

National Elk Refuge Response Strategy for the Presence of Chronic Wasting Disease in the Jackson Elk Herd

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Background

Introduction

Chronic wasting disease (CWD) is a disease of the nervous system that affects cervids, including deer, elk, caribou and moose. Caused by a prion, or abnormal protein, CWD results in degeneration of the nervous system. As the disease progresses, the animal begins to display abnormal behavior, weight loss, and loss of control of normal bodily functions. There is no known treatment or cure. Animals may show no visible signs of illness for a year or more after infection, as a result deer, elk, caribou or moose may be infected and shedding the prion even if they look healthy. CWD is contagious, with infectious prions passed between animals and from contaminated environments (including plants and soil) that accumulate prions over time. Prions are difficult to remove and environments may remain infectious for many years.

First identified as a disease in deer in a Colorado captive facility in 1967, CWD was identified as a transmissible spongiform encephalopathy (TSE) in 1978. CWD now affects cervids in 25 states, three Canadian provinces and continues to spread each year. On November 2018, CWD was detected in a mule deer within the bounds of the Jackson Elk herd unit. On December 16, 2020, the National Park Service (NPS) announced that a CWD-positive elk had been harvested on the park during the elk reduction hunt. CWD is now in the Jackson elk herd.

Nature of the disease

Prions are proteins that normally occur on the membranes of cells, but abnormal, resistant forms accumulate in the nervous system causing neurodegenerative disease. TSEs are caused by abnormally folded, resistant forms (PrP^{res}) of the normal host prions (PrP^{c}). CWD is a fatal TSE that occurs because of the CWD-specific abnormal prion identified as PrP^{CWD} .

Host species

CWD may be found in white-tailed deer, black-tailed deer, mule deer, elk, moose, caribou and reindeer.

Transmission

The spread of CWD occurs directly through direct contact between free-ranging animals, via movements of captive animals between fenced facilities, or occasionally spontaneously as a result of protein misfolding. Horizontal animal-to-animal transmission is very efficient and is likely a significant driver of disease transmission early in an outbreak.

CWD also spreads indirectly via PrP^{CWD} shed in feces, urine and saliva, as well as decomposing carcasses. Prions have also been detected in plant tissues, such that plant material may serve as an environmental reservoir in addition to soils. The prions are very stable in the environment, which remain infectious for many years.

Prevalence of infection, morbidity and mortality

In free-ranging cervids, estimated prevalence in core endemic areas has varied from year to year. The prevalence of CWD in white-tailed deer harvested in the Wyoming Game and Fish Department (WGFD) hunt area (65) was 32% in 2003 and 43% in 2010, and 33% (n = 132) overall during the study period (2003–2010; WGFD, unpublished data). In the South Converse Mule Deer Herd Unit, CWD prevalence in mule deer was 42.9% for 2016 (Wyoming WGFD 2016 CWD Surveillance Report). In the Laramie Peak Elk Herd Unit, the 2016 CWD prevalence in elk was 5.9% and the 2012-2016 average CWD prevalence in elk was 6.4% (Wyoming WGFD 2016 CWD Surveillance Report).

Once infected, it takes about 16 months for the animal to appear ill, although the animal likely sheds infectious CWD prions in feces, saliva and urine for most of the disease course. Death often occurs within two years after infection.

Animals appear healthy until the later stages of the disease and clinical signs alone are not diagnostic of CWD. Clinical signs may include:

- Weight loss
- Decreased social interaction, loss of awareness
- Tooth grinding
- Altered posture (head and ears lowered, wide-based stance)
- Head tremors
- Incoordination
- Increased drinking
- Excessive salivation
- Increased urination
- Aspiration pneumonia

Differential diagnosis

The clinical signs listed above may occur in association with other diseases such as epizootic hemorrhagic disease, bluetongue, brain abscesses and toxicity, and may therefore be indistinguishable from CWD without laboratory diagnostics.

Occurrence

CWD is currently found in Canada, the United States, South Korea, Norway, and Finland. See the following website for the latest map of CWD in North America:

https://www.usgs.gov/centers/nwhc/science/expanding-distribution-chronic-wasting-disease?qt-science_center_objects=0#qt-science_center_objects

Laboratory diagnosis

Diagnosis of CWD requires laboratory testing for the detection of PrP^{CWD} in the medial retropharyngeal lymph nodes (RLN) or the brain stem (obex), collected post-mortem. Our current protocol in collaboration with WGFD is for RLN as the primary sample.

