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Humane Euthanasia in Farm-Raised Foxes

ABSTRACT: *The Council Regulation on the protection of animals during killing, No.1099/2009, came to apply from 1st January 2013 onwards. This 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 operations. The Council Regulation also emphasizes the meaning of education, competence, and self-monitoring as means to improve the welfare of animals during killing. It encourages the making of guides to good practice in order to help business operator to plan and monitor the killing process accordingly. The Code of Good Practice (CGP) in humane killing of foxes is created for that purpose. The present CGP aims at providing the highest standards of welfare for farmed foxes (Blue fox Vulpes lagopus, Silver fox Vulpes vulpes, and their colour variants and crossings) in killing. The regulation states many acceptable killing methods for foxes. The key aspects and parameters affecting the humanity of killing of those methods are presented in CGP. However, more practical and detailed description of killing is given for the most used killing method – electrocution. As well as describes the key parameters, the CGP also gives examples of how and why these parameters are to be monitored. According to Council Regulation, all business operators are obligated to plan the killing procedures ahead by drawing up a Standard Operating Procedure (SOP). The CGP gives practical instructions for planning the content of SOP and examples of how the carrying out of SOP should be reported.*
KEY WORD: *Council Regulation, protection of animals, guides to good practice, humane killing of foxes, standard operating procedure, and monitoring.*

RESUME: *"Pembunuhan Perlahan Manusiawi pada Rubah yang Diternak". Peraturan Dewan tentang perlindungan hewan selama pembunuhan, No.1099/2009, mulai berlaku dari 1 Januari 2013 ke depan. Peraturan ini menetapkan aturan pembunuhan hewan yang diternak untuk produksi makanan, wol, bulu, atau produk lainnya serta pembunuhan hewan untuk tujuan pengurangan jumlah dan operasi hewan berkenaan. Peraturan Dewan juga menekankan arti pentingnya pendidikan, kompetensi, dan pengawasan-diri sebagai sarana untuk meningkatkan kebaikan bagi hewan saat dibunuh. Hal ini mendorong pembuatan Petunjuk Praktek yang Baik (PPyB) dalam rangka membantu pelaksana lapangan dalam merancang dan memantau proses pembunuhan yang sesuai. PPyB dalam pembunuhan perlahan manusiawi pada rubah dibuat untuk tujuan tersebut. Keberadaan petunjuk itu bertujuan untuk memberikan standar yang tinggi bagi kebaikan rubah yang diternak (rubah berkulit biru "vulpes lagopus", rubah berkulit perak "vulpes fox", serta rubah dengan kulit belang dan warna-warni) saat dibunuh. Peraturan tersebut menyatakan bahwa banyak metode pembunuhan yang layak bagi rubah. Aspek dan parameter utama yang mempengaruhi metode pembunuhan manusiawi tersaji dalam PPyB tersebut. Namun, penjelasan yang lebih praktis dan rinci tentang pembunuhan diberikan untuk metode pembunuhan yang paling sering digunakan, yaitu disetrum listrik. Selain menjelaskan parameter utama, PPyB juga memberikan contoh tentang bagaimana dan mengapa parameter ini harus diawasi. Menurut Peraturan Dewan, semua pelaksana lapangan diwajibkan untuk merancang prosedur pembunuhan ke depan dengan menyusun Prosedur Pelaksanaan Baku (PPB). PPyB memberikan instruksi praktis untuk merencanakan isi prosedur dan contoh bagaimana pelaksanaan prosedur tersebut harus dilaporkan.*
KATA KUNCI: *Peraturan Dewan, perlindungan hewan, petunjuk praktek yang baik, pembunuhan manusiawi rubah, prosedur pelaksanaan baku, dan pengawasan.*

INTRODUCTION

The present CGP (Code of Good Practice) for humane killing of foxes is based on Council Regulation (CR) No.1099/2009 (from here on referred to as "the Council Regulation" or "the Regulation"). It aims at providing the highest standards of welfare for farmed foxes (Blue fox *Vulpes lagopus*,

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How to cite this article? Korhonen, Hannu T. (2014). "Humane Euthanasia in Farm-Raised Foxes" in *SOSIOHUMANIKA: Jurnal Pendidikan Sains Sosial dan Kemanusiaan*, Vol.7(2) November, pp.189-196. Bandung, Indonesia: Minda Masagi Press, UNHAS Makassar, and UNIPA Surabaya, ISSN 1979-0112. Available online also at: http://www.sosiohumanika-jpssk.com/index.php?lang=en&p=journal&act=viewjurnal2&id=153&postact=detail
Chronicle of the article: Accepted (January 15, 2014); Revised (July 3, 2014); and Published (November 20, 2014).

