HETA 98–0339–2806
United States Department of Agriculture
Animal and Plant Health Inspection Service
Riverdale, Maryland

Teresa A. Seitz, MPH, CIH
Helga Daftarian, DO, MPH

PREFACE

The Hazard Evaluations and Technical Assistance Branch (HETAB) of the National Institute for Occupational Safety and Health (NIOSH) conducts field investigations of possible health hazards in the workplace. These investigations are conducted under the authority of Section 20(a)(6) of the Occupational Safety and Health (OSHA) Act of 1970, 29 U.S.C. 669(a)(6) which authorizes the Secretary of Health and Human Services, following a written request from any employer or authorized representative of employees, to determine whether any substance normally found in the place of employment has potentially toxic effects in such concentrations as used or found.

HETAB also provides, upon request, technical and consultative assistance to Federal, State, and local agencies; labor; industry; and other groups or individuals to control occupational health hazards and to prevent related trauma and disease. Mention of company names or products does not constitute endorsement by NIOSH.

ACKNOWLEDGMENTS AND AVAILABILITY OF REPORT

This report was prepared by Teresa Seitz and Helga Daftarian of HETAB, Division of Surveillance, Hazard Evaluations and Field Studies. Desktop publishing was performed by Ellen Blythe. Review and preparation for printing were performed by Penny Arthur.

Copies of this report have been sent to employee and management representatives at USDA/APHIS and the OSHA Regional Office. This report is not copyrighted and may be freely reproduced. Single copies of this report will be available for a period of three years from the date of this report. To expedite your request, include a self–addressed mailing label along with your written request to:

NIOSH Publications Office
4676 Columbia Parkway
Cincinnati, Ohio 45226
800–356–4674

After this time, copies may be purchased from the National Technical Information Service (NTIS) at 5825 Port Royal Road, Springfield, Virginia 22161. Information regarding the NTIS stock number may be obtained from the NIOSH Publications Office at the Cincinnati address.

For the purpose of informing affected employees, copies of this report shall be posted by the employer in a prominent place accessible to the employees for a period of 30 calendar days.

Highlights of the NIOSH Health Hazard Evaluation

Zoonotic Disease Hazards During Animal Welfare Inspections

In response to a request from the United States Department of Agriculture, Animal and Plant Health Inspection Service (USDA/APHIS), NIOSH evaluated potential zoonotic disease hazards to Veterinary Medical Officers (VMOs) and Animal Care Inspectors (ACIs) during animal welfare inspections.

What NIOSH Did

We observed animal welfare inspections at 16 facilities.

We talked to employees and CDSHOs about health and safety concerns.

We reviewed health and safety documents and medical monitoring records.

What NIOSH Found

Safety and sanitary conditions were highly variable at these facilities.

Unrestrained animals and other hidden hazards were often present.

Protective equipment use by inspectors was limited.

Medical monitoring policies were not well established.

Medical monitoring data were incomplete.

What USDA/APHIS Managers Can Do

Complete the draft safety and health document and put it into effect.

Conduct periodic hazard assessments.

Develop formal protective equipment and respiratory protection programs.

Provide a protective equipment and exposure kit to inspectors.

Improve the medical monitoring program.

Offer periodic training programs for inspectors.

What the VMOs and ACIs Can Do

Minimize direct contact with animals.

Avoid areas where infectious materials may become airborne (cleaning, cage washing, etc.).

Use protective equipment and respirators when needed, and wash hands often.

Learn procedures for cleaning wounds/splashes and reporting exposures.

Tell supervisors about health and safety concerns.

Attend training programs offered by USDA/APHIS.

CDC
CENTERS FOR DISEASE CONTROL AND PREVENTION

What To Do For More Information:
We encourage you to read the full report. If you would like a copy, either ask your health and safety representative to make you a copy or call 1-513/841-4252 and ask for HETA Report # 98-0339-2806

National Institute for Occupational Safety and Health
NIOSH

Health Hazard Evaluation Report 98–0339–2806
United States Department of Agriculture
Animal and Plant Health Inspection Service
Riverdale, Maryland
September 2000

Teresa A. Seitz, MPH, CIH
Helga Daftarian, DO, MPH

SUMMARY

In response to a September 1998 request from the United States Department of Agriculture, Animal and Plant Health Inspection Service (USDA/APHIS), a health hazard evaluation was conducted to assess potential zoonotic disease hazards encountered during animal welfare inspections. During the period January 25 to March 24, 1999, site visits were made to 16 facilities in the Eastern and Western regions to observe animal welfare inspections at businesses licensed by or registered with USDA. The businesses visited included research facilities, animal dealers, exhibitors, and breeders. National Institute for Occupational Safety and Health (NIOSH) investigators observed work practices, personal protective equipment use, and the extent and duration of contact with the animals during the inspections. Interviews were conducted with inspectors and other APHIS personnel, and various health and safety documents were reviewed.

The inspections revealed a wide variation in environmental conditions and potential zoonotic disease hazards at these facilities. There was potential for exposure to infectious materials via mucous membrane contact, airborne exposure, direct contact (bites, scratches) and indirect contact. Contact with nonhuman primates was of greatest concern to the inspectors because of the similarities in pathogen susceptibility and the potential for acquiring medically important infections such as tuberculosis (TB) and B Virus. Efforts were generally made by the inspectors to maintain a safe distance from the animals when possible; in some cases inspections were conducted outdoors or from behind a clear barrier. However, at several facilities the inspectors encountered hidden hazards (such as unrestrained animals), poor environmental conditions (such as inadequate lighting or insufficient caging materials), or the presence of undisclosed animals.

While baseline serum samples are collected from some USDA employees at the time of employment for evidence of prior brucellosis or psittacosis infection, the extent of participation by animal welfare inspectors was not known. Routine tuberculin skin testing for TB (either annually or semiannually) is required for all animal welfare inspectors, but sufficient information could not be obtained to determine TB infection or conversion rates, or to evaluate whether the tests had been conducted and interpreted according to current Centers for Disease Control and Prevention (CDC) guidelines. Illness and injury logs revealed nonspecific information on infectious diseases reported among APHIS personnel.

