NATIONAL ASSOCIATION of STATE PUBLIC HEALTH VETERINARIANS, INC.

MEMORANDUM

DATE: June 18, 2004

TO: State Public Health Veterinarians
State Epidemiologists
State Veterinarians
Others Concerned with Disease Control and Injury Prevention associated with Animals in Public Settings

FROM: Millicent Eidson, MA, DVM, DACVPM (Epidemiology)
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CoChairs, Compendium Committee

SUBJECT: *Compendium of Measures to Prevent Disease and Injury Associated with Animals in Public Settings, 2004*

On behalf of the National Association of State Public Health Veterinarians (NASPHV), we are pleased to provide you a copy of the *Compendium of Measures to Prevent Disease and Injury Associated with Animals in Public Settings, 2004*. Although there are many positive benefits of human-animal contact, infectious diseases, injuries, and allergic reactions are increasing reported for people having such contacts in public settings. This Compendium provides standardized procedures for use by public health officials, veterinarians, animal exhibitors, and others concerned with disease control and injury prevention, with the intent of minimizing risks associated with animals in public settings.

We recommend that you distribute this cover memorandum and the Compendium widely to persons responsible for oversight or regulation of animal contact venues, persons who operate such venues, and groups such as schools that may have animals in contact with the public. If you update any web links to this document, please delete links to the 2003 Compendium, to assure that interested people access the most current version. This Compendium will be updated again in 2005. Any comments or suggestions for the 2005 Compendium should be sent to Dr. Bender at Veterinary Public Health, University of Minnesota, 1354 Eckles Ave., 136F ABLMS Bldg., St. Paul, Minnesota 55108.

The major changes that were made in the 2004 Compendium include:

- Additional information about disease and injury risks is provided in Parts I - IV, as well as updated references in the bibliography (Part VI).

- Part V, Recommendations, has been updated to provide clarification of the need for separate animal and non-animal areas, with transition areas between them. Specific recommendations for each area are provided.

- A new Appendix B is included to help venue organizers in layout design. These two schematic designs provide guidance on how to separate animal and non-animal areas, and identification of transition areas.

- A new Appendix C has been added to provide guidelines for visiting and resident animals in schools. This one-page appendix was specifically designed to serve as a simple, stand-alone outline of animals that pose an increased risk in the school setting, conditions that should be in place for specific species concerns, and general recommendations for which animals are permitted in schools.

- The newly labeled Appendix D, Table of Disinfectants and Properties, has been updated with the assistance of personnel at the United States Department of Agriculture.

Compendium of Measures to Prevent Disease and Injury Associated with Animals in Public Settings, 2004

National Association of State Public Health Veterinarians (NASPHV)

Summary

A wide range of venues encourage or permit the public to come into contact with animals, resulting in millions of human-animal contacts each year. These settings include county or state fairs, petting zoos, animal swap meets, pet stores, zoologic institutions, circuses, farm tours, livestock birthing exhibits, educational exhibits at schools, and wildlife photo opportunities. Although there are many positive benefits of human-animal contact, infectious diseases, injuries, and allergic reactions acquired by people in these settings are increasingly reported. Infectious disease outbreaks reported during the last decade include *Escherichia coli* O157 enteritis among schoolchildren following visits to farms and petting zoos, salmonellosis in children who attended a reptile exhibit, *Coxiella burnetii* infections among shopping mall patrons attending an animal birthing exhibit, *Mycobacterium tuberculosis* infections in zoo elephant handlers, and ringworm in persons showing lambs. Additionally, the occurrence of rabid or potentially rabid animals in public settings have resulted in extensive exposure investigations and have necessitated the administration of rabies postexposure prophylaxis (PEP) to large numbers of people. Such incidents obviously have significant medical, public health, legal, and financial impacts. This Compendium provides standardized procedures for use by public health officials, veterinarians, animal exhibitors, and others concerned with disease control and injury prevention, with the intent of minimizing risks associated with animals in public settings.

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Compendium of Measures to Prevent Disease and Injury Associated with Animals in Public Settings, 2004

National Association of State Public Health Veterinarians (NASPHV)

INTRODUCTION

Contact with animals in public settings, such as petting zoos, fairs, and farm tours, provides opportunities for entertainment and education about animals and animal husbandry. However, inadequate understanding of disease transmission and animal behavior can lead to illness or injury among visitors, especially children, in these settings. Many diseases (termed "zoonoses") can be transmitted from animals to humans. Of particular concern are situations in which large numbers are exposed and/or become ill, necessitating public health investigation and medical follow-up. A recent review identified over 25 human disease outbreaks from 1990-2000 associated with visitors to animal exhibition settings.[1] In addition, animal contact can result in serious injuries, infections, and allergic reactions.

The NASPHV recognizes the many positive benefits of human-animal contact and believes that the risks of such contacts can be minimized in properly supervised and managed settings using appropriately selected animals that receive regular health examinations and preventive care. The recommendations in this Compendium provide standardized procedures for minimizing disease and injury risks from animal contacts.

Local and state public health, agricultural, environmental, wildlife, and other agencies and organizations are urged to use these recommendations in establishing their own guidelines or regulations for contacts with animals in public settings. There is a wide range of venues that allow public contact with animals, such as animal displays, petting zoos, animal swap meets, pet stores, zoologic institutions, nature parks, circuses, farm tours, livestock birthing exhibits, county or state fairs, schools, and wildlife photo opportunities. Those responsible for these venues are encouraged to use these recommendations to reduce risk and liability. Guidelines to reduce risks from animals in health-care facilities[2] and service animals have been developed.[3] Similiar recommendations are being developed for pet-assisted therapy. These types of contact are not specifically addressed in this Compendium, although the general principles and recommendations may be applicable in these settings.

