Section VIII-F: Arboviruses and Related Zoonotic Viruses

In 1979, the American Committee on Arthropod-Borne Viruses (ACAV) Subcommittee on Arbovirus Laboratory Safety (SALS) first provided biosafety recommendations for each of the 424 viruses then registered in the International Catalogue of Arboviruses, including Certain Other Viruses of Vertebrates.[1] Working together, SALS, the CDC and the NIH have periodically updated the catalogue by providing recommended biosafety practices and containment for arboviruses registered since 1979. These recommendations are based, in part, on risk assessments derived from information provided by a worldwide survey of laboratories working with arboviruses, new published reports on the viruses, as well as discussions with scientists working with each virus.

Table 6, located at the end of this Section, provides an alphabetical listing of 597 viruses and includes common name, virus family or genus, acronym, BSL recommendation, the basis for the rating, the antigenic group[2] (if known), HEPA filtration requirements, and regulatory requirements (i.e., import/export permits from either the CDC or the USDA). In addition, many of the organisms are classified as select agents and require special security measures to possess, use, or transport. (See Appendix F.) Table 4 provides a key for the SALS basis for assignment of viruses listed in Table 6.

Agent summary statements have been included for certain arboviruses. They were submitted by a panel of experts for more detailed consideration due to one or more of the following factors:

- at the time of writing this edition, the organism represented an emerging public health threat in the United States;
- the organism presented unique biocontainment challenge(s) that required further detail; and
- the organism presented a significant risk of laboratory-acquired infection.

These recommendations were made in August 2005; requirements for biosafety, shipping, and select agent registration can change. Please be sure to confirm the requirements with the appropriate Federal agency. If the pathogen of interest is one listed in Appendix D, contact the USDA for additional biosafety requirements. USDA guidance may supersede the information found in this Chapter.

Recommendations for the containment of infected arthropod vectors were drafted by a subcommittee of the American Committee on Medical Entomology (ACME), and circulated widely among medical entomology professionals. (See Appendix E.)

Some commonly used vaccine strains for which attenuation has been firmly established are recognized by SALS. These vaccine strains may be handled safely at BSL-2 (Table 5). The agents in Table 4 and 5 may require permits from USDA/DOC/DHHS.

Table 4. Explanation of Symbols Used in Table 6 to Define Basis for Assignment of Viruses to Biosafety Levels

Symbol	Definition
S	Results of SALS survey and information from the Catalog.[1]
IE	Insufficient experience with virus in laboratory facilities with low biocontainment.
A	Additional criteria.
A1	Disease in sheep, cattle or horses.
A2	Fatal human laboratory infection—probably aerosol.
A3	Extensive laboratory experience and mild nature of aerosol laboratory infections justifies BSL-2.
A4	Placed in BSL-4 based on the close antigenic relationship with a known BSL-4 agent plus insufficient experience.
A5	BSL-2 arenaviruses are not known to cause serious acute disease in humans and are not acutely pathogenic for laboratory animals including primates. In view of reported high frequency of laboratory aerosol infection in workers manipulating high concentrations of Pichinde virus, it is strongly recommended that work with high concentrations of BSL-2 arenaviruses be done at BSL-3.
A6	Level assigned to prototype or wild-type virus. A lower level may be recommended for variants with well-defined reduced virulence characteristics.
A7	Placed at this biosafety level based on close antigenic or genetic relationship to other viruses in a group of 3 or more viruses, all of which are classified at this level.
A8	BSL-2 hantaviruses are not known to cause laboratory infections, overt disease in humans, or severe disease in experimental primates. Because of antigenic and biologic relationships to highly pathogenic hantaviruses and the likelihood that experimentally infected rodents may shed large amounts of virus, it is recommended that work with high concentrations or experimentally infected rodents be conducted at BSL-3.

Table 5. Vaccine Strains of BSL-3 and BSL-4 Viruses that May Be Handled as BSL-2

Virus	Vaccine Strain
Chikungunya	181/25
Junin	Candid #1
Rift Valley fever	MP-12
Venezuelan equine encephalomyelitis	TC83 & V3526
Yellow fever	17-D
Japanese encephalitis	14-14-2

Based on the recommendations listed with the tables, the following guidelines should be adhered to where applicable.

Viruses with BSL-2 Containment Recommended

The recommendation for conducting work with the viruses listed in Table 6 at BSL-2 are based on the existence of historical laboratory experience adequate to assess the risks when working with this group of viruses. This indicates a) no overt laboratory-associated infections are reported, b) infections resulted from exposures other than by infectious aerosols, or c) if disease from aerosol exposure is documented, it is uncommon.

Laboratory Safety and Containment Recommendations

Agents listed in this group may be present in blood, CSF, various tissues, and/or infected arthropods, depending on the agent and the stage of infection. The primary laboratory hazards comprise accidental parenteral inoculation, contact of the virus with broken skin or mucous membranes, and bites of infected laboratory rodents or arthropods. Properly maintained BSCs, preferable Class II, or other appropriate personal protective equipment or physical containment devices are used whenever procedures with a potential for creating infectious aerosols or splashes are conducted.

BSL-2 practices, containment equipment, and facilities are recommended for activities with potentially infectious clinical materials and arthropods and for manipulations of infected tissue cultures, embryonate hen's eggs, and rodents.

Large quantities and/or high concentrations of any virus have the potential to overwhelm both innate immune mechanisms and vaccine-induced immunity. When a BSL-2 virus is being produced in large quantities or in high concentrations, additional risk assessment is required. This might indicate BSL-3 practices, including additional respiratory protection, based on the risk assessment of the proposed experiment.

Viruses with BSL-3 Containment Recommended

The recommendations for viruses listed in Table 6 that require BSL-3 containment are based on multiple criteria. SALS considered the laboratory experience for some viruses to be inadequate to assess risk, regardless of the available information regarding disease severity. In some cases, SALS recorded overt LAI transmitted by the aerosol route in the absence or non-use of protective vaccines, and considered that the natural disease in humans is potentially severe, life threatening, or causes residual damage.[1] Arboviruses also were classified as requiring BSL-3 containment if they caused diseases in domestic animals in countries outside of the United States.

Laboratory Safety and Containment Recommendations

The agents listed in this group may be present in blood, CSF, urine, and exudates, depending on the specific agent and stage of disease. The primary laboratory hazards are exposure to aerosols of infectious solutions and animal bedding, accidental parenteral inoculation, and contact with broken skin. Some of these agents (e.g., VEE virus) may be relatively stable in dried blood or exudates.

BSL-3 practices, containment equipment, and facilities are recommended for activities using potentially infectious clinical materials and infected tissue cultures, animals, or arthropods.

A licensed attenuated live virus is available for immunization against yellow fever. It is recommended for all personnel who work with this agent or with infected animals, and those entering rooms where the agents or infected animals are present.

Junin virus has been reclassified to BSL-3, provided that all at-risk personnel are immunized and the laboratory is equipped with HEPA-filtered exhaust. SALS also has reclassified Central European tick-borne encephalitis (CETBE) viruses to BSL-3, provided all at-risk personnel are immunized. CETBE is not a registered name in *The International Catalogue of Arboviruses* (1985). Until the registration issue is resolved taxonomically, CETBE refers to the following group of very closely related, if not essentially identical, tick-borne flaviviruses isolated from Czechoslovakia, Finland and Russia: Absettarov, Hanzalova, Hypr, and Kumlinge viruses. While there is a vaccine available that confers immunity to the CETBE group of genetically (>98%) homogeneous viruses, the efficacy of this vaccine against Russian spring-summer encephalitis (RSSE) virus infections has not been established. Thus, the CETBE group of viruses has been reclassified as BSL-3 when personnel are immunized with CETBE vaccine, while RSSE remains classified as BSL-4. It should be noted that CETBE viruses are currently listed as select agents and require special security and permitting considerations. (See Appendix F.)

Investigational vaccines for eastern equine encephalomyelitis (EEE) virus, Venezuelan equine encephalitis (VEE), western equine encephalomyelitis (WEE) virus, and Rift Valley fever viruses (RVFV), may be available in limited quantities and administered on-site at the Special Immunization Program of USAMRIID, located at Ft. Detrick, Frederick, MD. Details are available at the end of this section.

The use of investigational vaccines for laboratory personnel should be considered if the vaccine is available. Initial studies have shown the vaccine to be effective in producing an appropriate immunologic response, and the adverse effects of vaccination are within acceptable parameters. The decision to recommend vaccines for laboratory personnel must be carefully considered and based on an risk assessment which includes a review of the characteristics of the agent and the disease, benefits versus the risk of vaccination, the experience of the laboratory personnel, laboratory procedures to be used with the agent, and the contraindications for vaccination including the health status of the employee.

If the investigational vaccine is contraindicated, does not provide acceptable reliability for producing an immune response, or laboratory personnel refuse vaccination, the use of appropriate personal protective equipment may provide an alternative. Respiratory protection, such as use of a PAPR, should be considered in areas using organisms with a well-established risk of aerosol infections in the laboratory, such as VEE viruses.

Any respiratory protection equipment must be provided in accordance with the institution's respiratory protection program. Other degrees of respiratory protection may be warranted based on an assessment of risk as defined in Chapter 2 of this manual. All personnel in a laboratory with the infectious agent must use comparable personal protective equipment that meets or exceeds the requirements, even if they are not working with the organism. Sharps precautions as described under BSL-2 and BSL-3 requirements must be continually and strictly reinforced, regardless of whether investigational vaccines are used.

Non-licensed vaccines are available in limited quantities and administered on-site at the Special Immunization Program of USAMRIID. IND vaccines are administered under a cooperative agreement between the U.S. Army and the individual's requesting organization. Contact the Special Immunization Program by telephone at (301) 619-4653.

Enhanced BSL-3 Containment

Situations may arise for which enhancements to BSL-3 practices and equipment are required; for example, when a BSL-3 laboratory performs diagnostic testing on specimens from patients with hemorrhagic fevers thought to be due to dengue or yellow fever viruses. When the origin of these specimens is Africa, the Middle East, or South America, such specimens might contain etiologic agents, such as arenaviruses, filoviruses, or other viruses that are usually manipulated in a BSL-4

laboratory. Examples of enhancements to BSL-3 laboratories might include: 1) enhanced respiratory protection of personnel against aerosols; 2) HEPA filtration of dedicated exhaust air from the laboratory; and 3) personal body shower. Additional appropriate training for all animal care personnel should be considered.

