National Association of State Public Health Veterinarians, Inc.

December 31, 2007

MEMORANDUM

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

FROM: Ben Sun, D.V.M., M.P.V.M., Chair
Compendium of Animal Rabies Prevention and Control Committee

SUBJECT: *Compendium of Animal Rabies Prevention and Control, 2008*

The National Association of State Public Health Veterinarians (NASPHV) is pleased to provide the 2008 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 annually, revised as necessary, and the most current version replaces all previous versions. This cover memo summarizes the notable changes that were made to the document this year and provides updates on other rabies issues.

COMPENDIUM CHANGES

The introduction was expanded to highlight that the United States was recently declared free of canine variant rabies.

Part I A.10. Rabies Research was added to highlight the need for many types of studies for the development of science-based recommendations.

Part I B.5.(a). was expanded to clarify that isolation in the context of this document, refers to confinement of an animal in a manner which precludes human or animal contact. In addition, some of the factors were added that are used to make case-by-case evaluations regarding animals that exposed to rabies and overdue for rabies vaccination.

Part II C. was expanded to clarify that an adverse event includes rabies in a previously vaccinated animal.

Part III: Rabies Vaccines Licensed and Marketed in the U.S., 2008 was reordered for consistency but no changes were made to list of approved rabies vaccines.

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

RABIES UPDATES

As of December 31, one fatal human case of rabies virus infection was reported in 2007. An adult Minnesota resident was infected with rabies but no rabies antigen was recovered for variant characterization. A bat bite was reported approximately one month prior to clinical disease onset.

The second World Rabies Day will be on September 28, 2008. More information is available at: http://www.worldrabiesday.org/index_en.php.

The 19th annual international conference on Rabies in the Americas (RITA) will be held from September 28 – October 3, 2008 at the Centers for Disease Control and Prevention in Atlanta, GA. More information is available at: http://www.cdc.gov/rabies/events/rita.html.

CDC's Rabies Laboratory is attempting to collect specimens to evaluate the potential for rabies transmission via milk from lactating animals. When rabies is suspected in a lactating animal, milk and mammary tissue should be collected and stored. If the animal tests positive, 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

Although an uncommon occurrence, rodents (particularly groundhogs), beavers, and lagomorphs are occasionally diagnosed with the raccoon variant of rabies virus in the Eastern U.S. In order to better evaluate the potential for these animals to transmit rabies, the Rabies Section of CDC would like to receive the entire head of any rodent or lagomorph testing positive for rabies. Rabies diagnostic laboratories should store the heads of highly suspect rodents and lagomorphs until testing is completed, and send the specimens to CDC at the above address for further analysis if results are positive.

Compendium of Animal Rabies Prevention and Control, 2008*

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

Rabies is a fatal viral zoonosis and a serious public health problem (*1*). The disease is an acute progressive encephalitis caused by a lyssavirus. Although the United States has been declared free of canine rabies virus variant transmission, multiple viral variants are maintained in wild mammal populations and there is always a risk of reintroduction of canine rabies (*2*). 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 recommendations in this compendium serve as a basis for animal rabies prevention and control programs throughout the U. S. and facilitate standardization of procedures among jurisdictions, thereby contributing to an effective national rabies control program. This document is reviewed annually, revised as necessary, and 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; Part II contains recommendations for parenteral vaccination procedures; all animal rabies vaccines licensed by the United States Department of Agriculture (USDA) and marketed in the United States are listed in Part III.

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Association of Public Health Laboratories (APHL)
Council of State and Territorial Epidemiologists (CSTE)
National Animal Control Association (NACA)

Part I: Rabies Prevention and Control

A. PRINCIPLES OF RABIES PREVENTION AND CONTROL

1. **RABIES EXPOSURE:** Rabies is transmitted only 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 (*3*). Questions about possible exposures should be directed promptly to state or local public health authorities.

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

3. **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 administration of human rabies immune globulin and vaccine. The rationale for recommending preexposure and postexposure rabies prophylaxis and details of their administration can be found in the current recommendations of the Advisory Committee on Immunization Practices (ACIP) (*3*). 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.

4. **DOMESTIC ANIMALS:** 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 71 in 2006 (*2*). Because more rabies cases are reported annually involving cats (247 in 2006) 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. The recommended vaccination procedures and the licensed animal vaccines are specified in Parts II and III of the compendium respectively.