Silver fox *Vulpes vulpes*, and their colour variants and crossings) in killing (CR, 2009). This CGP is prepared in line with the regulation and latest scientific and practical assessments (Korhonen, Cizinauskas & Viitmaa, 2009; Huuki & Korhonen, 2013; Korhonen & Huuki, 2013b; and Korhonen *et al*. 2013). Therefore, it can be used as an instructive tool for the operators, when planning and reporting the killing procedures. These guidelines can, however, be considered to be a work in progress with new editions warranted as results of new scientific studies are published.

Picture 1:
Picture of experimental arrangements for humane killing in foxes. The experiment was set up at the Fur Farming Research Station of Kannus (MTT Agrifood Research Finland). The study comprised healthy female blue foxes (*Alopex lagopus*) in good condition. They were fed and kept according to normal farming procedures.

There are many acceptable killing methods available for foxes (Lambooy, 1983; Löliger, 1984; Korhonen, Cizinauskas & Viitmaa, 2009; and Hovland & Bakken, 2000). However, other methods than electrocution are rarely used in killing of foxes, and little scientific information is available on the proper methods and conditions of other killing methods (Huuki & Korhonen, 2013). Therefore, this CGP mainly concentrates on electrocution, and it is recommended to be used as a primary method in killing of foxes.

This CGP presents practical examples for proper humane killing of foxes with electrocution, according to the Council Regulation. However, it should be noted that the member states of EU (European Union) are also allowed to apply national regulations that are not necessarily described or taken into account in CGP. Moreover, the interpretation of the Council Regulation, competent authorities, and implementation practices of regulation may vary between EU countries. Therefore, it is necessary follow the implementation practices and legislation of that particular country, where the farm is operated.

The objective of this paper is to shortly introduce the content of CGP (Code of Good Practice) in killing of foxes.

MATERIALS AND METHODS

The basic research for this CGP (Code of Good Practice) was carried out by H.T. Korhonen, S. Cizinauskas & R. Viitmaa (2009). The research location was the MTT Agrifood Research Finland (the Fur Farming Research Station of Kannus, 63.54 ^{o}N, 23.54^{o}E). The study comprised healthy female blue foxes (*Alopex lagopus*) born between May 28 and June 12, 2004 and in good condition. They were fed and kept according to normal farming procedures. For details, see H.T. Korhonen, S. Cizinauskas & R. Viitmaa (2009).

THE CONTENT OF GOOD PRACTICE

First, **the Introduction of Council Regulation.** The main objective of the CR (Council Regulation) is to spare the animals from any avoidable pain, distress or suffering during their killing, and related operations. It lays down rules for the killing

