Publications

Animal Euthanasia

Special Reference Brief Series, SRB 2007-01
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About this document

The 2007 AVMA Guidelines on Euthanasia divide euthanatizing agents into three groups: inhalant agents, noninhalant pharmaceutical agents, and physical methods. Within these guidelines, euthanasia is defined as “the act of inducing humane death in an animal.” According to the Web site of the NC3Rs, humane death in an animal is one that “occurs with minimal pain and distress; achieves rapid unconsciousness and death; requires minimum restraint; avoids excitement; is appropriate for the age, species, and health of the animal; minimizes fear and psychological stress in the animal; is reliable, reproducible, irreversible, simple to administer and safe for the operator; and, so far as possible, is aesthetically acceptable for the person(s) involved.” One particular inhalant agent that has been the subject of considerable debate is carbon dioxide. The report from the 2006 Newcastle Consensus Meeting on Carbon Dioxide Euthanasia of Laboratory Animals provides a summary of points by experts on the problems associated with euthanasia using CO_2, good practice for CO_2 euthanasia, alternative gaseous euthanasia agents, and directions for future research. Additional information on humane endpoints and euthanasia are provided on the AWIC Web site and updated as needed.

This publication contains citations pertinent to the humane euthanasia of animals. It is divided into 8 groups as follows: Aquatic Animals, Birds, Dogs and Cats, General, Livestock, Reptiles, Rodents and Rabbits, Wildlife: Captive and Free Ranging. The sources of information which were published between the years 1995 to October 2007 include peer-reviewed journals, conference proceedings, theses, annual reports, dissertations, books, monographs, letters, Web pages, reviews, and patents.

Each citation in the bibliography contains descriptor terms, an abstract when available, and the NAL call number if the particular source is available at the National Agricultural Library (NAL). Information on how to request materials that are included in the collection of the NAL may be found at: http://www.nal.usda.gov/borrow-materials.

Readers are cautioned as to the dynamic nature of the internet and the fact that Web addresses and content are subject to change. All sites are current as of November 2007.

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Aquatic Animals

Barnett, J.E., P.D. Jepson, and I.A. Patterson (1999). **Drug-induced euthanasia of stranded cetaceans.** *The Veterinary Record* 145(10): 292. ISSN: 0042-4900.
Descriptors: cetacea, euthanasia, analgesics, etorphine, methotrimeprazine.

Battison, A., R. MacMillan, A. MacKenzie, P. Rose, R. Cawthorn, and B. Horney (2000). **Use of injectable potassium chloride for euthanasia of American lobsters (*Homarus americanus*).** *Comparative Medicine* 50(5): 545-550. ISSN: 1532-0820.
NAL Call Number: SF77.C65
Abstract: Potassium chloride (KCl: 330 mg/ml) was assessed as an euthanasia agent in American lobsters (*Homarus americanus*). Two groups of 10 lobsters (408.2 to 849.9 g) were maintained at 11.9 to 12.1 degrees C ('warm') and 1.5 to 2.5 degrees C ('cold') to evaluate the possible effect of ambient temperature on response to KCl. Death was defined as time of cardiac arrest, as viewed and measured by use of ultrasound. The KCl solution was injected (100 mg of KCl/100 g of body weight) at the base of the second walking leg to flood the hemolymph sinus containing the ventral nerve cord with potassium. Disruption of this 'central nervous system' was immediate, followed by cardiac arrest within 60 to 90 seconds. Group median (+/- SD) baseline heart rate was 42 +/- 14 'warm' and 36 +/- 5 'cold' beats per minute. Time until cardiac arrest ranged from 35 to 90 (57 +/- 18) seconds in the 'warm' group and from 40 to 132 (53 +/- 34) seconds in the 'cold' group. There was no significant difference between group medians for either parameter. Histologic lesions were limited to mild to moderate acute degeneration, characterized by cell swelling, loss of contraction bands, and occasional mild cytoplasmic vacuolation of skeletal muscle at the injection site. Injectable KCl solution was an effective, reliable method for euthanasia of H. americanus.
Descriptors: euthanasia methods, potassium chloride, abdominal muscles, heart rate, histocytochemistry temperature, ultrasonography, American lobsters, *Homarus americanus*.

Beklova, M. and M. Svoboda (1999). **Vyuziti oxidu uhliciteho k euthanasii ryb po testech toxicity]. [Utilization of CO2 for euthanasia of fishes after toxicity tests].** In: *Toxicity and Biodegradability of Matters Important in Water Management. Proceedings of the 9th Conference, September 13, 1999-September 15, 1999, Solan, Czech Republic,* Vyzkumny Ustav Rybarsky a Hydrobiologicky: Vodnany, Czech Republic, p. 41-45. ISBN: 8085887134.
Descriptors: fishes, CO2 euthanasia, carbon dioxide, toxicity testing.
Language of Text: Czech, Summary in English.

Blackmore, D.K., A. Nutman, G.R.G. Barnes, P. Madie, A.S. Davies, M.C. Bowling, M. Donoghue and E.J. Kirk (1997). **Preliminary investigations of techniques for killing whales.** In: M. Hindell and C. Kemper (Editors), *Marine Mammal Research in the Southern Hemisphere,* Ecology and Medicine, Surrey Beatty & Sons: Chipping Norton, Australia, p. 174-178. ISBN: 0949324760.
Descriptors: cetaceans, killing techniques, stranded animals, euthanasia.

Blackmore, D., P. Madie, M. Bowling, A. Nutman, A. Davies, W. McLeod, J. Taylor, and M. Degen (1995). **The use of a shotgun for the euthanasia of stranded cetaceans.** *New Zealand Veterinary Journal.* 43(4): 158-159. ISSN: 0048-0169.
NAL Call Number: 41.8 N483
Descriptors: *Delphinus delphis*, *Globicephala melaena*, euthanasia techniques, stranded animals, shotgun usage.

Boonman, J. (1998). **Euthanasie bij reptielen en amfibieen. [Euthanasia of reptiles and amphibians]**. *Lacerta* 56(4): 117-125. ISSN: 0023-7051.
Descriptors: amphibians, reptiles, literature review, euthanasia methods.
Language of Text: Dutch, Summary in English.

Borski, R.J. and R.G. Hodson (2003). **Fish research and the institutional animal care and use committee.** *ILAR Journal* 44(4): 286-294. ISSN: 1084-2020.
Descriptors: fish, animal welfare, anesthetics, euthanasia, animal care.

Brakes, P. and C. Bamber (2004). **Euthanasia of Cetaceans.** In: P. Brakes, A. Butterworth, M. Simmonds and P. Lymbery (Editors), *Troubled Waters: A Review of the Welfare Implications of Modern Whaling Activities,* World Society for the Protection of Animals: London, p. 78-83. ISBN: 0954706501.
Descriptors: philosophy, ethics, euthanasia, killing techniques, cetaceans, whales, whaling.

Burns, R. (1995). **Considerations in the euthanasia of reptiles, amphibians, and fish.** In: *Proceedings: Joint Conference of the American Association of Zoo Veterinarians, Wildlife Disease Association, and American Association of Wildlife Veterinarians, August 12-17 (1995), East Lansing, Michigan,* American Association of Zoo Veterinarians: p. 243-249.
Descriptors: fish, amphibians, reptiles, killing techniques, euthanasia methods.

Chessington World of Adventures Animal Presentations Team (2000). **Euthanasia - A keeper perspective.** *Ratel* 27(3): 102-103. ISSN: 0305-1218.
NAL Call Number: QL77.5.R37
Descriptors: *Zalophus californianus*, care in captivity, England, euthanasia, zoo, case report, animal keepers.

Daoust, P.Y. and A.I. Ortenburger (2001). **Successful euthanasia of a juvenile fin whale.** *Canadian Veterinary Journal* 42(2): 127-129. ISSN: 0008-5286.
NAL Call Number: 41.8 R3224
Abstract: A stranded juvenile fin whale was successfully euthanized with an intravenous injection of sedative and cardioplegic drugs. Veterinarians may face a number of serious difficulties if called to perform this task, and advance preparation is required for successful euthanasia of these animals.
Descriptors: euthanasia, mepivacaine, whales, Prince Edward Island.

Dunn, J.L. (2006). **Multiple-agent euthanasia of a juvenile fin whale, *Balanoptera physalus.*** *Marine Mammal Science* 22(4): 1004-1007. ISSN: 0824-0469.
NAL Call Number: QL713.2.M372
Descriptors: fin whales, euthanasia, *Balanoptera physalus*, use of multiple euthanizing agents.

Greer, L.L. and J. Whaley (2006). **Marine mammals**. In: C.K. Baer (Editor), *Guidelines for Euthanasia of Nondomestic Animals,* American Association of Zoo Veterinarians: Lawrence, USA, p. 66-74. ISBN: 0-689-70726-6.
Descriptors: animal welfare, barbiturates, capture of animals, carbon dioxide, carcass disposal, euthanasia, explosives, inhaled anesthetics, injectable anesthetics, potassium chloride, cetaceans, pinnipeds, whales, dolphins, seals, sea lions.
Notes: Available from AAZV.

Greer, L.L., J. Whaley and T.K. Rowles (2001). **Euthanasia.** In: L.A. Dierauf and F.M.D. Gulland (Editors), *CRC Handbook of Marine Mammal Medicine,* 2nd edition, CRC Press: Boca Raton, FL, p. 729-738. ISBN: 0849308399.
Descriptors: marine mammals, euthanasia techniques.

Hartman, K.H. (2006). **Fish**. In: C.K. Baer (Editor), *Guidelines for Euthanasia of Nondomestic Animals,* American Association of Zoo Veterinarians: Lawrence, USA, p. 28-38. ISBN: 0-689-70726-6.
Descriptors: anesthesia, animal welfare, aquaculture, aquarium fishes, euthanasia, immobilization, pain, regulations, fishes.
Notes: Available from the AAZV.

Lawrence, K. (2003). **Euthanasia of stranded whales**. *The Veterinary Record* 153(17): 540. ISSN: 0042-4900.
NAL Call Number: 41.8 V641
Descriptors: euthanasia, whales, Falkland Islands.

Murray, M.J. (2006). **Sea otters**. In: C.K. Baer (Editor), *Guidelines for Euthanasia of Nondomestic*

Animals, American Association of Zoo Veterinarians: Lawrence, USA, p. 75-77. ISBN: 0-689-70726-6.
Descriptors: anesthesia, animal welfare, euthanasia, restraint of animals, sea otters.
Notes: Available from AAZV .

Wright, K.M. (2001). **Restraint techniques and euthanasia.** In: K.M. Wright and B.R. Whitaker (Editors), *Amphibian Medicine and Captive Husbandry.,* Krieger Publishing Company: Malabar, p. 111-122. ISBN: 0894649175.
Descriptors: amphibians, euthanasia techniques, literature overview, physical restraint, sedation, anesthesia, husbandry.

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Birds

Anonymous (2006). **Ruimers beschermen tegen vogelgriep. [Mass euthanasia protects against avian influenza]**. *Tijdschrift Voor Diergeneeskunde* 131(10): 370. ISSN: 0040-7453.
Descriptors: disease outbreaks, hygiene, influenza in birds, zoonoses, birds, animal euthanasia.
Language of Text: Dutch.

Bennett, R.A. (2001). **Association disagrees with euthanasia method for avian species.** *Journal of the American Veterinary Medical Association* 218(8): 1262.
Abstract: 0003-1488
Descriptors: animal welfare, birds, euthanasia, veterinary.
Notes: Comment On: J Am Vet Med Assoc. 2001 Mar 1;218(5):669-96.

Coenen, A., A. Smit, Z. Li, and G.v. Luijtelaar (2000). **Gas mixtures for anaesthesia and euthanasia in broiler chickens.** *World's Poultry Science Journal* 56(3): 225-234. ISSN: 0043-9339.
NAL Call Number: 47.8 W89
Descriptors: broilers, turkeys, anesthesia, euthanasia, consciousness, carbon dioxide, oxygen, nitrogen, animal behavior, death, animal welfare, heart rate, animal use, refinement, electroencephalograms, controlled atmospheres, stunning, animal distress.

Farrell, T.T. (2006). **Slaughter of poultry.** *The Veterinary Record* 158(3): 108. ISSN: 0042-4900.
Descriptors: chickens, euthanasia, animal ethics, influenza in birds, animal welfare.
Notes: Comment In: Vet Rec. 2006 Feb 11;158(6):210.

Gerdes, U. (2004). **Tierschutzrelevante Sachverhalte bei der Totung von Geflugel im Seuchenfall. [Animal welfare relevant issues during the killing of poultry during epidemics]**. *Deutsche Tierarztliche Wochenschrift* 111(3): 113-114. ISSN: 0341-6593.
Abstract: In this article firstly the standards of the killing methods of poultry because of animal diseases and the parameter for the choice of a method are described. The following part deals with the effects of the different killing methods. Finally the most important control points during the killing of poultry are discussed.
Descriptors: animal welfare, disease outbreaks, euthanasia, poultry diseases, disease outbreaks prevention and control, poultry.
Language of Text: German.

Gerritzen, M.A. (2007). **Methoden voor het grootschalig doden van pluimvee voor dierziekte bestrijding: aanvaardbaar wat betreft ongeriefen efficientie. [Methods for large scale euthanasia of poultry to control disease: Acceptable in terms of grief and efficiency]**. *Tijdschrift Voor Diergeneeskunde* 132(4): 129-131. ISSN: 0040-7453.
Descriptors: chickens, mass euthanasia, animal ethics, infection control methods, carbon

dioxide.
Language of Text: Dutch.

Gerritzen, M.A., B. Lambooij, H. Reimert, A. Stegeman, and B. Spruijt (2004). **On-farm euthanasia of broiler chickens: Effects of different gas mixtures on behavior and brain activity.** *Poultry Science* 83(8): 1294-1301. ISSN: 0032-5791.
NAL Call Number: 47.8 Am33P
Abstract: The purpose of this study was to investigate the suitability of gas mixtures for euthanasia of groups of broilers in their housing by increasing the percentage of CO2. The suitability was assessed by the level of discomfort before loss of consciousness, and the killing rate. The gas mixtures injected into the housing were 1) 100% CO2, 2) 50% N2 + 50% CO2, and 3) 30% O2 + 40% CO2 + 30% N2, followed by 100% CO2. At 2 and 6 wk of age, groups of 20 broiler chickens per trial were exposed to increasing CO2 percentages due to the injection of these gas mixtures. Behavior and killing rate were examined. At the same time, 2 broilers per trial equipped with brain electrodes were observed for behavior and brain activity. Ten percent of the 2-wk-old broilers survived the increasing CO2 percentage due to the injection of 30% O2 + 40% CO2 + 30% N2 mixture, therefore this mixture was excluded for further testing at 6 wk of age. At 6 wk of age, 30% of the broilers survived in the 50% N2 + 50% CO2 group. The highest level of CO2 in the breathing air (42%) was reached by the injection of the 100% CO2 mixture, vs. 25% for the other 2 mixtures. In all 3 gas mixtures, head shaking, gasping, and convulsions were observed before loss of posture. Loss of posture and suppression of electrical activity of the brain (n = 7) occurred almost simultaneously. The results of this experiment indicate that euthanasia of groups of 2- and 6-wk-old broilers by gradually increasing the percentage of CO2 in the breathing air up to 40% is possible.
Descriptors: broiler chickens, carbon dioxide, nitrogen, death, consciousness, animal behavior, poultry, housing, distress, gas mixtures, euthanasia.

Gerritzen, M.A., B. Lambooij, H. Reimert, A. Stegeman, and B. Spruijt (2004). **On-farm euthanasia of broiler chickens: Effects of different gas mixtures on behaviour and brain activity**. *Poultry Science* 83(8): 1294-1301. ISSN: 0032-5791.
Descriptors: gas mixtures, euthanasia of broilers, poultry housing, CO2, loss of consciousness, animal behavior, killing rate, euthanizing groups of animals.

Gerritzen, M.A., E. Lambooij, H.G.M. Reimert, B.M. Spruijt, and J.A. Stegeman (2006). **Susceptibility of duck and turkey to severe hypercapnic hypoxia.** *Poultry Science* 85(6): 1055-1061. ISSN: 0032-5791.
Abstract: Large groups of poultry, including ducks and turkeys, are killed for disease control purposes with CO2. In this study, we examined the physiological reaction of White Pekin ducks and turkeys to increasing CO2 concentrations. Additionally, we examined the suitability of killing both species with increasing CO2 concentrations. Blood gas values showed similar reaction patterns for both species: a strong increase in pCO2 from approximately 40 to 200 mmHg, decreasing pO2 and O2 saturation, a decrease in pH from 7.4 to 6.7, and a strong shift in acid-base equilibrium (averaging 0 to -23). On the electroencephalogram, theta and delta waves occurred at 21 to 23% CO2, and suppression to a near isoelectric electroencephalogram occurred between 41.8 and 43.4% CO2 in inhaled air. Heartbeat declined from approximately 300 beats per min (bpm) at the start to 225 bpm at loss of posture to 150 bpm at 1 min before the heartbeat ceased. During the last phase of heart activity, an irregular rhythm and fibrillation were observed in addition to a decline in bpm. Blood gas values and electrophysiological data confirmed that ducks and turkeys lose consciousness before a level of 25% CO2 in inhaled air is reached and that both ducks and turkeys die within 13 min in an environment of 45% CO2 in inhaled air.
Descriptors: ducks, turkeys, euthanasia, mortality, carbon dioxide, hypercapnia, hypoxia, blood gases, consciousness, posture, electroencephalography, electrocardiography, Netherlands.