APHIS employees may be exposed to zoonotic agents during animal welfare inspections. Improved prevention efforts to eliminate or minimize such exposures are needed. Because engineering controls are not often available at the inspected facilities, inspectors must rely primarily on administrative and work practice controls and, secondarily, on the use of personal protective equipment to minimize exposures. Available medical surveillance data were too limited to fully evaluate the risk of infection and effectiveness of current prevention efforts. Recommendations are made in the report to strengthen the zoonotic disease prevention program for animal welfare inspectors.

Keywords: SIC 9651 (Regulation, Licensing, and Inspection of Miscellaneous Commercial Sectors), tuberculosis, TB, B Virus, nonhuman primate, animal, zoonoses, infection, inspection, animal welfare.

TABLE OF CONTENTS

INTRODUCTION

In September 1998, the National Institute for Occupational Safety and Health (NIOSH) received a request for technical assistance from a representative of the Safety, Health, and Environmental staff of the United States Department of Agriculture, Animal and Plant Health Inspection Service (USDA/APHIS). NIOSH was asked to provide assistance in identifying and assessing potential health hazards encountered during animal welfare inspections. USDA/APHIS also requested guidance on protective equipment use, immunization and medical surveillance, and standard operating procedures for reducing the risk of zoonotic disease transmission during animal welfare inspections. An interim report with recommendations was distributed to employee and management representatives in December 1999, and a summary of the findings and recommendations of the NIOSH evaluation was presented to Animal Care personnel in April 2000.

BACKGROUND

APHIS administers the Animal Welfare Act (AWA), which protects warm–blooded animals from inhumane treatment and neglect. Farm animals used for food, fiber, or other agricultural purposes are specifically excluded. Facilities covered under the AWA must be licensed by or registered with USDA and are subject to periodic, unannounced inspections to determine if adequate care and treatment are provided in the areas of housing, handling, sanitation, nutrition, water, veterinary care, and protection from extreme weather. AWA–covered businesses include animal dealers, exhibitors, transporters, and research facilities.

At the time of the NIOSH evaluation 64 Animal Care (AC) personnel conducted the AWA inspections. Approximately two–thirds of the inspectors were Veterinary Medical Officers (VMOs), with the remainder being Animal Care Inspectors (ACIs). These individuals are located throughout the country and work out of their homes using government vehicles to travel to and from the inspection sites. Inspections may last from several hours to one or more days, depending on the size and complexity of the business. At the conclusion of the site inspection, a report is prepared detailing any violations of the AWA, with instructions for correcting the problems within a given time frame. Legal action may be taken if deficiencies remain uncorrected at future inspections. In addition to the VMOs and ACIs, APHIS animal care supervisors and investigations personnel may participate in the on–site inspections.

METHODS

On January 25–29, 1999, NIOSH personnel visited eight facilities in Texas, and on March 22-24, 1999, eight facilities in Massachusetts, New York, and Connecticut. Some of the site visits were announced and some were unannounced. NIOSH personnel were accompanied by the collateral duty safety and health officers (CDSHOs) for that region. The businesses visited included dog kennels, traveling and roadside petting farms and zoos, exotic and wild animal breeding facilities, an exotic pet shop, other animal training and exhibiting facilities, an exotic feline sanctuary, a livestock/exotic pet auction facility, and research facilities. The research facilities included a university–based facility and a pharmaceutical/biomedical contract facility. Many of the sites were selected because they housed nonhuman primates (e.g., chimpanzees, baboons, and New World and Old World monkeys [including macaques]) which were of particular concern to the employees. Observations were made of work practices and personal protective equipment (PPE) use by AC personnel. NIOSH investigators were particularly interested in observing the extent and duration of contact with the animals and their enclosures, and

the various environmental conditions that the inspectors encounter.

Information on medical surveillance was provided by the requestor and other USDA personnel. NIOSH investigators interviewed USDA Eastern and Western Region CDSHOs and animal welfare inspectors who were present during the site visits. USDA representatives provided various documents for NIOSH review. These included the following: *Occupational Safety and Health and Animal Exposure Surveillance Program (OSH/AESP)* draft document, *Safety and Health Survey* form (draft), *Herpes B Prevention Guidelines* (interim policy), and the *APHIS Types of Injury Log* listing workers' compensation case descriptions for 4th Quarter Fiscal Years 1996, 1997, and 1998. Copies of the Federal Occupational Safety and Health Administration (OSHA) Log and Summary of Occupational Injuries and Illnesses (OSHA 100 Log) were not available for review.

EVALUATION CRITERIA

Information on several zoonotic infections that were discussed during the course of this evaluation can be found in the Appendix. A comprehensive listing of other important zoonoses and their health outcomes by route of exposure can be found in two recent review articles.[1,2]

RESULTS

Site Inspection Observations

It was evident from the site inspections that the environments encountered by the inspectors varied widely. Some of the businesses were family–owned and housed animals in and around owners' homes, while others were larger operations in which animals were housed in remote farm locations, in pet shops, or within academic or research settings. It was also apparent that safety and sanitary conditions were quite varied, as was the owners' and operators' knowledge of potential animal–related hazards.

There were also variations in individual work practices of the inspectors and in their use of PPE. While all inspectors utilized certain practices to minimize direct contact with the animals and enclosures, some appeared to be more consistent in doing so. All of the interviewed inspectors described situations where they had declined to conduct certain portions of the inspection due to health and safety considerations. Some inspectors were more consistent in requiring that the animals be restrained before they entered the individual's home or work area to conduct the inspection. Unrestrained animals included various farm animals, household pets, monkeys, and bear and tiger cubs. To avoid contact with animal cages, one inspector asked the facility staff to turn the cages so that the animals could be viewed from a distance. Whenever possible, inspectors would try to observe the animals and enclosures from a safe distance, and in many situations, this was done outdoors or from behind windows or other see–through panels. APHIS employees indicated that they would not inspect animals under quarantine, such as in a research setting where primates were known or suspected to have tuberculosis (TB).

