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ON THE LEADING EDGE: BSL-3 FACILITIES

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Public and private institutions have observed the upward trend in funding for BSL-3 facilities and research. Many have begun developing small BSL-3 facilities alongside their BSL-2 facilities, with plans for future conversion of BSL-2 labs to additional BSL-3 cleanroom suites as they secure funding to expand their research at that level. These institutions are seeking design and infrastructure that will provide the flexibility for cost-effective future conversion with the least disruption to ongoing research in adjacent labs. Here are some key space planning, mechanical/electrical/plumbing (MEP), and architectural requirements that must be considered to meet this goal.

SPACE PLANNING

Effective space planning is essential for ensuring that BSL-2 labs, once converted to BSL-3 containment rooms, can efficiently be incorporated into the growing BSL-3 facility. Adjacency is the key. For example, consider a layout that provides a central BSL-3 service corridor with shower-in facilities at the entrance, access to each of the BSL-3 suites along the length of the corridor, and shower-out facilities at the end of the corridor.

Similarly, locate BSL-2 labs along a service corridor that continues on the other side of a wall that is free of risers and conduit, with shower-out facilities at the far end of that second corridor. When the time comes to convert and incorporate these into the BSL-3 facility, the end-wall can easily or simply be opened and the existing entrance to the BSL-2 labs closed and sealed.

All utilities feeding the labs should be accessible from the ceiling above the service corridor to allow maintenance to be performed without entering cleanroom suites.

MEP REQUIREMENTS

Although maintenance of negative air pressure in BSL-2 labs is already a critical issue in the sizing and design of the mechanical system, it goes without saying that it is of paramount importance in a BSL-3 suite. The mechanical system must be sized to ensure that there will be sufficient air supply volume to maintain negative air pressure in the BSL-3 suites. Although it is not typically required for BSL-2 labs, by installing air supply ducts and diffusers at the ceiling and returns and the floor level, you can plan ahead for the requirements of BSL-3 suites.

Similarly, plan ahead for anticipated size of biosafety cabinets in future BSL-3 suites. For example, say that existing BSL-2 labs require 4-ft. fume hoods. If the owner anticipates replacing these with 6-ft. biosafety cabinet during the conversion, these will require additional capacity in the mechanical system. Moreover, unlike fume-hood exaust, biosafety-cabinet exhaust cannot be filtered and then recirculated into the BSL-3 suite.

In addition, you can prepare for future BSL-3 requirements by specifying molded, cast electrical black-boxes, electrical outlets, and lighting fixtures now, rather than simple punched boxes. The additional expense today is much lower than the cost of tearing out and replacing these fixtures in the future.

ARCHITECTURAL REQUIREMENTS

BSL-2 facility walls are typically constructed of gypsum board. This will suffice for future BSL-3 providing that they are free of cracks and crevices and finished with a hard, nonporous, washable coating, such as epoxy paint.

Similarly, ceilings must be seamless and finished with hard, non-porous materials. The suspended acoustic tile ceilings that typically are used in BSL-2 facilities are not acceptable at the BSL-3 level.

Although some designers recommend coved junctions between walls and ceilings, this may not be necessary if junctions are properly taped and sealed.

Floors must be covered with a durable, seamless material. BSL-3 suites will require heat-welded vinyl flooring with a cove base. Junctions between flooring and walls, and between flooring, fixed cabinets, and equipment, should be coved. BSL-2 suites can be retrofitted with seamless flooring and a cove base at the time of conversion, especially if suites are furnished with moveable casework with umbilical attachments to ceiling outlets. However, it is cheaper (in terms of life cycle cost), easier, and faster to do it now. Select case-work constructed of nonporous, durable materials.

Metal doors, preferably gasketed, with smooth hardware sealed at the junction with the doors, will allow for reuse and savings down the road.

CHANGE IS CERTAIN

Building in the flexibility for future conversion of BSL-2 to BSL-3 facilities comes at a price: probably double the cost of building BSL-2 labs. However, preparing for the conversion today – in today's dollars – will certainly be faster, less costly, and less disruptive than a top-to-bottom renovation in a few years. Many owners are taking this calculated risk for the opportunity to remain on the leading edge of biomedical research.