National Association of State Public Health Veterinarians, Inc.

May 31, 2011

MEMORANDUM

TO: State Public Health Veterinarians
State Epidemiologists
State Veterinarians
Other Parties Interested in Rabies Prevention and Control

FROM: Catherine M. Brown, DVM, MSc, MPH, Chair
Compendium of Animal Rabies Prevention and Control Committee

SUBJECT: *Compendium of Animal Rabies Prevention and Control, 2011*

The National Association of State Public Health Veterinarians (NASPHV) is pleased to provide the 2011 revision of the Compendium of Animal Rabies Prevention and Control for your use and for distribution to practicing veterinarians, wildlife rehabilitators, animal welfare organizations, and officials in animal control, public health, wildlife management, and agriculture in your state. This document is reviewed and revised as necessary, and the most current version replaces all previous versions. This cover memo summarizes the most notable changes that were made to the document and provides updates on other rabies issues.

COMPENDIUM CHANGES

Part I A.1. The national case definition for animal rabies was added for clarification of how rabies cases are defined for public health surveillance purposes.

Part I A.9. was expanded to: clarify that the Centers for Disease Control and Prevention's (CDC) rabies laboratory is available for confirmatory testing and on an emergency basis to expedite exposure management decisions; include information on testing methodology appropriate for field testing of surveillance specimens; and to clarify that there are no reliable ante mortem rabies tests available for use in animals.

Part I A.11. was expanded to include additional research topics that warrant further study.

Part III: The table of rabies vaccines licensed and marketed in the U.S. was updated for 2011.

Additional references have been added to provide scientific support for information provided in the document.

RABIES UPDATES

The fifth World Rabies Day will be on September 28, 2011. More information is available at: http://www.worldrabiesday.org.

The 22nd annual international conference on Rabies in the Americas (RITA) is scheduled for October 16-21, 2011 in San Juan, Puerto Rico. More information is available at: http://www.rabiesintheamericas.org/.

CDC's Rabies Laboratory is attempting to collect specimens to evaluate the potential for rabies transmission via milk from lactating animals. Over the past 15 years, CDC has received mammary tissue and unpasteurized milk from approximately 1 rabid cow per year. To date, no rabies virus antigen or nucleic acids have been detected. However, continued collection of appropriate samples is critical to obtain a sufficient sample size to make evidence based recommendations. When rabies is suspected in a lactating animal, milk and mammary tissue should be collected and stored. If rabies is diagnosed, the milk and mammary tissue should be shipped on dry ice to:

Dr. Charles E. Rupprecht
DASH, Building 18, Room SSB218
Centers for Disease Control and Prevention
1600 Clifton Road, NE
Atlanta, GA 30333
(404) 639-1050

Enhanced surveillance of the rabies virus variants currently circulating in the U.S. is critical for detecting new or introduced rabies virus variants. CDC requests an aliquot of CNS tissue from: rabid domestic animals (especially dogs); less common non-reservoir species (e.g. ruminants); and, from rabid carnivores in areas where bats are the only enzootic rabies reservoir, for antigenic and phylogenetic characterization. In addition, to better evaluate the potential of certain species groups to transmit rabies, the entire head of any rodent or lagomorph testing positive for rabies should be submitted to evaluate the presence of rabies virus in salivary glands. Where feasible, rabies diagnostic laboratories should store the heads of highly suspect rodents and lagomorphs until testing is completed. Positive specimens should be sent to CDC at the above address for further analysis.

Compendium of Animal Rabies Prevention and Control, 2011*

National Association of State Public Health Veterinarians, Inc. (NASPHV)

Rabies is a fatal viral zoonosis and a serious public health problem *(1).* All mammals are believed to be susceptible to the disease, and for purposes of this document, use of the term "animal" refers to mammals. The disease is an acute, progressive encephalitis caused by a lyssavirus. Rabies virus is the most important lyssavirus globally. In the United States, multiple rabies virus variants are maintained in wild mammalian reservoir populations such as raccoons, skunks, foxes, and bats. Although the U.S. has been declared free of canine rabies virus variant transmission, there is always a risk of reintroduction of these variants *(2-6).*

The virus is usually transmitted from animal to animal through bites. The incubation period is highly variable. In domestic animals it is generally 3-12 weeks, but can range from several days to months, rarely exceeding 6 months *(7)*. Rabies is communicable during the period of salivary shedding of rabies virus. Experimental and historic evidence document that dogs, cats, and ferrets shed virus a few days prior to clinical onset and during illness. Clinical signs of rabies are variable and include inappetance, dysphagia, cranial nerve deficits, abnormal behavior, ataxia, paralysis, altered vocalization, and seizures. Progression to death is rapid. There are currently no known effective rabies antiviral drugs.

