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EU Workshop on Non-Chemical Alternatives for Rodent Control (NoCheRo)

Report on the NoCheRo Workshop (Brussels, 20-21 November 2018)

German Environment Agency

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by

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Abstract: NoCheRo – Non-Chemical Alternatives for Rodent Control

The German Environment Agency together with the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety organized an EU workshop in order take the next step into the direction of rodent control with less risk for the environment and human health.

During the workshop, it became evident that rodent traps are already an integral part of professional and modern pest control management. The need for an objective assessment of their feasibility, efficacy and humaneness was recognized. The lack of criteria for the assessment and certification of rodent traps was identified to be a hindering fact to the process of establishing traps as a first choice control measure prior to the use of rodenticides in the everyday job of pest control operators. It was also identified as hindering their recognition as viable non-chemical alternatives within the comparative assessment for (anticoagulant) rodenticides under the EU Biocides Legislation (Biocidal Products Regulation (BPR) EU 528/2012).

One of the outcomes of the discussions was to initiate a working party. Its tasks should be to define criteria for the assessment and certification of traps and to draft a testing guideline. The criteria or guideline should be drafted in such a way that they can serve for the European Commission as a basis for seriously taking into consideration traps for the comparative assessment of rodenticides. It was envisaged to hold a follow-up workshop in 2020 to discuss draft criteria with a broader range of experts.

Kurzbeschreibung: NoCheRo – Nicht-chemische Alternativen der Nagetierbekämpfung

Das Umweltbundesamt hat zusammen mit dem Bundesministerium für Umwelt, Naturschutz und nukleare Sicherheit einen EU Workshop organisiert, um den nächsten Schritt in Richtung einer für Mensch und Umwelt sichereren Nagetierbekämpfung zu machen.

Es wurde deutlich, dass Nagetierfallen bereits jetzt einen integralen Bestandteil professioneller und moderner Schädlingsbekämpfung ausmachen. Eine unabhängige Bewertung von Fallen hinsichtlich ihrer Anwendbarkeit, Wirksamkeit und Tierschutzgerechtheit wurde als notwendig erachtet. Das Fehlen von Kriterien zur Bewertung und Zertifizierung von Fallen wurde als hinderlich bewertet, um sie als bevorzugte Bekämpfungsmethode von Schädlingsbekämpferinnen und Schädlingsbekämpfern zu etablieren. Fehlende Bewertungskriterien wurden auch als Grund für die Nicht-Berücksichtigung von Fallen als geeignete Alternative im Rahmen der vergleichenden Bewertung von (antikoagulanten) Rodentiziden nach Biozid-Verordnung (EU) Nr. 528/2012 angeführt.

Ein Ergebnis der geführten Diskussion während des Workshops war die Einberufung einer Arbeitsgruppe. Ihre Aufgabe soll es sein, Bewertungskriterien für die Testung von Fallen zu definieren und – darauf aufbauend – ein Zertifizierungssystem zu etablieren. Diese Kriterien sollen der Europäischen Kommission dazu dienen, Fallen als nicht-chemische Alternative bei der vergleichenden Bewertung von Rodentiziden bewerten zu können. Ein erster Entwurf der Bewertungskriterien wird voraussichtlich auf einer Folgeveranstaltung 2020 vorgestellt.

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List of abbreviations

AIHTS	Agreement on International Humane Trapping Standards
AR	Anticoagulant rodenticides
BMU	German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
BPR	Biocidal Products Regulation
CEPA	Confederation on European Pest Management Association
DG SANTE	The Directorate General for Health and Food Safety of the European Commission
DIY	Do-It-Yourself
ECHA	European Chemicals Agency
EU	European Union
EU COM	European Commission
FGAR	First-generation anticoagulant rodenticides
GFSI	Global Food Safety Initiative
IDPA	Infectious Diseases Protection Act (Infektionsschutzgesetz, IfSG)
IFS	International Featured Standards
IPM	Integrated pest management
ISO	International Organization for Standardization
NoCheRo	Non-chemical alternatives for rodent control
NZ	New Zealand
PBT	Persistent, bioaccumulative, toxic
PCO	Pest control operator
PT14	Product type 14 (Rodenticides)
SGAR	Second-generation anticoagulant rodenticides
TNsG	Technical Notes on Guidance
UBA	German Environment Agency
UK	United Kingdom of Great Britain and Northern Ireland

Summary

Anticoagulant rodenticides (AR) pose very high risks of primary and secondary poisoning to non-target organisms. Additionally, most AR are persistent, bioaccumulative and toxic (PBT-substances) and have been detected in numerous non-target animals worldwide. They are classified as toxic for reproduction and specific target organ toxic. Moreover, anticoagulant rodenticides are highly questionable in terms of humaneness, and resistance in target rodents against these active substances has been already observed in different countries.

Those critical properties would normally lead to prompt non-approval as biocidal active substances under the Biocidal Products Regulation (BPR) 528/2012. However, as of 2019, rodent control still relies largely on the use of AR. Their approval in the EU has just been renewed. This decision was taken due to the necessity to control rodents on the one hand and the lack of chemical and non-chemical alternatives on the other hand.

In recent years, however, non-chemical rodent control measures have experienced a renaissance. Advanced trap systems for rodents have been developed and become an integrated tool of professional pest control. Thus, non-chemical alternatives could possibly emerge to be the first choice in rodent control. However, in spite of their availability on the EU market, their practicability indoor and outdoor, their efficacy against rats and mice and their considerably lower impact on the environment, they have so far not been officially accepted as viable alternatives for the substitution of AR. One reason for this is a lack of harmonized criteria in order to decide on the grounds of EU-biocides law whether they are viable alternatives in comparison to AR.

Against this background, the German Environment Agency together with the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety organized an EU workshop in order to take a first step into the direction of rodent control with less risk for the environment and human health. The next renewal of the approval of anticoagulant rodenticides is due in 2024. It was the aim of the workshop to prepare the ground for non-chemical alternatives to be regarded as serious and assessable alternatives to biocidal products and as an option to ensure sufficient future rodent control without being dependent on substances with the above-mentioned critical properties.

During the workshop, it became evident that rodent traps are already an integral part of professional and modern pest control management. The need for an objective assessment of their feasibility, efficacy and humaneness was recognised. Moreover, knowledge transfer to those pest control operators who are not yet using them was considered necessary, as control strategies are different from the use of rodenticides. The lack of criteria for the assessment of rodent traps was identified to be an obstacle to establish them as a first choice control measure and to recognize traps as viable non-chemical alternatives within the comparative assessment for (anticoagulant) rodenticides under the BPR. Overall, the participants agreed that these alternatives deserve more attention and should be fostered as new technologies which will help not only modernise the pest control industry, but can also present a new means of tox-free and green pest control.

One of the outcomes of the discussions during the workshop was to initiate a working party to define criteria for the assessment and certification of traps and to draft a testing guideline which should serve for the European Commission as a basis for considering traps for the comparative assessment of rodenticides. A follow-up workshop to discuss proceedings of this working party with a broader range of stakeholders at EU level is scheduled for 2020.

Zusammenfassung

Antikoagulante Rodentizide (AR) bergen hohe Risiken der Primär- und Sekundärvergiftung von Nicht-Zieltieren, sind zumeist persistent, bioakkumulierend und toxisch (PBT Stoffe) und wurden bereits in einer Vielzahl von Nicht-Zieltieren weltweit nachgewiesen. Sie wurden als reproduktionstoxisch und spezifisch zielorgantoxisch eingestuft, sind höchst bedenklich in Bezug auf ihre Tierschutzgerechtheit und auch Resistenzen wurden bereits festgestellt.

Gemäß Biozid-Verordnung (EU) Nr. 528/2012 (BiozidVO) würden diese kritischen Eigenschaften normalerweise dazu führen, dass diese Wirkstoffe nicht genehmigt und nicht in Rodentiziden verwendet werden dürfen. Dennoch werden heutzutage zur Schadnagerbekämpfung weiterhin fast ausschließlich AR verwendet. Ihre Genehmigung in der EU wurde erst kürzlich sogar verlängert. Diese Entscheidung beruhte einerseits auf der Notwendigkeit, Ratten und Mäuse zu bekämpfen, und andererseits auf einem Mangel an chemischen und nicht-chemischen Alternativen.

In den letzten Jahren erlebten nicht-chemische Bekämpfungsmethoden jedoch eine Renaissance. Technisch hoch entwickelte Fallensysteme zur Nagetierbekämpfung wurden entwickelt und sind zu einem festen Bestandteil der professionellen und modernen Schädlingsbekämpfung geworden. Nicht-chemische Alternativen haben damit das Potenzial zu einer bevorzugten Bekämpfungsmethode im Bereich der Schadnagerbekämpfung zu avancieren. Nichtsdestotrotz wurden Fallen als Ersatz zu antikoagulanten Rodentiziden bisher nicht offiziell anerkannt. Einer der Gründe dafür ist das Fehlen von einheitlichen Kriterien, um auf Grundlage der BiozidVO über ihre Eignung als Alternative zu Rodentiziden zu entscheiden.

Vor diesem Hintergrund hat das Umweltbundesamt zusammen mit dem Bundesministerium für Umwelt, Naturschutz und nukleare Sicherheit einen europäischen Workshop organisiert, um einen ersten Schritt in Richtung einer für Mensch und Umwelt sichereren Nagetierbekämpfung zu machen. Im Jahr 2024 steht die nächste Entscheidung über die Verlängerung der Genehmigung von Antikoagulanzien nach BiozidVO an. Ziel des Workshops war es, einerseits bei der Schadnagerbekämpfung in Zukunft nicht von Wirkstoffen mit solch kritischen Eigenschaften abhängig zu sein und andererseits eine Entscheidungsgrundlage vorzubereiten, um Fallen als ernsthafte Alternativen zu Rodentiziden bewerten zu können.

Im Workshop wurde eine unabhängige Bewertung von Fallen hinsichtlich ihrer Anwendbarkeit, Wirksamkeit und Tierschutzgerechtheit als notwendig erachtet. Obwohl Nagetierfallen bereits jetzt einen integralen Teil professioneller Schädlingsbekämpfung darstellen, sollte die Weitergabe an Informationen zu Fallen an diejenigen, die diese Systeme noch nicht kennen und nutzen, verstärkt werden. Das Fehlen von Kriterien zur Bewertung von Fallen wurde als hinderlich für die Etablierung von Fallen als bevorzugte Bekämpfungsmethode gesehen. Fehlende Bewertungskriterien wurden auch als Grund für die Nicht-Berücksichtigung von Fallen als geeignete Alternative im Rahmen der vergleichenden Bewertung von (antikoagulanten) Rodentiziden nach BiozidVO angeführt. Grundsätzlich verdienten nicht-chemische Alternativen der Nagetierbekämpfung mehr Aufmerksamkeit und Förderung, um als neue Technologien zu einer moderneren und umweltgerechteren Schädlingsbekämpfung beizutragen.

Ein Ergebnis des Workshops war die Gründung einer Arbeitsgruppe, um Bewertungskriterien für die Testung und Zertifizierung von Fallen zu definieren, die der Europäischen Kommission dazu dienen sollen, Fallen bei der vergleichenden Bewertung von Rodentiziden bewerten zu können. Im Rahmen eines für 2020 geplanten weiteren EU Workshops sollen die Arbeiten der Expertengruppe einer breiteren Fachöffentlichkeit vorgestellt werden.

1 Introduction

1.1 Scope of the Workshop

The German Environment Agency (UBA) together with the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) organized an EU workshop on *Non-Chemical Alternatives for Rodent Control* (NoCheRo) with 50 participants representing the non-chemical as well as the chemical industry, pest control associations, EU authorities, national competent authorities and members of the scientific community. The workshop aimed to take a first step into the direction of rodent control with less risk for environment and health and to discuss the state of the art of non-chemical alternatives in rodent control.

