

# NATIONAL INSTITUTES OF HEALTH RISK GROUP

**Risk Group 1 (RG1)** - Agents that are not associated with disease in healthy adult humans

**Risk Group 2 (RG2)** - Agents that are associated with human disease which is rarely serious and for which preventive or therapeutic interventions are often available

**Risk Group 3 (RG3)** - Agents that are associated with serious or lethal human disease for which preventive or therapeutic interventions may be available (high individual risk but low community risk)

**Risk Group 4 (RG4)** - Agents that are likely to cause serious or lethal human disease for which preventive or therapeutic interventions are not usually available (high individual risk and high community risk)

## Appendix B-I. Risk Group 1 (RG1) Agents

RG1 agents are not associated with disease in healthy adult humans. Examples of RG1 agents include asporogenic *Bacillus subtilis* or *Bacillus licheniformis* (see Appendix C-IV-A, *Bacillus subtilis* or *Bacillus licheniformis* Host-Vector Systems, Exceptions); adeno-associated virus (AAV) types 1 through 4; and recombinant AAV constructs, in which the transgene does not encode either a potentially tumorigenic gene product or a toxin molecule and are produced in the absence of a helper virus. A strain of *Escherichia coli* (see Appendix C-II-A, *Escherichia coli* K-12 Host Vector Systems, Exceptions) is an RG1 agent if it (1) does not possess a complete lipopolysaccharide (*i.e.*, lacks the O antigen); and (2) does not carry any active virulence factor (*e.g.*, toxins) or colonization factors and does not carry any genes encoding these factors.

Those agents not listed in Risk Groups (RGs) 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.

## Appendix B-II. Risk Group 2 (RG2) Agents

RG2 agents are associated with human disease which is rarely serious and for which preventive or therapeutic interventions are *often* available.

### Appendix B-II-A. Risk Group 2 (RG2) - Bacterial Agents Including Chlamydia

*Acinetobacter baumannii* (formerly *Acinetobacter calcoaceticus*)

*Actinobacillus*

*Actinomyces pyogenes* (formerly *Corynebacterium pyogenes*)

*Aeromonas hydrophila*

*Amycolata autotrophica*

*Archaeobacterium 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 in Appendix B-III-A (RG3))

*Campylobacter coli*, *C. fetus*, *C. jejuni*

*Chlamydia psittaci*, *C. trachomatis*, *C. pneumoniae*

*Clostridium botulinum*, *Cl. chauvoei*, *Cl. haemolyticum*, *Cl. histolyticum*, *Cl. novyi*, *Cl. septicum*, *Cl. tetani*

*Corynebacterium diphtheriae*, *C. pseudotuberculosis*, *C. renale*

*Dermatophilus congolensis*

*Edwardsiella tarda*

*Erysipelothrix rhusiopathiae*

## NATIONAL INSTITUTES OF HEALTH RISK GROUP

*Escherichia coli* - all enteropathogenic, enterotoxigenic, enteroinvasive and strains bearing K1 antigen, including *E. coli* O157:H7

*Haemophilus ducreyi*, *H. influenzae*

*Helicobacter pylori*

*Klebsiella* - all species except *K. oxytoca* (RG1)

*Legionella* including *L. pneumophila*

*Leptospira interrogans* - all serotypes

*Listeria*

*Moraxella*

[Mycobacterium \(except those listed in Appendix B-III-A \(RG3\)\) including M. avium complex, M. asiaticum, M. bovis BCG vaccine strain, M. chelonae, 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. meningitidis*

*Nocardia asteroides*, *N. brasiliensis*, *N. otitidiscaviarum*, *N. transvalensis*

*Rhodococcus equi*

*Salmonella* including *S. arizonae*, *S. choleraesuis*, *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*

### **Appendix B-II-B. 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*

*Microsporium*

*Paracoccidioides braziliensis*

*Penicillium marneffeii*

*Sporothrix schenckii*

*Trichophyton*

### **Appendix B-II-C. 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*

NATIONAL INSTITUTES OF HEALTH  
RISK GROUP

*Cryptosporidium* including *C. parvum*

*Cysticercus cellulosae* (hydatid cyst, larva of *T. solium*)

