NRT Quick Reference Guide:
Coxiella burnetii (Causes the disease Q fever)

For reference, please see "Key References Cited/Used in National Response Team (NRT) Quick Reference Guides (QRGs) for Bacterial 2011 Revision." QRGs are intended for Federal On-Scene Coordinators (OSCs) and Remedial Program Managers (RPMs).

Agent Characteristics

Agent Classification: Biological **Type:** Bacteria (*Coxiella burnetii)*
Description: *C. burnetii is an obligate intracellular Gram negative microorganism found in humans, cattle, sheep, goats, cats, and rabbits. C. burnetii is resistant to heat, drying, and many common disinfectants. C. burnetii does not usually cause illness in livestock; however, the microorganisms are found in body fluids, milk, urine, and feces of infected animals. Q fever is a zoonotic disease (transferable between animals and humans) caused by C. burnetii. Infection of humans occurs through inhalation of the organisms from the air, and very few organisms are needed to cause disease. Approximately 50% of infected people show signs of illness.*

Biosafety Level: 3
HHS Select Agent: Yes
CDC Class: B
Incubation Period: 9-28 days
Person-to-Person Transmission: Yes, via contact with body fluids or thru unprotected sexual contact.

Other Forms of Transmission: Tick bite
Treatment: Supportive with antibiotics like doxycycline.
Infectivity/Lethality: High/Low
Persistence/Stability: Persistent in soil for months. Stable because resistant to heat, drying, and many common disinfectants, which enables the bacteria to survive for long periods of time in the environment.

Release Scenarios

CAUTION: REAEROSOLIZATION IS A CONCERN FOR ALL RELEASE SCENARIOS.
Air: *C. burnetii* poses an aerosol threat in its natural and specially engineered forms. Transmitted commonly by airborne dissemination of small cell variants (spore-like particles) in dust from contaminated surfaces; microorganisms may be carried >0.5 mile downwind.
Soil: Persists in soil for months due to its resistance to heat and desiccation.
Surfaces: Persists on surfaces for months due to its resistance to desiccation and common disinfectants.
Water: *C. burnetii* can pose a water threat.
Food: Unpasteurized milk and dairy products.
Other: To avoid animal to man transmission, milk should be pasteurized; dust control in agricultural related industries is essential and animal placentas, feces, and urine should be incinerated.

Health Effects

Onset	Symptoms may occur 9-28 days and the illness may last for weeks.
Signs/Symptoms per Exposure Route	**General:** Acute Q fever is characterized by sudden onset of fever, headache, malaise and interstitial pneumonitis. Pneumonia occurs frequently. Approximately 50% of infected people show signs of illness. Only 1-2% of people with acute Q fever die and most patients will recover without any treatment. A few people may develop chronic Q fever, an uncommon but serious disease, 1-20 years after the initial infection. Therefore, early treatment and diagnosis is important. Uncommon complication include chronic hepatitis, endocarditis (inner heart layer inflammation), aseptic meningitis (inflammation of brain membranes), encephalitis (inflammation of the brain), and osteomyelitis (infection of the bone). **Inhalation:** Primary route of exposure via dust from contaminated surfaces/premises. **Skin:** Direct contact with infected animals and after-birth tissue, wool, straw, manure fertilizer and clothing of exposed personnel. **Ingestion:** Ingestion of unpasteurized milk and dairy products has been responsible for some cases.

Effect Levels

Infectivity: *C. burnetii* is considered to be highly infectious.
Infective dose: As little as one organism can cause Q fever in a susceptible individual.
Lethality: Lethality <2% for treated individuals.