The recommendations in this compendium serve as a basis for animal rabies prevention and control programs throughout the United States and facilitate standardization of procedures among jurisdictions, thereby contributing to an effective national rabies control program. This document is reviewed and revised as necessary. The most current version replaces all previous versions. These recommendations do not supersede state and local laws or requirements. Principles of rabies prevention and control are detailed in Part I; recommendations for parenteral vaccination procedures are presented in Part II; and all animal rabies vaccines licensed by the United States Department of Agriculture (USDA) and marketed in the United States are listed and described in Part III.

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National Animal Control Association (NACA)

Part I. Rabies Prevention and Control

A. PRINCIPLES OF RABIES PREVENTION AND CONTROL

1. CASE DEFINITION: An animal is determined to be rabid after diagnosis by a qualified laboratory as specified in Part I.A.9. The national case definition for animal rabies requires laboratory confirmation by either:

- A positive direct fluorescent antibody test (preferably performed on central nervous system tissue); or
- Isolation of rabies virus (in cell culture or in a laboratory animal *(8)*.

2. RABIES EXPOSURE: Rabies is transmitted when the virus is introduced into bite wounds, open cuts in skin, or onto mucous membranes from saliva or other potentially infectious material such as neural tissue *(9)*. Questions regarding possible exposures should be directed promptly to state or local public health authorities.

3. PUBLIC HEALTH EDUCATION: Essential components of rabies prevention and control include ongoing public education, responsible pet ownership, routine veterinary care and vaccination, and professional continuing education. The majority of animal and human exposures to rabies can be prevented by raising awareness concerning: rabies transmission routes, avoiding contact with wildlife, and following appropriate veterinary care. Prompt recognition and reporting of possible exposures to medical professionals and local public health authorities is critical.

4. HUMAN RABIES PREVENTION: Rabies in humans can be prevented either by eliminating exposures to rabid animals or by providing exposed persons with prompt local treatment of wounds combined with the appropriate administration of human rabies immune globulin and vaccine. Exposure assessment should occur before postexposure rabies prophylaxis (PEP) is initiated and should include discussion between medical providers and public health officials. The rationale for recommending preexposure prophylaxis and details of both pre- and post-exposure prophylaxis administration can be found in the current recommendations of the Advisory Committee on Immunization Practices (ACIP) *(9,10)*. These recommendations, along with information concerning the current local and regional epidemiology of animal rabies and the availability of human rabies biologics, are available from state health departments.

5. DOMESTIC ANIMAL VACCINATION: Multiple vaccines are licensed for use in domestic animal species. Vaccines available include: inactivated or modified live virus vectored products; products for intramuscular and subcutaneous administration; products with durations of immunity from one to 4 years; and products with varying minimum age of vaccination. The recommended vaccination procedures and the licensed animal vaccines are specified in Parts II and III of this compendium, respectively. Local governments should initiate and maintain effective programs to ensure vaccination of all dogs, cats, and ferrets and to remove strays and unwanted animals. Such procedures in the United States have reduced laboratory confirmed cases of rabies in dogs from 6,949 in 1947 to 93 in 2009 *(2)*. Because more rabies cases are reported annually involving cats (274 in 2009) than dogs, vaccination of cats should be required *(2)*. Animal shelters and animal control authorities should establish policies to ensure that adopted animals are vaccinated against rabies.

6. RABIES IN VACCINATED ANIMALS: Rabies is rare in vaccinated animals *(11-13)*. If such an event is suspected, it should be reported to public health officials; the vaccine manufacturer; and USDA, Animal and Plant Health Inspection Service, Center for Veterinary Biologics (Internet: http://www.aphis.usda.gov/animal_health/vet_biologics/vb_adverse_event.shtml; telephone: 800-752-6255). The laboratory diagnosis should be confirmed and the virus variant characterized by the Centers for Disease Control and Prevention (CDC) rabies reference laboratory. A thorough epidemiologic investigation

including documentation of the animal's vaccination history and a description of potential rabies exposures should be conducted.

7. RABIES IN WILDLIFE: The control of rabies among wildlife reservoirs is difficult *(14)*. Vaccination of free-ranging wildlife or selective population reduction is useful in some situations *(15)*, but the success of such procedures depends on the circumstances surrounding each rabies outbreak (see Part I. C.). Because of the risk of rabies in wild animals (especially raccoons, skunks, coyotes, foxes, and bats), the American Veterinary Medical Association, American Public Health Association, Council of State and Territorial Epidemiologists, National Animal Control Association and the National Association of State Public Health Veterinarians strongly recommend the enactment and enforcement of state laws prohibiting their importation, distribution, translocation, and private ownership.

