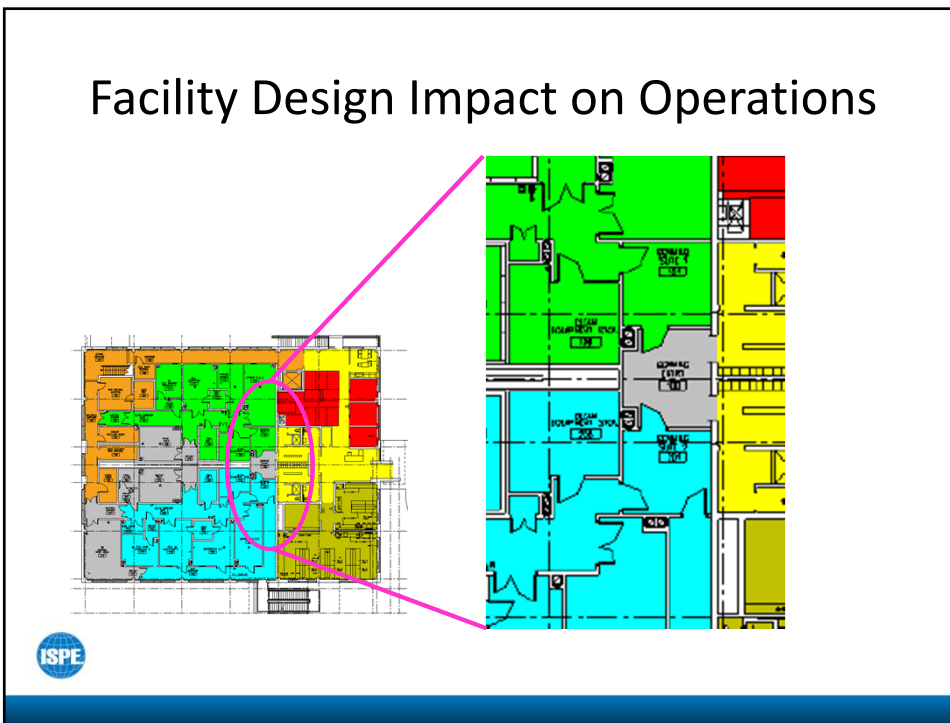
- What is the optimal material movement into and out of a clinical suite?
- What considerations need to be taken into account?
 - Number of Staff
 - Volume of raw materials/supplies
- What is the historical viewpoint of the organization?
- Each stakeholder's input alters the design



Facility Design Impact on Operations



Facility Design Impact on Operations



Summary - Design Considerations

- Final Design requires all disciplines early involvement and ownership
- Review of multiple scenarios
 - Single vs. Multi-product
 - Clinical, Commercial
 - Operational desires



Summary - Design Considerations

- Operations and Technology Change the Risk profile...
 - Potential Loss of Product with equipment failure
 - Level of complexity
 - Common rooms, Footprint
 - Closed/Open manipulations
 - Area Clearance
 - Flow requirements



Thank You!



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