

List of infectious materials allowable to be handled in Universiti Malaysia Pahang

This guide is to be used in handling mildly to moderate infectious material of standard strains. Non-purified strains from wild sources or those from blood borne need further considerations on their safety. According to the Laboratory Biosafety Manual (revised 2nd ed.) by World Health Organization (WHO), biosafety cabinet categorised as level 2 (or simply known as BSC 2) can be used in protection against microorganism in risk group 1 to 3 but not those in risk group 4. In simple terminology the risk groups 1 to 3 is as identified below:

- Risk Group 1 (RG1): Low individual and low community risk
- Risk Group 2 (RG2): Moderate individual risk, limited community risk
- Risk Group 3 (RG3): High individual risk, limited/moderate community risk

Additionally, described further as:

Risk Group 1

A microorganism that is unlikely to cause human or animal disease.

Risk Group 2

A pathogen that can cause human or animal disease but is unlikely to be a serious hazard to laboratory workers, the community, livestock or the environment. Laboratory exposures may cause serious infection, but effective treatment and preventive measures are available and the risk of spread of infection is limited.

Risk Group 3

A pathogen that usually causes serious human or animal disease but does not ordinarily spread from one infected individual to another. Effective treatment and preventive measures are available.

Also, there is a risk group 4 but not been considered for the university use due to its utmost severity having no known cure.

Based on these elaborations it is clear any researcher intending to handle infectious materials beyond RG2 need to be cautious and require to apply for **NOTICE OF INTENT (FORM B as found in URL: <https://oshmo.ump.edu.my/index.php/en/biosafety/ibbc-application-procedure>)** as the best practice. Ideally in any handling RG2 listed infectious material require to be conducted in a BSL-2 facility or at minimum capacity within a BSC2 containment cabinet with some strict containment procedures in place. The list provided for RG2 is separated in two: a list that can consider using BSC2 containment with additional precautionary measures suggested by IBBC once the application submitted and another list only to consider handling within a BSL2 facility.

An example of such precautionary procedures includes the use of open flames in a BSC2 cabinet. It is worth noting that open flames should be avoided and discouraged in the near microbe-free environment of the BSC cabinet. Such devices disrupt the air flow patterns designed to keep the air clean in the cabinet. Instead to sterilize the bacteriological loops a microburner or electric furnaces are available and are preferable to open flames.

Below given the listing of microorganisms for risk groups of RG2 and beyond. Note to readers as this is a dynamic list meaning not exhaustive and often require to be updated on the organisms after determining the hazards or in the event newer ones been discovered. The limited list of RG2 & RG3 listed in the table only serves as a guide to an investigator to plan the necessary risk management and handling protocols. The detailed lists of RG2 and RG3 can be obtained from Ministry of Health for notifiable human disease and Malaysia and Ministry of Agriculture and Food Industries (Department of Veterinary Services for terrestrial animals, Department of Fisheries for aquatic animals and Department of Agriculture for plant diseases). These national notifiable lists often follow the convention of international committee by the World Health Organization (for notifiable human diseases), the Food and Agriculture Organization (notifiable plant diseases) and the World Organization for Animal Health (OIE; for both terrestrial and aquatic animal diseases).

List of selected RG-2 bacteria can be considered to be handled in a BSC2 containment of a BSL1 facility (after approval of Preliminary Assessment Form by IBBC of UMP)

<i>Staphylococcus</i> spp. (standard strains of ATCC 29213, 25923 and 6538)	<i>Escherichia coli</i> (standard strains of ATCC 10536)	<i>Bacillus cereus</i> (standard strains of SBT8)	<i>Bacillus subtilis</i> (standard strains of ATCC 11774)
<i>Salmonella typhi</i> (standard strains of ATCC 13311)	<i>Pseudomonas aerogenosa</i> (standard strains of ATCC 15442)	<i>Acinetobacter baumannii</i> (standard strains of ATCC 19606)	<i>Klebsiella pneumoniae</i> (standard strains of ATCC BA 1114)

List of selected RG-2 bacteria ONLY to be handled within a BSL2 facility

<i>Acidovorax</i> spp.	<i>Clostridium</i> spp. (except <i>C. botulinum</i>)	<i>Legionella</i> spp.	<i>Serratia</i> spp.
<i>Actinomyces</i> spp.	<i>Corynebacterium diphtheria</i> , <i>C. pseudotuberculosis</i>	<i>Leptospira interrogans</i> (all serovars)	<i>Shigella</i> spp.
<i>Acinetobacter</i> spp.	<i>Coxiella burnetii</i> (serology)	<i>Listeria</i> spp., <i>Listeria monocytogenes</i>	Methicillin-resistant <i>Staphylococcus aureus</i> (e.g. MRSA ATCC43300)
<i>Aeromonas</i> spp.	<i>Dermatophilus congolensis</i>	<i>Moraxella</i> spp.	<i>Stenotrophomonas maltophilia</i>
<i>Afipia</i> spp.	<i>Eikenella corrodens</i>	<i>Mycobacterium</i> spp. other than <i>M.</i>	<i>Streptobacillus moniliformis</i>