The risk assessment of anticoagulant rodenticides (AR) under the EU Biocidal Products Regulation (BPR) 528/2012 showed that their use poses very high risks of primary and secondary poisoning to non-target organisms. Most AR, namely the so-called second-generation anticoagulant rodenticides (SGAR), were additionally identified as persistent, bioaccumulative and toxic (PBT-substances). At the same time they are classified as toxic for reproduction and specific target organ toxic. Residues of AR have been found in a vast variety of non-target animals in monitoring studies worldwide. In addition, anticoagulant rodenticides are highly questionable in terms of humaneness as they cause severe suffering and pain for several days to vertebrates. Finally, the development of resistance against these active substances has been observed in different EU Member States.

Those critical properties, some of them are even so-called exclusion criteria, would normally lead to prompt non-approval as biocidal active substances. However, as of 2019, rodent control still relies largely on the use of anticoagulant rodenticides. Their approval in the EU has just been renewed. This is mainly due to the fact that other authorized rodenticides cannot adequately substitute AR. Because rodents can transfer diseases to man and livestock and cause damage to goods, their control needs to be ensured.

In recent years, however, non-chemical rodent control measures have experienced a renaissance and have become an integrated tool of professional and modern pest control. This development is driven on the one hand by the technological progress in the field of digitalization and wireless connectivity and on the other hand by increasing regulatory restrictions on rodenticides under chemical legislation. In particular, anticoagulant rodenticides, which have been used almost exclusively for more than half a century to control commensal rodents, have become subjected to strict risk mitigation measures under different legal frameworks in the USA, Canada, and the EU due to their critical properties for human and animal health and the environment.

Thus, non-chemical alternatives could possibly emerge to be the first choice in rodent control. However, in spite of their availability on the EU market, their practicability indoor and outdoor, their efficacy against rats and mice and their considerably lower impact on the environment, they have so far not been officially accepted as viable alternatives for the substitution of AR. One reason for this is a lack of harmonized criteria in order to decide on the grounds of EU-biocides law whether they are viable alternative in comparison to AR.

The next renewal of approval of anticoagulant is due for 2024. It was the aim of the workshop to pave the way for the development of an option to ensure future rodent control without being dependent on substances with the above-mentioned critical properties. The aim was also to prepare the ground for non-chemical alternatives to be regarded as serious and assessable alternatives to biocidal products.

1.2 NoCheRo

Against the beforehand mentioned background, the German Environment Agency (UBA) decided to organize a workshop, aiming in the first place to have an initial exchange of stakeholders and in the mid-term to elaborate and discuss criteria to evaluate the efficacy, practicability and humaneness of non-chemical rodent control measures. In the long-term, this workshop might serve as a starting point for an international authorization or certification scheme for non-chemical rodent control measures.

The two-day workshop was subdivided into two parts, starting on both days with presentations followed by a World Café. During part one, the relevance of non-chemical alternatives in rodent control was looked at from three different perspectives (pest control industry, authority, academics). During part two, experts from Sweden, the UK, Germany and New Zealand presented scientific background on animal welfare aspects, existing trap type approval and certification systems and provided insight into government-led rat eradication programs using non-chemical control measures. In the subsequent group discussions, the focus of part one laid on organizational and of part two on technical aspects of non-chemical methods in rodent control with a view to establish a scientific based assessment.

The list of participants, the welcome addresses of Klaus Berend (Head of Unit, Pesticides and Biocides | DG SANTE, European Commission, EU COM) and Axel Vorwerk (Deputy Director General, Environmental Health and Chemical Safety | IG II BMU), as well as the transcripts of all presentations are attached to this report. The main points and outcomes of the group discussions are summarized in the following.

2 Detailed Report on the Workshop

2.1 Part A – Organizational Aspects

2.1.1 Organization for Information and Promotion of Traps

It was agreed that the non-chemical pest/rodent control industry need an umbrella organization, which represents their interests, speaks with a single voice and makes traps visible.

Overall tasks of such an organization should be:

- Dialog and cooperation with authorities (e.g. European Chemicals Agency (ECHA), EU COM), biocides industry, customers (e.g. food industry), auditors (e.g. food standards such as IFS), users/pest control operators (PCOs)
- Promotion of traps as efficacious, practical and affordable tools for rodent control and as viable and environment friendly alternatives to rodenticides
- Integration of traps in IPM-strategies and international standards for pest/rodent control
- Organization of training courses for professional users/PCOs
- Participation in public consultations organized by ECHA to identify alternatives for biocides/rodenticides that are considered candidates for substitution and provide members with (background) information on the biocidal products regulation/chemical legislation/on-going activities
- Removal of obstacles and prejudices that are often associated with traps (i.e. traps are difficult to handle, more expensive, their use time-consuming and labour-intensive, comparatively less efficacious, etc.)
- Highlight the beneficial properties of traps for rodent management
- Provision of information about available traps and new developments on the market

It was generally agreed that traps can be advantageous over rodenticides due to automation of pest control with self-servicing traps in combination with wireless communication (internet of things). Traps may provide a better/direct measure for success of the control campaign (possibility to record number of caught animals while supposedly poisoned rodents are assumed to die in hidden places). Traps can be equipped with a great diversity of baits and lures, specifically for the respective environment in which they are used, in contrast to rodenticides, where only ready-to-use formulations are allowed.

2.1.2 Possible Organization and Affiliation

The organizational affiliation of a possible pro-trap organization was also discussed. Since many companies, especially those providing pest control services, do not entirely rely on non-chemical pest control, and in some cases a clear line between chemical and non-chemical control may be difficult to draw, an organization entirely for the promotion of non-chemical methods may be difficult to start. Moreover, it would have to be decided whether such an organization will represent producers of non-chemical methods (trap manufacturers), users of such methods

(pest management services) or both. It has been emphasized that from the perspective of pest management companies, non-chemical and chemical pest control are not so much opposites, but rather complementary methods.

It was discussed that a user organization already exists with CEPA, the Confederation of European Pest Management Associations. However, many companies that produce traps are not member of CEPA. During the discussion, the point was raised whether existing organizations or associations may have a conflict of interest in respect to fostering non-chemical rodent control when they receive or are dependent on financial support through the chemical industry.

2.1.3 Certification or Authorisation for Rodent Traps

The majority of workshop participants clearly expressed that an objective assessment of traps is needed for the following reasons:

- Enhancement of acceptance and use of traps in rodent control due to approved efficacy
- Selection of efficacious and humane traps over those traps which do not fulfill efficacy or humaneness criteria
- Provision of more legal certainty to the users by approval of the humaneness of traps (avoiding animal welfare issues)
- Provision of more legal certainty to the manufacturers by setting transparent and mandatory requirements for the approval of traps with regard to their functionality
- Criteria and description of test methods can help in design of new and optimized traps

It was furthermore discussed how such an assessment can be organized, i.e. in the framework of a voluntary certification or on the legally binding base of an authorization. It was argued that **authorization by independent competent** authorities is desirable, but probably hard to achieve. It would enclose all alternatives and shake out those which do not function or fulfil the criteria for authorization. However, the implementation of an authorization within the EU has been considered as not achievable within a reasonably short time frame and is rather regarded as a long-term goal by most participants.

A practical approach might be to start out with a **certification** on a voluntary base (e.g. as an industry-led stewardship program) as a first step to establish efficacy and humaneness standards for traps. The establishment of a certification scheme may be achieved in a much shorter period than an authorization, but it will apply only to those alternatives which will be submitted voluntarily for approval. However, competition on the market may lead to a high pressure for manufacturers to apply for certification.

2.1.4 Affiliation and Implementation of a Certification Scheme for Traps

The majority of workshop members expressed the need to organize a certification/authorization scheme on an international level (at least on EU level) as established systems are already successfully implemented in different countries, e.g. Sweden, New Zealand, Ireland, Germany and the UK.

Criteria for the evaluation of traps differ among these countries, although endpoints such as time (seconds/minutes) to irreversible unconsciousness are similar (cf. part B of the workshop report on technical aspects). It is therefore most crucial to harmonize the existing criteria. The existing ISO standard 10990-4/AIHTS can serve as a starting point to adapt that criteria to rodent control. Agreed criteria should apply internationally.

It was suggested to implement a mutual recognition of already authorised traps among the participating countries. Once a trap has been approved in one country, this trap can then be authorised in another country without further assessment.

All stakeholders, namely efficacy experts, competent authorities, professional pest control operators, representatives of the trap industry as well as farmers should be included in the discussion process. The involvement of animal protection organization seems necessary to achieve an overall acceptability of the (humaneness) criteria; on the other hand, it might lead to a failure of agreement in the end. The food industry has also been identified as an important stakeholder since many of the industry standards require tox-free pest control. The Global Food Safety Initiative (GFSI) could be a focal point.

Once a trap has been certified, it was suggested to set up an independent website with a data base for information. This website should host the data of all approved traps. This should be seen as beneficial for companies. For cosmetics, there is a voluntary "safety data" website (rapex) that compiles data accessible for the general public. This data is checked by enforcement authorities. Hosting the website and providing up-to-date information might be one task for an umbrella organization/association of the non-chemical rodent control industry.

The participants of the workshop reached the conclusion that at the moment, an international organization needs to be found where the certification scheme for traps could be affiliated. Moreover, a technical guidance for trap testing and approval should be developed, and that during this process, proposals for an organizational affiliation of the certification scheme should be developed.

2.2 Part B – Technical Aspects

2.2.1 What's new? – Existing Trap Systems and Innovations

As of today, there are numerous traps/trap systems with many different modes of operation available on the market. The most abundant and frequently used ones are mechanical snap or spring traps. Besides classical mouse or rat traps (which can be sufficiently effective on their own), advanced, often high-tech trap systems for rodents nowadays are often multi-catch systems which are connected to monitoring devices (computers) over the internet. They can automatically sent status protocols so that rodent activity can be monitored remotely. During the workshop, different killing methods and all available trap types were compiled (table 1).

Table 1: Overview on available Trap Types

Trap types	Product name (producing company)
Snap traps/Spring traps/Break-back traps	e.g. Kness® traps
Electrocution	e.g. SmartTrap (Anticimex)
Glues traps/Glue boards	-
Drowning/Suffocation	e.g. Piper® 2.0 (Enthomos)
Live traps	e.g. Ugglan, Longworth
Gassing traps (using CO2)	e.g. RADAR (Rentokil®)
Explosives (against moles)	e.g. Rodenator®
Strangling traps	e.g. Nooski™ trap (Nooski Ltd.)

In general, it was agreed that a clear definition of traps is needed, and that terms and definitions in the ISO Standard 10990-4 (Methods for testing (mammal) killing-trap systems used on land or underwater) should be adopted to rodent control. Other existing legal documents such as the EU trapping Directive were also discussed, however there was uncertainty about whether this directive is in place and could serve as a template. When talking about traps further during the workshop, it was agreed that the focus should lay on professional use of traps and killing devices, and that restraining devices, like glue boards, are out of the scope of this workshop as are DIY traps.

Nowadays, modern rodent traps are often high tech devices which are equipped with digital components, e.g. a transmitter or/and sensors, enable them not only to kill rodents but also to monitor rodent activity and to communicate in real time with other digital devices such as smart phones or computers via the internet ("internet of things"). Moreover, advanced trap systems are focused on controlling and monitoring the target species' population, rather than eliminating individual animals. Organizing monitoring might be more convenient with digital options, like Wi-Fi based devices, making 24/7 monitoring possible and daily controls obsolete. Another field of important innovation is picture recognition software that is able to identify target species. This leads to very advanced traps that can distinguish between target and non-target species and therefore minimize the risk for non-targets. In this regard, it was also discussed that training of operators to keep them up-to-date with the technological development is important.

2.2.2 How to test Traps? Criteria for Efficacy and Animal Welfare

A consensus was reached that the following tiered trap testing approach, which is loosely based on the one presented by UBA and incorporates AIHTS standards, is a good idea to progressively assess a traps' efficacy and humaneness.

First step:

Technical analysis of the traps' principle functionality and physical characteristics in the laboratory: For mechanical traps, e.g. snap traps, this includes clamping force, trigger force and impact momentum of the spring; for other trap types the technical parameters would differ. For all trap types, a minimum threshold must still be specified.