Viruses with BSL-4 Containment Recommended

The recommendations for viruses assigned to BSL-4 containment are based on documented cases of severe and frequently fatal naturally occurring human infections and aerosol-transmitted laboratory infections. SALS recommends that certain agents with a close antigenic relationship to agents assigned to BSL-4 also be provisionally handled at this level until sufficient laboratory data indicates that work with the agent may be assigned to a lower biosafety level.

Laboratory Safety and Containment Recommendations

The infectious agents may be present in blood, urine, respiratory and throat secretions, semen, and other fluids and tissues from human or animal hosts, and in arthropods, rodents, and NHPs. Respiratory exposure to infectious aerosols, mucous membrane exposure to infectious droplets, and accidental parenteral inoculation are the primary hazards to laboratory or animal care personnel.[3,4]

BSL-4 practices, containment equipment, and facilities are recommended for all activities utilizing known or potentially infectious materials of human, animal, or arthropod origin. Clinical specimens from persons suspected of being infected with one of the agents listed in this summary should be submitted to a laboratory with a BSL-4 maximum containment facility.[5]

Dealing with Unknown Arboviruses

The ACAV has published reports documenting laboratory workers who acquired arbovirus infections during the course of their duties.[6] In the first such document, it was recognized that these laboratory infections typically occurred by unnatural routes such as percutaneous or aerosol exposure, that “lab adapted” strains were still pathogenic for humans, and that as more laboratories worked with newly identified agents, the frequency of laboratory-acquired infections was increasing. Therefore, to assess the risk of these viruses and provide safety guidelines to those working with them, ACAV appointed SALS to evaluate the hazards of working with arboviruses in the laboratory setting.[7,8]

The SALS committee made a series of recommendations, published in 1980, describing four levels of laboratory practices and containment guidelines that were progressively more restrictive. These levels were determined after widely-distributed surveys evaluated numerous criteria for each particular virus including: 1) past occurrence of laboratory-acquired infections correlated with facilities and practices used; 2) volume of work performed as a measure of

potential exposure risk; 3) immune status of laboratory personnel; 4) incidence and severity of naturally-acquired infections in adults; and 5) incidence of disease in animals outside the United States (to assess import risk).

While these criteria are still important factors to consider in any risk assessment for manipulating arboviruses in the laboratory, it is important to note that there have been many modifications to personal laboratory practices (e.g., working in BSC while wearing extensive personal protective equipment in contrast to working with viruses on an open bench top) and significant changes in laboratory equipment and facilities (e.g., BSC, PAPR) available since the initial SALS evaluation. Clearly, when dealing with a newly recognized arbovirus, there is insufficient previous experience with it; thus, the virus should be assigned a higher biosafety level. However, with increased ability to safely characterize viruses, the relationship to other disease-causing arboviruses can be established with reduced exposure to the investigators. Therefore, in addition to those established by SALS, additional assessment criteria should be considered.

One criterion for a newly identified arbovirus is a thorough description of how the virus will be handled and investigated. For example, experiments involving pure genetic analysis could be handled differently than those where the virus will be put into animals or arthropods.[9] Additionally, an individual risk assessment should consider the fact that not all strains of a particular virus exhibit the same degree of pathogenicity or transmissibility. While variable pathogenicity occurs frequently with naturally identified strains, it is of particular note for strains that are modified in the laboratory. It may be tempting to assign biosafety levels to hybrid or chimeric strains based on the parental types but due to possible altered biohazard potential, assignment to a different biosafety level may be justified.[10] A clear description of the strains involved should accompany any risk assessment.

Most of the identified arboviruses have been assigned biosafety levels; however, a number of those that are infrequently studied, newly identified, or have only single isolation events may not have been evaluated by SALS, ACAV, CDC, or the NIH (Table 6). Thorough risk assessment is important for all arboviral research and it is of particular importance for work involving unclassified viruses. A careful assessment by the laboratory director, institutional biosafety officer and safety committee, and as necessary, outside experts is necessary to minimize the risk of human, animal, and environmental exposure while allowing research to progress.

Chimeric Viruses

The ability to construct cDNA clones encoding a complete RNA viral genome has led to the generation of recombinant viruses containing a mixture of genes from two or more different viruses. Chimeric, full-length viruses and truncated replicons have been constructed from numerous alphaviruses and flaviviruses. For example, alphavirus replicons encoding foreign genes have been used

widely as immunogens against bunyavirus, filovirus, arenavirus, and other antigens. These replicons have been safe and usually immunogenic in rodent hosts leading to their development as candidate human vaccines against several virus groups including retroviruses.[11-14]

Because chimeric viruses contain portions of multiple viruses, the IBC, in conjunction with the biosafety officer and the researchers, must conduct a risk assessment that, in addition to standard criteria, includes specific elements that need to be considered before assigning appropriate biosafety levels and containment practices. These elements include: 1) the ability of the chimeric virus to replicate in cell culture and animal model systems in comparison with its parental strains;[15] 2) altered virulence characteristics or attenuation compared with the parental viruses in animal models;[16] 3) virulence or attenuation patterns by intracranial routes using large doses for agents affecting the CNS;[17,18] and 4) demonstration of lack of reversion to virulence or parental phenotype.

Many patterns of attenuation have been observed with chimeric flaviviruses and alphaviruses using the criteria described above. Additionally, some of these chimeras are in phase II testing as human vaccines.[19]

Chimeric viruses may have some safety features not associated with parental viruses. For example, they are generated from genetically stable cDNA clones without the need for animal or cell culture passage. This minimizes the possibility of mutations that could alter virulence properties. Because some chimeric strains incorporate genomic segments lacking gene regions or genetic elements critical for virulence, there may be limited possibility of laboratory recombination to generate strains exhibiting wild-type virulence.

Ongoing surveillance and laboratory studies suggest that many arboviruses continue to be a risk to human and animal populations. The attenuation of all chimeric strains should be verified using the most rigorouscontainment requirements of the parental strains. The local IBC should evaluate containment recommendations for each chimeric virus on a case-by-case basis, using virulence data from an appropriate animal model. Additional guidance from the NIH Office of Biotechnology Activities and/or the Recombinant DNA Advisory Committee (RAC) may be necessary.

West Nile Virus (WNV)

WNV has emerged in recent years in temperate regions of Europe and North America, presenting a threat to public and animal health. This virus belongs to the family *Flaviviridae* and the genus *Flavivirus*, Japanese encephalitis virus antigenic complex. The complex currently includes Alfuy, Cacipacore, Japanese encephalitis, Koutango, Kunjin, Murray Valley encephalitis, St. Louis encephalitis,

Rocio, Stratford, Usutu, West Nile, and Yaounde viruses. Flaviviruses share a common size (40-60nm), symmetry (enveloped, icosahedral nucleocapsid), nucleic acid (positive-sense, single stranded RNA approximately 10,000-11,000 bases) and virus morphology. The virus was first isolated from a febrile adult woman in the West Nile District of Uganda in 1937.[20] The ecology was characterized in Egypt in the 1950s; equine disease was first noted in Egypt and France in the early 1960s.[21,22] It first appeared in North America in 1999 as encephalitis reported in humans and horses.[23] The virus has been detected in Africa, Europe, the Middle East, west and central Asia, Oceania (subtype Kunjin virus), and most recently, North America.

Occupational Infections

LAI with WNV have been reported in the literature. SALS reported 15 human infections from laboratory accidents in 1980. One of these infections was attributed to aerosol exposure. Two parenteral inoculations have been reported recently during work with animals.[24]

Natural Modes of Infections

In the United States, infected mosquitoes, primarily members of the *Culex* genus, transmit WNV. Virus amplification occurs during periods of adult mosquito blood-feeding by continuous transmission between mosquito vectors and bird reservoir hosts. People, horses, and most other mammals are not known to develop infectious viremias very often, and thus are probably "dead-end" or incidental hosts.

Laboratory Safety and Containment Recommendations

WNV may be present in blood, serum, tissues, and CSF of infected humans, birds, mammals, and reptiles. The virus has been found in oral fluids and feces of birds. Parenteral inoculation with contaminated materials poses the greatest hazard; contact exposure of broken skin is a possible risk. Sharps precautions should be strictly adhered to when handling potentially infectious materials. Workers performing necropsies on infected animals may be at higher risk of infection.

BSL-2 practices, containment equipment, and facilities are recommended for activities with human diagnostic specimens, although it is unusual to recover virus from specimens obtained from clinically ill patients. BSL-2 is recommended for processing field collected mosquito pools whereas BSL-3 and ABSL-3 practices, containment equipment, and facilities are recommended for all manipulations of WNV cultures and for experimental animal and vector studies, respectively.

Dissection of field collected dead birds for histopathology and culture is recommended at BSL-3 containment due to the potentially high levels of virus found in such samples. Non-invasive procedures performed on dead birds (such as oropharyngeal or cloacal swabs) can be conducted at BSL-2.

Special Issues

Transfer of Agent Importation of this agent may require CDC and/or USDA importation permits. Domestic transport of this agent may require a permit from USDA/APHIS/VS. A DoC permit may be required for the export of this agent to another country. See Appendix C for additional information.

Eastern Equine Encephalitis (EEE) Virus, Venezuelan Equine Encephalitis (VEE) Virus, and Western Equine Encephalitis (WEE) Virus

VEE, EEE, and WEE viruses are members of the genus *Alphavirus* in the family *Togaviridae*. They are small, enveloped viruses with a genome consisting of a single strand of positive-sense RNA. All three viruses can cause encephalitis often accompanied by long-term neurological sequelae. Incubation period ranges from 1-10 days and the duration of acute illness is typically days to weeks depending upon severity of illness. Although not the natural route of transmission, the viruses are highly infectious by the aerosol route; laboratory acquired infections have been documented.[25]

Occupational Infections

These alphaviruses, especially VEE virus, are infectious by aerosol in laboratory studies and more than 160 EEE virus, VEE virus, or WEE virus laboratory-acquired infections have been documented. Many infections were due to procedures involving high virus concentrations and aerosol-generating activities such as centrifugation and mouth pipetting. Procedures involving animals (e.g., infection of newly hatched chicks with EEE virus and WEE virus) and mosquitoes also are particularly hazardous.