Some of the variation in PPE use was dependent on the hazards encountered in the particular environment (research vs. non–research setting, presence of nonhuman primates), while some appeared to be due to differences in perception of risk, availability of the PPE, and feeling awkward wearing PPE while facility employees and/or visitors were not similarly protected. PPE was more commonly used in research facilities, and in some cases was required and supplied by the facility being inspected (mask with fluid shield, disposable coveralls, hat and shoe coverings, and eye protection). Some employees had received respirator use training and were fit–tested with disposable N95 respirators, but these respirators

were not used by APHIS employees during any of our site visits and we were informed that they were not often worn. At a chimpanzee breeding facility, face shields were worn by the inspectors to protect against fluid splatter and splashes from the chimps, but this was a relatively new procedure. Disposable foot coverings were worn at one of the dog kennel inspections. No special protective clothing such as coveralls was worn at any of the site inspections. Some employees had purchased waterless hand cleaners and disinfectant sprays for their soiled boots or shoes.

Document Reviews and Interviews

The OSH/AESP document was drafted as a supplement to the *APHIS Safety and Health Manual for Animal Care Employees*. This document outlines the goals for the animal exposure surveillance program, which include the following: establishing immunization and routine monitoring guidelines for certain zoonotic diseases; explaining the purpose and use of PPE; establishing protocols for preventing occupational injuries and occupational exposure to pathogens or hazardous chemicals; and providing occupational safety and health education to AC personnel. Participants in the program would include all VMOs and ACIs who perform animal welfare inspections. Other USDA employees covered under these guidelines include Headquarters staff personnel who routinely visit animal facilities, as well as Regional Office staff and supervisors who may accompany inspectors in the field. Elements of the immunization program for AC personnel include pre– and post–exposure vaccination and/or screening guidelines for the following diseases: tetanus, TB, rabies, Q–fever, and B virus infection.

At the time of the evaluation, AC employees were required to undergo routine purified protein derivative (PPD)–tuberculin skin testing annually or semiannually. Pre–exposure vaccination was recommended, but not required, for tetanus and rabies. Guidelines for Q-fever and B Virus were limited to recommendations for exposure avoidance and immediate treatment measures to be taken in the event of exposure.

According to information provided by the requestor, baseline serum samples are normally obtained from USDA personnel who begin their employment with APHIS. These serum samples are sent to a contracted clinic network, that analyzes them for serologic evidence of prior brucellosis or psittacosis infection. According to the requestor, approximately 600 baseline screening tests for brucellosis are done each year APHIS–wide. However, the extent of participation by AC personnel is unknown, and there was no information provided on the extent of follow–up testing for these individuals. Results of serum screening are normally sent to the employee's private physician, who is supposed to provide the results to the individual employee. If a screening result is abnormal, the physician is supposed to send a notification letter with the results of the screening test to USDA. This information is placed in the employee's individual file which is maintained by each APHIS region.

A review of the *APHIS Types of Injury Logs* for 4th Quarter Fiscal Years (FY) 1996, 1997, and 1998 revealed nonspecific information regarding infectious diseases reported among APHIS personnel. Infectious disease–related illness categories noted in the logs included brucellosis, hepatitis, tuberculosis, Lyme disease, "virological/infective/parasitic diseases, not otherwise classified," and "traumatic virological/infective/parasitic diseases." Sufficient information was not provided to distinguish the number of new cases of each disease for each new fiscal year from existing cases being carried over from previous years. Similarly, the log provided no detail as to the job category for each individual case, whether the employee worked in Animal Care, Veterinary Services, or Plant Protection and Quarantine (PPQ), or the specific occupational exposure context in which the infection occurred.

Information was obtained from the requestor regarding the number of APHIS employees who had demonstrated a positive tuberculin skin test while working for the USDA. Based on the information from an informal survey conducted by the requestor, six PPD–positive individuals were identified over the last four years. Three of the employees did not work for AC and the requestor was unable to furnish additional information about the remaining three cases. During the course of the NIOSH evaluation a CDSHO conducted a phone survey to obtain current information on the tuberculin skin test status of animal welfare inspectors. However, this information has several limitations in assessing the risk of TB infection among inspectors, including lack of available baseline skin test data for comparison, and lack of sufficient information to determine if skin tests were conducted and interpreted according to current Centers for Disease Control and Prevention (CDC) guidelines. Recall bias and confidentiality issues are additional concerns.

Information provided by the USDA Medical Officer in August 1999 indicated that there is currently no comprehensive medical surveillance system for USDA/APHIS as a whole, and that the extent and quality of medical surveillance varies among USDA regions. The USDA Medical Officer indicated that brucellosis had been previously diagnosed in USDA veterinarians, as had one case of leptospirosis in an ACI. No further information regarding these cases was available.

The "Herpes B Prevention Guidelines" document provided by AC to the VMOs and ACIs was also reviewed. This document contains the interim policy designed to protect AC employees from exposure to B virus while performing inspections. The policy recommends maintaining a minimum distance of five feet from animals and enclosures to minimize animal bites, scratches, body fluid splashes, or accidental injury from contact with sharp enclosure edges. For inspections of macaque species involving a distance of five feet or less, a full face shield and goggles/safety glasses must be worn. Although guidelines for immediate post–injury wound care and splash–injury care are included in the guidelines, inspectors did not have access to pre–arranged emergency medical consultation at all times, and may not have had sufficient materials for adequate wound care in the field.

DISCUSSION

It is estimated that over 200 infectious diseases can be transmitted from animals to humans.[2] Given that approximately 350 species of animals are covered under the AWA, specific recommendations cannot be written to cover all potential zoonoses or all possible exposure situations that may be encountered during AWA inspections. Primary prevention efforts aimed at eliminating or controlling occupational exposures to zoonotic agents through use of engineering controls, administrative controls, and PPE are most important. Unfortunately, the typical engineering controls used to minimize exposure to biohazards (such as special caging, barriers, local exhaust ventilation, and good general ventilation) are often not present in the inspected facilities and this aspect of the work environment is not under the control of USDA/APHIS.