Personnel Safety

Concerns	**Decisions regarding PPE, sampling, and decon should not be made without verifying if the Q fever outbreak was naturally occurring or from an engineered source.** Check with the Health & Safety Officer regarding PPE, Medical Surveillance, & Health & Safety Plan (HASP). Level of PPE may vary depending upon the incident & site specific circumstances. The PPE Levels listed are general suggestions only & may not provide protection for some decon & other chemicals that workers may be exposed to during response/recovery operations. For decon of workers, use warm soapy water, taking care to avoid abrading the skin.
Medical	**Baseline:** Annual physical & respiratory function exams. **THERE IS NO U.S. FOOD & DRUG ADMINISTRATION APPROVED HUMAN Q FEVER VACCINE.** **Treatments Available:** Supportive accompanied with antibiotics, such as doxycycline.
First Aid	**During Incident:** Conduct medical monitoring; use PPE as designated by the HASP; record the PPE Levels used; monitor for fever & other signs/symptoms as listed under Health Effects &, if necessary, ensure medical attention is obtained as soon as possible. **Post Incident:** Monitor for signs/symptoms. If necessary, ensure medical attention is provided ASAP.
PPE	**Emergency Response to a Suspected Biological Incident:** Possible PPE Levels for emergency responders is based on scenario risks from highest level of protection to least: **1)** Pressure-demand Self Contained Breathing Apparatus (SCBA) with Level A protective suit, when: **a)** Event is uncontrolled, **b)** The type(s) of airborne agent(s) is unknown, **c)** The dissemination method is unknown, **d)** Dissemination via an aerosol-generating device is still occurring, **e)** Dissemination via an aerosol-generating device has stopped, but there is no information on the duration of dissemination, or what the exposure concentration may be. **2)** Pressure-demand SCBA with Level B protective suit, when: **a)** The suspected biological aerosol is no longer being released, **b)** Other conditions may present a splash hazard. **3)** Full-facepiece respirator with P100 filter or PAPR with HEPA filters, when: An aerosol-generating device was not used to create high airborne concentrations. **4)** Disposable hooded coveralls, gloves, & foot coverings, when: Dissemination was by a letter, package, or other material that can be bagged, contained, etc. **Other Workers:** PPE recommendations for workers other than emergency responders must be developed in the HASP for the specific scenario. PPE recommendations will vary by job type (e.g., cleanup, decon, etc.), type of exposure (e.g., airborne or surface/liquid/soil hazard), & any other site hazards (e.g., chemical, physical, etc.).

Field Detection

Fixed Aerosol Monitoring: A release of *C. burnetii* can only be confirmed once patients present with symptoms & are diagnosed. Consult EPA/HQ-EOC at 202-564-3850 for more information.

Portable Aerosol Monitoring: Refer to the manufacturer's aseptic sampling methods, flow rates, & sampling times. Ensure that the appropriate pump is used for the selected sampling method. Traditional wet sampling methods (e.g., impingers & impactors) might not work well because *C. burnetti* is an obligate intracellular microorganism which requires embryonated chicken eggs or cell lines for growth.

Sampling

Concerns: BEFORE OBTAINING SAMPLES: Identify sample transportation requirements; Contact EPA/HQ-EOC (202-564-3850) for ERLN contract laboratories able to analyze these types of samples; Clearly identify & coordinate with the laboratory to be used since most labs cannot analyze all types of media (e.g., wipes, swabs, and HEPA vacuum samples); Coordinate with the sample disposal facility for acceptance criteria (i.e., sample decon requirements); Coordinate with investigative units (EPA-CID & FBI) to ensure sample chain-of-custody is maintained between the groups. **Note:** Detection/analytical equipment & sampling techniques will be highly site-specific & depend on: **1)** the characteristics of the agent; **2)** the type of contaminated surfaces (e.g., porous v. nonporous); **3)** the phases/purposes of sampling (initial ID v. post-decon sampling); **4)** the way in which samples are handled so as not to adversely affect viability; **5)** transportation regulations **6)** the acceptance criteria of the analytical laboratory **& 7)** the sample decon requirements for the waste disposal facilities to be used. See LABORATORY ANALYSIS, below.