PART I. ENTERIC (INTESTINAL) DISEASES

Enteric diseases pose one of the greatest risks from animal contact settings.[4] A number of enteric bacteria and parasites are zoonotic and therefore can be spread from animals to humans. Many of these pathogens have a low infectious dose.[5-7] Although most human enteric diseases are transmitted through contaminated food and water, transmission also occurs from contact with animals or their environment. Recently, there have been a number of reported outbreaks among visitors to petting zoos, fairs, and farms. Organisms linked to human disease outbreaks due to animal contact in exhibition settings include *Escherichia coli* O157, *Campylobacter*, *Salmonella*, and *Cryptosporidium.*[8-16] Although these reports usually document cattle, sheep, and goats as sources for infection, pets, wildlife, and exotic animals should not be overlooked as potential sources of enteric infections.

The primary mode of transmission for enteric diseases is the fecal/oral route. Since animal fur, hair, skin, and saliva[17] can become contaminated with fecal organisms, transmission may occur when people pet, touch, or are licked by animals. Transmission has occurred from fecal contamination of foods (including raw milk[18-20] and 'sticky' foods such as cotton candy[21]), water,[22-24] and environmental surfaces.[11,25-27]

Many animals harbor enteric pathogens. Animals infected with organisms such as *E. coli* O157 and *Salmonella* often show no signs of illness. Additionally, infected animals shed the pathogens intermittently. Thus, while removing sick animals (especially those with diarrhea) is necessary to protect

animal and human health, it is not sufficient -- animals that appear healthy may still be infectious and contaminate the environment. Some of these organisms live a long time in the environment.[28-32] Because of the intermittent shedding and limitations of current laboratory tests, culturing fecal specimens or other attempts to identify, screen, and remove infected animals may not be effective in eliminating transmission risk. Antimicrobial agents cannot be depended upon to eliminate infection and shedding of enteric pathogens, nor can they prevent reinfection. For these reasons, all animals (livestock, pets, and wildlife) should be considered as potential shedders of enteric pathogens.

Several factors increase the likelihood of transmission at animal exhibits. Animals are more likely to shed pathogens because of stress induced by prolonged transportation, confinement, crowding, and increased contact with people.[33-39] Commingling of animals increases the probability that an animal shedding organisms will infect other animals. The prevalence of some enteric pathogens may be higher in immature animals[40-42] and most petting zoos exhibit young animals. Shedding of *E. coli* O157 and *Salmonella* is highest in the summer and fall when many petting zoos, traveling animal exhibits, and agricultural fairs are scheduled.[39,43,44]

Because these venues are very popular, there is a risk of a large number of people being exposed. The behaviors and actions of people are significantly related to the risk of infections or outbreaks. Among these are inadequate hand-washing; large numbers of children among attendees; a lack of close supervision of children; hand-to-mouth activities (e.g,. smoking, eating, use of pacifiers, and thumb-sucking) in proximity to animals; and a lack of education or awareness of the risk.

The layout and maintenance of the facility can also contribute to the risk of infection. Risk factors include inadequate hand-washing facilities;[1] structural deficiencies associated with temporary food service facilities; poor separation between animal exhibits and food-consuming areas;[45] and contaminated or poorly maintained drinking water[23,24] and sewage/manure disposal systems.

Lessons from Recent Outbreaks

Two *E. coli* O157 outbreaks at farm petting zoos in Pennsylvania and Washington states were reported by the Centers for Disease Control and Prevention (CDC).[13,15] Both outbreaks highlight a common theme of inadequate hand-washing facilities at animal exhibit settings visited primarily by children. As a result, CDC provided recommendations for enteric disease prevention in such settings.[15]

In the Pennsylvania outbreak, 51 human cases were identified with illness within 10 days of visiting a dairy farm.[13] The median age of patients was 4 years. Sixteen patients (31%) were hospitalized and eight (16%) developed the hemolytic-uremic syndrome (HUS), a potentially fatal sequela from *E. coli* O157 infection. Patients were more likely to have had contact with cattle, especially calves, or manure. Other activities associated with infection included hand-mouth contact, such as nail biting, and purchasing food from an outdoor concession. Those individuals who washed their hands before eating or after touching animals were less likely to become ill. The same strain of *E. coli* O157 was isolated from cattle, people, and the farm environment. More than 75,000 people, mostly children, visited the farm on the days associated with transmission, and an estimated 7,000 subsequently developed diarrhea. An assessment of the farm environment found that there were no areas for eating and drinking separate from the animal contact areas. In addition, hand-washing facilities were limited, not configured for children, and children were unsupervised.

Failure to properly wash hands was a contributing factor in other petting zoo-related outbreaks with organisms including *Cryptosporidium*[10] and *Salmonella*.[11] The protective effect of hand-washing and the persistence of these organisms in the environment are demonstrated by an outbreak of *Salmonella* at a Colorado zoo.[11] In January 1996, public health investigators identified 65 cases (mostly children) associated with touching a wooden barrier around the Komodo dragon exhibit. Well children were more likely to have washed their hands after visiting the exhibit. *Salmonella* was isolated from 39 cases, a Komodo dragon, and the wooden barrier.