Hess, L. (2005). **Euthanasia techniques in birds**. *Journal of Avian Medicine and Surgery* 19(3): 242-245. ISSN: 1082-6742.
Online: http://www.bioone.org
Descriptors: animal welfare, euthanasia techniques, surgery, birds.

Kingston, S.K., C.A. Dussault, R.S. Zaidlicz, N.H. Faltas, M.E. Geib, S. Taylor, T. Holt, and B.A. Porter Spalding (2005). **Evaluation of two methods for mass euthanasia of poultry in disease outbreaks.** *Journal of the American Veterinary Medical Association* 227(5): 730-738. ISSN: 0003-1488.
NAL Call Number: 41.8 Am3
Descriptors: poultry, Newcastle disease, avian influenza, disease outbreaks, euthanasia, animal welfare, mortality, anesthesia, carbon dioxide, poultry housing, mass euthanasia.

Kummerfeld, N. (2003). **Tierschutzgerechte und tierarztlich kompetente Euthanasie von Zier- und Wildvogeln. [Animal welfare legislation and responsible veterinary euthanasia of ornamental and wild birds]**. *Praktische Tierarzt* 84(4): 284-288. ISSN: 0032-681X.
Descriptors: animal welfare, birds, euthanasia, legislation, ornamental birds, wild birds,

veterinary medicine.
Language of Text: German.

Kummerfeld, N., R. Korbel, and M. Lierz (2005). **Therapie oder Euthanasie von Wildvoegeln - tieraerztliche und biologische Aspekte. [Therapy or euthanasia of free ranging birds - aspects with importance for veterinary medicine and birds biology].** *Tieraerztliche Praxis Ausgabe K Kleintiere Heimtiere* 33(6): 431-439. ISSN: 1434-1239.
Descriptors: injured wild birds, treatment techniques, euthanasia, animal welfare, veterinary intervention, goals and options.
Language of Text: German, Summary in English and German.

Ludders, J.W. (2001). **Another reader opposing thoracic compression for avian euthanasia.** *Journal of the American Veterinary Medical Association* 218(11): 1721. ISSN: 0003-1488.
Descriptors: animal welfare, asphyxia veterinary, birds, euthanasia veterinary, thorax.
Notes: Comment On: J Am Vet Med Assoc. 2001 Apr 15;218(8):1262.

McKeegan, D.E.F., J. McIntyre, T.G.M. Demmers, C.M. Wathes, and R.B. Jones (2006). **Behavioural responses of broiler chickens during acute exposure to gaseous stimulation.** *Applied Animal Behaviour Science* 99(3-4): 271-286. ISSN: 0168-1591.
Descriptors: chickens, broilers, gases, carbon dioxide, argon, nitrogen, inhalation exposure, acute effects, chemical concentration, animal behavior, feeding behavior, animal welfare, euthanasia, controlled atmosphere stunning, gas stunning, aversion.

Orosz, S. (2006). **Birds**. In: C.K. Baer (Editor), *Guidelines for Euthanasia of Nondomestic Animals,* American Association of Zoo Veterinarians: Lawrence, USA, p. 46-49. ISBN: 0-689-70726-6.
Descriptors: animal welfare, birds, euthanasia, methodology, wild birds, birds.
Notes: Available from AAZV.

Raj, A.B., V. Sandilands, and N.H. Sparks (2006). **Review of gaseous methods of killing poultry on-farm for disease control purposes.** *The Veterinary Record* 159(8): 229-235. ISSN: 0042-4900.
Abstract: Poultry may need to be culled in the event of an outbreak of disease. Gassing has advantages over mechanical and electrical methods or overdoses of anaesthetics because large numbers can be killed simultaneously and little or no handling of the birds is required. However, gaseous killing methods may have welfare implications for the birds, which may find various gases more or less aversive, may undergo respiratory distress and/or experience convulsions, and may remain conscious for a considerable time before they die. In addition, the gases used may present health and safety risks to human operators, and be difficult to supply and deliver.
Descriptors: agriculture methods, disease outbreaks, euthanasia, methods, poultry, poultry diseases.

Raj, A.B.M. (2004). **Stunning and slaughter**. In: *Welfare of the laying hen Papers from the 27th Poultry Science Symposium of the World' s Poultry Science Association, UK Branch, July, 2003, Bristol, UK,* CABI Publishing: Wallingford, UK, p. 375-389. ISBN: 0851998135.
Descriptors: animal welfare, argon, carbon dioxide, euthanasia of animals, method of slaughter, poultry, stunning.

Reynolds, D. (2006). **Humane slaughter of birds.** *The Veterinary Record* 158(6): 210. ISSN: 0042-4900.
Descriptors: animal welfare standards, euthanasia, methods, influenza in birds, birds.
Notes: Comment On: Vet Rec. 2006 Jan 21;158(3):108.

Rollin, B.E. (2004). **An ethicist's commentary on using wood chippers to kill chickens.** *Canadian Veterinary Journal* 45(1): 9. ISSN: 0008-5286.
Descriptors: animal welfare, ethics, euthanasia, chickens, veterinary medicine.
Notes: Comment In: Can Vet J. 2004 Apr;45(4):285; author reply 285.

Shane, S.M. (2006). **Emergency depletion and disposal of poultry flocks**. *World Poultry* 22(5): 42-44. ISSN: 1388-3119.
Online: www.agriworld.nl
Descriptors: mass culling, birds, disease outbreaks, animal welfare, carbon dioxide, composting, carcass disposal, euthanasia, poultry.

Smith, G.D. (2007). **Requests information on euthanasia method in a budgerigar**. *Journal of the American Veterinary Medical Association* 230(3): 338-339; Author Reply 339. ISSN: 0003-1488.
Descriptors: anesthesia, animal euthanasia, bird diseases, budgerigar.
Notes: Comment On: J Am Vet Med Assoc. 2006 Nov 15;229(10):1567-8.

van Luijtelaar, G., Li ZhongHua, and A. Coenen (1999). **Inhalation euthanasia in broiler chickens**. *World Poultry* 15(11): 40-43. ISSN: 1388-3119.
Descriptors: chickens, broilers, poultry, inhalation euthanasia, stress, animal welfare, carbon dioxide, nitrogen.

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Dogs and Cats

Andersen, M.C., B.J. Martin, and G.W. Roemer (2004). **Use of matrix population models to estimate the efficacy of euthanasia versus trap-neuter-return for management of free-roaming cats.** *Journal of the American Veterinary Medical Association* 225(12): 1871-1876. ISSN: 0003-1488.

Abstract: OBJECTIVE: To evaluate the efficacy of trap-neuter-return and trap-euthanatize management strategies for controlling urban free-roaming cat populations by use of matrix population models. DESIGN: Prospective study. SAMPLE POPULATION: Estimates of free-roaming cat populations in urban environments. PROCEDURE: Data from the literature describing the biology of free-roaming cat populations in urban environments were gathered. A matrix population model was developed with a range of high and low survival and fecundity values and all combinations of those values. The response of population growth rate to a range of management actions was assessed with an elasticity analysis. RESULTS: All possible combinations of survival and fecundity values of free-roaming cats led to predictions of rapid, exponential population growth. The model predicted effective cat population control by use of annual euthanasia of > or = 50% of the population or by annual neutering of > 75% of the fertile population. Elasticity analyses revealed that the modeled population was most susceptible to control through euthanasia. CONCLUSIONS AND CLINICAL RELEVANCE: Free-roaming cat populations have a high intrinsic growth rate, and euthanasia is estimated to be more effective at reducing cat populations than trap-neuter-return programs.

Descriptors: castration, cats, euthanasia, animal population control methods, population dynamics, program evaluation, prospective studies, survival analysis.

Arnemo, J.M. (2005). **Eutanasi av husdyr ved skyting. [Euthanasia of domestic animals by firearms]**. *Norsk Veterinaertidsskrift* 117(6): 457-463. ISSN: 0332-5741.

Descriptors: animal welfare, euthanasia of livestock, firearms, guidelines.

Language of Text: Norwegian, Summary in English.

Bartlett, P., A. Bartlett, S. Walshaw, and S. Halstead (2005). **Rates of euthanasia and adoption for dogs and cats in Michigan animal shelters.** *Journal of Applied Animal Welfare Science* 8(2): 97-104. ISSN: 1088-8705.

Descriptors: animal rescue shelters, animal law, animal welfare, Michigan.

Boissevain, I. (2002). **Euthanasie zonder toestemming van de eigenaar. [Euthanasia without approval of the owner]**. *Tijdschrift Voor Diergeneeskunde* 127(18): 564. ISSN: 0040-7453.

Descriptors: euthanasia, animal ethics, legislation, cats, emergency medical services, animal ownership.

Language of Text: Dutch.

Carpenter, S. (2002). **Questions regarding article on pet relinquishments, euthanasias.** *Journal of the American Veterinary Medical Association* 220(7): 963; Author Reply 963. ISSN: 0003-1488.

Descriptors: companion animals, animal behavior, human-pet bonding, breeding, cats, dogs, personality assessment.
Notes: Comment On: J Am Vet Med Assoc. 2002 Feb 1;220(3):306-11.

Das, B.C., M.A. Hossain, and M.R. Alam (2000). **Assessment of certain drugs for euthanasia in indigenous dogs**. *Bangladesh Veterinarian* 17(2): 95-99. ISSN: 1012-5949.
Descriptors: dogs, magnesium sulfate, thiopentone, xylazine, dosage, euthanasia, pulse, respiration rate, urination.

Davis, H., P. Irwin, M. Richardson, and A. O' Brien Malone (2003). **When a pet dies: Religious issues, euthanasia and strategies for coping with bereavement**. *Anthrozoos* 16(1): 57-74. ISSN: 0892-7936.
Online: www.thepress.purdue.edu
Descriptors: coping with death, euthanasia of pets, human behavior, ownership, pets, religion, questionnaire.

Edney, A.T.B. (1998). **Reasons for the euthanasia of dogs and cats.** *Veterinary Record Journal of the British Veterinary Association* 143(4): 114. ISSN: 0042-4900.
Descriptors: dogs, cats, euthanasia, animal injuries, behavior problems, England, illness, old age, reasons.

Elkins, A.D. (1998). **Euthanasia of a family pet: Stressful for both the practice team and the client.** *Canine Practice* 23(6): 17, 19. ISSN: 1057-6622.
Descriptors: pets, euthanasia, emotions, stress, pain, client, team.

Elkins, A.D. (1998). **Euthanasia of a family pet: Stressful for the both the practice team and the client.** *Feline Practice* 26(5): 5, 13. ISSN: 1057-6614.
NAL Call Number: SF985.F4
Descriptors: pets, euthanasia, veterinarians, psychological stress, customer relations, cats, distress, pain.

Froslie, A. and J. Teige (1998). **Avlivning av dyr av dyrevernhensyn. [Killing animals for humane reasons]**. *Norsk Veterinaertidsskrift* 110(11): 707-711. ISSN: 0332-5741.
Descriptors: euthanasia, pets, professional ethics, animal welfare, dogs.
Language of Text: Norwegian, Summary in English.

Gee, R. (2001). **Euthanasia of greyhounds.** *The Veterinary Record* 149(12): 368. ISSN: 0042-4900.
Descriptors: dogs, euthanasia, veterinary medicine, data collection, forms and records, licensure, greyhounds.

Gorodetsky, E. (1997). **Epidemiology of dog and cat euthanasia across Canadian prairie provinces.** *Canadian Veterinary Journal* 38(10): 649-652. ISSN: 0008-5286.
Descriptors: cats, data collection, dogs, age factors, Canada, animal welfare, attitudes, breeding, euthanasia statistics and numerical data.

Lumb, W.V., K. Doshi, and R.J. Scott (2000). **Estudo comparativo do T-61 e pentobarbital para eutanasia em cae. [A comparative study of T-61 and pentobarbital for euthanasia of dogs]**. *A Hora Veterinaria* 19(114): 39-41. ISSN: 0101-9163.
Descriptors: euthanasia, pentobarbital, T-61, electroencephalography, respiration, poisoning, euthanasia of animals, dogs, arterial blood pressure, time to collapse, signs of recovery.
Language of Text: Portuguese, Summary in English.

Lund, J.D. (2006). **En undersogelse fra 1999 viste, at mange mennesker vaelger at fa deres hund aflivet pa grund af problemer med dens adfaerd. Nu skal en ny undersogelse vise, hvordan status er i dag. [Euthanasia of pet dogs because of behavioural problems]**. *Dansk Veterinaertidsskrift* 89(9): 10-13. ISSN: 0106-6854.
Descriptors: Denmark, dogs as pets, euthansia because of behavior problems, aggression, animal behavior, bites.
Language of Text: Danish, Summary in English.

Lund, J.D. and D.B. Soerensen (1997). **Aflivning af familiehunde paa grund af adfaerdsproblemer. [Euthanasia of companion dogs because of behaviour problems]**. *Dansk Veterinaertidsskrift* 80(15): 655-659. ISSN: 0106-6854.
Descriptors: dogs, pet animals, destruction of animals, abnormal behavior, sex, age groups, euthanasia.
Language of Text: Danish, Summary in English and Danish.

Mallery, K.F., L.M. Freeman, N.K. Harpster, and J.E. Rush (1999). **Factors contributing to the decision for euthanasia of dogs with congestive heart failure.** *Journal of the American Veterinary Medical Association* 214(8): 1201-1204. ISSN: 0003-1488.
Abstract: OBJECTIVE: To determine the prevalence of clinical signs that affect quality of life in dogs with congestive heart failure (CHF), and to characterize the role of these clinical signs in the decision for euthanasia. DESIGN: Prospective study. ANIMALS: 38 dogs with CHF that had been euthanatized within the preceding 22 months. PROCEDURE:

Clinical information and factors affecting the decision for euthanasia were reviewed and recorded from medical records of dogs with CHF. Each owner was then interviewed via telephone to determine whether their dog had anorexia or other clinical signs of disease prior to euthanasia, their perception of their dogs' quality of life, and the most important factor and contributing factors that influenced the decision to euthanatize their dog. RESULTS: Of the 38 dogs with CHF, > 70% had weakness (35 dogs), coughing (33), anorexia (32), weight loss (32), dyspnea (30), or exercise intolerance (28) reported by their owners. Factors often named by owners as most important in the decision for euthanasia were poor prognosis given by the attending veterinarian, recurrent clinical signs of CHF (ie, coughing, dyspnea, or ascites), and poor quality of life. Weakness, anorexia, and recurrent clinical signs of CHF were the most common contributing factors in the decision for euthanasia. CLINICAL IMPLICATIONS: Anorexia, weight loss, and exercise intolerance are common in dogs euthanatized because of CHF. The importance of quality of life and poor prognosis in making a decision for euthanasia suggests that addressing these factors may improve patient management.
Descriptors: human-animal bond, dogs, euthanasia, congestive heart failure, quality of life, anorexia, cough, dyspnea, prospective studies, questionnaires, retrospective studies, weight loss.

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Descriptors: veterinary practice, owner grieving, veterinarian, veterinary nurse, euthanasia, death of pet.

Menezes, D.C.R., A.M. Quessada, A.L.S. Guimaraes, and E.C.S. de Almeida (2005). **Eutanasia em pequenos animais em Teresina-PI. [Euthanasia in small animals in Teresina-PI]**. *Semina: Ciencias Agrarias Londrina* 26(4): 575-579. ISSN: 1676-546X.
Descriptors: report, animal hospitals, animal welfare, reasons for euthanasia, German Shepherd, dogs, cats.
Language of Text: Portuguese, Summary in English.

Mikkelsen, J. and J.D. Lund (1999). **Aflivning af hunde pa grund af adfaerdsproblemer. En epidemiologisk undersogelse over euthanasi af hunde i Danmark - med saerlig fokus pa aggressionsproblemer. [Euthanasia of dogs because of behavioural problems. An epidemiological study on euthanasia of dogs in Denmark - with particular reference to aggression problems]**. *Dansk Veterinaertidsskrift* 82(11): 474-479. ISSN: 0106-6854.
Descriptors: questionnaire study, veterinary medicine, reasons for euthanasia, dogs, behavioral problems.
Language of Text: Danish, Summary in English.

Passantino, A., C. Fenga, C. Morciano, C. Morelli, M. Russo, C.d. Pietro, and M. Passantino (2006). **Euthanasia of companion animals: A legal and ethical analysis**. *Annali Dell' Istituto Superiore Di Sanita* 42(4): 491-495. ISSN: 0021-2571.
Descriptors: euthanasia, companion animals, legislation, Italy, ethics, veterinary medicine.
Language of Text: Italian, Summary in English.

Piirainen, K. and S. Taponen (2003). **Ongelmakayttaytyminen lemmikkikoirien lopetussyyna. [Behaviour problems as reason of euthanasia]**. *Suomen Elainlaakarilehti* 109(3): 132-138. ISSN: 0039-5501.
Descriptors: abnormal behavior, euthanasia, behavior problems, dogs, pet animals, risk factors, size of dog, aggression.
Language of Text: Finnish, Summary in English.

Ramsay, E.C. and R.W. Wetzel (1998). **Comparison of five regimens for oral administration of medication to induce sedation in dogs prior to euthanasia.** *Journal of the American Veterinary Medical Association* 213(2): 240-242. ISSN: 0003-1488.
Descriptors: dogs, euthanasia, oral administration, acepromazine, dosage, combination drug therapy, drug effects, neuroleptics, comparison.

Rippe, K.P. (1998). **Therapieren oder euthanasieren? Wie weit darf (und soll) der Tierarzt in der Behandlung eines Tieres gehen?. [Therapy or euthanasia? How far can (and should) the veterinarian go in the treatment of pet animals?]**. *Schweizer Archiv Fuer Tierheilkunde* 140(4): 143-148. ISSN: 0036-7281.
Descriptors: veterinary medicine, animal owners, pet animals, euthanasia, moral dilemma, ethics, treatment options.
Language of Text: German, Summary in English.

