Risk Groups & Containment Levels

Risk Groups

A risk group classification is used to describe the hazards associated with a microorganism based upon an agent's ability to cause disease in a host, the severity of that disease, and the availability of effective treatments for the disease. The OSU Institutional Biosafety Committee utilizes four general risk groups during its review of proposed research involving biohazardous materials:

Risk Group 1	A microorganism that is unlikely to cause disease in humans, animals, or plants
Risk Group 2	A pathogen that can cause disease in humans, animals, or plants, but is unlikely to be a serious hazard to lab personnel, the community, livestock, or the environment
Risk Group 3	A pathogen that often causes serious disease in humans, animals, or plants, but presents a low risk to the community, livestock, or the environment due to the availability of preventative measures & treatments
Risk Group 4	A pathogen that often causes life-threatening disease in humans, animals, or plants and presents a significant hazard to the community, livestock, or the environment due to ease of transmissibility and/or the absence of preventative measures & treatments

Note: *The NIH Guidelines for Research Involving Recombinant or Synthetic Nucleic Acid Molecules* (*NIH Guidelines*) only contain risk group classifications for human etiologic agents. Thus, the above risk groups for plant pathogens and non-zoonotic animal pathogens do not apply when categorizing research under the *NIH Guidelines*.

Containment Levels

A containment level classification is used to describe the laboratory characteristics that are needed to safely contain a given organism. Each level is made up of a combination of lab practices & technique, safety equipment, and facility design. The containment level required for a given project often corresponds with the risk group of the microorganism(s) in use; however, the IBC is ultimately responsible for determining the required level for each given project. The OSU IBC utilizes a variety of containment levels for containment of proposed research involving biohazardous materials.

Basic Biosafety Levels

The biosafety level (BSL) describes the degree of physical containment required to isolate biohazardous material inside a laboratory/facility to reduce the potential for exposure of laboratory workers, the community, and the environment. BSLs range from BSL-1 (lowest containment) to BSL-4 (highest containment) and can be applied to basic laboratory research using non-pathogenic wild-type or transgenic microorganisms, common non-zoonotic animal pathogens, and plant pathogens of local origin. At OSU, researchers may conduct work at biosafety levels 1, 2, & 3.

Biosafety Level 1 (BSL-1)	Appropriate for work involving well-characterized agents that are not known to cause disease in a healthy adult host as well as those that present minimal hazard to the community and/or the environment (e.g., plant & animal pathogens that are very common in the area) Examples: *E. coli* K12, *Bovine herpesvirus* 1, *Botrytis cinerea*
Biosafety Level 2 (BSL-2)	Appropriate for work involving agents known to cause non-serious disease in a healthy adult host and that present moderate hazard to the community and/or the environment Examples: *E. coli* O157:H7, *Influenza A virus*, *Phoma glycinicola*
Biosafety Level 3 (BSL-3)	Appropriate for work involving agents with the potential for respiratory transmission which are known to cause serious disease in healthy adult humans or animals and that present moderate risk to the community and livestock Examples: *Yersinia pestis*, *Histoplasma capsulatum*, *West Nile virus*

Animal Biosafety Levels

The vertebrate animal biosafety level (ABSL) describes the criteria for housing of animals that have been experimentally infected with a pathogenic agent or present a risk to the environment. ABSLs range from ABSL-1 (lowest containment) to ABSL-4 (highest containment) and can be applied to infectious disease research in animals as well other studies that may require containment (e.g., housing of transgenic animals). At OSU, researchers may conduct work at animal biosafety levels 1, 2, & 3.