Natural Modes of Infection

Alphaviruses are zoonoses maintained and amplified in natural transmission cycles involving a variety of mosquito species and either small rodents or birds. Humans and equines are accidental hosts with naturally acquired alphavirus infections resulting from the bites of infected mosquitoes.

EEE virus occurs in focal locations along the eastern seaboard, the Gulf Coast and some inland Midwestern locations of the United States, in Canada, some Caribbean Islands, and Central and South America.[26] Small outbreaks of human disease have occurred in the United States, the Dominican Republic, Cuba, and Jamaica. In the United States, equine epizootics are common occurrences during the summer in coastal regions bordering the Atlantic and Gulf of Mexico, in other eastern and Midwestern states, and as far north as Quebec, Ontario, and Alberta in Canada.

In Central and South America, focal outbreaks due to VEE virus occur periodically with rare large regional epizootics involving thousands of equine cases and deaths in predominantly rural settings. These epizootic/epidemic viruses are theorized to emerge periodically from mutations occurring in the continuously circulating enzootic VEE viruses in northern South America. The classical epizootic varieties of the virus are not present in the United States. An enzootic subtype, Everglades virus (VEE antigenic complex subtype II virus), exists naturally in southern Florida, while endemic foci of Bijou Bridge virus (VEE antigenic complex subtype III-B virus), have been described in the western United States.[27]

The WEE virus is found mainly in western parts of the United States and Canada. Sporadic infections also occur in Central and South America.

Laboratory Safety and Containment Recommendations

Alphaviruses may be present in blood, CSF, other tissues (e.g., brain), or throat washings. The primary laboratory hazards are parenteral inoculation, contact of the virus with broken skin or mucus membranes, bites of infected animals or arthropods, or aerosol inhalation.

Diagnostic and research activities involving clinical material, infectious cultures, and infected animals or arthropods should be performed under BSL-3 practices, containment equipment, and facilities. Due to the high risk of aerosol infection, additional personal protective equipment, including respiratory protection, should be considered for non-immune personnel. Animal work with VEE virus, EEE virus and WEE virus should be performed under ABSL-3 conditions. HEPA filtration is required on the exhaust system of laboratory and animal facilities using VEE virus.

Special Issues

Vaccines Two strains of VEE virus (TC-83 and V3526) are highly attenuated in vertebrate studies and have been either exempted (strain TC-83) or excluded (strain V3526) from select agent regulations. Because of the low level of pathogenicity, these strains may be safely handled under BSL-2 conditions without vaccination or additional personal protective equipment.

Investigational vaccine protocols have been developed to immunize at-risk laboratory or field personnel against these alphaviruses, however, the vaccines are available only on a limited basis and may be contraindicated for some personnel. Therefore, additional personal protective equipment may be warranted in lieu of vaccination. For personnel who have no neutralizing antibody titer (either by previous vaccination or natural infection), additional respiratory protection is recommended for all procedures.

Select Agent VEE virus and EEE virus are select agents requiring registration with CDC and/or USDA for possession, use, storage and/or transfer. See Appendix F for additional information.

Transfer of Agent Importation of this agent may require CDC and/or USDA importation permits. Domestic transport of this agent may require a permit from USDA/APHIS/VS.

Rift Valley Fever Virus (RVFV)

RVFV was first isolated in Kenya in 1936 and subsequently shown to be endemically present in almost all areas of sub-Saharan Africa.[28] In periods of heavy rainfall, large epizootics occur involving primarily sheep, cattle, and human disease, although many other species are infected. The primordial vertebrate reservoir is unknown, but the introduction of large herds of highly susceptible domestic breeds in the last few decades has provided a substrate for massive virus amplification. The virus has been introduced into Egypt, Saudi Arabia, and Yemen and caused epizootics and epidemics in those countries. The largest of these was in 1977 to 1979 in Egypt with many thousands of human cases and 610 reported deaths.[29]

Most human infections are symptomatic and the most common syndrome consists of fever, myalgia, malaise, anorexia, and other non-specific symptoms. Recovery within one to two weeks is usual but hemorrhagic fever, encephalitis, or retinitis also occurs. Hemorrhagic fever develops as the primary illness proceeds and is characterized by disseminated intravascular coagulation and hepatitis. Perhaps 2% of cases will develop this complication and the mortality is high. Encephalitis follows an apparent recovery in <1% of cases and results in a substantial mortality and sequelae. Retinal vasculitis occurs in convalescence of a substantial but not precisely known proportion of cases. The retinal lesions are often macular and permanent, leading to substantial loss of visual acuity.

Infected sheep and cattle suffer a mortality rate of 10-35%, and spontaneous abortion occurs virtually in all pregnant females. Other animals studied have lower viremia and lesser mortality but may abort. This virus is an OIE List A disease and triggers export sanctions.

Occupational Infections

The potential for infection of humans by routes other than arthropod transmission was first recognized in veterinarians performing necropsies. Subsequently, it became apparent that contact with infected animal tissues and infectious aerosols were dangerous; many infections were documented in herders, slaughterhouse workers, and veterinarians. Most of these infections resulted from exposure to blood and other tissues including aborted fetal tissues of sick animals.

There have been 47 reported laboratory infections; before modern containment and vaccination became available virtually every laboratory that began work with the virus suffered infections suggestive of aerosol transmission.[30,31]

Natural Modes of Infection

Field studies show RVFV to be transmitted predominantly by mosquitoes, although other arthropods may be infected and transmit. Mechanical transmission also has been documented in the laboratory. Floodwater *Aedes* species are the primary vector and transovarial transmission is an important part of the maintenance cycle.[32] However, many different mosquito species are implicated in horizontal transmission in field studies, and laboratory studies have shown a large number of mosquito species worldwide to be competent vectors, including North American mosquitoes.

It is currently believed that the virus passes dry seasons in the ova of flood-water *Aedes* mosquitoes. Rain allows infectious mosquitoes to emerge and feed on vertebrates. Several mosquito species can be responsible for horizontal spread, particularly in epizootic/epidemic situations. The vertebrate amplifiers are usually sheep and cattle, with two caveats; as yet undefined native African vertebrate amplifier is thought to exist and very high viremias in humans are thought to play some role in viral amplifications.[33]

Transmission of diseases occurs between infected animals but is of low efficiency and virus titers in throat swabs are low. Nosocomial infection rarely if ever occurs. There are no examples of latency with RVFV, although virus may be isolated from lymphoid organs of mice and sheep for four to six weeks post-infection.

Laboratory Safety and Containment Recommendations

Concentrations of RVFV in blood and tissues of sick animals are often very high. Placenta, amniotic fluid, and fetuses from aborted domestic animals are highly infectious. Large numbers of infectious virus also are generated in cell cultures and laboratory animals.

BSL-3 practices, containment equipment and facilities are recommended for processing human or animal material in endemic zones or in non-endemic areas in emergency circumstances. Particular care should be given to stringent aerosol containment practices, autoclaving waste, decontamination of work areas, and control of egress of material from the laboratory. Other cultures, cells, or similar biological material that could potentially harbor RVFV should not be used in a RVFV laboratory and subsequently removed.

Diagnostic or research studies outside endemic areas should be performed in a BSL-3 laboratory. Personnel also must have additional respiratory protection (such as a PAPR) or be vaccinated for RVFV. In addition, the USDA may require

full BSL-3-Ag containment for research conducted in non-endemic areas in loose-housed animals. (See Appendix D.)

Special Issues

Vaccines Two apparently effective vaccines have been developed by the Department of Defense (DoD) and have been used in volunteers, laboratory staff, and field workers under investigational protocols, but neither vaccine is available at this time.

Select Agent RVFV is a select agent requiring registration with CDC and/or USDA for possession, use, storage and/or transfer. See Appendix F for additional information.

The live-attenuated MP-12 vaccine strain is specifically exempted from the Select Agent rules. In general, BSL-2 containment is recommended for working with this strain.

The USDA may require enhanced ABSL-3, ABSL-3, or BSL-3-Ag facilities and practices for working with RVFV in the United States. (See Appendix D.) Investigators should contact the USDA for further guidance before initiating research.

Transfer of Agent Importation of this agent may require CDC and/or USDA importation permits. Domestic transport of this agent may require a permit from USDA/APHIS/VS.

Table 6. Alphabetic Listing of 597 Arboviruses and Hemorrhagic Fever Viruses*

Name	Acronym	Taxonomic Status (Family or Genus)	Recommended Biosafety Level	Basis of Rating	Antigenic Group	HEPA Filtration on Lab Exhaust
Abras	ABRV	*Orthobunvavarus*	2	A7	Patois	No
Absettarov	ABSV	*Flavivirus*	4	A4	B[f]	Yes
Abu Hammad	AHV	*Nairovirus*	2	S	Dera Ghazi Khan	No
Acado	ACDV	*Orbivirus*	2	S	Corriparta	No
Acara	ACAV	*Orthobunyavirus*	2	S	Capim	No
Adelaide River	ARV	*Lyssavirus*	2	IE	Bovine Ephemeral Fever	No
African Horse sickness	AHSV	*Orbivirus*	3[c]	A1	African Horsesickness	Yes
African Swine Fever	ASFV	*Asfivirus*	3[c]	IE	Asfivirus	Yes