Rogelberg, S., C. Reeve, C. Spitzmuller, N. DiGiacomo, O. Clark, L. Teeter, A. Walker, P. Starling, and N. Carter (2007). **Impact of euthanasia rates, euthanasia practices, and human resource practices on employee turnover in animal shelters.** *Journal of the American Veterinary Medical Association* 230(5): 713-719. ISSN: 0003-1488.
Descriptors: animal shelters, companion animals, dogs, cats, euthanasia, shelter personnel.

Rollin, B.E. and L. Lunetta (2000). **An ethicist's commentary on euthanizing deaf Dalmatian puppies.** *Canadian Veterinary Journal* 41(6): 438-439. ISSN: 0008-5286.
Descriptors: animal welfare, deafness, dog diseases, ethics, euthanasia, dogs.
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Descriptors: euthanasia, companion animals, veterinary medicine, cats, dogs.
Language of Text: Italian.

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Descriptors: veterinarians, dogs, cats, euthanasia, behavior problems, counseling, gonadectomy, roles.

Stauch, S. (2006). ***Euthanasie in der Kleintierpraxis. [The euthanasia of dogs and cats in a small animal veterinary practice]***. Dissertation, Freie Universitat Berlin: Berlin, Germany. 142 p.
Descriptors: small animal practice, veterinary medicine, euthanasia, aging animals, dogs, cats.
Language of Text: German, Summary in English.

Steele, B. (2002). **Euthanasia of NGRC-registered greyhounds.** *The Veterinary Record* 150(23): 732. ISSN: 0042-4900.
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Descriptors: euthanasia, pets, veterinarians.
Language of Text: English, French.

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Descriptors: University of Bologna, euthanasia, data collection, private veterinary hospitals, decline in rates of euthanasia, prevalence of disease, vaccination programs.
Language of Text: Italian, Summary in English.

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Descriptors: euthanasia, animal welfare, dogs, pedigree, greyhounds.

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Notes: Comment On: Vet Rec. 2007 Jun 30;160(26):915.

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NAL Call Number: 41.8 Am3
Descriptors: euthanasia of animals, animal welfare, veterinary drugs, animal behavior, human health and safety, efficacy.
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Notes: Comment In: Lab Anim (NY). 2004 Sep;33(8):15-6.

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Descriptors: decision making, euthanasia, urinary incontinence, attitude of health personnel, dogs.
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Notes: Comment On: Vet Rec. 2007 Jun 30;160(26):915-6.

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Language of Text: Dutch.

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Language of Text: Dutch.

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Descriptors: euthanasia, veterinary medicine, decision making.
Notes: Comment In: Vet Rec. 2000 Jul 22;147(4):116.

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Descriptors: euthanasia, ethics, legislation, animal ethics, Great Britain.
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Language of Text: Romanian, Summary in English and French.

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Language of Text: Russian.

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Language of Text: Russian.

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Abstract: Performing euthanasia is likely one of the most challenging tasks a veterinarian faces. Four students at Tufts University School of Veterinary Medicine felt that they and their classmates needed additional training on this subject. They informally surveyed their classmates to determine what topics and formats the students desired. The findings were used to develop the Euthanasia Workshop at the university, a voluntary series of lectures and discussions on technical and emotional issues relating to euthanasia. The four students then informally surveyed 30 North American veterinary colleges to determine the scope of euthanasia training in other veterinary programs. They found that euthanasia, while often covered within other courses, is rarely taught as a stand-alone course.
Descriptors: euthanasia of animals, education, veterinary schools, United States.

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Descriptors: animal care committees, animal ethics, laboratory animal science, cervical dislocations, euthanasia methods.
Notes: Comment On: Lab Anim (NY). 2004 Sep;33(8):15.

Dixon, G. (2000). **Decisions on euthanasia.** *The Veterinary Record* 147(2): 55. ISSN: 0042-4900.
Descriptors: veterinary ethics, euthanasia, decision making, professional patient relations, veterinary medicine.
Notes: Comment On: Vet Rec. 2000 Jul 1;147(1):27.

Erickson, M.C. (2004). **A personal view of euthanasia procedures.** *Journal of the American Veterinary Medical Association* 225(7): 1026. ISSN: 0003-1488.
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Notes: Comment On: J Am Vet Med Assoc. 2004 Jun 1;224(11):1774-9.

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Notes: Comment On: Lab Anim (NY). 2004 Sep;33(8):15.

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Language of Text: French.

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Descriptors: euthanasia, legislation, professional ethics, veterinary profession.
Language of Text: Swedish.

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Notes: Available from AAZV.

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Descriptors: animal euthanasia, veterinarians, treatment failure.
Notes: Comment In: Vet Rec. 2007 Jun 30;160(26):915.

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Descriptors: police officers, occupational hazards, wild animals, capture of animals, rabies, aggression, euthanasia, species differences, emergencies.

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Descriptors: domestic animals, human-pet bonding, euthanasia, veterinarians, dogs.

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Descriptors: animal welfare, carbon dioxide, ethics, euthanasia, laboratory animals.
Language of Text: German; Spanish; French; Italian.
Notes: Conference Information: Newcastle consensus meeting on carbon dioxide euthanasia of laboratory animals, University of Newcastle upon Tyne, UK, 27-28 February 2006.

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Descriptors: veterinary medicine, euthanasia, mortality, duration, data collection, costs and returns, morbidity, statistical analysis, errors.

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Descriptors: decision making, euthanasia, veterinary medicine, attitude of health personnel.
Notes: Comment In: Vet Rec. 2000 Jul 22;147(4):116.

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Descriptors: animal care committees, euthanasia, animal ethics, laboratory animal

science, cervical dislocations.
Notes: Comment On: Lab Anim (NY). 2004 Sep;33(8):15.

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Descriptors: dogs, cats, euthanasia, socioeconomic status, abnormal behavior, animal diseases, supply, pets, United States, old age, shelters.

Kietzmann, M. (2003). **Euthanasie trachtiger Tiere. [Euthanasia of pregnant animals]**. *Deutsche Tierarztliche Wochenschrift* 110(5): 188-189. ISSN: 0341-6593.
Abstract: For euthanasia of pregnant animals, a rapid and painless death is essential. The technique of euthanasia should minimize stress and anxiety experienced by the animal so far as possible. The death is induced by an anoxia in the central nervous system or by a pharmacologic inhibition of essential neuronal functions. Pentobarbital is the best suited drug for euthanasia of animals and especially of pregnant animals. Combinations with muscle relaxing agents should not be used because of possible apnoe without unconsciousness.
Descriptors: euthanasia of pregnant animals, hypnotics and sedatives, pentobarbital administration and dosage, chemically induced anoxia.
Language of Text: German.

Klein, P.N. (2000). **Concerns about euthanasia report.** *Journal of the American Veterinary Medical Association* 217(9): 1293-1294. ISSN: 0003-1488.
Descriptors: animal welfare, euthanasia veterinary, scientific standards, veterinary medicine.

Kopaladze, R.A. (2000). **Metody evtanazii eksperimental'nykh zhivotnykh--etika, estetika, bezopasnost' personala. [Methods for the euthanasia of experimental animals--the ethics, esthetics and personnel safety]**. *Uspekhi Fiziologicheskikh Nauk* 31(3): 79-90. ISSN: 0301-1798.
Abstract: In this paper there are shown chemical and physical methods of euthanasia of vertebrate animals. All methods are divided into three categories: A) Acceptable methods of euthanasia, B) methods acceptable only for unconscious animals, C) methods that are not acceptable for euthanasia. The acceptability or non-acceptability of the method is determined by ethic or aesthetic conceptions and also by conceptions of the personnel safety and the environment. There is provided a table of acceptable methods of euthanasia. Recommendations of working group of the Federation of Laboratory Animal Science Association (FELASA) were taken into consideration in this paper. The survey can be useful for the experimenters and personnel concerned with laboratory animals.
Descriptors: animal technicians, laboratory animals, acceptable methods of euthanasia, ethics, primates, suvey.
Language of Text: Russian.

Kreeger, T.J. (2006). **Personnel safety**. In: C.K. Baer (Editor), *Guidelines for Euthanasia of Nondomestic Animals,* American Association of Zoo Veterinarians: Lawrence, USA, p. 9-13. ISBN: 0-689-70726-6.
Descriptors: euthanasia, occupational hazards, personnel, animals.
Notes: Available from AAZV.

Kreger, M.D. (Compiler) (1997). ***Animal Euthanasia January 1990-November 1997***, US Department of Agriculture: Washington, DC, 51 p.
Online: http://www.nal.usda.gov/awic/pubs/oldbib/srb9801.htm
NAL Call Number: aS21.D27S64
Descriptors: animals, destruction of animals, bibliographies.
Notes: Updates AWIC Special Reference Briefs Series no. SRB 93-06.

Lejonhud, K. (1998). ***Euthanasi - Avlivning. [Euthanasia - Destruction of Animals]***. 13. Skara, Sweden: Foerdjupningsarbete - Sveriges Lantbruksuniversitet, Djursjukvaardarprogrammet, 24 p.
Descriptors: dogs, cats, horses, pet animals, death, destruction of animals, animal welfare, legislation, anesthesia, euthanasia.
Language of Text: Swedish, Summary in English and Swedish.

Ludders, J.W., R.H. Schmidt, F.J. Dein, and P.N. Klein (2001). **Drowning can no longer be considered euthanasia: Reply to Bluett.** *Wildlife Society Bulletin* 29(2): 748-750. ISSN: 0091-7648.
Descriptors: ethics, euthanasia techniques, euthanasia by drowning, welfare aspects, reply to criticism.

Ludders, J.W., R.H. Schmidt, F.J. Dein, and P.N. Klein (1999). **Drowning is not euthanasia.** *Wildlife Society Bulletin* 27(3): 666-670. ISSN: 0091-7648.
Descriptors: euthanasia by drowning, physiology evidence, brain, electroencephalogram during drowning, unacceptable euthanasia technique, heart beat, respiratory function.

Lumb, W.V. (2006). **Thoughts on euthanasia and quality-of-life commentary.** *Journal of the American Veterinary Medical Association* 228(11): 1676-7; Author Reply 1677. ISSN: 0003-1488.
Descriptors: animal welfare, euthanasia, quality of life, communication, ethics.
Notes: Comments: Comment On: J Am Vet Med Assoc. 2006 Apr 1;228(7):1014-6.

Luy, J.P. (1999). ***Die Totungsfrage in der Tierschutzethik. [The killing of animals from the aspect of animal welfare ethics]***. Dissertation, Fachbereich Veterinarmedizin, Freie Universitat: Berline, Germany. 172 p.
Descriptors: animal welfare, ethics, slaughter, euthanasia.
Language of Text: German, Summary in English.

MacKay, C.A. (2005). **Euthanasia - a practice dilemma!** In: *Veterinary technician and practice manager Proceedings of the North American Veterinary Conference, January 8, 2005-January 12, 2005, Orlando, Florida,* Eastern States Veterinary Association: Gainesville, Florida, USA, Vol. 19, p. 51.
Descriptors: animal welfare, animal behavior, euthanasia, pets, veterinary practice, cats, dogs.

Main, D.C. (2000). **Decisions on euthanasia.** *The Veterinary Record* 147(2): 55. ISSN: 0042-4900.
Descriptors: dogs, animal ethics, euthanasia, bioethical issues, ethics committees.
Notes: Comment On: Vet Rec. 2000 Jul 1;147(1):27.

Manette, C.S. (2004). **A reflection on the ways veterinarians cope with the death, euthanasia, and slaughter of animals.** *Journal of the American Veterinary Medical Association* 225(1): 34-38. ISSN: 0003-1488.
Descriptors: animals, slaughter, death, veterinarians, cope, reflection.

Martin, F., K.L. Ruby, T.M. Deking, and A.E. Taunton (2004). **Factors associated with client, staff, and student satisfaction regarding small animal euthanasia procedures at a veterinary teaching hospital.** *Journal of the American Veterinary Medical Association* 224(11): 1774-1779. ISSN: 0003-1488.
Descriptors: animal euthanasia, factors, procedures, satisfaction, students, staff, client, veterinary teaching hospital.

Martin, F., K.L. Ruby, T.M. Deking, and A.E. Taunton (2004). **Exploring the bond: Factors associated with client, staff, and student satisfaction regarding small animal euthanasia procedures at a veterinary teaching hospital**. *Journal of the American Veterinary Medical Association* 224(11): 1774-1779. ISSN: 0003-1488.
Descriptors: veterinary medicine, veterinary teaching hospital, small animal euthanasia, methods, pets.

Matsuda, Y. (2007). **Assessment and criterion of pain, distress, and euthanasia.** *Folia Pharmacologica Japonica* 129(1): 19-23. ISSN: 0015-5691.
Descriptors: pain, distress, euthanasia, pain and distress assessment.
Language of Text: Japanese.

Matsuda, Y. (2006). **Evaluation and standard of pain, distress, and euthanasia**. *Journal of Pharmacological Sciences* 100(Suppl. 1): 40P. ISSN: 1347-8613.
Descriptors: euthanasia, evaluation, pain, distress.
Notes: Meeting Information: 79th Annual Meeting of the Japanese Pharmacological Society, Yokohama, Japan; March 8 -10, 2006.

Maurin Blanchet, H. (2001). **Euthanasie de l' animal de laboratoire. [Laboratory animals euthanasia]**. *Bulletin De L'Academie Veterinaire De France* 154(2): 185-194. ISSN: 0001-4192.
Descriptors: laboratory animals, destruction of animals, regulations, euthanasia.
Language of Text: French, Summary in English and French.

Maurin Blanchet, H. (2001). **Propos sur l'euthanasie de l'animal de laboratoire. [Remarks about euthanasia of laboratory animals]**. *STAL, Sciences Et Techniques De L' Animal De Laboratoire* 26(2): 107-116. ISSN: 0339-722X.
Descriptors: animal experiments, animal welfare, euthanasia, laboratory animals.
Language of Text: French, Summary in English.

Mayevsky, A., E. Barbiro Michaely, L. Ligeti, and A.C. Maclaughlin (2002). **Effects of euthanasia on brain physiological activities monitored in real-time**. *Neurological Research* 24(7): 647-651. ISSN: 0161-6412.
Descriptors: euthanasia, pain, suffering, comparison of methods, cats.

McMillan, F.D. (2001). **Rethinking euthanasia: Death as an unintentional outcome.** *Journal of the American Veterinary Medical Association* 219(9): 1204-1206. ISSN: 0003-1488.
NAL Call Number: 41.8 Am3
Descriptors: euthanasia, death, unintentional outcome, stress.

Milani, M. (2005). **The art of terminal illness and injury: The client and the animal.** *Canadian Veterinary Journal* 46(4): 364-367. ISSN: 0008-5286.
Descriptors: veterinary medicine, veterinarians, death and dying, bioethics, pets, euthanasia, animal diseases, terminal illness and injury.
Notes: This issue available in photocopy form only.

Milani, M. (2005). **Terminal bond problems.** *Canadian Veterinary Journal* 46(10): 942-944. ISSN: 0008-5286.
Descriptors: veterinarians, pets, euthanasia, pet care, emotions, human behavior, veterinary medicine, ethics, animal welfare.

Moore, G.E., K.D. Burkman, M.N. Carter, and M.R. Peterson (2001). **Causes of death or reasons for euthanasia in military working dogs: 927 cases (1993-1996).** *Journal of the American Veterinary Medical Association* 219(2): 209-214. ISSN: 0003-1488.
Descriptors: dogs, working animals, euthanasia, longevity, gender differences, breed differences, dog breeds, causes of death.

Moore, L.D. (2002). **Seeking alternatives to euthanasia.** *Journal of the American Veterinary Medical Association* 220(1): 20; Author Reply 20. ISSN: 0003-1488.
Descriptors: euthanasia, quality of life, animal welfare, palliative care.
Notes: Comment On: J Am Vet Med Assoc. 2001 Nov 1;219(9):1204-6.

Morrow, W.E.M. (1999). **Euthanasia hazards**. *Occupational Medicine* 14(2): 235-246. ISSN: 0885-114X.
Descriptors: euthanasia hazards, occupational health, animal euthanasia, chemical methods, psychological effects, training, physical methods.

Morton, D.B. (2000). **Decisions on euthanasia.** *The Veterinary Record* 147(4): 116. ISSN: 0042-4900.
Descriptors: euthanasia, professional autonomy, veterinary medicine.
Notes: Comment On: Vet Rec. 2000 Jul 15;147(3):82.

Nau, J.Y. (2006). **Le veterinaire et l'euthanasie par temps d'epizootie. [The veterinarian and euthanasia during epizootic outbreaks]**. *Revue Medicale Suisse* 2(86): 2577. ISSN: 1660-9379.
Descriptors: disease outbreaks, euthanasia, animal legislation and jurisprudence, zoonoses, France.
Language of Text: French.

O'mara, K.T., W.K. Hinds, and R.W. Phillips (1994). **Euthanasia during life science research in space.** *Contemporary Topics in Laboratory Animal Science* 33(1): 68-72. ISSN: 1060-0558.
Descriptors: veterinary medicine, experimental animals, euthanasia, space research.

Otten, D.R. (2001). **Advisory on proper disposal of euthanatized animals**. *Journal of the American Veterinary Medical Association* 219(12): 1677-1678. ISSN: 0003-1488.
Descriptors: veterinary medicine, carcass disposal, legislation, wildlife, euthanasia.