*Echinococcus* including *E. granulosus*, *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. peruviana*, *L. tropica*

*Loa loa* filaria worms

*Microsporidium*

*Naegleria fowleri*

*Necator* human hookworms including *N. americanus*

*Onchocerca* 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

**Appendix B-II-D. Risk Group 2 (RG2) - Viruses**

Adenoviruses, human - all types

Alphaviruses (Togaviruses) - Group A Arboviruses

Eastern equine encephalomyelitis virus

Venezuelan equine encephalomyelitis vaccine strain TC-83

Western equine encephalomyelitis virus

Arenaviruses

Lymphocytic choriomeningitis virus (non-neurotropic strains)

Tacaribe virus complex

[Other viruses as listed in the reference source \(see Section V-C, Footnotes and References of Sections I through IV\)](#)

Bunyaviruses

Bunyamwera virus

Rift Valley fever virus vaccine strain MP-12

[Other viruses as listed in the reference source \(see Section V-C, Footnotes and References of Sections I through IV\)](#)

Caliciviruses

Coronaviruses

Flaviviruses (Togaviruses) - Group B Arboviruses

Dengue virus serotypes 1, 2, 3, and 4

Yellow fever virus vaccine strain 17D

NATIONAL INSTITUTES OF HEALTH  
RISK GROUP

[Other viruses as listed in the reference source \(see Section V-C, Footnotes and References of Sections I through IV\)](#)

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

[Herpesviruses - except Herpesvirus simiae \(Monkey B virus\) \(see Appendix B-IV-D, Risk Group 4 \(RG4\) - Viral Agents\)](#)

Cytomegalovirus

Epstein Barr virus

*Herpes simplex* types 1 and 2

*Herpes zoster*

Human herpesvirus types 6 and 7

Orthomyxoviruses

[Influenza viruses types A, B, and C \(except those listed in Appendix B-III-D, Risk Group 3 \(RG3\) - Viruses and Prions\)](#)

Tick-borne orthomyxoviruses

Papovaviruses

All human papilloma viruses

Paramyxoviruses

Newcastle disease virus

Measles virus

Mumps virus

Parainfluenza viruses types 1, 2, 3, and 4

Respiratory syncytial virus

Parvoviruses

Human parvovirus (B19)

Picornaviruses

Coxsackie viruses types A and B

Echoviruses - all types

Polioviruses - all types, wild and attenuated

Rhinoviruses - all types

Poxviruses - all types except Monkeypox virus (see [Appendix B-III-D, Risk Group 3 \(RG3\) - Viruses and Prions](#)) and restricted poxviruses including Alastrim, Smallpox, and Whitepox (see [Section V-L, Footnotes and References of Sections I through IV](#))

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

Rhabdoviruses

Rabies virus - all strains

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

Togaviruses (see Alphaviruses and Flaviviruses)

Rubivirus (rubella)

### **Appendix B-III. Risk Group 3 (RG3) Agents**

RG3 agents are associated with serious or lethal human disease for which preventive or therapeutic interventions may be available.

#### **Appendix B-III-A. Risk Group 3 (RG3) - Bacterial Agents Including Rickettsia**

*Bartonella*

*Brucella* including *B. abortus*, *B. canis*, *B. suis*

*Burkholderia (Pseudomonas) mallei*, *B. pseudomallei*

*Coxiella burnetii*

NATIONAL INSTITUTES OF HEALTH  
RISK GROUP

*Francisella tularensis*

[Mycobacterium bovis \(except BCG strain, see Appendix B-II-A, Risk Group 2 \(RG2\) - Bacterial Agents Including Chlamydia\), M. tuberculosis](#)