Post-mortem diagnostic tests

Immunohistochemistry (IHC) is the gold standard. The obex and retropharyngeal lymph nodes are placed in a 10% buffered formalin jar (10:1 ratio of formalin to tissue sample) and shipped to the WGFD's Wildlife Health Laboratory in Laramie, Wyoming for analysis. Samples are typically aggregated weekly to increase shipping efficiency and laboratory analyses. All samples collected by the National Elk Refuge (NER or Refuge) are transferred to the WGFD Disease Biologist at the Jackson, WGFD office, who forwards all samples from the Jackson Herd Segment to the state laboratory. Test results are provided on a computer-based automated system managed by WGFD and accessed by NER biologists, other staff members and the general public for their individual results of hunter harvested elk and deer. Enzyme-linked immunosorbent assay (ELISA) is a screening test. Place the fresh obex sample and retropharyngeal lymph nodes in whirl-pak bags, keep samples chilled on icepacks. Ship using overnight delivery. Frozen samples are also acceptable if packing precautions are made to ensure that the samples remain frozen until delivery to the laboratory.

Protein misfolding cyclic amplification (PMCA) and Real time quaking-induced conversion (RT-QuIC) are new diagnostic amplification techniques that are used in research but have not been applied in the field for surveillance.

Ante-mortem diagnostic tests

Although live animal sampling techniques have been developed using recto anal mucosa-associated lymphoid tissue (RAMALT) and tonsillar biopsy, these specialized techniques are difficult to perform and have a much lower rate of success in detecting CWD.

Resistance to physical and chemical action

Prions can remain in the soil for several years and are resistant to inactivation by most chemical agents, radiation, and moderate heat.

Only a few disinfectants exist for inactivate prions, these include CIP100, hypochlorous acid (HOCl) and bleach.

Incineration with heat exceeding 1000°C (1832°F), alkaline digestion in specially designed equipment, and disposal in certified municipal landfills are used for disposal of tissues and carcasses of animals with CWD.

Prevention

Because CWD is difficult to manage in free-ranging populations, disease prevention is critical. Preventive measures include:

- Basic epidemiological principle- prevent transmission of PrP^{cwd} from infected to susceptible animals.
- Prevent infected animals from coming in contact with susceptible animals.
- Prevent infected animals from contaminating CWD-free areas.
- Prevent contact between susceptible animals and CWD-contaminated areas.

In practice, this means:

- Reduce reliance on supplemental feeding to decrease artificial congregations of animals that enhance CWD transmission by:
 - Decrease the length of feeding season.
 - Continue spreading out the feed spatially to distribute animals more thinly and decrease animal contact.
 - Restricting or banning the importation of live cervids into CWD-free areas.
- Monitor whole-herd disease within game farms with depopulation or test and cull.
- Ban hunters from bringing whole carcasses, or any nervous system materials, into their home states.

A Bison and Elk Management Plan (Plan) was finalized in April 2007 with the signing of the National Environmental Policy Act Record of Decision. This 15-year plan guides management of both species for both NER and Grand Teton National Park. The Plan has two primary purposes. First, the Plan provides managers with goals, objectives, and strategies for managing bison and elk on the NER and in Grand Teton National Park for the next 15 years, in support of the purposes for which two areas were established. Second, it contributes to the missions and management policies of the U.S. Fish and Wildlife Service and the NPS. For details on elk management that may be relevant to the potential introduction and transmission of CWD in the Jackson elk herd go to

<https://www.fws.gov/bisonandelkplan/>

Treatment

There are no treatments or vaccines available for CWD.

Response Strategy Implementation

Upon discovery of positive CWD detection within the Jackson Elk Herd Unit the following response strategies shall be implemented as soon as practical but no later than one year from initial detection of CWD in Jackson Elk Herd. Timing is critical in order to prepare for eventual CWD detection on the NER.

1. Reporting

- Provide NER CWD testing reports from the WGFD Wildlife Health Laboratory to NPS, and local WGFD Brucellosis feed ground manager.

