

# **REVIEW OF COUNCIL DIRECTIVE 93/119/EC**

## **ON THE PROTECTION OF ANIMALS AT THE TIME OF SLAUGHTER OR KILLING**

**Submission by Respect for Animals and  
Humane Society International (UK)**

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### **Introduction**

Directive 93/119 sets out standards for the killing of animals farmed for their fur (Annex F)<sup>1</sup>.

We (Respect for Animals and Humane Society International (UK)) wish to raise a number of points with regard to the methods currently permitted.

First, we wish to make clear that in our view, the slaughter of animals farmed for their fur takes place for reasons that are markedly different from that of animals raised for meat. For interest, we enclose a copy of a statement produced by an international group of academics (The Ethical Case Against Fur Farming).<sup>2</sup>

In addition, we draw your attention to the statement issued by the Farm Animal Welfare Council (FAWC) in the UK on 4 April 1989 - 'Farm Animal Welfare Council Disapproves of mink and fox farming'. FAWC expressed its concern about the 'keeping of what are essentially wild animals in small barren cages.' The Council believed that 'pelting sheds should be sited away

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<sup>1</sup> The Annex lists the following 'permitted methods':

1. Mechanically-operated instruments which penetrate the brain.
2. Injection of an overdose of a drug with anaesthetic properties.
3. Electrocution with cardiac arrest.
4. Exposure to carbon monoxide.
5. Exposure to chloroform.
6. Exposure to carbon dioxide.

The competent authority shall decide on the most appropriate method of killing for the different species concerned in compliance with the general provisions of Article 3 of this Directive.

<sup>2</sup>[http://www.respectforanimals.co.uk/home.php/facts/more/the\\_ethical\\_case\\_against\\_fur\\_farming/](http://www.respectforanimals.co.uk/home.php/facts/more/the_ethical_case_against_fur_farming/)

from the enclosures so that mink and fox do not become distressed by the scent released from the anal glands during pelting.'

As you will also be aware, the UK has banned fur factory farming on the grounds of public morality.

Like the British government and in line with public opinion, we are opposed to the killing of animals for fur but for as long as the fur trade continues we strongly feel that the highest possible standards of welfare are implemented.

We are concerned that none of the methods currently used to kill animals on fur farms meet even the minimum standards that should be required.

### **European Food Safety Authority (EFSA)**

We note that the Commission has requested opinions from EFSA on methods used to kill the majority of animals farmed for their meat. We note that the EFSA opinions do not cover the killing of animals farmed for their fur, but that many scientific studies have been conducted that are relevant to the issue.

Article 13.2 (A) of Directive 93/119 EEC states that: the annexes to the directive shall be amended by the Council acting on a proposal from the Commission....in particular in order to adapt them to technological and scientific progress.

In the years following entry into force of the Directive, although EFSA has not evaluated killing methods applied for the purpose of killing animals farmed for fur, there have been evaluations that are relevant to some of the killing methods employed by the fur factory farming industry.

On 22<sup>nd</sup> December 2005 the EFSA Panel on Animal Health and Welfare (AHAW) published an Opinion on aspects of the biology and welfare of laboratory animals including recommendations of the humane killing of laboratory animals and on 13 February 2006, EFSA adopted an Opinion of the Scientific Panel on Animal Health and Welfare (AHAW) relating to the welfare aspects of the main systems of stunning and killing applied to commercially farmed deer, goats, rabbits, ostriches, ducks, geese<sup>3</sup>. Both of these Opinions cover the killing of animals using carbon dioxide gas (CO<sub>2</sub>), which is a method currently allowed under Directive 93/119 for the killing of mustelids and chinchilla.

EFSA also adopted an Opinion relating to the slaughter of farm animals<sup>4</sup>. Although this opinion did not include the killing of animals on fur factory farms it did look at gassing and other aspects of the slaughter process that are relevant to this review.