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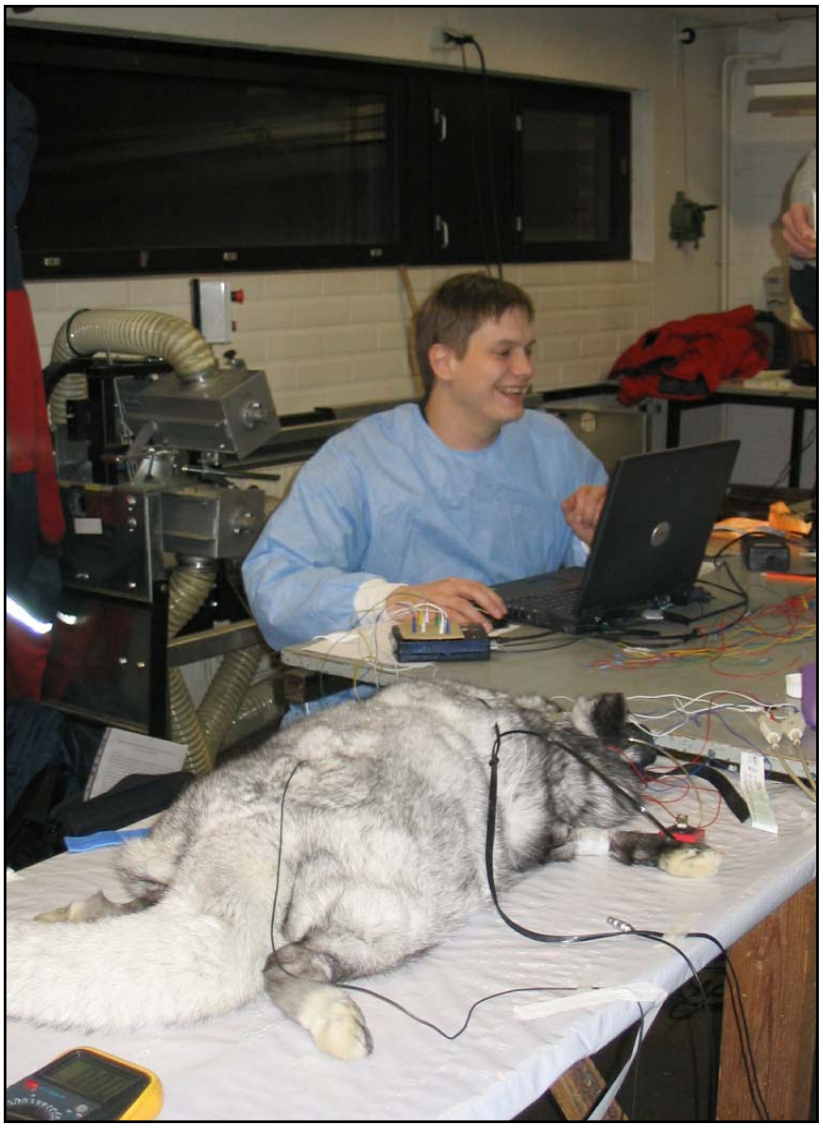
of animals bred for the production of food, wool, fur, or other products as well as the killing of animals for the purpose of depopulation and for related operations. The CR and its statements are discussed throughout the CGP (Code of Good Practice), as they apply to foxes.

Second, **Competence Requirements and Education for Killing of Animals**. The CR (Council Regulation) also emphasizes the meaning of education, competence, and self-monitoring. The competence requirements of the persons involved in killing of animals are also discussed in CGP (Code of Good Practice). The farm owner, the manager, or other person responsible for the killing must have a certificate of competence for killing fur animals, and must ensure that everyone that is involved in the killing of animals is properly trained to do so. Killing and related operations shall be carried out by persons holding a certificate of competence or persons trained and supervised by persons with such a certificate.



Picture 2:
Measurement of Electro-Encaphalo-Graphy (EEG) and Electro-Cardio-Gragphy (ECG) during euthanasia process in blue fox.

In order to have a certificate for killing of foxes, a person must have proper education concerning the killing of foxes. The member states are allowed to issue certificates by way of simplified procedure until 8th of December 2015, if a person has been involved in fox farming and killing for a long period of time (at least 3 years).

Third, **Acceptable Killing Methods and Killing Equipment**. The regulation states the acceptable killing methods for each animal species. The methods and specific requirements of all methods are introduced in CGP (Code of Good Practice). Acceptable methods for foxes are head to body electrocution, gasification with pure carbon monoxide or with carbon monoxide associated with other gasses, firearm with a free projectile, and lethal injection.

Stunning methods, such as head only electrocution, penetrative captive bolt device can be used, provided that the death is ensured immediately afterwards by e.g. bleeding, pithing, electrocution, or

Table 1:
The Key Parameters to be Checked When Killing Foxes with "Head-to-Body" Electrocution.

Parameter	Head-to-Body Electrocution
Minimum current (A or mA)	• **0.3 A**
Minimum voltage (V)	• **110 V**
Maximum frequency (Hz)	• The lower the better. Defined by the manufacturer (100 Hz in most recent models of appliances)
Frequency of calibration of the equipment	• At least once a year • Charge of the battery as many times as necessary ─ during killing at least daily • A meter and display connected to the equipment helps to monitor the proper function
Minimum time of exposure(s)	• **≥ 3 sec**, (≥ 5 sec recommended)
Optimisation of the current flow	• The correct placement and holding pressure of electrodes • High enough voltage and amperage in relation to body size • Physical environment and prevention of miss-conduction
Prevention of electrical shocks before stunning	• On-off switch • Shelter from rain and moisture • Non-conducting materials in restraining device • Cleanness of the environment
Position and contact surface area of electrodes	• One electrode to the rectum and the other to the mouth • Rod shaped electrodes transfer the current accurately
Maximum stun-to-stick/killing time	• If electrocuted properly, death occurs within minutes with head-to-body electrocution • If a two-step stunning method is used, final killing should be performed without delay