Name	Acronym	Taxonomic Status (Family or Genus)	Recommended Biosafety Level	Basis of Rating	Antigenic Group	HEPA Filtration on Lab Exhaust
Aguacate	AGUV	*Phlebovirus*	2	S	Phlebotomus Fever	No
Aino	AINOV	*Orthobunyavirus*	2	S	Simbu	No
Akabane	AKAV	*Orthobunyavirus*	3[c]	S	Simbu	Yes
Alenquer	ALEV	*Phlebovirus*	2	IE	Phlebotomus Fever	No
Alfuy	ALFV	*Flavivirus*	2	S	B[f]	No
Alkhumra	ALKV	*Flavivirus*	4	A4	B[f]	Yes
Allpahuayo	ALLPV	*Arenavirus*	3	IE	Tacaribe	No
Almeirim	ALMV	*Orbivirus*	2	IE	Changuinola	No
Almpiwar	ALMV	*Rhabdoviridae*	2	S		No
Altamira	ALTV	*Orbivirus*	2	IE	Changuinola	No
Amapari	AMAV	*Arenavirus*	2	A5	Tacaribe	No
Ambe	AMBEV	*Phlebovirus*	2	IE		No
Ananindeua	ANUV	*Orthobunyavirus*	2	A7	Guama	No
Andasibe	ANDV	*Orbivirus*	2	A7		No
Andes	ANDV	*Hantavirus*	3[a]	IE	Hantaan	No
Anhanga	ANHV	*Phlebovirus*	2	S	Phlebotomus Fever	No
Anhembi	AMBV	*Orthobunyavirus*	2	S	Bunyamwera	No
Anopheles A	ANAV	*Orthobunyavirus*	2	S	Anopheles A	No
Anopheles B	ANBV	*Orthobunyavirus*	2	S	Anopheles B	No
Antequera	ANTV	*Bunyaviridae*	2	IE	Resistencia	No
Apeu	APEUV	*Orthobunyavirus*	2	S	C[f]	No
Apoi	APOIV	*Flavivirus*	2	S	B[f]	No
Araguari	ARAV	Unassigned	3	IE		No
Aransas Bay	ABV	*Bunyaviridae*	2	IE	UPOLU	No
Arbia	ARBV	*Phlebovirus*	2	IE	Phlebotomus Fever	No
Arboledas	ADSV	*Phlebovirus*	2	A7	Phlebotomus Fever	No
Aride	ARIV	*Unassigned*	2	S		No
Ariquemes	ARQV	*Phlebovirus*	2	A7	Phlebotomus Fever	No
Arkonam	ARKV	*Orbivirus*	2	S	Ieri	No
Armero	ARMV	*Phlebovirus*	2	A7	Phlebotomus Fever	No
Aroa	AROAV	*Flavivirus*	2	S	B[f]	No
Aruac	ARUV	*Rhabdoviridae*	2	S		No

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Arumateua	ARMTV	*Orthobunyavirus*	2	A7		No
Arumowot	AMTV	*Phlebovirus*	2	S	Phlebotomus Fever	No
Aura	AURAV	*Alphavirus*	2	S	A[f]	No
Avalon	AVAV	*Nairovirus*	2	S	Sakhalin	No
Babahoyo	BABV	*Orthobunyavirus*	2	A7	Patois	No
Babanki	BBKV	*Alphavirus*	2	A7	A[f]	No
Bagaza	BAGV	*Flavivirus*	2	S	B[f]	No
Bahig	BAHV	*Orthobunyavirus*	2	S	Tete	No
Bakau	BAKV	*Orthobunyavirus*	2	S	Bakau	No
Baku	BAKUV	*Orbivirus*	2	S	Kemerovo	No
Bandia	BDAV	*Nairovirus*	2	S	Qalyub	No
Bangoran	BGNV	*Rhabdoviridae*	2	S		No
Bangui	BGIV	*Bunyaviridae*	2	S		No
Banzi	BANV	*Flavivirus*	2	S	B[f]	No
Barmah Forest	BFV	*Alphavirus*	2	A7	A[f]	No
Barranqueras	BQSV	*Bunyaviridae*	2	IE	Resistencia	No
Barur	BARV	*Rhabdoviridae*	2	S	Kern Canyon	No
Batai	BATV	*Orthobunyavirus*	2	S	Bunyamwera	No
Batama	BMAV	*Orthobunyavirus*	2	A7	Tete	No
Batken	BKNV	*Thogotovirus*	2	IE		No
Bauline	BAUV	*Orbivirus*	2	S	Kemerovo	No
Bear Canyon	BRCV	*Arenavirus*	3	A7		No
Bebaru	BEBV	*Alphavirus*	2	S	A[f]	No
Belem	BLMV	*Bunyaviridae*	2	IE		No
Belmont	ELV	*Bunyaviridae*	2	S		No
Belterra	BELTV	*Phlebovirus*	2	A7	Phlebotomus Fever	No
Benevides	BENV	*Orthobunyavirus*	2	A7	Capim	No
Benfica	BENV	*Orthobunyavirus*	2	A7	Capim	No
Bermejo	BMJV	*Hantavirus*	3	IE	Hantaan	No
Berrimah	BRMV	*Lyssavirus*	2	IE	Bovine Ephemeral Fever	No
Beritoga	BERV	*Orthobunyavirus*	2	S	Guama	No
Bhanja	BHAV	*Bunyaviridae*	3	S	Bhanja	No
Bimbo	BBOV	*Rhabdoviridae*	2	IE		No

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Bimitti	BIMV	*Orthobunyavirus*	2	S	Guama	No
Birao	BIRV	*Orthobunyavirus*	2	S	Bunyamwera	No
Bluetoungue (exotic serotypes)	BTV	*Orbivirus*	3[c]	S	Bluetongue	No
Bluetoungue (non-exotic)	BTV	*Orbivirus*	2[c]	S	Bluetongue	No
Bobaya	BOBV	*Bunyaviridae*	2	IE		No
Bobia	BIAV	*Orthobunyavirus*	2	IE	Olifantsylei	No
Boraceia	BORV	*Orthobunyavirus*	2	S	Anopheles B	No
Botambi	BOTV	*Orthobunyavirus*	2	S	Olifantsylei	No
Boteke	BTKV	*Vesiculovirus*	2	S	Vesicular Stomatitis	No
Bouboui	BOUV	*Flavivirus*	2	S	B[f]	No
Bovine Ephemeral Fever	BEFV	*Lyssavirus*	3[c]	A1	Bovine Ephemeral Fever	No
Bozo	BOZOV	*Orthobunyavirus*	2	A7	Bunyamwera	No
Breu Branco	BRBV	*Orbivirus*	2	A7		No
Buenaventura	BUEV	*Phlebovirus*	2	IE	Phlebotomus Fever	No
Bujaru	BUJV	*Phlebovirus*	2	S	Phlebotomus Fever	No
Bunyamwera	BUNV	*Orthobunyavirus*	2	S	Bunyamwera	No
Bunyip Creek	BCV	*Orbivirus*	2	S	Palyam	No
Burg El Arab	BEAV	*Rhabdoviridae*	2	S	Matariva	No
Bushbush	BSBV	*Orthobunyavirus*	2	S	Capim	No
Bussuquara	BSQV	*Flavivirus*	2	S	B[f]	No
Buttonwillow	BUTV	*Orthobunyavirus*	2	S	Simbu	No
Bwamba	BWAV	*Orthobunyavirus*	2	S	Bwamba	No
Cabassou	CABV	*Alphavirus*	3	IE	A[f]	Yes
Cacao	CACV	*Phlebovirus*	2	S	Phlebotomus Fever	No
Cache Valley	CVV	*Orthobunyavirus*	2	S	Bunyamwera	No
Cacipacore	CPCV	*Flavivirus*	2	IE	B[f]	No
Caimito	CAIV	*Phlebovirus*	2	S	Phlebotomus Fever	No
Calchaqui	CQIV	*Vesiculovirus*	2	A7	Vesicular Stomatitis	No
California Encephalitis	CEV	*Orthobunyavirus*	2	S	California	No
Calovo	CVOV	*Orthobunyavirus*	2	S	Bunyamwera	No
Cananeia	CNAV	*Orthobunyavirus*	2	IE	GUAMA	No

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Candiru	CDUV	*Phlebovirus*	2	S	Phlebotomus Fever	No
Caninde	CANV	*Orbivirus*	2	IE	Changuinola	No
Cano Delgadito	CADV	*Hantavirus*	3[a]	IE	Hantaan	No
Cape Wrath	CWV	*Orbivirus*	2	S	Kemerovo	No
Capim	CAPV	*Orthobunyavirus*	2	S	Capim	No
Caraipe	CRPV	*Orthobunyavirus*	2	A7		No
Carajas	CRJV	*Vesiculovirus*	2	A7	Vesicular Stomatitis	No
Caraparu	CARV	*Orthobunyavirus*	2	S	C[f]	No
Carey Island	CIV	*Flavivirus*	2	S	B[f]	No
Catu	CATUV	*Orthobunyavirus*	2	S	Guama	No
Chaco	CHOV	*Rhabdoviridae*	2	S	Timbo	No
Chagres	CHGV	*Phlebovirus*	2	S	Phlebotomus Fever	No
Chandipura	CHPV	*Vesiculovirus*	2	S	Vesicular Stomatitis	No
Changuinola	CGLV	*Orbivirus*	2	S	Changuinola	No
Charleville	CHVV	*Lyssavirus*	2	S	Rab	No
Chenuda	CNUV	*Orbivirus*	2	S	Kmerovo	No
Chikungunya	CHIKV	*Alphavirus*	3	S	A[f]	Yes
Chilibre	CHIV	*Phlebovirus*	2	S	Phlebotomus Fever	No
Chim	CHIMV	*Bunyaviridae*	2	IE		No
Chobar Gorge	CGV	*Orbivirus*	2	S	Chobar Gorge	No
Clo Mor	CMV	*Nairovirus*	2	S	Sakhalin	No
Coastal Plains	CPV	*Lyssavirus*	2	IE	Tibrogargan	No
Cocal	COCV	*Vesiculovirus*	2	A3	Vesicular Stomatitis	No
Codajas	CDJV	*Orbivirus*	2	A7		No
Colorado Tick Fever	CTFV	*Coltivirus*	2	S	Colorado Tick Fever	No
Congo-Crimean Hemorrhagic Fever	CCHFV	*Nairovirus*	4	A6	CCHF	Yes
Connecticut	CNTV	*Rhabdoviridae*	2	IE	Sawgrass	No
Corfou	CFUV	*Phlebovirus*	2	A7	Phlebotomus Fever	No
Corriparta	CORV	*Orbivirus*	2	S	Corriaparta	No
Cotia	CPV	*Poxviridae*	2	S		No
Cowbone Ridge	CRV	*Flavivirus*	2	S	B[f]	No

