The term "Safety Officer" carries with it the onus of a police state. I've never found that my dictating how something should be done has been acceptable to research personnel. Having said this, it is incumbent on the safety professionals to carefully evaluate their suggestions so that they are not requiring compliance in a way that is detrimental to the continuing operations of the organization. It is possible to work safely and efficiently at the same time. It is our responsibility as safety professionals to point out the requirements and then to work with the research personnel to develop safe, efficient methods to comply with those requirements. We are not in the lab doing the work and our job is to encourage laboratory personnel to understand the requirements and provide suggestions for procedures that meet those requirements. We can then evaluate their suggestions and provide them with guidance as to the safest procedures that should be implemented. Failure to develop a safe alternative method; however, should be reported to the top management of the organization so that appropriate action can be taken to protect personnel, the environment, and the organization.

It is my opinion that safe operation of any research facility begins with a top management that does the following: understands and accepts its responsibility for ensuring that personnel follow appropriate safety rules, is concerned and committed to safety operations, and requires close interaction between safety professionals and the research personnel. It is only with such an interactive program that we can ensure a safe working environment for our personnel and prevent unnecessary adverse publicity for the organization.

Biosafety Tips

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Biosafety Tips brings you practical approaches to biosafety or "news you can use." If you are looking for a useful and sensible solution to a biocontainment problem, or perhaps a reference to help convince a skeptical researcher of the need for caution, this is the place to look. In this column, I share biosafety insights for managing a variety of workplace situations. I welcome feedback and suggestions for future topics. Please e-mail any comments or suggestions to karen_byers@dfci.harvard.edu or to Co-Editor Barbara Johnson at barbara_johnson@verizon.net.

Analysis of a Brucella Outbreak in a Veterinary Vaccine Manufacturing Plant

In a previous Biosafety Tips column (Volume 12, Number 3), the investigation of a Brucella outbreak in a clinical laboratory caused by streaking a slant on the open bench was described (Staszkiewicz, 1991). Another interesting and instructive outbreak of Brucella in a veterinary vaccine manufacturing plant was reported in the *American Journal of Public Health* (Olle-Goig, 1987). One hundred and sixty four staff members worked at the plant and were enrolled in a medical surveillance plan that included annual physicals conducted by the plant physician. The main building had a bacteriological laboratory and offices on the first floor, administrative offices on the second floor, an avian virology laboratory on the third floor, and the plant pharmacy, kitchen, and dining room were housed on the fourth floor. Separate, additional buildings were used for foot and mouth disease vaccine preparation, research, bottling, printing, and shipping. Four fresh-water wells supplied drinking and manufacturing water.

Outbreak Timeline

In August 1982, a few staff members returning from their annual four-week vacation were ill. The occupational health physician diagnosed Brucellosis. Additional cases were reported through the end of September; there were 22 clinically ill employees. A serological survey indicated another six staff had been exposed to Brucella; the total attack rate for staff was 17.1% (28/164). The mean incubation period before symptoms was 10 weeks with a range of five to 14 weeks.

Use of Attenuated Brucella

Vaccines against Brucella were manufactured on request, and Brucella vaccine was made from a live attenuated strain of *Brucella melitensis*, Rev-1, the first week in June. The plant closed on July 16 for the annual four-week vacation. It would be logical to assume that employees were exposed while handling the live Brucella vaccine. However, only five staff members worked in the bacteriology laboratory handling Brucella under an exhaust canopy, and only one of them became infected. Access to the laboratory was limited to the five bacteriological laboratory staff.

Epidemiological Survey

The occupational health physician reported the first cases of Brucellosis to the Epidemiological Surveillance Section of the Health Department of the Generalitat de Catalunya. The public health authority inspected the facility, completed serological monitoring, and conducted a survey to determine eating habits, source of drinking water, routine or accidental contact with Brucella in the workplace, number of years worked in the laboratory, geographical location of the workplace in the plant complex, and any acute illness in the three months prior to the outbreak. A careful analysis of the survey forms revealed that the following factors were NOT associated with infection:

- Number of years in the laboratory
- Type of work—manipulating Brucella, or bottling or labeling vaccine
- Wells #2, #3, #4
- Being a veterinarian
- Eating homemade cheese or drinking fresh milk
- Belonging to a family of farmers.

Factors that were associated with infection included: eating in the dining room, and, with a weaker association, drinking water from well #1.

Investigation of Outbreak Source

Did the outbreak originate in the kitchen or the dining room? Samples of milk, cheese, and ice cream were tested, but the cultures were negative for Brucella. However, as a precaution, the kitchens were closed and disinfected. Were the wells the source? Brucella was not cultured from the water in any of the wells. However, as a precaution, staff members were prohibited from drinking well water until a purification system was installed. Extensive work on the masonry surrounding the plumbing of the main building had been done during the vacation shutdown. Perhaps Brucella had contaminated some surfaces in the laboratory and been carried into the plumbing? To test this theory, a non-toxic dye was poured down the drain in the bacteriological laboratory. However, the dye did not appear in the well.

The original survey forms were reanalyzed to determine the geographical location where the infected staff members worked. This important clue had been overlooked in the previous analysis.

Geographical Location of Workstation and Attack Rates

- Group A—high exposure—worked in an area on the first two floors of the main building and had open windows on the façade. The attack rate for Group A was 39.5% (15/38).
- Group B—medium exposure—employees worked on the other floors of the main building, or in an area without windows opening on the façade The attack rate for Group B was 27.3% (6/22).
- Group C—no exposure—worked in buildings other than the main building. The attack rate for Group C was 6.7% (7/104). It was hypothesized that since Group C occasionally went to the main building to eat lunch in the dining room they may have been exposed there at some point.

Assessing the Potential for Airborne Transmission of Brucella

Live *Brucella melitensis* cultures were handled under a negative pressure, bell-shaped, containment device. The exhaust from the bell and the laboratory was located on the main façade of the building. Windows directly above the exhaust could have provided the opportunity for aerosol infection of staff. To test this theory, air sampling was conducted by exposing sterile bacteriological media to air from the exhaust duct. An incineration device had been installed in the exhaust duct after the outbreak began. Brucella was again manipulated in the bacteriology laboratory under the exhaust bell, and air from the exhaust duct was sampled before and after the air was drawn through the incineration device. Plates exposed to exhaust air before it passed through the incinerator grew Brucella; plates exposed to the exhaust air downstream from the incineration device did not.

Conclusion

Fortunately, all 22 staff members recuperated successfully and returned to work producing veterinary vaccines. Appropriate containment for the manufacture of Brucella vaccine was provided by the in-line incineration device in the exhaust duct, which heated the exhaust air to 300°C before discharge. I assume that the windows remained closed, just as an extra precaution!

References

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