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<sup>3</sup> [http://www.efsa.europa.eu/EFSA/Scientific\\_Opinion/ahaw\\_op\\_ej326\\_stunning2\\_en1.pdf](http://www.efsa.europa.eu/EFSA/Scientific_Opinion/ahaw_op_ej326_stunning2_en1.pdf)

<sup>4</sup> Opinion of the scientific Panel on Animal Health and Welfare on a request from the Commission related to welfare aspects of the main systems of stunning and killing the main commercial species of animals, *The EFSA Journal* (2004), 45, 1-29. Available at: [http://www.efsa.europa.eu/EFSA/Scientific\\_Opinion/opinion\\_ahaw\\_02\\_ej45\\_stunning\\_en1.pdf](http://www.efsa.europa.eu/EFSA/Scientific_Opinion/opinion_ahaw_02_ej45_stunning_en1.pdf)

The Opinion stated that, with certain exceptions for religious slaughter, in some countries, stunning before slaughter is a statutory requirement in the EU so that ‘slaughter can be performed without avoidable fear, anxiety, pain, suffering and distress.’

With regard to stun/killing methods, EFSA says that each method should only be applied once and that if this application fails, resulting in the stun not being successful, a suitable backup method should be available to immediately kill the animal. This is particularly relevant to the electrocution of fox on fur factory farms where the rectal electrode used can be ejected after the application of current.

EFSA also stresses the need for those carrying out slaughter to be ‘competent, properly trained and have a positive attitude towards the welfare of animals.’

### **Scientific Committee on Animal Health and Animal Welfare (SCAHAW)**

In December 2001, SCAHAW adopted a report on The Welfare of Animals Kept for Fur Production.<sup>5</sup>

Section 8 of the report covers the killing of animals kept for fur production. It says that ‘killing of mink kept for fur production is always carried out on site.’

Describing the slaughter of mink thus:

‘All killing methods involve moving progressively along a shed, removing selected animals from their cages. As with weaning etc., this usually causes both handled and non-handled mink to vocalise, and at least in nervous strains is probably a source of short-term stress to both the euthanised mink and their unpelted shed-mates. Where a gaseous euthanising method is used, the chamber/cart itself may also be a source of disturbance.’

More stress is probably induced during the actual gassing process ‘unless unconsciousness is instantaneous’. In addition, due to the large number of animals placed inside the gas chamber at one time, the animals ‘may pile up and be killed in part by suffocation.’, leading to the suggestion that mink being gassed individually is ‘thought to be more acceptable.’

The main method of killing foxes is by electrocution. According to SCAHAW, ‘Foxes and raccoon-dogs are commonly electrocuted by an apparatus with two electrodes, one inserted in the rectum while the other is applied to the mouth. It is believed to induce unconsciousness immediately if the apparatus is used properly, i.e. keeping the current at a correct intensity (0.3 amp, 110 V for 3-4 seconds).

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<sup>5</sup> [http://ec.europa.eu/food/animal/welfare/international/out67\\_en.pdf](http://ec.europa.eu/food/animal/welfare/international/out67_en.pdf)

## Examination of the main methods used on fur factory farms to slaughter animals

### Gassing

Mink are usually killed by gassing using carbon monoxide (CO) or carbon dioxide (CO<sub>2</sub>).

The EFSA Opinion on slaughter says that non-aversive gases or mixtures are needed if gassing is to be humane and that it requires 'sophisticated technical equipment'.

EFSA also recommends that the concentrations of gas and exposure times need to be monitored and records should be kept which are open to external review. This is not the situation in commercial fur factory farms.

### CARBON MONOXIDE

According to the American Veterinary Medical Association (AVMA), the 'only acceptable source is compressed CO in cylinders'<sup>6</sup> but also that 'only 1 animal should be introduced into the chamber at a time, and death should be confirmed in each case'.

On a commercial fur factory farm, thousands, even tens of thousands of animals are slaughtered in the quickest time possible. This is because the animals are killed as soon as they have completed their first winter's moult and before any damage is done to the fur. The main method used is described in Mink Production<sup>7</sup>:

A killing box consists of a container on wheels.....A tube is connected to the exhaust pipe of an ordinary petrol engine and the exhaust gas is led through the tube, passing a thick layer of glass wool on the way. The cleaned and cooled gas (CO) then enters the box. The animals are put into the box through a trapdoor in the lid. Within a short space of time they fall asleep and die. The box, which takes 25-30 mink at a time, must be tight and a layer of dry sawdust is laid in the bottom to absorb urine.'