8. RABIES SURVEILLANCE: Enhanced laboratory-based rabies surveillance and variant typing are essential components of rabies prevention and control programs. Accurate and timely information and reporting is necessary to: guide human PEP decisions; determine the management of potentially exposed animals; aid in emerging pathogen discovery; describe the epidemiology of the disease; and assess the need for and effectiveness of vaccination programs for domestic animals and wildlife. Every animal submitted for rabies testing should be reported to CDC to evaluate surveillance trends. Electronic laboratory reporting and notification of animal rabies surveillance data should be implemented *(16)*. Optimal information on animals submitted for rabies testing should include species, point location, vaccination history, rabies virus variant (if rabid), and human or domestic animal exposures. Rabid animals with a history of importation within 60 days into the United States are immediately notifiable by state health departments to CDC; all indigenous cases should follow standard notification protocols *(17)*. Integration with standard public health reporting and notification systems should facilitate the transmission of the above data elements.

9. RABIES DIAGNOSIS:

a) The direct fluorescent antibody (DFA) test is the gold standard for rabies diagnosis. The DFA test should be performed in accordance with the established national standardized protocol (http://www.cdc.gov/rabies/docs/standard_dfa_protocol_rabies.pdf) by a qualified laboratory that has been designated by the local or state health department *(18,19)*. Animals submitted for rabies testing should be euthanized *(20,21)* in such a way as to maintain the integrity of the brain so that the laboratory can recognize the anatomical parts. Except in the case of very small animals, such as bats, only the head or brain (including brain stem) should be submitted to the laboratory. To facilitate prompt laboratory testing, submitted specimens should be stored and shipped under refrigeration without delay. The need to thaw frozen specimens will delay testing. Chemical fixation of tissues should be avoided to prevent significant testing delays and because it might preclude reliable testing. Questions about testing of fixed tissues should be directed to the local rabies laboratory or public health department.

b) Rabies testing should be available on an emergency basis to expedite exposure management decisions *(18)*. When confirmatory testing is needed by state health departments (e.g., inconclusive results, unusual species, mass exposures), the CDC rabies laboratory can provide results within 24 hours of submission *(22)*.

c) A direct rapid immunohistochemical test (DRIT) is being used by trained field personnel in surveillance programs for specimens not involved in human or domestic animal exposures *(23-26)*. All positive DRIT results need to be confirmed by DFA testing at a qualified laboratory.

d) Currently, there are no USDA licensed rapid test kits commercially available for rabies diagnosis. Unlicensed tests should not be used due to several concerns: the sensitivity/specificity are not known; the tests have not been validated against current standard methods; the excretion of virus in the saliva is intermittent and the amount varies over time; any test result would need to be confirmed by more

reliable methods such as DFA testing on brain tissue; and the interpretation of results may place exposed animals and persons at risk.

10. RABIES SEROLOGY: Some jurisdictions require evidence of vaccination and rabies virus antibodies for animal importation purposes. Rabies virus antibody titers are indicative of a response to vaccine or infection. Titers do not directly correlate with protection because other immunologic factors also play a role in preventing rabies, and our abilities to measure and interpret those other factors are not well-developed. Therefore, evidence of circulating rabies virus antibodies in animals should not be used as a substitute for current vaccination in managing rabies exposures or determining the need for booster vaccinations *(27-30)*.

11. RABIES RESEARCH: Information derived from well-designed studies is essential for the development of science-based recommendations. Data are needed in several areas including: viral shedding periods for domestic livestock and lagomorphs; potential shedding of virus in milk; earliest age at which rabies vaccination is effective and protective effect of maternal antibody; duration of immunity; postexposure prophylaxis protocols for domestic animals; models for treatment of clinical rabies; extra label vaccine use in domestic animals and wildlife rabies reservoirs; host-pathogen adaptations and dynamics; and the ecology of wildlife rabies reservoir species, especially in relation to the use of oral rabies vaccines.

B. PREVENTION AND CONTROL METHODS IN DOMESTIC AND CONFINED ANIMALS

1. PREEXPOSURE VACCINATION AND MANAGEMENT: Parenteral animal rabies vaccines should be administered only by or under the direct supervision of a licensed veterinarian on premises. Rabies vaccinations may also be administered under the supervision of a licensed veterinarian to animals held in animal control shelters before release. The veterinarian signing a rabies vaccination certificate must ensure that the person administering vaccine is identified on the certificate and is appropriately trained in vaccine storage, handling, administration, and in the management of adverse events. This practice assures that a qualified and responsible person can be held accountable for properly vaccinating the animal. Within 28 days after initial vaccination, a peak rabies virus antibody titer is reached, and the animal can be considered immunized *(29,31-33)*. An animal is currently vaccinated and is considered immunized if the initial vaccination was administered at least 28 days previously or booster vaccinations have been administered in accordance with this compendium.

