## Biological Agent Reference Sheet (BARS)
Agent: Dengue Fever Virus (DENV1, 2, 3, or 4)

### Agent Characteristics

<table>
<thead>
<tr>
<th>Risk Group (RG)</th>
<th><strong>RG-2</strong> associated with human disease, rarely serious; preventive or therapeutic interventions often available</th>
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<tbody>
<tr>
<td>Agent Type</td>
<td>Virus Biohazard</td>
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#### Description

Dengue virus, DENV (a member of the *Flaviviridae*) has a spherical enveloped virion 40-50 nm in diameter. The genome is single-stranded, positive sense RNA surrounded by an icosahedral nucleocapsid. The virus occurs in four distinct types (serotypes) DENV 1-4.

Dengue Virus causes the most common arthropod-borne viral disease in humans with 50–100 million infections per year. Dengue virus causes an acute febrile disease known as dengue or dengue fever (breakbone fever), although most infections are asymptomatic. In some cases, it also causes severe dengue (formerly known as dengue hemorrhagic fever (DHF) or dengue shock syndrome (DSS)). DENV is endemic in most regions of the tropics (Asia, India, Caribbean, Africa, Central and South America, and Mexico). The disease is maintained mostly by a human-mosquito-human cycle; non-human primate infection is common in West Africa. Prior exposure to one type of DENV serotype is believed to pre-dispose an individual to severe dengue when infected with a second DENV serotype.

#### Host Range

Humans, mosquitoes (as a vector: *Aedes spp., Stegomyia spp.*) and non-human primates

#### Host Shedding

- **Blood**
- **Saliva**
- **Urine**
- **Direct contact**
- **Other:**
- **Feces**
- **Other:**

#### Routes of Exposure to Humans

- **Aerosol/Inhalation**
- **Animal Bites**
- **Arthropod Vectors**
- **Contaminated Items**
- **Direct Contact**
- **Ingestion**
- **Mucous Membranes**
- **Percutaneous**
- **Vertical Transmission**
- **Broken skin**

#### Infectious Dose

Less than 10 plaque forming units (PFU). Fewer than 10 PFU led to infection in 50% of volunteers treated with an attenuated dengue virus vaccine candidate.

#### Incubation Period

From 3 to 14 days; usually 4 to 7 days

#### Health Hazards

**Signs and Symptoms**

- Flu-like symptoms (i.e. fever, headache, dehydration, weight loss, lethargy)
- Cutaneous symptoms (i.e. skin lesions, rash)
- Gastrointestinal symptoms (i.e. loss of appetite, nausea, vomiting, diarrhea)
- Respiratory symptoms (i.e. coughing, sneezing)
- Neurological symptoms (i.e. loss of sensation, ataxia)
- Musculoskeletal symptoms (i.e. joint and muscle pain)
- Lymphoreticular symptoms (i.e. enlarged internal organs or lymph nodes)
- Reproductive Health concerns (i.e. abortion, fetal abnormalities) – request a Reproductive Health Consultation
- Other:

**Immunizations**

- Available
- Not Available

**Prophylaxis**

- None Available

### Agent Viability

<table>
<thead>
<tr>
<th>Disinfection</th>
<th>☒ 1:10 Bleach Dilution ☐ 70% Ethanol</th>
<th>☐ Other:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inactivation</td>
<td>Viruses are sensitive to moist heat (121°C for at least 15 min), dry heat (160-170°C for at least 1 hour), and low temperature sterilization (i.e. Ethylene oxide or plasma sterilization). The virus is also inactivated at a pH of 3.</td>
<td></td>
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</table>

#### Survival Outside Host

The virus is stable in dried blood for up to 9 weeks at room temperature.

### Laboratory Hazards

- High energy-creating activities (centrifugation, sonication, high pressure systems, vortexing, tube cap popping)
- Handling of sharps (needles, scalpels, microtome blades, broken glass, etc.)
- Splash/droplet-creating activities (shaking incubators, liquid culturing, mechanical pipetting)
- Equipment contamination
- Exposed skin/uncovered wounds

#### Laboratory Acquired Infection History

11 cases reported up to 1988; one case resulted from splashing infectious material in the face.

### Laboratory Handling Guidelines

#### Laboratory Biosafety Level (BSL) 3

- **BSL-2** ☐ with special practices

#### Attenuated Strain Alternatives

- ☒ EHS Laboratory Safety Training (CULearn #2555)
- ☒ EHS Chemical Waste Disposal (CULearn #2716)
- ☒ EHS Bloodborne Pathogens Training (CULearn #1064)
- ☒ Lab-specific protocol training
- ☒ CULearn BARS Course # 2277.69

#### Training

- ☐ Benchtop
- ☐ Biosafety Cabinet
- ☐ Chemical Fume Hood
- ☒ Centrifuge lids or safety cups; samples are loaded/unloaded inside the BSC
- ☒ Use of safety-engineered sharps
- ☒ Other: Sticky paper and UV trap lights to prevent potential escape of infected vector insects