Clearly the accepted commercial practices do not meet the criteria set by the AVMA and the crude killing box used does not meet EFSA's requirement of being 'sophisticated technical equipment' (rarely is there available even a means to measure the gas concentration).

Like EFSA, the Canadian Council on Animal Care (CCAC) has also examined the euthanasia of laboratory animals<sup>8</sup>. It refers to the fact that if CO is obtained

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<sup>6</sup> JAVMA, Vol 218, No 5, March 1, 2001, p678.

<sup>7</sup> Mink Production, p48, Scientifur, 1985 (English edition).

<sup>8</sup> [http://www.ccac.ca/en/CCAC\\_Programs/Guidelines\\_Policies/GUIDES/ENGLISH/V1\\_93/CHAP/CHXII.HTM](http://www.ccac.ca/en/CCAC_Programs/Guidelines_Policies/GUIDES/ENGLISH/V1_93/CHAP/CHXII.HTM)

using the exhaust of a petrol engine it will contain impurities and 'thus can produce irritation and discomfort.' It adds that irritant-free CO is mandatory.

Butterworth (see appendix) concludes that, for a variety of reasons, 'CO is an unacceptable method for killing animals kept for their fur.'

EFSA, in its review of the biology and welfare of laboratory animals,<sup>9</sup> lists the disadvantages of using CO:

- ❑ Poor welfare can be caused in hypoxia tolerant species
- ❑ The operators' health and safety is a major concern.
- ❑ Convulsions were observed in humans, dogs, cats and mink after they had reached complete unconsciousness ....
- ❑ Exhaust gases from motor vehicles contain several elements e.g. particulates that cause irritation to the mucous membranes and a considerable degree of excitation and should not be used.
- ❑ *Time to loss of consciousness*: Highly variable and could take up to 2 minutes

With regard to the first point, since mink are adapted to dive (although not for long periods) they could be said to have a degree of hypoxia tolerance.

Only two advantages were referred to:

- ❑ Administration of CO in home cages would eliminate the need for handling animals
- ❑ Mixing unfamiliar groups of animals should be avoided.

In the commercial setting of a mink factory farm these 'advantages' either do not apply or, in the case of the second point, highlight why gassing using CO is not suitable.

Lambooy describes the behaviour of mink gassed using filtered exhaust gas in the way that would be used on a mink factory farm: 'When the animals were placed in the box and forced to inhale filtered exhaust gases, they moved nervously, became extremely excited and showed convulsions for a period of 12 +/- 6 seconds (mean +/- sd). These convulsions commenced 23 +/- 5 seconds after placing the animal in the box.'<sup>10</sup> Significantly less convulsions were observed when CO from a cylinder was administered and the authors recommend this method but the time to coma in these experimental mink was still 21 (+/- 7) seconds.

Even this time is unacceptably long and does not meet the criteria required for a humane death. In the commercial setting these idealised, laboratory, conditions are very unlikely to be met and the animals suffering would be greater.

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<sup>9</sup> [http://www.efsa.europa.eu/EFSA/Scientific\\_Opinion/ahaw\\_labanimalswelfare\\_report1.pdf](http://www.efsa.europa.eu/EFSA/Scientific_Opinion/ahaw_labanimalswelfare_report1.pdf)

<sup>10</sup> Euthanasia of mink with carbon monoxide. E. Lambooy, J.A. Roelofs, N. van Voorst. The Veterinary Record, April 13, 1985.

Hansen<sup>11</sup> used 4% CO to gas mink and found the average time to unconsciousness was 64 seconds and time to death to be 215 seconds. He also noted convulsions in the experimental subjects. Due to the large standard deviations recorded in the times to death of the animals, the authors recommend that it is only safe to remove the mink from the gas chamber after a minimum of 6.5 minutes.

## CARBON DIOXIDE

Most work carried out on the use of CO<sub>2</sub> concludes that it is not suitable for killing mink.