Given this absence of engineering controls, administrative controls or changes in work practices should be used to minimize employee exposures to zoonotic agents whenever possible. All of the inspectors we spoke with utilized such practices to some extent to either eliminate the exposure entirely (by refraining from conducting certain portions of the inspection because of a perceived hazardous situation) or minimize exposure by maintaining a safe distance from the animals and not directly contacting the animals or their enclosures. Although PPE is considered the least desirable means of protecting employees, we encountered some situations where PPE was needed. This occurred at the research facilities, at

an indoor chimpanzee breeding facility, and in an indoor enclosure for macaques.

Secondary prevention efforts include medical surveillance programs that complement the primary prevention efforts listed above. In addition to providing valuable information for detecting infection and disease at an early or subclinical stage, these programs can help monitor the effectiveness of primary prevention efforts. At one site, the AC inspector learned during the NIOSH visit about a group of nonhuman primates that had been placed under quarantine for suspected tuberculosis shortly after the site inspection the previous year. Despite the fact that this inspector may have had exposure to infectious animals, the inspector did not learn of this possible exposure for several months. This situation highlights the need for periodic surveillance for TB infection and appropriate follow–up evaluation of those who test positive to determine the effectiveness of existing prevention efforts.

NIOSH investigators were not able to obtain detailed, substantive medical surveillance data on AC employees during this evaluation; therefore, the medical conclusions and recommendations that are made in this report are general in nature. For example, despite the fact that AC employees were required to undergo annual or semi–annual tuberculin skin testing, written records documenting the test results were not available. The HHE requestor and CDSHOs provided some verbal information on skin test results, but it was not sufficient to determine either the incidence of TB infection among animal welfare inspectors or the risk factors of occupational TB transmission in this setting. One reason for the difficulty in obtaining this information is that some of the key individuals responsible for maintaining and analyzing the medical data were no longer working at APHIS, and their positions had not been filled at the time of this report. In addition, the Eastern Regional Office was in the process of moving during the course of the NIOSH evaluation. Despite these constraints, it was clear that medical surveillance data were not located in a central or easily retrievable location, and surveillance policies were not well established.

CONCLUSION

The draft OSH/AESP document prepared by the CDSHOs and safety committee members provides useful information on the prevention of several important zoonotic diseases. In addition to finalizing and implementing the policies within this document, a more comprehensive hazard assessment of other zoonotic disease hazards not covered in the draft document should be initiated. This assessment should include consideration of work procedures and associated biohazards, potential routes of exposure, and potential adverse health outcomes. Specific recommendations for minimizing or eliminating exposures and for medical surveillance of all potentially exposed employees can then be developed. Recommendations are offered below to strengthen the zoonotic disease prevention program for employees participating in animal welfare inspections.

RECOMMENDATIONS

Work Practices

2 1 .

Minimize direct contact with animals. Examples of work practices that can be employed include ensuring that, when feasible, animals are locked or otherwise restrained outdoors when indoor enclosures are inspected, not touching animals or their enclosures, viewing animals outdoors (or from a safe distance) whenever possible, and asking facility employees to turn cages for viewing animals (but only if these employees are adequately trained and protected). Also, facility personnel should be required to restrain loose animals, including household pets, before the inspection is conducted. Periodic training programs should emphasize these

practices, and AC employees should be encouraged to share their experiences about other work practices that have been found to be effective. If an inspection cannot be done safely, then inspectors should be allowed to stop an inspection or skip an area until it can be made safe. Employees should be encouraged to consult with supervisors should this situation arise.

2 2 .
To prevent hand–to–mouth contact or direct skin contact with potentially infectious materials, employees should be reminded to wash their hands after removing gloves, at the conclusion of the site inspection, and as needed during the course of the inspection.

2 3 .
To minimize inhalation of infectious aerosols, employees should not enter areas where aerosol generating activities (e.g., cleaning, necropsies, surgery, cage washing) are being conducted.

2 4 .
The responsible party at the inspected facility should be questioned about any changes that have occurred since the previous APHIS inspection, including any new animals housed on–site. This should be done on–site, prior to conducting the inspection.

Personal Protective Equipment

1. In accordance with the OSHA regulation on PPE, a written, comprehensive PPE program should be established that clearly identifies the PPE required for specific tasks.[3] The required PPE should be selected based on a thorough worksite hazard assessment that considers work procedures, hazards, routes of exposure, and potential adverse health outcomes.

2. Where respirators are used for protection against airborne hazards such as *Mycobacterium tuberculosis*, a respirator program that is consistent with the requirements of the OSHA Respiratory Protection Standard for general industry should be established.[4] This standard requires the development of a written program, employee training, annual fit testing, and medical clearance before respirators are assigned to employees. Employees with beards or other facial hair that prevents a tight face seal should not be allowed to wear tight–fitting respirators. Loose–fitting, powered air purifying respirators (PAPRs) are an option for these employees. AC employees should not rely on the use of respirators provided by the inspection facility, although they may use such a respirator if they have been properly fit–tested on the specific size and model respirator that is supplied.

3. A PPE "kit" should be created and provided to all AC personnel who conduct animal welfare inspections. This kit should contain at least the following items: a respirator (minimum of an N95), disposable gloves, a face shield that prevents droplet splashes to the head from running down into the eyes and prevents mucous membrane exposure around the edges, safety glasses or goggles, non–slip boots or other shoe coverings, spray disinfectant, sunscreen, insect repellent, disposable towels, water bottle, and a biological/infectious waste bag. In addition, a first aid kit that includes items needed for immediate cleansing of wounds or splashes to mucous membranes should be included. The kit should contain at least the following items: scrub brush, povidone–iodine solution, bandages, and eye care kit. A sufficient supply of replacement items should be available to all field personnel.