Regardless of the age of the animal at initial vaccination, a booster vaccination should be administered 1 year later (see Parts II and III for vaccines and procedures). No laboratory or epidemiologic data exist to support the annual or biennial administration of 3- or 4-year vaccines after the initial series. Because a rapid anamnestic response is expected, an animal is considered currently vaccinated immediately after a booster vaccination *(34)*.

a) DOGS, CATS AND FERRETS

All dogs, cats, and ferrets should be vaccinated against rabies and revaccinated in accordance with Part III of this compendium. If a previously vaccinated animal is overdue for a booster, it should be revaccinated. Immediately after the booster, the animal is considered currently vaccinated and should be placed on a booster schedule, depending on the labeled duration of the vaccine used.

b) LIVESTOCK

All horses should be vaccinated against rabies *(35)*. Livestock, including species for which licensed vaccines are not available, that have frequent contact with humans (e.g., in petting zoos, fairs, and other public exhibitions) should be vaccinated against rabies *(36,37)*. Consideration should also be given to vaccinating livestock that are particularly valuable.

c) CAPTIVE WILD ANIMALS AND HYBRIDS (the offspring of wild animals crossbred to domestic animals).

(1) Wild animals or hybrids should not be kept as pets *(38-40)*. No parenteral rabies vaccines are licensed for use in wild animals or hybrids *(41)*.

(2) Animals that are maintained in exhibits and in zoological parks and are not completely excluded from all contact with rabies vectors can become infected. Moreover, wild animals might be incubating rabies when initially captured; therefore, wild-caught animals susceptible to rabies should be quarantined for a minimum of 6 months. Employees who work with animals at such facilities should receive preexposure rabies vaccination. The use of pre- or postexposure rabies vaccinations for handlers who work with animals at such facilities might reduce the need for euthanasia of captive animals that expose handlers. Carnivores and bats should be housed in a manner that precludes direct contact with the public *(36,37)*.

2. STRAY ANIMALS: Stray dogs, cats, and ferrets should be removed from the community. Local health departments and animal control officials can enforce the removal of strays more effectively if owned animals are required to have identification and are confined or kept on leash. Strays should be impounded for at least 3 business days to determine if human exposure has occurred and to give owners sufficient time to reclaim animals.

3. IMPORTATION AND INTERSTATE MOVEMENT OF ANIMALS:

a) INTERNATIONAL. CDC regulates the importation of dogs and cats into the United States (*5*). Importers of dogs must comply with rabies vaccination requirements (42 CFR, Part 71.51[c] [http://www.cdc.gov/animalimportation/dogs.html]) and complete CDC form 75.37 (http://www.cdc.gov/animalimportation/pdf/dog-import.pdf). These regulations require dogs imported from rabies endemic countries to be vaccinated for rabies and confined for varying timeframes depending on age, prior vaccination status, and country of origin. The appropriate health official of the state of destination should be notified within 72 hours of the arrival of any imported dog required to be placed in confinement under these regulations. Failure of the owner to comply with these confinement requirements should be promptly reported to the Division of Global Migration and Quarantine, CDC (telephone: 404-639-4528 or 404-639-4537).

Federal regulations alone are insufficient to prevent the introduction of rabid animals into the United States *(3,4,42,43)*. All imported dogs and cats are subject to state and local laws governing rabies and should be currently vaccinated against rabies in accordance with this compendium. Failure of the owner to comply with state or local requirements should be referred to the appropriate state or local official.

b) AREAS WITH DOG-TO-DOG RABIES TRANSMISSION. Canine rabies virus variants have been eliminated in the United States *(2,6)*. Rabid dogs have been introduced into the continental United States from areas with dog-to-dog rabies transmission *(3,4,42,43)*. The movement of dogs for the purposes of adoption or sale from areas with dog-dog rabies transmission increases the risk of introducing canine-transmitted rabies to areas where it does not currently exist and should be prohibited.

c) INTERSTATE. Before interstate (including commonwealths and territories) movement, dogs, cats, ferrets, and horses should be currently vaccinated against rabies in accordance with this compendium's recommendations (see Part I. B.1.). Animals in transit should be accompanied by a currently valid NASPHV Form 51, Rabies Vaccination Certificate (http://www.nasphv.org/Documents/RabiesVacCert.pdf). When an interstate health certificate or certificate of veterinary inspection is required, it should contain the same rabies vaccination information as Form 51.

4. ADJUNCT PROCEDURES: Methods or procedures that enhance rabies control include the following (http://www.rabiesblueprint.com/spip.php?article119):

a) IDENTIFICATION. Dogs, cats, and ferrets should be identified (e.g., metal or plastic tags or microchips) to allow for verification of rabies vaccination status.

b) LICENSURE. Registration or licensure of all dogs, cats, and ferrets is an integral component of an effective rabies control program. A fee is frequently charged for such licensure, and revenues collected are used to maintain rabies or animal control activities. Evidence of current vaccination should be an essential prerequisite to licensure.

c) CANVASSING. House-to-house canvassing by animal control officials facilitates enforcement of vaccination and licensure requirements.

d) CITATIONS. Citations are legal summonses issued to owners for violations, including the failure to vaccinate or license their animals. The authority for officers to issue citations should be an integral part of each animal control program.

e) ANIMAL CONTROL. All local jurisdictions should incorporate stray animal control, leash laws, animal bite prevention, and training of personnel in their programs.

f) PUBLIC EDUCATION. All local jurisdictions should incorporate education covering responsible pet ownership, bite prevention, and appropriate veterinary care in their programs.