The EFSA Opinion on killing laboratory animals evaluated the use of CO<sub>2</sub> to kill the commonest laboratory species, and goes into considerable detail 'as it is both contentious and also the subject of much new data'. Similarly, the EFSA Opinion covering the killing of rabbits looks at the use of CO<sub>2</sub> and refers to the EFSA laboratory animal study, noting the general recommendation that the AWAH Panel had to 'abandon its use in laboratory species, including rabbits'.

The CCAC observed that 'Carbon dioxide has proven to be non-effective in killing diving mammals' and adds that 100% CO<sub>2</sub> is required to kill mink.

Butterworth concludes that CO<sub>2</sub> is an 'unpalatable and unacceptable method for group killing of mink, fox or other animals kept for their fur.'

Carbon dioxide induces acidosis and inhibition of neurones that leads to a loss of consciousness, insensibility and finally death. Two issues arise from the scientific literature: 1) the risk of compromising animal welfare is high and inherent to CO<sub>2</sub>; and 2) the method of administration of the gas itself could further confound or exacerbate this risk.

Aversion studies have provided evidence to suggest that animals unable to escape from an environment containing carbon dioxide experience distress and even pain before loss of consciousness (Ambrose et al., 2000<sup>12</sup>; Leach et al 2002 a<sup>13</sup> and b<sup>14</sup> and 2004<sup>15</sup>). In particular, lung odema and lung

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<sup>11</sup> Euthanasia of Mink (*Mustella vison*) by means of Carbon dioxide (CO<sub>2</sub>), Carbon monoxide (CO) and Nitrogen (N<sub>2</sub>)., N. Enggaard Hansen, Annette Creutzberg and H.B. Simonsen. Br. Vet. J. (1991). 147, 140.

<sup>12</sup> Ambrose, N., Wadham, J. and Morton, D. 2000. In: Refinement of Euthanasia. Progress in the Reduction, Refinement and Replacement of Animal Experimentation (M Balls, AM van Zeller, ME Halder, eds). Amsterdam: Elsevier

<sup>13</sup> Leach, M. C., Bowell, V. A. Allan, T. F. and Morton, D.B., 2002a. Degrees of aversion shown by rats and mice to different concentrations of inhalation anaesthetics. Veterinary Record, 150: 606-815.

<sup>14</sup> Leach, M. C., Bowell, V. A. Allan, T. F. and Morton, D.B., 2002b. Aversion to gaseous euthanasia agents in rats and mice. Comparative Medicine, 52: 249-257.

haemorrhaging occur prior to loss of consciousness regardless of whether carbon dioxide alone or a mixture of carbon dioxide and oxygen is used.

The shortness of breath (dyspnoea) displayed by animals exposed to CO<sub>2</sub> is compared by the EFSA Panel to the sense of breathlessness or suffocation described by human subjects who have voluntarily engaged in trials to identify the effects of CO<sub>2</sub> exposure. These feelings and physiological effects are also described by people suffering from asthma - the consequence often being 'helplessness, fear and anxiety' or panic attacks. The Panel states that: 'the possibility that animals also experience these mental states cannot be ruled out because, given a free choice, they escape from CO<sub>2</sub> atmospheres' and that 'it is . . . reasonable to assume, based on current understanding of comparative respiratory anatomy and physiology, that laboratory animals can also experience similar feelings to humans. The cumulative stress associated with the induction of unconsciousness is a serious welfare concern. In this regard, exposure to low concentrations of carbon dioxide causes distress and higher concentrations cause pain'.

Additional evidence that the use of CO<sub>2</sub> is aversive is available. For example, data on killing of various species using this method including mink (Raj, 1996<sup>16</sup>; Raj and Gregory, 1995<sup>17</sup>; 1996 Cooper, Mason and Raj, 1998<sup>18</sup>) have reported that aversion to CO<sub>2</sub> is more overwhelming than motivation to feed (in a CO<sub>2</sub> atmosphere).

Kirkden et al looked at the addition of oxygen to carbon dioxide to see if it reduced aversion.<sup>19</sup> They found that such an addition 'may slightly' improve the procedure but that a mixture of 70% CO<sub>2</sub> and 30% O<sub>2</sub> is almost as aversive as CO<sub>2</sub> alone. Their conclusion was that 'alternative killing methods are still urgently required.'