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Csiro Village	CVGV	*Orbivirus*	2	S	Palyam	No
Cuiaba	CUIV	*Rhabdoviridae*	2	S		No
Curionopolis	CRNPV	*Rhabdoviridae*	2	A7		No
Dabakala	DABV	*Orthobunyavirus*	2	A7	Olifantsylei	No
D'Aguilar	DAGV	*Orbivirus*	2	S	Palyam	No
Dakar Bat Virus	DBV	*Flavivirus*	2	S	B[f]	No
Deer Tick Virus	DRTV	*Flavivirus*	3	A7		No
Dengue Virus Type 1	DENV-1	*Flavivirus*	2	S	B[f]	No
Dengue Virus Type 2	DENV-2	*Flavivirus*	2	S	B[f]	No
Dengue Virus Type 3	DENV-3	*Flavivirus*	2	S	B[f]	No
Dengue Virus Type 4	DENV-4	*Flavivirus*	2	S	B[f]	No
Dera Ghazi Khan	DGKV	*Nairovirus*	2	S	Dera Ghazi Khan	No
Dobrava-Belgrade	DOBV	*Hantavirus*	3[a]	IE		No
Dhori	DHOV	*Orthomyxoviridae*	2	S		No
Douglas	DOUV	*Orthobunyavirus*	3	IE	Simbu	No
Durania	DURV	*Phlebovirus*	2	A7	Phlebotomus Fever	No
Dugbe	DUGV	*Nairovirus*	3	S	Nairobi Sheep Disease	No
Eastern Equine Encephalitis	EEEV	*Alphavirus*	3[c]	S	A[f]	No
Ebola (Including Reston)	EBOV	*Filovirus*	4	S	EBO	Yes
Edge Hill	EHV	*Flavivirus*	2	S	B[f]	No
Enseada	ENSV	*Bunyaviridae*	3	IE		No
Entebbe Bat	ENTV	*Flavivirus*	2	S	B[f]	No
Epizootic Hemorrhagic Disease	EHDV	*Orbivirus*	2	S	Epizootic Hemorrhagic Disease	No
Erve	ERVEV	*Bunyaviridae*	2	S	Thiafora	No
Estero Real	ERV	*Orthobunyavirus*	2	IE	Patois	No
Eubenangee	EUBV	*Orbivirus*	2	S	Eubenangee	No
Everglades	EVEV	*Alphavirus*	3	S	A[f]	Yes
Eyach	EYAV	*Coltivirus*	2	S	Colorado Tick Fever	No
Farmington	FRMV	*Vesiculovirus*	2	A7		No
Flanders	FLAV	*Rhabdoviridae*	2	S	Hart Park	No

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Flexal	FLEV	*Arenavirus*	3	S	Tacaribe	No
Fomede	FV	*Orbivirus*	2	A7	Chobar Gorge	No
Forecariah	FORV	*Bunyaviridae*	2	A7	Bhanja	No
Fort Morgan	FMV	*Alphavirus*	2	S	A[f]	No
Fort Sherman	FSV	*Orthobunyavirus*	2	A7	Bunyamwera	No
Frijoles	FRIV	*Phlebovirus*	2	S	Phlebotomus Fever	No
Gabek Forest	GFV	*Phlebovirus*	2	A7	Phlebotomus Fever	No
Gadgets Gully	GGYV	*Flavivirus*	2	IE	B[f]	No
Gamboa	GAMV	*Orthobunyavirus*	2	S	Gamboa	No
Gan Gan	GGV	*Bunyaviridae*	2	A7	Mapputta	No
Garba	GARV	*Rhabdoviridae*	2	IE	Matariva	No
Garissa	GRSV	*Orthobunyavirus*	3	A7	Bunyamwera	No
Germiston	GERV	*Orthobunyavirus*	3		Bunyamwera	Yes
Getah	GETV	*Alphavirus*	2	A1	A[f]	No
Gomoka	GOMV	*Orbivirus*	2	S	Ieri	No
Gordil	GORV	*Phlebovirus*	2	IE	Phlebotomus Fever	No
Gossas	GOSV	*Rhabdoviridae*	2	S		No
Grand Arbaud	GAV	*Phlebovirus*	2	S	Uukuniemi	No
Gray Lodge	GLOV	*Vesiculovirus*	2	IE	Vesicular Stomatitis	No
Great Island	GIV	*Orbivirus*	2	S	Kemerovo	No
Guajara	GJAV	*Orthobunyavirus*	2	S	Capim	No
Guama	GMAV	*Orthobunyavirus*	2	S	Guama	No
Guanarito	GTOV	*Arenavirus*	4	A4	Tacaribe	Yes
Guaratuba	GTBV	*Orthobunyavirus*	2	A7	Guama	No
Guaroa	GROV	*Orthobunyavirus*	2	S	California	No
Gumbo Limbo	GLV	*Orthobunyavirus*	2	S	C[f]	No
Gurupi	GURV	*Orbivirus*	2	IE	Changuinola	No
Hantaan	HTNV	*Hantavirus*	3[a]	S	Hantaan	No
Hanzalova	HANV	*Flavivirus*	4	A4	B[f]	Yes
Hart Park	HPV	*Rhabdoviridae*	2	S	Hart Park	No
Hazara	HAZV	*Nairovirus*	2	S	CHF-Congo	No
Highlands J	HJV	*Alphavirus*	2	S	A[f]	No
Huacho	HUAV	*Orbivirus*	2	S	Kemerovo	No

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Hughes	HUGV	*Nairovirus*	2	S	Hughes	No
Hypr	HYPRV	*Flavivirus*	4	S	B[f]	Yes
Iaco	IACOV	*Orthobunyavirus*	2	IE	Bunyamwera	No
Ibaraki	IBAV	*Orbivirus*	2	IE	Epizootic Hemorrhagic Disease	Yes
Icoaraci	ICOV	*Phlebovirus*	2	S	Phlebotomus Fever	No
Ieri	IERIV	*Orbivirus*	2	S	Ieri	No
Ife	IFEV	*Orbivirus b*	2	IE		No
Iguape	IGUV	*Flavivirus*	2	A7	B[f]	No
Ilesha	ILEV	*Orthobunyavirus*	2	S	Bunyamwera	No
Ilheus	ILHV	*Flavivirus*	2	S	B[f]	No
Ingwavuma	INGV	*Orthobunyavirus*	2	S	Simbu	No
Inhangapi	INHV	*Rhabdoviridae*	2	IE		No
Inini	ININV	*Orthobunyavirus*	2	IE	Simbu	No
Inkoo	INKV	*Orthobunyavirus*	2	S	California	No
Ippy	IPPYV	*Arenavirus*	2	S	Tacaribe	No
Iriri	IRRV	*Rhabdoviridae*	2	A7		No
Irituia	IRIV	*Orbivirus*	2	S	Changuinola	No
Isfahan	ISFV	*Vesiculovirus*	2	S	Vesicular Stomatitis	No
Israel Turkey Meningitis	ITV	*Flavivirus*	2 with 3 practices	S	B[f]	No
Issyk-Kul	ISKV	*Bunyaviridae*	3	IE		No
Itacaiunas	ITCNV	*Rhabdoviridae*	2	A7		No
Itaituba	ITAV	*Phlebovirus*	2	IE	Phlebotomus Fever	No
Itaporanga	ITPV	*Phlebovirus*	2	S	Phlebotomus Fever	No
Itaqui	ITQV	*Orthobunyavirus*	2	S	C[f]	No
Itimirim	ITIV	*Orthobunyavirus*	2	IE	Guama	No
Itupiranga	ITUV	*Orbivirus b*	2	IE		No
Ixcanal	IXCV	*Phlebovirus*	2	A7	Phlebotomus Fever	No
Jacareacanga	JACV	*Orbivirus*	2	IE	Corriparta	No
Jacunda	JCNV	*Phlebovirus*	2	A7	Phlebotomus Fever	No
Jamanxi	JAMV	*Orbivirus*	2	IE	Changuinola	No
Jamestown Canyon	JCV	*Orthobunyavirus*	2	S	California	No

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Japanaut	JAPV	*Orbivirus b*	2	S		No
Japanese Encephalitis	JEV	*Flavivirus*	3[c]	S	B[f]	No
Jari	JARIV	*Orbivirus*	2	IE	Changuinola	No
Jatobal	JTBV	*Orthobunyavirus*	2	A7		No
Jerry Slough	JSV	*Orthobunyavirus*	2	S	California	No
Joa	JOAV	*Phlebovirus*	2	A7		No
Johnston Atoll	JAV	Unassigned	2	S	Quaranfil	No
Joinjakaka	JOIV	*Rhabdoviridae*	2	S		No
Juan Diaz	JDV	*Orthobunyavirus*	2	S	Capim	No
Jugra	JUGV	*Flavivirus*	2	S	B[f]	No
Junin	JUNV	*Arenavirus*	4	A6	Tacaribe	Yes
Jurona	JURV	*Vesiculovirus*	2	S	Vesicular Stomatitis	No
Juruaca	JRCV	*Picornavirus* [b]	2	A7		No
Jutiapa	JUTV	*Flavivirus*	2	S	B[f]	No
Kadam	KADV	*Flavivirus*	2	S	B[f]	No
Kaeng Khoi	KKV	*Orthobunyavirus* [b]	2	S		No
Kaikalur	KAIV	*Orthobunyavirus*	2	S	Simbu	No
Kairi	KRIV	*Orthobunyavirus*	2	A1	Bunyamwera	No
Kaisodi	KSOV	*Bunyaviridae*	2	S	Kaisodi	No
Kamese	KAMV	*Rhabdoviridae*	2	S	Hart Park	No
Kamiti River	KRV	*Flavivirus*	2	A7		No
Kammavanpettai	KMPV	*Orbivirus*	2	S		No
Kannamangalam	KANV	*Rhabdoviridae*	2	S		No
Kao Shuan	KSV	*Nairovirus*	2	S	Dera Ghazi Khan	No
Karimabad	KARV	*Phlebovirus*	2	S	Phlebotomus Fever	No
Karshi	KSIV	*Flavivirus*	2	S	B[f]	No
Kasba	KASV	*Orbivirus*	2	S	Palyam	No
Kedougou	KEDV	*Flavivirus*	2	A7	B[f]	No
Kemerovo	KEMV	*Orbivirus*	2	S	Kemerovo	No
Kern Canyon	KCV	*Rhabdoviridae*	2	S	Kern Canyon	No
Ketapang	KETV	*Orthobunyavirus*	2	S	Bakau	No
Keterah	KTRV	*Bunyaviridae*	2	S		No
Keuraliba	KEUV	*Rhabdoviridae*	2	S	Le Dantec	No

