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Neovison Vison: Code of Good Practice for Euthanasia in Mink

ABSTRACT: *The new European regulation lays down rules for the killing of animals bred for the production of food, wool, fur, or other products as well as the killing of animals for the purpose of depopulation and for related operators. Regulation emphasizes the meaning of education, competence, and self-monitoring. The operators are obligated to draw up and implement standard operating procedures (SOP). The purpose is to unify the methods and practices used in killing of animals and thereby improve the welfare of animals. SOP needs to set objectives, operating procedures, define the main parameters to be monitored, and guidelines for situations in which an animal is not stunned or killed as expected. The regulation obligates killing device manufacturers to give instructions and recommendations, which are to be taken in to account when drawing up SOP. The killing device must be maintained and checked according to the manufacturers' instructions by persons, specifically trained for this purpose on a regular basis. The new regulation allows the mink to be euthanized with carbon monoxide (CO), carbon dioxide (CO₂), electricity, shooting, and passing through the bolt gun; and the emergency killing of animals weighting less than 5 kg with a blow in the head. Killing will be monitored by observing the animals and monitoring the key parameters affecting the efficiency of euthanasia. These are: concentration, exposure time, temperature, and sufficient filtration. Upon request, SOP, records, and other documents must be given to the competent authority.*
KEY WORD: *Killing methods, gas euthanasia, fur farming, good practice, standard operating procedures, and farmed mink.*

RESUME: *Makalah ini berjudul "Neovison Vison: Pedoman Praktek yang Baik untuk Euthanasia dalam Cerpelai". Peraturan Eropa baru menerapkan ketentuan untuk membunuh jenis binatang untuk produksi makanan, wol, bulu, atau produk lain dan juga membunuh binatang untuk tujuan pengurangan populasi dan pelaksana yang terkait. Peraturan menekankan arti pendidikan, kompetensi, dan pengawasan diri. Para pelaksana diwajibkan untuk mempersiapkan dan mengimplementasikan prosedur operasional standar (POS). Tujuannya adalah untuk menyatukan metode dan praktek yang digunakan dalam membunuh binatang dan dengan demikian meningkatkan kesejahteraan binatang. POS perlu menentukan tujuan, prosedur pengoperasian, menentukan parameter utama yang akan diawasi, dan pedoman-pedoman untuk situasi-situasi dimana binatang tidak dibius atau dibunuh seperti yang diharapkan. Peraturan mewajibkan produsen alat pembunuh untuk memberikan instruksi/petunjuk dan rekomendasi, yang akan dipertimbangkan ketika mempersiapkan POS. Alat pembunuh harus dipelihara dan diperiksa menurut instruksi produsen oleh orang-orang, khususnya yang terlatih untuk tujuan ini. Peraturan baru mengizinkan cerpelai dibunuh dengan karbon monoksida (CO), karbon dioksida (CO₂), listrik, tembakan, dan menembakan senjata api; serta pembunuhan darurat binatang yang memiliki berat kurang dari 5 kg dengan tembakan di kepala. Pembunuhan akan diawasi dengan mengamati binatang dan mengamati parameter utama yang mempengaruhi efisiensi pembiusan. Parameter tersebut adalah konsentrasi, waktu pencahayaan, suhu, dan filtrasi yang cukup. Atas permintaan, POS, catatan, dan dokumen lainnya harus diberikan kepada pihak berwenang yang kompeten.*

KATA KUNCI: *Metode pembunuhan, pembiusan gas, peternakan bulu, praktek yang baik, prosedur operasional standar, dan cerpelai yang diternakan.*

INTRODUCTION

The new European Council Regulation (EC No.1099/2009) on the protection of animals at the time of killing has been put in practise from the beginning of 2013. The regulation lays down rules for the killing of animals bred for the production of food, wool, fur, or other products as well as

the killing of animals for the purpose of depopulation and for related operators. Regulation emphasizes the role of education, competence, and self-monitoring in euthanasia of animals.

The new regulation allows the mink to be euthanized with carbon monoxide (CO), carbon dioxide (CO₂), electricity, shooting,

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and passing through the bolt gun; and the emergency killing of animals weighting less than 5 kg with a blow in the head. Killing will be monitored by observing the animals and monitoring the key parameters affecting the efficiency of euthanasia.