## ELECTROCUTION

SCAHAW said that 'when using this method the farmer would induce the current for 30-60 seconds then take a break of 15 seconds and induce the current again for 30-60 seconds. The initial current should ensure cardiac arrest and loss of brain function. The last induced current is just an extra

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<sup>15</sup> Leach, M. C., Bowell, V. A. Allan, T. F. and Morton, D.B., 2004. Measurement of aversion to determine humane methods of anaesthesia and killing. *Animal Welfare*, 13: 577-586.

<sup>16</sup> Raj, A.B.M., 1996. Aversive reactions of turkeys to argon, carbon dioxide, and a mixture of carbon dioxide and argon. *Veterinary Record*, 138: 592-593.

<sup>17</sup> Raj, A.B.M., and Gregory, N.G., 1995. Welfare implications of the gas stunning of pigs 1. Determination of aversion to the initial inhalation of carbon dioxide or argon. *Animal Welfare*, 4: 273-280.

<sup>18</sup> Cooper, J., Mason, G. and Raj, M., 1998. Determination of aversion of farmed mink (*Mustela vison*) to carbon dioxide. *The Veterinary Record*, 143: 359-361.

<sup>19</sup> Kirkden, RD, Niel, L, Stewart, SA and Weary, DM 2008 Gas killing of rats: the effect of supplemental oxygen on aversion to carbon dioxide. *Animal Welfare* 2008, 17: 79-87

precaution. The current used is also lethal to humans and instructions should be followed strictly.'

These times have never been witnessed by groups that have filmed the process of fox electrocution in practice. The period of application of the electrodes has invariably been significantly shorter.

The electrocution of animals, including the use of rectal electrocution, is now banned in New York State.

The AVMA disapproves of electrocution, as carried out on fur factory farms. It says: 'Techniques that apply electric current from head to tail.....are unacceptable.'<sup>20</sup> Because, it says, 'Use of a nose-to-tail or nose-to-foot method alone may kill the animal by inducing cardiac fibrillation, but the animal may be conscious for a period of time before death.'<sup>21</sup>

Electrical methods of stunning/killing are identified as being in 'urgent' need of scrutiny and revision by EFSA.<sup>22</sup>

## CONCLUSIONS

It is quite clear that the main methods used to kill animals in fur factory farms are inappropriate.

In contravention of the conditions specified by EFSA, these methods cause 'avoidable fear, anxiety, pain, suffering and distress.'

The huge numbers of animals being slaughtered in a very short period of time and the level of handling of animals that are still essentially wild and not used to human contact mitigate against the slaughtering process being capable of being made humane.

Like Butterworth, Humane Society International (UK) and Respect for Animals believe that there are no methods currently in use that are suitable for killing animals in commercial fur factory farms.

Electrocution and gassing using both carbon monoxide and carbon dioxide should be banned as the way they are applied causes unnecessary pain, distress and suffering and, unless very radical steps are taken they cannot be made humane.

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<sup>20</sup> Ibid. p683.

<sup>21</sup> Ibid, p688.

<sup>22</sup> Opinion of the scientific Panel on Animal Health and Welfare on a request from the Commission related to welfare aspects of the main systems of stunning and killing the main commercial species of animals, *The EFSA Journal* (2004), 45, p 7.

## APPENDIX

### REVIEW OF METHODS USED TO SLAUGHTER ANIMALS ON FUR FARMS

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25<sup>th</sup> Jan 2008

*METHODS OF KILLING FUR ANIMALS – As listed in Council Directive 93/119/EC of 22 December 1993 on the protection of animals at the time of slaughter or killing.*

- 1. Mechanically-operated instruments which penetrate the brain.*
- 2. Injection of an overdose of a drug with anaesthetic properties.*
- 3. Electrocution with cardiac arrest.*
- 4. Exposure to carbon monoxide.*
- 5. Exposure to chloroform.*
- 6. Exposure to carbon dioxide.*

*The competent authority shall decide on the most appropriate method of killing for the different species concerned in compliance with the general provisions of Article 3 of this Directive.*