Enteric pathogens can contaminate and persist in animal housing areas, e.g., *E. coli* O157 can survive in soil for months.[26,28,30] Environmental persistence was recently illustrated by an Ohio outbreak in which 23 people became ill after handling sawdust, attending a dance, or eating and drinking in a building where animals were shown within the previous week. *E. coli* O157 was recovered from numerous environmental sources within the building, including floor sawdust 42 weeks after the fair ended.[26] Transmission of *E.*

coli O157 from airborne dust was implicated in an Oregon county fair outbreak with 60 cases, mostly children. Illness was associated with visiting an exhibition hall that housed goats, sheep, pigs, rabbits, and poultry, but was not associated with touching animals or their pens, eating, or inadequate hand-washing. The same organism was recovered from ill people and the building.[27]

The impact of improper facility design was illustrated by one of the largest waterborne outbreaks in the United States. Nearly 800 suspected cases of *E. coli* O157 and *Campylobacter* were identified among attendees at a New York county fair, due to consumption of water and food contaminated because of deficiencies in the water distribution system at the fair.[23]

Sporadic Infections

The risk of enteric disease transmission is also demonstrated by a large number of sporadic infections not attributed to recognized outbreaks. A study of sporadic *E. coli* O157 infections among selected U.S. states and counties in 1996 and 1997 found that patients, especially children, were more likely to have visited a farm with cows.[46] Other studies also found an association between *E. coli* O157 infection and visiting a farm[47] or living in a rural area.[48] Epidemiologic studies of human cryptosporidiosis have documented contact with cattle or visiting farms as risk factors for infection.[49,50] Furthermore, a recent FoodNet study of campylobacteriosis attributed infections to raw milk consumption (4.3%) or contact with farm animals (2.0%).[51] Farm residents were at lower risk of infection with *Cryptosporidium*[49] and *E. coli* O157[52] than farm visitors, presumably because of the residents' immunity acquired due to their early and frequent exposure to these organisms.

PART II. INJURIES/RABIES

Injuries associated with animals in public settings may include bites, kicks, scratches, stings, crushing of the hands or feet, and being pinned between the animal and a fixed object. These injuries have been associated with a number of species including big cats, monkeys, domestic animals, and zoo animals. The settings have included public stables, petting zoos, traveling photo opportunities, schools, children's parties, and camel rides.[a,b,c,d] Contact with mammals may expose persons to rabies through contamination of mucous membranes, bites, scratches, or other wounds with infected saliva or nervous tissue. Although no human rabies deaths have been recorded due to animal contact in public exhibits, a large number of rabies exposures have occurred, requiring extensive public health investigation and medical follow-up. An estimated 665 persons received rabies post-exposure prophylaxis (PEP) after handling a rabid kitten in a public display area in a New Hampshire pet store in 1994.[53] In New York State, 465 persons who attended a county fair in 1996 received PEP because of contact with a rabid goat.[54] In Wyoming incidents, 12 persons in contact with a rabid pony at a rodeo and 40 persons in contact with a rabid dog (brought in for 'show and tell') at a school received PEP.[1] After a bear from a petting zoo died with neurologic signs in Iowa, an estimated 400 people from 10 states required follow-up. One hundred-fifty received PEP after feeding the bear, wrestling with it, or being nipped by it.[55,56,] (Although initial laboratory tests indicated the bear was rabid, final test results did not find evidence of rabies.) There are profound public health and medical care challenges associated with mass potential rabies exposures. These include the difficulty in identifying, contacting, correctly assessing exposure risks, and providing timely medical treatment for large numbers of people. This is especially important for this fatal disease.

PART III. OTHER INFECTIONS

Infections from animal bites are common and often require extensive treatment or hospitalization. Pathogens commonly associated with animal bites include *Pasteurella*, *Staphylococcus*, *Streptococcus*, *Capnocytophaga canimorsus*, *Bartonella* (cat scratch disease), and *Streptobacillus* (rat bite fever).

Skin contact with animals in public settings may result in human infection. Fifteen cases of ringworm (or 'club lamb fungus') caused by *Trichophyton* and *Microsporum gypseum* were documented among owners and family members who showed lambs during the lamb show season in Georgia.[57] Ringworm

infection in 23 people and multiple animal species were traced to a *Microsporum canis* infection in a hand-reared zoo tiger cub.[58] Orf virus infections (contagious ecthyma or 'sore mouth') have occurred in goats and sheep at a children's petting zoo[59] and in persons having contact with an infected lamb at Easter photo opportunities.[a] A zoo attendant, subsequent to handling various species of infected exotic animals, developed an extensive papular skin rash from a cowpox-like virus.[60]

Twelve circus elephant handlers at an exotic animal farm in Illinois were found to be infected with *Mycobacterium tuberculosis* after three elephants died of *M. tuberculosis* disease. One handler had signs consistent with active tuberculosis.[61] Although humans can be a source of infection for elephants, medical history and testing of the handlers indicated that the elephants had been a likely source of exposure for most of the human infections in this instance. In a Louisiana incident, seven animal handlers at a zoo who were previously negative for tuberculosis tested positive after an *M. bovis* outbreak in rhinoceroses and monkeys.[62] Concerns about risk of exposure to the public led to development of USDA guidelines about removal of infected animals from public contact.[63]

Some monkey species kept as pets or used in public exhibitions (especially macaques) are frequently infected with Herpes B virus, either asymptomatically or with mild oral lesions. Human exposure by bites or through fluids can result in a fatal meningoencephalitis.[64,65] Due to difficulties with laboratory testing to confirm monkey infection and high Herpes B prevalence, monkey bites can require intensive public health and medical follow-up.