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Keystone	KEYV	*Orthobunyavirus*	2	S	California	No
Khabarovsk	KHAV	*Hantavirus*	3[a]	IE	Hantaan	No
Khasan	KHAV	*Nairovirus*	2	IE	CCHF	No
Kimberley	KIMV	*Lyssavirus*	2	A7	Bovine Ephemeral Fever	No
Kindia	KINV	*Orbivirus*	2	A7	Palyam	No
Kismayo	KISV	*Bunyaviridae*	2	S	Bhanja	No
Klamath	KLAV	*Vesiculovirus*	2	S	Vesicular Stomatitis	No
Kokobera	KOKV	*Flavivirus*	2	S	B[f]	No
Kolongo	KOLV	*Lyssavirus*	2	S	Rab	No
Koongol	KOOV	*Orthobunyavirus*	2	S	Koongol	No
Kotonkan	KOTV	*Lyssavirus*	2	S	Rab	No
Koutango	KOUV	*Flavivirus*	3	S	B[f]	No
Kowanyama	KOWV	*Bunyaviridae*	2	S		No
Kumlinge	KUMV	*Flavivirus*	4	A4	B[f]	Yes
Kunjin	KUNV	*Flavivirus*	2	S	B[f]	No
Kununurra	KNAV	*Rhabdoviridae*	2	S		No
Kwatta	KWAV	*Vesiculovirus*	2	S	Vesicular Stomatitis	No
Kyasanur Forest Disease	KFDV	*Flavivirus*	4	S	B[f]	Yes
Kyzylagach	KYZV	*Alphavirus*	2	IE	A[f]	No
La Crosse	LACV	*Orthobunyavirus*	2	S	California	No
Lagos Bat	LBV	*Lyssavirus*	2	S	Rab	No
Laguna Negra	LANV	*Hantavirus*	3[a]	IE		No
La Joya	LJV	*Vesiculovirus*	2	S	Vesicular Stomatitis	No
Lake Clarendon	LCV	*Orbivirus b*	2	IE		No
Landjia	LJAV	*Rhabdoviridae*	2	S		No
Langat	LGTV	*Flavivirus*	2	S	B[f]	No
Lanjan	LJNV	*Bunyaviridae*	2	S	Kaisodi	No
Las Maloyas	LMV	*Orthobunyavirus*	2	A7	Anopheles A	No
Lassa	LASV	*Arenavirus*	4	S	Tacaribe	Yes
Latino	LATV	*Arenavirus*	2	A5	Tacaribe	No
Lebombo	LEBV	*Orbivirus*	2	S		No
Lechiguanas	LECHV	*Hantavirus*	3[a]	IE	Hantaan	No

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Le Dantec	LDV	*Rhabdoviridae*	2	S	Le Dantec	No
Lednice	LEDV	*Orthobunyavirus*	2	A7	Turlock	No
Lipovnik	LIPV	*Orbivirus*	2	S	Kemerovo	No
Llano Seco	LLSV	*Orbivirus*	2	IE	Umatilla	No
Lokern	LOKV	*Orthobunyavirus*	2	S	Bunyamwera	No
Lone Star	LSV	*Bunyaviridae*	2	S		No
Louping Ill	LIV	*Flavivirus*	3[c]	S	B[f]	Yes
Lukuni	LUKV	*Orthobunyavirus*	2	S	Anopheles A	No
Macaua	MCAV	*Orthobunyavirus*	2	IE	Bunyamwera	No
Machupo	MACV	*Arenavirus*	4	S	Tacaribe	Yes
Madrid	MADV	*Orthobunyavirus*	2	S	C[f]	No
Maguari	MAGV	*Orthobunyavirus*	2	S	Bunyamwera	No
Mahogany Hammock	MHV	*Orthobunyavirus*	2	S	Guama	No
Main Drain	MDV	*Orthobunyavirus*	2	S	Bunyamwera	No
Malakal	MALV	*Lyssavirus*	2	S	Bovine Ephemeral	No
Manawa	MWAV	*Phlebovirus*	2	S	Uukumiemi	No
Manitoba	MNTBV	*Rhabdoviridae*	2	A7		No
Manzanilla	MANV	*Orthobunyavirus*	2	S	Simbu	No
Mapputta	MAPV	*Bunyaviridae*	2	S	Mapputta	No
Maporal	MPRLV	*Hantavirus*	3[a]	IE	Hantaan	No
Maprik	MPKV	*Bunyaviridae*	2	S	Mapputta	No
Maraba	MARAV	*Vesiculovirus*	2	A7		No
Marajo	MRJV	Unassigned	2	IE		No
Marburg	MARV	*Filovirus*	4	S	Marburg	Yes
Marco	MCOV	*Rhabdoviridae*	2	S		No
Mariquita	MRQV	*Phlebovirus*	2	A7	Phlebotomus Fever	No
Marituba	MTBV	*Orthobunyavirus*	2	S	C[f]	No
Marrakai	MARV	*Orbivirus*	2	S	Palyam	No
Matariya	MTYV	*Rhabdoviridae*	2	S	Matariva	No
Matruh	MTRV	*Orthobunyavirus*	2	S	Tete	No
Matucare	MATV	*Orbivirus*	2	S		No
Mayaro	MAYV	*Alphavirus*	2	S	A[f]	No
Mboke	MBOV	*Orthobunyavirus*	2	A7	Bunyamwera	No
Meaban	MEAV	*Flavivirus*	2	IE	B[f]	No

Name	Acronym	Taxonomic Status (Family or Genus)	Recommended Biosafety Level	Basis of Rating	Antigenic Group	HEPA Filtration on Lab Exhaust
Melao	MELV	*Orthobunyavirus*	2	S	California	No
Mermet	MERV	*Orthobunyavirus*	2	S	Simbu	No
Middelburg	MIDV	*Alphavirus*	2	A1	A[f]	No
Minatitlan	MNTV	*Orthobunyavirus*	2	S	Minatitlan	No
Minnal	MINV	*Orbivirus*	2	S	Umatilla	No
Mirim	MIRV	*Orthobunyavirus*	2	S	Guama	No
Mitchell River	MRV	*Orbivirus*	2	S		No
Mobala	MOBV	*Arenavirus*	3	A7	Tacaribe	No
Modoc	MODV	*Flavivirus*	2	S	B[f]	No
Moju	MOJUV	*Orthobunyavirus*	2	S	Guama	No
Mojui Dos Campos	MDCV	*Orthobunyavirus*	2	IE		No
Mono Lake	MLV	*Orbivirus*	2	S	Kemerovo	No
Mont. Myotis Leukemia	MMLV	*Flavivirus*	2	S	B[f]	No
Monte Dourado	MDOV	*Orbivirus*	2	IE	Changuinola	No
Mopeia	MOPV	*Arenavirus*	3	A7		No
Moriche	MORV	*Orthobunyavirus*	2	S	Capim	No
Morro Bay	MBV	*Orthobunyavrius*	2	IE	California	No
Morumbi	MRMBV	*Phlebovirus*	2	A7	Phlebotomus Fever	No
Mosqueiro	MQOV	*Rhabdoviridae*	2	A7	Hart Park	No
Mossuril	MOSV	*Rhabdoviridae*	2	S	Hart Park	No
Mount Elgon Bat	MEBV	*Vesiculovirus*	2	S	Vesicular Stomatitis	No
M'Poko	MPOV	*Orthobunyavirus*	2	S	Turlock	No
Mucambo	MUCV	*Alphavirus*	3	S	A[f]	Yes
Mucura	MCRV	*Phlebovirus*	2	A7	Phlebotomus Fever	No
Munguba	MUNV	*Phlebovirus*	2	IE	Phlebotomus Fever	No
Murray Valley Encephalitis	MVEV	*Flavivirus*	3	S	B[f]	No
Murutucu	MURV	*Orthobunyavirus*	2	S	C[f]	No
Mykines	MYKV	*Orbivirus*	2	A7	Kemerovo	No
Nairobi Sheep Disease	NSDV	*Nairovirus*	3[c]	A1	Nairobi Sheep Disease	No
Naranjal	NJLV	*Flavivirus*	2	IE	B[f]	No
Nariva	NARV	*Paramyxoviridae*	2	IE		No
Nasoule	NASV	*Lyssavirus*	2	A7	Rab	No

Name	Acronym	Taxonomic Status (Family or Genus)	Recommended Biosafety Level	Basis of Rating	Antigenic Group	HEPA Filtration on Lab Exhaust
Navarro	NAVV	*Rhabdoviridae*	2	S		No
Ndelle	NDEV	*Orthoreovirus*	2	A7	Ndelle	No
Ndumu	NDUV	*Alphavirus*	2	A1	A[f]	No
Negishi	NEGV	*Flavivirus*	3	S	B[f]	No
Nepuyo	NEPV	*Orthobunyavirus*	2	S	C[f]	No
Netivot	NETV	*Orbivirus*	2	A7		No
New Minto	NMV	*Rhabdoviridae*	2	IE	Sawgrass	No
Ngaingan	NGAV	*Lyssavirus*	2	S	Tibrogargan	No
Ngari d	NRIV	*Orthobunyavirus*	3	A7	Bunyamera	No
Ngoupe	NGOV	*Orbivirus*	2	A7	Eubenangee	No
Nique	NIQV	*Phlebovirus*	2	S	Phlebotomus Fever	No
Nkolbisson	NKOV	*Rhabdoviridae*	2	S	Kern Canyon	No
Nodamura	NOV	*Alphanodavirus*	2	IE		No
Nola	NOLAV	*Orthobunyavirus*	2	S	Bakau	No
Northway	NORV	*Orthobunyavirus*	2	IE	Bunyamwera	No
Ntaya	NTAV	*Flavivirus*	2	S	B[f]	No
Nugget	NUGV	*Orbivirus*	2	S	Kemerovo	No
Nyamanini	NYMV	Unassigned	2	S	Nyamanini	No
Nyando	NDV	*Orthobunyavirus*	2	S	Nyando	No
Oak Vale	OVV	*Rhabdoviridae*	2	A7		No
Odrenisrou	ODRV	*Phlebovirus*	2	A7	Phlebotomus Fever	No
Okhotskiy	OKHV	*Orbivirus*	2	S	Kemerovo	No
Okola	OKOV	*Bunyaviridae*	2	S	Tanga	No
Olifantsvlei	OLIV	*Orthobunyavirus*	2	S	Olifantsylei	No
Omo	OMOV	*Nairovirus*	2	A7	Qalyub	No
Omsk Hemorrhagic	OHFV	*Flavivirus*	4	S	B[f]	Yes
O'Nyong-Nyong	ONNV	*Alphavirus*	2	S	A[f]	Yes
Oran	ORANV	*Hantavirus*	3[a]	IE	Hantaan	No
Oriboca	ORIV	*Orthobunyavirus*	2	S	C[f]	No
Oriximina	ORXV	*Phlebovirus*	2	IE	Phlebotomus Fever	No
Oropouche	OROV	*Orthobunyavirus*	3	S	Simbu	Yes
Orungo	ORUV	*Orbivirus*	2	S	Orungo	No
Ossa	OSSAV	*Orthobunyavirus*	2	S	C[f]	No