5. **RABIES IN VACCINATED ANIMALS:** Rabies is rare in vaccinated animals (*4*). If such an event is suspected, it should be reported to state 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; or e-mail: CVB@usda.gov). The laboratory diagnosis should be confirmed and the virus variant characterized by a rabies reference laboratory. A thorough epidemiologic investigation should be conducted.

6. **RABIES IN WILDLIFE:** The control of rabies among wildlife reservoirs is difficult (*5*). Vaccination of free-ranging wildlife or selective population reduction might be useful in some situations, 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 AVMA, CSTE, NACA, and NASPHV strongly recommend the enactment and enforcement of state laws prohibiting their importation, distribution, translocation, and private ownership.

7. **RABIES SURVEILLANCE:** Laboratory-based rabies surveillance and variant typing are essential components of rabies prevention and control programs. Accurate and timely information is necessary to guide human postexposure prophylaxis 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 wildlife.

8. **RABIES DIAGNOSIS:** Rabies testing should be performed in accordance with the established national standardized protocol for rabies testing (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 (*6,7*). Euthanasia (*8*) should be accomplished 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 laboratory processing and prevent a delay in testing, any animal or animal specimen being submitted for testing should preferably be stored and shipped under refrigeration and not be frozen. Chemical fixation of tissues should be avoided to prevent significant testing delays and because it may preclude reliable testing. Questions about testing of fixed tissues should be directed to the local rabies laboratory or public health department.

9. **RABIES SEROLOGY:** Some "rabies-free" jurisdictions may 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 should not be used as a substitute for current vaccination in managing rabies exposures or determining the need for booster vaccinations in animals (*9-11*).

10. **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 livestock and lagomorphs, potential shedding of virus in milk, earliest age at which rabies vaccination is effective, postexposure prophylaxis for domestic animals, extra label vaccine use in domestic animals and wildlife rabies reservoirs, and the ecology of wildlife rabies reservoir species, especially in relationship 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 veterinarian. Rabies vaccinations may also be administered under the supervision of a veterinarian to animals held in animal control shelters prior to release. Any veterinarian signing a rabies 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 (*12*). 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 following the initial series. Because a rapid anamnestic response is expected, an animal is considered currently vaccinated immediately after a booster vaccination (*13*).

(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 following the booster, the animal is considered currently vaccinated and should be placed on a schedule depending on the labeled duration of the vaccine used.

(b) LIVESTOCK

Consideration should be given to vaccinating livestock that are particularly valuable. Animals that have frequent contact with humans (e.g., in petting zoos, fairs, and other public exhibitions) and horses traveling interstate should be currently vaccinated against rabies (*14*,*15*).

(c) CONFINED ANIMALS

(1) WILD

No parenteral rabies vaccines are licensed for use in wild animals or hybrids (the offspring of wild animals crossbred to domestic animals). Wild animals or hybrids should not be kept as pets (*16*-*19*).

(2) MAINTAINED IN EXHIBITS AND IN ZOOLOGICAL PARKS

Captive mammals that 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 (*14*).

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 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. Importers of dogs must comply with rabies vaccination requirements (42 CFR, Part 71.51[c] [http://www.cdc.gov/ncidod/dq/animal.htm]) and complete CDC form 75.37 (http://www.cdc.gov/ncidod/dq/pdf/animal/dog_quarantine_notice_08-04-06-cdc7537.pdf). 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 the CDC regulation. Failure of the owner to comply with these confinement requirements should be promptly reported to the Division of Global Migration and Quarantine, CDC (telephone: 404-639-3441).

Federal regulations alone are insufficient to prevent the introduction of rabid animals into the United States (*20*,*21*). 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) INTERSTATE. Before interstate movement (including commonwealths and territories) dogs, cats, ferrets, and horses should be currently vaccinated against rabies in accordance with the 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.

(c) AREAS WITH DOG-TO-DOG RABIES TRANSMISSION. Canine rabies virus variants have been eliminated in the United States (*2*). Rabid dogs have been introduced into the continental United States from areas with dog-to-dog rabies transmission (*20*,*21*). This practice poses the risk of introducing canine-transmitted rabies to areas where it does not currently exist. The movement of dogs for the purposes of adoption or sale from areas with dog-to-dog rabies transmission should be prohibited.