Second step:

This includes animal testing in the laboratory for the determination of trap efficacy and humaneness. Appropriate criteria are >90% efficacy (9 out of ten tested rats were trapped/killed) based on the TNsG PT14 for biocide products authorization as well as humaneness criteria based on the AIHTS. The latter one subdivides traps into two to three categories depending on the time span needed until irreversible unconsciousness of the target species. Additionally, it was suggested to calculate a capture rate instead of capture efficiency and to include an equivalent to palatability. However, for bait products, acceptable palatability is given as >20% but this will not suffice for traps; here, palatability was proposed to correspond to the number of visitors.

Third step:

A field test proving the traps efficacy under realistic scenarios. Although this might represent the best application, field tests are time, labour and cost intensive and therefore often difficult to conduct. Also, it might be difficult to determine harmonized parameters for field testing as "field" comprises many diverse scenarios. A pre- and post-treatment census of rodents at site has been suggested as a measure of control. Efficacy criteria of >90 % shall also apply to field tests.

There was a consensus that further details on how to test traps and which criteria to consider should be discussed with a smaller group of people/within a working group and that the results obtained should be presented at a follow-up meeting.

2.2.3 Is there such a Thing as "humane" Traps according to Animal Welfare Standards?

The following killing methods were discussed whether they could be regarded as "humane":

- CO_2 traps
- Snap traps
- Electrocution
- (fast) drowning/suffocation in liquids with reduced surface tension

It was strongly emphasized that the correct use of each trap type is an important driver of a traps' humaneness and should be considered. Exclusion criteria for certain trap types could be non-selectivity and inhumaneness. Live traps were not considered to be humane, mainly due to the high level of stress to the captured animals, especially when using multiple capture traps.

2.2.4 Paving the Way for the next Comparative Assessment of Rodenticides

It was repeatedly mentioned that anticoagulant rodenticides are often used for monitoring purposes and that this specific use is best to be done with traps. At the same time, there was an agreement that a complete substitution of anticoagulant rodenticides in all areas of use is not possible for now. The reduction of their use, however, and their replacement through traps in many fields of application, mainly for professional use, is already feasible and being done.

2.3 Conclusions

It became evident that rodent traps are already an integral part of professional and modern pest control management. The need for an objective assessment of their feasibility, efficacy and humaneness was recognised. Moreover, knowledge transfer to those pest control operators who are not yet using them was considered as necessary, as control strategies are different from the use of rodenticides. This includes information on their benefits to the environment, integrated pest control strategies, as well as practical training courses.

The lack of criteria for the assessment and certification of rodent traps was identified to be a hindering fact to the process of establishing traps as a first choice control measure prior to the use of rodenticides in the everyday job of PCOs. It was also identified as hindering their recognition as viable non-chemical alternatives within the comparative assessment for (anticoagulant) rodenticides under the BPR (EU 528/2012).

An outcome of the discussions during the workshop was to install a working party, comprising experts from industry and science. According to many participants' considerations, its tasks should be to define criteria for the assessment and certification of traps and to draft a testing guideline. The criteria or guideline should be drafted in such a way that they can serve for the European Commission as a basis for seriously taking into consideration traps in a comparative assessment with chemical rodenticides. A reasonable time frame for the working party to develop a draft document that can later serve as a basis for a technical guidance document was agreed to be developed until 2020. It was envisaged to hold a follow-up workshop then in order to discuss the draft with a broader range of experts.

Throughout the workshop it became apparent that members of the industry need a common voice to approach the following tasks:

- Promotion of the advantages of trap systems as opposed to the use and possible overuse of rodenticides
- Definition of criteria for trap efficacy and the level of humaneness
- Definition of criteria for trap testing: physical properties
- Implementation of an assessment scheme for traps
- Implementation of an (international/EU) authorization or certification scheme
- Pavement of the way to consider traps within the comparative assessment of rodenticides by conducting and publishing scientifically sound lab and/or field tests in peer-reviewed journals

Overall, the participants of this first workshop on non-chemical alternatives for rodent control agreed that these alternatives deserve more attention and should be fostered as new technologies which will help not only modernise the pest control industry, but can also present a new means of tox-free and green pest control.

2.4 Outlook

A working party will be organised, comprising members of experts from industry and science. Its tasks will be to find possibilities for certification and to draft a testing guideline. It has to be figured out where this test guideline will be published, and to which level the testing criteria can be made compulsory for the (European) market.

A number of important details still need to be discussed, such as humaneness, efficacy, or the use of baits in traps; this will be debated with a smaller group of experts at the newly founded working party. At the next workshop supposedly held in Brussels again, the report and guideline drafted by the working party will be presented and shall be discussed.

A rough schedule for the planned follow-up activities to the workshop is outlined below.

1. Short-term aims
   a. Follow-up workshop presumably in 2020
   b. Working party will develop a draft of a technical guidance document for trap testing until follow-up workshop supposedly in 2020

2. Mid-term aims
   a. Adopted technical guidance document until re-authorization of AR in 2024
   b. Consideration of traps as non-chemical alternative within the next comparative assessment
   c. Implementation of an international/EU-wide (voluntary) certification scheme for traps

3. Long-term aim
   a. Development and implementation of an international/EU-wide authorization scheme for traps as non-chemical alternatives (cf. Sweden)

A Appendix: Welcome Addresses and Presentations

A.1 Welcome Addresses (Transcripts)

A.1.1 Erik Schmolz | Head of Section "Health Pests and their Control" (German Environment Agency)

Welcome to the workshop on chemical alternatives for rodent control. When we started to organise, or having the idea for the workshop and started to organise the workshop, we quickly realised that the name of the workshop is much too long for practical purposes. So we thought about an abbreviation. "Non-chemical rodent control" No-Che-Ro. Somehow, we realised that this sounds Spanish. Nochero. Is anybody here speaking Spanish? And knows what that means? Nochero is a Spanish word for "night watchman". It's a shame, no one is here to appreciate that (laughter). And since rodents are mostly nocturnal, active at night, we thought it might be a fitting name for the workshop and so we stuck with it. So now it is the NoCheRo-Workshop.

We are here at the Landesvertretung Niedersachsen in Europa (representation of the state of Lower Saxony in Europe), and we are very grateful for the hospitality from the people here at the representation that gave us the room for this workshop.

We are very happy that we have our representative of the Federal Ministry for the Environment, Natural Conservation and Nuclear Safety here to give a welcome. Axel Vorwerk is the deputy director general and head of the directorate of environmental health and chemical safety. Thank you very much!

A.1.2 Axel Vorwerk | Deputy Director General "Environmental Health and Chemical Safety" (Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, Germany)

Thank you very much for the warm welcome! I would like to welcome you all to this workshop here in Brussels today. A special welcome goes to Klaus Berend from the European Commission. On behalf of the Federal Ministry for the Environment, we would like to express our gratitude for the Commission's support for this matter. A matter that might, at first, sound rather low ranking. Some of you might be wondering why using non-chemical alternatives in rodent control is such an important issue that makes it necessary to organise an international event as this. We are here today because we are caught in a dilemma. Our overall goal is to ensure sufficient control of rodents without anticoagulant rodenticides. But currently, biocidal products containing anticoagulants are the main options for rodent control. If they are used competently, they are generally reliable and efficient means of pest control. But apart from this desirable effect, anticoagulants have a number of critical properties. The vast majority of them are what is known as PBT substances. As you all know, it is a basic principle of the EU's chemical policy that PBT substances should no longer enter the environment. To give you an idea of what PBT means in real life, I would like to mention two examples of the well-documented evidence we have of their environmental burden. Numerous studies with birds of prey, for example owls, reveal a widespread appearance of anticoagulant rodenticides. This is even true for remote areas, for example the North of Norway. In Germany, anticoagulant rodenticides have been found in edible freshwater fish, and current data revealed that the contamination is far more common than we

previously thought. Moreover, anticoagulant rodenticides are also toxic for reproduction, and they cause target rodents severe suffering and pain for up to several days before they die. Compared to other biocides, this list of critical properties really does give rise to very serious concerns. In fact, PBT and repro-toxicity are even exclusion criteria in EU legislation which normally lead to prompt non-approval of active substances. But as I said in the beginning, we face a dilemma here. Rodents such as mice and rats are abundant. Wherever there is something to eat and a place to nest, there will be rodents. Rodents can transfer diseases to men and livestock, and they cause damage to goods. So there are situations where rodent control is indispensable.

Unfortunately, there is no viable alternative biocide at hand. This is why anticoagulant rodenticides have not been banned, but are approved again until 2024. Since they fulfil the exclusion criteria, this decision was made according to an exemption rule under EU biocides law. There was a clear precondition for making this exception. It had to be shown that anticoagulant rodenticides are essential to control as they pose an essential danger to human health. This was demonstrated on the basis of a comparative assessment. The result was that for the time being, there is no viable alternative. But when it comes to non-chemical alternatives, I am convinced that they could be part of the solution. Why is that not yet the case? This is actually the core question behind this workshop. The fact is that our biocidal expertise on chemicals is not helping us to find a way out of the dilemma. So one of the aims of this workshop is to expand knowledge of non-chemical alternatives and the fact that they work. When we talk about non-chemical alternatives, we basically mean traps. And when I say traps, I can imagine thought bubbles appearing many of your heads showing a common wooden household snap-trap for mice. But considerable technical progress is being made and professional high-tech devices are being developed. This morning, we are going to hear first-hand accounts of the state of the art, and I can assure you that afterwards, you will definitely be conjuring up a different image, when hearing the word "trap". There is more to be done, however, than simply making alternatives better. What we also need, are clear and harmonised criteria in order to be able to select those non-chemical alternatives that are real viable options. Otherwise a comparative assessment of biocidal products with non-chemical alternatives will not work. We need criteria comparable to those for conventional biocidal products. Criteria addressing efficacy, humaneness and risks. The EU biocides law clearly states that the EC must have criteria for how such a comparative assessment is to be carried out. This is not an easy task, and we would like to help the EC in doing so. These criteria can also play another important role. If we imagine the business operator in the food industry for example, one of the things that can jeopardise his whole business is a scandal about a lack of hygiene. This is why reliable rodent control is of utmost importance in many areas, and there is no room for experiments with solutions that just might work. The current situation is such that you can either use a biocidal product with the confidence that it is efficacious and can be used without any legal uncertainties. Or you can use a trap system which generally entails a lack of harmonised authorisation, legal uncertainty and no independent proof of efficacy. In the pest control sector, business owners need to be able to make informed decisions. In order to make more people choose non-chemical alternatives, we need clear criteria for the assessment of their suitability. In 2024, we will inevitably have to review the approval of anticoagulant rodenticides, and there will be another comparative assessment. We should strive to have a far better basis next time so that we can make an informed decision. We will be grateful if the EC picks up on our initiative.

There is one more thing that can help us to reach our goals. We should foster networking among and between the biocides community and the trap community. With that in mind, I am especially happy to invite you to stay for lunch and use this opportunity to make contacts and start networking while here.

Thank you very much for your attention.

A.1.3 Klaus Berend | Head of Unit "Pesticides and Biocides" (EU Commission)

Good morning everybody, and thank you for the very kind words of introduction. I am not the only one from the commission, my colleague Vincent Delvaux is also here, and he will stay for the entire workshop, while I can only be here for the morning session today due to other obligations and commitments. While listening to Mr. Vorwerk, I realised that a lot of what I wanted to say, he has already said. So it is the usual dilemma what am I going to say now, maybe emphasising a few points that he made of which we fully agree. The first one is, I think you said it like that, Mr. Vorwerk, we are indeed in a dilemma by the fact that almost all the active substances used for rodent control are very problematic and meet the exclusion criteria. When we have a new one, as we do right now under approval decision, and everybody had hoped that this could be an alternative with less problems but with the new criteria for identifying endocrine disruptors that one [unrecognizable] is now also falling under the exclusion criteria.

So we have not made a lot of progress and also the suffering that you have mentioned, the dangers of secondary poisoning are also prevalent for this one. So the dilemma continues, even with a new substance being soon approved and in the end the Member States agree with us that we should approve this alternative nonetheless. So we welcome very much this initiative from Germany to bring together experts and those with knowledge about non-chemical alternatives. And we hope that today's workshop is the beginning of a process that will lead then to developing standards, if you want to use that word, or at least the criteria that we are looking for that these alternatives are indeed efficacious, that they are reliable and that they have a controlling effect that is comparable to that of the chemical alternatives. Because then indeed they will be truly accepted, meaning they could replace rodenticides. Mr. Vorwerk, we can certainly discuss that whether we should be the leaders for this process.