5. POSTEXPOSURE MANAGEMENT: This section refers to any animal exposed (see Part I.A.2.) to a confirmed or suspected rabid animal. Wild mammalian carnivores or bats that are not available or suitable for testing should be regarded as rabid animals.

a) DOGS, CATS AND FERRETS. Any illness in an exposed animal should be reported immediately to the local health department. If signs suggestive of rabies develop (e.g., paralysis, seizures, etc.), the animal should be euthanized and the head shipped for testing as described in Part I.A.9.

(1) Dogs, cats, and ferrets that have never been vaccinated and are exposed to a rabid animal should be euthanized immediately. If the owner is unwilling to have this done, the animal should be placed in strict isolation for 6 months. Isolation in this context refers to confinement in an enclosure that precludes direct contact with people and other animals. Rabies vaccine should be administered upon entry into isolation or up to 28 days before release to comply with preexposure vaccination recommendations (see Part I.B.1.a.). There are currently no USDA licensed biologics for postexposure prophylaxis of previously unvaccinated domestic animals, and there is evidence that the use of vaccine alone will not reliably prevent the disease in these animals *(44)*.

(2) Animals overdue for a booster vaccination should be evaluated on a case-by-case basis based upon severity of exposure, time elapsed since last vaccination, number of previous vaccinations, current health status, and local rabies epidemiology to determine need for euthanasia or immediate revaccination and observation/isolation.

(3) Dogs, cats, and ferrets that are currently vaccinated should be revaccinated immediately, kept under the owner's control, and observed for 45 days. The rationale for an observation period is based in part on the potential for: overwhelming viral challenge, incomplete vaccine efficacy, improper vaccine administration, variable host immunocompetence, and immune-mediated fatality (i.e., early death phenomenon) *(12,45-47)*.

b) LIVESTOCK. All species of livestock are susceptible to rabies; cattle and horses are the most frequently reported infected species *(2)*. Any illness in an exposed animal should be reported immediately to the local health and agriculture officials. If signs suggestive of rabies develop, the animal should be euthanized and the head shipped for testing as described in Part I.A.9.

(1) Unvaccinated livestock should be euthanized immediately. If the animal is not euthanized, it should be observed and confined on a case-by-case basis for 6 months.

(2) Livestock exposed to a rabid animal and currently vaccinated with a vaccine approved by USDA for that species should be revaccinated immediately and observed for 45 days.

(3) Multiple rabid animals in a herd or herbivore-to-herbivore transmission are uncommon *(48)*; therefore, restricting the rest of the herd if a single animal has been exposed to or infected by rabies is usually not necessary.

(4) Handling and consumption of tissues from exposed animals might carry a risk for rabies transmission. Risk factors depend in part on the site(s) of exposure, amount of virus present, severity of wounds, and whether sufficient contaminated tissue has been excised. If an exposed animal is to be custom or home-slaughtered for consumption, it should be done immediately after exposure, and all tissues should be cooked thoroughly. Persons handling exposed animals, carcasses, and tissues should use barrier precautions *(49,50)*. Historically, federal guidelines for meat inspectors required that any animal known to have been exposed to rabies within 8 months be rejected for slaughter *(51)*. USDA Food and Inspection Service (FSIS) and state meat inspectors should be notified if such exposures occur in food animals before slaughter.

Rabies virus is widely distributed in tissues of rabid animals *(52-54)*. Tissues and products from a rabid animal should not be used for human or animal consumption *(55,56)* or transplantation *(57)*. Pasteurization and cooking will inactivate rabies virus *(58)*; therefore, inadvertently drinking pasteurized milk or eating thoroughly cooked animal products does not constitute a rabies exposure.

c) OTHER ANIMALS. Other mammals exposed to a rabid animal should be euthanized immediately. Animals maintained in USDA-licensed research facilities or accredited zoological parks should be evaluated on a case-by-case basis in consultation with public health authorities. Management options may include isolation, observation, or administration of rabies biologics.