Name	Acronym	Taxonomic Status (Family or Genus)	Recommended Biosafety Level	Basis of Rating	Antigenic Group	HEPA Filtration on Lab Exhaust
Ouango	OUAV	*Rhabdoviridae*	2	IE		No
Oubangui	OUBV	*Poxviridae*	2	IE		No
Oubi	OUBIV	*Orthobunyavirus*	2	A7	Olifantsylei	No
Ourem	OURV	*Orbivirus*	2	IE	Changuinola	No
Pacora	PCAV	*Bunyaviridae*	2	S		No
Pacui	PACV	*Phlebovirus*	2	S	Phlebotomus Fever	No
Pahayokee	PAHV	*Orthobunyavirus*	2	S	Patois	No
Palma	PMAV	*Bunyaviridae*	2	IE	Bhanja	No
Palestina	PLSV	*Orthobunyavirus*	2	IE	Minatitlan	No
Palyam	PALV	*Orbivirus*	2	S	Palyam	No
Para	PARAV	*Orthobunyavirus*	2	IE	Simbu	No
Paramushir	PMRV	*Nairovirus*	2	IE	Sakhalin	No
Parana	PARV	*Arenavirus*	2	A5	Tacaribe	No
Paroo River	PRV	*Orbivirus*	2	IE		No
Pata	PATAV	*Orbivirus*	2	S		No
Pathum Thani	PTHV	*Nairovirus*	2	S	Dera Ghazi Khan	No
Patois	PATV	*Orthobunyavirus*	2	S	Patois	No
Peaton	PEAV	*Orthobunyavirus*	2	A1	Simbu	No
Pergamino	PRGV	*Hantavirus*	3[a]	IE		No
Perinet	PERV	*Vesiculovirus*	2	A7	Vesicular Stomatitis	No
Petevo	PETV	*Orbivirus*	2	A7	Palyam	No
Phnom-Penh Bat	PPBV	*Flavivirus*	2	S	Bf	No
Pichinde	PICV	*Arenavirus*	2	A5	Tacaribe	No
Picola	PIAV	*Orbivirus*	2	IE	Wongorr	No
Pirital	PIRV	*Arenavirus*	3	IE		No
Piry	PIRYV	*Vesiculovirus*	3	S	Vesicular Stomatitis	No
Pixuna	PIXV	*Alphavirus*	2	S	A[f]	No
Playas	PLAV	*Orthobunyavirus*	2	IE	Bunyamwera	No
Pongola	PGAV	*Orthobunyavirus*	2	S	Bwamba	No
Ponteves	PTVV	*Phlebovirus*	2	A7	Uukuniemi	No
Potosi	POTV	*Orthobunyavirus*	2	IE	Bunyamwera	No
Powassan	POWV	*Flavivirus*	3	S	B[f]	No
Precarious Point	PPV	*Phlebovirus*	2	A7	Uukuniemi	No

Name	Acronym	Taxonomic Status (Family or Genus)	Recommended Biosafety Level	Basis of Rating	Antigenic Group	HEPA Filtration on Lab Exhaust
Pretoria	PREV	*Nairovirus*	2	S	Dera Ghazi Khan	No
Prospect Hill	PHV	*Hantavirus*	2	A8	Hantaan	No
Puchong	PUCV	*Lyssavirus*	2	S	Bovine Ephemeral ever	No
Pueblo Viejo	PVV	*Orthobunyavirus*	2	IE	Gamboa	No
Punta Salinas	PSV	*Nairovirus*	2	S	Hughes	No
Punta Toro	PTV	*Phlebovirus*	2	S	Phlebotomus Fever	No
Purus	PURV	*Orbivirus*	2	IE	Changuinola	No
Puumala	PUUV	*Hantavirus*	3[a]	IE	Hantaan	No
Qalyub	QYBV	*Nairovirus*	2	S	Qalyub	No
Quaranfil	QRFV	Unassigned	2	S	Quaranfil	No
Radi	RADIV	*Vesiculovirus*	2	A7	Vesicular Stomatitis	No
Razdan	RAZV	*Bunyaviridae*	2	IE		No
Resistencia	RTAV	*Bunyaviridae*	2	IE	Resistencia	No
Restan	RESV	*Orthobunyavirus*	2	S	C[f]	No
Rhode Island	RHIV	*Rhabdoviridae*	2	A7		No
Rift Valley Fever	RVFV	*Phlebovirus*	3[c]	S	Phlebotomus Fever	Yes
Rio Bravo	RBV	*Flavivirus*	2	S	B[f]	No
Rio Grande	RGV	*Phlebovirus*	2	S	Phlebotomus Fever	No
Rio Preto	RIOPV	Unassigned	2	IE		No
Rochambeau	RBUV	*Lyssavirus*	2	IE	Rab	No
Rocio	ROCV	*Flavivirus*	3	S	B[f]	Yes
Ross River	RRV	*Alphavirus*	2	S	A[f]	No
Royal Farm	RFV	*Flavivirus*	2	S	B[f]	No
Russian Spring-Summer Encephalitis	RSSEV	*Flavivirus*	4	S	B[f]	Yes
Saaremaa	SAAV	*Hantavirus*	3[a]	IE	Hantaan	No
Sabia	SABV	*Arenavirus*	4	A4		Yes
Sabo	SABOV	*Orthobunyavirus*	2	S	Simbu	No
Saboya	SABV	*Flavivirus*	2	S	B[f]	No
Sagiyama	SAGV	*Alphavirus*	2	A1	A[f]	No
Saint-Floris	SAFV	*Phlebovirus*	2	S	Phlebotomus Fever	No
Sakhalin	SAKV	*Nairovirus*	2	S	Sakhalin	No

Name	Acronym	Taxonomic Status (Family or Genus)	Recommended Biosafety Level	Basis of Rating	Antigenic Group	HEPA Filtration on Lab Exhaust
Salanga	SGAV	*Poxviridae*	2	IE	SGA	No
Salehabad	SALV	*Phlebovirus*	2	S	Phlebotomus Fever	No
Salmon River	SAVV	*Coltivirus*	2	IE	Colorado Tick Fever	No
Sal Vieja	SVV	*Flavivirus*	2	A7	B[f]	No
San Angelo	SAV	*Orthobunyavirus*	2	S	California	No
Sandfly Fever, Naples	SFNV	*Phlebovirus*	2	S	Phlebotomus Fever	No
Sandfly Fever, Sicilian	SFSV	*Phlebovirus*	2	S	Phlebotomus Fever	No
Sandjimba	SJAV	*Lyssavirus*	2	S	Rab	No
Sango	SANV	*Orthobunyavirus*	2	S	Simbu	No
San Juan	SJV	*Orthobunyavirus*	2	IE	Gamboa	No
San Perlita	SPV	*Flavivirus*	2	A7	B[f]	No
Santarem	STMV	*Bunyaviridae*	2	IE		No
Santa Rosa	SARV	*Orthobunyavirus*	2	IE	Bunyamwera	No
Saraca	SRAV	*Orbivirus*	2	IE	Changuinola	No
Sathuperi	SATV	*Orthobunyavirus*	2	S	Simbu	No
Saumarez Reef	SREV	*Flavivirus*	2	IE	B[f]	No
Sawgrass	SAWV	*Rhabdoviridae*	2	S	Sawgrass	No
Sebokele	SEBV	Unassigned	2	S		No
Sedlec	SEDV	*Bunyaviridae*	2	A7		No
Seletar	SELV	*Orbivirus*	2	S	Kemerovo	No
Sembalam	SEMV	Unassigned	2	S		No
Semliki Forest	SFV	*Alphavirus*	3	A2	A[f]	No
Sena Madureira	SMV	*Rhabdoviridae*	2	IE	Timbo	No
Seoul	SEOV	*Hantavirus*	3[a]	IE	Hantaan	No
Sepik	SEPV	*Flavivirus*	2	IE	B[f]	No
Serra Do Navio	SDNV	*Orthobunyavirus*	2	A7	California	No
Serra Norte	SRNV	*Phlebovirus*	2	A7		No
Shamonda	SHAV	*Orthobunyavirus*	2	S	Simbu	No
Shark River	SRV	*Orthobunyavirus*	2	S	Patois	No
Shokwe	SHOV	*Orthobunyavirus*	2	IE	Bunyamwera	No
Shuni	SHUV	*Orthobunyavirus*	2	S	Simbu	No
Silverwater	SILV	*Bunyaviridae*	2	S	Kaisodi	No
Simbu	SIMV	*Orthobunyavirus*	2	S	Simbu	No