We are certainly willing to facilitate it. The meeting today here in the offices of one of the German Laender but in the future, if other meetings are necessary, we will be very happy to host them. We have meeting rooms and can make them available and all the facilities that come with that.

If I remember correctly, one of the elements that came up in 2017, when we asked the BPC [Biocidal Products Committee] for an opinion on the elements that are important for the comparative assessment of the rodenticides to the non-chemical alternatives, was a certain criticism towards the guidance document that we have drawn up for conducting comparative assessments. We are definitely and absolutely prepared to also look into that, make a revision of that guidance document with a more appropriate wording. If then your work here has led to standards or robust criteria, robust evidence that is asked for in the guidance and another wording is more suitable criteria, we are certainly happy to look into that and take that up.

One question that I had on coming here and that I have already asked Mr. Vorwerk, when we talked a bit before, is whether any Member State – and we hear from some today who believe in the alternative techniques – already refused an authorisation of a rodenticide in view of the availability of such non-chemical alternatives. I am not aware of any but I am curious to hear if today during the workshop that could also be mentioned that indeed some of the Member States are already so confident that what they have available as non-chemical alternatives is good enough that they actually refused authorisation.

One thing that I look forward to and in particular of course also learning more about such alternatives because indeed I was probably one of those with the balloon above the head about

the traps. As I grew up on a farm, I also thought about cats of course as the natural predators that we had around all the time. One time though we had an infestation by rats and in the end there was no solution other than using rodenticides. This was not a pleasant experience, neither for us nor for the neighbours, but in the end there were no other solutions. That is all that has to be done. So from our side, we give our full support for this initiative. We will be glad to support and help as much as we can. If there are any specifics to facilitate the process or to support it through particular actions, we are certainly happy to do that and we look forward to working with all of you and also to the results that will hopefully be available in time for the next round of the renewals. That is indeed an important point in time that we have to keep in mind.

Ideally the results of this work should be available a bit before, so that everybody can familiarise themselves with this work and the outcome and be fully aware when it comes to the next round of the renewals of the authorisations. With that I would like to wish us all a very successful and interesting first workshop on this topic. Thank you.

A.2 Presentations (Transcripts)

A.2.1 Nils Martenson | Swedish Environmental Protection Agency | Approval of Traps in Sweden: Background and System for Certification

Thank you for the invitation and the opportunity to give an overview on the Swedish system for approval and certification of traps. As you have all heard during the introduction, it is a really interesting topic to see these differences between the rodenticides, and traps and how we can use them. My name is Nils Martenson, and I work as administrative officer at the Wildlife Management Unit at the SEPA.

First, I will provide you with a bit of background. The SEPA is a public agency that carries out assignments on behalf of the Swedish government starting its work over 50 years ago. Among other things, it is the national administrative authority for hunting and wildlife management. In Sweden, all use of traps on mammals and birds is regulated by law. The use of traps falls under the hunting legislation and is therefore managed by the SEPA. The pictures here symbolise some of the environmental objectives that the agency works to achieve, and hunting and wildlife management is a natural part of these objectives.

In Sweden, all mammals are strictly protected. I can only kill and hunt when the law says so, and this goes for rodents as well which might separate Sweden from other EU Member States. The fact that rats and mice are as strictly protected as other mammals means that all kinds of traps used for catching them also gets regulated by law.

The principal law in Sweden that regulates hunting, and also by extension the system for catching animals with traps, is the Hunting Act which is decided then by the Swedish parliament. This Hunting Act and its related regulations have a long history in Sweden, the current ones dating back to the mid-eighties. It was also then that the system of approving traps came into force. One of the main reasons why every trap must be approved in Sweden is based on the main principle of the Hunting Act which stipulates that the animals should not be exposed to unnecessary suffering. The idea that all traps used for hunting should be approved was jointly developed by the authorities as well as by both organisations working for animal welfare and those representing the hunting interest and trapping industry. That was back in the mid-eighties. Therefore, the system was widely accepted when it got incorporated into the law.

The authorities, mainly charged for the testing in the beginning, were the Environmental Protection Agency, the Swedish Board of Agriculture and the Swedish National Veterinary Institute. It was mainly the Swedish Veterinary Institute that developed the criteria regarding the level of suffering that could be accepted for traps to be approved. Those criteria that were developed are mainly still in use for both killing and non-killing devices, though they have been more clearly specified in later years and complemented with relevant ISO-standards. The cost for testing the traps was the State's responsibility until 2014.

Just in the first few years after the testing was introduced in the eighties, over 400 traps were tested. Since the mid-eighties around 170 traps were approved, and the numbers are increasing. Of the 170 traps approved, there are 120 non-killing trapping devices alone and around 50 killing trapping devices. And of these 7 are non-killing devices for rats and mice, and 10 killing devices are approved for rats and 23 for mice. The reason, while relatively few traps were approved for rats and mice, is in a part due to the fact that for a long time, rodenticides were totally dominant, also in Sweden, and therefore, few traps were notified for testing.

On our webpage is a list displaying all the approved traps that can be used in Sweden.

Current regulations:

We have the SEPA which has the mandate to issue specific regulations regarding the criteria for the approval of traps. The latest version of these regulations came into force in 2013. These regulations clearly specify the requirements a trap must meet so that animals are not exposed to unnecessary suffering, that the traps are selective so that people and property – property can also be for example domestic animals – are not exposed to danger.

When a trap gets approved by the SEPA, it means that the specific design gets approved, that is basically called type in the Swedish system. This means that all similar traps that have the same design can also be used. The type gets a specific number that has to be displayed on all traps that are being used under that specific approval. The trap also gets mentioned by name on the list of the SEPA, so that it is easier to find approved traps in stores. The basic idea with the design, with the approval of the type is that similar traps do not have to be tested again which reduces costs and processing time and the use of laboratory animals and so on.

The SEPA has these drawings on their webpage for many of the approved traps. One example is shown in this picture here. The original idea behind this was to make it possible to build the traps yourself based on drawings. But for obvious reasons, this has become a bit more difficult in recent years since the traps have become more and more advanced as mentioned also in the introduction. This also helps to identify what an approved trap looks like. This one, the cage, is a non-killing device for rats, and this one is an old killing device for mice.

Every trap used to catch mammals or birds in Sweden has to meet the requirements set up by the SEPA in the specific regulation. Also, every trap has to be approved and certified by the agency before it can be used. To get a trap approved is done by applying for an approval to the SEPA. In connection with the application, test results must be attached showing that the trap meets the requirements in the regulations: For example, that animals are not exposed to unnecessary suffering, that the trap is selective, safe for humans and so forth. Based on these results, the agency decides whether a trap should be allowed for use in Sweden or not. The one who is applying for approval can freely choose testing institutes as long as they meet the criteria in the regulations. The tests do not have to be implemented in Sweden either, they can be performed anywhere in the world, as long as the institute meets the correct standards. In addition to performing the tests according to the regulations, the test institute must meet certain principles set up by the OECD regarding laboratory and field testing. Non-killing trapping

devices are tested in the natural environment. Killing trapping devices can be tested either in a laboratory or in a natural environment but laboratory should be chosen primarily. That is probably the alternative when it comes to rats and mice. This is rather a quick overview but after lunch, there will be a much more detailed account of the approval process and what criteria a trap must meet to be approved.

Some words on alternatives. When the latest regulation on the approval of traps came into force, the SEPA also looked into other options. One of these was to lay down general requirements in the regulations regarding design and effect. It would then be the manufacturers' responsibility to test the traps and make sure that these requirements are met before they were put into use. But this option was ruled out, as it would probably have required extensive operational supervision, and it is also made even more problematic because of the fact that the sale of the traps is not regulated in Sweden. It is only the actual use of the traps that is regulated. Another similar option would have been to only have general requirements in the regulation and then demand the users to only use traps meeting those requirements. Once more, the operational supervision would be problematic and also the responsibility imposed on the user to implement the law in the correct way. Another option would have been doing individual tests for every application but that is not feasible of course since the number would have been too high.

In summary, the system of type approval is considered to have the main advantages that the particular design is being approved and stamped with the dedicated type number. It is easy for customers and regulators to see what kind of trap it is and for what animals it has been approved. The approval is made in advance before the traps are being used which gives good control regarding not exposing animals to unnecessary suffering, and putting people and property at risk. Finally, this also gives the authorities good control over which trap is being used.

Now some words about traps already approved or in use in other EU-Member States, and in what way those can be used in Sweden. Because the Swedish legislation states that a trapping device that has been tested in another EU country or a country belonging to the European free trade association may be used if the product and animal welfare are equivalent to the Swedish. However, such devices must be notified to the SEPA before use. Furthermore, the application must contain approval from a national authority. After the application received approval, the trap will receive a type number and can thereafter be used as if the trap had been approved in Sweden. If the SEPA finds reason to stop the use of a trapping device that had been notified, a formal decision against the trap has to be made from the agency. When applying this system with notifications, Sweden recognises the principle of mutual recognition within the union, since only a notification containing documentation of approval is sufficient for a trap to be used in Sweden.

Some conclusions on the Swedish system of approval:

The main aim of the Swedish system is to set the bar high for animal welfare which also includes rats and mice. The high animal welfare level is also a necessity in Sweden if the system is to meet the legal requirements regarding not to expose mammals to unnecessary suffering in the Hunting Act.

The system is also meant to give the authorities good control over approved traps to make it easy for users and regulators to see which traps are approved. However, the high animal welfare and safety standards probably mean that the system for certification becomes more time-consuming and complex. The test procedures also mean higher costs for certifying traps compared to other systems or if you do not have a system at all.

Another note: The Swedish system is not focused on having as much effective traps as possible. However, there is a belief that it is possible to combine animal welfare and effectiveness when approving traps. Furthermore, it is probably also reasonable to think that the producers of traps will make the traps as effective as possible within the regulations at hand. If you have a high level of animal welfare in the regulations, probably, the producer will adapt to that.

One of the obvious risks with this system that puts great importance on animal welfare is that only few traps might get approved both because of the criteria that have to be met and because of the costs. In Sweden, both non-killing and killing trapping devices have been tested and approved since the latest regulations came into force. The number of applicants though has been few and decreasing. The exact cause has not been stated but in fact it might be for the reasons earlier mentioned, but also because the state funded all the tests until 2014. Now it is the applicant's obligation to pay for the tests, and applications may have been decreasing because of that. In addition, it can be said that an increase of requests for notification can be seen since the new regulations came into force. This, of course, works just as well.

When checking the background in the Swedish system, it was also mentioned that one of the advantages in Sweden is the close contact that was developed early on with interest organisations, people from the industry and the implementers of traps. Of course, they differ on some questions but the direct contact has been of great value many times and can be worth considering.

Also the actual possibility to carry out the tests may be worth considering. The only test institutes that have been used in Sweden for the test of killing trapping devices are the Swedish Veterinary institute and the Swedish University of Agricultural Sciences. This might be a factor regarding the availability to quickly and effectively get traps approved. That institutes performing the tests might be few and only government based if the process becomes more complicated. There is a major decrease in applications for new traps regarding other animals than rats and mice.

Finally, it might be worth mentioning that the system in Sweden allows all traps – approved or not – to be sold and owned, and it is only the actual use that is regulated. Regarding rats and mice, it might be worth considering that a complicated system with few new traps entering the market may trigger the use of illegal traps, and that it might be even harder to control when the sales are not regulated.

It is also of high importance that the awareness of the existing systems is high among the public if you want to avoid the use of illegal traps. Among professional users and companies, however, the knowledge and rule compliance tend to be higher than among private users. That was all from my side, and as already mentioned, a much more detailed presentation will follow after lunch. If you have any questions, I will gladly try to answer them. Thank you!