Zoonotic pathogens may be transmitted by direct or indirect contact with reproductive fluids, aborted fetuses, or newborns from infected dams. Live birthing exhibits, usually involving livestock such as cattle, pigs, goats, or sheep, are becoming increasingly popular at agricultural fairs. Although the public usually does not have direct contact with the animal during birthing, newborns and their dams are usually available for petting and observation afterward. Q fever, leptospirosis, and brucellosis are serious zoonoses that may be associated with contact with reproductive materials.

Q fever (*Coxiella burnetii*) is a rickettsial disease that most commonly infects cattle, sheep, and goats. Q fever sometimes causes abortion in animals, but more often the infection is asymptomatic. During parturition, the organism may be shed in high numbers and become aerosolized. Most people exposed to Q fever develop an asymptomatic infection, but clinical illness can range from an acute influenza-like illness to life-threatening endocarditis. A large Q fever outbreak involving 95 confirmed cases and 41 hospitalizations was linked to goats and sheep giving birth at petting zoos. Notably, the petting zoos were in indoor shopping malls, suggesting that indoor birthing exhibits may pose a risk for Q fever transmission.[66]

Chlamydial infections in sheep, goats, and birds may result in reproductive problems in exposed persons.[67-69] *Chlamydophila psittaci* infection in birds resulted in an outbreak of pneumonia among the staff at the Copenhagen Zoo.[70] In 2003, several cases of monkeypox occurred among persons who had contact with infected prairie dogs at a child day care center[71] or while visiting a retail pet store.[e]

Ecto- and endo-parasites pose some concern where humans and exhibit-animals interact. Many authorities view *Sarcoptes scabiei*, a skin mite, as one species with multiple varieties that infect humans and specific animals including swine, dogs, cats, foxes, cattle, and coyotes.[72,73] Even though human infestation from animal sources is usually self-limiting, skin irritation and itching may occur for several days and be difficult to diagnose.[72-74] Animal fleas occasionally bite people, increasing the risk of infection or allergic reaction. Fleas also serve as the intermediate host for one tapeworm species that could infect children. Numerous other animal helminthes may infect humans fecal/orally or through contact with animals or contaminated earth.[75,76] Parasite control through veterinary care and sound husbandry coupled with hand-washing reduces risks associated with ecto- and endo-parasites.[77]

PART IV. ALLERGY/ASTHMA

Asthma is a serious public health problem in the United States, affecting an estimated 15 million people and causing 5,000 deaths each year.[78] Asthma and allergies are exaggerated reactions of the body's immune system to proteins also known as allergens. Inhalation is one of the most common ways for allergens to enter the body.

Although there are many types of proteins that induce allergic reactions, some are associated with animal dander, scales, fur, feathers, body wastes (urine), and saliva.[79,80] Allergies induced by dog and cat contact are estimated to occur in approximately 15% of the population.[78] In addition, dust and feed accumulations in animal areas attract and absorb moisture that can create an environment for the growth of allergenic molds and other microorganisms.

Venues with animals, particularly those in which animals normally are not found (e.g., schools, childcare centers, non-animal related businesses), should recognize the potential threat that animals can pose to people with allergies and/or asthma. In addition, it is the responsibility of those with known allergies to animals to avoid common animal settings.

PART V. RECOMMENDATIONS

Only a few states have specific guidelines or legislation for petting zoo exhibitors and other animal exhibition venues.[1,15,81-83] Recommendations to prevent enteric infections at animal exhibitions and agricultural fairs were developed in the United Kingdom in 1989,[84] 1995,[85] and 2000.[86] In the U.S., the American Zoo and Aquarium Association (AZA) has guidelines and standards for AZA accredited institutions to reduce risks associated with public contact in zoologic parks.[87] In accordance with the Animal Welfare Act, the United States Department of Agriculture's (USDA) Animal Care licenses and inspects certain animal exhibits for humane treatment of animals, but this Act is not intended for human health protection. There are no federal laws to address the risk for transmission of pathogens at venues where the public has contact with animals, but guidelines to reduce the risk of enteric pathogens were issued by the Centers for Disease Control and Prevention (CDC) in 2001.[15] CDC also issued recommendations for preventing transmission of *Salmonella* from reptiles to humans.[88] Guidelines have been developed by the Association for Professionals in Infection Control and Epidemiology (APIC) to address risks associated with the use of service animals in health care settings.[3] The guidelines above contributed to the recommendations in this Compendium.

Opportunities for animal contact with the public occur in a wide variety of settings. Recommendations provided by this Compendium need to be tailored to each specific setting. The Compendium should be incorporated into guidelines and regulations developed at the state or local level, and should be disseminated to persons who own or manage animals in public settings. Incidents of disease transmission or injury should be promptly reported to public health authorities and investigated.