Name	Acronym	Taxonomic Status (Family or Genus)	Recommended Biosafety Level	Basis of Rating	Antigenic Group	HEPA Filtration on Lab Exhaust
Simian Hemorrhagic Fever	SHFV	*Arterivirus*	2	A2	Simian Hemorrhagic Fever	No
Sindbis	SINV	*Alphavirus*	2	S	A[f]	No
Sin Nombre	SNV	*Hantavirus*	3[a]	IE	Hantaan	No
Sixgun City	SCV	*Orbivirus*	2	S	Kemerovo	No
Slovakia	SLOV	Unassigned	3	IE		No
Snowshoe Hare	SSHV	*Orthobunyavirus*	2	S	California	No
Sokoluk	SOKV	*Flavivirus*	2	S	B[f]	No
Soldado	SOLV	*Nairovirus*	2	S	Hughes	No
Somone	SOMV	Unassigned	3	IE	Somone	No
Sororoca	SORV	*Orthobunyavirus*	2	S	Bunyamwera	No
Spondweni	SPOV	*Flavivirus*	2	S	B[f]	No
Sripur	SRIV	*Rhabdoviridae*	3	IE		No
St. Louis Encephalitis	SLEV	*Flavivirus*	3	S	B[f]	No
Stratford	STRV	*Flavivirus*	2	S	B[f]	No
Sunday Canyon	SCAV	*Bunyaviridae*	2	S		No
Tacaiuma	TCMV	*Orthobunyavirus*	2	S	Anopheles A	No
Tacaribe	TCRV	*Arenavirus*	2	A5	Tacaribe	No
Taggert	TAGV	*Nairovirus*	2	S	Sakhalin	No
Tahyna	TAHV	*Orthobunyavirus*	2	S	California	No
Tai	TAIV	*Bunyaviridae*	2	A7	Bunyamwera	No
Tamdy	TDYV	*Bunyaviridae*	2	IE		No
Tamiami	TAMV	*Arenavirus*	2	A5	Tacaribe	No
Tanga	TANV	*Bunyaviridae*	2	S	Tanga	No
Tanjong Rabok	TRV	*Orthobunyavirus*	2	S	Bakau	No
Tapara	TAPV	*Phlebovirus*	2	A7		No
Tataguine	TATV	*Bunyaviridae*	2	S		No
Tehran	THEV	*Phlebovirus*	2	A7	Phlebotomus Fever	No
Telok Forest	TFV	*Orthobunyavirus*	2	IE	Bakau	No
Tembe	TMEV	*Orbivirus b*	2	S		No
Tembusu	TMUV	*Flavivirus*	2	S	B[f]	No
Tensaw	TENV	*Orthobunyavirus*	2	S	Bunyamwera	No
Termeil	TERV	*Bunyavirus b*	2	IE		No
Tete	TETEV	*Orthobunyavirus*	2	S	Tete	No

Name	Acronym	Taxonomic Status (Family or Genus)	Recommended Biosafety Level	Basis of Rating	Antigenic Group	HEPA Filtration on Lab Exhaust
Thiafora	TFAV	*Bunyaviridae*	2	A7	Thiafora	No
Thimiri	THIV	*Orthobunyavirus*	2	S	Simbu	No
Thogoto	THOV	*Orthomyxoviridae*	2	S	Thogoto	No
Thottapalayam	TPMV	*Hantavirus*	2	S	Hantaan	No
Tibrogargan	TIBV	*Lyssavirus*	2	S	Tibrogargan	No
Tilligerry	TILV	*Orbivirus*	2	IE	Eubenangee	No
Timbo	TIMV	*Rhabdoviridae*	2	S	Timbo	No
Timboteua	TBTV	*Orthobunyavirus*	2	A7	Guama	No
Tinaroo	TINV	*Orthobunyavirus*	2	IE	Simbu	No
Tindholmur	TDMV	*Orbivirus*	2	A7	Kemerovo	No
Tlacotalpan	TLAV	*Orthobunyavirus*	2	IE	Bunyamwera	No
Tonate	TONV	*Alphavirus*	3	IE	A[f]	Yes
Topografov	TOPV	*Hantavirus*	3[a]	IE	Hantaan	No
Toscana	TOSV	*Phlebovirus*	2	S	Phlebotomus Fever	No
Toure	TOUV	Unassigned	2	S		No
Tracambe	TRCV	*Orbivirus*	2	A7		No
Tribec	TRBV	*Orbivirus*	2	S	Kemerovo	No
Triniti	TNTV	*Togaviridae*	2	S		No
Trivittatus	TVTV	*Orthobunyavirus*	2	S	California	No
Trocara	TROCV	*Alphavirus*	2	IE	A[f]	No
Trombetas	TRMV	*Orthobunyavirus*	2	A7		No
Trubanaman	TRUV	*Bunyaviridae*	2	S	Mapputta	No
Tsuruse	TSUV	*Orthobunyavirus*	2	S	Tete	No
Tucurui	TUCRV	*Orthobunyavirus*	2	A7		No
Tula	TULV	*Hantavirus*	2	A8		No
Tunis	TUNV	*Phlebovirus*	2	A7	Phlebotomus Fever	No
Turlock	TURV	*Orthobunyavirus*	2	S	Turlock	No
Turuna	TUAV	*Phlebovirus*	2	IE	Phlebotomus Fever	No
Tyuleniy	TYUV	*Flavivirus*	2	S	B[f]	No
Uganda S	UGSV	*Flavivirus*	2	S	B[f]	No
Umatilla	UMAV	*Orbivirus*	2	S	Umatilla	No
Umbre	UMBV	*Orthobunyavirus*	2	S	Turlock	No
Una	UNAV	*Alphavirus*	2	S	A[f]	No
Upolu	UPOV	*Bunyaviridae*	2	S	Upolu	No

Name	Acronym	Taxonomic Status (Family or Genus)	Recommended Biosafety Level	Basis of Rating	Antigenic Group	HEPA Filtration on Lab Exhaust
Uriurana	UURV	*Phlebovirus*	2	A7	Phlebotomus Fever	No
Urucuri	URUV	*Phlebovirus*	2	S	Phlebotomus Fever	No
Usutu	USUV	*Flavivirus*	2	S	B[f]	No
Utinga	UTIV	*Orthobunyavirus*	2	IE	Simbu	No
Uukuniemi	UUKV	*Phlebovirus*	2	S	Uukuniemi	No
Vellore	VELV	*Orbivirus*	2	S	Palyam	No
Venezuelan Equine Encephalitis	VEEV	*Alphavirus*	3[c]	S	A[f]	Yes
Venkatapuram	VKTV	Unassigned	2	S		No
Vinces	VINV	*Orthobunyavirus*	2	A7	C[f]	No
Virgin River	VRV	*Orthobunyavirus*	2	A7	Anopheles A	No
Vesicular Stomatitis-Alagoas	VSAV	*Vesiculovirus*	2[c]	S	Vesicular Stomatitis	No
Vesicular Stomatitis-Indiana	VSIV	*Vesiculovirus*	2[c]	A3	Vesicular Stomatitis	No
Vesicular Stomatitis-New Jersey	VSNJV	*Vesiculovirus*	2[c]	A3	Vesicular Stomatitis	No
Wad Medani	WMV	*Orbivirus*	2	S	Kemerovo	No
Wallal	WALV	*Orbivirus*	2	S	Wallal	No
Wanowrie	WANV	*Bunyaviridae*	2	S		No
Warrego	WARV	*Orbivirus*	2	S	Warrego	No
Wesselsbron	WESSV	*Flavivirus*	3[c]	S	B[f]	Yes
Western Equine Encephalitis	WEEV	*Alphavirus*	3	S	A[f]	No
West Nile	WNV	*Flavivirus*	3	S	B[f]	No
Whataroa	WHAV	*Alphavirus*	2	S	A[f]	No
Whitewater Arroyo	WWAV	*Arenavirus*	3	IE	Tacaribe	No
Witwatersrand	WITV	*Bunyaviridae*	2	S		No
Wongal	WONV	*Orthobunyavirus*	2	S	Koongol	No
Wongorr	WGRV	*Orbivirus*	2	S	Wongorr	No
Wyeomyia	WYOV	*Orthobunyavirus*	2	S	Bunyamwera	No
Xiburema	XIBV	*Rhabdoviridae*	2	IE		No
Xingu	XINV	*Orthobunyavirus*	3			No
Yacaaba	YACV	*Bunyaviridae*	2	IE		No
Yaounde	YAOV	*Flavivirus*	2	A7	B[f]	No

Name	Acronym	Taxonomic Status (Family or Genus)	Recommended Biosafety Level	Basis of Rating	Antigenic Group	HEPA Filtration on Lab Exhaust
Yaquina Head	YHV	*Orbivirus*	2	S	Kemerovo	No
Yata	YATAV	*Rhabdoviridae*	2	S		No
Yellow Fever	YFV	*Flavivirus*	3	S	B[f]	Yes
Yogue	YOGV	*Bunyaviridae*	2	S	Yogue	No
Yoka	YOKA	*Poxviridae*	2	IE		No
Yug Bogdanovac	YBV	*Vesiculovirus*	2	IE	Vesicular Stomatitis	No
Zaliv Terpeniya	ZTV	*Phlebovirus*	2	S	Uukuniemi	No
Zegla	ZEGV	*Orthobunyavirus*	2	S	Patois	No
Zika	ZIKV	*Flavivirus*	2	S	B[f]	No
Zirqa	ZIRV	*Nairovirus*	2	S	Hughes	No

* Federal regulations, import/export requirements, and taxonomic status are subject to changes. Check with the appropriate federal agency to confirm regulations.

[a] Containment requirements will vary based on virus concentration, animal species, or virus type. See the Hantavirus agent summary statement in the viral agent chapter.

[b] Tentative placement in the genus.

[c] These organisms are considered pathogens of significant agricultural importance by the USDA (see Appendix D) and may require additional containment (up to and including BSL-3-Ag containment). Not all strains of each organism are necessarily of concern to the USDA. Contact USDA for more information regarding exact containment/permit requirements before initiating work.

[d] Alternate name for Ganjam virus.

[e] Garissa virus is considered an isolate of this virus, so same containment requirements apply.

[f] Antigenic groups designated A, B, and C refer to the original comprehensive and unifying serogroups established by Casals, Brown, and Whitman based on cross-reactivity among known arboviruses (2,21). Group A viruses are members of the genus *Alphavirus*, group B belong to the family *Flaviviridae*, and Group C viruses are members of the family *Bunyaviridae*.

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