2. Define zones

- Initial Response Area-The initial response area will be defined by the boundaries of NER when a Presumptive Positive CWD detection is made in any cervid within the Jackson Elk Herd Unit.
- Transport Restriction Zone-One or more contiguous counties, or portions of counties, that contains the initial response area. Transportation of cervid carcasses or parts, as defined below, from the initial response area will not be allowed outside of this zone.
- Surveillance zone -The surveillance zone will be defined as the Jackson Elk Herd Unit, consistent with the Wyoming Game and Fish Chronic Wasting Disease Management Plan.

3. Changes to hunting regulations in this area after detection

- CWD sampling is mandatory for all elk harvested on NER in accordance with Refuge hunting regulations. Heads from harvested elk are placed in bear proof collection canisters staged at specific parking areas on the Refuge. Refuge biological staff are responsible for collecting and sampling all heads deposited in collection sites.
- Work with WGFD to evaluate and consider extending hunting season to facilitate increase elk harvest and timing of harvest. This is congruent with the Refuge 2015 Comprehensive Conservation Plan (CCP) and hunt plan.
- Take actions to increase the likelihood of hunter success through the evaluation and restructuring of hunting access on the Refuge to capitalize on peak elk occupancy during the hunting season, within the bounds of hunter safety. This is an ongoing effort and congruent with the CCP and hunt plan.
- WGFD has a CWD surveillance program and tests all appropriate samples received.
- Develop new requirements for hunting guides.
- Educate and post information for hunters regarding transmission of CWD.
- Require CWD sampling for all animals acquired by hunters.

4. Determine if changes to visitor access in this area after detection are needed

- All horses used on NER should have their hooves picked prior to being loaded on the trailer.
- Review the following current practice of collecting and selling antlers:
 - 8,000 pounds of antlers sold every year
 - Boy scout collections
 - Considerations should be made for antler material entering medicinal or food chain.

5. Biosecurity

- Although decontamination is achieved by only a few chemicals, appropriate disinfection will reduce CWD transmission risk. Most disinfectants have only been demonstrated to be effective under controlled laboratory conditions.
- Supplies and equipment must be first cleaned to remove large amounts of dirt and debris before they may be disinfected. After disinfection, rinsing with water may reduce the risk of damage to equipment.
- Concentrated (40% solution) household bleach may be effective in decontaminating instruments if immersed for up to 5 minutes.
- CIP100 is an alkaline cleanser that is effective at prion disinfection by soaking for at least 15 minutes in a solution of 2 ½ ounces per gallon of 113 degree Fahrenheit water.
- HOCL may be effective in decontaminating instruments susceptible to damage from caustic chemicals.
- In spite of the existence of disinfection protocols, equipment used in a CWD-affected area should not be transported to or used in an area not affected by CWD.
- Employees' boots may effectively transfer infectious CWD materials. Following removal of large dirt and debris, use of a boot bath or disinfectant mat with any of the disinfection agents above will reduce the risk of CWD contamination of other areas.
- Cervid carcass management could potentially have significant trophic effects on carnivores and scavengers, such that appropriate disposal of the most infectious CWD carcass materials should be used to reduce transmission risk while still allowing for scavenging of the remainder of the carcass.
- Incinerate:
 - Complete carcasses of all cervids showing clinical signs
 - Remaining portions of all previously scavenged carcasses
 - Head, spine and bones of all cervids
 - Allow to remain on the landscape for availability to scavengers:
 - Muscle
 - Organs, excluding brain and spinal cord (head, spine and bones will be incinerated)
 - Transport of materials for incineration should be completed with dedicated vehicles that travel the minimum distance possible. Vehicles should be cleaned, and possibly disinfected, before entering areas not affected by CWD.

6. Biosafety

- To maximize safety, protocol reviews and Job Hazard Analysis should be completed prior to the following activities:
- CWD sampling per WGFD guidance on website, <https://wgfd.wyo.gov/Wildlife-in-Wyoming/More-Wildlife/Wildlife-Disease/CWD-in-Wyoming-Wildlife/CWD-Testing>

- Euthanasia with firearms protocol (Appendix A)
- Carcass handling
- Incineration
- For potential public health issues and their mitigation; see Centers for Disease Control and Prevention (<https://www.cdc.gov/prions/cwd/index.html>) and Wyoming Department of Health (<https://health.wyo.gov/publichealth/infectious-disease-epidemiology-unit/disease/prion-diseases/>).
- Testing hunter-killed animals, reporting (currently available through WFGD)
- Personal Protective Equipment (PPE) as defined by the JHA's mentioned above, should be maintained in adequate supply at all times. At a minimum, boots, coveralls and disposable gloves that can be disinfected should be worn at all times when working with materials potentially infectious from CWD. Eye protection may also be appropriate.