		<i>tuberculosis</i> complex	
<i>Arcanobacterium haemolyticum</i>	<i>Enterococcus</i> spp.	<i>Mycobacterium tuberculosis</i> complex (except multi-drug resistant strains)	<i>Streptococcus</i> spp.
<i>Bacterioides pertussis</i>	<i>Erysipelothrix rhusiopathiae</i>	<i>Mycoplasma</i> spp., <i>M. pneumoniae</i>	<i>Treponema palladium</i> (serology, darkfield microscopy, PCR)
<i>Borrelia</i> spp. (serology)	<i>Escherichia coli</i> of those strains genetically modified, includes <i>enteropathogenic</i> (EPEC), <i>enteroaggregative</i> (EAEC), <i>enterotoxigenic</i> (ETEC), and <i>Shiga-like toxin producing</i> (STEC)	<i>Neisseria gonorrhoeae</i> , unspiciated <i>Neisseria</i> , <i>N. meningitidis</i>	<i>Ureaplasma ureolyticum</i>
<i>Brucella</i> spp. (serology)	<i>Fusobacterium</i> spp.	<i>Nocardia</i> spp.	<i>Vibrio cholerae</i> , <i>V. parahaemolyticus</i> , <i>V. vulnificus</i>
<i>Burkholderia</i> spp. (except <i>B. mallei</i>)	<i>Gardnerella vaginalis</i>	<i>Pasteurella</i> spp.	<i>Yersinia</i> spp. (except <i>Y. pestis</i>)
<i>Campylobacter</i>	<i>Haemophilus</i> spp.	<i>Pseudomonas</i> spp.	<i>Chlamydia</i> spp. (except <i>C. psittaci</i>)
<i>Capnocytophaga</i> spp.	<i>Helicobacter</i> spp.	<i>Rhodococcus equi</i>	<i>Klebsiella</i> spp.
<i>Kingella kingae</i>	<i>Salmonella enterica</i> serovars	<i>Salmonella</i> Paratyphi A and B	-

List of selected RG-2 parasites ONLY to be handled within a BSL2 facility

<i>Acanthamoebae</i> spp.	<i>Cyclospora cayentanensis</i>	<i>Hymenolepis</i> spp.	<i>Taenia solium</i>
<i>Angiostrongylus cantonensis</i>	<i>Cystoisospora belli</i>	<i>Leishmania</i> spp.	<i>Toxocara</i> spp.
<i>Anisakis</i> spp.	<i>Diphyllobothrium latum</i>	<i>Loa loa</i>	<i>Toxoplasma gondii</i>
<i>Ascaris lumbricoides</i>	<i>Echinococcus</i> spp.	<i>Naegleria fowleri</i>	<i>Trichinella</i> spp.
<i>Babesia</i> spp.	<i>Entamoeba histolytica</i>	<i>Opisthorchis</i> spp.	<i>Trichuris trichuria</i>
<i>Balamuthia mandrillaris</i>	<i>Enterobius vermicularis</i>	<i>Plasmodium</i> spp. (human and simian)	<i>Trypanosoma</i> spp.
<i>Brugia</i> spp.	<i>Fasciola hepatica</i>	<i>Schistosoma</i> spp.	<i>Wuchereria bancrofti</i>
<i>Clonorchis sinensis</i>	<i>Giardia</i> spp.	<i>Strongyloides stercoralis</i>	<i>Taenia saginata</i>
<i>Cryptosporidium</i> spp.	<i>Hookworm</i> spp.	-	-

List of selected RG-2 fungi or fungal-like organisms ONLY to be handled within a BSL2 facility

<i>Aspergillus fumigatus</i> and <i>A. flavus</i>	<i>Cryptococcus gattii</i>	<i>Microsporium spp.</i>	<i>Trichophyton spp</i>	<i>Aspergillus fumigatus</i> and <i>A. flavus</i>
<i>Candida albicans</i>	<i>Cryptococcus neoformans</i>	<i>Scedosporium spp</i>	<i>Candida albicans</i>	<i>Cladophialophora spp</i>
<i>Cladophialophora spp</i>	<i>Epidermophyton floccosum</i>	<i>Sporothrix schenckii</i>	-	-

List of selected RG-2 viruses and prions ONLY to be handled in a BSL2 facility

Adenovirus	Zika	Human metapneumovirus	Mammalian reoviruses 1-3
Lymphocytic Choriomeningitis virus (LCMV) - non neurotropic and laboratory adapted strains	Hepatitis C	Human parvovirus	Primate T-cell lymphotropic viruses type 1 and 2 (serology, tests not involving propagation or culture)
Tacaribe virus complex	Pegivirus (previously known as GB virus or Hepatitis G)	Encephalomyocarditis virus	Human T-cell lymphotropic viruses type 1 and 2 (serology, tests not involving propagation or culture)
Astrovirus	Duck hepatitis B	Hepatitis A virus	Human immunodeficiency virus type 1 and 2 (HIV) (serology, tests not involving propagation or culture)
Feline calicivirus	Orthohepadnavirus	Coxsackievirus	Simian immunodeficiency virus (serology, tests not involving propagation or culture)
Norovirus	Hepatitis B	Echovirus	Barmah Forest alphavirus
Sapporo-like caliciviridae	Hepatitis E	Enterovirus	Ross River virus
Rabbit haemorrhagic disease	Alphaherpesvirinae simplex and varicella	Poliovirus 1,2 and 3	Semliki Forest alphavirus
Hepatitis Ef	Betaherpesvirinae cytomegalovirus and human beta herpes virus 5, 6 and 7	Parechovirus	Equine viral arteritis