A.2.2 Daniel Schroeer | Futura Germany | Alternatives in Pest Management

I am really happy that non-chemical alternatives are finally being targeted on such a high level. Today, I want to take you on a journey to explain how we found that alternatives can help us. As Dr. Schmolz correctly mentioned, we are not only producers, but we also have a servicing business. On the service side, we had mostly clients that did not want poison any more. So we were basically driven to find alternatives. Not only because our clients did not want this anymore, but also because it did not work anymore. We had issues with resistance, issues with bait avoidance and things like that. It was really hard for us, and we were in search for something better. So what we did was not only motivated by ecological reasons, which is very important, no doubt, but mainly because we needed something better.

As we are really hands-on people, we roll up our sleeves and go and perform pest control, whether it be in your home or on big sites. So we are very curious and try to find solutions that help us better. On the other hand, there is the environment to be considered, and I am really glad that the Umweltbundesamt, the German Environment Agency, invited us over here today to the workshop. Also the environmental agencies throughout Europe are doing numerous studies investing a lot of money and time to find out what these PBT substances do, as Dr. Vorwerk already explained, they are to be seen as very critical and need to be phased out. Until now for these man-made chemicals, no long-term effects have been explored yet.

One figure: In Germany, we use a lot of rodenticides (all sources for all figures at the end of this presentation). If you put these rodenticides all packed up on europalettes with each palette containing 240 kg of rodenticides and stacked all these europalettes on top of each other, they would make 7–8 times the Eiffel Tower. This just to give you a feeling of how much in Germany alone is used each year (figures from 2015). As far as we have been informed, there has been a drastic increase over the last few years, so today the palette stack would be even higher.

As I said, environmental reasons are important, but they were only our second motivation. Our first motivation was an efficient product or a concept. So the 2nd point is a perfect concept because basically, and we all agree in the industry, we need a toolbox, we need diverse products. Not just one product, one trap. We need a whole toolbox of products that can help us for each and every solution in the market, because the market is individual, and every customer has different needs and requirements for pest control.

The first and most important part of this concept is definitely IPM, Integrated Pest Management. IPM consists of a pyramid as shown here on the right. This pyramid consists of a lot of things that you do before you use the peak which is pesticides. For instance, I'll be closing the door so that no rodents will come in. That is IPM basically. Another thing about IPM is repelling rodents or trapping rodents or using other biological products that help us to keep them out. Because if they keep out, if they find no way to get in, then 90 % of my problem is done as rats do not become 100 years old, they die after a year or two.

The next step is monitoring. We want to monitor if a rodent is present. Because in most of the cases, we do not have an active infestation. We just need to monitor by law if something is present. One of the things that we use in monitoring basics is a product that we manufactured because we needed something that did not exist. NARA is a synthetic monitoring product (examples of products on the table over there). It is a non-toxic product, like a gummy bear, that smells like chocolate, fish, meat, whatever you or your rodents love. When a rodent nibbles on this, it can be supervised, manually or with a camera sensor, all kinds of vision sensors on it that informs us of any activity going on. Then, we can do either IPM or trapping. So information is needed, and this is one solution that is feasible. Many big institutions, like the American Institute of Baking, have stated that they are in compliance with these products. So this is no theory

anymore, but it is being used worldwide in the millions by the largest pest-control operators, something that actually works.

Second comes repelling. Repelling is keeping away, this also falls under the PT 18/19. Repelling is not something that always works, but sometimes it does. As I said earlier, we need a big and diverse toolbox. We need a lot of products that help us to cure a rodent infestation. In 99 % of the cases, closing a hole is the best thing to do, but sometimes you need to repel something with a spray or a foam. My wish would be that the PT18 and 19 regulations will be revised or at least re-evaluated, because currently, we have to register a repellent or attractor. Let us say I have a glass of Nutella, and I say this can also be used for rodents, they are attracted to this, so I have to register this. That means a lot of money and work pouring in there. This is basically stopping innovation. The more PT 18 and 19 products we have, the more of an armoury we have that helps us to use a little less of rodenticides. So we should look into PT 18 and 19 and make it more flexible so more monitoring products are legally approved. This means a lot of competition for us as a business, but overall it is good for the sector so I think this is something that we should all look into.

Going further in monitoring, something we cannot ignore anymore is remote sensors. In Europe alone, 100,000, 200,000 digitized sensors are already used. These sensors are included in every mouse trap and report to us if there has been activity, a catch, no catch, what size of animal it is. They deliver information 24/7. You know, we have a service business, people need to drive somewhere, collect information, which is basically how the business was built up. Today easy sensors ranging from 10 EUR to 1,000 EUR exist and can be a superb aid. When it comes to your point, Nils, when it comes to environmental protection, animal welfare, the daily control of traps – it helps a lot. You can have a beeping device, like a smoke detector, that beeps when a trap goes off like in a supermarket. Or you can have a big system with cameras and sensors reporting like you would have in a huge factory. So this is something that we can all use and that we do use already. It is not future, it is present.

Another thing that we use a lot is cameras, because we like the visual: A picture says more than a thousand words. I saw that a few persons in here have already used and tried this product. I can assure you that it is quite fun to use. Every morning when I wake up – I am a rodent nerd, I admit – I open my phone and check all the new pictures on our sites and I think: "Oh, there is something there, let us do something about it." I can see how and where the rodents move, so we can close that hole. Things are getting easy: Everybody has a smartphone in their pockets. It is 2018, so why should we not use technology to our advance. And people actually do this already. One example, I want to share with you today is from sewer-baiting. For decades, we have thrown poison into the sewer and expected the rats there to eat it and die. One of my predecessors already mentioned a new and very alarming study from the German EPA on rodenticide residue in aquatic environments and fishes. We might argue whether the percentage right now is relevant or not, but what cannot be argued is that it is in there and was found in all kinds of fish tested and this makes it very alarming. And sewer-baiting in all the canals and sewers has something to do with this.

So we did a lot of testing, put cameras into sewers and evaluated the endless hours of videotaping.

What we put down into the sewer was: a wooden trap, a plastic trap, synthetic lures, organic lures, rodenticide lures. And nothing was touched by the rats in our many test environments. Maybe our rats are different and I invite you all to try the same, but in our test, this was the case. So what we did again was an IPM.

The product used is quite new, as you see that from the 3D drawing, and it is patent pending, but fortunately, we can already talk about it today. It is a product with which we decided we close the sewer, because we found that rats do not eat anything, and we can't trap them but they use the ladder, jump out and use it as a kind of entrance gate going in and out and returning to the safe, warm sewer and live there. So once we closed the holes, the rats could not get out anymore, and as they do not live to ten, twenty years old, a population moves somewhere else quite quickly when they do not find anything to eat, and after a certain time the infestation will be going down.

This is something very low-cost and very easy to do and one innovation we found with the use of technology and information. And with this easy solution the problem is solved forever.

One more thing that we are very passionate about is trapping. It helped us to cure some of the most eager rodent infestations in Germany where we were able to catch all rodents without using any bait or any toxins. This trap that we manufactured is called gorilla trap. It was tested by the German Environmental Agency. The tests of the Infektionsschutzgesetz (IFSG), the Infections Protection Act, showed that more than 90 % of an infestation can be cured with these traps. They kill quickly so the animal welfare is protected. Sweden approved of them immediately, and the test results by the German Environmental Agency were good. So these traps are not only blue angel certified, which is the oldest eco-label in the world, they are also § 18 approved which is unique in Germany. The approved trap is a regular break-back-trap that is very low price and will be used in the millions. We are very happy about this as now professional users have a kind of security with a product that they use.

The next point is pest control 4.0. Here, I want to take you along and inspire you to look at different sectors. Around 40 % of intra-logistics worldwide is done by autonomous vehicles and robots already. Reason why I'm saying that, we believe that our smartphone is what means digitalisation, it is not. Autotomized driving, digitised robots, internet of things – that is digitisation. Helping not only the end-consumer, but also helping businesses, that is the big part. So while we are doing individual mouse-traps and reading these facts, we can probably all agree that a digital mousetrap is not that far away. Again, this is not future, but present. The first digital mousetrap that we brought to the market was 12 years ago. This was a clumsy old thing but it developed like a Nokia to an iPhone x. This is our concept that we believe in.

Now for some facts and figures: Anticimex is one of the world's multinational large service businesses, next to Rentokil, Orkin and others that are also in the same category of large world players. They were so kind to share some data with us, so I can present this to you. They use over 35,000 digital traps in Sweden already, and each year this goes up by almost a 3 figure percentage. So digitization exists in pest control, and all digitized products used are traps. Trap prices range from 1 EUR to 1,000 EUR. This makes for a huge portfolio of alternatives for every budget and situation.

Secondly, the amount of rodenticides used by Anticimex was reduced from 2014 and 2017 from 200,000 kg to 100,000 kg in Sweden. While this is still a lot, the reduction is enormous. Back in the day, a lot more rodenticides were being used. My parents used to work in pest control, and I also grew up on a farm, things were a lot different back then, and there are clear changes to be seen. We have so much new technology, so many new things at hand that can help us. The trend is clear: It is going digital, it is going non-toxic.

Here are some screenshots from Anticimex and other big players in the world that already market digital and non-toxic products on their websites. This is not something that I am making up, but facts, products that are being sold every day to their clients. Not in the future, but in the present, and we can do it.

To sum it up: Alternatives are the present already, and when you look at the industry it becomes clear that we can use those – and already do. Efficacy, an efficient product that is working is the most important thing that we need as pests carry diseases and need to be controlled. So products need to be absolutely successful. Also, ecological considerations are extremely important, and they are getting more and more so with every study that comes out. While still some might want to stick to established methods, this is a new chance that we should grab. All the results from studies from environmental agencies throughout Europe are something that we cannot and should not ignore anymore.

Last but not least, that's my personal opinion, let's not hold on to something that's obsolete. Many small, midsize and multinational business has proven that it's possible. It gives you more digitalized information, it allows forecasting, identification with cameras of the animal, etc. It is 2018, in few months it's 2019, and all of us are using 5–10 connective products in our home already. In the next five years, we can't count the digital objects in our private home anymore. Everything will be talking to the internet. So we can use this innovation within our own sector and do something good for the environment while having evenly successful, efficient product. Thank you.

A.2.3 Bruce Warburton | Manaaki Whenua-Landcare Research, NZ | Using Traps for Managing Rodents

Greetings to you all, and thank you to the organisers for the invitation and the opportunity to participate in the workshop.

Today I will speak about using traps and managing rodents, but let us start with some context first.

In NZ, we have no native mammals apart from two species of bats. NZ never had any mammals apart from these bats. Now we have about 35 species, all of them were introduced, and some of them are invasive, including the rodents. We have four species of rodents: ship rat, Norway rat, the Polynesian rat that was introduced by the Maori and the house mouse. So control in NZ is primarily and particularly about conservation. Here are some examples of endemic species, most of them threatened or endangered. Primarily, they earned this status because of ship rats predating these animals. We have commensal rodents of course, and we have standard commercial industries that control these around cities and towns. But the big driver in NZ for innovation is around control of rodents for reasons of conservation. The very large-scale operations carried out by the Department of Conservation that is tasked particularly with managing the conservational estate probably lie close to 7–800,000 hectares of rodent control. This means large forest areas. One single operation might be around 100,000 hectares. Most of these operations are done using aerially applied bait that contains 1080. Anticoagulants, like Brodifacoum, are confined to island eradications around NZ. If it is used in mainland NZ sanctuaries, it is used there to try and eradicate the rodents there. We work very closely with NGOs such as Island Conservation International that is also interested in eradicating rodents from a range of islands.

Why are anticoagulants used for eradicating? Rodents, like us, suffer from the dilemma of all omnivores. They eat a wide array of food, but with novel foods, they have to be cautious as they do not know whether it is safe to eat. To get those very cautious animals, particularly when you try to eradicate whole populations, requires slow-acting toxins as in anticoagulants. So as the picture shows, they eat and eat again, and gradually the toxin builds up until they have a lethal

dose and die. This is why anticoagulants are used for eradication. But there is a lot of opposition to anticoagulants in NZ as over here for the well-known reasons.