Recommendations for Education

Education is essential to reduce risks associated with animal contact in public settings. The public must be educated so they can weigh the benefits and risks of animal contact. Animal owners, exhibit operators, and their staff must be informed to make appropriate management decisions. Specific recommendations for education include:

- **Provide Educational Materials:** Include information about the risks of enteric diseases, injuries, rabies, and other diseases, and ways to reduce risks. Include information about which animals pose a greater risk of disease transmission or injury and which people are at increased risk of serious infections. Materials should be age- and language-appropriate. Provide the messages in multiple formats, such as signs, handouts, brochures, etc.
- **Provide Education Prior to Contact:** Provide information to fair exhibitors, those arranging school field trips and classroom exhibits, and persons receiving animal exhibition or education licenses, so that they can educate the visitors prior to arrival. Information should also be available to individuals at the entrance to animal contact areas.
- **Train Staff:** Staff at animal contact venues should be trained in reducing the risk of disease and injury associated with animals. They need to comply with local and state requirements about reporting of animal bites, scratches, or other injuries.

General Recommendations for Controlling Public Contact with Animals

The public's contact with animals should occur in controlled settings in order to reduce the potential for injuries or disease and to increase the likelihood that exposures will be reported, documented, and handled appropriately. Design of facilities or contact settings should minimize risk and facilitate hand washing (see Appendix A for hand-washing recommendations). Some jurisdictions may wish to have more restrictive recommendations in areas where animal contact is specifically encouraged (such as petting zoos). Design requirements may include double barriers to prevent contact with animals or contaminated surfaces other than in specified interaction areas. Consideration should be given to manure disposal and waste water runoff, in relation to pedestrian traffic. Control methods should focus on facility design and management. Three areas should be addressed: animal areas (where animal contact is possible or encouraged), transition areas, and non-animal areas (see Appendix B for schematics of possible facility designs). Special guidelines may be necessary for certain settings such as schools (see Appendix C). Recommendations for cleaning should be based on the likely disease organisms and the ability of disinfectants to inactivate them (see Appendix D). Specific recommendations are outlined below.

Recommendations for Animal Areas

These recommendations apply both to settings in which animal contact is possible (such as county fairs) and settings in which direct animal contact is encouraged (such as petting zoos). However, in settings in which direct animal contact is encouraged, extra precautions should be taken to reduce the risk of injuries and disease transmission.

For areas in which animal contact is possible, design of the entry and exit points for animal contact areas should be planned to facilitate visitor flow through transition areas (see Appendix B for recommendations). The transition areas should include educational information and hand-washing facilities. Fences, gates, or other types of barriers can restrict uncontrolled access to animals and animal contact areas, and ensure that visitors exit through transition areas.

- **Food and Beverages**: No food and beverages should be allowed in animal areas. In addition, smoking, carrying toys, and use of pacifiers and baby bottles should not be permitted in animal areas.
- **Cleaning**: Manure and soiled animal bedding should be removed promptly. Animal waste should be temporarily stored in appropriate labeled containers, preferably lined with plastic bags. Waste containers and tools used for waste removal (e.g., shovels, pitchforks) should be kept within designated animal areas, and restricted from public access. Manure and soiled bedding should not be transported or removed through non-animal areas or transition areas used by human visitors. If manure or soiled bedding must be transported through these areas, they should be in closed containers or bags to prevent spillage.
- **Supervision of Children**: For children less than 5 years old, animal contacts should be carefully supervised to discourage hand-to-mouth contact and to ensure appropriate hand-washing when needed.
- **Staff**: Staff must be present in areas of animal contact to encourage appropriate human animal interactions, to reduce risk (e.g., by promptly cleaning up wastes), and to receive reports of injuries and exposures.
- **Feeding Animals:** If feeding animals is permitted, only food sold by the venue for that purpose should be allowed. Food sold for animal consumption should not be eaten by people and should not be provided in containers that can be eaten by people (e.g., ice cream cones). This policy will reduce the risk of animal bites and the likelihood of children eating food that has come into contact with animals.
- **Use of animal areas for public (non-animal) activities:** Zoonotic pathogens can contaminate the environment for long periods of time.[26] If animal areas must be utilized for public events (i.e., weddings, dances, etc.), cleaning and disinfection is essential, particularly if food and beverages are served. Materials with smooth, impervious surfaces such as steel, plastic, and concrete are easier to clean than materials such as wood or dirt floors. It is important to remove organic material (bedding, feed, and manure) before using disinfectants. A list of disinfectants is provided in Appendix D.

Recommendations For Transition Areas (Between Animal Areas And Non-Animal Areas)

It is important to provide transition areas for visitors to pass through when entering and exiting animal areas. The transition areas between animal and non-animal areas should be defined as clearly as possible, even if they need to be conceptual rather than physical (see Appendix B). Information should be provided in these areas to reduce the risk of infection or injury, and to provide hand-washing facilities upon exiting.

- **Entrance transition areas** should inform visitors that they are entering an animal area. Signs instructing visitors not to eat, drink, or place their hands in their mouth while in the animal area should be posted.
- **Exit transition areas** should be clearly marked with signs instructing the public to wash their hands. Hand-washing stations should be available and accessible to children. See Appendix A for detailed recommendations for hand-washing.

Recommendations For Non-Animal Areas

Non-animal areas are areas in which animals are not permitted, with the exception of service animals.

