Biological Risk Management and Containment

NIH Classification of Biohazardous Agents by Risk Group

Work Practices Reference Information

Containment Laboratory Guidelines

Version 2- February 2021

Approved by: Vice-Chancellor
Document Owner: Associate Director, Health, Safety and Wellbeing
Content Manager: Manager, Hazard and Containment

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Record of Amendments to Version 2

Date	Page number	Nature of amendment

Contents

1. Who is this reference document for?

This document is intended for **principal investigators (PIs), designated persons in charge, designated laboratory person (DLPs),** technical staff and students trained in the safe use of risk biological materials in appropriate containment facilities.

Knowing the classification of these materials by risk group is essential to meeting the requirements of the Biological Risk Management and Containment Standard.

2. Requirements of the Biological Risk Management and Containment Standard

2.1. Working with RG2 micro-organism or higher

Work with micro-organisms with a risk classification of Risk Group 2 or higher (as per the ASNZ2243.3 risk classification) must receive prior approval from the University of **Auckland Biological Safety Committee**. This requirement also applies to clinical specimens that have been shown to contain such micro-organisms.

2.1.1. How are applications made to the BSC?

Only principal investigators (PIs) can formally apply to the BSC. However, other laboratory personnel and students are most welcome to contact the BSC with any queries or concerns: Biological Safety Committee.

2.2. Importing or developing GMOs

Applications to import or develop GMOs of any Risk Group require an approval by the Environmental Protection Authority (EPA).

2.2.1. Applications to the EPA

Applications to the EPA are to be made to the University of Auckland Biological Safety Committee in the first instance.

3. NIH classification of biohazardous agents by risk group

ASNZ2243.3 classification of biohazardous agents by risk group. Lists shown here are based on NIH documentation. Those agents not listed in Risk Groups 2, 3 and 4 are not automatically or implicitly classified in RG1; a risk assessment must be conducted based on the known and potential properties of the agents and their relationship to agents that are listed.

3.1. Risk Group 1 (RG1) agents

RG1 (low individual and community risk) agents are unlikely to cause human or animal disease. Examples of RG1 agents include asporogenic *Bacillus subtilis*, *Escherichia coli*-K12 and adeno-associated virus types 1 through 4.

3.2. Risk Group 2 (RG2) agents

RG2 (moderate individual risk, limited community risk) agents are unlikely to be a significant risk to laboratory workers, the community, livestock, or the environment; laboratory exposures may cause infections, but effective treatment and preventive measures are available, and the risk of spread is limited.

3.2.1. Risk Group 2 (RG2) - bacterial agents including Chlamydia

- *Acinetobacter baumannii* (formerly *Acinetobacter calcoaceticus*)
- *Actinobacillus*
- *Actinomyces pyogenes* (formerly *Corynebacterium pyogenes*)
- *Aeromonas hydrophila*
- *Amycolata autotrophica*
- *Archanobacterium haemolyticum* (formerly *Corynebacterium haemolyticum*)
- *Arizona hinshawii* - all serotypes
- *Bacillus anthracis*
- *Bartonella henselae*, *B. quintana*, *B. vinsonii*
- *Bordetella* including *B. pertussis*
- *Borrelia recurrentis*, *B. burgdorferi*

