

## Large Scale Containment Comparison of BSL-1 and BL1 Standards

The following table was prepared to compare BSL-1 and BL1 standards for large scale containment (>10L in one vessel) and to highlight the additional containment standards required for large scale activities compared to “bench scale” BSL-1/BL1 activities. This table is a generalized summary of the requirements. For full details of the requirements, review the standards in their entirety using the links provided. **If your research plans involve culturing modified or unmodified microbial agents in a system that exceeds 10 liters, please notify VU Biosafety ([VUBiosafety@vanderbilt.edu](mailto:VUBiosafety@vanderbilt.edu)) before initiating activities.**

### Applicable Standards:

[Biosafety in Microbiological and Biomedical Laboratories](#) (BMBL) Appendix M and Section IV – apply to all agents assigned to BSL-1/BL1

[NIH Guidelines for Research Involving Recombinant or Synthetic Nucleic Acid Molecules \(RDNA\)](#) (NIHG) Appendices G & K – apply to agents assigned to BL1 that contain RDNA

Category	BMBL (Section IV) BSL-1/BL1 NIHG (Appendix G) <span style="color: green;">≤10L in one vessel (“bench scale”)</span>	BSL-1-Large Scale BMBL (Appendix M) <span style="color: green;">&gt;10L in one vessel</span>	BL1-Large Scale NIHG (Appendix G & K) <span style="color: green;">&gt;10L in one vessel</span>
General Hazards	<ul style="list-style-type: none"> <li>Degree of hazard to health or the environment posed by the organism</li> <li>Hazard posed by the potential release of aerosols</li> </ul>	<ul style="list-style-type: none"> <li>Aerosol generation from pressurized vessels and lines for biological reactors</li> <li>High volumes and high concentration of product</li> <li>Risk associated with specialized equipment</li> <li>Large volume of chemicals required for inactivation of the biological agent</li> <li>Biological agent and genetic material risk</li> </ul>	<ul style="list-style-type: none"> <li>Degree of hazard to health or the environment posed by the organism</li> <li>Hazard posed by the potential release of aerosols</li> <li>The NIHG does not address other hazards accompanying the large scale cultivation (e.g., toxic properties of products; physical, mechanical, and chemical aspects of downstream processing) and expects that these hazards will be considered separately.</li> </ul>
Engineering Controls/Lab Features	<ul style="list-style-type: none"> <li>Surfaces must be resistant to chemicals and easy to clean. Laboratory furniture is sturdy. Spaces between benches, cabinets, and equipment are accessible for cleaning.</li> <li>Each laboratory has a door for access control.</li> <li>Each laboratory contains a sink for hand washing and an eye wash.</li> <li>If the laboratory has windows that open, they are fitted with fly screens.</li> <li>Special containment equipment is generally not required for manipulations of agents assigned to BSL-1/BL1.</li> </ul>	<ul style="list-style-type: none"> <li>The lab design must include controls to prevent contamination spread within the facility and to the environment.</li> <li>HVAC system, room pressure, and airflow: The design of the airflow must provide personnel and environmental protection.</li> <li>Surfaces must be resistant to chemicals and easy to clean.</li> <li>Spill Containment: When designing for spill containment, consider the biological, chemical, and physical processes in an area.</li> </ul>	<ul style="list-style-type: none"> <li>Surfaces must be resistant to chemicals and easy to clean. Laboratory furniture is sturdy. Spaces between benches, cabinets, and equipment are accessible for cleaning.</li> <li>Each laboratory has a door for access control.</li> <li>Each laboratory contains a sink for hand washing and an eye wash.</li> <li>If the laboratory has windows that open, they are fitted with fly screens.</li> <li>Engineering controls like the use of a closed system should be implemented to reduce exposure via aerosols.</li> <li>Engineering controls should be in place to contain potential large scale spills.</li> </ul>

Category	<b>BMBL (Section IV) BSL-1/BL1 NIHG (Appendix G) ≤10L in one vessel (“bench scale”)</b>	<b>BSL-1-Large Scale BMBL (Appendix M) &gt;10L in one vessel</b>	<b>BL1-Large Scale NIHG (Appendix G &amp; K) &gt;10L in one vessel</b>
Containment Requirements	<ul style="list-style-type: none"> <li>• Eating, drinking, smoking, mouth pipetting, and applying cosmetics are prohibited in the workplace.</li> <li>• Changing and hand washing facilities as well as protective clothing, appropriate to the risk, to be worn during work should be provided.</li> <li>• Work surfaces are decontaminated once a day and after any spill of viable material.</li> <li>• All contaminated liquid or solid wastes are decontaminated before disposal.</li> <li>• Mechanical pipetting devices are used; mouth pipetting is prohibited.</li> <li>• Personnel wash their hands after handling biological materials.</li> <li>• All procedures are performed carefully to minimize the creation of aerosols.</li> </ul>	<ul style="list-style-type: none"> <li>• Viable organisms should be handled in a closed system or other primary containment.</li> <li>• The integrity of the vessel used for containment must be tested regularly.</li> <li>• Culture fluids should not be removed from a system until organisms are inactivated.</li> <li>• Waste solutions and materials should be inactivated.</li> <li>• Control of aerosols by engineering or procedural controls should be in place to prevent or minimize release of organisms.</li> <li>• Exhaust gases from a closed system should be treated to minimize or prevent release of viable organisms.</li> <li>• A closed system that has contained viable organisms should not be opened until sterilized by a validated procedure.</li> <li>• The closed system should be maintained at as low a pressure as possible to maintain integrity of containment features.</li> <li>• The closed system shall incorporate monitoring or sensing devices to monitor the integrity of containment.</li> <li>• Emergency plans and spill procedures are required for handling large losses of cultures.</li> <li>• The area and access to the area must be controlled to ensure that potential spills, leaks, and aerosols are contained.</li> <li>• Containment requirements listed for BSL-1 apply here as well.</li> </ul>	<ul style="list-style-type: none"> <li>• Viable organisms should be handled in a closed system or other primary containment.</li> <li>• The integrity of the vessel used for containment must be tested regularly and this testing must be documented.</li> <li>• Culture fluids should not be removed from primary containment until organisms are inactivated by a valid inactivation procedure. If culture fluids contain viable organisms or viral vectors intended as final product then they may be removed from the primary containment by way of a closed system.</li> <li>• Collection or addition to the system must be conducted in a manner which minimizes the release of aerosols or contamination of exposed surfaces.</li> <li>• Exhaust gases removed from a closed system or other primary containment equipment shall be treated by filters which have efficiencies equivalent to high efficiency particulate air/HEPA filters.</li> <li>• A closed system or other primary containment equipment shall not be opened for maintenance or other purposes unless it has been sterilized.</li> <li>• Emergency plans must include methods and procedures for handling spills.</li> <li>• Spills and accidents which result in overt exposures to organisms containing recombinant or synthetic nucleic acid molecules are immediately reported to the Laboratory Director.</li> <li>• Containment requirements listed for BL1 apply here as well.</li> </ul>