Recently, there was a big push by our last government to address our pest problems. They came up with a group called "predator-free 2050". They want to eradicate rats (ship-rats, Norway rats), possums – the latter were introduced to develop a fur trade from Australia – and stoats, which were introduced to control rabbits, which in their turn had also been introduced. So they want to make NZ predator-free, the predators being the rats, stoats and possums, by 2050. It is an aspirational goal, one that we will not be able to meet with current technology. So we are looking for new technologies and what might be used in the future. Many community groups are involved in this conservation initiative. Let me show you some of those. There are over 300 community-based pest control groups in NZ, and they prefer to use traps rather than toxins.

Here comes just one example of a community group. They are using the GoodNature trap, a recently developed trap called the A24. It runs using a cylinder of CO_2 gas screwed to it and can potentially catch up to 24 rats. Here on this map you see the location of the traps, marked with red dots. Those areas were monitored. You can see the index of rat abundance, these are ship rats. The bottom line shows very low levels where they have been doing the trapping. In the non-treatment area where there has been no trapping, the rat incidences are quite high shown by the red line.

This shows clearly that in this particular area traps were being used very effectively to manage ship rat populations. But again, it depends on the size of the area whether they can be cost-effective. These are reasonably small areas with some hundreds of hectares rather than thousands of hectares.

Another area, there is an operation run by the Department of Conservation to protect the Kokako, an endangered bird species. Again, this shows the effectiveness of a trapping network. In this case, they are using Victor Professional Traps. This is a large area of remote forest, but again, quite small in comparison with only 200-300 hectares.

Unfortunately, the size of ship rat populations in these forest environments are often driven by the food that the forest produces, and we get periodic fruiting or seeding events. When we have a year where there is a lot of seed, it is very difficult to hold their population down with trapping. So some of these groups have to integrate both trapping and poison to maintain the populations at low levels, particularly in years with a high reproductivity.

We will now look at what has been happening over the last two to three centuries. The old snapback traps have been around probably 300 or 400 years. There has been incremental improvement over the last 100 years or so. Here, we have the gorilla trap and other snapback traps, the T-Rex. More recently, there is the GoodNature trap that I have mentioned before. We have electric traps now, or electrocution traps I should say, and others that kills by CO_2.

The question is now how to get the step-change, how do we get what we need without using toxins. One aspect of current traps is they all require the animal to choose to interact with the trap. If the animal does not choose to interact with the trap, the trap will not catch it. We call these active traps. What we are looking for are passive traps where the animal does not have a choice. We can talk about trap capture efficiency in terms of conditional probabilities. Given a rodent encounters a trap, what is the probability it is captured, as often a rat will visit a trap and choose not to interact with it. So here we have a rodent that encounters a trap and chooses not to interact with it. Then it comes along again, encounters the trap and again chooses not to interact with it. That can happen two, three, four times. Eventually, it might get captured, but in

this example, the probability is 0.2 or one to five. We want to get that probability to one. And once we get to that traps, we will have a real chance to compete with toxins.

There is work being done by a private group in NZ called Cacophony. They are not interested in intellectual property, so all their work is in the public domain - open source. Worldwide, a lot of work is going on with Artificial Intelligence (AI), with facial recognition. That science is also used in species or pest recognition. And right now, we are probably at the stage of being able to identifying the key species we are interested in with about a 95% confidence. So that science is being done, and it is done by using thermal imaging. On this video, this animal is a cat, which is fairly obvious, and this is a ship rat. The AI is able to recognise those species with 95 % + confidence. Now the step that is being worked on is integrating this AI into a trap that makes that trap passive so the animal does not have to do anything to get captured.

On this video here is a rat coming along, we have an AI device here: "Ah, it is a rat." And the trap makes the choice to capture the rat. So we have a catchability of 1. As soon as we get to that level of sophistication, these traps will compete very well with toxins. We are not there yet, but we might be there within the next two, three, maybe four years, hopefully by 2024.

My last slide is just to give you a few ideas of what else is going on in rodent control. Three examples here:

The top one is a product a colleague is working on. It is called DR8, it is based on Norbormide that has been around for 40 or 50 years. It is a *Rattus*-specific toxin. But Norbormide did not work, because it acted too quickly. The rats did not eat enough initially, then they got sick and therefore developed an aversion to that toxin. So my colleague has developed a pro-drug that is non-toxic. The animal eats it and the non-toxic pro-drug is metabolised into the toxic form. It delays the onset of the active ingredient. It works very well for Norway rats, but it is not working quite so well for ship rats, because they appear to be a bit more resistant.

The other work that we are doing is developing species-selective toxins, though right now, this is at a very early stage. By using genome mining, we are trying to identify the Achilles heel, the weak point of the physiology of the target species. So we look at the genome and try to identify the gene that turns off or on a critical phase of the animal physiology. With this a toxin can be designed that can turn this gene on or off, whatever is required. So again early stages, and it is probably likely still 10 or 20 years away. But it is an exciting area of research.

The other work that is going on, and this was really the reason why our previous government came up with the idea of "predator free 2050", is gene drives. There is a lot of research in gene drive being done in the medical field. Bill Gates has been funding a significant amount of work on gene drives to control mosquitoes, to control Malaria. There are two organisations, one in the USA and one in Australia at Adelaide University, working at using gene drives to manage rodents. CRISPR, which is a gene editing tool, can be used to insert genes into a genome that may make females only produce male offspring. So in other words, you could actually drive a species to extinction. If you want to know more about the work, check out a group called GBIRd (Genetic Biocide for Invasive Rodents). There is information on the web about what they are doing in detail.

Those three options, along with the artificial intelligence, and integrating that with pest traps, provide quite a bright future in my opinion, and we are on the cusp of the required step changes. And I think the sunset of anticoagulants is not too far away.

Thank you!

A.2.4 Emil Ekström | Swedish Environmental Protection Agency | The Type Approval Process of Trapping Devices - Legislation, Purpose and Procedure in Sweden

Thank you for the opportunity to talk about the Swedish approval system. First, we go for a quick look at the legislation. As mentioned before, we have our Hunting Law which is passed by parliament. Also we have our Regulation on Hunting which is decided by our government. And then we have our Regulation on Type Approval, which is decided by the SEPA. Basically, the message is the same for the whole legislation: no unnecessary suffering is allowed. Also you may only use those trapping devices that are approved. According to the Swedish system, the trapping of rats and mice is considered as hunting. They are a part of the Swedish wildlife, and as such, they have the same status as other animals in the wildlife. So if we apply this framework to traps for rats and mice, we will use the same legal system for wild boar and lynx.

As mentioned before, the Swedish system is only a system for type approval. It does not deal with the selling of these traps or importing them or something like that, and that is also where my competence is. I do not really know much about the other legal aspects actually. The main focus of my presentation will be on this type approval process. The main source will be the last regulation I mentioned, the Regulation on Type Approval.

It is worth noting that this presentation is only half the story. We also have the Regulation on the Use of Traps. These regulations will have to be followed as well to make sure that you do not cause any unnecessary suffering or any risks to humans. For example, a trap needs to be looked after. Also if it is a non-killing device, of course somebody has to go there and either kill or release the animal, otherwise they would start to suffer eventually, no matter how good the trap is. These regulations cover both killing and non-killing trapping devices for wild animals. They aim to ensure safety and prevent unnecessary suffering. To be a bit clearer on the safety issue, the main concern will be children, trap users, domestic animals, like cats and dogs. When we talk about selectivity of traps, it is its ability to limit by-catch. The reason for this being an objective is that we do not want traps to interfere with other wildlife. There could be for instance endangered species that you do not want to catch. This is even more important if it is a killing device of course. If it is a non-killing device, at least, you have the chance to release the animal. Also it could be argued that all by-catch will cause unnecessary suffering, because you trap an animal that you do not really want to trap and by doing that you cause some suffering.

So what suffering is unnecessary? Probably, it is no big surprise that we do not have a clear cut answer in our Hunting Law. However, trapping devices are not required to be perfect. Some suffering is accepted in all hunting, regardless if it is by use of firearm or with using traps. These regulations could be viewed as an attempt to clarify when animal suffering is unacceptable and when by-catch is acceptable. It is also worth mentioning that after the approval they can be used by both professionals and the general public as long as you meet the other criteria for hunting. Besides these objectives, we also have of course tried to provide a transparent, predictable and fair procedure which is not mentioned in the regulation but is part of our other laws in Sweden, the administrative laws of acceptance, to be precise. Also we have the possibility to make exemptions for research where you can use other traps. This will be of course a lot more small scale and focused on one instant, one situation.

Our starting point will be that these devices will be comparable to weapons, such as firearms. They are supposed to be used without human control, not with constant supervision. So they have the potential to be dangerous. Now you have to remember that we are talking about traps that can be used for a lot of different species in Sweden, some of them are larger, some smaller. One example comes from Svalbard, and it is probably not used anymore, but I am still including it to show that there is a wide scope of trapping devices. The Polar Bear is not a native species

in Sweden [laughter], but this is an example of a very dangerous trap. Inside the trap, a rifle is hidden, and if you set off the device, it will fire [unrecognizable].

To repeat: The Swedish approval system is based on types, not on trademarks or trade names. As you can see from the slide "the type", we undertook quite an extensive attempt to define what "the type" is.

To sum it up: We tried to separate different designs from each other and call them different types. Why is this important to mention? According to our regulations, if there are deviations from this definition of type that have a relevance to suffering, safety or selectivity, you have to apply for a new type approval. Hereby, we are trying to set the limit for what "an approved type" means. And it is left to the user to make sure that they are using a legal trap. To facilitate this, we have a list that we update on our webpage where you can find information on legal traps, their number and also some information on how they are supposed to be made and things like that. Here just examples of drawings on the list which of course would be completed with other information.

As mentioned before, some of these you are able to make on your own. We already had the question about patents and the protection of secrets and rights regarding the traps. The only answer I have is that we assume that the intellectual property rights are already taken care of. When we get the application, we will release this information, so it is no secret after we get them. This is how it works in Sweden. If you send something to the government agency, it is going to be easily available for the public. I would not say that this approach is without any flaws. We touched on that earlier that we do not have that much knowledge on how common it is that illegal traps are actually being used since they can be bought in the stores. At least, we can order that it is possible to choose a legal trap that has been reviewed and is safe to use.

Now we move into this procedure for approval. We have a different process when it comes to traps that have already been approved in other EU countries. We call it the notification procedure. It does not involve any approval at all from our side. We just confirm the notification. This is the standard procedure for type approval. Unfortunately, it does not really always work out as perfectly as according to the scheme but this is how we try to make it work. First, we get the application. We have a preliminary assessment. We can deny without testing, we can approve without testing. I will get into a little bit more detail later on. We have the requirements for the testing and the test report. We hear also the Swedish Board of Agriculture on these issues. And then we make the decision on approval or denial of these applications. If we are to deny without testing, we still hear the board of agriculture.

Now I will try to walk you through these steps, and I will wrap it up with talking a bit about revocation of approvals. Briefly, let me just mention the basics: There is an application fee; its purpose is of course to not get us swamped with applications that are not serious. There are specifications of what we need from the applicant. We check if this trap is already approved as the applicant might not know that it is close to another design. We ask for test results if there are any already available. And then we look at the decision if we can deny or approve without testing. That is the preliminary assessment, and according to our regulations, we have the possibility to decide to reject an application if it is clear and obvious from the material that we have, that the trapping device will cause unnecessary suffering or be a risk to humans and property. The background to this is that we have animal welfare concern regarding to testing as well. We do not want to perform any unnecessary tests. In 2016, we worked on a strategy for animal welfare in research and testing. This is based on the 3R principles. I am not sure if you are familiar with those but it is reuse, reduce, replace. We tried to incorporate that into the application of these regulations. But to sum it up: We are not supposed to have any testing that

is not needed. But even if we have these possibilities for exceptions from testing, we have to be careful to apply them. Because in the end, there can be legal procedures following this where we have to explain why we denied an application without any testing or why we approved it. So in general, I can say that we are very careful using this approach and I cannot think of any example from us making exemptions from the requirement of testing prior to an approval. I think that we never opted for approving without testing. And I am not talking about the typing exam in other EU countries. Those are, of course, different procedures.