- *Burkholderia* (formerly *Pseudomonas* species) except those listed as Risk Group 3
- *Campylobacter coli*, *C. fetus*, *C. jejuni*
- *Chlamydia psittaci*, *C. trachomatis, C. pneumoniae*
- *Clostridium botulinum*, *C. chauvoei*, *C. haemolyticum*, *C. histolyticum*, *C. novyi*, *C. septicum*, *C. tetani*
- *Coxiella burnetii* – specifically the Phase II, Nine Mile strain, plaque purified, clone 4
- *Corynebacterium diphtheriae*, *C. pseudotuberculosis*, *C. renale*
- *Dermatophilus congolensis*
- *Edwardsiella tarda*
- *Erysipelothrix rhusiopathiae*
- *Escherichia coli* - all enteropathogenic, enterotoxigenic, enteroinvasive and strains bearing K1 antigen, including *E. coli* O157:H7
- **Francisella tularensis* specifically **F. tularensis* subspecies *novicida* [aka *F. novicida*], strain Utah 112; **F. tularensis* subspecies *holarctica* LVS; **F. tularensis* biovar *tularensis* strain ATCC 6223 (aka strain B38). *For research involving high concentrations, RG3 practices should be considered.
- *Haemophilus ducreyi*, *H. influenza*
- *Helicobacter pylori*
- *Klebsiella* - all species except *K. oxytoca* (RG1)
- *Legionella* including *L. pneumophila*
- *Leptospira interrogans* - all serotypes
- *Listeria*
- *Moraxella*
- *Mycobacterium* (except those listed as Risk Group 3) including *M. avium* complex, *M. asiaticum*, *M. bovis* BCG vaccine strain, *M. chelonei*, *M. fortuitum*, *M. kansasii*, *M. leprae*, *M. malmoense*, *M. marinum*, *M. paratuberculosis*, *M.scrofulaceum*, *M. simiae*, *M. szulgai*, *M. ulcerans*, *M. xenopi*
- *Mycoplasma*, except *M. mycoides* and *M. agalactiae* which are restricted animal pathogens
- *Neisseria gonorrhoeae, N. meningitides*
- *Nocardia asteroides*, *N. brasiliensis*, *N. otitidiscaviarum*, *N. transvalensis*
- *Pseudomonas aeruginosa*
- *Rhodococcus equi*

- *Salmonella* including *S. arizonae*, *S. cholerasuis*, *S. enteritidis*, *S. gallinarum-pullorum*, *S. meleagridis*, *S. paratyphi*, A, B, C, *S. typhi*, *S. typhimurium*
- *Shigella* including *S. boydii*, *S. dysenteriae*, type 1, *S. flexneri*, *S. sonnei*
- *Sphaerophorus necrophorus*
- *Staphylococcus aureus*
- *Streptobacillus moniliformis*
- *Streptococcus* including *S. pneumoniae*, *S. pyogenes*
- *Treponema pallidum*, *T. carateum*
- *Vibrio cholerae*, *V. parahemolyticus*, *V. vulnificus*
- *Yersinia enterocolitica*
- *Yersinia pestis* specifically pgm(−) strains (lacking the 102 kb pigmentation locus) and lcr(−) strains (lacking the LCR plasmid)

3.2.2. Risk Group 2 (RG2) - fungal agents

- *Blastomyces dermatitidis*
- *Cladosporium bantianum*, *C. (Xylohypha) trichoides*
- *Cryptococcus neoformans*
- *Dactylaria galopava* (*Ochroconis gallopavum*)
- *Epidermophyton*
- *Exophiala* (*Wangiella*) *dermatitidis*
- *Fonsecaea pedrosoi*
- *Microsporum*
- *Paracoccidioides braziliensis*
- *Penicillium marneffei*
- *Sporothrix schenckii*
- *Trichophyton*

3.2.3. Risk Group 2 (RG2) - parasitic agents

- *Ancylostoma* human hookworms including *A. duodenale*, *A. ceylanicum*
- *Ascaris* including *Ascaris lumbricoides suum*
- *Babesia* including *B. divergens*, *B. microti*
- *Brugia filaria* worms including *B. malayi, B. timori*
- *Coccidia*