4. ADJUNCT PROCEDURES: Methods or procedures that enhance rabies control include the following:

(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.1.) 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. Unvaccinated dogs, cats, and ferrets 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 1 month prior to 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 (*22*). Animals overdue for a booster vaccination need to be evaluated on a case-by-case basis (e.g., severity of exposure, time elapsed since last vaccination, number of prior vaccinations, current health status, local rabies epidemiology). Dogs, cats, and ferrets that are currently vaccinated should be revaccinated immediately, kept under the owner's control, and observed for 45 days. Any illness in an isolated or confined animal should be reported immediately to the local health department. If signs suggestive of rabies develop, the animal should be euthanized and the head shipped for testing as described in Part I.A.8.

(b) LIVESTOCK. All species of livestock are susceptible to rabies; cattle and horses are the most frequently reported infected species (*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. Unvaccinated livestock should be euthanized immediately. If the animal is not euthanized it should be kept under close observation for 6 months. Any illness in an animal under observation should be reported immediately to the local health department. If signs suggestive of rabies develop, the animal should be euthanized and the head shipped for testing as described in Part I.A.8.

Handling and consumption of tissues from exposed animals may 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 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 . Historically, federal guidelines for meat inspectors required that any animal known to have been exposed to rabies within 8 months be rejected for slaughter. USDA Food and Inspection Service (FSIS) meat inspectors should be notified if such exposures occur in food animals prior to slaughter.

Rabies virus may be widely distributed in tissues of infected animals (*23*). Tissues and products from a rabid animal should not be used for human or animal consumption (*24*). Pasteurization temperatures will inactivate rabies virus, therefore, inadvertently drinking pasteurized milk or eating thoroughly cooked animal products does not constitute a rabies exposure.

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

(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.

6. MANAGEMENT OF ANIMALS THAT BITE HUMANS:

(a) DOGS, CATS, AND FERRETS. Rabies virus may be excreted in the saliva of infected dogs, cats, and ferrets during illness and/or for only a few days prior to illness or death (*25-27*). A healthy dog, cat, or ferret that bites a person should be confined and observed daily for 10 days (*28*); administration of rabies vaccine to the animal is not recommended during the observation period to avoid confusing signs of rabies with possible side effects of vaccine administration. 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.8. Any stray or unwanted dog, cat, or ferret that bites a person may be euthanized immediately and the head submitted for rabies examination.

(b) OTHER BITING ANIMALS. Other biting animals which 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 bite, the epidemiology of rabies in the area, the biting animal's history, current health status, and potential for exposure to rabies. Prior vaccination of these animals may 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 (*29-36*). A rapid and comprehensive response includes the following measures:

(a) Characterize the virus at a national or regional 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 multi-agency response.
(h) Provide public and professional outreach and education.

8. DISASTER RESPONSE:

Animals may 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) (*37*). Animal rabies vaccination and exposure histories are often not available for displaced animals. Disaster response creates situations where animal caretakers may lack appropriate training and preexposure vaccination. For these 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 postexposure prophylaxis. Such measures include:

(a) Coordinate relief efforts of individuals and organizations with the local emergency operations center prior to deployment.
(b) Examine each animal at a triage site for 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 that include personal protective equipment, previous rabies vaccination, and appropriate training in animal handling (see Part I.C.).
(g) Maintain documentation of animal disposition and location (e.g., returned to owner, died or euthanized, adopted, relocated to another shelter, address of new location).
(h) Provide facilities to confine and observe animals involved in exposures (see Part I.A.1.).
(i) Report human exposures to appropriate public health authorities (see Part I.B.6.).

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 bite or otherwise expose persons, pets, or livestock should be considered for euthanasia and rabies examination. A person bitten 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 postexposure prophylaxis (*3*).

Translocation of infected wildlife has contributed to the spread of rabies (*30-34*); therefore, the translocation of known terrestrial rabies reservoir species should be prohibited. While 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 licensed oral vaccines for the mass vaccination of free-ranging wildlife should be considered in selected situations, with the approval of the state agency responsible for animal rabies control (*5*,*38*). The distribution of oral rabies vaccine 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 oral rabies vaccination 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, suburban areas) may be indicated for the removal of selected high-risk species of wildlife (*5*). State agriculture, public health, and wildlife agencies should be consulted for planning, coordination, and evaluation of vaccination or population-reduction programs.