*Pasteurella multocida* type B -"buffalo" and other virulent strains

Rickettsia akari, R. australis, R. canada, R. conorii, R. prowazekii, R. rickettsii, R. siberica, R. tsutsugamushi, R. typhi (R. mooseri)

*Yersinia pestis*

**Appendix B-III-B. Risk Group 3 (RG3) - Fungal Agents**

*Coccidioides immitis* (sporulating cultures; contaminated soil)

*Histoplasma capsulatum*, *H. capsulatum* var.. *duboisii*

**Appendix B-III-C. Risk Group 3 (RG3) - Parasitic Agents**

None

**Appendix B-III-D. Risk Group 3 (RG3) - Viruses and Prions**

Alphaviruses (Togaviruses) - Group A Arboviruses

Semliki Forest virus

St. Louis encephalitis virus

[Venezuelan equine encephalomyelitis virus \(except the vaccine strain TC-83, see Appendix B-II-D \(RG2\)\)](#)

[Other viruses as listed in the reference source \(see Section V-C, Footnotes and References of Sections I through IV\)](#)

Arenaviruses

Flexal

Lymphocytic choriomeningitis virus (LCM) (neurotropic strains)

Bunyaviruses

Hantaviruses including Hantaan virus

Rift Valley fever virus

Flaviviruses (Togaviruses) - Group B Arboviruses

Japanese encephalitis virus

Yellow fever virus

[Other viruses as listed in the reference source \(see Section V-C, Footnotes and References of Sections I through IV\)](#)

Orthomyxoviruses

Influenza viruses 1918-1919 H1N1 (1918 H1N1), human H2N2 (1957-1968), and highly pathogenic avian influenza H5N1 strains within the Goose/Guangdong/96-like H5 lineage (HPAI H5N1).

Poxviruses

Monkeypox virus

Prions

[Transmissible spongiform encephalopathies \(TME\) agents \(Creutzfeldt-Jacob disease and kuru agents\)\(see Section V-C, Footnotes and References of Sections I through IV, for containment instruction\)](#)

Retroviruses

Human immunodeficiency virus (HIV) types 1 and 2

Human T cell lymphotropic virus (HTLV) types 1 and 2

Simian immunodeficiency virus (SIV)

Rhabdoviruses

Vesicular stomatitis virus

**Appendix B-IV. Risk Group 4 (RG4) Agents**

# NATIONAL INSTITUTES OF HEALTH RISK GROUP

RG4 agents are likely to cause serious or lethal human disease for which preventive or therapeutic interventions are *not usually* available.

## **Appendix B-IV-A. Risk Group 4 (RG4) - Bacterial Agents**

None

## **Appendix B-IV-B. Risk Group 4 (RG4) - Fungal Agents**

None

## **Appendix B-IV-C. Risk Group 4 (RG4) - Parasitic Agents**

None

## **Appendix B-IV-D. Risk Group 4 (RG4) - Viral Agents**

Arenaviruses

Guanarito virus

Lassa virus

Junin virus

Machupo virus

Sabia

Bunyaviruses (Nairovirus)

Crimean-Congo hemorrhagic fever virus

Filoviruses

Ebola virus

Marburg virus

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

Herpesviruses (alpha)

Herpesvirus simiae (Herpes B or Monkey B virus)

Paramyxoviruses

Equine morbillivirus

Hemorrhagic fever agents and viruses as yet undefined

## **Appendix B-V. 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.

Baculoviruses

Herpesviruses

Herpesvirus ateles

Herpesvirus saimiri

Marek's disease virus

Murine cytomegalovirus

Papovaviruses

Bovine papilloma virus

Polyoma virus

Shope papilloma virus

NATIONAL INSTITUTES OF HEALTH  
RISK GROUP

Simian virus 40 (SV40)

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

**Appendix B-V-1. Murine Retroviral Vectors**

Murine retroviral vectors to be used for human transfer experiments (less than 10 liters) that contain less than 50% of their respective parental viral genome and that have been demonstrated to be free of detectable replication competent retrovirus can be maintained, handled, and administered, under BL1 containment.