- *Cryptosporidium* including *C. parvum*
- *Cysticercus cellulosae* (hydatid cyst, larva of *T. solium*)
- *Echinococcus* including *E. granulosis*, *E. multilocularis*, *E. vogeli*
- *Entamoeba histolytica*
- *Enterobius*
- *Fasciola* including *F. gigantica, F. hepatica*
- *Giardia* including *G. lamblia*
- *Heterophyes*
- *Hymenolepis* including *H. diminuta, H. nana*
- *Isospora*
- *Leishmania* including *L. braziliensis*, *L. donovani*, *L. ethiopia*, *L. major*, *L. mexicana*, *L. peruvania*, *L. tropica*
- *Loa loa* filaria worms
- *Microsporidium*
- *Naegleria fowleri*
- *Necator* human hookworms including *N. americanus*
- *Onchoerca filaria* worms including, *O. volvulus*.
- *Plasmodium* including simian species, *P. cynomologi*, *P. falciparum*, *P. malariae, P. ovale, P. vivax*
- *Sarcocystis* including *S. sui hominis*
- *Schistosoma* including *S. haematobium, S. intercalatum, S. japonicum, S. mansoni, S. mekongi*
- *Strongyloides* including *S. stercoralis*
- *Taenia solium*
- *Toxocara* including *T. canis*
- *Toxoplasma* including *T. gondii*
- *Trichinella spiralis*
- *Trypanosoma* including *T. brucei brucei, T. brucei gambiense, T. brucei rhodesiense, T. cruzi*
- *Wuchereria bancrofti* filaria worms

3.2.4. Risk Group 2 (RG2) - viruses

3.2.4.1. Adenoviruses, human - all types

3.2.4.2. Alphaviruses (Togaviruses) - Group A Arboviruses

- Chikungunya vaccine strain 181/25
- Eastern equine encephalomyelitis virus
- Venezuelan equine encephalomyelitis vaccine strain TC-83
- Western equine encephalomyelitis virus

3.2.4.3. Arenaviruses

- Junin virus candid #1 vaccine strain
- Lymphocytic choriomeningitis virus (non-neurotropic strains)
- Tacaribe virus complex

3.2.4.4. Bunyaviruses

- Bunyamwera virus
- Rift Valley fever virus vaccine strain MP-12

3.2.4.5. Caliciviruses

3.2.4.6. Coronaviruses (exception for SARS and MERS, see below)Flaviviruses (Togaviruses) - Group B Arboviruses

- Dengue virus serotypes 1, 2, 3, and 4
- Japanese encephalitis virus strain SA 14-14-2
- Yellow fever virus vaccine strain 17D

3.2.4.7. Hepatitis A, B, C, D, and E viruses

3.2.4.8. Herpesviruses - except Herpesvirus simiae *(Monkey B virus) (see Risk Group 4 (RG4) -Viral Agents)*

- Cytomegalovirus
- Epstein Barr virus
- Herpes simplex types 1 and 2
- *Herpes zoster*
- Human herpesvirus types 6 and 7

3.2.4.9. Orthomyxoviruses

- Influenza viruses types A, B, and C
- Tick-borne orthomyxoviruses

3.2.4.10. Papovaviruses

- All human papilloma viruses

3.2.4.11. Paramyxoviruses

- Newcastle disease virus
- Measles virus
- Mumps virus
- Parainfluenza viruses types 1, 2, 3, and 4
- Respiratory *syncytial* virus

3.2.4.12. Parvoviruses

- Human parvovirus (B19)

3.2.4.13. Picornaviruses

- Coxsackie viruses types A and B

- *Echoviruses* - all types
- Polioviruses - all types, wild and attenuated
- *Rhinoviruses* - all types

3.2.4.14. Poxviruses - all types except Monkeypox virus (see Risk Group 3 (RG3) -viruses and prions) and restricted

3.2.4.15. Poxviruses including Alastrim, Smallpox, and Whitepox

3.2.4.16. Reoviruses - all types including Coltivirus, human Rotavirus, and Orbivirus (Colorado tick fever virus)

3.2.4.17. Rhabdoviruses

- Rabies virus - all strains
- Vesicular stomatitis virus - laboratory adapted strains including VSV- Indiana, San Juan, and Glasgow

3.2.4.18. Togaviruses (see Alphaviruses and Flaviviruses)

- Rubivirus (rubella)

3.3. Risk Group 3 (RG3) agents

RG3 (high individual risk, limited to moderate community risk) agents usually cause serious human or animal disease and may present a significant risk to laboratory workers. It could present a limited to moderate risk if spread in the community or the environment, but there are usually effective preventive measures or treatment available.