With pure CO₂ and pure CO methods, these are: concentration, the exposure time, and temperature; and with exhaust gas method: concentration, the exposure time, temperature, and sufficient filtration. Fur farmers, must notify the authority about the killing in advance. Killing is done under direct supervision and in the presence of a person holding a certificate of competence issued for all the operations carried out in his supervision.

Farmers are obligated to draw up and implement standard operating procedures (SOP). The purpose of SOP is to unify the methods and practices used in killing of animals, and thereby improve the welfare of animals and the competitiveness of operators on the market. Standard Operating Procedures need to set objectives, operating procedures, define the main parameters to be monitored, and guidelines for situations in which an animal is not stunned or killed as expected.

The code of good practise for CO and CO₂ Euthanasia in Mink is written in order to unify killing practices European wide, and aid the farmer in planning of SOP. The code of good practice shortly describes the content of Council Regulation (EC No.1099/2009) that concerns the killing of mink and gives recommendations concerning the killing.

This paper shortly describes the content of the code of good practice in killing of mink and highlights the key points of which the farmer should be aware of.¹

MATERIAL AND METHODS

The basic research for this code of good practice was carried out in 2010-2012. The main research location was the

MTT Agrifood Research Finland. The research project consisted of clarification of the following partial components: (1) Present euthanasia methods in use and the situation on mink farms; (2) Functionality of impure carbon monoxide equipments; and (3) Efficiency of the euthanasia methods in mink. The present paper is based on original project results published in Hannu T. Korhonen (2010); Hannu T. Korhonen *et al.* (2012); and Hannu T. Korhonen, S. Cizinauskas and J. Jesernics (2012).

DEFINITION OF EUTHANASIA AND KILLING

The term *euthanasia* is derived from the Greek terms, *eu* meaning good; and *thanatos* meaning death. A "good death" would be one that occurs with minimal pain and distress. In the context of the present guidelines, euthanasia can be considered the act of inducing humane death in a mink. Euthanasia techniques here should result in rapid loss of consciousness followed by cardiac or respiratory arrest and the ultimate loss of brain function (Korhonen, Cizinauskas & Viitmaa, 2009; and Korhonen *et al.*, 2011).

Another word related to euthanasia is *killing* which means any intentionally induced process which causes the death of an animal. *Emergency killing* means the killing of animals which are injured or have a disease associated with severe pain or suffering and where there is no other practical possibility to alleviate this pain or suffering.

EUTHANIZING AGENTS

The euthanizing agents here are gases, either carbon monoxide (CO) or carbon dioxide (CO₂). The main principle for proper killing is that any gas that is inhaled must reach a certain concentration in the alveoli before it can be effective. The suitability of a particular agent depends on whether an animal experiences distress between the time it begins to inhale the agent and the time it loses consciousness. Therefore, a proper gas concentration in the chamber and the animal's alveoli with proper exposure time

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is essential for a humane way of euthanasia (Korhonen, Sepponen & Eskeli, 2013).

CO is a toxic gas yet colourless, odourless, and tasteless. It is very difficult for people and animals to detect. CO does not cause any essential irritation. Symptoms of mild acute poisoning in humans include headache, vertigo, and flu-like effects. Greater exposure can lead to significant toxicity of the central nervous system and heart, and even death.

CO causes adverse effects mainly by binding to haemoglobin (HbCO) in the blood. This prevents oxygen from binding to haemoglobin, which reduces the oxygen-carrying capacity of the blood and leading to hypoxia. The toxic effects of carbon monoxide are cumulative and can, therefore, cause symptoms of poisoning even at very low concentrations during a long period of time. According to the official chemical card, a safe exposure level in humans is 30 ppm during an 8 hour work day. At concentrations of 12.5 – 75%, CO is highly explosive.

Both filtered engine produced CO as well as pure source CO from cylinders can be used for euthanasia of mink. CO is a highly toxic gas. Since it is odourless, it must be used only under well-ventilated conditions and safety instructions for those using it must be strictly adhered to. Information about the properties of the gas, safety limits, and safety precautions are presented in the safety data sheet provided by the gas supplier and e.g. in the official chemical safety card.

Exhaust gases from motor are used in euthanasia of mink. Depending on the motor, exhaust gas from the motors of relatively old feeding trucks contain on average 6-9% of carbon monoxide and exhaust gas from killing trolleys on average 2-7% of carbon monoxide. Exhaust gases from car motors provided with catalysts, contain a low level of carbon monoxide (on average 0.01-0.29%), and therefore cannot be used in euthanasia of animals. Without filtering the amount of impurities in exhaust CO is less than 1% and the filtering reduces the amount of impurities even further.