Overhulse, K.A. (2002). **Coping with lab animal morbidity and mortality: a trainer's role.** *Lab Animal* 31(6): 39-42. ISSN: 0093-7355.
Descriptors: laboratory animals, morbidity, mortality, euthanasia, stress management, psychosocial factors, psychological stress; human animal relations, training officers, laboratory workers, grief.

Parker, J.S. (2006). **Thoughts on euthanasia and quality-of-life commentary.** *Journal of the American Veterinary Medical Association* 228(11): 1677-1678; Author Reply 1678. ISSN: 0003-1488.
Descriptors: animal welfare, human-pet bonding, animal euthanasia, ethics, quality of life, pain prevention and control.
Notes: Comment On: J Am Vet Med Assoc. 2006 Apr 1;228(7):1014-.

Peruccio, C. (1997). **Eutanasia o terapia eroica? [Euthanasia or heroic therapy?]**. *Obiettivi e Documenti Veterinari* 18(10): 3-4. ISSN: 0392-1913.
Descriptors: euthanasia, therapy, animals, veterinary medicine.
Language of Text: Italian.

Przezdziecka, D. and J. Szarek (2000). **Analiza aspektow praktycznych i teoretycznych eutanazji. [Practical and ethical aspects of euthanasia]**. *Magazyn Weterynaryjny* 9(1): 48-50. ISSN: 1230-4425.
Descriptors: animal welfare, euthanasia, ethics.
Language of Text: Polish.

Raj, A.B.M., M.C. Leach, and D.B. Morton (2004). **Carbon dioxide for euthanasia of laboratory animals.** *Comparative Medicine* 54(5): 470-471. ISSN: 1532-0820.
Descriptors: endpoints, animal use refinement, general anesthetics, euthanasia, carbon dioxide, laboratory animals.

Reeve, C.L., C. Spitzmuller, S.G. Rogelberg, A. Walker, A. Schultz, and O. Clark (2004). **Employee reactions and adjustment to euthanasia-related work: Identifying turning-point events through retrospective narratives.** *Journal of Applied Animal Welfare Science* 7(1): 1-25. ISSN: 1088-8705.
Descriptors: labor, psychological stress, euthanasia, animal rescue shelters, employee reactions.

Reilly, J.S. (Editor) (2001). ***Euthanasia of Animals Used for Scientific Purposes.***, Australian and New Zealand Council for the Care of Animals in Research and Teaching (ANZCCART): Adelaide, South Australia, 106 p. ISBN: 0958682143.
NAL Call Number: SF756.394.R45 2001
Descriptors: animals used for scientific purposes, euthanasia of animals, moral and ethical aspects of animal experimentation.

Rhoades, R.H. (2002). ***The Humane Society of the United States Euthanasia Training Manual.***, 1st edition, Humane Society Press: Washington, DC, 174 p. ISBN: 0965894266.
NAL Call Number: SF756.394 .R46 2002
Descriptors: euthanasia of animals, training manual, Humane Society of the United States, HSUS.

Richardson, D.M. (2000). **Euthanasia: A nettle we need to grasp.** *Ratel* 27(3): 80-88. ISSN: 0305-1218.
Descriptors: zoos and wildlife parks, ethics, care in captivity, euthanasia in zoos.

Robins, J.F. (2000). **Euthanasia as a management tool in zoos.** *Ratel* 27(3): 98-100. ISSN: 0305-1218.
Descriptors: zoos, wildlife parks, euthanasia as management tool, ethics, care in captivity, Scotland.

Rogelberg, S., C. Reeve, C. Spitzmuller, N. DiGiacomo, O. Clark, L. Teeter, A. Walker, P. Starling, and N. Carter (2007). **Impact of euthanasia rates, euthanasia practices, and human resource practices on employee turnover in animal shelters.** *Journal of the American Veterinary Medical Association* 230(5): 713-719. ISSN: 0003-1488.
Descriptors: animal shelters, companion animals, dogs, cats, euthanasia, shelter personnel.

Rohlf, V. and P. Bennett (2005). **Perpetration-induced traumatic stress in persons who euthanize nonhuman animals in surgeries, animal shelters, and laboratories.** *Society and Animals Social Scientific Studies of the Human Experience of Other Animals* 13(3): 201-219. ISSN: 1063-1119.
Abstract: This study explored possible identification of Perpetration-induced Traumatic Stress (PITS) in workers whose occupations required euthanizing nonhuman animals and determining whether event or person-related factors influenced symptoms. The sample included 148 animal workers: veterinarians, veterinary nurses, and research and animal shelter staff. The Impact of Event Scale-Revised (IES-R) assessed traumatic stress. Experimenters constructed additional scales measuring satisfaction with social support, participation in various types of training, and concern over animal death. More than 70% of participants reported affinity toward animals had strongly influenced their occupation selection. Half the sample perceived animal death--particularly euthanasia--as one of the least desirable jobs. Of the sample, 11% reported experiencing moderate levels of traumatic symptoms. The study found lower levels of euthanasia-related stress were associated with increased satisfaction with social support and length of time working with animals. Those who reported high levels of concern about animal death reported higher levels of euthanasia-related stress. The study found occupational context was not associated with different levels of euthanasia-related stress symptoms--even though reasons for administering euthanasia differed significantly between occupations.
Descriptors: animal technicians, euthanasia, stress disorders, veterinarians, occupational health.

Rollin, B. (1999). **An ethicist's commentary on the case of clients having trouble explaining euthanasia to their children.** *Canadian Veterinary Journal* 40(8): 535-536. ISSN: 0008-5286.
Descriptors: child, euthanasia, animal rights, child, dogs.
Language of Text: French, English.

Rollin, B. (1999). **An ethicist's commentary on the case of the veterinary technician who lies in order to have a dog euthanized.** *Canadian Veterinary Journal* 40(5): 299. ISSN: 0008-5286.
Descriptors: animal technicians, medical ethics, euthanasia, dogs, employment.

Rollin, B.E. (2006). **Euthanasia and quality of life.** *Journal of the American Veterinary Medical Association* 228(7): 1014-1016. ISSN: 0003-1488.
Descriptors: euthanasia, quality of life, bioethics, veterinary medicine, literature reviews, animal welfare, pets.

Rollin, B.E. (2002). **The use and abuse of Aesculapian authority in veterinary medicine.**

Journal of the American Veterinary Medical Association 220(8): 1144-1149. ISSN: 0003-1488.
Descriptors: veterinary medicine, veterinarians, euthanasia, alternative medicine, consent, authority.

Rollin, B.E. (2006). **An ethicist's commentary on characterizing of convenience euthanasia in ethical terms.** *Canadian Veterinary Journal* 47(8): 742. ISSN: 0008-5286.
Descriptors: animal welfare ethics, euthanasia, veterinary medicine, animals.

Rollin, B.E. (2001). **An ethicist's commentary on the ethics of killing healthy animals.** *Canadian Veterinary Journal* 42(12): 908. ISSN: 0008-5286.
Descriptors: animal welfare, ethics, veterinary medicine, domestic animals, laboratory animals.

Rollin, B.E. (2000). **An ethicist's commentary on the ethics of painless killing.** *Canadian Veterinary Journal* 41(9): 662-663. ISSN: 0008-5286.
Descriptors: ethics, animal euthanasia, veterinary medicine, animal welfare.

Rollin, B.E. (2003). **An ethicist's commentary on veterinarians treating unowned animals and euthanizing unwanted animals.** *Canadian Veterinary Journal* 44(5): 363-364. ISSN: 0008-5286.
Descriptors: animal welfare ethics, euthanasia, veterinarians, health care costs, ownership.

Rollin, B.E. (1997). **An ethicist's commentary on the case of the veterinarian who wishes to improve rural euthanasia.** *Canadian Veterinary Journal* 38(6): 334-335. ISSN: 0008-5286.
Descriptors: animal welfare standards, professional ethics, euthanasia, Canada, cats, dogs, rural areas, sheep.
Notes: Comment In: Can Vet J. 1997 Nov;38(11):678.

Rollin, B.E. (1996). **An ethicist's commentary on the case of the veterinarian who euthanized an animal thinking that he had received owner permission.** *Canadian Veterinary Journal* 37(9): 519-520. ISSN: 0008-5286.
Descriptors: domestic animals, medical ethics, euthanasia, veterinary standards, animal rights, Canada, dogs.

Rollin, B.E. and L. Lunetta (2000). **An ethicist's commentary on euthanizing deaf Dalmatian puppies.** *Canadian Veterinary Journal* 41(6): 438-439. ISSN: 0008-5286.
Descriptors: animal welfare, deafness, dog diseases, ethics, euthanasia, dogs.
Notes: Erratum In: Can Vet J 2000 Jul;41(7):537.

Sarma, P.C. (2005). **Euthanasia in animals**. *North East Veterinarian* 5(3): 17-19. ISSN: 0973-2004.
Descriptors: euthanasia, animal welfare, decapitation, electrocution, guidelines, inhalation and injectable anesthetics, veterinary practice.

Serpa, M.F. (1997). **Responsibilidades do medico veterinario na pratica da eutanasia. [Responsibilities of the veterinarian in the practice of euthanasia]**. *Revista Brasileira De Medicina Veterinaria* 19(6): 231-232. ISSN: 0100-2430.
Descriptors: euthanasia, veterinary medicine, ethics, animals.
Language of Text: Portuguese, Summary in English.

Shalev, M. (2002). **OLAW clarifies PHS policy regarding use of carbon dioxide for euthanasia of small laboratory animals.** *Lab Animal* 31(8): 17-18. ISSN: 0093-7355.
Descriptors: animal welfare, laboratory animals, carbon dioxide poisoning, veterinary euthanasia, United States Public Health Service, veterinary medicine standards.

Shalev, M. (2001). **Implementing revised guidelines on euthanasia and preventing farm animal disease transmission.** *Lab Animal* 30(6): 16. ISSN: 0093-7355.
Descriptors: animal disease transmission, animal welfare legislation, euthanasia, domestic animals, guidelines, public policy, United States.

Shaw, J.R. and L. Lagoni (2007). **End-of-life communication in veterinary medicine: Delivering bad news and euthanasia decision making**. *Veterinary Clinics of North America Small Animal Practice* 37(1): 95-108,VIII,IX. ISSN: 0195-5616.
Descriptors: end-of-life conversations, veterinary practices, ethics, SPIKES six-step model, euthanasia decision making.

Sonnenschmidt, R. (2002). **Alternativen zur Euthanasie in der Tiertherapie. [Alternative to euthanasia in animal therapy]**. *Ganzheitliche Tiermedizin* 16(3): 114-125. ISSN: 0939-7868.
Descriptors: animal welfare, euthanasia, therapy.
Language of Text: German, Summary in English.

Steffey, E.P. (2001). **Euthanizing agents**. In: H.R. Adams (Editor), *Veterinary Pharmacology and Therapeutics,* 8th edition, Iowa State University Press: Ames, Iowa, p. 397-402. ISBN:

0813817439.
Descriptors: carbon monoxide, carbon dioxide, hydrogen cyanide, inhaled anesthetics, nitrogen, injectable anesthetics, barbiturates, chloral hydrate, ethanol, euthanizing agents.

Stewart, M.F. (1999). ***Companion Animal Death: A Practical and Comprehensive Guide for Veterinary Practice***, Butterworth-Heinemann: Oxford, UK, 188 p. ISBN: 0750640766.
Descriptors: euthanasia, veterinary medicine, professional ethics and manner, treatment and therapy, dogs, cats, pets.

Swindle, M.M., G.A. Vogler, L.K. Fulton, R.P. Marini and S. Popilskis (2002). **Preanesthesia, anesthesia, analgesia, and euthanasia**. In: J.G. Fox, L.C. Anderson, F.M. Loew and F.W. Quimby (Editors), *Laboratory Animal Medicine,* 2nd edition, Academic Press: London, UK, p. 956-1003. ISBN: 0122639510.
Descriptors: anesthesia, analgesics, animal welfare, euthanasia, laboratory animals, preanesthetic, dogs.

Taboada, J. (1998). **Euthanasia**. In: D.M. McCurnin (Editor), *Clinical Textbook for Veterinary Technicians,* 4th edition, W.B. Saunders: Philadelphia, USA, p. 715-721. ISBN: 0721621961.
Descriptors: euthanasia, veterinary technicians, textbook.

Topal, A. (2000). **Hayvanlarda otanazi. [Euthanasia of animals]**. *Veteriner Fakultesi Dergisi, Uludag Universitesi* 19(1/2): 141-147. ISSN: 1301-3173.
Descriptors: drug delivery systems, euthanasia, pain, animals.
Language of Text: Turkish, Summary in English.

Travers, W. and A. Hood (2000). **Euthanasia as a management tool.** *Ratel* 27(3): 90-93. ISSN: 0305-1218.
Descriptors: zoos, wildlife parks, euthanasia as management tool, ethics, care in captivity, United Kingdom.

van Logtesteijn, J.G. (2003). **Het doden van dieren. Maatschappelijke en ethische aspecten. [Animal euthanasia. Medical and ethical aspects]**. *Tijdschrift Voor Diergeneeskunde* 128(9): 297-298. ISSN: 0040-7453.
Descriptors: euthanasia, animal ethics, veterinary legislation, domestic animals, laboratory animals, wild animals, zoo animals, Netherlands.
Language of Text: Dutch.

Varner, G.E. (1996). **Conceptions of animal well-being and managerial euthanasia.** In: G.M. Burghardt, J.T. Bielitzki, J.R. Boyce and D.O. Schaeffer (Editors), *The Well-Being of Animals in Zoo and Aquarium Sponsored Research,* Scientists Center for Animal Welfare: Greenbelt, Maryland, p. 49-53.
NAL Call Number: QL77.5.W45 1996
Descriptors: zoos, wildlife parks, animal well-being, managerial euthanasia, animal welfare.
Notes: Available from SCAW, 7833, Walker Drive, Suite 340, Greenbelt, MD 20770. Tel: 301-345-3500.

White, D.J. and R. Shawhan (1996). **Emotional responses of animal shelter workers to euthanasia.** *Journal of the American Veterinary Medical Association* 208(6): 846-849. ISSN: 0003-1488.
Descriptors: human-pet bonding, animal shelters, occupational hazard, emotional stress.

Wijsmuller, J.M. (1997). **Euthanasie of therapie? [Euthanasia or therapy?]**. *Tijdschrift Voor Diergeneeskunde* 122(6): 171. ISSN: 0040-7453.
Descriptors: animals, antineoplastic agents, animal welfare, euthanasia.
Language of Text: Dutch.

Williams, V. (2004). **The use of carbon dioxide for euthanasia and anaesthesia**. *Surveillance Wellington* 31(4): 28-30. ISSN: 0112-4927.
Descriptors: euthanasia, anesthesia, animal welfare, carbon dioxide.

Yasar, A. (1997). **Veteriner hekimliginde otanazi (euthanasia). [Euthanasia in veterinary medicine]**. *Veteriner Bilimleri Dergisi* 13(2): 11-16. ISSN: 1011-2057.
Descriptors: euthanasia, veterinary medicine, ethics.
Language of Text: Turkish, Summary in English.

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Livestock

On Farm Euthanasia of Swine: Options for the Producer (2001). American Association of Swine Practitioners : National Pork Producers Council in cooperation with the National Pork Board: Des Moines, Iowa, 4 p. ISBN: 1-892769-10-7.
Online: http://www.aasp.org/aasv/euthanasia.pdf
NAL Call Number: HV4731.O5 2001
Abstract: Good information on euthanasia of swine with tables on Appropiatness of various methods and Specific euthanasia methods for swine with diagrams for blunt trauma, captive bolt, gun shot and electrocution.
Descriptors: Internet resource, euthanasia, swine, methods, appropiatness, pain, distress.

Anonymous (1997). **Equine euthanasia and client bereavement.** *Equine Practice* 19(3): 39-42. ISSN: 0162-8941.
NAL Call Number: SF951.E62
Descriptors: horses, destruction of animals, grieving, emotions.

Arnemo, J.M. (2005). **Eutanasi av husdyr ved skyting. [Euthanasia of domestic animals by firearms]**. *Norsk Veterinaertidsskrift* 117(6): 457-463. ISSN: 0332-5741.
Descriptors: animal welfare, euthanasia of livestock, firearms, guidelines.
Language of Text: Norwegian, Summary in English.

Baert, K. and P. de Backer (1999). **The development of a routine method for detecting embutramide, the main component of the veterinary euthanasia drug, T-61Reg.** *Vlaams Diergeneeskundig Tijdschrift* 68(3): 145-147. ISSN: 0303-9021.
Descriptors: euthanasia, injectable anesthetics, drug residue detection, horses, T-61, embutramide.
Language of Text: Dutch.

Baird, J. (2000). **Euthanasia of horses.** *The Veterinary Record* 147(1): 28. ISSN: 0042-4900.
Descriptors: euthanasia, horses, wounds, gunshot, animal welfare, catheterization, skull.
Notes: Comment On: Vet Rec. 2000 Jun 24;146(26):754-7.

Barnekow, K.H. and J. Beck Friis (2002). **Veterinarer anser att djurskyddet paverkats av nedlagd nodslakt. [Veterinarians consider that animal welfare considerations have had an influence on the discontinuation of euthanasia (in abattoirs)]**. *Svensk Veterinartidning* 54(1): 27-29. ISSN: 0346-2250.
Descriptors: abattoirs, animal welfare, euthanasia, legislation, slaughterhouses, veterinary medicine.
Language of Text: Swedish.

Barrowman, R.J. (2006). **Euthanasia of exotic pigs.** *The Veterinary Record* 158(25): 872. ISSN: 0042-4900.
Descriptors: exotic pigs, euthanasia, swine, pot bellied pigs.