3.3.1. Risk Group 3 (RG3) - bacterial agents including *Rickettsia*

- *Bartonella*

- *Brucella* including *B. abortus, B. canis, B. suis*
- *Burkholderia (Pseudomonas) mallei, B. pseudomallei*
- *Coxiella burnetii*
- *Francisella tularensis*
- *Mycobacterium bovis* (except BCG strain, see Risk Group 2 (RG2) - Bacterial Agents)
- *Mycobacterium tuberculosis*
- *Orientia tsutsugamushi* (was *R. tsutsugamushi*)
- Pasteurella *multocida* type B -"buffalo" and other virulent strains
- *Rickettsia akari, R. australis, R. canada, R. conorii, R. prowazekii, R. rickettsii, R. siberica, R. typhi (R. mooseri)*
- *Yersinia pestis*

3.3.2. Risk Group 3 (RG3) - fungal agents

- *Coccidioides immitis* (sporulating cultures; contaminated soil)
- *Histoplasma capsulatum, H. capsulatum var. duboisii*

3.3.3. Risk Group 3 (RG3) - parasitic agents

None

3.3.4. Risk Group 3 (RG3) - viruses and prions

3.3.4.1. Alphaviruses (Togaviruses) - Group A Arboviruses

- Chikungunya virus (except the vaccine strain 181/25, see RG2)
- Semliki Forest virus
- St. Louis encephalitis virus
- Venezuelan equine encephalomyelitis virus (except the vaccine strain TC- 83, see RG2)

3.3.4.2. Arenaviruses

- Flexal

- *Lymphocytic choriomeningitis* virus (LCM) (neurotropic strains)

3.3.4.3. Bunyaviruses

- Hantaviruses including Hantaan virus
- Rift Valley fever virus

3.3.4.4. Coronaviruses

- SARS-associated coronavirus (SARS-CoV and SARS-CoV-2)
- Middle East respiratory syndrome coronavirus (MERS-CoV)

3.3.4.5. Flaviviruses (Togaviruses) - Group B Arboviruses

- Japanese encephalitis virus
- West Nile virus (WNV)
- Yellow fever virus

3.3.4.6. Poxviruses

- Monkeypox virus

3.3.4.7. Prions

- Transmissible *spongioform encephalopathies* (TME) agents (Creutzfeldt- Jacob disease and kuru agents)

3.3.4.8. Retroviruses

- Human immunodeficiency virus (HIV) types 1 and 2
- Human T cell lymphotropic virus (HTLV) types 1 and 2
- Simian immunodeficiency virus (SIV)

3.3.4.9. Rhabdoviruses

- Vesicular stomatitis virus

3.4. Risk Group 4 (RG4) Agents

RG4 (high individual and community risk) agents usually produce life-threatening human or animal disease, represent a significant risk to laboratory workers and may be readily transmissible from one individual to another. Effective treatment and preventive measures are not usually available.

3.4.1. Risk Group 4 (RG4) - Bacterial Agents

None

3.4.2. Risk Group 4 (RG4) - Fungal Agents

None

3.4.3. Risk Group 4 (RG4) - Parasitic Agents

None

3.4.4. Risk Group 4 (RG4) - Viral Agents

3.4.4.1. Arenaviruses

- Guanarito virus
- Lassa virus
- Junin virus (except the candid #1 vaccine strain, see RG2)
- Machupo virus
- Sabia