6. MANAGEMENT OF ANIMALS THAT BITE HUMANS:

a) Dogs, Cats, and Ferrets. Rabies virus is excreted in the saliva of infected dogs, cats, and ferrets during illness and/or for only a few days before illness or death *(59-61)*. Regardless of rabies vaccination status, a healthy dog, cat, or ferret that exposes a person should be confined and observed daily for 10 days from the time of the exposure *(62)*; administration of rabies vaccine to the animal is not recommended during the observation period to avoid confusing signs of rabies with rare adverse reactions *(13)*. Any illness in the animal should be reported immediately to the local health department. Such animals should be evaluated by a veterinarian at the first sign of illness during confinement. If signs suggestive of rabies develop, the animal should be euthanized and the head submitted for testing as described in Part I.A.9. Any stray or unwanted dog, cat, or ferret that exposes a person may be euthanized immediately and the head submitted for rabies examination.

b) Other Animals. Other animals that might have exposed a person to rabies should be reported immediately to the local health department. Management of animals other than dogs, cats, and ferrets depends on the species, the circumstances of the exposure, the epidemiology of rabies in the area, the exposing animal's history, current health status, and the animal's potential for exposure to rabies. The shedding period for rabies virus is undetermined for most species. Previous vaccination of these animals might not preclude the necessity for euthanasia and testing.

7. OUTBREAK PREVENTION AND CONTROL. The emergence of new rabies virus variants or the introduction of non-indigenous viruses poses a significant risk to humans, domestic animals, and wildlife *(63-70)*. A rapid and comprehensive response includes the following measures *(71)*:

a) Characterize the virus at the national reference laboratory.
b) Identify and control the source of the introduction.
c) Enhance laboratory-based surveillance in wild and domestic animals.
d) Increase animal rabies vaccination rates.
e) Restrict the movement of animals.
f) Evaluate the need for vector population reduction.
g) Coordinate a multiagency response.
h) Provide public and professional outreach and education.

8. DISASTER RESPONSE: Animals might be displaced during and after man-made or natural disasters and require emergency sheltering (http://www.bt.cdc.gov/disasters/petshelters.asp and http://www.avma.org/disaster/default.asp) *(72).* Animal rabies vaccination and exposure histories often are not available for displaced animals. Disaster response creates situations where animal caretakers might lack appropriate training and preexposure vaccination. In such situations, it is critical to implement and coordinate rabies prevention and control measures to reduce the risk of rabies transmission and the need for human PEP. Such measures include actions to:

a) Coordinate relief efforts of individuals and organizations with the local emergency operations center before deployment.
b) Examine each animal at a triage site for possible bite injuries or signs of rabies.
c) Isolate animals exhibiting signs of rabies, pending evaluation by a veterinarian.
d) Ensure that all animals have a unique identifier.
e) Administer a rabies vaccination to all dogs, cats and ferrets unless reliable proof of vaccination exists.
f) Adopt minimum standards for animal caretakers as feasible, including personal protective equipment, preexposure rabies vaccination, and appropriate training in animal handling *(73).*
g) Maintain documentation of animal disposition and location (e.g., returned to owner, died or euthanized, adopted, relocated to another shelter, and address of new location).
h) Provide facilities to confine and observe animals involved in exposures (see Part I.B.6.).
i) Report human exposures to appropriate public health authorities (see Part I.A.3.).

C. PREVENTION AND CONTROL METHODS RELATED TO WILDLIFE

The public should be warned not to handle or feed wild mammals. Wild mammals and hybrids that expose persons, pets, or livestock should be considered for euthanasia and rabies diagnosis. A person exposed by any wild mammal should immediately report the incident to a healthcare provider who, in consultation with public health authorities, can evaluate the need for PEP (*9,10).*

Translocation of infected wildlife has contributed to the spread of rabies *(63-68,74)*; therefore, the translocation of known terrestrial rabies reservoir species should be prohibited. Whereas state regulated wildlife rehabilitators and nuisance wildlife control operators may play a role in a comprehensive rabies control program, minimum standards for persons who handle wild mammals should include rabies vaccination, appropriate training, and continuing education.

1. CARNIVORES: The use of oral rabies vaccines (ORV) for the mass vaccination of free-ranging wildlife should be considered in selected situations, with the approval of the appropriate state agencies *(14,75).* There have been documented successes using ORV to control rabies in wildlife in North America *(75-78).* The currently licensed vaccinia-vectored ORV is labeled for use in raccoons and coyotes. The distribution of ORV should be based on scientific assessments of the target species and followed by timely and appropriate analysis of surveillance data; such results should be provided to all stakeholders. In addition, parenteral vaccination (trap-vaccinate-release) of wildlife rabies reservoirs may be integrated into coordinated ORV programs to enhance their effectiveness. Continuous and persistent programs for trapping

or poisoning wildlife are not effective in reducing wildlife rabies reservoirs on a statewide basis. However, limited population control in high-contact areas (e.g., picnic grounds, camps, and suburban areas) might be indicated for the removal of selected high-risk species of wildlife. State agriculture, public health, and wildlife agencies should be consulted for planning, coordination, and evaluation of vaccination or population reduction programs *(14)*.