- Food and beverages should only be prepared, served, and consumed in the designated non-animal areas. Hand-washing facilities must be available (see Appendix A for detailed recommendations.)
- If animals or animal products (e.g., animal pelts, animal waste, owl pellets)[89] are brought into school settings (see Appendix C), careful cleaning must be done (see Appendix D for list of disinfectants). Animals and animal products should not be brought into school cafeterias and other food-consumption areas.

Recommendations for Animal Care and Management

The risk of disease or injuries from animal contacts can be reduced by carefully managing the specific animals used for such contacts. Considerations for management of animals in contact with the public should include:

- **Animal Care**: Animals should be monitored daily by the owners or caretakers for any signs of illness, and receive veterinary care if signs of illness occur. No ill animals or animals from herds with a recent history of abortion or diarrhea should be on exhibit. Animals should be housed to minimize stress and overcrowding, which can increase shedding of microorganisms.
- **Veterinary Care**: Owners should retain and use the services of a licensed veterinarian. Vaccination, preventive care, and parasite control appropriate to the species should be provided. Screening for some specific diseases should be considered, e.g., tuberculosis (elephants,[63] primates) and Q fever (ruminants in birthing exhibits).[90]
- **Rabies:** If feasible, in areas with high rabies incidence, animals should be housed to reduce potential exposures from wild animal reservoirs. Mammals used in venues where contact is encouraged, such as petting zoos, should be current on rabies immunizations.[91] For previously unvaccinated mammals, vaccinate at least 3 months prior to public contact to minimize the chance that these animals will be shedding rabies virus during the venue. In high incidence areas, it is particularly critical that all mammals in situations where public contact could occur (e.g., fairs) be current on rabies immunization. If there is no licensed rabies vaccine for a particular species used in a public contact setting, licensed rabies vaccines may be used by veterinarians 'off-label'. This use will not provide the same level of assurance as vaccination of a species with a licensed vaccine, but may decrease the probability of rabies and rabies exposures. Mammals that are too young to be immunized at least 3 months prior to potential human contacts should be used only if additional restrictive measures are available to reduce and manage risks (e.g., use only animals that were born to vaccinated mothers and were housed to avoid rabies exposure). Another measure may be the use of logs and registers to facilitate locating groups or individuals, in situations that may require tracing of contacts.
- **Dangerous Animals**: Because of their strength, unpredictability, venom, or the pathogens they may carry, some animals are not appropriate in exhibit settings where there is a possibility of animal contact. These species include non-human primates (e.g., monkeys and apes) and carnivores (e.g., lions, tigers, ocelots, wolves/wolf-hybrids and bears). In addition, rabies reservoir species such as bats, raccoons, skunks, foxes, and coyotes should not be used.

- **Animal Births**: If animal births occur, ensure that the public has no contact with animal birthing products. The environment must be thoroughly cleaned after each birth and all waste products appropriately discarded. Having such events outside is preferable; if held inside, there are risks of organisms being spread through ventilation systems.

Additional Recommendations

- **Recommendations for High-Risk Populations:** Groups at high risk for serious infection include the elderly, children less than 5 years old, and people who are pregnant or immunocompromised (such as those with HIV/AIDS, without a functioning spleen, or on immunosuppressive therapy). People at high risk should observe heightened precautions at any animal exhibit. These precautions may include restriction of animal contact or strict enforcement of risk reduction methods such as hand-washing. Such people should avoid animals at greater risk for transmitting enteric diseases including calves and other young ruminant animals, young poultry, reptiles, amphibians, and ill animals.
- **Milk Consumption:** Attendees should not consume unpasteurized dairy products (including milk from the bulk tank).
- **Drinking Water:** Local public health authorities should inspect drinking water systems prior to use. Only potable water should be used for human consumption. Back-flow prevention devices should be installed between outlets in livestock areas and water lines supplying other uses on the grounds. If the water supply is from a well, adequate distance must be maintained from possible sources of contamination such as animal holding areas, manure piles, etc. Clear maps of the water distribution system should be available to use in identifying potential or actual problems. Minimize the use of outdoor hoses, and do not leave hoses on the ground. Mark those accessible to the public as "not for human consumption."

[a] M. Eidson New York State Department of Health, personal communication, 2003.
[b] J. Bender, University of Minnesota, personal communication, 2003.
[c] M. Jay-Russell, California Department of Health, personal communication, 2003.
[d] G. Swinger, Tennessee Department of Health, personal communication, 2003.
[e] J. Kazmierczak, Wisconsin Department of Health, personal communication, 2004.

PART VI. REFERENCES

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Appendix A: Hand-washing Recommendations to Reduce Disease Transmission from Animals in Public Settings

Hand-washing is the single most important prevention step for reducing disease transmission.

How to Hand-wash

- Wet hands with running water, place soap into palms, rub together to make a lather, scrub hands vigorously for 20 seconds, rinse soap off of hands, then dry hands with a disposable towel.
- It is advisable to turn off the faucet using a disposable towel. Young children need assistance in washing hands.

Hand-washing Facilities or Stations

- Hand-washing facilities should be accessible, sufficient for the maximum anticipated attendance, and configured for use by children and adults.
- Hands should always be washed after leaving animal areas and prior to eating or drinking.
- Hand-wash stations should be conveniently located between animal and non-animal areas (exit transitional area) and in food concession areas.
- Maintenance should include routine cleaning and restocking of towels and soap.
- Running water should be of sufficient volume and pressure to remove soil from hands. Volume and pressure might be significantly reduced if the water supply is furnished from a holding tank. Therefore, a permanent pressured water supply is preferable.
- The design of the hand-wash unit should leave the hands free for hand-washing.
- Hot water is preferable, but if the hand-wash stations are supplied with only cold water, a soap that emulsifies more easily in cold water should be provided.
- Communal basins do not constitute adequate hand-washing facilities.