4. Although the draft OSH/AESP manual provided phone numbers for two medical personnel to contact in the event of a potential exposure to B virus, only daytime work phone numbers were listed. Because emergencies could occur outside of the typical 8:00 a.m. to 4:30 p.m. workday, especially for employees outside the Eastern Time Zone, emergency contacts must be available 24 hours a day on an on–call basis and

current phone numbers should be provided to all applicable personnel.

Medical Surveillance

1. A multidisciplinary team involving occupational medicine, industrial hygiene, CDSHOs, and other health and safety professionals should be involved in the design of the medical surveillance program. These individuals should be familiar with the occupational risks and exposure hazards (biological, physical, and chemical) affecting AC inspectors. Routine visits to the work site are needed to understand the work duties and potential exposures. These individuals should be familiar with the CDC recommendations regarding zoonotic diseases (Herpes B Virus infection, Lyme Disease, etc.)[5,6] and other applicable guidelines and recommendations. These guidelines should be incorporated into formal policy documents which are specific for each issue being addressed.

2. Copies of preplacement, periodic, and episodic physical examination records, as well as medical records documenting occupational illness and injury care, should be maintained in a centralized location by an occupational health and safety specialist who is familiar with maintenance of medical records and issues of medical record confidentiality.

3. Recommendations for immunizations should be based on the results of the hazard assessment. In general, like everyone, AC employees should be up to date on tetanus and diphtheria immunization.[7] Other immunizations should be considered for certain subgroups of employees if they have an identifiable risk, and a safe and effective vaccine is available. This may include AC employees who perform additional duties such as animal necropsies that may put them at risk for diseases acquired through bloodborne or airborne routes of exposure. Pre–exposure prophylaxis for rabies is recommended for persons at high risk of exposure as defined by occupation and level of endemicity in the animal population.[2] For those individuals working in outdoor environments which pose an increased risk for acquisition of vector–borne disease such as Lyme disease, guidelines outlining measures designed to minimize arthropod bites (including avoidance, minimizing skin exposure through the use of adequate protective clothing, and use of appropriate repellants) should be provided. Lyme disease vaccine should be considered for persons at high risk of exposure to ticks in areas where the disease is endemic.

4. A comprehensive TB surveillance program should be maintained, and results of periodic tuberculin skin testing should be maintained in a centralized computer database. Such a database will allow medical personnel to track PPD conversions and take appropriate action. NIOSH investigators support the recommendation in the draft OSH/AESP document that TB screening be provided annually for all AC employees, with more frequent testing (i.e., semiannually) as required for entry into specific research facilities. Employees who convert their skin test should be further evaluated by a health care professional to determine possible risk factors for conversion and the need for changes in prevention practices to minimize future exposures. Non–routine duties that may place inspectors at risk for TB infection such as participating in animal necropsies with Veterinary Services employees or conducting elephant inspections and training, as well as exposures outside the workplace, must also be considered.

5. Employee participation in the brucellosis and psittacosis screening program should be clarified and the need for such screening should be further evaluated to determine its value.

Training

1. AC inspectors should undergo routine occupational health and safety training that describes hazards and risks, stresses the

importance of timely reporting of all injuries and illnesses of suspected occupational origin, emphasizes the importance of receiving appropriate immunizations and screening tests, and provides a thorough review of proper PPE use and maintenance.

REFERENCES

1. Hart CA, Trees AJ, Duerden BI [1997]. Zoonoses. J Med Microbiol 46:4–33.

2. Weber DJ and Rutala WA [1999]. Zoonotic Infections. Occupational Medicine: State of the Art Reviews 14 (2), Apr–June, p. 247–284.

3. CFR [2000]. 29 CFR 1910.132. Personal Protective Equipment. Code of Federal Regulations. Washington, DC: U.S. Government Printing Office, Office of the Federal Register.

4. CFR [2000]. 29 CFR 1910.134. Respiratory Protection. Code of Federal Regulations. Washington, DC: U.S. Government Printing Office, Office of the Federal Register.

5. CDC [1998]. Fatal *cercopithecine herpesvirus 1* (B virus) infection following a mucocutaneous exposure and interim recommendations for worker protection. U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention. Morbidity and Mortality Weekly Report 47(49):1073–1076, 1083.

6. CDC [1999]. Recommendations for the use of Lyme disease vaccine: recommendations of the advisory committee on immunization practices (ACIP). U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention. Morbidity and Mortality Weekly Report 48(RR–07):1–17.

7. CDC [1991]. Diphtheria, tetanus and pertussis: recommendations for vaccine use and other preventive measures: recommendations of the immunization practices advisory committee (ACIP). U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control. Morbidity and Mortality Weekly Report 40(RR–10):1–28.

APPENDIX

Leptospirosis

Leptospirosis is a bacterial disease caused by organisms in the *Leptospira* genus. Many animals carry the bacterium, including rodents, dogs, cattle, pigs, horses, and other wild animals. Approximately 100 – 200 human cases are reported annually in the U.S., about 50% of which occur in Hawaii.[1] The organisms are excreted in the urine of infected animals and can survive in soil or water for weeks under favorable conditions. The bacterium can enter the body via cuts or other openings in the skin, or through contact with the conjunctiva and mucous membranes. Occupationally acquired infections are usually caused by accidental parenteral inoculation, direct or indirect contact with cultures or infected animals (especially urine), and animal bites.[2] Infection can also occur from inhalation of aerosols containing the organism, such as during cage cleaning.[3] Although rare, transmission may also occur through ingestion of food contaminated with the urine of infected rats.

The time between exposure to a contaminated source and illness ranges from two days to four weeks.[1] The infected individual typically presents with a sudden onset of fever, headache, chills, muscle aches, vomiting, diarrhea, and sometimes rash. The illness may present in two phases with the first phase having the symptoms described above. The second phase, if present, is more severe and may result in kidney or liver failure, or meningitis. This later phase is also called Weil's disease.[1] The severity and duration of symptoms are shortened with timely administration of antibiotics. A vaccine is not currently available for humans.