Animal Biosafety Level 1 (ABSL-1)	Appropriate for work involving laboratory animals exposed to well-characterized agents that are not known to cause disease in a healthy adult human or animal as well as those that present minimal hazard to the community and/or the environment (e.g., non-zoonotic animal pathogens that are very common in the environment or require a vector that is not present) Also appropriate for non-pathogen work involving transgenic animals Examples: *Bovine viral diarrhea virus*, *Plasmodium berghei*
Animal Biosafety Level 2 (ABSL-2)	Appropriate for work involving laboratory animals infected with an agent known to cause disease in a healthy adult human or animal and that presents a moderate hazard to the community and/or environment Examples: *Influenza A virus*, *E. coli* O157:H7, *Trypanosoma cruzi*
Animal Biosafety Level 3 (ABSL-3)	Appropriate for work involving laboratory animals infected with an agent that: 1) is known to cause very serious disease in a healthy adult human or animal, 2) presents a potential for aerosol transmission, and/or 3) presents moderate risk to the community and/or livestock Examples: *Mycobacterium tuberculosis*, *Rickettsia rickettsii*

Arthropod Containment Levels

The arthropod containment level (ACL) describes the facilities and practices required to contain arthropod vectors of disease. ACLs range from ACL-1 (lowest containment) to ACL-4 (highest containment). The containment level for infected arthropods must be at least that required for the pathogen regardless of the environmental competency of the arthropod or the pathogen. At OSU, researchers may conduct work at arthropod containment levels 1, 2, & 3.

Arthropod Containment Level 1 (ACL-1)	Appropriate for work with uninfected arthropod vectors and those infected with a non-infectious organism or insignificant pathogen, including: 1. Arthropods that are present in the geographic region 2. Exotic arthropods that would not be viable in the local environment 3. Exotic arthropods that may be temporarily viable in the local environment given that active vector-borne disease transmission is not present Example: Mosquitoes carrying *P. berghei*
Arthropod Containment Level 2 (ACL-2)	Appropriate for work involving native and exotic arthropods infected with a Risk Group 2 pathogen Work with uninfected genetically modified arthropods also requires ACL-2 containment provided that the modification has no effect on viability, survivorship, host range, or vector capacity Example: Fies carrying *E. coli* O157:H7
Arthropod Containment Level 3 (ACL-3)	Appropriate for work involving potential or known vectors that are infected with a Risk Group 3 pathogen Example: Fleas carrying *Yersinia pestis*

Biosafety Level – Plants

The plant biosafety levels (BSL-P) describe the containment measures needed to avoid transmission of a recombinant or synthetic nucleic acid [r(s)NA] molecule-containing plant genome or release of r(s)NA-derived organisms associated with plants. BSL-Ps are primarily aimed at environmental

protection and range from BSL1-P (lowest containment) to BSL4-P (highest containment). At OSU, researchers may conduct work at BL-P 1, 2, & 3.

Biosafety Level 1 – Plants (BL1-P)	Appropriate for work involving: 1. Transgenic plants that would not be able to survive and spread in the environment, and if released, would not pose a risk to the environment 2. Modified microorganisms that cannot spread rapidly and are not known to have any negative effects on natural or managed ecosystems Example: Plants using *Agrobacterium* DNA segments as part of the transformation process
Biosafety Level 2 – Plants (BL2-P)	Appropriate for work with transgenic plants and associated organisms that, upon release, may be viable in the environment, but would have little impact or could be easily managed. Required for work involving: 1. Transgenic plants exhibiting a new weedy characteristic or those capable of interbreeding with reeds and other species in the vicinity 2. Transgenic research utilizing the entire genome of an indigenous infectious agent 3. Transgenic plant-associated microbes that are native to the area and potentially harmful to the environment, but that can be easily managed 4. Transgenic plant-associated microbes that are exotic to the area, but pose no risk to managed or natural ecosystems 5. Plant-associated transgenic insects or small animals that pose no risk to managed or natural ecosystems Example: Sunflower that has been transformed with wheat genes that confer resistance to *Sclerotinia*
Biosafety Level 3 – Plants (BL3-P)	Appropriate for research involving transgenic plants, plant pathogens, or other organisms that have a recognized potential for significant detrimental impact on the environment. 1. Transgenic plants containing genes from an exotic pathogen in which a complete functional genome of the microbe could be reconstituted 2. Transgenic plants or organisms that containment genes coding for vertebrate toxins 3. Experiments using transgenic microbial pathogens of insects or small animals that associate with plants if the pathogen could cause harm in the local environment Example: Inoculation of transgenic peanut plants containing fungal resistance genes with *Aspergillus flavus* strains that produce aflatoxin