CO₂ is a colourless and odourless gas. It is heavier than air. At low levels, it has few toxicological effects and is typically safer to use than CO. According to the official chemical card a safe exposure level in humans is 5,000 ppm during an 8 hour working day. In animals, inhalation of CO₂ at a concentration of > 7.5% may increase the pain threshold and higher concentrations may even have a certain anaesthetic effect. Essential irritation effect has not been described. When released with high pressure, CO₂ forms a mixture of gas and dry ice, which can be even as low as -78°C.

Hypercapnia is a condition in which there is too much CO₂ in the blood. *Hypercapnia* can induce increased cardiac output, elevated arterial blood pressure, and a propensity for arrhythmias. At high concentrations (>75%), CO₂ normally cause headache, confusion, lethargy, and death.

Carbon monoxide differs from carbon dioxide in that it has a cumulative effect whereas the effect of carbon dioxide is reversible to a certain point. Carbon dioxide is a natural substance in an animal's blood stream and its' concentration levels are regulated through breathing, whereas animals have not developed any mechanisms for eliminating carbon monoxide from their bodies. This is why the death can be achieved with a lower concentration of CO than CO₂.

STANDARD OPERATING PROCEDURES AND REPORTING

The business operator is obliged to plan the killing of animals and related operations in advance by drawing up standard operating procedure. Upon request the standard operating procedure has to be made available to the competent authority. The standard operating procedure has to: (1) *take in to account manufacturers' recommendations*; (2) *define for each stunning method used, on the basis of available scientific evidence, the key parameters ... ensuring their effectiveness to stun the animals*; and (3) *specify the measures to be taken when the checks ... indicate that an animal is not properly stunned ...* (AVMA, 2007; and EC No.1099/2009).

The farmer has to make sure that the daily killing operations are carried out in accordance with the standard operating procedure and document the follow-up of killing procedures. The control report should include at least the following: (1) Name of the person/s responsible for killing; (2) A copy of the certificate of competence; (3) Date/s, starting time, and ending time of the killing; (4) Results of parameters and check-ups; and (5) Report of the equipment check-ups and possible service information (ICSCs, 2002; and EC No.1099/2009).

The authorities must be informed about the beginning of killing of mink in advance. Killing equipment, especially the motors used in CO production, are to be checked before the killing begins. The reports concerning the condition and service procedures of the killing equipment have to be kept at least for a year.

GENERAL INSTRUCTIONS FOR CO AND CO₂ EUTHANASIA

The code of good practice describes the properties of two gasses mostly used in killing of mink, i.e. carbon monoxide (CO) and carbon dioxide (CO₂). The source of CO₂ is without exception commercially filled cylinders, but the source of CO can be either a cylinder or an engine adapted for killing.

The killing must be done in such a way as to cause as little pain, distress, and suffering for the animals as possible. The equipment must be planned, constructed, and maintained in such a way that the animals are not injured. Standard sized chambers (~0.7 m²) or commercial equipment is recommended, since the regulation obligates the manufacturers to give specific instructions for e.g. how the equipment should be used and for how many animals it is developed. The proper function of the equipment is recommended to be checked before the start of killing.

On the Specific Instructions for CO Euthanasia. When euthanizing animals with CO (either pure source or from exhaust gas), it must be possible to have the animals under visual supervision at all times, and thus an inspection facility (e.g. transparent

glass) should be made available on the killing chamber. The animals shall be placed in to the chamber one by one, and it must be ensured that before the next animal is introduced the previous one is unconscious or dead.

First, Engine CO. According to regulation, a gas produced by an engine, specially adapted for the purpose of killing of animals, may be used provided that the person responsible for killing has previously verified that gas has been suitable cooled, sufficiently filtered, and is free from any irritant component or gas.

The engine must be kept running sufficiently long (normally more than 3 minutes in ca. 0.7 m³ chamber) before placing the first mink to the chamber (Korhonen *et al.*, 2011). When using exhaust gases, the gas mixture has to contain more than 1% of carbon monoxide. However, a higher concentration (not less than 4%) is recommended to produce a rapid unconsciousness (Korhonen *et al.*, 2011).

It is recommended to keep the engine running all the time when adding mink to the chamber. The engine must be kept running for a sufficient amount of time after adding the last mink to the chamber (normally more than 3 min), until all the animals are dead. The functionality of engine used for gas production should be checked yearly before the beginning of killing.