Q fever

Q fever is caused by the rickettsia, *Coxiella burnetti*. This organism infects mainly cattle, sheep, and goats, and is considered highly infectious (estimated human infectious dose by inhalation [$ID_{25–50}$] is 10 organisms).[4] It is also resistant to drying and environmental conditions.[5] The organism is usually transmitted to humans via aerosols; however, direct contact with animals and contaminated materials has also been associated with infections.[6] The rickettsia are shed in the urine, feces, milk, and birth products (placental tissues, amniotic fluids, etc.) of infected animals.[7] Most of the outbreaks reported in the United States have involved sheep.

Most patients with Q fever are asymptomatic. For individuals who do become symptomatic, Q fever can manifest as either an acute or chronic infection. Symptoms of acute Q fever include chills, high fever, headache, myalgia, fatigue, anorexia, chest pain, cough, and abdominal pain. Chronic Q fever may involve endocarditis or hepatitis.[8] Treatment for Q fever involves administration of antibiotics. Although an investigational Q fever vaccine is available, CDC and National Institutes of Health (NIH) guidelines recommend that use of this vaccine be limited to those at high risk of exposure (and with no demonstrated sensitivity to the Q fever antigen).[9]

Brucellosis

Brucellosis is a disease caused by bacteria of the genus *Brucella*. Brucella species known to cause human disease (and their usual reservoir hosts) are *B. abortus* (cattle), *B. melitensis* (goats and sheep), *B. suis* (swine), and *B. canis* (dogs). Brucellosis is a nationally notifiable disease in the U.S. (with the exception

of Texas). Infection can occur from inhalation of aerosols containing the organism, by direct conjunctival or skin contact (breaks in the skin), or ingestion.

In 1998, 79 cases were reported to CDC. A large percentage of reported brucellosis cases in the U.S. are associated with ingestion of unpasteurized dairy products containing *B. melitensis* from the Mediterranean countries and Mexico.[10] Brucellosis is predominantly an occupational disease of those working with infected animals or their tissues, especially dairy farm workers, veterinarians, and abattoir workers. Because the uterus of infected animals contains a high concentration of *Brucella* organisms, the risk for exposure to the organism is increased for individuals exposed during the birthing process and to birthing products.

The incubation period for brucellosis varies from five days to several months, with more than 30 days being typical. The signs and symptoms of brucellosis are nonspecific; thus there may be considerable underreporting of this disease. Onset may be acute or insidious, and usual symptoms include weakness, fever, chills, sweats, headaches, myalgia/arthralgia (muscle/joint pain), anorexia (decreased appetite), and weight loss. The course of illness is variable. Symptoms often last months without treatment and may be very debilitating. Even with appropriate treatment, a patient may be ill for a month or longer, with approximately 2–10 % having one or more relapses.[11] The relapse rate is higher if the prescribed course of antibiotic therapy is discontinued before six weeks. Cases of brucellosis resulting from *B. canis* are similar to those caused by other *Brucella* species, although the symptoms are generally not as severe.[3]

Tetanus

Tetanus is an acute disease caused by an exotoxin produced by *Clostridium tetani* bacteria. *C. tetani* spores are ubiquitous in the environment and can be found in soil, dust, and animal feces.

Although not a zoonotic disease, tetanus may result from spores introduced into the body through a puncture wound (animal bite or scratch or other environmental injury). Under anaerobic conditions (low oxygen content), the spores germinate and produce the toxin.

The incubation period generally ranges from 3 to 21 days. There are three clinical forms of the disease, with generalized tetanus occurring most commonly. This form is characterized by generalized rigidity and painful muscular contractions of the neck and jaw muscles. Other complications and death may result from tetanus infections. The case–fatality rate ranges from 10–90%.[6] Active immunization with tetanus toxoid is universally recommended. Guidelines for initial immunization and booster doses have been published.[12]

Rabies

Rabies is a disease caused by a rhabdovirus of the genus *Lyssavirus*. Rabies infection usually occurs through the introduction of saliva from the bite of a rabid animal. It is also possible, though rare, for infection to result from direct contact with infectious materials such as saliva, in the eyes, nose, mouth, or a wound.[13] Airborne transmission from exposure to infectious aerosols has been reported in a laboratory setting and in a cave, though this is believed to occur very rarely.[2]

Initial symptoms include headache, fever, malaise, and sensory changes around the wound. In the latter stages, paralysis, muscle spasms, delirium and convulsions can occur, followed by death due to respiratory paralysis. Because there is no treatment for the disease once symptoms appear, prompt administration of post exposure prophylaxis (PEP) is recommended after exposure to rabies to prevent development of the disease.

CDC has recently published guidelines for PEP and recommendations for pre–exposure vaccination for persons at high risk of exposure, as defined by occupation and level of endemicity in the animal population.[14] The CDC guidelines also include recommendations for the immediate cleaning of wounds with soap and water, irrigation with a virucidal agent such as povidone–iodine solution, and flushing with copious amounts of water.

Lyme Disease

In the U.S., Lyme disease is transmitted by deer ticks and western black–legged ticks that are infected with *Borrelia burgdorferi* bacteria. It is the most common vector–borne infection in the U.S. The number of cases of Lyme disease reported annually has increased approximately 25–fold since national surveillance began in 1982. During 1993–1997, a mean of 12,451 cases were reported annually to CDC.[15] Under–reporting of the disease is believed to be significant. Although almost all states have reported cases of Lyme disease, the majority have come from New England and the mid– and south Atlantic regions.[16] Infections generally occur during the late spring and early summer months.