Hand-washing Agents

- Liquid soap dispensed by a hand or foot pump is recommended.
- When soap and water are not available, alcohol-based hand sanitizers are effective against many common disease agents, such as *E. coli, Salmonella*, and *Campylobacter*.
- Hand sanitizers may be less effective if hands are grossly soiled. They are also ineffective against certain organisms (i.e., bacterial spores, *Cryptosporidium*, and certain viruses). Therefore, gross contamination and dirt should be removed to the extent possible before using hand sanitizers.

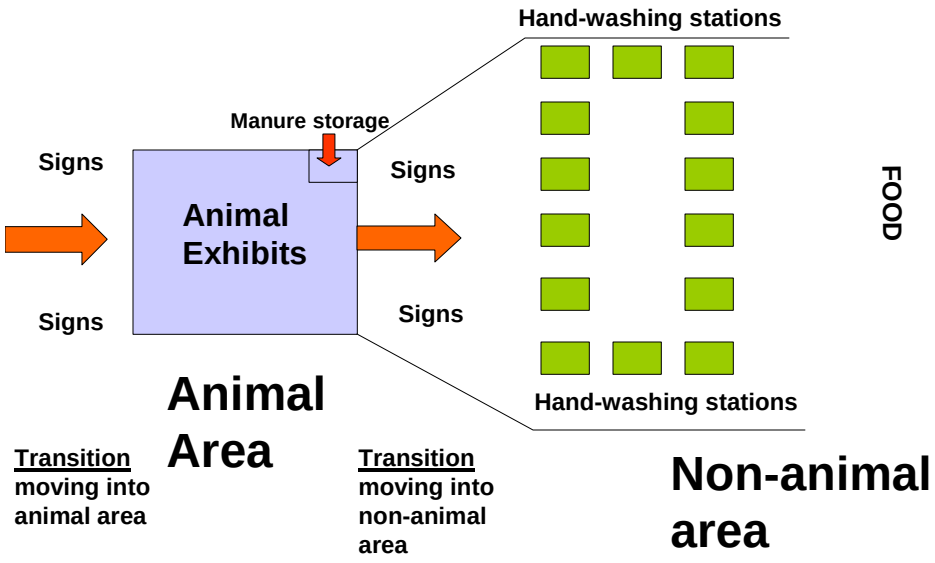
Signs

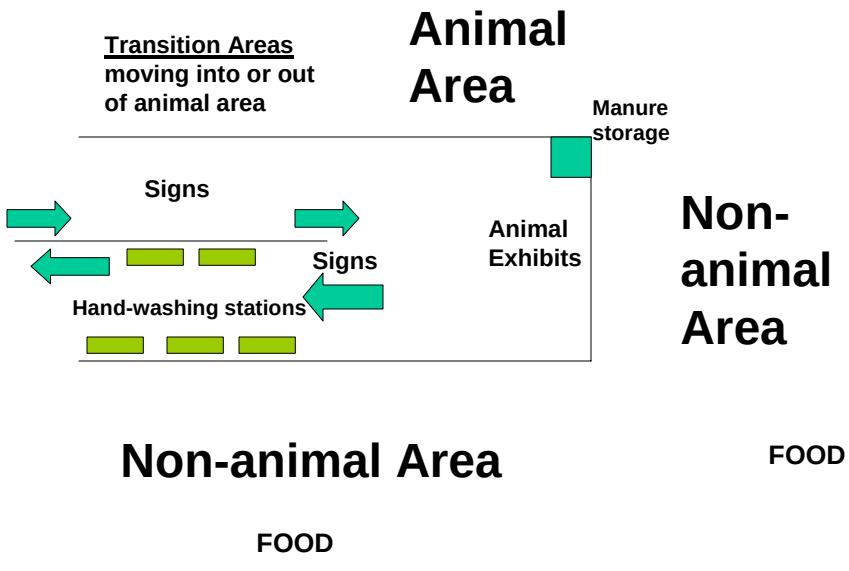
- Hand-wash reminder signs must be posted at exits from animal areas.
- Signs should direct visitors and animal handlers to the location of hand-wash stations.
- Instructional signs should be posted at the hand-wash stations and at restroom lavatories to ensure proper hand-wash practices.
- The placement of hand-wash reminder signs at food concession areas is recommended.

An example of the type of information that should be considered for a hand-washing sign is:

Hand-washing: How and When	
How: - Wet hands with running water - Place soap into palms - Rub together to make a lather - Scrub hands vigorously for 20 sec - Rinse soap off of hands - Dry hands	**When:** - After going to the toilet - After exiting animal areas - Before eating - Before preparing foods

Appendix B: Two Possible Designs for Animal Contact Facilities
Separation of Animal and Non-animal Areas, Identification of Transition Areas





Appendix C: Guidelines for Visiting and Resident Animals in Schools

Animals are effective and valuable teaching aids. Safeguards are required to reduce the risk of infection and injury. These abbreviated recommendations are based on guidelines developed by Dr. Bill Johnston of the Alabama Department of Public Health and adapted by Dr. Gail Hansen of the Kansas Department of Health and Environment.[92] Recommendations are also available from the National Science Teachers Association[93] and the National Association of Biology Teachers.[94]