Second, Pure CO. According to council regulations, when using a pure source of carbon monoxide, a concentration of not less than 4% is demanded for the euthanasia of mink. When using cylinder CO, a sufficient pre-gasification is required before the first animal is placed into the chamber. Gas flow can be kept continuous during killing procedure. The gas has to be kept flowing until all the animals are dead.

On the Specific Instructions for CO₂ Euthanasia. Carbon dioxide from cylinders can be used in euthanasia of mink. CO₂ euthanasia can be performed in pits, tunnels, containers, or building previously sealed. It is recommended that the carbon dioxide euthanasia chamber contains the appropriate concentration of carbon dioxide before any

Table 1:
The Key Parameters to be Checked When Killing Mink with Different Killing Methods

Parameter	Pure Carbon Monoxide	Exhaust Carbon Monoxide	Carbon Dioxide
Gas concentration	≥ 4% CO	≥ 1% of CO*	≥ 80% CO ₂
Duration of exposure	~3-4 min	~3-4 min	~3-4 min
Quality of gas	Manufacturers purity information	-	Manufacturers purity information
Temperature of gas	Not a marked problem	Can be really hot, must be cooled	Can be really cold. The gas inlet must not be pointed towards animals
Filtration of gas	-	Must be sufficiently filtered	-

mink are introduced. According to council regulation, “*The minimum concentration of 80% of carbon dioxide shall be used*” (EC No.1099/2009).

The gas flow is recommended to be kept flowing when adding the animals into the chamber. After post-gasification, when all the animals are dead, the chamber can be emptied. Under no circumstances shall gases enter into the chamber or location where animals are to be stunned and killed in a way that it could create burns or excitement by freezing or lack of humidity.

Since carbon dioxide does not have a cumulative toxic effect and the animal may recover consciousness after an insufficient exposure to the gas (AVMA 2007), it is recommended to visually supervise the animals during the killing procedure.

MONITORING OF KILLING EFFICIENCY

Regular checks for proper death of the animals have to be made, as well as checks of key parameters affecting the efficiency of killing. The key parameters to be checked are i.e. CO-concentration, quality of the gas, duration of exposure, and temperature of the gas and sufficient filtration (table 1).

Gas concentration and exposure time are key factors affecting the effectiveness of the killing process. The higher concentration of gas in the air, the quicker the acquired concentration in the blood stream is achieved. There should be a possibility to evaluate the concentration of gas inside the chamber. The concentration of gas is recommended to be checked at least when testing the equipment and killing protocol and once or more during killing.

Otherwise, the checking of proper concentration is done by visually observing animals. Gas manufacturers are mainly responsible for the purity and quality of pure gases purchased in cylinders. The exhaust gasses from the engines have to be properly filtered. During killing, the efficiency of filtering is evaluated by regularly observing the behaviour of the animals and the dirtiness of filter. In addition, the amount of impurities is recommended to be check at the yearly check of the motor.

The temperature may also cause pain and distress and it should be regularly checked. Where emission gases from the motors can be very hot and have to be properly cooled, carbon dioxide gas can be really cold when released with high pressure. Too high or low temperatures are not an essential problem with cylinder CO gas but according to regulation, it should also be monitored. In addition, the animals can produce a lot of heat themselves.

Quality of gas, sufficient filtration, and temperature affect the quality aspects of death and, therefore, the observation of animals behaviour during killing is necessary (table 2).

BEHAVIOURAL INDICATIONS OF DEATH

Inhaled CO (carbon monoxide) and CO₂ (carbon dioxide) gases first affects brain and brainstem, which can be seen as loss of electroencephalography (EEG) and brainstem auditory evoked responses (BAER) and, thereafter, respiration and heart rate are affected. While sensitivity to pain is essentially related to consciousness and

Table 2:
 Signs of Good and Improper Stunning in Relation to Different Key Parameters

Signs of Good Stunning	Key Parameters	Signs of Improper Stunning
Quick recumbency*	Concentration	Slow recumbency
Cessation of voluntary movements		Escape attempts
Loss of sensory and pain reflexes		Excessive movement
Loss of head's and neck's muscle tension		Disturbed vocalisation
More frequent and more deep breathing		Coughing
Calmness	Quality of gas	Deep gasping of breath before loss of consciousness
No disturbed vocalisation or escape attempts		Seizures
No coughing, sneezing or other signs of irritation in the breathing organs		Pain and pressure reflexes are present
No wetting, blinking or rubbing of the eyes.	Temperature	Coughing, sneezing, wheezing sounds from the breathing organs
		Rubbing, blinking and wetting of eyes
		Disturbed vocalisation
		Escape attempts
		Disturbed vocalisation
		Shivering

function of brain, gases can be considered to primarily and effectively lead to a state of non-pain.