7. Begin heightened CWD surveillance

- During feeding season: Daily observation of animals during feeding for 60 minutes (increased from 30 minutes); euthanasia and removal of animals with clinical signs consistent with CWD.
- Weekly observation of cervids (moose, deer, elk) for clinical signs consistent with CWD during weekly ungulate counts.
- During periods of elk occupancy on NER outside of the feeding season, increase frequency of observations to identify animals with clinical signs consistent with CWD.
- Area of increased surveillance: the standard ungulate survey area: 11,400 acre (southern half of the NER)
- Explore use of drones for detecting animals with clinical signs.

8. CWD testing

- Ensure surveillance and sample numbers allow for detection levels at the 99% confidence interval.
- Follow WGFD retropharyngeal lymph node removal for CWD testing: <https://wgfd.wyo.gov/WGFD/media/content/PDF/Vet%20Services/Removal-of-Retropharyngeal-Lymph-Nodes-for-CWD-Testing-WGFD.pdf> .
- Sampling and Testing
 - All elk harvested during the NER hunt (mandatory)
 - All symptomatic animals
 - Road kills – this is the jurisdiction of WGFD and the Wyoming Department of Transportation; however, NER staff will respond to carcasses when needed.
 - Wolf kills – consider collaring additional wolves to facilitate early detection of wolf kills for CWD detection.

9. Information management and data sharing

- Informal data sharing practices are already in place between WGFD, FWS, and NPS.

- Communication status with partners and stakeholders.
- Coordinate with the R6 Regional External Affairs Office, Refuge Chief, Regional Director and the NRPC Wildlife Health office.
- Coordinate with the CWD Working Group and other Federal, State, and local agencies, tribal entities, producer groups, and the Land-Grant University-based Cooperative Extension System to ensure consistent messaging regarding wildlife health, livestock health, public health, and food safety.
- Assure stakeholders that NER is working on the issue in an informed and timely manner in close coordination with the WGFD and NPS
- Create talking points for WGFD, FWS, and NPS to use for consistency in messaging.
- Distribute the pre-approved fact sheets.
- Begin joint press releases.
- Post Refuge website information and alerts.
- Post social media updates.
- Hold town hall meetings.
- Develop response protocols for reporting of sick cervids by the public.

10. Public outreach and education

- Follow pre-approved public information plan for CWD confirmation on NER, including a Frequently Asked Questions sheet.
- Brief the media, public, industry, and others on the CWD outbreak status and the actions taken to control it.
- Give consistent guidance (WGF, Bridger-Teton National Forest, Grand Teton National Park and NER) of how the public can report sick cervids.
- Increase outreach to Bridger-Teton NF, Grand Teton NP, and NER elk hunters in collaboration with WGFD.
- Be clear about public health issues associated with CWD – work with local public health department and CDC.

11. Feeding

- Preferred option with regards to feeding include:
 - Reducing our reliance on supplemental feeding to decrease artificial congregations of animals that enhance CWD transmission via the Bison and Elk Step-down Management Plan.
 - Request the WGFD to evaluate and consider decreasing to state's elk population objectives for the Jackson Herd.

12. Euthanasia

- Ensure that all staff team members involved in euthanasia procedures have the required firearms certification training and training from the Refuge biologist in euthanasia protocol, prior to euthanizing animals (Appendix A). Currently, the following staff team members are authorized to euthanize animals on the Refuge:

Refuge Wildlife Biologist, Refuge Deputy project Leader, project Leader and Senior Law Enforcement Officer.

- Continue use of non-toxic ammunition.

13. Animal Welfare

- Lethal collection of symptomatic animals for surveillance
- Euthanasia protocol (Please see the end of this document or consult the euthanasia guidelines at <https://sites.google.com/a/fws.gov/fws-wildlife-health/animal-welfare>)
- Euthanize if any of the following signs are present:
 - Weight loss
 - Decreased social interaction
 - Loss of awareness
 - Tooth grinding
 - Altered posture (head and ears lowered, wide-based stance)
 - Head tremors
 - Incoordination
 - Increased drinking
 - Excessive salivation
- Consider timing, location, and people present when preparing to euthanize.
- Ensure CWD sample collection is performed on each euthanized animal.