When we do this preliminary assessment, we have to make sure that all the general standards are met. The design must not be cruel, at least not in a way directly obvious to us, while we are reviewing the application. There must be steps made to make sure that it is selective as far as possible. By selective, I mean that it is not able to be triggered by other animals than the intended species. If it is a really big trap with the risk of getting people stuck in it, it has to be equipped with emergency exits that can be operated from inside. For example, traps for wild boar are big enough for children to get into. It has to be sufficiently strong so that animals cannot break them. Then we have some limitations on the methods that are used on these traps, for instance, you cannot use gas, hooks and glues or things like that. If one of these criteria is not met, we can deny the application without moving forward to testing. When it comes to killing devices, it is limited to smaller animals. With the exemption of beaver, none of these animals tend to weigh more than 4 kg on average. For beaver traps, there are special requirements. You have to report before you use them, and also there is a special training that you have to do before you are allowed to use them. Since they are regularly used on the water, you need to put up signs to limit the risk a bit. The main reason behind this limitation to smaller animals is that a killing device need to be less powerful if it is supposed to kill a smaller animal rather than a larger one. There is no similar limitation to the non-killing devices. Also the trap needs to be designed so that the actual killing mechanism hits the intended animal in a certain way. There has to be something leading the head of the rodent to the right place in the trap. When we talk about slightly larger animals for killing traps such as martens and minks, there must be protective covers to make it less likely that domestic animals or children can get into the operating mechanism. We have some special requirements on non-killing trapping devices which is that you must not have sharp or pointy details inside. You must not have cracks or holes to get stuck in. There must not be any slippery floor. And of course, as they can be used in winter, you have to avoid metal and things that can get cold and cause injuries. There must be no lack of proper ventilation, and you have to be able to inspect the traps. I want you to bear in mind that this is for all different kinds of species. If, for instance, it comes to wild boar, they can be really powerful inside the trap. When they are stressed by the whole situation, there can be really ugly scenes inside the traps. Here comes a list of somewhat obvious design flaws that we tried to avoid before testing and any moving forward with the application.

Also mentioned before: The applicant pays for the test. I am not quite sure what these tests usually cost. Do you know anything about that, Nils?

[Nils Martenson:] I heard that for the testing of a mice trap, for example the Swedish Veterinary Institute, takes about 15,000 EUR. – 15? – Yes.

[Emil Ekstroem:] Also obviously, we do not want the testing to be done for product development. It is for approval only. So after you filed the application and sent it in for testing, that is it. You do not change anything with the application.

Now we move on to the testing and the evaluation of the tests itself. We have some general requirements for testing, requirements on the testing institute and the testing staff, plus there

are also specific requirements for killing and non-killing devices. Also we have some instructions for us, the case handlers, on how to evaluate the test results. I am not going into the requirements on the test reports. They are quite lengthy, but there is a specification on how it is supposed to be like. The main purpose behind this is that we get a standardised documentation that we can rely on during evaluation. Testing should be in accordance with the regulations and the manufacturers' instructions. It has to follow good scientific practice. Three copies of the device have to be tested to make sure that there are no quality inconsistencies. We have some standards that refer to the testing institute. We also have some standards for the staff doing the tests. I am not too familiar with these actually, but since there have only been two testing institutes on the market in Sweden so far, it has not been a main concern. Both of these fulfil the criteria. The people doing the tests need to be suitably trained and experienced. One of them has to be experienced in trapping with this device, and one has to be experienced on the intended animal species. Also one veterinary surgeon has to take part.

A short look on the requirements for killing trapping devices: Testing is limited to 12 animals. It is supposed to be in a laboratory if possible, otherwise in the field. It has to be corresponding to natural conditions. Also you cannot force the animals into the trap. The tests need to be filmed and so on. After you trapped the animals, you have to have X-rays and autopsies done. When it comes to killing devices, the main purpose is to find out how long the time is between the triggering of the device until the animal is permanently unconscious. You measure this time in seconds. This is performed by the veterinary surgeon that also makes sure that the animal is permanently unconscious by checking eye reflexes and the pulse to make sure that it is actually dead once the test is finished. The definition of the animal being dead is when the heart has stopped. If during the tests any animals get injured or anything like that, they have to be killed as soon as possible. There are also rules on stopping the tests.

Since we are talking about rodents, I want to mention that we have some special requirements on the tests for rodents. As there can be larger and smaller mice or rats, we have two weight classes. For instance, when it comes to rats, half of the animals has to be 200 g each and half of them 450–500 g each. You start with the smaller ones. Because of animal welfare aspects, we have rules on stopping the tests. Basically, these rules apply if you realise that this is not going to be a successful application. If three animals are not unconscious within the maximum time limit, you stop the test. If it is obvious that the mechanism does not hit its target, you stop the tests. Also if it breaks down from the handling and is not of proper quality. And of course, we do not move on with the process of that and the application will be denied. When it comes to non-killing trapping devices, we have to use 20 animals. It is pretty much the same requirements with the addition of rules on by-catch that you have to release them early. To put it into perspective and maybe some food for thought when you think about testing procedures, I put down some aspects that might be considered. For instance in Sweden, we have a lot of variation in the seasons and that might cause problems for testing and delay it. You have ethical aspects and sometimes you cannot hunt and you cannot use the traps. For example, if the animals have offspring, you do not want to catch the mothers etc. There can be problems to figure out how to use bait and how to get animals into the trap. In general, this can be a time consuming process. That adds to all the other time consuming elements of this procedure. Also there can be an actual risk of not being able to proceed, because you do not catch enough animals. This problem might get bigger even if you want to test the trap for 3 or 4 species simultaneously, but maybe they do not even occur in the same regions in Sweden, so you would have to do one test in the North and one test in the South. Of course, this has to be compared to laboratory testing which is good because you can control every factor but it is not realistic. Selectivity cannot be tested and you do not get the beauty of unforeseen problems. These are just some points to be considered when thinking about testing procedure.

How to evaluate the test results? There are some different standards for killing and non-killing trapping devices. When we evaluate the test, we base it on the report we get from the testing institute. In laboratory tests, at least nine of the animals tested must be unconscious and have permanent insensibility until they die within a specified time limit. We have a chart that tells us which time limit is acceptable for different animals. Then we categorise into classes A, B and C, where A is the best categorisation with the least animal suffering, meaning the shortest time limit which is assumed to cause the least suffering. For instance, if we talk about rats and mice, we have a maximum limit for class A that would be 15 sec. 80% of the animals tested have to be permanently unconscious within 15 sec. For class C, there would be 45 sec that is, of course, the maximum. To meet the criteria for selectivity, only one individual of another species can be trapped, and of course, this only applies to field tests. When it comes to non-killing trapping devices, we have a classification according to points. To me not being an expert on this, it is a bit complicated. I cannot go into detail on how we figured out this point system. I have not prepared any answers to that but it is based on the severity of the injuries. So you assess the injuries and then points are given. For instance, a minor injury to a claw will give you two points. If the animal loses a whole toe, this will bring 25 points. Obviously, this point system is reversed, so the less points you have, the better the trap. For major damage to internal organs will get 100 points. We also have this class A, B and C, where C is the limit for what can be approved. And again, we have regulations demanding that you stop the tests if you reach the maximum allowed points. We have the same criteria on selectivity because these non-killing trapping devices are tested in the field.

We follow this up with a formal decision of approval and also make a registration in our list with the type number which is to be used with this trap. According to the legislations on type approval, we can combine the approval with conditions. This has been quite common until August 2018 when we got new regulations on the use of trapping devices, because these regulations are supposed to eliminate the need of special conditions for every trap. We will have to see how well it works. In some instances it might be hard to regulate the whole field beforehand, before you know what the traps will be like. If we deny an application, the decision will be tried by our courts if it is illegal. Also we have the possibility to revoke an approval. So far, I am not aware of any cases where we have done this but it is worthwhile to notice that in those cases the burden of proof will be reversed, with us bearing it. So we have to figure out how to prove that this trap is not safe and that it is causing unnecessary suffering and things like that. An alternative solution, which is not used in Sweden though, would be to limit the approval to a certain time and then review it, but that would be a bit more time consuming. So we opted for this procedure. As I said before, so far, there have not been any revocations, but we have not been doing a systematic review of traps either. Basically, you could say that we wait for a concern to reach us and then we might act on it.

Thank you!

A.2.5 Erik Schmolz | German Environment Agency | Certification and Approval of Non-Chemical Alternatives in Germany

Before we start our discussions in small groups, it will now be my time to give a short presentation. Firstly, let me introduce myself. I am Erik Schmolz, head of the Institute of Health Pests and their Control at the German Environment Agency. In our laboratory, we are testing biocides as well as devices or traps against health pest organisms.

Certification is not the same as authorisation. We have to make clear that these are two different things. Certification means a proof that something has a certain quality, whereas the

authorisation regulates the access to the market. Certification can be a substitute for authorisation when it comes to traps, and it should require test and evaluation of efficacy, humaneness, safety for users and non-target organisms as with the Swedish approach. To have certification as a voluntary process, which means that not everything that is on the market has to be certified, might make it easier to implement and more easily accepted by companies and applicants. It is the competition on the market that gives an incentive for companies to apply for certification. The goal, or the big advantage of a certification, is that it allows a fact-oriented comparison of, let us say, biocides with non-chemical alternatives as well as non-chemical alternatives among themselves. In Germany, we have a law which prescribes a sort of certification which seems to be a bit contradictory but I will try to explain. The German Infectious Diseases Protection Act (IDPA) regulates everything about infectious diseases and human health. Among a lot of other things, it also regulates that competent health authorities on a local level are allowed to order measures to control health pests. Which should be no big surprise, but this means that you might lose certain civil rights in this process. Let us assume that you have an apartment block which is infested by cockroaches or rats, and it is very clear that the treatment in just one apartment does not really help. So you have to have a control operation or management in the whole apartment block and the health authorities can order an official pest control operation in this apartment block. The pest control operator then has access to each apartment even if it has to be forced. So this is clearly a very severe thing. Here, the lawmaker decided that for these officially ordered pest control measures only those products are allowed to be used that have been tested and approved. This testing is done by the German Environment Agency, and this is what our lab is doing.

The Infectious Diseases Protection Act does not separate between biocides and non-chemical alternatives. Both can be tested and certified for use according to this Act. The target organisms are limited, so only health pest organisms are considered as target organisms, vectors like mosquitoes, cockroaches or rodents. We first tested biocides for years, mostly rodenticides in our case now, and then realised that there is a development on the market: Now we have an increasing number of interesting trap systems which can be used against health pest organisms, rats for instance, so we have to test them also and we can include them in the list. So we developed methods and criteria for testing the efficacy of the rodent traps. While our main focus is on efficacy, other laws like the Animal Welfare Act need to be considered and humaneness will be tested as well. Over the last time, we had more and more applications for traps but only few for rodenticides. And more and more companies want their traps tested for humaneness, as there is a lot of scepticism against traps among the public, efficacy only comes second. Details of the testing will be provided by Susanne Hein tomorrow in part B of the workshop.

Very important to understand is that the application for listing, whether you have a biocide or a non-chemical alternative, is voluntary. That means you can sell the product for other uses on the market, but for officially ordered pest control operations, your product needs to be included in our list. One requirement which is very crucial is that they must be available on the German market because it is a specific national law. We do testing, we have test reports and the companies, the applicants, receive the test reports for further use. We have some applications to be included to the list, and then the companies receive the test reports for the Swedish trap approval for instance.

This is the list of biocides and traps according to the Infectious Diseases Protection Act in Germany. There is also the so called Blue Angel, the first eco-label established in 1978. Since then around, there are 120 product groups with approx. 1,400 companies having their products labelled, like paints, etc. Even though the majority of companies are based inside

Germany, a significant 22 % is located in other countries. The owner of the Blue Angel label is the German Federal Ministry for the Environment. An independent label jury serves as the decision making body which decides which products can be labelled and which not. With our tests for non-chemical alternatives, we approached our colleagues from the Blue Angel and convinced them that we also need product process categories like non-toxic pest-control and prevention which includes rodent traps, traps for insects, window screens against insects. We also have thermal processes against insects, wood-boring insects or others like bed-bugs which can be controlled thermally. To get a label, no biocides are allowed in the product or in the process. When it comes to pest control, a proof of efficacy is required. The user value of the products must comply with the requirements of the IDPA, and rodent traps must also be in accordance with the German Animal Welfare Act.