#### *II. Specific requirements*

- 1. Mechanically-operated instruments which penetrate the brain*
  - (a) Instruments must be positioned so as to ensure that the projectile enters the cerebral cortex.*
  - (b) This method is permitted only if it is followed by immediate bleeding.*
- 2. Injection of an overdose of a drug with anaesthetic properties*

*Only those anaesthetics, doses and applications which cause immediate loss of consciousness followed by death may be used.*

**We would like to address concerns regarding the acceptability of each method.**

#### **Projectiles penetrating the brain**

Animals may be killed by projectiles which enter the cerebral cortex. If a captive-bolt method is used, bleeding out (exsanguination) must be performed immediately after stunning to ensure death. The potential hazards of free bullet projectiles and the requirement for very tight restraint of the animal if a captive or percussive stunning method is used make it likely that these techniques are likely to be very stressful to mink or fox during the handling phase, and the requirement to bleed out to ensure death may be considered unhygienic.

Application of a method to the head requires very robust restraint of the animal which make these techniques very stressful to animals farmed for their fur. The requirement to bleed out to ensure death may be considered unhygienic. In practice, and for these reasons, use of these methods is not common in Mink or Fox.

## Electrocution

Electrocution, using alternating current, has been used as a method for killing mink and fox by induction of cardiac fibrillation, which causes cerebral hypoxia. However, cardiac arrest alone is known to be extremely painful in humans, and loss of consciousness takes 10 to 30 seconds or more after the onset of cardiac fibrillation. In fox, the very robust restraint required to place rectal and oral electrode is likely to be very distressing. If cardiac arrest is induced by rectal / oral electrodes without first induction of a stunned state by electricity passing effectively through the brain, then this is likely to induce severe pain during cardiac arrest. The main method of killing foxes is by electrocution.

*'Foxes and raccoon-dogs are commonly electrocuted by an apparatus with two electrodes, one inserted in the rectum while the other is applied to the mouth. It is believed to induce unconsciousness immediately if the apparatus is used properly, i.e. keeping the current at a correct intensity (0.3 amp, 110 V for 3-4 seconds). When using this method the farmer would induce the current for 30-60 seconds then take a break of 15 seconds and induce the current again for 30-60 seconds. The initial current should ensure cardiac arrest and loss of brain function. The last induced current is just an extra precaution. The current used is also lethal to humans and instructions should be followed strictly.'* SCAHAW (2001).

The use of techniques of electrocution that involves insertion of electrodes into an animal's orifices is not permitted in other commercial slaughter processes for farmed animals, and killing by cardiac arrest alone would be considered unacceptable in other farmed animals during commercial slaughter and killing.

Killing by electrocution requires special skills and equipment that will ensure passage of sufficient current through the brain to induce loss of consciousness, followed by cardiac fibrillation. The animal must also be individually and robustly restrained, this causing significant distress. Electrocution may be hazardous to personnel, it is aesthetically objectionable because of violent extension and stiffening of the limbs, head, and neck. Techniques that apply electric current from head to tail, head to foot, or head to moistened metal plates on which the animal is standing are unacceptable. (AVMA 2007)

Electrocution requires considerable restraint, and use of electrodes inserted into orifices in some species. If cardiac arrest is induced without first inducing unconsciousness, then there is potential for severe pain and distress. Electrocution equipment presents hazards to the operator.

## Carbon monoxide

Carbon monoxide (CO) is a colorless, odorless gas. It combines with hemoglobin to form carboxyhemoglobin and blocks uptake of O<sub>2</sub> leading to hypoxia (low blood oxygen). CO has been created by three main methods -

- a) The chemical reaction between sodium formate and sulphuric acid.
- b) Exhaust fumes from idling petrol engines, from tractors or feeding machines. These exhaust gases need to be cooled, and can contain pollutants, and even when filtered,

exhaust gases induce unconsciousness slower than pure CO.  
c) Compressed 100% CO from cylinders.

The first 2 techniques are associated with problems, such as production of other gases including particulates (smoke) and toxic & irritant pollutants from engine fumes, inadequate concentrations of CO in the resulting gas mixture, inadequate cooling of the gas, and the potential for poor maintenance of equipment. The only reliable source would be CO from cylinders.