14. Disposal

- Purchase mobile incinerator meeting temperature specifications for prions.
- Establish protocols for the incinerator.
- Incinerator operations and associated JHA (completed after incinerator is delivered and operator training is received from the vendor).
- Determine where the ashes will go and how will they be packaged and transported.
- Evaluate potential Air quality issues.
- Dedicated equipment for lifting animals into the incinerator.
- Establish Back-up option for when the incinerator goes down (municipal landfill, walk-in freezer, portable incinerator)
- Set maximum travel distances with potentially positive carcasses (i.e. out of the county? Jackson Elk Herd Unit?).

15. Habitat

- Consider cost/benefit of habitat and forage enhancement on the Refuge relative to artificially concentrating animals and creating potentially highly contaminated areas on the Refuge.

16. Cleaning and Disinfection

- Adhere to section 15 (Recommended Decontamination and Disinfection Methods for Equipment, page 76) of the AFWA Technical Report on Best Management Practices for Prevention, Surveillance, and Management of CWD:

[https://www.fishwildlife.org/application/files/9615/3729/1513/AFWA Technical Report on CWD BMPs FINAL.pdf](https://www.fishwildlife.org/application/files/9615/3729/1513/AFWA_Technical_Report_on_CWD_BMPs_FINAL.pdf)

17. Health and Safety and Personal Protective equipment

- Adhere to section 22 (CWD and Public Health, page 106) of the AFWA Technical Report on Best Management Practices for Prevention, Surveillance, and Management of Chronic Wasting Disease:

[https://www.fishwildlife.org/application/files/9615/3729/1513/AFWA Technical Report on CWD BMPs FINAL.pdf](https://www.fishwildlife.org/application/files/9615/3729/1513/AFWA_Technical_Report_on_CWD_BMPs_FINAL.pdf)

18. Research opportunities

- Evaluate how conducting research, collecting additional samples influence the response.
- Update existing CWD population models with additional prevalence and demographic data.
- Look at predation of CWD positive animals by predators.
- Test the hypothesis that predators preferentially select CWD positive prey.
- Study digestion/pass-through and prion load in predators.
- Ante-mortem testing techniques.
- Environmental sampling to estimate prion loads.
- PRNP polymorphism, genotyping, and CWD latency.
- Use of drones for monitoring.
- Quantifying elk density and aggregation patterns relative to infectious disease prevalence and transmission on the Refuge.
- Remote sensing of native range productivity and availability of forage to inform feed season start and end dates.

Appendix A. Field Euthanasia of Ungulates

According to the American Veterinary Medical Association Euthanasia Guidelines (the animal welfare gold standard for euthanasia techniques in vertebrates), the only acceptable methods for euthanasia of wild ungulates are the non-inhaled agents, specifically barbiturates and barbituric acid derivatives (such as pentobarbital).

Current federal drug regulations require strict accounting for barbiturates, and these must be used under the supervision of personnel registered with the US Drug Enforcement Agency (DEA).

Given that these drugs are not always available for use by biologists without the presence of a veterinarian, and that chemical euthanasia may create secondary toxicity in scavengers and humans, the methods of euthanasia listed in this fact sheet are alternatives to euthanasia by lethal injection and are all considered acceptable with conditions. This categorization means that: certain conditions must be met to consistently produce humane death; the euthanasia methods may have greater potential for operator error or human safety hazard, are not well

documented in the scientific literature, or may require a secondary method to ensure death. Acceptable (practices?) with conditions for physical methods of euthanasia also suggests that sedation or anesthesia is used in conjunction with these methods as a best practice.

Irrespective of the approach chosen, all methods of euthanasia should be performed in a low stress, quiet environment and only by properly trained personnel. Contact the Wildlife Health office for more detailed information and training opportunities on humane euthanasia techniques for free-ranging wildlife.

Which method of euthanasia is right for your situation?

The chart on the next page lists the euthanasia techniques that are acceptable with conditions and can be applied by a biologist in the field. The method you chose will depend on a number of factors:

- The ability of personnel to induce loss of consciousness and death using a given technique without causing pain or distress.
- Reliability and safety of the technique.
- Training and logistics required for use of the technique in the field or facility.
- The health status of the animal and how easily it can be captured.
- Compatibility with the purpose for euthanasia (such as needing to preserve brain and lymph node tissue for diagnosis of CWD).