2. BATS: From the 1950's to date, indigenous rabid bats have been reported from every state except Hawaii and have caused rabies in at least 43 humans in the United States *(79-92).* Bats should be excluded appropriately from houses, public buildings, and adjacent structures to prevent direct association with humans *(93,94)*. Such structures should then be made bat-proof by sealing entrances used by bats. Controlling rabies in bats through programs designed to reduce bat populations is neither feasible nor desirable.

Part II. Recommendations for Parenteral Rabies Vaccination Procedures

A. VACCINE ADMINISTRATION: All animal rabies vaccines should be restricted to use by or under the direct supervision of a veterinarian *(95)*, except as recommended in Part I.B.1.

B. VACCINE SELECTION: Part III lists all vaccines licensed by USDA and marketed in the United States at the time of publication. New vaccine approvals or changes in label specifications made subsequent to publication should be considered as part of this list. Any of the listed vaccines can be used for revaccination, even if the product is not the same as previously administered. Vaccines used in state and local rabies control programs should have at least a 3-year duration of immunity. This constitutes the most effective method of increasing the proportion of immunized dogs and cats in any population *(96)*. No laboratory or epidemiologic data exist to support the annual or biennial administration of 3- or 4-year vaccines following the initial series.

C. ADVERSE EVENTS: Currently, no epidemiologic association exists between a particular licensed vaccine product and adverse events *(13,97-98)*. Although rare, adverse events including vomiting, injection site swelling, lethargy, hypersensitivity, and rabies in a previously vaccinated animal have been reported. Adverse events should be reported to the vaccine manufacturer and to USDA, Animal and Plant Health Inspection Service, Center for Veterinary Biologics (Internet: http://www.aphis.usda.gov/animal_health/vet_biologics/vb_adverse_event.shtml; telephone: 800-752-6255). No contraindication to rabies vaccination exists. Animals with a previous history of anaphylaxis can be medically managed and observed after vaccination *(46)*.

D. WILDLIFE AND HYBRID ANIMAL VACCINATION: The safety and efficacy of parenteral rabies vaccination of wildlife and hybrids have not been established, and no rabies vaccines are licensed for these animals. Zoos or research institutions may establish vaccination programs to attempt to protect valuable animals, but these should not replace appropriate public health activities that protect humans (see Part I.B.1.c.2).

E. ACCIDENTAL HUMAN EXPOSURE TO VACCINE: Human exposure to parenteral animal rabies vaccines listed in Part III does not constitute a risk for rabies virus infection. Human exposure to vaccinia-vectored oral rabies vaccines should be reported to state health officials *(100,101)*.

F. RABIES CERTIFICATE: All agencies and veterinarians should use NASPHV Form 51 (revised 2007), Rabies Vaccination Certificate, or an equivalent. This form can be obtained from vaccine manufacturers, NASPHV (http://www.nasphv.org/Documents/RabiesVacCert.pdf), or CDC (http://www.cdc.gov/rabies/pdf/nasphv_form51.pdf). The form must be completed in full and signed by the administering or supervising veterinarian. Computer generated forms containing the same information are also acceptable.