Carbon monoxide is a cumulative poison. In people, the most common symptoms of early CO toxicosis are headache, dizziness, and weakness. As concentrations of carboxyhemoglobin increase, these signs may be followed by decreased visual acuity, tinnitus, nausea, progressive depression, confusion, and collapse. Because CO stimulates motor centers in the brain, loss of consciousness may be accompanied by convulsions and muscular spasms. If pure CO is used, this causes Mink to collapse in about 1 minute, to cease breathing in 2 minutes, and to stop the heart beating in 5 to 7 minutes. These are long periods of time; the time taken to induce unconsciousness was 64 seconds for CO ( $\geq 7\%$ ) (Hansen et al. 1991) this is rather a prolonged period and would not be tolerated as a method for inducing 'immediate insensibility' for animals stunned mechanically or electrically under commercial slaughterhouse conditions. The SCAHAW report states that carbon monoxide can be slow to take effect.

The fact that mink are capable of detecting and avoiding hypoxic states, means that confining them in a CO gaseous atmosphere until they are rendered unconscious, raises an important welfare issue (Raj & Mason 1999).

The SCAHAW (2001) report says that mink, perhaps because they are diving animals, differ from other (farmed) animals in that they can detect anoxia (low blood  $O_2$ ) and they find it aversive.

Chronic exposure to low concentrations of carbon monoxide may be a health hazard to people, especially with regard to cardiovascular disease and teratogenic effects and so an efficient exhaust or ventilation system is essential to prevent accidental exposure of humans.

Above concentrations of about 10%, CO can be explosive and personnel using CO must be instructed thoroughly in its use and must understand its hazards and limitations.

The CO chamber must be well constructed and should allow for separation of individual animals, and verifiable records of concentrations and outcomes should be kept.

The chamber must be well lit and have view ports that allow personnel direct observation of the animals.

Concerns over poor CO concentration reliability, the use of contaminated engine fumes, animals detection of hypoxia, the long period to insensibility in animals killed using CO and human health and safety concerns promote the view that use of CO is an unacceptable method for killing animals kept for their fur.

## Carbon dioxide

Some diving animals have physiological mechanisms for coping with hyper-Capnia (high circulating CO<sub>2</sub> levels). Therefore, it is necessary to have a sufficient concentration of CO<sub>2</sub> to kill the animal by hypoxemia following induction of anesthesia with CO<sub>2</sub>.

The EFSA Opinion stresses that “The gas used to induce unconsciousness should be non-aversive”. CO<sub>2</sub> is an acidic gas, combining with fluid in the nasal passages and airways to form carbonic acid H<sub>2</sub>CO<sub>3</sub>, an acid which can only exist as CO<sub>2</sub> in solution. Carbonic acid, is pungent, irritant and aversive and may stimulate nociceptors (pain receptors) in the nasal mucosa. Some humans exposed to concentrations of around 50% CO<sub>2</sub> report that inhaling the gas is unpleasant and that higher concentrations are noxious. Depending upon the delivery system, CO<sub>2</sub> gas may be delivered at very low temperature and this can add to the aversive nature of the gaseous atmosphere. CO<sub>2</sub> is also a potent respiratory stimulant, inducing breathlessness and a potential for a sense of respiratory distress or ‘panic’ before loss of consciousness intervenes.

Several investigators have suggested that inhalation of high concentrations of CO<sub>2</sub> may be distressing to animals. Without CO<sub>2</sub> mink would enter a chamber within 16 seconds (SD 2.1), but when there was CO<sub>2</sub> in the chamber, they would not enter it and coughed and recoiled from the chamber entrance. (Cooper et al 1998). Where mink were allowed to freely enter a tunnel containing a reward (a novel object) – all mink entered the tunnel which did not contain CO<sub>2</sub>, and no mink remained for a period of more than 10 seconds in the tunnel filled with CO<sub>2</sub>. Hens, turkeys and pigs can detect CO<sub>2</sub> and, if given the choice, will avoid it (Raj & Gregory 1991, 1995, Raj 1996). The inhalation of high concentration of CO<sub>2</sub> by pigs results in hyper ventilation and signs of respiratory distress, with some animals attempting to escape (Raj & Gregory 1996) and Simonsen *et al* (1981) found that cats showed behavioural changes indicative of discomfort, including defensive postures and attempts to escape when exposed to CO<sub>2</sub>. The EFSA Opinion (2004) concluded that at concentrations above 30%, carbon dioxide is known to be aversive and causes irritation of the mucous membranes that can be painful, and elicits hyperventilation and gasping before loss of consciousness and the SCAHAW reports states that mink find CO<sub>2</sub> “highly aversive”.