Unacceptable methods of euthanasia for all species: freezing, drowning, use of car exhaust or other unapproved gases, injection of chemicals other than anesthetics or euthanasia solution(s).

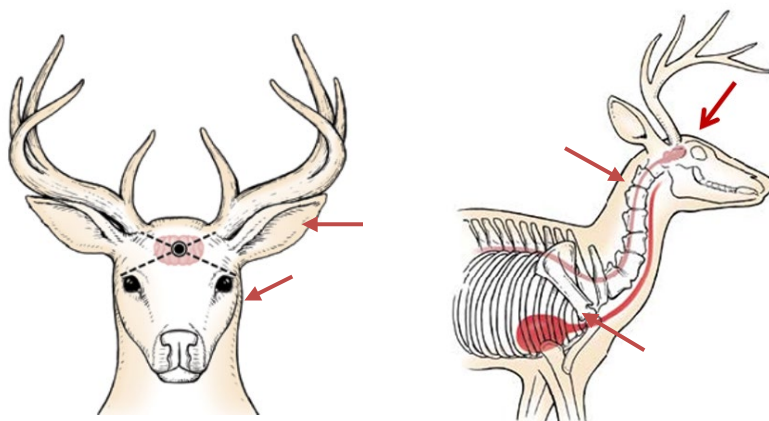
Please do not hesitate to contact us with questions:

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Categorized as acceptable with conditions for ungulates

	Gunshot or Captive bolt
Mode of action	Head shot - physical damage to brain, direct concussion of brain tissue. Cervical spinal cord – respiration and cardiac function cease. Heart shot – blood loss. **A neck shot may be preferable to a head shot in order to preserve the lymph nodes and brainstem for CWD testing**
Training required	Yes
Animal welfare considerations	If the animal is injured but not killed, it should be dispatched by a second shot or exsanguination

Restraint necessary	No – may be applied to free-roaming animals; may also be performed at point-blank with animal inside cage trap
Rapidity	Immediate, muscle activity may continue
Safety for personnel	Injury to personnel, the public, and other animals
Biosafety/ biosecurity concerns	Exposure to brain tissue and blood
Carcass consumption by scavengers	Depends on type of shot used; animals euthanized with lead shot should be made unavailable to scavengers
Impacts on sample collection	Cannot use brain for diagnostics if a head shot is used
Portable into the field	Yes
Equipment needed	Firearm, ammunition; captive bolt, charge
Cost	\$800 – 2,000



Under field conditions, gunshot can be targeted at the brain from in front of the animal (at close range) or the side; at the vertebral column (neck shot is acceptable if it severs the vertebral column and spinal cord); or the heart. A second shot may be required to ensure quick death.

Firearms and shot placement:

- Using firearms greater than .22 caliber is essential to penetrate the skull of adult animals, solid-point bullets are preferable
- Rifles are more appropriate for euthanasia of ungulates than shotguns, as some types of slugs have high expansion with poor penetration
- Have two firearms on-site and ready with appropriate ammunition for euthanasia operations to ensure a second shot can be placed quickly when necessary
- If no diagnostic tests are planned, and no specimen preservation is needed for health or forensics, a shot to the brain is the preferred method
- If a necropsy is planned, or CWD testing desired, a neck shot should be implemented
- A heart shot is the least preferred method as time to death is longer

Death of shot animals should always be confirmed by observing the following:

- Absence of rhythmic, respiratory movements
- Absence of heartbeat
- Absence of eye protection reflex (corneal reflex) or 'blink' when surface of eye is touched
- A fixed, glazed expression in the eyes
- Loss of color in mucous membranes (become mottled and pale without refill after pressure is applied)

References

American Association of Zoo Veterinarians (AAZV). Guidelines for Euthanasia of Nondomestic Animals. 2006

AVMA euthanasia guidelines 2013:

<https://www.avma.org/KB/Policies/Documents/euthanasia.pdf>

Longair JA, Finley GG, Laniel MA, et al. Guidelines for the euthanasia of domestic animals by firearms. *Can Vet J* 1991;32:724–726.

<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1481111/pdf/canvetj00073-0022.pdf>