TABLE 1

Summary of Guidelines for Biosafety Containment Levels for Plants, Arthropods And Their Associated Microbes In Greenhouses[1,2]

BL-P	PRACTICES	FACILITIES (SECONDARY BARRIERS)
1	Standard BSL-1 Practices plus: • Personnel must read and follow written greenhouse practices and procedures • Experiments currently in progress are recorded • Inactivation of experimental organisms before disposal outside of greenhouse • Undesired species control plan implemented • Motile macroorganisms are housed in appropriate cages and if released, escape from the facility is minimized	• Greenhouse floor is composed of gravel or other porous material and walkways are of an impervious material (e.g. concrete) • Windows and other openings may be open and do not require barriers to contain or exclude pollen, microbes, or small flying animals • Screens are recommended
2	BL1-P practices plus: • Records of all plants, microbes or small animals brought in or removed from the facility • Any accidental spill or release of microbe shall be reported to the GD*, IBC, NIH/OBA and other applicable authorities • Decontamination of run-off water is recommended • Gravel or similar floors should be treated periodically to inactivate/eliminate potentially trapped organisms • Signs must be posted when a restricted experiment is in progress • Signs should be posted if organisms with potential for detrimental impact on managed or natural ecosystems and/or risk to human health are present • A greenhouse practices manual should be prepared and include contingencies for unintentional release of organisms	BL1-P facility plus: • Greenhouse floor is composed of an impervious material (e.g. concrete) • Screens on windows and openings to exclude birds and arthropods • Autoclave available • Minimize the ingress of arthropods through intake fans • Containment can be satisfied by using a growth chamber or growth room within a building that limits access and escape of micro and macroorganisms in a way that satisfies the intent of BL2-P guidelines
3	BL2-P practices plus: • Access restricted to those required for program or support purposes • Any accidental spill or release of microbe shall be reported to the BSO† in addition to those identified in BL2-P practices • Experimental materials are sterilized in an autoclave or rendered biologically inactive before disposal, including water • Decontamination of containers used to transport materials into or out of the facility • Disposable clothing is worn if deemed necessary by the GD; disposable clothing is removed before exit and decontaminated prior to washing or disposal • Hands are washed upon exiting the facility • All procedures are performed to minimize aerosol formation and excessive splashing of soil/potting material	BL2-P facility plus: • Standard BSL-3 facility design • Greenhouse floor is composed of an impervious material (e.g. concrete) with provision for collection and decontamination of liquid run-off • Windows are closed and sealed and resistant to breakage • Double door (i.e. pass-through) autoclave is recommended • Vacuum lines are protected with HEPA filters and liquid disinfectant traps

*GD – Greenhouse Director

†BSO – Biosafety Officer

References:

1. *A Practical Guide to Containment: Plant Biosafety in Research Greenhouses,* D. Adair & R. Irwin, Information Systems for Biotechnology; Blacksburg, VA; 2008. http://www.isb.vt.edu/

2. NIH Guidelines for Research Involving Recombinant or Synthetic Nucleic Acids, Appendix P. http://osp.od.nih.gov/office-biotechnology-activities/biosafety/nih-guidelines