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# Multiproduct Facilities: Considerations Beyond Cleaning



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Speed and agility aren't just important to athletes. Facilities owners need these attributes in order to win the race to market. In a multi-product environment, achieving an agile plant requires moving past the mindset that cleaning philosophies and schedules are the only issues owners need to address in order to sustain a plant's viability and long-term usefulness. In reality, a number of key decisions made when designing a new facility or a plant expansion can significantly impact the ability to respond to technological, therapeutic focus and market shifts.

## DESIGNING TODAY FOR THE FUTURE

To be competitive, owners need to understand the factors that drive the design and construction not just today, but for five to ten years into the future. In addition to current product requirements, what is necessary to accommodate products in the development pipeline? Potential contract products? Drugs that are coming off patent? By designing facilities correctly, large pharma companies, contract manufacturers and generic manufacturers alike can lower future rework and facility modification costs. That's because you can design the correct infrastructure to accommodate the character-

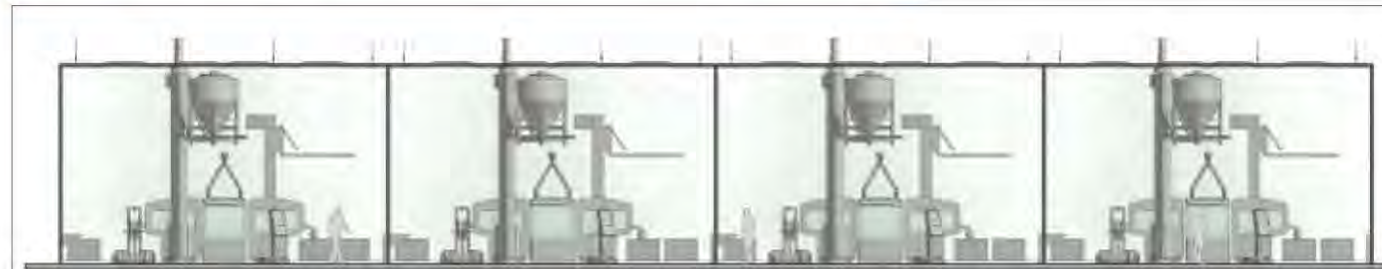
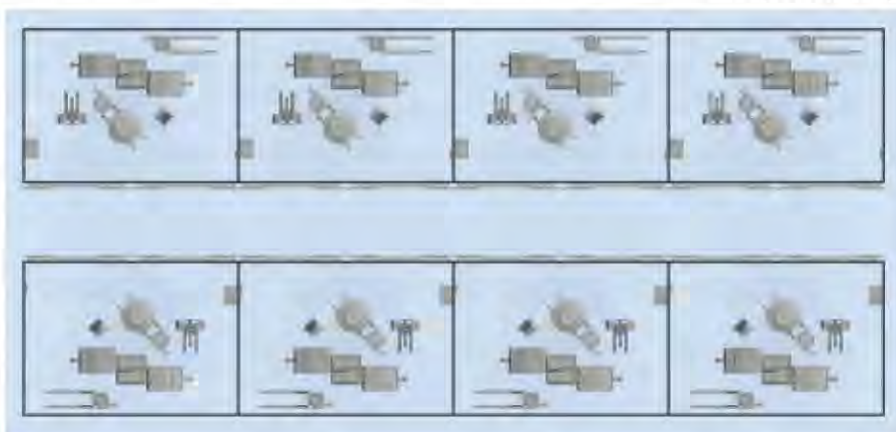
istics of the compounds you will want to produce.

For example, if your strategic plan does not include manufacturing solvent-based products, then the expense of intrinsically safe equipment controls, Class I Division 1 electrical fixtures and lighting solvent abatement systems and wastewater collection is difficult to justify. On the other hand, you can't handle solvent-based products without that specialized infrastructure, so if they are on the horizon, the additional upfront investment makes better economic sense than a tear-out and retrofit. The same is true if you are likely to want to produce potent products. It is faster and more cost effective to switch to potent product manufacture if process systems are equipped to accept primary containment devices and the facility is designed to provide secondary containment, including ventilation, airlocks and decontamination capabilities.

Another factor to consider when planning multiproduct facilities is whether to leverage single-use manufacturing technologies. The best decisions in this regard take into account equipment adaptation to process changes, capital investment restrictions and yearly operating cost allowances. Take, for example, single-use technologies for containment applications. Selecting a disposable soft-wall containment solution may be more pragmatic than choosing a rigid bolt-on isolator. As process needs evolve, the single-use isolator can be adapted with minor capital investment compared to a rigid-wall solution. Single-use isolators increase

production cycle time because they do not require cleaning. They also eliminate concerns regarding potential cross-contamination, because no other components are handled within these disposable isolators.

Ultimately, the flexibility of the facility and the robustness of the processing room design will determine how efficiently the unit operations can be changed over, new equipment added or swapped out and production schedules modified to align with changes in market demand and business decisions.