CAUTION: ONLY MANUFACTURER CERTIFIED HEPA VACUUM EQUIPMENT SHOULD BE USED.
A site-specific sampling plan should be reviewed & approved by appropriate Subject Matter Experts &/or through ICS channels.
Sampling Location Plans: If *C. burnetii* was engineered and the release was limited to a small area due to opening a letter or container, start with an area thought to

	be free of contamination & work in concentric circles towards the initial point of contamination. Be concerned about other contaminated areas due to foot traffic/ventilation systems (elevator buttons, mail, corners of hallways, baseboards, light switches, door knobs, etc). Based on site characteristics & laboratory capacity, the sampling plan may be judgmental, probabilistic, or a combination thereof.
	Consult EPA/HQ-EOC at 202-564-3850 for Environmental Response Laboratory Network (a.k.a. ERLN laboratory) contact information for personnel who can explain/describe the sampling procedure most compatible with their current analytical procedure. **Types of Samples:** Air, water, soil, surfaces, dairy production/livestock **Note:** While *C. burnetii* DNA can be detected long after the bacteria themselves have perished & might be of forensic interest, the presence of the DNA says little about the potential human risk in the days following a release. **Air:** Dry sampling (useful only for molecular analyses) includes gelatin, cellulose acetate & Teflon methods. Refer to the manufacturer's aseptic sampling methods, flow rates, & sampling times. Ensure that the appropriate pump is used for the selected sampling method. Traditional wet sampling methods (e.g., impingers & impactors) might not work well because *C. burnetti* is an obligate intracellular microorganism which requires embryonated chicken eggs or cell lines for growth. **Water**: Since *C. burnetii* can persist in water, any potable water sources should be sampled. If the potable water is chlorinated, the chlorine needs to be neutralized immediately with a sodium thiosulfate or other neutralizer at the concentration specified by the analytical laboratory prior to shipment. As chlorine levels can vary substantially throughout a drinking water system, it is not always appropriate to assume that a sample is chlorinated based solely on a description of the water treatment processes in use. **Soil:** A surface soil sample from a depth of less than 1 inch (2.54 cm) should be obtained from a non-vegetated area. **Surfaces: 1)** Wipe & Swab Sampling (for non-porous surfaces): Sterile macrofoam swabs moistened with 1X phosphate-buffered saline supplemented with 0.01% Tween-20 (PBST). If this solution is not available, use sterile de-ionized water (DI). Do NOT use dry wipes or swabs. **2)** HEPA Vacuum Sampling (for both porous & non-porous surfaces): collect samples in a HEPA sock designed to fit into an inlet nozzle of a manufacturer certified HEPA vacuum cleaner. Good for screening & determining the extent & location of contamination in large areas. **Agriculture & Wildlife:** Upon confirmation of an outbreak, ensure these agencies are notified immediately since Q fever is a zoonotic vector borne disease; USDA at 202-720-5711 & National Center for Emerging and Zoonotic Infectious Diseases at 800-232-4636 (after hours call the Directors Emergency Operations Center at 770-488-7100).
	Samples that test for Re-aerosolization: Obtain wipe samples of the air duct system (filters, areas of particulate deposition) if exposure occurred indoors.
	Sample Packaging & Shipping: The packaging & shipping of samples are subject to strict regulations established by DOT, CDC, USPS, OSHA, & IATA. Contact the sample-receiving laboratory to determine if they have additional packaging, shipping or labeling requirements (e.g., DO NOT X-RAY). Samples should be packaged in an air-tight container & kept at temperatures of 40-50°F (4-10°C). Ensure samples are not placed directly on the ice used for cooling the shipping container.
Laboratory Analysis	**CAUTION: Many labs may not be able to perform analysis on all matrices (e.g., wipes & soil).** The goal of laboratory analysis for environmental sampling purposes is to determine if viable *C. burnetii* is present in the sample. **Note**: The selected laboratory may use a tiered approach. If a tiered approach is used, the initial analysis may only determine if select/particular components of the bacterium are present in the sample (e.g., presence or absence). It may take additional time (up to weeks depending on the laboratory) to determine if the bacterium are viable & still able to cause adverse effects.