Baumans, V., J.C. Meijer, Z.L. Haberham, H.N.M.d. Groot, and L.J. Hellebrekers (1998). **Euthanasie bij jonge biggen: gas of injectie? [Piglet euthanasia: gas or injection?]**. *Tijdschrift Voor Diergeneeskunde* 123(24): 738-742. ISSN: 0040-7453.
Descriptors: euthanasia, piglets, carbon dioxide, swine, pentobarbital, animal welfare, discomfort, comparison.
Language of Text: Dutch, Summary in English.

Bengtsson, B., R. Niskanen, and K. Forslund (1999). **Avlivning av vuxna notkreatur med pentobarbitalnatrium i etanollosning. [Euthanasia of adult beef cattle by intravenous injection of pentobarbital sodium]**. *Svensk Veterinartidning* 51(13): 633-636. ISSN: 0346-2250.
Descriptors: beef cattle, intravenous injection, pentobarbital, euthanasia, xylazine, heart diseases, animal welfare, dosage, injectable anesthetics, analgesics, cardiac arrest.
Language of Text: Swedish, Summary in English.

Berg, C. (2001). **Une mort "Humaine" pour les bovins: l'euthanasie des bovins: La mort sans la souffrance. [Euthanasia of cattle: Death without pain]**. *Point Veterinaire* 32(215): 14-15. ISSN: 0335-4997.
Descriptors: euthanasia, slaughter, cattle.
Language of Text: French.

Biggs, A. and J.M. Blackwell (2005). **Emergency slaughter, and changes to the OTM rule.** *The Veterinary Record* 157(16): 490-491. ISSN: 0042-4900.
Descriptors: consumer product safety, euthanasia, legislation, cattle, emergencies, Great Britain.
Notes: Comment On: Vet Rec. 2005 Oct 1;157(14):423-4.

Butterworth, A. (2000). **Euthanasia of large animals.** *The Veterinary Record* 147(3): 84. ISSN: 0042-4900.
Descriptors: euthanasia, cattle, veterinary medicine.
Notes: Comment On: Vet Rec. 2000 Jul 1;147(1):28.

Butterworth, A. and S. Wotton (2005). **Emergency slaughter, and changes to the OTM rule.** *The Veterinary Record* 157(16): 491. ISSN: 0042-4900.
Descriptors: consumer product safety legislation, euthanasia, cattle, emergencies, veterinary medicine, Great Britain.
Notes: Comment On: Vet Rec. 2005 Oct 1;157(14):423-4.

Chevillon, P., C. Mircovich, S. Dubroca, and J.Y. Fleho (2005). **Tecnicas de eutanasia en granja. [On-farm euthanasia of pigs]**. *SUIS*(19): 26-35. ISSN: 1510-2173.
Descriptors: captive bolt, stunning, carbon dioxide, electronarcosis, euthanasia, piglets, slaughtering equipment, trauma, pigs, cranial trauma.
Language of Text: Spanish, Summary in English.

Chevillon, P., C. Mircovich, S. Dubroca, and J.Y. Fleho (2004). **Euthanasie en elevage de porc. [Euthanasia in pig farming]**. *Techni Porc* 27(4): 21-27. ISSN: 0181-6764.
Descriptors: captive bolt pistol, euthanasia method, piglets, pigs, stunning.
Language of Text: French, Summary in English.

Choiniere, M. (2005). **Method of euthanasia in food animals must be practical and safe.** *The Canadian Veterinary Journal* 46(2): 105; Author Reply 106. ISSN: 0008-5286.
Descriptors: euthanasia, animal ethics, animal welfare, Canada, cost benefit analysis, safety, swine.
Notes: Comment On: Can Vet J. 2004 Oct;45(10):806.

Deegen, E. (2004). **Totung von Pferden im Rahmen der Pferdepraxis. [Killing of horses in equine practice]**. *Praktische Tierarzt* 85(6): 417-419. ISSN: 0032-681X.
Descriptors: anesthetics, animal welfare, euthanasia, slaughter, horses.
Language of Text: German.

Deleu, S. (2002). **'Massale vernietiging gezonde dieren Middeleeuws'. [Massive destruction of healthy animals is from the Middle Ages]**. *Tijdschrift Voor Diergeneeskunde* 127(3): 87-89. ISSN: 0040-7453.
Descriptors: disease outbreaks, euthanasia, foot and mouth disease, meat standards, animal welfare, consumer product safety.
Language of Text: Dutch.

DiNucci, N. (2000). **Euthanasia of horses.** *The Veterinary Record* 147(23): 668. ISSN: 0042-4900.
Descriptors: euthanasia, animal welfare, horses.

Endenburg, N., J. Kirpensteijn, and N. Sanders (1999). **Equine euthanasia: The veterinarian's role in providing owner support.** *Anthrozoos* 12(3): 138-141. ISSN: 0892-7936.
Descriptors: euthanasia, horses, human behavior, veterinary services, equine, owner support.
Notes: In the special issue: Papers from IAHAIO Conference, Prague, 1998, "The

Changing Roles of Animals in Society" Part 1 / edited by J.A. Serpell, D.C. Turner and N. Endenburg. Meeting held September 10-12, 1998, Prague, Czech Republic.

Finnie, J.W., P.C. Blumbergs, J. Manavis, G.E. Summersides, and R.A. Davies (2000). **Evaluation of brain damage resulting from penetrating and non-penetrating captive bolt stunning using lambs.** *Australian Veterinary Journal* 78(11): 775-778. ISSN: 0005-0423.
Abstract: OBJECTIVE: To compare the brain damage in sheep resulting from penetrating and non-penetrating captive bolt stunning. DESIGN: The unrestrained heads of anaesthetised lambs were impacted in the temporal region with penetrating and non-penetrating captive bolt pistols (humane stunners) using a constant charge. Two hours after head impact, brains were perfusion-fixed with 4% paraformaldehyde. Coronal sections were stained with haematoxylin and eosin and immunohistochemically for amyloid precursor protein, a sensitive marker of axonal and neuronal reaction in brains after trauma. Pathological changes in these brains were then quantified by morphometric analysis. RESULTS: The skull was fractured in 50% of lambs after a non-penetrating head impact and in all animals after a penetrating head wound. Impact contusions were present in 80% of lambs receiving a non-penetrating head injury and in all of those with a penetrating wound. Total contusion area was similar in both groups. Amyloid precursor protein-positive axons and neurons, and haemorrhage, were widely distributed in the brain after both head impact types, but there was no statistically significant difference between the two groups. Multifocal necrosis of the cerebellar granular layer was found in all lambs with non-penetrating head injury, but in none with a penetrating injury. CONCLUSIONS: The structural brain damage, a mixture of focal and diffuse injury, produced by penetrating and non-penetrating captive bolt pistols was overall similar and of sufficient severity to suggest that both types of weapon are acceptable for euthanasia.
Descriptors: brain injuries, euthanasia, sheep injuries, gunshot wounds, animal welfare, euthanasia.

Finnie, J.W., J. Manavis, P.C. Blumbergs, and G.E. Summersides (2002). **Brain damage in sheep from penetrating captive bolt stunning.** *Australian Veterinary Journal* 80(1-2): 67-69. ISSN: 0005-0423.
Abstract: OBJECTIVE: To determine the severity and distribution of structural changes in the brains of adult sheep stunned by penetrating captive bolt. PROCEDURE: The unconstrained heads of ten, anaesthetised, unhorned, 2-year-old Merino sheep were impacted at the summit of the head with a penetrating captive bolt pistol. Six sheep were ventilated and four received no respiratory support. Two hours after impact, brains from the six ventilated sheep were perfusion-fixed with 4% paraformaldehyde. Sixteen whole, serial coronal sections from each brain were stained with haematoxylin and eosin and immunohistochemically for amyloid precursor protein, a sensitive marker of axonal and neuronal reaction in the brain after trauma. Pathological changes in these brains were then quantified by morphometric analysis. RESULTS: Structural change in all impacted brains was a mixture of focal injury around the wound track and more widely distributed damage in the cerebral hemispheres, cerebellum and brainstem, but varied considerably in severity between individual sheep. All nonventilated sheep died rapidly following respiratory arrest. CONCLUSIONS: After penetrating captive bolt stunning, damage to the central reticular formation, axonal connections, and the cortical mantle is the likely reason for failure of respiratory control and traumatic loss of consciousness.
Descriptors: brain injuries, sheep, captive bolt, stunning, euthanasia , gunshot wounds, trauma severity indices.

Gardner, D.L. (1999). **Practical and humane methods for bovine euthanasia.** *Veterinary Medicine* 94(1): 92-93. ISSN: 8750-7943.
Descriptors: cattle, euthanasia, animal welfare, practical, humane, methods.

Gardner, D.L. (1997). **Practical and humane bovine euthanasia.** *American Association of Bovine Practitioners Conference*(no. 30): 124-126. ISSN: 0743-0450.
NAL Call Number: SF961.A5
Descriptors: cattle, euthanasia, humane, practical.
Notes: Conference Information: Meeting held on Sept. 18-21, 1997, Montreal, Quebec, Canada.

Garry, F.B. and D.L. Gardner (1998). **Methods for bovine euthanasia.** In: *Proceedings of the North American Veterinary Conference, January 10, 1998-January 14, 1998, Orlando, Florida,* Vol. 12, p. 906-907.
NAL Call Number: SF605.N672
Descriptors: cattle, euthanasia methods, animal welfare, bovine, cattle.

Grandin, T. (1998). **Handling of crippled and nonambulatory livestock.** *Animal Welfare Information Center Bulletin* 9(1-2): 1-2. ISSN: 1050-561X.
Online: http://www.nal.usda.gov/awic/newsletters/v9n1/9n1grand.htm
Descriptors: cattle, swine, lameness, body condition, animal transport, euthanasia, slaughter, animal welfare.

Hellebrekers, L.J. and V. Baumans (2000). **Gebruik schietmasker zonder het dier te laten**

verbloeden. [Use of captive bolt pistol without exsanguinating the animal.]. *Tijdschrift Voor Diergeneeskunde* 125(19): 586. ISSN: 0040-7453.
Descriptors: abattoirs, slaughterhouses, ethics, euthanasia, pain, cattle, firearms, swine.
Language of Text: Dutch.

Herbert, W.J. (1996). **Chemical euthanasia of horses. [Correspondence].** *Veterinary Record* 139(4): 100. ISSN: 0042-4900.
Descriptors: horses, destruction of animals, magnesium, sulphates, euthanasia, horses.

Hodgkinson, O., J.M. Morris, and E.J.A. Macholc (2006). **Euthanasia of exotic pigs**. *The Veterinary Record* P.: 28. ISSN: 0042-4900.
Descriptors: Veterinary-euthanasia, Potbellied-pig.

House, C.J. (2000). **Euthanasia of horses.** *The Veterinary Record* 147(3): 83. ISSN: 0042-4900.
Descriptors: adjuvants, anesthesia, anesthetics, chloral hydrate, dibucaine administration, euthanasia, firearms, horses, secobarbital administration, cellulose administration, injections, intravenous.
Notes: Comment On: Vet Rec. 2000 Jun 24;146(26):754-7.

Huxley, J. (2006). **Assessment and management of the recumbent cow.** *In Practice* 28(4): 176-184. ISSN: 0263-841X.
Descriptors: dairy cows, downer animals, medical history, disease diagnosis, nonsteroidal anti inflammatory agents, animal welfare, euthanasia.

Jones, R.S. and D.C. Knottenbelt (2001). **Disagree with use of muscle relaxant before euthanasia.** *Journal of the American Veterinary Medical Association* 218(12): 1884. ISSN: 0003-1488.
Descriptors: euthanasia, horses, neuromuscular depolarizing agents, succinylcholine, muscle relaxants.
Notes: Comment On: J Am Vet Med Assoc. 2001 Mar 1;218(5):669-96.

Knottenbelt, D.C. (1999). **Chemical destruction of horses.** *The Veterinary Record* 145(2): 54-55. ISSN: 0042-4900.
Descriptors: animal welfare, euthanasia, horses, barbiturates, dehydration, veterinary medicine.

Lenz, T.R. (2004). **An overview of acceptable euthanasia procedures, carcass disposal options, and equine slaughter legislation**. In: *Proceedings of the 50th Annual Convention of the American Association of Equine Practitioners, December 4, 2004-December 8, 2004, Denver, Colorado,* American Association of Equine Practitioners (AAEP): Lexington, Kentucky, USA, p. 191-195.
Online: http://www.aaep.org
Descriptors: equine slaughter legislation, carcass disposal, euthanasia methods, horses, equine.

Luy, J., E. Deegen, A. Grabner, and B.W. Hertsch (2006). **Totung von Equiden. [Killing of equidae]**. *Pferdeheilkunde* 22(6): 795-802. ISSN: 0177-7726.
Descriptors: animal welfare, euthanasia, law and legislation, horses, professional ethics.
Language of Text: German, Summary in English.

Maisch, A., M. Ritzmann, and K. Heinritzi (2005). **Die tierschutzgerechte Euthanasie beim Schwein mit Pentobarbital. [The humane euthanasia of pigs with pentobarbital]**. *Tierarztliche Umschau* 60(12): 679-683. ISSN: 0049-3864.
Descriptors: pigs, euthanasia, humane, pentobarbital, horses, small animals, stress free.
Language of Text: German, Summary in English.

Mantell, J.A.R. (1996). **mBEVA [British Equine Veterinary Association] guidelines for the destruction of horses under an all risks mortality insurance policy. [Correspondence].** *Veterinary Record* 139(14): 352. ISSN: 0042-4900.
Descriptors: destruction of animals, horses, livestock insurance, agricultural insurance, euthanasia.

Mantell, J.A.R. (1999). **Chemical destruction of horses**. *Veterinary Record* 145(1): 27. ISSN: 0042-4900.
Descriptors: euthanasia of horses, detomidine, codeine, barbiturates, injectable anesthetics, case reports.

Mason, D.E. (1995). **How I treat euthanasia in horses when the clients are present.** *North American Veterinary Conference* 9: 431. ISSN: 0341-6593.
NAL Call Number: SF605.N672
Descriptors: destruction of animals, horses, euthanasia, veterinary profession.
Notes: Meeting Information: Meeting held on Jan. 14-18, 1995 in Orlando, Florida.

Maxwell, G.A. (2006). **Euthanasia of exotic pigs.** *The Veterinary Record* 159(2): 60. ISSN: 0042-4900.
Descriptors: animal euthanasia, azaperone, carbon dioxide, hypnotics, sedatives,

intramuscular injections, pentobarbital administration, swine.
Notes: Comment On: Vet Rec. 2006 Jun 24;158(25):872.

Meyer, R.E. and W.E.M. Morrow (2005). **Carbon dioxide for emergency on-farm euthanasia of swine.** *Journal of Swine Health and Production* 13(4): 210-217. ISSN: 1537-209X.
Online: http://www.aasv.org/shap/issues/v13n4/v13n4p210.html
Descriptors: swine, euthanasia, carbon dioxide, biosecurity.

Meyer, R.E. and W.E.M. Morrow (2006). **Physiology of euthanasia**. In: C.K. Baer (Editor), *Guidelines for Euthanasia of Nondomestic Animals,* American Association of Zoo Veterinarians: Lawrence, USA, p. 6-8. ISBN: 0-689-70726-6.
Descriptors: anesthetics, animal welfare, euthanasia, hypoxia, pain physiology, stunning.
Notes: Available from AAZV.

Millar, G.I. and D.S. Mills (2000). **Observations on the trajectory of the bullet in 15 horses euthanased by free bullet.** *Veterinary Record Journal of the British Veterinary Association* 146(26): 754-757. ISSN: 0042-4900.
Descriptors: horses, euthanasia, trajectories, brain, skull, gunfire and bomb damage.

Miller, N. (2006). **Provisions for emergency slaughter of cattle**. *The Veterinary Record* 158(13): 454. ISSN: 0042-4900.
Descriptors: animal welfare, cattle, animal euthanasia, consumer product safety.

Morris, J.M. (2006). **Euthanasia of exotic pigs.** *The Veterinary Record* 159(1): 28. ISSN: 0042-4900.
Descriptors: euthanasia, animal, firearms, swine, animal welfare.
Notes: Comment On: Vet Rec. 2006 Jun 24;158(25):872.

Morris, P.J. and B. Gonzales (2006). **Swine**. In: C.K. Baer (Editor), *Guidelines for Euthanasia of Nondomestic Animals,* American Association of Zoo Veterinarians: Lawrence, USA, p. 87-88. ISBN: 0-689-70726-6.
Descriptors: anesthesia, anesthetics, analgesics, antiinflammatory agents, euthanasia, feral pigs, wild pigs, pigs, Suidae, Tayassuidae.
Notes: Available from AAZV.

Morrow, W.E.M., R.E. Meyer, J. Roberts, and D. Lascelles (2006). **Financial and welfare implications of immediately euthanizing compromised nursery pigs**. *Journal of Swine Health and Production* 14(1): 25-34. ISSN: 1537-209X.
Descriptors: animal welfare, costs, economic analysis, euthanasia, pigs, compromised pigs.
Language of Text: Spanish.

Nau, J.Y. (2006). **Le veterinaire et l'euthanasie par temps d' epizootie (2). [The veterinarian and euthanasia during times of animal epidemics (2)]**. *Revue Medicale Suisse* 2(88): 2706. ISSN: 1660-9379.
Descriptors: domestic animals, cattle diseases, disease outbreaks, bovine spongiform encephalopathy, euthanasia, veterinarians, cattle, France, legislation.
Language of Text: French.

Reynolds, J. (2004). **Euthanasia of livestock: Why, when and how**. In: *Large animal: Proceedings of the North American Veterinary Conference, Volume 18, January 17, 2004-January 21, 2004, Orlando, Florida,* Eastern States Veterinary Association: Gainesville, Florida, USA, p. 60.
Descriptors: euthanasia methods, livestock, animal welfare.