Lyme disease is a multistage, inflammatory illness that affects multiple systems. Stage I normally involves the development of a "bull's eye" rash (erythema migrans) around the area of the bite, followed by general tiredness, fever, headache, stiff neck, muscle aches, and joint pain. If untreated, some persons may later develop arthritis, neurologic abnormalities, and rarely, cardiac problems (stage II). Late Lyme disease (stage III) occurs more than four months after disease onset and may include a skin condition referred to as acrodermatitis chronica atrophicans, chronic arthritis, and chronic neurologic disorders.[16] Antibiotics are used to treat all stages of Lyme disease, with the specific regimen dependent on the stage of the disease being treated and its manifestations.[16]

Prevention and control of Lyme disease can be accomplished by avoiding tick–infested habitats, minimizing skin exposure through the use of adequate protective clothing, and use of appropriate repellants.[15] Vaccination for Lyme disease is currently available. The current CDC recommendations take into account both geographic risk and activities and behaviors relating to tick exposure.[15]

Psittacosis

Psittacosis is caused by infection with *Chlamydia psittaci* bacteria. It is a nationally reportable disease in the U.S. While most cases have resulted from exposure to infected pet birds such as parakeets, parrots, cockatiels, and macaws, transmission has also been documented from free–ranging birds.[17] Infection is usually acquired by inhaling the organism which has been aerosolized from respiratory secretions or dried feces of infected birds. It has an incubation period of about 5–14 days, although longer periods have been reported. The severity of the infection ranges from inapparent illness to systemic illness with severe pneumonia.[17] Symptomatic infection usually begins with a sudden onset of fever, chills, headache, tiredness, and muscle aches, followed by a dry, nonproductive cough. *C. psittaci* infection can also result in endocarditis, myocarditis, and occasionally, neurological complications.[18] Antibiotics are used to treat the disease. Recommendations for controlling human infection from birds have recently been published by the American Veterinary Medical Association (AVMA).[17]

B Virus

Cercopithecine herpesvirus 1, also known as B virus, is a lifelong infection in at least 70% of captive adult macaques (monkeys of the *Macaca* genus),[19] but not other primates. The virus may be shed during intermittent reactivations from saliva, urogenital secretions, and conjunctival fluid.[20] Viral shedding may or may not be accompanied by overt symptoms;[20] thus, macaques should always be regarded as potentially infectious. There are approximately 40 known cases of human B virus infection.[21] B virus disease in humans usually results from macaque bites or scratches, needlestick injuries, or contact with infectious products from the macaques. However, B virus infection and subsequent death of a primate researcher resulting from ocular exposure to an undetermined fluid was recently reported.[20] One case of person–to–person transmission has also been reported. Incubation periods may be as short as two days, but more commonly are two to five weeks. Viral infection in humans rapidly progresses to ascending encephalomyelitis, with a high case fatality rate.[21] Prompt diagnosis and initiation of therapy are crucial in preventing death or permanent disability in surviving patients.[22] Guidelines for preventing B virus infections have been published and focus on preventing exposure through engineering, administrative and work practice controls, and use of personal protective equipment.[20,21,23]

Tuberculosis

Mycobacterium tuberculosis, M. Africanum and *M. bovis*, etiologic agents of human tuberculosis, are closely related organisms of the *M. tuberculosis* complex. While there are many other mycobacterial species that have been isolated from animals,[24] some of which can represent an infection hazard for humans (such as those in the *M. avium* complex), they are not discussed further here.

Humans are considered the main reservoir for *M. tuberculosis*, but there are many animal species that can become infected, including nonhuman primates, dogs, cats, and elephants.[16] Recently, a case of zoonotic TB infection in a marmoset was reported; the source of the exposure was believed to be a person living in a house with this companion animal who had been treated for pulmonary TB eight years previously.[25] Cattle are considered the main reservoir of *M. bovis* infection in mammals, but infection has been found in many other animals, such as nonhuman primates, deer, elk, seals, elephants, rhinoceroses, lions, cheetah, leopards, and buffalo.[26,27,28,29,30,31,32,33] TB transmission involving *M. tuberculosis* and *M. bovis* from infected animals (seals, rhinoceroses, elk, and elephants) to humans has been reported, although rarely, between zoological workers and other animal handlers.[26,28,30,33] TB transmission was believed to occur via aerosols, such as those generated from coughing, cleaning of animal areas, slaughtering, and necropsy.

TB infection occurs when a person inhales aerosolized *M. tuberculosis* (or related species) and the bacteria become established in the alveoli of the lungs and spread throughout the body. The body's immune system is usually able to prevent further multiplication and spread of the bacteria; however, some of the bacilli remain dormant and viable for many years. At this point, a person will usually have a positive tuberculin skin test. The dose required to initiate infection is not known. In general, people who become infected with *M. tuberculosis* have about a 10% risk for developing active TB during their lifetime.[34] This risk is greatest during the first 2 years after infection. Immunocompromised persons have a greater risk for the progression of latent TB infection (LTBI) to active TB disease. CDC recommends that persons with LTBI be evaluated and, if appropriate, prescribed drug therapy to prevent the progression from LTBI to active TB disease.[34]

References

1. CDC [1999]. Leptospirosis. http://www.cdc.gov/ncidod/dbmd/diseaseinfo/leptospirosis_t.htm. U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention. December 1999.

2. Sewell DL [1995]. Laboratory–associated infections and biosafety. Clinical Microbiology Reviews 8:389–405.

3. Fox JG, Lipman NS [1991]. Infections transmitted by large and small laboratory animals. Infectious Disease Clinics of North America 5:131–163.

4. Wedum AG, Barkley WE, Hellman A [1972]. Handling of infectious agents. J Am Vet Med Assoc 161:1557–1567.

5. Wedum AG and Kruse RH [1969]. Assessment of risk of human infection in the microbiology laboratory. Misc Pub 30, Industrial Health and Safety Directorate, Fort Detrick, Frederick, MD.

6. Benenson AS, ed. [1995]. Control of communicable diseases manual. 16th ed. Washington, DC: American Public Health Association, pp. 71–74, 267–270, 275–279, 379–382, 383–390. 459–463.