2. **BATS.** Indigenous rabid bats have been reported from every state except Hawaii and have caused rabies in more than 40 humans in the United States (*39-46*). Bats should be excluded from houses, public buildings, and adjacent structures to prevent direct association with humans (*47*,*48*). 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 (*49*) except as recommended in Part I.B.1. All vaccines must be administered in accordance with the specifications of the product label or package insert.

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 (*50*). 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 (*51*,*52*). Adverse events, including rabies in a previously vaccinated animal, 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; or e-mail: CVB@usda.gov).

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. Parenteral vaccination (trap-vaccinate-release) of wildlife rabies reservoirs may be integrated into coordinated oral rabies vaccination programs as described in Part I.C.1. to enhance their effectiveness. Zoos or research institutions may establish vaccination programs, which attempt to protect valuable animals, but these should not replace appropriate public health activities that protect humans (see Part I.B.1.(c)(2)) (*9*).

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 (*53*).

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). 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.

Part III: Rabies Vaccines Licensed and Marketed in the U.S., 2008

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	Fort Dodge Animal Health License No. 112	Fort Dodge Animal Health	Dogs Cats	1 ml 1 ml	3 months[b] 3 months	Annually Annually	IM[c] or SC[d] IM or SC
RABVAC 3	Fort Dodge Animal Health License No. 112	Fort Dodge Animal Health	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	Fort Dodge Animal Health License No. 112	Fort Dodge Animal Health	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
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	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	Dogs Cats	1 ml 1 ml	3 months 3 months	Annually Annually	IM or SC SC
CONTINUUM RABIES	Intervet, Incorporated License No. 286	Intervet, Incorporated	Dogs Cats	1 ml 1 ml	3 months 3 months	1 year later & triennially 1 year later & quadrennially	SC SC
PRORAB-1	Intervet, Incorporated License No. 286	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
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	8 weeks	Annually	SC
C) COMBINATION (Inactivated rabies)							
CONTINUUM DAP-R	Intervet, Incorporated License No. 286	Intervet, Incorporated	Dogs	1 ml	3 months	1 year later & triennially	SC
CONTINUUM Feline HCP-R	Intervet, Incorporated License No. 286	Intervet, Incorporated	Cats	1 ml	3 months	1 year later & quadrennially[e]	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	Annually	SC
PUREVAX Feline 4/ Rabies	Merial, Incorporated License No. 298	Merial, Incorporated	Cats	1ml	8 weeks	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. Non-rabies fractions have a 3 year duration (see label)

Rabies Vaccine Manufacturer Contact Information

Manufacturer	Phone Number	Internet Address
Fort Dodge Animal Health	800-533-8536	http://www.wyeth.com/divisions/fort_dodge.asp
Intervet, Incorporated	800-835-0541	http://www.intervetusa.com
Merial, Incorporated	888-637-4251	http://us.merial.com/
Pfizer, Incorporated	800-366-5288	http://www.pfizerah.com
Schering-Plough Animal Health	800-521-5767	http://www.spah.com/usa/

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; or e-mail: CVB@usda.gov).

REFERENCES:

