

## Going Modular for High Containment Labs

By: Komal Hatti, NCARB, LEED AP  
SME R&D, Sr. Process Architect  
IPS- Integrated Project Services, LLC



High containment labs are defined as research facilities with BSL-3, ABSL-3, BSL-4 or ABSL-4 classification per BMBL. A pre-engineered, turnkey and modular solution with pharmaceutical underpinnings is a **safer, smarter and more sustainable** approach for these complex facilities, as outlined below:

1. **Engineering and construction expertise:** Engineering and construction expertise for low containment labs can be found easily. In contrast, there are very few qualified professionals with experience in high containment lab design and construction. A **pre-engineered** product removes geographical constraints and produces a **superior quality** product due to controlled construction environment.
2. **Standardized design:** High containment labs have mostly identical components. The only variation is size of the lab room itself. Following the principles of flex lab design and BMBL guidelines, a **flex module** can be easily developed that can grow in size and be flexible enough to receive most lab equipment.

3. **Pharmaceutical design philosophy:** BMBL guidelines for high containment labs focus heavily on containment and decontamination. These exact concerns form the foundation for CGMP guidelines for pharmaceutical grade manufacturing facilities. A smarter approach therefore is to start the design with **cleanroom** and CGMP mindset, a design team that has biosecurity and chemical engineering expertise, in addition to a typical AE team. On the other hand, most low containment labs are relatively large and require a designer with a good understanding of lean principles, process flows and mechanical systems for cross-contamination prevention.
4. **Validation requirements:** While failure of a mechanical system in a low containment lab will result in sample loss, productivity loss and minor illness, it will most certainly be fatal in case of a high containment lab. They require extensive post-construction testing and validation. **Off-site validation** of a modular, standardized product is easier and less expensive.
5. **Cost neutral:** Per square foot cost for a high containment lab is similar to that of a pharmaceutical clean room, and significantly higher than a typical lab. Small project size, complex engineering systems and lack of engineering and construction resources are to blame. Against this backdrop, a turnkey, pre-engineered, cleanroom product makes a lot of **economic sense**.

An ideal product solution for high containment labs uses a **flex ABSL-3 module** as the starting point. Components are added or subtracted to achieve variation in complexity for BSL-3, BSL-4 and ABSL-4 labs, while accommodating varying lab sizes. Due to off-site construction, this approach has far a superior carbon impact compared to a traditional build.