

## 9 Additional Research Needs

This section describes additional research needs that will help transportation agencies to prevent or minimize the effects of a biohazard incident. The additional research needs that FHWA should sponsor or promote were identified by transportation and emergency response experts, including individuals with experience in preparing emergency response plans for transportation agencies and conducting emergency response exercises. Some of these could be funded through U.S. DOT, while others could be funded through the Department of Homeland Security, the Transportation Research Board, or other parties. These research areas represent opportunities to meet identified and emerging needs for emergency preparedness and response for biohazard events. The recommended research areas are listed by urgency of the need for research and the relative amount of funding likely to be needed to conduct the research, with the highest urgency and lowest cost research listed first.

**Promising ITS Systems:** Some ITS systems currently under development or in the early stages of deployment may be crucial in a biohazard emergency. Additional research into these technologies is warranted to identify their optimal implementation and use. This research should focus on the best use of existing systems and the capabilities and deployment of new systems.

- **Vehicle-based data acquisition:** This type of technology can enhance information collection. Mobile data terminals and vehicle probe technology such as Automatic Vehicle Location, AVI, and GPS can have critical applications during the response to a biohazard incident. By being able to track each individual emergency response vehicle on the scene, emergency response and transportation officials can better manage resources during an incident. In addition, this vehicle probe technology can also be used to monitor the flow of traffic around the incident and on alternate routes. Vehicle probes can serve in both an incident management and traffic management role during a biohazard incident. In addition, some systems can allow vehicles to communicate with each other in addition to relaying information to a central location. Systems that allow responders to communicate with and control ITS equipment from their vehicles allow emergency responders more direct and rapid access to data from ITS systems. This allows for greater local control of those systems, which may be critical to controlling the spread of a biohazard.
- **Real-time detectors:** The rapid detection of a biohazard release is critical to containing its spread and mitigating its effects. However, transportation systems generally lack the capability to detect biohazards in real time. Additional research is needed into the cost, availability, and application of real-time biohazard detectors, and how to best integrate them into existing ITS infrastructure. For example, additional research could help to identify the optimal placement of detectors within a particular system, the most effective means to acquire and process data from detectors, and the optimal integration of detectors with existing ITS systems.
- **Remote data collection:** Response to a biohazard event may require that the personnel and equipment introduced into the affected area be minimized to prevent their contamination and the spread of the biohazard. Remote data collection could reduce the potential exposure for both first responders and the public. Additional research is needed to identify the existing and emerging ITS systems that are best suited for remote data collection in biohazard emergencies, and the optimal deployment of these technologies.
- **Digital technologies for geospatial, spatial, and temporal imaging:** Imaging technologies can help to delineate the affected area and potentially locate sources of

biohazard releases, particularly when used with computer models. Additional research should be conducted on the practical and effective use of these technologies in the planning, prevention, and response phases. In addition, research should be conducted into how these technologies could enhance the performance of ITS technologies and decision-support tools.

**Development and Testing of Interoperability:** Because a biohazard release could affect multiple geographic regions, ITS system interoperability is critical for effective biohazard emergency response. Research should be conducted to identify functional requirements for system compatibility. Standards are critical to creating a nationwide ITS architecture that is flexible enough to satisfy individual state and local transportation agencies' needs and stringent enough create a interoperable system. Such research should include: developing a nationwide inventory of ITS capabilities; working with the manufacturers of ITS technologies, trade associations, transportation agencies, and other stakeholders to develop standards; conducting outreach to educate infrastructure investment decision-makers about these standards; and supporting field tests of system interoperability.

**Effects of Decontamination:** Many biohazard events will require decontamination of transportation infrastructure. Infrastructure components critical to biohazard response, such as emergency vehicles and ITS, may also require decontamination during a biohazard emergency. Decontamination may result in damage to this infrastructure. Additional research is needed to determine the potential impacts of decontamination on transportation infrastructure, including ITS systems. This research should be disseminated so that the effects of decontamination activities can be accounted for in the design and construction of transportation infrastructure and in emergency planning and response.

**Agricultural and Food-Borne Biohazards:** Research should be done to more fully investigate the potential use of ITS technologies in biohazard incidents involving agricultural and food-borne biohazards. For example, Commercial Vehicle Information Systems and Networks (CVISN) could be useful in tracking the movement of contaminated livestock or food and enforcing a stop animal movement order.