7. NRC [1997]. Occupational health and safety in the care and use of research animals. National Research Council. Washington DC: National Academy Press. pp. 81–82.

8. Raoult D, Marrie T [1995]. State of the Art Clinical Article – Q fever. Clinical Infectious Diseases, 20:489–96.

9. CDC/NIH [1999]. Biosafety in Microbiological and Biomedical Laboratories. U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention and National Institutes for Health, 4th Edition, HHS Publication No. (CDC) 93–8395.

10. Kaufmann AF and Wenger JD [1992]. Brucellosis. *In*: Last JM and Wallace RB, eds. Public health and preventive medicine. Norwalk, CT: Appleton and Lange, p. 263.

11. Moyer NP and Holcomb LA [1988]. Brucellosis. Chapter 14. *In*: Balows A and Hausler WJ, eds. Diagnosis of infectious diseases – principles and practice. Bol. 1. Springer Verlag, p. 143.

12. CDC [1991]. Diphtheria, tetanus and pertussis: recommendations for vaccine use and other preventive measures: recommendations of the immunization practices advisory committee (ACIP). U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control. Morbidity and Mortality Weekly Report 40(RR–10):1–28.

13. CDC [2000]. Rabies question & answer. http://www.cdc.gov/ncidod/dvrd/rabies/Ques&Ans/q&a.htm U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention.

14. CDC [1999]. Human rabies prevention – United States, 1999: recommendations of the advisory committee on immunization practices (ACIP). U.S. Department of Health and Human Services, Public

Health Service, Centers for Disease Control and Prevention. Morbidity and Mortality Weekly Report 48(RR–01):1–21.

15. CDC [1999]. Recommendations for the use of Lyme disease vaccine: recommendations of the advisory committee on immunization practices (ACIP). U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention. Morbidity and Mortality Weekly Report 48(RR–07):1–17.

16. Weber DJ, Rutala WA [1999]. Zoonotic infections. Occupational Medicine: State of the Art Reviews 14: 247–284.

17. AVMA [2000]. Compendium of measures to control *Chlamydia psittaci* infection among humans (Psittacosis) and pet birds (avian chlamydiosis), 2000. http://www.avma.org/pubhlth/psittacosis.htm

18. CDC [1999]. Psittacosis Technical Information. http://www.cdc.gov/ncidod/dbmd/diseaseinfo/psittacosis_t.htm. U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention.

19. Weigler BJ [1992]. Biology of B virus in macaque and human hosts: a review. Clin Infect Dis 14:555–67.

20. NIOSH [1999]. NIOSH Hazard ID: *Cercopithecine herpesvirus 1* (B virus) infection resulting from ocular exposure. U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, DHHS (NIOSH) Publication No.99–100.

21. Holmes GP, Chapman LE, Stewart JA, Straus SR, Hilliard JK, Davenport DS [1995]. Guidelines for the prevention and treatment of B–virus infections in exposed persons. Clin Infect Dis 20:421–439.

22. Ostrowski SR, Leslie MJ, Parrott T, Abelt S, Piercy PE [1998]. B–virus from pet macaque monkeys: an emerging threat in the United States? Emerg Infect Dis [serial online] 1998 Jan-Mar; Vol 4(1). Available from: URL: http://www.cdc.gov/ncidod/EID/eid.htm.

23. CDC [1998]. Fatal *cercopithecine herpesvirus 1* (B virus) infection following a mucocutaneous exposure and interim recommendations for worker protection. U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention. Morbidity and Mortality Weekly Report 47(49):1073–1076, 1083.

24. Thoen CO, Richards WD, Jarnagin JL [1977]. Mycobacteria isolated form exotic animals. J Am Vet Med Assoc, May 1;170(9):987–90.

25. Michel AL, Huchzermeyer HF [1998]. The zoonotic importance of *Mycobacterium tuberculosis*: transmission from human to monkey. J S Afr Vet Assoc, Jun; 69(2):64–5.

26. Thompson PJ, et al. [1993]. Seals, seal trainers, and mycobacterial infection. Am Rev Respir Dis, Jan; 147(1):164–7.

27. Stetter MD, et al. [1995]. Epizootic of *Mycobacterium bovis* in a zoologic park. J Am Vet Med Assoc, Dec 15;207(12):1618–21.

28. Dalovisio JR, Stetter M, Mikota–Wells S [1992]. Rhinoceros' rhinorrhea: cause of an outbreak of infection due to airborne *Mycobacterium bovis* in zookeepers. Clin Infect Dis Oct; 15(4):598–600.

29. Liss GM, et al. [1994]. Occupational exposure to *Mycobacterium bovis* infection in deer and elk in Ontario. Can J Public Health Sep–Oct; 85(5):336–9.

30. Fanning A, Edwards S, Hauer G [1991]. *Mycobacterium bovis* infection in humans exposed to elk in Alberta. Can Dis Wkly Rep Nov 2; 17(44):239–40, 243.

31. Thorel MF, Karoui C, Varnerot A, Fleury C, Vincent V [1998]. Vet Res Mar–Apr; 29(2):207–12.

32. Wilson P, Weavers E, West B, Taylor M, Kavanagh J, Jones P [1984]. *Mycobacterium bovis* infection in primates in Dublin Zoo: epidemiological aspects and implication for management. Lab Anim Oct; 18(4):383–7.

33. Michalak K, Austin C, Diesel S, Bacon MJ, Zimmerman P, Maslow JN [1998]. *Mycobacterium tuberculosis* infection as a zoonotic disease: transmission between humans and elephants.

34. CDC [1994]. Guidelines for preventing the transmission of *Mycobacterium tuberculosis* in health–care facilities. U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention. Morbidity and Mortality Weekly Report 43(RR–13).

For Information on Other
Occupational Safety and Health Concerns

Call NIOSH at:
1–800–35–NIOSH (356–4674)
or visit the NIOSH Web site at:
www.cdc.gov/niosh

Delivering on the Nation's promise:
! Safety and health at work for all people
through research and prevention