1. Rabies. In: Heymann D, ed. Control of communicable diseases manual. 18th ed. Washington, DC: American Public Health Association; 2004:438–47.
2. Blanton JD, Hanlon CA, Rupprecht CE. Rabies surveillance in the United States during 2006. J Am Vet Med Assoc 2007;231:540-56. Available at: http://www.cdc.gov/rabies/publications/.
3. CDC. Human rabies prevention—United States, 1999. Recommendations of the Advisory Committee on Immunization Practices (ACIP). MMWR 1999;48:(No. RR-1). Available at: http://www.cdc.gov/mmwr/preview/mmwrhtml/00056176.htm.
4. McQuiston J, Yager PA, Smith JS, Rupprecht CE. Epidemiologic characteristics of rabies virus variants in dogs and cats in the United States, 1999. J Am Vet Med Assoc 2001;218:1939–42.
5. Hanlon CA, Childs JE, Nettles VF, et al. Recommendations of the Working Group on Rabies. Article III: Rabies in wildlife. J Am Vet Med Assoc 1999;215:1612–8.
6. Hanlon CA, Smith JS, Anderson GR, et al. Recommendations of the Working Group on Rabies. Article II: Laboratory diagnosis of rabies. J Am Vet Med Assoc 1999;215:1444–6.
7. Rudd RJ, Smith JS, Yager PA, et al. A need for standardized rabies-virus diagnostic procedures: Effect of cover-glass mountant on the reliability of antigen detection by the fluorescent antibody test. Virus Res 2005; 111:83-8.
8. American Veterinary Medical Association. AVMA Guidelines on Euthanasia. June 2007. Available at: http://www.avma.org/issues/animal_welfare/euthanasia.pdf, accessed December 2007.
9. Tizard I, Ni Y. Use of serologic testing to assess immune status of companion animals. J Am Vet Med Assoc 1998;213:54–60.
10. Rabies and Other Lyssavirus Infections. In: Greene CE, Infectious Diseases of the Dog and Cat. 3rd ed., Saunders Elsevier; 2006;167-83.
11. Rupprecht CE, Gilbert J, Pitts R, Marshall K, Koprowski H. Evaluation of an inactivated rabies virus vaccine in domestic ferrets. J Am Vet Med Assoc 1990;196:1614-16.
12. Aubert MF. Practical significance of rabies antibodies in cats and dogs. Rev Sci Tech. 1992 Sep;11(3):735-60.
13. Cliquet F, Verdier Y, Sagné L, et al. Neutralising antibody titration in 25,000 sera of dogs and cats vaccinated against rabies in France, in the framework of the new regulations that offer an alternative to quarantine. Rev Sci Tech. 2003 Dec;22(3):857-66.
14. National Association of State Public Health Veterinarians. Compendium of measures to prevent disease and injury associated with animals in public settings, 2006. Available at http://www.nasphv.org.
15. Bender J, Schulman S. Reports of zoonotic disease outbreaks associated with animal exhibits and availability of recommendations for preventing zoonotic disease transmission from animals to people in such settings. J Am Vet Med Assoc 2004;224:1105–9.
16. American Veterinary Medical Association. Private ownership of wild animals. Available at: http://www.avma.org/issues/policy/wild_animal_ownership.asp, accessed December 2007.
17. Position on canine hybrids. In: Directory and resource manual. Schaumburg, IL: American Veterinary Medical Association; 2002;88–9.
18. Siino BS. Crossing the line. American Society for the Prevention of Cruelty to Animals, Animal Watch 2000;Winter:22–9.
19. Jay MT, Reilly KF, DeBess EE, Haynes EH, Bader DR, Barrett LR. Rabies in a vaccinated wolf-dog hybrid. J Am Vet Med Assoc 1994;205:1729–32.
20. CDC. An imported case of rabies in an immunized dog. MMWR 1987;36:94–6,101. Available at: http://www.cdc.gov/mmwr/preview/mmwrhtml/00000874.htm.
21. CDC. Imported dog and cat rabies—New Hampshire, California. MMWR 1988;37:559–60. Available at: http://www.cdc.gov/mmwr/preview/mmwrhtml/00001275.htm.
22. Hanlon CA, Niezgoda MN, Rupprecht CE. Postexposure prophylaxis for prevention of rabies in dogs. Am J Vet Res 2002;63:1096–100.
23. Charlton, KM. The pathogenesis of rabies and other lyssaviral infections: recent studies. Curr Top Microbiol Immunol 1994;187:95-119.
24. CDC. Mass treatment of humans who drank unpasteurized milk from rabid cows—Massachusetts, 1996–1998. MMWR 1999;48:228–9. Available at: http://www.cdc.gov/mmwr/preview/mmwrhtml/00056759.htm.
25. Vaughn JB, Gerhardt P, Paterson J. Excretion of street rabies virus in saliva of cats. J Am Med Assoc 1963;184:705.
26. Vaughn JB, Gerhardt P, Newell KW. Excretion of street rabies virus in saliva of dogs. J Am Med Assoc 1965;193:363–8.
27. Niezgoda M, Briggs DJ, Shaddock J, Rupprecht CE. Viral excretion in domestic ferrets (*Mustela putorius furo*) inoculated with a raccoon rabies isolate. Am J Vet Res 1998;59:1629–32.
28. Tepsumethanon V, Lumlertdacha B, Mitmoonpitak C, Sitprija V, Meslin FX, Wilde H. Survival of naturally infected rabid dogs and cats. Clin Infect Dis 2004;39:278–80.
29. Jenkins SR, Perry BD, Winkler WG. Ecology and epidemiology of raccoon rabies. Rev Infect Dis 1988;10:Suppl 4:S620–5.