Add note: **Bolded texts** are minimum values stated in the council regulation.

prolonged exposure to anoxia. In case of an emergency, if no other killing methods are available, a percussive blow to the head can be used as a stunning method for foxes weighing less than 5 kg, provided that the method is not used routinely, and the amount of animals killed per person does not exceed 70 animals per day. The death of animals must be ensured also after percussive blow to the head by methods described above.

Even though all methods are acceptable, other methods than head to body electrocution are rarely used. Moreover, the effects of head to body electrocution on welfare are the only ones that are scientifically documented (Lambooy, 1983; and Korhonen, Cizinauskas & Viitmaa, 2009). Therefore, the main focus of the CGP is in the killing of foxes by electrocution.

The CGP describes the main principles, equipment requirements, and proper techniques of all above mentioned killing methods, as far as scientific information has been available. The regulation, however, highlights the meaning of equipment manufacturers in instructing the proper use of equipment. The manufacturers are obligated to make the instructions publicly available via the internet, and the business operators must take in to account the instructions when drawing up a standard operating procedure.

Fourth, **Standard Operating Procedures, Key Parameters, and Reports of Checks**. Related to this point, the operators are obligated to plan in advance the killing procedure and related operations by drawing up SOP (Standard Operating Procedures). The SOP must be made available to competent authorities upon request.

When drawing up SOP, the operator has to describe the killing procedure and define the key parameters, taking in to account the manufacturers' instructions, and recommendations. The CGP (Code of Good Practice) can be used as an instructive

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Table 2:
Signs of Good and Improper Stunning Related to Key Parameters Affecting the Quality of Death during Electrocution

Signs of Good Stunning and Death	Signs of Improper Stunning and Death

• Immediate loss of consciousness
• Loss of sensory and pain reflexes
• Loss of all muscle tension after electrocution:
  • Minor movement may occur due to clonic muscle spasm
• Cessation of voluntary movements:
  • No vocalisation, attempts to open eyes or stand up
• Cessation of breathing:
  • No coughing or gasping of breath
• No other signs of distress
• No heartbeat can be detected
	• Insufficient loss of consciousness
	• Sensory and pain reflexes are present
	• Muscle tension remains present:
	  • Severe seizures
	• Excessive movement:
	  • Disturbed vocalisation, attempts to open eyes or stand up
	• Recovery of breathing:
	  • Deep gasping of breath or coughing
	• Some other signs of distress
	• Heartbeat can be detected

tool when drawing up SOP, as it rationalises many aspects of the key parameters stated in the regulation.

The business operator has to ensure that the killing is carried out according to the protocol. The effectiveness of killing has to be monitored by performing checks on death and on different kinds of key parameters that are essential for successful humane killing. Table 1 presents the key parameters that have to be defined if head to body electrocution is used, and some aspects that need to be considered when defining the parameter.

In addition to key parameters, the business operator has to perform checks on proper death and stunning. The behavioural indications and possible means to measure proper stunning and humane death are described in the CGP (Code of Good Practice). Table 2 presents some behavioural indications of proper and improper stunning and death brought about with head to body electrocution.

The frequency of checks depends on the previous results of checks, and the conditions on which the killing is performed. The CGP (Code of Good Practice) contains practical examples of recording sheets for checks, which can be used as a basis when monitoring the killing.

About the Behavioural Indications of Death. Regular checks are made for any signs of life (i.e. that the fox is not breathing and the heart has stopped). Breathing should cease immediately after electrocution. If electrocution has not been administered sufficiently long or the current or voltage has been too low, the animal may recover from electrocution, which may be seen as a recovery of heartbeat and rhythmic breathing. In addition, there may be attempts to visual observation of the environment and movement.

It is difficult to evaluate the level of consciousness/sensibility just by observing the animal. 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. Pedal reflex can be tested, for example, by pinching the skin between the toes. Palpebral reflex is tested by gently touching the corner of the eye. Corneal reflex is tested by touching the eye very gently with a cotton swab or a finger.