Maintaining 100% CO<sub>2</sub> under commercial conditions can be difficult. Because CO<sub>2</sub> is heavier than air, incomplete filling of a chamber may permit animals to climb or raise their heads above the higher concentrations and avoid exposure. It is apparent that concentrations below 100% take significant periods of time to induce unconsciousness – Hansen (1991) noted that a concentration of 70% CO<sub>2</sub> by volume took 900 seconds (15 minutes) to induce unconsciousness. European Council Directive (93/199/EC) states that animals must be put into the chamber only when the gas is at the maximum concentration possible from a supply of 100% CO<sub>2</sub>. Long killing times may result if high concentrations are not achieved, and ‘long time to insensibility’ would not be tolerated for farm animals slaughtered in slaughter-house conditions. The SCAHAW report recommends that “Killing mink with CO<sub>2</sub> should be avoided, and humane methods developed.”

The aversiveness of this gas and the practical difficulties in achieving reliable high concentration of gas in the killing chamber, make CO<sub>2</sub> an unpalatable and unacceptable method for group killing of mink, fox or other animals kept for their fur.

## Argon

Argon is an inert, tasteless, colourless gas. It is possible that under hypoxic conditions, minks' responses to anoxia induced by argon differ from those to CO<sub>2</sub>.

In studies by Raj and Mason (1999) the duration of the stay in an experimental chamber containing argon atmosphere was much reduced. Mink would leave the chamber, panting, after a short period (less than 23 seconds), indicating that they were able to detect and respond to the effects of hypoxia (low blood O<sub>2</sub>). This short period is similar to their voluntary dive times in water, which are typically under 30 seconds (Dunstone, 1993) as mink are not well-adapted for prolonged dives.

Mink may thus differ from pigs, poultry and humans, who do not find anoxia detectable or aversive (Raj and Gregory 1995, Raj 1996), minks' surprising ability to detect the lack of oxygen is probably because as semi-aquatic animals, they detect hypoxia as a means of terminating dives (Raj and Mason 1999).

The finding that mink detect and respond to hypoxia and will show effort to move away from environments causing hypoxia raises significant welfare concerns, and promotes the view that the use of Argon is an unacceptable method for killing mink.

## Lethal injection

The intra-peritoneal injection of pentobarbitone sodium takes several minutes to kill as the agent must be absorbed into the peritoneal blood supply and reach sufficient concentration to cause respiratory suppression. Pentobarbitone sodium can also cause peritoneal irritation unless diluted, and dilution slows the speed of action. However, in commercial settings, when many mink, fox or other animals kept for fur would have to be killed rapidly by farm workers welfare issues may be raised. Additionally, pentobarbitone is a restricted drug in most countries, making this method impracticable.

The irritation and discomfort caused during the absorption stage, and the controlled nature of the drug pentobarbitone make this method of killing impractical for commercial use.

## Surveillance and operator competence

The EFSA Opinion (2004) recommends that  
*“All operators involved with stunning and slaughter should be properly trained, their skills and knowledge examined, in particular in the field of welfare, and the person should be certified to be competent and should have a positive attitude towards improving animal welfare. They should also attend retraining courses and their ability to implement new knowledge and acquire new skills should be assessed as new technologies evolve.”*

At present, state surveillance and supervision of the slaughter process for farmed fur animals is at a low level in many countries. For example, in Ireland the Department of Agriculture observed slaughter of about 1,200 mink (0.37%) and 20 foxes (1.5%)

during two 2 killing seasons (CIWF data).

In view of the EFSA recommendation, any method permitted for killing of mink, fox and other species kept for their fur should only be carried out by trained, competent users who are certified for the techniques used and who are monitored for competence on an ongoing and regular basis.

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