Case Studies in Biosafety and Biosecurity: Observation, Investigation, and Mitigation

Larry Sater, Responsible Official
Peter Davis, Biosafety Officer
Colorado Department of Public Health and Environment
BIOSAFETY CASE STUDY:  
OOPS! HOW WAS I EXPOSED TO A SELECT AGENT?
Exposures to select agents

- Nearly ½ of Sentinel laboratories that referred isolates for rule-out or confirmation of select agents to the Colorado (CDPHE) State Laboratory in 2015 were discovered to have exposures to their staff from the select agents during rule-out/refer testing.
- The select agents included *Francisella tularensis* and *Yersinia pestis*.
- Exposed laboratorians were placed on fever watch, some on prophylactic antibiotics.
- Common factors were a lack of knowledge of what constitutes an exposure and proper biosafety practices.
Examples of exposure cases

- Streaking culture plates outside of containment
- Fixing slides for Gram stain on an open bench
- Physician suspected a select agent but failed to notify the laboratory when the specimens were submitted for testing
- Colonies did not appear like they did in published references
- A biochemical test result was not consistent with the algorithm for the select agent
- Sniffing culture plates as part of the examination
Lessons learned

- Use Universal Precautions
- Follow ASM and LRN protocols when testing
- Bacteria do not always go by the book in appearance or test results
- Keep an open mind, do not be biased by information that is sent with the specimens
- Samples are submitted for testing because people do not know what the organism is
- Biosafety & appropriate PPE are a laboratorian’s friends
- Sniffing culture plates is a bad thing!
BIOSAFETY CASE STUDY:
THIS NEVER HAPPENED BEFORE!
Multiple cases of pneumonic plague

- After a rancher’s dog was taken to a veterinary clinic, the dog’s health declined and it was euthanized and buried on the ranch.
- Within days, rancher developed fever and coughing, transferred to hospital A in a general care room.
- Rancher’s condition worsened, coughing up blood, spouse stayed at bedside.
- LRN laboratory confirmed *Yersinia pestis* in specimens, clinical diagnosis of pneumonic plague.
- Necropsy of dog revealed *Yersinia pestis* in the lungs.
- Spouse, veterinarian and veterinary assistant diagnosed with early stage pneumonic plague.
Exposures during the event

- Since index case (rancher) was not in isolation while coughing blood, nor wearing a mask, up to 120 exposures of hospital A staff, patients and visitors
- Specimens tested for veterinary clinic staff at hospital B resulted in exposures in the clinical laboratory
- Necropsy on dog was performed, students observing the necropsy were not wearing PPE, resulting in exposures
- Approximately 200 total exposures with fever watch and some antibiotic prophylaxis, with no additional human plague cases
- Tally: 4 human & 1 dog cases of pneumonic plague
Rare, unlikely event, but it happened

- Extremely rare case of canine to human transmission of pneumonic plague
- Strongly suspected rare case of human to human transmission of pneumonic plague in the modern era
- Rare to have several human cases of pneumonic plague in one event in the modern era
- Universal precautions would have significantly lowered exposure numbers
- Improved communications between health and veterinary care facilities would have reduced exposures
- Isolation of the index patient and prevention of aerosols during coughing would have reduced exposures
BIOSAFETY CASE STUDY:
RICIN SUICIDE INCIDENT AND RESPONSE
Toxin Suicide

Incident:

• Law enforcement made contact with a sickly individual that claimed to have injected himself with ricin after inspiration from an episode of Breaking Bad

• The individual was taken to the hospital on a mental health hold, subsequently transferred to a different hospital, placed in a medically induced coma and intubated. Shortly there after, he passed away

• The deceased individuals remains were cremated shortly after his death, in line with his religious views.

• Autopsy was not performed
Toxin Suicide: Observation

• Gaps in communication
• Conclusions made and disseminated, prevented access to resources
• Incident ownership was not immediately identified
Toxin Suicide: Investigation

• Events that occurred, did not trigger notifications
• Information was disseminated to the public which prevented the FBI from providing resources because it was concluded to be an isolated incident and a “suicide” before an investigation had taken place
• Information was conveyed that an assessment team was deployed to investigate the scene to contain or mitigate
Toxin Suicide: Mitigation

• Procedures and processes were developed for LE and EMS to report any substances that could potentially cause harm to first responders
• Identified roles/responsibilities of LPH for chemical/WMD agents
• Procedures for notifying first responders after an “incident” is declared by PH
• Process for improving coordination with PIO
BIOSECURITY CASE STUDY: UNSECURE STORAGE OF BIOLOGICAL AND CHEMICAL TOXINS
Toxin Storage: Observation

While conducting the annual Chemical Inventory for our facility, a clear storage container (that was being stored on the counter) was observed to contain chemicals not listed on the current Chemical Inventory.

Upon inspection, it was found to contain several deadly toxins. Some well-known, some only known by their hazard warnings.
Toxin Storage: Observation

Here’s a handful of the lethal compounds that were being stored improperly:

- Abrine
- Aconitine
- Brucine
- Colchicine
- Digitoxin
- Digoxin
- Emetine dihydrochloride
- Eserine
- Paraoxon
- Phorate
- Potassium cyanide
- Strychnine
Toxin Storage: Investigation

The individual that was using the toxins for analysis was personally aware of the hazards associated with each of the compounds

But....

The individual had never considered that the compounds could be used maliciously and although some of the compounds were not known to the general public as deadly; the hazard warnings, readily available SDS’, and the internet could make that information obtainable
Toxin Storage: Mitigation

The storage container was relocated to a secured, and video-monitored room that was already being utilized to store highly toxic substances.

An SRA-approved individual was made responsible for the toxins security within that room.

A chain-of-custody log was created to track the individuals use of the toxins, how much of the toxins were used during their work, when the toxins were returned, and what quantity was returned.
Train, test, observe and follow-up:

4 Essential practices to improve safety and security in the laboratory