Rollin, B.E. (2004). **An ethicist's commentary on good versus natural death.** *Canadian Veterinary Journal* 45(10): 806. ISSN: 0008-5286.
Descriptors: animal welfare, euthanasia, animal ethics, Canada, pentobarbital administration and dosage, swine.
Notes: Comment In: Can Vet J. 2005 Feb;46(2):105; author reply 106.

Shalev, M. (2001). **Implementing revised guidelines on euthanasia and preventing farm animal disease transmission.** *Lab Animal* 30(6): 16. ISSN: 0093-7355.
Descriptors: animal disease transmission, animal welfare legislation, euthanasia, domestic animals, guidelines, public policy, United States.

Shalev, M. (2004). **USDA encourages humane slaughter of animals.** *Lab Animal* 33(10): 14-15. ISSN: 0093-7355.
Descriptors: abattoirs, animal welfare, euthanasia, United States Department of Agriculture, cattle, sheep, swine.

Shearer, J.K. (2005). **Euthanasia of cattle: Indications and practical considerations**. In: *Proceedings of the North American Veterinary Conference: Large animal Volume 19, January 8, 2005-January 12, 2005, Orlando, Florida,* Eastern States Veterinary Association: Gainesville, Florida, USA, p. 28-29.
Descriptors: cattle, euthanasia methods, indications, considerations.

Siegmann Ruland, G.S. and A. Schedel Stupperich (1999). **Euthanasie bei Pferden: Einschlafern oder Bolzenschuss? [Euthanasia by injection or killing by captive bolt]**. *Tierarztliche Umschau* 54(9): 504-508. ISSN: 0049-3864.
Descriptors: slaughter, animal welfare, legislation, euthanasia of animals, stunning, horses, animal care.
Language of Text: German, Summary in English.

Siegmann Ruland, G.S. and A. Schedel Stupperich (1999). **Euthanasia by injection or killing by captive bolt**. *Tieraerztliche Umschau* 54(9): 504-508. ISSN: 0049-3864.
Descriptors: euthanasia, method, injection, captive bolt, horse, quick, pain, stress.
Language of Text: German.

Simmons, A. (2006). **Provisions for emergency slaughter of cattle.** *The Veterinary Record* 158(15): 522. ISSN: 0042-4900.
Descriptors: cattle diseases, euthanasia, cattle, veterinary emergencies, legislation, Scotland, veterinary medicine.
Notes: Comments: Comment On: Vet Rec. 2006 Apr 1;158(13):454.

Slater, S. (2007). **Older cattle disposal scheme**. *The Veterinary Record* 160(3): 451. ISSN: 0042-4900.
Descriptors: cattle, veterinary emergencies, animal euthanasia methods, legislation, Great Britain, letter.

Thomsen, P.T., A.M. Kjeldsen, J.T. Sorensen, and H. Houe (2004). **Mortality (including euthanasia) among Danish dairy cows (1990-2001).** *Preventive Veterinary Medicine* 62(1): 19-33. ISSN: 0167-5877.
Descriptors: dairy cows, mortality, cattle diseases, risk assessment, dairy breeds, animal age, euthanasia, lactation, Netherlands, cause of death.

Tzika, E.D., A. Sbiraki, S.K. Kritas, C. Alexopoulos, and S.C. Kyriakis (2000). **Indications and methods of the compulsory application of euthanasia in swine enterprises**. *Deltion Tes Ellenikes Kteniatrikes Etaireias (Bulletin of the Hellenic Veterinary Medical Society)* 51(3): 188-194. ISSN: 0257-2354.
Descriptors: euthanasia, pig farming, pigs, methods.
Language of Text: Greek, Summary in English.

UK Humane Slaughter Association. (1999). ***Humane Killing of Livestock Using Firearms***. 23 p.

Descriptors: guidance notes, humane killing, balistics, correct shooting positions, carcass disposal, euthanasia technique, diagrams.

UK Humane Slaughter Association. (1999). ***Farewell: Making the Right Decision [Destruction of Horses]***. 14 p.
Descriptors: pamphlet, horse owners, methods of euthanasia, carcass disposal, horses.

van den Bogaard, A.E. and R. Hoenderken (2000). **Alternatief voor verbloeden na het gebruik van een schietmasker. Een aanvulling op een advies: gebruik schietmasker zonder het dier te laten verbloeden. [Alternative way to use the captive bolt pistol. Additional advice: Use the captive bolt pistol without bleeding the animal to death]**. *Tijdschrift Voor Diergeneeskunde* 125(23): 725-726. ISSN: 0040-7453.
Descriptors: abattoirs, euthanasia, hemorrhage, phlebotomy, captive bolt.
Language of Text: Dutch.

von Holleben, K. and M. von Wenzlawowicz (1999). **Tierschutzgerechtes Toten von Tieren in landwirtschaftlichen Betrieben. [Humane killing of animals in agricultural management]**. *Deutsche Tierarztliche Wochenschrift* 106(4): 163-165. ISSN: 0341-6593.
Abstract: The special problem of handling weak, chronically ill, injured farm animals or those not sellable for slaughter is described. Farmers generally do not have sufficient knowledge in killing animals. They need external help or they must take specific training courses to get the necessary knowledge. Solutions how to improve animal welfare in this field are given.
Descriptors: animal diseases, animal husbandry, animal welfare, domestic animals, euthanasia, Germany.
Language of Text: German.

Von Maisch, A., M. Ritzmann, and K. Heinritzi (2005). **We fierschutzgerechte euthannsie beim schwein mit pentobarbital. [The humane euthanasia of pigs with pentobarbital]**. *Tieraerztliche Umschau* 60(12): 679-683. ISSN: 0049-3864.
Descriptors: swine, pigs, humane euthanasia, pentobarbital, horses, small animals, study, healthy, sick, saline solution.

Woodward, K.N. and A.K. Gray (1996). **Chemical euthanasia of horses.** *The Veterinary Record* 138(24): 600. ISSN: 0042-4900.
Descriptors: animal feed, barbiturates, euthanasia, food contamination, horses.

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Animal Euthanasia

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Wildlife: Captive and Free Ranging

American Association of Zoo Veterinarians. (2006). ***Guidelines for Euthanasia of Nondomestic Animals***, C.K. Baer (Editor), American Association of Zoo Veterinarians: Lawrence, Kansas, USA, 111 p. ISBN: 0-689-70726-6.
NAL Call Number: SF756.394 .G84 2006
Abstract: "This document represents an attempt by the professional zoological and wildlife community to gather and publish the best-known procedures for euthanatizing the animals they manage. Although guidelines for euthanasia have been published previously, the present effort provides the beginning of an ongoing quest for procedures that mitigate pain and distress and provide for a humane termination of life for species other than those commonly defined as domestic animals."
Descriptors: euthanasia of animals, handbooks, manuals, zoo animals, management
Notes: Available from AAZV.

Atkinson, M.W. (2006). **Megavertebrates**. In: C.K. Baer (Editor), *Guidelines for Euthanasia of Nondomestic Animals,* American Association of Zoo Veterinarians: Lawrence, USA, p. 89-93. ISBN: 0-689-70726-6.
Descriptors: large animals, hippos, rhinos, elephants, anesthesia, anesthetics, animal welfare, euthanasia, restraint of animals.
Notes: Available from AAZV.

Berndtsson, L.T. (1996). ***Euthanasia of Furbearing Animals***, Research and development for animal health, Statens Veterinaermedicinska Anstalt: Uppsala, Sweden, 99 p. ISBN: 9197246905.
Descriptors: minks, foxes, fur bearing animals, destruction of animals, animal welfare.

Contamin, H. (2004). **Anesthesie, analgesie et euthanasie des primates non humains (PNH): aspects pratiques. [Anaesthesia, analgesia and euthanasia of non-human primates: practical aspects]**. *STAL, Sciences Et Techniques De L' Animal De Laboratoire* 29(2/3): 25-31. ISSN: 0339-722X.
Descriptors: anesthesia, butorphanol, diazepam, euthanasia, flunixin, ketamine, ketoprofen, pentobarbital, xylazine, nonhuman primates.
Language of Text: French.

Contamin, H. (2004). **Anesthesie, analgesie et euthanasie des primates non humains (pnh): Aspects pratiques [??]**. *STAL* 29(2-3): 25-31. ISSN: 0339-722X.
Descriptors: nonhuman primates, anesthesia, analgesia, euthanasia, aspects, practices.
Language of Text: French.

Cooper, J., G. Mason, and M. Raj (1998). **Determination of the aversion of farmed mink (*Mustela vison*) to carbon dioxide**. *Veterinary Record* 143(13): 359-361. ISSN: 0042-4900.
Descriptors: carbon dioxide, euthanasia, animal welfare, mink, animal behavior, detection of CO2, humane euthanasia.

Cooper, J.E. and M.E. Cooper (2006). **Ethical and legal implications of treating casualty wild animals.** *In Practice* 28(1): 2-6. ISSN: 0263-841X.
Descriptors: small animal practice, animal injuries, animal handling, euthanasia, human wildlife relations, animal law, wildlife rehabilitation, United Kingdom.

Drew, M.L. (2006). **Wildlife issues**. In: C.K. Baer (Editors), *Guidelines for Euthanasia of Nondomestic Animals,* American Association of Zoo Veterinarians: Lawrence, USA, p. 19-22. ISBN: 0-689-70726-6.
Descriptors: animal welfare, drugs, euthanasia, guidelines, licences, wild animals.
Notes: Available from AAZV.

Engel, H. (2001). **Zum problem toten uberzahliger und alter tiere im zoo. [Killing of surplus and old animals in zoological gardens]**. *Deutsche Tierarztliche Wochenschrift* 108(3): 123-124. ISSN: 0341-6593.
Descriptors: animal welfare, euthanasia, overcrowding, zoo animals, aged animals.
Language of Text: German, Summary in English.

Gallagher, J., R.H. Muirhead, A.T. Turnbull, J.I. Davies, W.L. Ashton, J. Smith, J. Daykin, and A. McDiarmid (2006). **TB policy and the badger culling trials.** *The Veterinary Record* 158(15): 524. ISSN: 0042-4900.
Descriptors: disease reservoirs, Mustelidae, tuberculosis, disease prevention and control, cattle, England, euthanasia, veterinary medicine.
Notes: Comment On: Vet Rec. 2006 Mar 25;158(12):418.

Heard, D. (2006). **Bats**. In: C.K. Baer (Editor), *Guidelines for Euthanasia of Nondomestic Animals,* American Association of Zoo Veterinarians: Lawrence, USA, p. 57-58. ISBN: 0-689-70726-6.
Descriptors: anesthesia, anesthetics, carbon dioxide, carbon monoxide, decapitation, euthanasia, guidelines, xylazine, zoonoses, Chiroptera, bats.
Notes: Available from AAZV.

Meyer, R.E. and W.E.M. Morrow (2006). **Physiology of euthanasia**. In: C.K. Baer (Editor), *Guidelines for Euthanasia of Nondomestic Animals,* American Association of Zoo Veterinarians: Lawrence, USA, p. 6-8. ISBN: 0-689-70726-6.
Descriptors: anesthetics, animal welfare, euthanasia, hypoxia, pain physiology, stunning.
Notes: Available from AAZV.

Miller, D.S., S. Citino and J. Sikarskie (2006). **Hoofstock**. In: C.K. Baer (Editor), *Guidelines for Euthanasia of Nondomestic Animals,* American Association of Zoo Veterinarians: Lawrence, USA, p. 82-86. ISBN: 0-689-70726-6.
Descriptors: hoofstock, ungulates, anesthesia, analgesics, animal welfare, euthanasia.
Notes: Available from AAZV.

Murray, M.J. (2006). **Invertebrates**. In: C.K. Baer (Editor), *Guidelines for Euthanasia of Nondomestic Animals,* American Association of Zoo Veterinarians: Lawrence, USA, p. 25-27. ISBN: 0-689-70726-6.
Descriptors: animal welfare, aquatic invertebrates, euthanasia methods, invertebrates.
Notes: Avaialable from AAZV.

O'Rourke, K. (2002). **Euthanatized animals can poison wildlife: Veterinarians receive fines.** *Journal of the American Veterinary Medical Association* 220(2): 146-147. ISSN: 0003-1488.
Descriptors: adjuvants, anesthesia poisoning, euthanasia, pentobarbital poisoning, raptors, wild animals.

Pye, G.W. (2006). **Marsupials**. In: C.K. Baer (Editor), *Guidelines for Euthanasia of Nondomestic Animals,* American Association of Zoo Veterinarians: Lawrence, USA, p. 52-56. ISBN: 0-689-70726-6.
Descriptors: marsupials, kangaroos, wallabies, anesthesia, euthanasia, restraint of animals, Acrobates, Dasyuridae, Didelphidae, Macropodidae, marsupials, Peramelidae, Phascolarctos, Tarsipes, Vombatus.
Notes: Available from AAZV.

Pye, G.W. (2006). **Monotremes**. In: C.K. Baer (Editor), *Guidelines for Euthanasia of Nondomestic Animals,* American Association of Zoo Veterinarians: Lawrence, USA, p. 50-51. ISBN: 0-689-70726-6.
Descriptors: hedgehogs, anesthesia, euthanasia, Monotremata, Platypus, Tachyglossidae.
Notes: Available from AAZV.

Raj, M. and G. Mason (1999). **Reaction of farmed mink (*Mustela vison*) to argon-induced hypoxia**. *Veterinary Record* 145(25): 736-737. ISSN: 0042-4900.
Descriptors: effects of hypoxia, euthanasia, carbon dioxide, argon, animal welfare, animal behavior, mink.

Rennie, A.E. and H.M. Buchanan Smith (2006). **Refinement of the use of non-human primates in scientific research. III. Refinement of procedures.** *Animal Welfare*

15(3): 239-261. ISSN: 0962-7286.
Descriptors: nonhuman primates, laboratory animals, animal use refinement, animal well being, animal welfare, animal stress, distress, pain, restraint of animals, blood sampling, surgery, postoperative care, analgesia, humane endpoints, euthanasia.

Schwartz, J.A., R.J. Warren, D.W. Henderson, D.A. Osborn, and D.J. Kesler (1997). **Captive and field tests of a method for immobilization and euthanasia of urban deer.** *Wildlife Society Bulletin* 25(2): 532-541. ISSN: 0091-7648.
Descriptors: *Odocoileus virginianus*, culling, sedation, urban habitats, immobilization, euthanasia methods, management implications, South Carolina.

Sikarskie, J.G. and S.R. Hollamby (2006). **Carnivores**. In: C.K. Baer (Editor), *Guidelines for Euthanasia of Nondomestic Animals,* American Association of Zoo Veterinarians: Lawrence, USA, p. 78-81. ISBN: 0-689-70726-6.
Descriptors: anesthesia, anesthetics, animal welfare, carbon dioxide, carbon monoxide, decapitation, euthanasia, halothane, isoflurane, stunning, carnivores.
Notes: Available from AAZV.

Stoskopf, M.K., R.E. Meyer, M. Jones, and D.O. Baumbarger (1999). **Field immobilization and euthanasia of American opossum.** *Journal of Wildlife Diseases* 35(1): 145-149. ISSN: 0090-3558.
Abstract: Seventeen recently trapped opossum, *Didelphis virginiana*, (median weight 2.45 kg; range = 1.6-5.0 kg; quartiles = 1.8-3.3 kg) were immobilized with either telazol (15 or 30 mg/kg) or a mixture of medetomidine (100 micrograms/kg), butorphanol (0.2 mg/kg), and ketamine HCl (10 mg/kg) based on estimated weights. Anesthetized animals were subjected to cardiac puncture for blood withdrawal and toe pinch. Euthanasia was accomplished by intracardiac administration of 1 ml of concentrated pentobarbital sodium/phenytoin solution. Weights were underestimated for 14 of 17 animals, but were within 0.5 kg of the actual weight. Both drug combinations provided rapid and calm immobilization. Median time to recumbency for the medetomidine-butorphanol-ketamine group (n = 5) was 6 min (range = 4-10 min; quartiles = 6 and 8 min). The median time to recumbency was not statistically different for the low (n = 6) and high dose (n = 6) telazol groups, 3 and 3.5 min respectively (quartiles 3; 3.5 and 4; 5.5 min). The stronger heart beat with telazol immobilization facilitated cardiac puncture. All five animals administered the medetomidine-butorphanol-ketamine mixture and three of six animals given the low telazol dose reacted to cardiac puncture. Only one of six animals given the estimated 30 mg/kg dose of telazol reacted slightly to cardiac puncture. We conclude that 30 mg/kg telazol provides sufficient immobilization and analgesia to allow accurate cardiac puncture of the opossum if the procedure is performed within 5 to 10 min of recumbency. Intracardiac administration of concentrated pentobarbital sodium/phenytoin solution followed by bilateral thoracotomy provides appropriate euthanasia suitable for field situations.
Descriptors: euthanasia, immobilization, opossums, analgesics, anesthetics, animal welfare, butorphanol, drug combinations, hypnotics and sedatives, imidazoles, ketamine, medetomidine, muscle relaxants, pentobarbital, phenytoin, tiletamine, zolazepam.

Summers, L. and K. Christe (2006). **Nonhuman primates**. In: C.K. Baer (Editor), *Guidelines for Euthanasia of Nondomestic Animals,* American Association of Zoo Veterinarians: Lawrence, USA, p. 59-60. ISBN: 0-689-70726-6.
Descriptors: anesthesia, anesthetics, barbiturates, euthanasia, potassium chloride, nonhuman primates, monkeys.
Notes: Available from AAZV.