Animals that pose an increased risk

These animals that should be avoided in school displays unless there are special precautions:

- Wild mammals, for example, any mammal that is not a domestic dog, cat, ferret, ungulate (cow, sheep, goat, pig, horse), pet rabbit, or pet rodent (mice, rats, hamsters, gerbils, guinea pigs, and chinchillas)
- Animals at higher risk of rabies such as raccoons, skunks, foxes, coyotes, and bats
- Wolf-dog hybrids
- Aggressive or unpredictable animals
- Stray animals with unknown health and vaccination history
- Baby chicks and ducks due to risk of shedding *Salmonella* or *Campylobacter*
- Venomous or toxin-producing animals (spiders, insects, reptiles, and amphibians)
- Reptiles (including turtles, lizards, and non-venomous snakes) and amphibians

Conditions for specific animals

Some animal species may be permitted as pets or for school demonstrations, under special conditions:

- Non-psittacine birds such as canaries, finches, mynahs, and diamond doves are appropriate for school use. Due to risk of infection with psittacosis, psittacine birds such as parrots, parakeets, budgies, and cockatiels should be allowed only if children do not handle them or clean their cages. Cages should be clean and the bird's wastes contained. If housed permanently on school property, they should be treated with tetracyclines selected in consultation with a veterinarian experienced in avian medicine.
- Fish can be excellent pets in schoolrooms, if disposable gloves are worn when cleaning aquariums, and used tank water is not disposed of in sinks used for food preparation or obtaining drinking water.
- Pet rabbits and rodents (e.g., mice, rats, hamsters, gerbils, guinea pigs, and chinchillas) are appropriate for school use, if housed indoors in cages and not previously exposed to rabies reservoir species.
- Guide, hearing, or other service animals and law enforcement animals may be allowed if under the control of a responsible adult familiar with the specific animal.
- Ferrets can be allowed but should not be handled by children, only by the person responsible for them.

General guidelines for animals permitted in schools

Animals should be handled and housed humanely with appropriate precautions:

- They are displayed by an experienced professional in enclosed cages or under appropriate restraint.
- Animals are not allowed to roam or fly free. Areas for animal contact are designated.
- Contacts with children are supervised.
- Children must wash hands after any contacts.
- Animals are not allowed in areas where food or drink are consumed.
- Areas contaminated by the animal or its wastes are thoroughly cleaned.
- Animals have a health certificate from a veterinarian and a verified rabies vaccination (if appropriate).
- Animals are clean and free of internal (worms) and external parasites such as fleas, ticks, and mites.
- Special precautions may be necessary with children who are immunocompromised or are asthmatic.

Appendix D: Table of Disinfectants and Properties

All surfaces should be cleaned thoroughly before disinfection. For basic disinfection, a 1:100 dilution of household bleach (i.e., 2.5 tablespoons per gallon) or a 1:1,000 dilution of quaternary ammonium compounds (e.g., Roccal or Zephiran) may be used. For disinfection when a particular organism has been identified, use the table below. All compounds require a contact time of at least 10 minutes. Local and /or state environmental health officers may have recommendations for appropriate disinfectant selection and precautions for environmental impact. Additional information is available from Purdue University's National Biosecurity Resource Center for Animal Health Emergencies.[95]

Compound	**Chlorine[a] 0.01-5%**	**Iodine Iodophor 0.5-5%**	**Chlorhexidine 0.05-0.5%**	**Alcohol[b] 70**	**Oxidizing Agents 0.2-3%**	**Phenol 0.2-3%**	**Quaternary Ammonium 0.1-2%**
Examples	Clorox	Tincture/ Provodine	Nolvasan	Rubbing alcohol	Virkon-S	pHisoHex	Roccal-D
Bactericidal	Good	Good	Good	Good	Good	Good	Good
Virucidal	Good	Good	Poor	Fair	Good	Poor[d]	Poor
Envelope Viruses	Yes	Yes	limited	Yes	Yes	limited	limited
Non-Envelope Viruses	Yes	limited	No	No	Yes	No	No
Bacterial Spores	Good[c]	Poor	Poor	Poor[c]	Fair-Good	Poor	Poor
Fungicidal	Good	Fair	Fair to Good	Good	Fair	Fair	Fair
Protozoal Parasites	Fair strong Conc	Poor	Poor	Poor	Poor	Poor	Fair (Ammonia)
Effective in Organic Matter	Poor	Poor	Fair	Poor	Poor	Good	Poor
Inactivated by soap	No	Yes	No	No	No	No	Yes
Effective in Hard water	Yes	No	Yes	Yes	Yes	Yes	No
Residual activity	Poor	Poor	Good	Fair	Poor	Poor	Fair

Adapted from Nebraska Cooperative Extension and USDA

[a]Bleach should be diluted to 1:32, mixed fresh daily and replaced whenever contaminated with organic matter (1:32 dilution of 5.75% solution provides > 1500 ppm chlorine).

[b]Rubbing alcohol is flammable.

[c]Alcohol synergistically potentiates the sporicidal effect of hypochlorites. Mix 5.75% solution of hypochlorite 1:1 with 50% ethyl alcohol/water. Mix fresh at the time of use and provide contact time of at least 30 minutes.

[d]2-phenylphenol (ortho-phenylphenol) is fair.