In most cases, all the muscles of an animal are relaxed after electrocution. In some cases, the animal may experience some involuntary movement (e.g. twitching) of limbs and facial muscles shortly after electrocution, which is due to electrocution induced *clonic* muscle spasm (*cf* Korhonen, Harri & Asikainen, 1983; and Korhonen & Huuki, 2013a). However, excessive movement, seizures, coughing, or distressed vocalization are signs of improper death.

If any of the tested foxes show any signs

of life or any other signs related to distress, pain or suffering, the operator has to kill the animals as quickly as possible by re-administering the electrocution or by using other alternative killing method. Thereafter, the equipment has to be checked and adjusted (calibrated) before killing any more foxes with the equipment in question.

About the Changes in Brain and Heart. The animal is unconscious immediately after stunning as documented by the absence of all reflexes (Korhonen, Cizinauskas & Viitmaa, 2009). The EEG (Electro-Encaphalo-Graphy) recording showed a status *epilepticus* pattern immediately after stunning, and in none of the animals was a return to normal brain pattern observed. Such a generalised status *epilepticus* is connected with state of total unconsciousness and leads to ultimately to brain death. All the foxes had respiratory arrest and heart fibrillation after stunning.

Picture 3:
Electric stunning device for foxes. Electrical stunning produces is an immediate and irreversible state of unconsciousness and, therefore, is a humane way of euthanasia of farmed foxes.

The heart changes were irreversible in all cases and most probably contributed heavily to the death of the brain after stunning, as the fibrillating heart is not able to provide the necessary blood flow to the brain and other organs. This leads to failure of multiple organ systems and inevitable death. Rapid disappearance of the BAER after stunning indicates brainstem affection and death. Magnetic resonance imaging examination and histopathological examination of the brain revealed no severe changes to the brains of any of the foxes, indicating that stunning mainly affects the function of the brain without distorting the anatomy of the brain (Korhonen, Cizinauskas & Viitmaa, 2009).

About the Definition of Killing. A word "killing" means any intentionally induced process which causes the death of an animal. A "good death" or "humane death" would be one that occurs with minimal pain and distress. In the context of the present guidelines, killing should be considered as an act of inducing humane death in a fox. Killing techniques should result in rapid loss of consciousness followed by cardiac or respiratory arrest and the ultimate loss

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Picture 4:
Research team euthanasia at Kannus Research Farm in Finland

of brain function (*cf* Korhonen, Sepponen & Eskeli, 2013; and Korhonen & Niemelä, 2014).

For readability's sake the term "humane way of killing" is later in this CGP (Code of Good Practice) abbreviated as "killing". However, the reader should always bear in mind the underlying principles to avoid causing pain, distress, and suffering both before and during the killing.

CONCLUSION [1]

The CR (Council Regulation), No.1099/2009, promotes the development of guides to good practice. The newly released CGP (Code of Good Practice) for humane killing of foxes can be used as an instructive tool, when drawing up standard operating procedures. It gives instructions and suggestions for execution of killing procedure in accordance with the council regulation. Electrical stunning produces is an immediate and irreversible state of unconsciousness and, therefore, is a humane way of euthanasia of farmed foxes.

The CR on the protection of animals during killing came to apply from 1st of January 2013 onwards. This 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 operations. The CR also emphasizes the meaning of education, competence, and self-monitoring as means to improve the welfare of animals during killing. It encourages the making of guides to good practice in order to help business operator to plan and monitor the killing process accordingly.

The CGP (Code of Good Practice) in humane killing of foxes is created for that purpose. The present CGP aims at providing

[1]***Acknowledgements:*** Research team euthanasia is kindly acknowledged for valuable help in carrying out these experiments. Special thanks to Sigitas Cizinauskas, Ranno Viitmaa, Jaakko Huuki, Eero Uunila, Johanna Korpela, and Pekka Eskeli. But all contents and interpretations related to this article are solely rested to my responsibility academically.

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According to the CR, all business operators are obligated to plan the killing procedures ahead by drawing up a Standard Operating Procedure (SOP). The CGP gives practical instructions for planning the content of SOP and examples of how the carrying out of SOP should be reported. In addition, CGP also discusses in short the competence requirements that are stated in the council regulation. However, it should be noted that the member states of EU (European Union) are also allowed to apply national regulations that are not necessarily described or taken into account in this CGP. Moreover, the interpretation of the council regulation, competent authorities, and implementation practices of regulation may vary between EU countries.

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