Alphacoronavirus 229E	Gammaherpesvirinae	Rhinovirus	Rubella
Porcine Epidemic Diarrhoea Virus	Lymphocryptovirus	JC polyomavirus	Unassigned rubivirus
Betacoronavirus	Human gammaherpesvirus 4 and 8	BK polyomavirus	Deltavirus
SARS-related coronavirus (serology, tests not involving replication)	Influenza (all strains and candidate vaccine strains except those listed as RG3)	Simian virus 40 (SV40)	Hepatitis deltavirus
MERS-related coronavirus (serology and tests not involving propagation or culture)	Human papillomavirus	Molluscum contagiosum virus	Reoviruses 1 to 3
OC43 SARS	Measles	Vaccinia orthopox	Avian metapneumovirus
Mouse hepatitis virus	Menangle	Cowpox	Yellow fever (strain 17D)
Dengue 1,2,3 and 4	Mumps	Orf	Saumarez Reef
Japanese encephalitis (Nakayama strain)	Human parainfluenza 2 and 4	Pseudocowpox	Respiratory syncytial pneumovirus
Kokobera	Newcastle disease (vaccine and moderate virulent strains)	Gertsman-Straussler syndrome (prion)	Human rotavirus
West Nile (Kunjin strain)	Avian paramyxoviruses 2 to 9	Some Kuru and Creutzfeldt-Jakob agents	West Nile (Sarafend strain)
Murray Valley encephalitis	Sendai respirovirus	Bluetongue viruses (endemic strains)	Human parainfluenza 1 and 3
Epizootic haemorrhagic disease viruses of deer	Food and Mouth Disease virus	Alphaspeudorabies	Rabies virus
Rotavirus A	Human rhinovirus	Nuclear polyhedrosis virus	Vccinia virus
Rous Sarcoma virus	Bovine entrovirus	Animal papillomavirus	

List of selected RG-3 bacteria

Not to be used at the university

<i>Bacillus anthracis</i>	<i>Brucella</i> spp. (except serology and <i>B. ovis</i>)	<i>Francisella tularensis</i> (Type A)	<i>Yersinia pestis</i>
<i>Bartonella bacilliformis</i>	<i>Chlamydia psittaci</i>	<i>Mycobacterium tuberculosis</i> complex	<i>Histoplasma</i> spp.

<i>Burkholderia mallei</i>	<i>Coxiella burnetii</i> (cultures, animal work and concentrates)	<i>Rickettsia</i> spp.	<i>Penicillium marneffei</i> (syn <i>Talaromyces marneffei</i>)
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List of selected RG-3 fungi or fungal-like organisms

Not to be used at the university

<i>Blastomyces dermatitidis</i>	<i>Coccidioides posadasii</i>	<i>Paracoccidioides brasiliensis</i>	<i>Coccidioides immitis</i>
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List of selected RG-3 viruses

Not to be used at the university

Lymphochoriomeningitis (LCM) neurotropic strains	Japanese encephalitis	Mapuera rubulavirus	Chikungunya
Oropouche	St Louis encephalitis	Newcastle Disease (exotic strains)	Eastern equine encephalitis
Phlebovirus	Tick-borne viruses	Primate T-cell lymphotropic viruses Type 1 and 2 (syn Human lymphotropic viruses Type 1 and 2)	Western equine encephalitis
Rift Valley Fever virus (Zinga virus)	West Nile virus	Human Immunodeficiency Virus Types 1 and 2 (propagative <i>in vitro</i> activities)	Venezuelan equine encephalitis
Hantaan and related viruses	Yellow Fever	Simian immunodeficiency virus (propagative <i>in vitro</i> activities)	Hantaan and related viruses
SARS coronavirus (from cultures and concentrates)	Avian influenza (exotic pathogenic strains)	Australian Bat Lyssavirus	SARS coronavirus (from cultures and concentrates)
MERS-related coronavirus (propagative <i>in vitro</i> activities)	Influenza (highly pathogenic strains)	Rabies fixed strain (CVS II)	MERS-related coronavirus (propagative <i>in vitro</i> activities)
Mokola			

List of selected RG-4 viruses

Strictly not to be used at the university

Guanarito arenavirus	Mopeia viruses	Ebola	Tick-born encephalitis
Junin arenavirus	Sabia virus	Marburg	Herpes virus simiae (B virus)
Lassa arenavirus	Crimean-Congo haemorrhagic fever	Kyasanur Forest Disease	Hendra paramyxovirus
Machupo arenavirus	Hazara nairovirus	Omsk haemorrhagic fever disease	Nipah paramyxovirus