III.Rabies Vaccines Licensed and Marketed in the U.S., 2011

Product Name	Produced by	Marketed by	For Use In	Dosage	Age at Primary Vaccination[a]	Booster Recommended	Route of Inoculation
A) MONOVALENT (Inactivated)							
RABVAC 1	Boehringer Ingelheim Vetmedica, Inc. License No. 112	Boehringer Ingelheim Vetmedica, Inc.	Dogs Cats	1 ml 1 ml	3 months[b] 3 months	Annually Annually	IM[c] or SC[d] IM or SC
RABVAC 3	Boehringer Ingelheim Vetmedica, Inc. License No. 112	Boehringer Ingelheim Vetmedica, Inc.	Dogs Cats Horses	1 ml 1 ml 2 ml	3 months 3 months 3 months	1 year later & triennially 1 year later & triennially Annually	IM or SC IM or SC IM
RABVAC 3 TF	Boehringer Ingelheim Vetmedica, Inc. License No. 112	Boehringer Ingelheim Vetmedica, Inc.	Dogs Cats Horses	1 ml 1 ml 2 ml	3 months 3 months 3 months	1 year later & triennially 1 year later & triennially Annually	IM or SC IM or SC IM
CONTINUUM RABIES	Intervet, Incorporated License No. 165A	Intervet, Incorporated	Dogs Cats	1 ml 1 ml	3 months 3 months	1 year later & triennially 1 year later & quadrennially	SC SC
EQUI-RAB	Intervet, Incorporated License No. 165A	Intervet, Incorporated	Horses	1 ml	4 months	Annually	IM
PRORAB-1	Intervet, Incorporated License No. 165A	Intervet, Incorporated	Dogs Cats Sheep	1 ml 1 ml 2 ml	3 months 3 months 3 months	Annually Annually Annually	IM or SC IM or SC IM
DEFENSOR 1	Pfizer, Incorporated License No. 189	Pfizer, Incorporated	Dogs Cats	1 ml 1 ml	3 months 3 months	Annually Annually	IM or SC SC
DEFENSOR 3	Pfizer, Incorporated License No. 189	Pfizer, Incorporated	Dogs Cats Sheep Cattle	1 ml 1 ml 2 ml 2 ml	3 months 3 months 3 months 3 months	1 year later & triennially 1 year later & triennially Annually Annually	IM or SC SC IM IM
RABDOMUN	Pfizer, Incorporated License No. 189	Schering-Plough Animal Health	Dogs Cats Sheep Cattle	1 ml 1 ml 2 ml 2 ml	3 months 3 months 3 months 3 months	1 year later & triennially 1 year later & triennially Annually Annually	IM or SC SC IM IM
RABDOMUN 1	Pfizer, Incorporated License No. 189	Schering-Plough Animal Health	Dogs Cats	1 ml 1 ml	3 months 3 months	Annually Annually	IM or SC SC
IMRAB 1	Merial, Incorporated License No. 298	Merial, Incorporated	Dogs Cats	1 ml 1 ml	3 months 3 months	Annually Annually	SC SC
IMRAB 1 TF	Merial, Incorporated License No. 298	Merial, Incorporated	Dogs Cats	1 ml 1 ml	3 months 3 months	Annually Annually	SC SC
IMRAB 3	Merial, Incorporated License No. 298	Merial, Incorporated	Dogs Cats Sheep Cattle Horses Ferrets	1 ml 1 ml 2 ml 2 ml 2 ml 1 ml	3 months 3 months 3 months 3 months 3 months 3 months	1 year later & triennially 1 year later & triennially 1 year later & triennially Annually Annually Annually	IM or SC IM or SC IM or SC IM or SC IM or SC SC
IMRAB 3 TF	Merial, Incorporated License No. 298	Merial, Incorporated	Dogs Cats Ferrets	1 ml 1 ml 1 ml	3 months 3 months 3 months	1 year later & triennially 1 year later & triennially Annually	IM or SC IM or SC SC
IMRAB Large Animal	Merial, Incorporated License No. 298	Merial, Incorporated	Cattle Horses Sheep	2 ml 2 ml 2 ml	3 months 3 months 3 months	Annually Annually 1 year later & triennially	IM or SC IM or SC IM or SC
B) MONOVALENT (Rabies glycoprotein, live canary pox vector)							
PUREVAX Feline Rabies	Merial, Incorporated License No. 298	Merial, Incorporated	Cats	1ml	3 months	Annually	SC
C) COMBINATION (Inactivated rabies)							
CONTINUUM DAP-R	Intervet, Incorporated License No. 165A	Intervet, Incorporated	Dogs	1 ml	3 months	1 year later & triennially	SC
CONTINUUM Feline HCP-R	Intervet, Incorporated License No. 165A	Intervet, Incorporated	Cats	1 ml	3 months	1 year later & triennially	SC
Equine POTOMAVAC + IMRAB	Merial, Incorporated License No. 298	Merial, Incorporated	Horses	1 ml	3 months	Annually	IM
D) COMBINATION (Rabies glycoprotein, live canary pox vector)							
PUREVAX Feline 3/ Rabies	Merial, Incorporated License No. 298	Merial, Incorporated	Cats	1ml	8 weeks 3 months	Every 3 weeks until 3 months & annually 3 weeks later & annually	SC
PUREVAX Feline 4/ Rabies	Merial, Incorporated License No. 298	Merial, Incorporated	Cats	1ml	8 weeks 3 months	Every 3 weeks until 3 months & annually 3 weeks later & annually	SC
E) ORAL (Rabies glycoprotein, live vaccinia vector) - RESTRICTED TO USE IN STATE AND FEDERAL RABIES CONTROL PROGRAMS							
RABORAL V-RG	Merial, Incorporated License No. 298	Merial, Incorporated	Coyotes Raccoons	N/A	N/A	As determined by local authorities	Oral

a. Minimum age (or older) and revaccinated one year later
b. One month = 28 days
c. Intramuscularly
d. Subcutaneously
e. Fort Dodge Animal Health was recently acquired by Boehringer Ingelheim Vetmedica, Inc.

Rabies Vaccine Manufacturer Contact Information

Manufacturer	Phone Number	Internet Address
Boehringer Ingelheim Vetmedica, Inc.	800-638-2226	Not available
Intervet, Inc.	800-441-8272	http://www.intervetusa.com
Merial, Inc.	888-637-4251	http://us.merial.com
Pfizer, Inc.	800-366-5288	http://www.pfizerah.com

ADVERSE EVENTS: Adverse events should be reported to the vaccine manufacturer and to USDA, Animal and Plant Health Inspection Service, Center for Veterinary Biologics (Internet: http://www.aphis.usda.gov/animal_health/vet_biologics/vb_adverse_event.shtml; telephone: 800-752-6255;).

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