Wack, R., P. Morris, J. Sikarskie and D.S. Miller (2006). **Criteria for humane euthanasia and associated concerns**. In: C.K. Baer (Editor), *Guidelines for Euthanasia of Nondomestic Animals,* American Association of Zoo Veterinarians: Lawrence, USA, p. 3-5. ISBN: 0-689-70726-6.
Descriptors: animal welfare, euthanasia, pain, regulations, training, wild animals, zoo animals.
Notes: Available from AAZV.

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Reptiles

Baier, J. (2006). **Amphibians**. In: C.K. Baer (Editor), *Guidelines for Euthanasia of Nondomestic Animals,* American Association of Zoo Veterinarians: Lawrence, USA, p. 39-41. ISBN: 0-689-70726-6.
Descriptors: animal welfare, euthanasia, guidelines, methodology, regulations, wild animals, amphibians.
Notes: Available from AAZV.

Baier, J. (2006). **Reptiles**. In: C.K. Baer (Editor), *Guidelines for Euthanasia of Nondomestic Animals,* American Association of Zoo Veterinarians: Lawrence, USA, p. 42-45. ISBN: 0-689-70726-6.
Descriptors: animal welfare, euthanasia, methodology, regulations, wild animals, reptiles.
Notes: Available from AAZV.

Baines, F.M. and R.R. Davies (2004). **The euthanasia of reptiles.** *Herptile* 29(2): 60-71. ISSN: 0953-2021.
Descriptors: reptiles, euthansia techniques, humane methods.

Boonman, J. (1998). **Euthanasie bij reptielen en amfibieen. [Euthanasia of reptiles and amphibians]**. *Lacerta* 56(4): 117-125. ISSN: 0023-7051.
Descriptors: amphibians, reptiles, literature review, euthanasia methods.
Language of Text: Dutch, Summary in English.

Burns, R. (1995). **Considerations in the euthanasia of reptiles, amphibians, and fish.** In: *Proceedings: Joint Conference of the American Association of Zoo Veterinarians, Wildlife Disease Association, and American Association of Wildlife Veterinarians, August 12-17 (1995), East Lansing, Michigan,* American Association of Zoo Veterinarians: p. 243-249.
Descriptors: fish, amphibians, reptiles, killing techniques, euthanasia methods.

Fehr, M. (2002). **Tierschutzgerechte Euthanasie bei Kaninchen, Meerschweinchen, kleinen Nagern und Reptilien. [Humane euthanasia of rabbits, rodents and reptiles]**. *Praktische Tierarzt* 83(2): 128-135. ISSN: 0032-681X.
Descriptors: animal welfare, techniques, rabbits, reptiles, rodents, humane euthanasia.
Language of Text: German, Summary in English.

Fehr, M. (2002). **Nyulak, tengerimalacok, kisragcsalok es hullok allatvedelmi kovetelmenyeknek megfelelo eutanaziaja. [Euthanasia of rabbits, guineapigs, rodents and reptiles, respecting animal welfare requirements]**. *Magyar Allatorvosok Lapja* 124(5): 307-311. ISSN: 0025-004X.
Descriptors: animal welfare, euthanasia, guinea pigs, mice, rabbits, rats, reptiles.
Language of Text: Hungarian.

Mader, D.R. (1996). **Euthanasia and necropsy.** In: D.R. Mader (Editor), *Reptile Medicine and Surgery,* W.B. Saunders Company: Philadelphia, p. 277-281. ISBN: 0721652085.

Descriptors: reptiles, euthanasia, diagnostic techniques, necropsy.

Martelli, P., S. Luz, and W. Meyer (2001). **Informationen zur Euthanasierung von Schlangen - mit Empfehlungen zu qualfreien Vorgehensweisen. [Information on euthanasia of snakes with recommendation of practical procedures]**. *Kleintierpraxis* 46(2): 105-109. ISSN: 0023-2076.
Descriptors: animal welfare, euthanasia, snakes, reptiles, techniques.
Language of Text: German, Summary in English.

Martelli, P., S. Luz, and W. Meyer (2001). **Informationen zur Euthanasierung von Schlangen - mit Empfehlungen zu qualfreien Vorgehensweisen. [Informations on euthanasia of snakes - with recommendations for procedures causing the least distress possible.]**. *Kleintierpraxis* 46(2): 105-109. ISSN: 0023-2076.
Descriptors: snakes, euthanasia techniques, recommendations for various procedures.
Language of Text: German, Summary in English and German.

McArthur, S. (2004). **Anaesthesia, analgesia and euthanasia.** In: S. McArthur, R. Wilkinson and J. Meyer (Editors), *Medicine and Surgery of Tortoises and Turtles.,* Blackwell Publishing: Oxford, p. 379-401. ISBN: 1405108894.
Descriptors: reptiles, sedation, anesthesia, analgesia, euthanasia techniques.

Pizzi, R. and S. McArthur (2004). **Euthanasia technique for chelonians.** *The Veterinary Record* 154(19): 607-608. ISSN: 0042-4900.
Descriptors: euthanasia methods, turtles, chelonians.

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Rodents and Rabbits

Abubakar, D.A., J.B. Adeyanju, and A.A. Tadros (2006). **Laboratory animal euthanasia using intra-medullary injection of air**. *Sahel Medical Journal* 9(1): 7-9. ISSN: 1118-8561.
Online: http://www.ajol.info/viewarticle.php?jid=73&id=26274&layout=abstract
Descriptors: animal welfare, euthanasia, small laboratory animals, medulla oblongata, rats, air injection, intramedullary.

Aldred, A.J., M.C. Cha, and K.A. Meckling Gill (2002). **Determination of a humane endpoint in the L1210 model of murine leukemia.** *Contemporary Topics in Laboratory Animal Science* 41(2): 24-27. ISSN: 1060-0558.
Descriptors: mice, experimental design, leukemia, animal models, animal welfare, posture, animal behavior, mortality, euthanasia, animal husbandry, animal use alternatives, animal use refinement, laboratory mammals.

Artwohl, J., P. Brown, B. Corning, and S. Stein (2006). **Report of the ACLAM Task Force on Rodent Euthanasia.** *Journal of the American Association for Laboratory Animal Science* 45(1): 98-105. ISSN: 1559-6109.
Abstract: The ACLAM Task Force on Rodent Euthanasia was appointed by President Lynn Anderson in 2002 in response to growing concerns and controversy regarding techniques that were commonly used for rodent euthanasia. Three issues were targeted as the focus of the report: euthanasia of fetal and neonatal rodents, the use of carbon dioxide for rodent euthanasia, and the impact of euthanasia techniques on data. The charge to the Task Force was to create a document that summarized in a scholarly and comprehensive manner all available data-based literature relevant to these topics, to assess the scientific merit of the design and conclusions of those studies, and to compile valid information into a concise and cohesive document that could serve as a resource for diplomates, other veterinarians, IACUC members, regulatory bodies, and research scientists. The Task Force has fulfilled this charge in an exemplary manner. During 2004-2005, the ACLAM officers and Board of Directors (BOD) reviewed and critiqued 2 draft versions of the report, and suggestions for change were incorporated into the document presented here. In July 2005, the BOD voted to forego the usual process of distributing the document to theACLAM membership for comment before release based on 2 considerations. First, the literature relevant to rodent euthanasia is continually expanding. As such, at each revision, the Task Force was compelled to incorporate new data and citations. Their consensus view was that new data would continue to emerge, and the document would require continual revision as the review process continued. Related to that, the 2nd consideration of the BOD was that information already accumulated would be of immediate utility to the stake-holders listed above. In lieu of a pre-publication comment period, the BOD and the Task Force instead invite all diplomates, as well as other parties, to comment via email or mail to the BOD liaison for this project, who will compile and maintain all remarks. After an interval deemed appropriate by the ACLAM President, a 2nd Task Force will be appointed to update and modify the Report. Comments will be considered at that time. I want to personally thank all members of the Task Force for their conscientious and comprehensive efforts in compiling this information. They have

created a valuable and informative synthesis that should serve as a resource to the community for years to come.
Descriptors: laboratory animals, euthanasia methods, laboratory animal science, advisory committees, animal welfare, carbon dioxide toxicity, drug delivery systems, psychological stress, rodents.

Brooks, S.P.J., B.J. Lampi, and C.G. Bihun (1999). **The influence of euthanasia methods on rat liver metabolism**. *Contemporary Topics in Laboratory Animal Science* 38(6): 19-24. ISSN: 1060-0558.
Descriptors: euthanasia, rats, liver metabolism, influence, method, optimal method, impact on experimental data.

Conlee, K.M., M.L. Stephens, A.N. Rowan, and L.A. King (2005). **Carbon dioxide for euthanasia: concerns regarding pain and distress, with special reference to mice and rats.** *Laboratory Animals* 39(2): 137-161. ISSN: 0023-6772.
Abstract: Carbon dioxide (CO2) is the most commonly used agent for euthanasia of laboratory rodents, used on an estimated tens of millions of laboratory rodents per year worldwide, yet there is a growing body of evidence indicating that exposure to CO2 causes more than momentary pain and distress in these and other animals. We reviewed the available literature on the use of CO2 for euthanasia (as well as anaesthesia) and also informally canvassed laboratory animal personnel for their opinions regarding this topic. Our review addresses key issues such as CO2 flow rate and final concentration, presence of oxygen, and prefilled chambers (the animal is added to the chamber once a predetermined concentration and flow rate have been reached) versus gradual induction (the animal is put into an empty chamber and the gas agent(s) is gradually introduced at a fixed rate). Internationally, animal research standards specify that any procedure that would cause pain or distress in humans should be assumed to do so in non-human animals as well (Public Health Service 1986, US Department of Agriculture 1997, Organization for Economic Cooperation and Development 2000). European Union guidelines, however, specify a certain threshold of pain or distress, such as 'skilled insertion of a hypodermic needle', as the starting point at which regulation of the use of animals in experimental or other scientific procedures begins (Biotechnology Regulatory Atlas n.d.). There is clear evidence in the human literature that CO2 exposure is painful and distressful, while the non-human literature is equivocal. However, the fact that a number of studies do conclude that CO2 causes pain and distress in animals indicates a need for careful reconsideration of its use. Finally, this review offers recommendations for alternatives to the use of CO2 as a euthanasia agent.
Descriptors: animal welfare, laboratory animals, carbon dioxide, euthanasia methods, laboratory animal science, carbon dioxide, dose response relationship, mice, rats.

Danneman, P.J., S. Stein, and S.O. Walshaw (1997). **Humane and practical implications of using carbon dioxide mixed with oxygen for anesthesia or euthanasia of rats.** *Laboratory Animal Science* 47(4): 376-385. ISSN: 0023-6764.
NAL Call Number: 410.9 P94
Abstract: A series of studies was undertaken to determine whether CO2 can be used as a humane as well as practical agent for euthanasia or anesthesia of rats. Human volunteers rated the degree of discomfort associated with breathing 50 to 100% CO2 mixed with oxygen. Increasing concentrations of CO2 were judged as progressively more noxious, from "highly unpleasant" for 50% CO2 to "painful" for 100% CO2. The practical aspects of anesthesia and euthanasia with 50 to 100% CO2 were studied, using male Sprague Dawley rats. Time to anesthesia and death were inversely related to CO2 concentration, as were the frequency and severity of adverse reactions, including seizures and hemorrhaging from the nose. The severity of edema and hemorrhage, which were observed on histologic examination of the lungs of all rats euthanized with CO2, were greatest in the animals exposed to the lowest concentrations. There were no significant effects of CO2 concentration on time to recumbency or recovery, and there were no significant effects of precharging versus not precharging the chamber on any of the parameters studied. It was concluded that, although CO2 can be used in a humane manner, the concentrations that are least likely to cause pain and distress are associated with the longest times to anesthesia and death, highest incidence of unwanted side effects, and most severe histologic changes in the lungs. Acceptably humane and reasonably practical euthanasia or anesthesia can be achieved using a nonprecharged chamber and a low gas flow rate so that conscious animals are never exposed to CO2 concentrations >70%.
Descriptors: rats, laboratory animals, carbon dioxide, oxygen, anesthesia, euthanasia of animals, pain, animal welfare.

Fehr, M. (2002). **Tierschutzgerechte Euthanasie bei Kaninchen, Meerschweinchen, kleinen Nagern und Reptilien. [Humane euthanasia of rabbits, rodents and reptiles]**. *Praktische Tierarzt* 83(2): 128-135. ISSN: 0032-681X.
Descriptors: animal welfare, techniques, rabbits, reptiles, rodents, humane euthanasia.
Language of Text: German, Summary in English.

Fehr, M. (2002). **Nyulak, tengerimalacok, kisragcsalok es hullok allatvedelmi kovetelmenyeknek megfelelo eutanaziaja. [Euthanasia of rabbits, guineapigs,**

rodents and reptiles, respecting animal welfare requirements]. *Magyar Allatorvosok Lapja* 124(5): 307-311. ISSN: 0025-004X.
Descriptors: animal welfare, euthanasia, guinea pigs, mice, rabbits, rats, reptiles.
Language of Text: Hungarian.

Gebhardt Henrich, S.G., K. Fischer, A.R. Hauzenberger, P. Keller, and A. Steiger (2007). **The duration of capture and restraint during anesthesia and euthanasia influences glucocorticoid levels in male golden hamsters.** *Lab Animal* 36(4): 41-46. ISSN: 0093-7355.
Descriptors: golden hamsters, glucocorticoids, animal stress, litter (bedding).

Gos, T., R. Hauser, and M. Krzyzanowski (2002). **Regional distribution of glutamate in the central nervous system of rat terminated by carbon dioxide euthanasia.** *Laboratory Animals* 36(2): 127-133. ISSN: 0023-6772.
Abstract: Carbon dioxide euthanasia is an established method for the termination of small laboratory animals. It has also been employed by the authors in neurobiological research on the postmortem glutamate concentration in the structures of rat brains. The following investigations were aimed at optimizing the termination procedure based on the CO2 saturation rate of the inhaled air. Two rates of CO2 flow were applied, and the higher one significantly augmented the glutamate level in the hippocampus and cerebellum. The relationship between this finding and signs of central fear reaction is discussed. The authors conclude that lower rather than higher CO2 flow in euthanasia procedures is gentler and is therefore preferable for use with laboratory animals.
Descriptors: rats, euthanasia, carbon dioxide, dosage, fearfulness, animal welfare, amygdala, hippocampus, cerebellum, glutamic acid, animal use refinement, fear reaction.

Grahwit, G. (2005). **Toeten kleiner Nagetiere Anlaesse, Methoden and tierschutzgemaesse Bewertung. [Euthanasia of small rodents. Reasons, methods, and assessment of animal welfare].** *Deutsche Tieraerztliche Wochenschrift* 112(3): 95-97. ISSN: 0341-6593.
Descriptors: German Animal Welfare Act, euthanasia of vertebrates, available methods of euthanasia, small rodents, assessment of animal welfare, literature review.
Language of Text: German, Summary in English and German.

Hackbarth, H., N. Kuppers, and W. Bohnet (2000). **Euthanasia of rats with carbon dioxide--animal welfare aspects.** *Laboratory Animals* 34(1): 91-96. ISSN: 0023-6772.
Abstract: A method of inducing euthanasia by carbon dioxide (CO2) inhalation in the home cage of an animal is described and tested for distress by behavioural as well as by hormonal measures. The animals were maintained in their home cage while CO2 was induced at a flow of 6 l/min. The behaviour of the animals was measured continuously as were the serum concentrations of glucose, ACTH and corticosterone 30, 75 and 120 s after the CO2 was introduced into the cage. In order to test for distress, two groups of rats were pre-treated with acepromazine (orally) and pentobarbiturate (i.p. injection) respectively, in order to reduce possible distress caused by CO2 euthanasia, and were compared with control groups. There were no signs of distress by behavioural or by hormonal changes. All changes seen could be attributed to experimental effects and, especially as there was no difference between the pre-treated and the control groups of rats, it must be assumed that the described method of euthanasia is in concordance with animal welfare, it leads to rapid death without severe distress or pain, and it seems therefore to be 'humane'.
Descriptors: animal welfare, carbon dioxide, euthanasia, anesthesia, sedatives, animal behavior, rats.

Hayward, M. (2001). **Disagrees with one aspect of the euthanasia panel report.** *Journal of the American Veterinary Medical Association* 219(7): 907. ISSN: 0003-1488.
Descriptors: euthanasia, intraperitoneal injections, pain, rats.
Notes: Comment On: J Am Vet Med Assoc. 2001 Apr 15;218(8):1262.

Henke, J., C. Faltermeier, and W. Erhardt (2003). **Anasthesie, Analgesie und Euthanasie bei kleinen Heimtieren. [Anaesthesia, analgesia and euthanasia of small pets]**. *Tierarztliche Praxis Ausgabe K, Kleintiere/Heimtiere* 31(6): 394-397. ISSN: 1434-1239.
Descriptors: anesthesia, analgesia, euthanasia, inhaled anesthetics, injectable anesthetics, small animal practice, chinchillas, gerbils, guineapigs, hamsters, mice, rabbits, rats, veterinary medicine.
Language of Text: German.