Typical behaviours before death are activity/restlessness, hyperventilation, uncoordinated movement, and recumbency. When euthanized with carbon monoxide or carbon dioxide gases, the mink soon starts to hyperventilate after it is placed in to the gas chamber. Carbon monoxide reduces the oxygen level of blood, causing the increase in breathing frequency. Carbon dioxide is an important factor in the regulation of breathing.

Increase in carbon dioxide levels of blood increases the frequency of breathing in order to remove the excess carbon dioxide from the blood. Loss of coordination occurs more rapidly in mink exposed to $\geq 80\%$ concentrations of CO_2 than in mink exposed to 4-6% concentrations of CO. In appropriate gas concentrations, mink become recumbent in ca. 30 seconds and in ca. one minute, when euthanized with CO_2 and CO respectively.

The mink is unconscious when it still breaths, but is otherwise immobile, it is recumbent, has lost muscle tension and does not react to environmental stimuli. The animal is dead when it has stopped breathing and the heart has stopped. When euthanizing mink in appropriate gas concentrations ($\geq 80\% \text{CO}_2$, $\geq 4\% \text{CO}$), the death occurs in ca. 3 and ca.4 minutes with

CO_2 and CO respectively.

It is difficult to evaluate the level of consciousness/sensibility just by observing the animal. However, the level of consciousness can be tested by testing whether or not the animal reacts to external stimuli. This can be done by testing pain related reflexes, e.g. pedal pain withdrawal reflex and palpebral or corneal reflexes from the eye. However, testing these reflexes during the gas euthanasia can be impractical and even dangerous for the operator. Therefore, the easiest and most practical way to make sure that the unconsciousness and death are achieved humanely is to make sure that the gas concentration and exposure times are sufficient, and the behavioural signs of unconsciousness and death are observed regularly.

When the gas chamber is emptied, regular checks are made for any signs of life (i.e. that the mink is not breathing and the heart has stopped). If any of the tested mink show any signs of life, it and all other animals alive have to be properly euthanized and the necessary measures have to be taken to adjust and fix the killing equipment.

Unconscious animals may experience involuntary movement (e.g. twitching). However, excessive movement, seizures, coughing, or distressed vocalizing may be signs of improper euthanizing conditions. If the animal shows these or any other signs related to distress, pain or suffering,

the operator has to euthanize the animals as quickly as possible, by adjusting the equipment or by using other alternative euthanizing methods. Thereafter, the equipment has to be checked and adjusted (calibrated) before killing any more mink with the equipment in question.

On the Emergency Killing. The standard operating procedure is planned and carried out in order to reduce the risks of unsuccessful death of an animal, and to improve the welfare of an animal during the killing procedure and related procedures. However, even if the standard operating procedure is followed accurately, there is always a risk of malfunction of the equipment.

The operator has to state in the standard operating procedure instructions the appropriate measures to be taken in case of malfunction of the equipment. The person in charge should always have fully functional euthanizing equipment as a backup. In case gas-euthanizing equipment is not available, the emergency killing can be done by electrocution, penetrative captive bolt device, by shooting, or if the mink weights less than 5 kg by percussive blow to the head.

CONCLUSION

The operators are obligated to draw up and implement standard operating procedures (SOP). The purpose of SOP is to unify the methods and practices used in killing of animals, and thereby improve the welfare of animals and the competitiveness of operators on the market. SOP need to set objectives, operating procedures, define the main parameters to be monitored, and guidelines for situations in which an animal is not stunned or killed as expected.

The new regulation allows the mink to be euthanized with carbon monoxide (CO), carbon dioxide (CO₂), electricity, shooting, and passing through the bolt gun; and the emergency killing of animals weighting less than 5 kg with a blow in the head. Killing will be monitored by observing the animals and monitoring the key parameters affecting the efficiency of euthanasia.

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The Farmers of Mink in Europe
(Source: www.google.com, 15/1/2013)

The farmers consider that all three euthanasia methods, namely: cylinder CO (carbon monoxide), cylinder CO₂ (carbon dioxide), and filtered exhaust CO are effective and useful ways of killing mink in farming practice.