3.4.4.2. Bunyaviruses (Nairovirus)

- Crimean-Congo hemorrhagic fever virus

3.4.4.3. Filoviruses

- Ebola virus
- Marburg virus

3.4.4.4. Flaviruses (Togaviruses) - Group B Arboviruses

- Tick-borne encephalitis virus complex including Absetterov, Central European encephalitis, Hanzalova, Hypr, Kumlinge, Kyasanur Forest disease, Omsk hemorrhagic fever, and Russian spring-summer encephalitis viruses

3.4.4.5. Herpesviruses (alpha)

- *Herpesvirus simiae* (Herpes B or Monkey B virus)

3.4.4.6. Paramyxoviruses

- Equine *morbillivirus*

3.4.4.7. Hemorrhagic fever agents and viruses as yet undefined

3.5. Animal Viral Etiologic Agents in Common Use

The following list of animal etiologic agents is appended to the list of human etiologic agents. None of these agents is associated with disease in healthy adult humans; they are commonly used in laboratory experimental work.

A containment level appropriate for RG1 human agents is recommended for their use. For agents that are infectious to human cells, e.g., amphotropic and xenotropic strains of murine leukemia virus, a containment level appropriate for RG2 human agents is recommended.

3.5.1. Baculoviruses

3.5.2. Herpesviruses

- Herpesvirus ateles
- Herpesvirus saimiri
- Marek's disease virus
- Murine cytomegalovirus

3.5.3. Papovaviruses

- Bovine papilloma virus
- Polyoma virus
- Shope papilloma virus
- Simian virus 40 (SV40)

3.5.4. Retroviruses

- Avian leukosis virus
- Avian sarcoma virus
- Bovine leukemia virus
- Feline leukemia virus
- Feline sarcoma virus
- Gibbon leukemia virus
- Mason-Pfizer monkey virus
- Mouse mammary tumor virus
- Murine leukemia virus
- Murine sarcoma virus
- Rat leukemia virus

4. Definitions

Designated laboratory person (DLP) means the trained person in each research group who has been given the authority to receive purchase requests made in SQERM and to make a formal request for a purchase order via PeopleSoft. In containment and transitional facilities DLPs will have additional training to enable them to scrutinise documentation for restricted items and provide support to researchers.

Designated person in charge means a staff member in any of the following roles: sector manager, facility manager, floor manager, technical manager or an appointed delegate.

Principal Investigator (PI): In the context of hazard containment and transitional facilities, a principal investigator is the holder of an independent grant administered by the University and the lead researcher for the grant project, usually in the sciences, such as a laboratory study or a clinical trial. The phrase is also often used as a synonym for "head of the laboratory" or "research group leader." The PI is responsible for assuring compliance with applicable University standards and procedures, and for the oversight of the research study and the informed consent process. Although the PI may delegate tasks, they retain responsibility for the conduct of the study.

5. Appendix 1

5.1. How to make an application for higher risk "wild-type" micro-organisms

To undertake work with wild-type micro-organisms that carry a risk classification of RG2 or greater*, you must gain prior approval from the University of Auckland Biological safety Committee (UABSC). Once approved, this work must be conducted safely in facilities suitable for the organism.

5.2. The application process

1. Submit the Application form for Higher Risk Micro-organisms following the steps in the Infonetica Ethics platform (link to infonetica)
    - Focus on procedures to control the risks when working with these organisms
    - Describe your project in language that can be understood by the lay person
    - On the other hand, sufficient technical detail should be supplied for scientific assessment of your proposal
    - Supply any additional information that is relevant to your project
    - Include the proposed location for the work and names of participants (staff and students)

2. Submit your application using the Initial Application Process in the Infonetica platform (step by step instructions are in the Infonetica Infonetica user guide

3. The principal investigator must submit the application

4. Your application must be submitted via the Infonetica users guide Users guide at least 10 working days before the next scheduled UABSC meeting in order to be assessed at the relative meeting.

* According to the ASNZ2243.3 Classification of Risk Group set out in this document.