Howell, R.L., C.L. Donegan, and C.A. Pinkert (2003). **Mouse embryo yield and viability after euthanasia by CO2 inhalation or cervical dislocation.** *Comparative Medicine* 53(5): 510-513. ISSN: 1532-0820.
Abstract: Efficient production of transgenic mice requires high yields of viable, healthy embryos. Cervical dislocation (without prior anesthesia) rather than CO2 inhalation as a means of euthanasia has been justified on the basis of the increased yield of viable ova, but controlled studies have not directly supported this contention. The American Veterinary Medical Association (AVMA) and Canadian Council on Animal Care (CCAC) Guides, and respective Institutional Animal Care and Use Committees (IACUC) have

supported the use of CO2 as a preferred, humane method. The study reported here was undertaken to determine the relative yields of viable embryos from mice euthanized either by inhalation of 100% CO2 or by cervical dislocation. Inbred and hybrid mouse strains, representative of common strains used in genetic engineering experimentation included C57BL/6, FVB/N, and B6SJLF1. There was no difference in the embryo yields in comparisons using the two methods of euthanasia (P = 0.534). Decisions regarding the method of euthanasia can be made on the basis of criteria other than those associated with embryo yield and viability.
Descriptors: carbon dioxide, embryo physiology, euthanasia, spinal injuries, animal welfare, cell culture techniques, animal ethics, laboratory animal science, mice, inbred C57BL, trangenic mice.

Johnson, R. (2005). **Evaluation of comparison between CO2O2 and CO2 gas in the euthanasia of mice**. *Animal Technology and Welfare* 4(2): 117-119. ISSN: 0264-4754.
Descriptors: mice, euthanasia, CO2O2, CO2, comparison, animal welfare, stress.
Notes: Poster presentation originally presented at The Institute of Animal Technology Annual Congress, March 2005.

Kirkden, R.D., L. Niel, and D.M. Weary (2005). **Aversion to carbon dioxide.** *Laboratory Animals* 39(4): 453-455. ISSN: 0023-6772.
Descriptors: animal welfare, laboratory animals, carbon dioxide poisoning, euthanasia, rats.
Notes: Comment On: Lab Anim. 2005 Jul;39(3):353-4.

Klaunberg, B.A., J. O'malley, T. Clark, and J.A. Davis (2004). **Euthanasia of mouse fetuses and neonates.** *Contemporary Topics in Laboratory Animal Science* 43(5): 29-34. ISSN: 1060-0558.
Abstract: We sought to determine whether any of the common methods of euthanasia for adult rodents would lead to an acceptable death for fetuses or neonates. We wanted to identify a method that was rapid, free of signs of pain or distress, reliable, and minimally distressful to the person performing the procedure and that minimized the amount of handling required to perform the procedure. We evaluated six methods of euthanasia, with and without anesthesia, in three age groups of mice: gravid mice (E14-20) and neonatal pups (P1-P7 and P8-P14). Euthanasia methods included: halothane inhalation, carbon dioxide inhalation, intraperitoneal sodium pentobarbital, intravenous potassium chloride, and cervical dislocation with and without anesthesia. Noninvasive echocardiography was used to assess heartbeat during euthanasia. With cardiac arrest as the definition of death, no method of euthanasia killed fetal mice. Halothane inhalation (5% by vaporizer) was not an acceptable method of euthanasia for mice of the age groups tested. Intraperitoneal administration of sodium pentobarbital for euthanasia required a higher dose than the previously established dose, and there is a risk of reduced efficacy in pregnant animals due to potential intrauterine injection. Carbon dioxide asphyxiation was the most efficient method of euthanasia for neonatal mouse pups P1-14. For pregnant adult mice, intravenous potassium chloride under anesthesia, carbon dioxide asphyxiation, and cervical dislocation alone or under anesthesia were excellent methods of euthanasia. Copyright 2004 American Association for Laboratory Animal Science
Descriptors: laboratory animals, euthanasia, mice, newborn animals, carbon dioxide, echocardiography, halothane poisoning, chemically induced heart arrest, pentobarbital poisoning, potassium chloride poisoning, spinal injuries.

Kuppers, N. (1997). ***Beurteilung der CO2-Betabung von Laborratten auf Tierschutzgerechtigkeit. [Humane aspects of anaesthetizing laboratory rats with carbon dioxide]***. Dissertation, Fachbereich Veterinarmedizin, Freie Universitat: Berlin, Germany.
Descriptors: laboratory animals, euthanasia, carbon dioxide, rats.
Language of Text: German, Summary in English.

Leach, M., M. Raj, and D. Morton (2005). **Aversiveness of carbon dioxide.** *Laboratory Animals* 39(4): 452-453. ISSN: 0023-6772.
Descriptors: animal welfare, carbon dioxide poisoning, euthanasia, animal methods, laboratory animals, rats.
Notes: Comment On: Lab Anim. 1999 Apr;33(2):155-61.

Leach, M.C., V.A. Bowell, T.F. Allan, and D.B. Morton (2002). **Aversion to gaseous euthanasia agents in rats and mice.** *Comparative Medicine* 52(3): 249-257. ISSN: 1532-0820.
Abstract: Despite euthanasia being the most common of all procedures carried out on laboratory animals, the potential distress associated with gaseous agents has received little interest until recently, with growing concern over use of carbon dioxide as a humane method of euthanasia. The distress associated with exposure to carbon dioxide, argon, and carbon dioxide-argon mixtures was investigated in rats and mice by measuring the degree of aversion on exposure to low, medium, and high concentrations of these agents. Animals were exposed to the various concentrations in a test chamber containing air or gas mixtures that they were able to enter and leave at will. Aversion was assessed, using measurements of initial withdrawal time and total dwelling time in the test chamber, as

they were the most sensitive measurements of aversion. Comparisons between euthanasia agent and control (air) treatments indicated that concentrations of agents recommended for rapid and efficient induction are associated with some degree of aversion. Carbon dioxide and the carbon dioxide-argon mixtures were more aversive than was argon for rats and mice. These findings suggest that induction with carbon dioxide either alone or in combination with argon is likely to cause considerable distress before the loss of consciousness in rodents, which is unacceptable considering that effective and more humane alternatives are available.
Descriptors: rats, mice, euthanasia, hypoxia, carbon dioxide, argon, mixtures, animal welfare, distress, animal use refinement, escape responses, laboratory mammals.

Leach, M., V. Bowell, T. Allan, and D. Morton (2004). **Measurement of aversion to determine humane methods of anaesthesia and euthanasia.** *Animal Welfare* 13(Suppl.): S77-S86. ISSN: 0962-7286.
Descriptors: anesthesia, laboratory animals, rats, mice, carbon dioxide, halothane, general anesthetics, animal welfare, aversion, euthanasia.

McClure, D. and N. Anderson (2006). **Rodents and small mammals**. In: C.K. Baer (Editor), *Guidelines for Euthanasia of Nondomestic Animals,* American Association of Zoo Veterinarians: Lawrence, USA, p. 61-65. ISBN: 0-689-70726-6.
Descriptors: euthanasia, guidelines, inhaled anesthetics, potassium chloride, stunning, rabbits, rodents, CO2.
Notes: Available from AAZV.

McIntyre, A. and N. Lipman (2006). **Controversy exists on the use of carbon dioxide (CO2) for the euthanasia of rodents.** *Journal of the American Association for Laboratory Animal Science JAALAS* 45(4): 7. ISSN: 1559-6109.
Descriptors: laboratory animals, carbon dioxide toxicity, euthanasia, animal methods, rodents.

McIntyre, A.R., R.A. Drummond, E.R. Riedel, and N.S. Lipman (2007). **Automated mouse euthanasia in an individually ventilated caging system: System development and assessment.** *Journal of the American Association for Laboratory Animal Science* 46(2): 65-73. ISSN: 1559-6109.
Descriptors: mice, euthanasia, automation, animal housing, cages, ventilation systems, systems analysis, carbon dioxide, animal stress, distress.

Nemzek, J.A., H.Y. Xiao, A.E. Minard, G.L. Bolgos, and D.G. Remick (2004). **Humane endpoints in shock research.** *Shock* 21(1): 17-25. ISSN: 1073-2322.
Abstract: In biomedical research using animal models, the phrase "humane endpoints" refers to predetermined criteria used to judge when the research animals should be humanely euthanized. The intended goal of humane endpoints is to minimize the distress or suffering of research animals; however, if applied incorrectly, this well-intended concept could lead to premature decisions and inaccurate data, resulting in a waste of animal life. A concensus on specific endpoints for shock and inflammation research is not available but several biochemical, physical and behavioral parameters have been suggested for other research models. In addition, the authors have found, in the studies presented here, that increasing body weight, decreased body temperature, and inability to ambulate are important parameters in a model of cecal ligation and puncture. However, it is clear that the applicability of these endpoints may change with the model of disease, intensity of insults, experimental treatments and other factors. Consequently, humane endpoints should be assigned cautiously and preferably after preliminary studies to prevent aberrant research results. In order to accomplish this, investigators must become aware of certain concepts including: when to implement endpoints, what endpoints to consider, and how to establish the endpoints for their studies. Equipped with the basic principles of humane endpoints, investigators can make informed decisions that meet current standards of animal care while still achieving the scientific goals of their research studies.
Descriptors: research design, sepsis, shock, animal welfare, laboratory animals, body temperature, disease models, euthanasia, mice, rats, research.
Notes: Comment In: Shock. 2004 Aug;22(2):189; author reply 189-90.

Niel, L. and D.M. Weary (2006). **Behavioural responses of rats to gradual-fill carbon dioxide euthanasia and reduced oxygen concentrations.** *Applied Animal Behaviour Science* 100(3-4): 295-308. ISSN: 0168-1591.
Online: doi:10.1016/j.applanim.2005.12.001
Descriptors: rats, laboratory animals, euthanasia, carbon dioxide, argon, hypoxia, distress, physical activity, vocalization, escape behavior, animal well being.

Patrican, L.A. and R. Vaidyanathan (1996). **Arthropod succession in rats euthanized with carbon dioxide and sodium pentobarbital.** *Journal of the New York Entomological Society* 103(2): 197-207. ISSN: 0028-7199.
Descriptors: insects, habitat succession, euthanized mammalian carcasses, New York, decomposition of carcasses.

Pecaut, M.J., A.L. Smith, T.A. Jones, and D.S. Gridley (2000). **Modification of immunologic and**

hematologic variables by method of CO2 euthanasia. *Comparative Medicine* 50(6): 595-602. ISSN: 1532-0820.

Abstract: Background and Purpose: The major goal was to determine whether variations in the method of CO2 euthanasia would induce significant immunologic differences. Methods: Young adult C57BL/6 mice (n = 40) were euthanized, using four regimens: 70% CO2/30% O2; 70% CO2/30% O2 leads to 100% CO2; 100% CO2-naive chamber; and 100% CO2 pre-charged chamber. Time to recumbency and euthanasia and body, liver, lung, spleen, and thymus masses were determined. Blood and spleen were further evaluated for leukocyte, lymphocyte, and thrombocyte counts, erythrocyte characteristics, distribution of lymphocyte subpopulations, spontaneous and mitogen-induced blastogenesis, complement activity, and cytokine production. Results: Time to euthanasia was five- to eightfold longer in mice exposed to 70% CO2/30% O2 than that for any other group. There were slight increases in mean erythrocyte volume (MCV) and mean erythrocyte hemoglobin (MCH) for all groups, compared with those for the 100% CO2 pre-charged group. Circulating cytotoxic T (CD8(+)) lymphocyte percentages and numbers, and spontaneous blastogenesis of leukocytes in blood and spleen, also were affected by euthanasia method. Conclusions: The method of CO2 euthanasia can result in significant differences in immunologic/hematologic variables. Thus, consistency in euthanasia procedures may be important in accurate interpretation of research data.

Descriptors: mice, euthanasia, carbon dioxide, mixtures, oxygen, lymphocytes, spleen, lymphocyte proliferation, blood serum, blood plasma, transforming growth factors, interleukin-2, tumor necrosis factor, experimental design, animal welfare, distress, hematologic tests, leukocyte count, complement activation.

Persinger, M.A. (2003). **Rats' preferences for an analgesic compared to water: An alternative to "killing the rat so it does not suffer".** *Perceptual and Motor Skills* 96(2): 674-680. ISSN: 0031-5125.

Abstract: A common policy in research institutions is to kill rats when they display chronic disabilities or recurrent injuries. These guidelines appear to be derived from an oxymoron that "it's better for a rat to be killed so it does not suffer pain" and from untested assumptions that rats cannot control "pain." In a two-bottle paradigm, 10 rats with a history of brain damage following status epilepticus from a single systemic injection of lithium and pilocarpine were given options to consume freely either tap water or 1 mg/cc of acetaminophen in tap water. During periods of fresh lesions due to persistent gnawing or acute injuries associated with tonic-clonic convulsions, the rats consumed 3 to 10 times the fluid from the bottles containing acetaminophen (equivalent to 5 to 10 extra-strength Tylenol tablets per day for a 70-kg person) relative to periods when no lesions or old lesions were present. These results suggest that rats with chronic injuries sufficient to be terminated according to Animal Care guidelines may be capable of reducing the aversive physiological conditions associated with tissue damage by selecting analgesic treatments.

Descriptors: analgesics administration and dosage, choice behavior, euthanasia, pain prevention and control, water, rats.

Notes: Comment In: Contemp Top Lab Anim Sci. 2003 Jul;42(4):7.

Pritchett, K., D. Corrow, J. Stockwell, and A. Smith (2005). **Euthanasia of neonatal mice with carbon dioxide.** *Comparative Medicine* 55(3): 275-281. ISSN: 1532-0820.

Abstract: Exposure to carbon dioxide (CO2) is the most prevalent method used to euthanize rodents in biomedical research. The purpose of this study was to determine the time of CO2 exposure required to euthanize neonatal mice (0 to 10 days old). Multiple groups of mice were exposed to 100% CO2 for time periods between 5 and 60 min. Mice were placed in room air for 10 or 20 min after CO2 exposure, to allow for the chance of recovery. If mice recovered at one time point, a longer exposure was examined. Inbred and outbred mice were compared. Results of the study indicated that time to death varied with the age of the animals and could be as long as 50 min on the day of birth and differed between inbred and outbred mice. Institutions euthanizing neonatal mice with CO2 may wish to adjust their CO2 exposure time periods according to the age of the mice and their genetic background.

Descriptors: inhalation anesthesia, animal welfare, carbon dioxide administration, euthanasia, age factors, newborn animals, mice, species specificity.

Sharp, J., T. Azar, and D. Lawson (2006). **Comparison of carbon dioxide, argon, and nitrogen for inducing unconsciousness or euthanasia of rats.** *Journal of the American Association for Laboratory Animal Science* 45(2): 21-25. ISSN: 1559-6109.

Abstract: We compared CO(2), Ar, and N(2) for inducing unconsciousness and euthanasia of Sprague-Dawley rats. We determined time to unconsciousness and monitored heart rate (HR) and mean arterial blood pressure (MAP) by radiotelemetry to assess stress, recovery after exposure, and time of death. Unconsciousness (mean +/- standard error) occurred 24 +/- 3, 87 +/- 8, and 93 +/- 8 s after short-term exposure to CO(2), Ar, and N(2), respectively. During exposure, CO(2) depressed HR, whereas Ar and N(2) increased HR. Upon removal from the chamber, rats' HR rapidly normalized after CO(2) or N(2) but remained elevated for 60 min after Ar. During exposure, all agents depressed MAP, which returned to resting levels 10 to 50 min after rats' removal from the chamber. For euthanasia, CO(2) at approximately 100% induced unconsciousness in 37 +/- 3 s, increased and then depressed MAP and HR, and caused death at 188 +/- 15 s. CO(2) at

approximately 30% induced unconsciousness in 150 +/- 15 s, decreased HR and MAP, and induced death at 440 +/- 9 s. Ar at approximately 100% increased MAP but decreased HR, induced unconsciousness with hyperreflexia at 54 +/- 4 s, and caused death at 197 +/- 20 s. N(2) at approximately 100% decreased MAP but not HR and produced unconsciousness with hyperreflexia at 164 +/- 17 s and death at 426 +/- 28 s. We conclude that CO(2) effectively produced unconsciousness and euthanasia, but we were unable to ascertain distress. Ar also appears effective but produced hyperreflexia and tachycardia. N(2) was ineffective.
Descriptors: laboratory animals, argon, carbon dioxide, euthanasia methods, nitrogen, chemically induced unconsciousness, blood pressure, heart rate, Sprague Dawley rats, reflex, abnormal drug effects.

Smith, W. and S.B. Harrap (1997). **Behavioural and cardiovascular responses of rats to euthanasia using carbon dioxide gas.** *Laboratory Animals* 31(4): 337-346. ISSN: 0023-6772.
Descriptors: rats, behavior, animal welfare, carbon dioxide, destruction of animals, laboratory animals.

Stutler, S.A., E.W. Johnson, K.R. Still, D.J. Schaeffer, R.A. Hess, and D.P. Arfsten (2007). **Effect of method of euthanasia on sperm motility of mature Sprague-Dawley rats.** *Journal of the American Association for Laboratory Animal Science JAALAS* 46(2): 13-20. ISSN: 1559-6109.
Descriptors: rats, euthanasia, methodology, carbon dioxide, anesthetics, decapitation, spermatozoa, sperm motility, volatile anesthetics.

Wood, R.W. (2005). **Aversiveness of carbon dioxide.** *Laboratory Animals* 39(3): 353-354. ISSN: 0023-6772.
Descriptors: animal welfare, laboratory animals, carbon dioxide toxicity, escape reaction, euthanasia, research design, animal ethics, mice, rats, reproducibility of results.
Notes: Comment On: Comp Med. 2002 Jun;52(3):249-57.

Young, A. (2006). **Halothane induction results in differing behaviours compared with Carbon Dioxide mixed with Oxygen when used as a rat euthanasia agent**. *Animal Technology and Welfare* 5(2): 49-59. ISSN: 1742-0385.
Online: www.iat.org.uk
Descriptors: rat, euthanasia, halothane, oxygen-carbon dioxide mixture, delivery rates, discomfort.

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