Compression Suite: Top, eight replicated modular rooms. Bottom, plan and elevation views

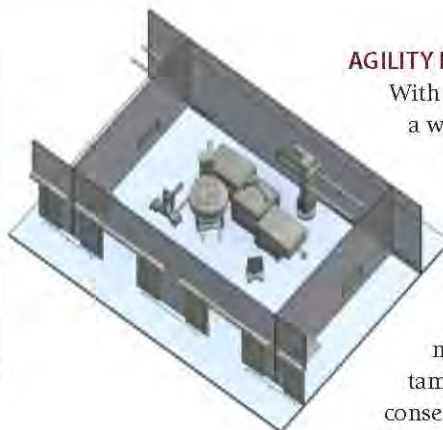


Right and far right, Modular Compression Room. In room views.

## PLANNING FOR INCREASED DEMAND

Process development provides another opportunity to design in efficiency and flexibility. One aspect of that is matching equipment size to batch size. This can reduce unnecessary capital investment for larger equipment, avoid underutilized resources and free up valuable facility footprint for other use. Making the optimal decisions in this regard requires allowing for the reality that production may need to increase—for example, with the move from clinical to commercial quantities or with increasing market demand. A flexible facility makes it possible to clone an efficient, well-utilized equipment train, leveraging the existing design and validation documentation, and double production. When scaling out, rather than scaling up, all standard operating procedures and cleaning procedures remain identical to the existing train, thereby avoiding the challenges associated with traditional scale-up and helping speed time to market.

Another approach is to consider leveraging aspects of continuous or semi-continuous processing. Innovators in the industry are beginning to explore these concepts, which have proven successful in food, cosmetics, chemicals and other manufacturing processes. It enables the owner to address increased demand simply by altering the run time for the process, without adding capital equipment. Continuous processing equipment options and availability will increase as pharmaceutical manufacturers become more comfortable with their ability to define their own batch units for sampling—for example, by time increments—and realize the advantages that continuous processing, or some hybrid continuous process approach, provides to their business model. During the feasibility and concept phases of the project, investigate the sizes and orientations of the continuous equipment. If continuous processing isn't selected initially, consider designing rooms and floor plans that allow for installation of continuous equipment in the future. This could potentially leverage some of the work-in-process areas that may not be required for continuous processing. Decisions around process design should be planned upfront with input from all stakeholders, including research and development, quality control, quality assurance and operations.



## AGILITY EQUALS ADAPTABILITY

With a clear idea of strategic goals and a well-designed process, the next step is to fit the process into the available area within budget constraints. It's understood that an effective layout philosophy will address material and personnel flows to help mitigate mix-up and cross-contamination of products. Utilizing conservative airlock strategies that properly segregate rooms and/or suites

of rooms will allow the flexibility to repurpose those areas for different types of products without jeopardizing the existing production or generating any potential cross-contamination areas. An agile facility need not be modular, but laying it out with clusters of process rooms that have good flow patterns, robust room sizes and sufficient technical space allows the owner to repurpose suites as needed or to replicate them for expansion. Similar to cloned production lines, modular suites with the same basic design allow use of the same SOPs, gowning philosophies and cleaning procedures, again saving time to manufacturing.

When designing room layouts, build in the flexibility to use the rooms for different operations as needed. Create utilities panels in the wall with all commonly used utilities, such as compressed air, nitrogen, electrical, purified water, hot/cold domestic water and dust collection. Another consideration is to provide sufficient space and height to accommodate future equipment needs—for example, if the business strategy includes products that require spray drying, such vertical equipment is difficult if not impossible to install unless the space has been designed for it. For rooms that do not currently need elevated ceiling heights, consider running duct work and piping at a higher elevation to allow for ceiling bumps that future process operations might require. When assigning adjacent mechanical/technical spaces to process rooms, an agile facility takes into account equipment that could be required in the future.

The same modular/cloning process philosophy described above also applies to utility systems. Start with modularly designed utilities using manifold piping systems for distribution, and add compressors, vacuum pumps, water purification skids and storage vessels to the mechanical areas to increase capacity when production increases. In many cases it makes sense to install oversized storage vessels, which are not significantly more expensive than smaller ones, at the outset, so they are available when production increases.

## THINKING AHEAD SUPPORTS LONG-RANGE SUCCESS

A successful multiproduct facility enables its owner to move quickly and cost efficiently from production of one compound to another in support of strategic business goals. Optimizing this transition requires more than just an effective cleaning philosophy. It requires making appropriate processing decisions as well as design decisions when building or expanding the facility. When facilities, suites, process lines and utilities are designed for agility, operators have the flexibility to change out unit operations for a variety of drug products and the capability to scale out to increase capacity in the face of market demand.



Compression Suite: Eight replicated modular rooms. 3-dimensional view