**Biological Agent Reference Sheet (BARS)**

**Agent: Clostridium difficile**

### Agent Characteristics

<table>
<thead>
<tr>
<th>Risk Group (RG)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>☒ RG-2</td>
<td>Associated with human disease, rarely serious; preventive or therapeutic interventions often available</td>
</tr>
<tr>
<td>☐ RG-3</td>
<td>Associated with serious or lethal human disease; preventive or therapeutic interventions may be available</td>
</tr>
</tbody>
</table>

**Agent Type**

- Bacteria

**Description**

Clostridium difficile is a Gram positive, anaerobic, rod shaped, spore forming bacteria that causes infectious diarrhea and colitis. Abdominal pain, bloating, and diarrhea are caused by enterotoxins and cytotoxins released by *C. difficile*. Disease frequently follows antibiotic treatment and normal gut flora disruption, which allows *C. difficile* to overgrow.

The spores of this organism are much more resistant to disinfection. Any surface, device, or material (such as caging, PPE, etc.) that becomes contaminated may serve as a reservoir for the *C. difficile* spores.

**Host Range**

- Humans, pigs, calves

**Host Shedding**

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

**Routes of Exposure to Humans**

- ☒ Aerosolize droplets that can be swallowed
- ☒ Arthropod Vectors
- ☒ Direct Contact
- ☒ Musculoskeletal symptoms (i.e. joint and muscle pain)
- ☒ Neurological symptoms (i.e. loss of sensation, ataxia)
- ☒ Respiratory symptoms (i.e. coughing, sneezing)
- ☒ Skin/Contact with skin lesions
- ☒ digestive symptoms (i.e. nausea, vomiting, diarrhea)
- ☒ Additional mucous membrane protection (where aerosolization is a concern)
- ☒ Ingestion (Primary)
- ☒ Infection History
- ☒ Equipment contamination
- ☒ Exposed skin/uncovered wounds
- ☒ Vertical Transmission

**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)
- ☒ Lymphoreticular symptoms (i.e. enlarged internal organs or lymph nodes)
- ☒ Neurological symptoms (i.e. loss of sensation, ataxia)
- ☒ Respiratory symptoms (i.e. coughing, sneezing)
- ☒ Cutaneous symptoms (i.e. skin lesions, rash)
- ☒ Gastrointestinal symptoms (i.e. loss of appetite, nausea, vomiting, diarrhea)
- ☒ Additional mucous membrane protection (where aerosolization is a concern)

**Immunizations**

- ☒ Available
- ☒ Not Available

**Prophylaxis**

- Guidance can be found on the CDC’s *C. difficile* webpage: [https://www.cdc.gov/hai/organisms/cdiff/cdiff_infect.html](https://www.cdc.gov/hai/organisms/cdiff/cdiff_infect.html)

**Waste Management**

- Regulated Medical Waste (RMW)

**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 Handling Guidelines**

<table>
<thead>
<tr>
<th>Laboratory Biosafety Level (BSL)</th>
<th>☒ BSL-2 ☒ with special practices</th>
</tr>
</thead>
</table>

**Training**

- ☒ EHS Laboratory Safety Training (CULearn #2555)
- ☒ EHS Bloodborne Pathogens Training (CULearn #1074)
- ☒ Lab-specific protocol training

**Lab Engineering Controls**

- ☒ Benchtop (for aerosol containment)
- ☒ Biosafety Cabinet
- ☒ Chemical Fume Hood
- ☒ Centrifuge lids or safety cups; samples are loaded/unloaded inside the BSC
- ☒ Use of safety-engineered sharps
- ☒ Other:

**Personal Protective Equipment (PPE)**

- ☒ Eye protection (strongly recommended)
- ☒ Single gloves
- ☒ Additional gloves (strongly recommended)
- ☒ Snap-front lab coat with cinch cuffs
- ☒ Disposable solid front gown
- ☒ Additional mucous membrane protection (where aerosolization is a concern)
- ☒ Disposable outer sleeves
- ☒ Other:

**Animal Vivarium Guidance**

<table>
<thead>
<tr>
<th>Animal Housing Biosafety Level (ABSL)</th>
<th>☒ ABSL-1 ☒ ABSL-2 ☒ ABSL-3</th>
</tr>
</thead>
</table>

**Animal Biosecurity**

- ☒ Experimental animals are housed separately
- ☒ Information not available

**Perform Inoculations**

- ☒ Benchtop
- ☒ Biosafety Cabinet
- ☒ Cage Changing Station

**Change Cages**

- ☒ Benchtop
- ☒ Biosafety Cabinet
- ☒ Cage Changing Station

**Additional Vivarium Guidance**

- MUST USE 1:1 Dilution of *Spor-Klenz Concentrate* for 1 minute of contact time

### Agent Viability

**Disinfection**

- ☒ 1:5 Bleach Dilution
- ☒ 70% Ethanol
- ☒ Other: 2% glutaraldehyde, with prolonged contact time; 1:1 dilution of Spor-Klenz Concentrate; Chlorine Dioxide.

**Inactivation**

- Spores are fairly resistant; moderate susceptibility to 1% sodium hypochlorite; susceptible to high level disinfectants (>2% glutaraldehyde) with prolonged contact time.

**Survival Outside Host**

- *C. difficile* is able to survive in soil, meat, and vegetables

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*Agent Viability refers to the ability of an agent to survive under various conditions.*

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**Biosafety Level 2 Containment Requirements Summary**

| Exposure and Spill Procedures | | |
|-----------------------------|-------------------------|
| Mucous Membranes            | Flush eyes, mouth or nose for 15 minutes at eyewash station. See: responding to exposures. |
| Other Exposures             | Wash with soap and water for 15 minutes (open wounds, sores, etc.) and a minimum of 20 seconds of soap and water for areas with intact skin. See: responding to exposures. |
| Small Spills                | Notify others working in the lab. Evacuate area and allow 30 minutes for aerosols to settle. Don appropriate PPE. Cover area of the spill with paper towels and apply disinfectant, working from the perimeter toward the center. Allow 30 minutes of contact time before disposal and cleanup of spill materials. See: spill cleanup. |
| Large Spills                | Request assistance from the EHS Spill Team by calling CUPD dispatch. Call 911 from a campus phone or 607-255-1111 from a mobile phone. |
| Incident Reporting          | Immediately report the incident to supervisor and complete the EHS online injury/illness report as soon as possible. |

### Medical Follow Up

<table>
<thead>
<tr>
<th>During Business Hours</th>
<th>After Hours Care: Cornell Health Services 24-hour phone consultation line or local urgent care as listed on above webpage.</th>
<th>Emergencies: Call 911 from a campus phone or 607-255-1111 from a mobile phone.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cornell Health</td>
<td>607-255-5155 (24-hour phone consultation line)</td>
<td></td>
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</table>

### 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. Alcohol-based hand sanitizer will not inactivate spores.

**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 disinfectant.
  - 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)**

| 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. |

### Special Considerations
- Because alcohol does not kill *Clostridium difficile* spores, use of soap and water is more efficacious than alcohol-based hand rubs. However, early experimental data suggest that, even using soap and water, the removal of *C. difficile* spores is more challenging than the removal or inactivation of other common pathogens.
- Preparing contamination of the hands via glove use remains the cornerstone for preventing *Clostridium difficile* transmission.
- Use antibiotics judiciously. Speak with your supervisor or primary healthcare provider before handling *Clostridium difficile* culture if you are on antibiotic treatment.

See lab protocols for additional information, any deviations from this BARS, and for lab-specific expectations.
Agent: Clostridium difficile

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