30. CDC. Translocation of coyote rabies—Florida, 1994. MMWR 1995;44:580–7. Available at: http://www.cdc.gov/mmwr/preview/mmwrhtml/00038451.htm.
31. Rupprecht CE, Smith JS, Fekadu M, Childs JE. The ascension of wildlife rabies: a cause for public health concern or intervention? Emerg Infect Dis 1995;1(4):107–14. Available at: http://www.cdc.gov/ncidod/eid/vol1no4/rupprech.htm#top.
32. Constantine DG. Geographic translocation of bats: known and potential problems. Emerg Infect Dis 2003;9(1):17-21. Available at: http://www.cdc.gov/ncidod/EID/vol9no1/02-0104.htm.
33. Krebs JW, Strine TW, Smith JS, Rupprecht CE, Childs JE. Rabies surveillance in the United States during 1993. J Am Vet Med Assoc 1994;205:1695-709.
34. VF Nettles, JH Shaddock, RK Sikes, and CR Reyes. Rabies in translocated raccoons. Am J Public Health 1979;69:601-2.
35. RM Engeman, KL Christensen, MJ Pipas, and DL Bergman. Population monitoring in support of a rabies vaccination program for skunks in Arizona J Wildl Dis 2003;39:746-50.
36. Leslie MJ, Messenger S, Rohde RE, et al. Bat-associated Rabies Virus in Skunks. Emerg Infect Dis 2006;12(8):1274-7. Available at: http://www.cdc.gov/ncidod/EID/vol12no08/05-1526.htm.
37. The Humane Society of the United States. HSUS Disaster Services. Available at: http://www.hsus.org/hsus_field/hsus_disaster_center/.
38. Slate D, Rupprecht CE, Rooney JA, Donovan D, Lein DH, Chipman RB. Status of oral rabies vaccination in wild carnivores in the United States. Virus Res 2005;111:68-76.
39. Messenger SL, Smith JS, Rupprecht CE. Emerging epidemiology of bat-associated cryptic cases of rabies in humans in the United States. Clin Infect Dis 2002;35:738–47.
40. CDC. Human rabies—California, 2002. MMWR 2002;51:686–8. Available at: http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5131a4.htm.
41. CDC. Human rabies—Tennessee, 2002. MMWR 2002;51:828–9. Available at: http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5137a2.htm.
42. CDC. Human rabies—Iowa, 2002. MMWR 2003;52:47–8. Available at: http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5203a3.htm.
43. CDC. Human death associated with bat rabies—California, 2003. MMWR 2004;53:33–5. Available at: http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5302a4.htm.
44. CDC. Recovery of a patient from clinical rabies, Wisconsin, 2004. MMWR 2004;53:1171-3. Available at: http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5350a1.htm.
45. CDC. Human rabies – Mississippi, 2005. March 3, 2006 / 55(08);207-8. Available at: http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5508a4.htm.
46. CDC. Human rabies – Indiana and California, 2006. April 20, 2007 / 56(15);361-5. Available at: http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5615a1.htm.
47. Frantz SC, Trimarchi CV. Bats in human dwellings: health concerns and management. In: Decker DF, ed. Proceedings of the first eastern wildlife damage control conference. Ithaca, NY: Cornell University Press; 1983:299–308.
48. Greenhall AM. House bat management. US Fish and Wildlife Service, Resource Publication 143; 1982.
49. American Veterinary Medical Association. Model rabies control ordinance. Available at: http://www.avma.org/issues/policy/rabies_control.asp, accessed December 2007.
50. Bunn TO. Canine and feline vaccines, past and present. In Baer GM, ed. The natural history of rabies. 2nd ed. Boca Raton, FL: CRC Press; 1991:415–25.
51. Gobar GM, Kass PH. World wide web-based survey of vaccination practices, postvaccinal reactions, and vaccine site-associated sarcomas in cats. J Am Vet Med Assoc 2002;220:1477–82.
52. Macy DW, Hendrick MJ. The potential role of inflammation in the development of postvaccinal sarcomas in cats. Vet Clin North Am Small Anim Pract 1996;26:103–9.
53. Rupprecht CE, Blass L, Smith K et al. Human infection due to recombinant vaccinia-rabies glycoprotein virus. N Engl J Med 2001;345:582–6.