	Laboratory Information: Contact EPA/HQ-EOC (202-564-3850) for ERLN contract laboratories able to analyze these types of samples.
Decontamination/Cleanup	**CAUTION: ONLY MANUFACTURER CERTIFIED HEPA VACUUM EQUIPMENT SHOULD BE USED.** **Decon Planning:** Site-specific decon/cleanup plan should be developed & approved by all necessary organizations/SMEs via ICS channels. Responders should develop a plan that takes into account: **1)** Nature of contamination including purity, physical properties, how it entered the facility, etc.; **2)** Extent of contamination, including the amount & possible pathways that have spread the agent. It is advisable to isolate the contaminated area; & **3)** Objectives of decon, including decon of critical items for re-use & the treatment, removal, or packaging of other items for disposal. **Note:** Crisis exemptions from EPA's Office of Pesticide Programs might be necessary depending on decontaminating agents used. **CAUTION: DECON SOLUTIONS SHOULD NOT BE DEPLOYED AS A SPRAY WHENEVER POSSIBLE**. **Decon Methods:** Decon decisions will be site & situation specific but due to re-aerosolization concerns, ***under NO circumstances should a non-HEPA vacuum cleaner or a broom be used.*** EPA's National Decon Team (800-329-1841) can provide specific decontamination parameters & requirements for using readily available commercial items such as household bleach. **Methods used on surfaces: 1)** Source reduction steps, including HEPA vacuuming; **2)** Liquid disinfectants such as 70% ethanol, 5% chloroform, and 5% Enviro-Chem are able to inactivate *C. burnetii* after a 30 minute exposure. (**Note**: Traditional liquid disinfectants such as 0.5 % hypochlorite, 2% Roccal, 5% Lysol, and 5% formalin are unable to inactivate 10E8 *C. burnetii* after a 24 hour exposure at 25°C.) **Fumigation:** Uses gas or vapor to decontaminate facilities in which there is evidence of high levels of contamination, re-aerosolization, or if decontamination of limited access areas is required (e.g. HVAC systems). **Fumigants:** Unfortunately, chlorine dioxide & vaporized hydrogen peroxide efficacy presently is untested. **Other Decon: 1)** Chemical sterilization with ethylene oxide and formaldehyde gas can be used to decontaminate items in an off-site sterilization chamber. **2)** Irradiation with cobalt-60 & electron beam technologies can be used to destroy *C. burnetii* at off-site locations. This procedure may destroy magnetic media. Chemical sterilization and irradiation may be useful in decontaminating items that are intended to be returned to owners. **Verification of Decon:** Site and situation specific. Please contact ERT (732-321-6660) and NDT (800-329-1841) for further assistance.
Waste Disposal	**CAUTION:** Hazardous waste transportation & disposal are regulated federally; however more stringent regulations may exist under state authority. These regulations differ from state-to-state. Detailed state regulations can be found at www.envcap.org.
	Waste Disposal Planning: Waste generated from assessment & cleanup activities should be autoclaved, chemically disinfected, or fumigated & then tested to be sure the agent(s) were inactivated. Waste disposal for agent-contaminated wastes generated from the decontamination & disposal activities will be problematic. Landfills willing to take these wastes may be limited & incineration may be prohibitively expensive or impractical. All waste disposal options should be investigated as early into the response process as possible. Transportation of the agent contaminated wastes from the site to the landfill or incinerator may be problematic as well. First, agreements must be reached between the waste sender & acceptor BEFORE transport, followed by timely public notification of the transport & disposal phases. Transportation of hazardous waste may cross several states and localities, which may exceed federal regulations. Requirements for transporting hazardous materials, & procedure for exemption, are specified in http://www.fmcsa.dot.gov/safety-security/hazmat/complyhmregs.htm#hmp. The U.S. EPA has developed a web-based Incident Waste Management Planning & Response Tool which contains guidance related to waste transportation, contact information for potential treatment, disposal facilities, & state regulatory offices, packaging guidance to minimize risk to workers, & guidance to minimize the potential for contaminating the treatment or disposal facility. Access to the EPA's web based disposal tool requires pre-registration (http://www2.ergweb.com/bdrtool/login.asp).