#### Lab Engineering Controls

- ☒ Eye protection
- ☐ Single gloves
- ☐ Additional gloves (recommended)
- ☒ Snap-front lab coat with cinch cuffs
- ☐ Disposable solid front gown
- ☐ Additional mucous membrane protection
- ☐ Disposable outer sleeves
- ☐ Other:

#### Waste Management

- ☒ Regulated Medical Waste (RMW)

#### Shipping Guidance

Refer to EHS Biological Materials Shipping

1Formal medical advice is obtained during medical consultations with Cornell Health or primary healthcare provider as needed.
2Based on NIH definitions. Final Risk Group (RG) designation will be assigned upon a case-by-case review by the Cornell University Institutional Biosafety Committee (IBC).
3Formal medical advice is obtained during medical consultations with Cornell Health or primary healthcare provider as needed.
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Animal Vivarium Guidance

**Animal Housing Biosecurity Level (ABSL)**

- **ABSL-1**
- **ABSL-2**
- **ABSL-3**

**Animal Biosecurity**

- Experimental animals are housed separately
- Information not available

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<thead>
<tr>
<th>Exposure and Spill Procedures</th>
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<tr>
<td><strong>Mucous Membranes</strong></td>
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<tr>
<td><strong>Other Exposures</strong></td>
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<tr>
<td><strong>Small Spills</strong></td>
</tr>
<tr>
<td><strong>Large Spills</strong></td>
</tr>
<tr>
<td><strong>Incident Reporting</strong></td>
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</tbody>
</table>

**Medical Follow Up**

Emergencies:

Call 911 from a campus phone or 607-255-1111 from a mobile phone.

Students may be seen at Cornell Health, Student Health Services.

Employees may choose a healthcare provider of their choice. Occupational medicine providers include Cayuga Medical Associates Occupational Medicine 607-339-0680, WellNow Urgent Care - 607-319-4563, Guthrie Occupational Medicine - 1-800-244-4886

**Biosafety Level 2 Containment Requirements Summary**

**Personal Hygiene**

- Remove PPE before leaving the lab – avoid wearing PPE in public spaces.
- Wash hands frequently with soap and water after removing gloves, handling samples, leaving lab, etc.
- Change gloves frequently while working, and before removing samples from the biosafety cabinet to minimize potential contamination of equipment and surfaces within the lab.

**Standard Microbiological Practices**

In addition to standard BSL1 practices:

- Biohazard signs and labels on equipment.
- Use a biological safety cabinet (BSC), such as a Class II Type A2, for manipulations that can generate infectious aerosols.
- Use aerosol containing devices for high energy activities which may generate infectious aerosols. For example, centrifugation of agents which may generate infectious aerosols will use gasketed rotors or buckets. Rotors or buckets will be removed and opened inside a BSC. Centrifuge tubes will be filled and opened in a BSC.
- Vacuum lines are protected with liquid disinfectant-filled traps and 0.45 micron filters.
- Sharps handling and safety practices are implemented.
- Decontaminate work surfaces after completion of work and after any spill or splash of potentially infectious material with appropriate disinfec tant.
- Chemically disinfect all surfaces and equipment.
- Potentially infectious materials are placed in durable, leak proof, labeled primary containers during collection, handling, processing, and secondary containers during storage, or transport within a facility.
- Windows in BSL-2 labs remain closed.

**Special Practices**

- All persons entering the laboratory are advised of the potential hazards and meet specific entry/exit requirements.
- The laboratory supervisor ensures that lab personnel demonstrate proficiency in standard and special microbiological practices before working with such agents.
- Laboratory equipment are routinely decontaminated, as well as, after spills, splashes or other potential contamination.
- Spills involving infectious materials are contained, decontaminated, and cleaned up by staff properly trained and equipped to work with infectious material.
- Equipment is decontaminated before repair, maintenance, or removal from the laboratory.

**Regulated Medical Waste (RMW)**

- **Pickup Request**
  - Soft waste:
    - All materials that come into contact with this agent must be placed in a biohazard waste bag.
    - If working in a BSC, have a biohazard waste bag inside the BSC for waste collection.
    - All equipment, tubes, and waste bags that are brought out of the biosafety cabinet are wiped with appropriate disinfectant.
    - Place smaller red bag waste from BSC into larger red bag outside the BSC for transport.
  - Sharps waste:
    - Place in leak proof sharps container labeled with the biohazard symbol. If working in a BSC, place a sharps container in the BSC.
  - Liquid waste:
    - Add EHS-approved disinfectant to appropriate concentration, hold for contact time specified per manufacturer’s guidelines, and then gently pour down the drain.

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**BARS_Dengue_Virus**

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Controlled document if viewed online. Uncontrolled if viewed in print.

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## Special Considerations

| Experiment-Specific Requirements | See lab protocols for additional information, any deviations from this BARS, and for lab-specific expectations. |

## References

3. CDC. Dengue [http://www.cdc.gov/dengue](http://www.cdc.gov/dengue) as viewed February 11, 2019

*Cornell EHS would like to thank Emory University for the use of their Biological Agent Reference Sheet (BARS) format and some content.*