We set up some criteria for humane killing. The focus here is on the onset of the irreversible unconsciousness which was the same as for the IDPA. Meanwhile the National Law on Animal Welfare has changed, so we needed to revise our test methods. This is also something that Susanne will report on tomorrow, as this will take too much time today. Thank you!

A.2.6 Bruce Warburton | Manaaki Whenua-Landcare Research, NZ | Trap Testing: Standards and Guidelines

Susanne asked me if today I could dig down a little deeper on the testing we do in NZ. I thought I would start with a wee bit of background on the ISO (International Organisation on Standardisation) process. There is a big process for about 10 years now to try and develop the first international standards for testing humane traps. Then, I will go through the NZ testing guidelines that we use for testing traps in NZ and continue with the implementation of those guidelines, processes and some recent results. I will finish off on some issues that have come up during the testing that I think might be of value to anyone else developing guidelines.

So the ISO standard really came out of Canada where people were very keen to keep the fur trade going. They developed a Canadian humane trap standard and then thought, why can we not make this Canadian standard into an international standard. This is why they approached ISO, and ISO said if you can get more than 7 countries interested in developing an international standard then we will support it. In 1987, quite a while ago, Technical Committee 191 was formed and met first in 1987. Canada provided the secretariat, chairman of that group was Neal Jotham. Initially, 7 countries were involved. Among them, Canada, the USA, Sweden, NZ, Germany got involved recently early in the process, and Argentina was also involved. Later in the process, France, Belgium and England also got involved. That is quite a number of countries. While this process did evolve from the fur trade, it did include all trapping, so pests were included in the process. The process got overtaken by animal rights groups that were opposed to the fur trade, and that sort of muddied the water and made the process very difficult.

It included kill traps and restraining traps. Here, just some examples for kill traps and restraining traps. The ISO process trying to develop those standards took about 10 years, and at the very start, the time frame for kill traps was about 10 min as this was considered acceptable in some traps people used in catching fur-bearers. Soon, it dropped to 3 min, and for most of the discussion period over these 10 years, 3 min was the accepted time frame to irreversible unconsciousness. This was going to be the international standard. But as more countries got involved and also animal rights people got involved, it was argued that 3 min was not acceptable and the only acceptable standard was instantaneous unconsciousness.

Clearly, that was just unachievable so in the end the committee decided that, as they could not get an agreement on a time frame, the standards changed from a pass-fail criteria type of standard just to a process standard. So 2 standards came out in 1997, one related to killing traps and one related to restraining traps. But they only considered the testing process. They had no pass-fail criteria. Those criteria were left to the individual countries to decide what they wanted, whether it is 30 sec, 3 min or 5 min or whatever.

Because of the failure to have a pass-fail criteria, Canada in conversation with the EU and the Russian Federation developed a tripartite agreement which some of you are aware of, the Agreement on International Humane Trapping Standards, the AIHTS. Again, that was put in place to try and keep the fur trade operating. They came up with three times, you can see there are 3 sets of times here, 45 sec for *Mustela erminea*, the stout or weasel, 2 min, 120 sec, for another 3 species, and everything else was 300 sec, that is 5 min. This standard was a lot looser than the ISO standard with 3 min. Animal welfare would have been better with 3 min and an ISO standard. So the animal rights people actually did not do any favours to animal welfare.

This was a short background. There is an international standard out there, the ISO. You do not want to reinvent the wheel. You should have a look at those if you are not aware of them. NZ was involved in that process, and I was the NZ representative on this ISO process. We wanted a standard in NZ, so we could evaluate traps and say which ones are acceptable and which are not. So we based our guideline on the ISO standard. We have under our Ministry of Primary Industries a group called the National Animal Welfare Advisory Committee, the NAWAC. They developed a guideline, as you can see here the NAWAC guideline no. 9 assessing the welfare performance of restraining and kill traps.

I will continue on the topic of kill traps rather than restraining traps. There are two classes of traps, class A and class B. For a trap to be classified as a class A trap, the animals have to be rendered irreversibly unconscious in 30 sec. For B class, it is irreversible unconsciousness in 3 min. There is a minimum sample size of ten, and if you use this minimum sample size, 10 out of these 10 must be rendered irreversibly unconscious within 3 min. As you see here, if you use more than those numbers of animals, you can have some failures. There is some statistics behind that, some people may not agree to those statistics and the probability that some animals may not be rendered unconscious in that time frame, so it is something to think about in terms of sample sizes. But you are always trying to optimise or choose between using more animals to be more confident of the test versus trying to minimise the number of animals for animal welfare issues. The trap testing guideline does include capture efficiency and target specificity, but the testing we do currently is just purely focused on the animal welfare performance of the traps. The capture efficiency part compares your new trap with current accepted sort of best-practice traps. So it is not about comparing capture efficiency of traps with toxins. That is a challenging issue.

That is just a distribution of the number of tests we have been doing over the years. When we started off, we did quite a few, because now traps have been tested. The MPI (Ministry of Primary Industries) funded some research and we did quite a bit of testing. As you can see in green that is the number of rodent traps that have been tested. And it is just picking up again the “Predator Free 2050”.

In the pen trials that we do, we capture life target animals from the wild and acclimatise them to captivity. They are individually housed in testing areas or pens depending on the species we are testing. They are monitored with video cameras, and then a poor technician, or me, sits in the dark and waits until we hear that the trap goes off, and then we stop the time. The

time to unconsciousness is monitored by the palpebral or corneal reflex, which means that if you touch an animal's eye they will blink, and if they go unconscious that reflex stops. It can take quite a lot of time as you are relying on animals to do their thing. You cannot force them into the trap. It is a sort of natural behaviour process, and this also influences the price. A typical test for rat traps, ship rats or Norway rats costs about 7,000 EUR, about 11–12,000 NZD.

These are the rat traps that have passed the guidelines, and again, we have Norway rats and ship rats. You can see a series of DOC traps here, pictured is one on the top right, a large, powerful trap. The Victor professional and the Nooski, which is the bottom right one here with the rubber ring, it got passed for Norway rats. A series of them have passed for ship rats as well. One of the issues that we have in NZ is, while we have those two species, some traps might only get tested for someone that wants them to be tested for one particular species. But they market the trap that it passed the NAWAC guidelines for rats, while it has only passed for ship rats or only for Norway rats. As you probably all know, ship rats are under 120 grams vs Norway rats with 300 g or more. A rat is not always a rat. You have to be really careful here with what trap suppliers or manufacturers to use the data for that you provide.

This is some work that we have done with the Victor professional snap back trap. In its raw form, it has not been tested, but we are about to test it because a lot of people are using it. The one in the middle, we put a shroud over the bait and trigger area. That is to guide the animal front on into the trap. That has been tested and passed on Norway rats. More recently, there is a commercial cover that has gone onto the Victor trap. This was passed for stoats and ship rats. The key issue is that it is not only the trap that we are testing. It is the trap plus the tunnel, or the cover, plus the bait. So you cannot just pass the trap and say this is going to meet the guidelines. It depends on how the trap is set – an extremely important issue. Just to elaborate on this a wee bit: We have just tested this T-Rex rat trap that passed. When the submitter of that trap to our test provided us with the initial information on how they wanted this trap to be set, with this tunnel and this bait, so this is what we did. And you can see the top left and the middle one, they both failed. Both traps were meant to be entered through a side entrance, but with the animals going in sideways that trap failed. So we went back to the manufacturers and said, we think the reason is because it is a side entry. It might pass, though, with a straight on entry. So we tried this and put the trap into a PFNZ (Predator-Free New Zealand) wooden tunnel with a front on entrance, and the trap passed. So what we passed was that trap set in that tunnel and baited that way. It is not the T-Rex alone in itself that really passes the guidelines.

This is a snapping trap, and we did a lot of developing with Predator-Free New Zealand (PFNZ) just to see if we can get this working. It is really popular with community groups because it is really easy to set. We wanted to try and get it to pass the guidelines. We modified the trap quite a bit and finally ended up having the bait way behind the baiting holder. So that again the animals line up in the trap so they get a straight on head first position.

That is just an example of a test report. During the first trial here, we only tested one animal and it failed. Typically you have to get 10 out of 10. So if you start the trial and it fails, we do not do any more. That trap failed on the first rat. It caught it on the rear leg because the animal would just climb over the trap after we had set it up in the ineffectual way recommended by the supplier. So we went back to the supplier and said, we think, we can do better than that and will change some things. We went into the 2nd trial. Here the first animal passed but the 2nd animal failed. So we went through several variations, changing the trigger size, changing where the bait was put, and finally we got 10 out of 10.

One of the issues we came up against in the last couple of months is the following. We tested a T-Rex trap, and now there is a Graham's rat trap and a hippo rat trap out there which are all copies. So if we tested the T-Rex, does that mean also those other two traps have passed? There is the issue of who pays: A private individual business paid for the T-Rex trap. Why should these other people piggyback on these test results? To tell you the truth, we have not resolved this question yet but will continue discussing it.

Let me finish this off with some discussion points.

- I want to re-emphasize that the tests need to include the set-up and the bait, it is not just the trap itself.
- What time to unconsciousness is acceptable? We have accepted 3 min, but to others that might not be acceptable, you might want 30 sec or 5 min or whatever.
- Copies: Can copies be mechanically tested, or are they just assumed to meet the standard? Again, there is fairness on one side, the commercial issue, someone having paid for the testing and other people are piggybacking on it. On the other side, there are clear benefits for animals as we would not need any more for testing. If mechanical testing alone would be enough to know if the trap configuration works, if it is a similar one that has exactly the same configuration and the spring is the same, should we not be able to approve that?
- Trap modification: We were talking to a trap supplier who recently had their trap passed. They said, next year, they want to modify it to make it better. Does that mean that this trap has to be re-submitted and tested again? This is an issue that again we have not resolved yet.
- Used traps: We typically test new traps. Our guideline says that a trap has to be set and fired a certain amount of times. Should we set and fire them 50 times or more? Should we retest some of the traps after 3 or 4 years of use, as spring tension does decline?
- Animal size is another issue that has come up. How do we test the range of weights among one species? One sensible way of dealing with that might be to introduce classes with light-weight and heavy-weight ones.
- Sample size and statistical power: The 10 out of 10 from the table I showed you, give you a 90% probability that the trap will perform better than 70% of the [unrecognizable], which is not that good really. If you want to be better than that, you have to have a higher sample size, but this means killing more animals and therefore is just another issue to deal with.
- Capture efficiency: As I said, we solely focus on animal welfare through these guidelines. Capture efficiency is sort of left up to the industry and the people using it. There are ways of testing it as well but it is just an additional cost.

What I thought, I would just finish off with is that we do these tests and trials, and if a trap passes, people still need to know how to use them, how to set them, and what is the best way of doing it. The MPI (Ministry of Primary Industries) has a website called bionet (www.bionet.nz). Here, they put all the best practice information together. You can see two example documents here. One is for the responsible use of bait stations, an operator's guide, and the 2nd one is "Kill traps: a guideline to trap possums, ferrets, stoats and feral cats using kill traps". So there is a lot of online material to help, either professionals or the public, on how best to use these tools.

Lastly, the department of conservation has a lot of material online, too. Particularly now, they have been generating a lot of help with community groups involved in the predator free 2050 initiative. You can go to their website and they have online help around site-specific issues. For example, if there are non-target species in the area, e.g. kiwi, how to choose your traps or toxins, capture efficiency and that sort of thing. That is how all that other wider issue of trap use is dealt with through this other online documentation. That is it, thank you!

A.2.7 Sandra Baker | University of Oxford, Wildlife Conservation Research Unit | Testing the Humaneness of Kill Traps: Ending Double Standards for Rats and Mice in the UK

I am going to speak today on the work we have done on testing the humaneness of traps in the UK. In the UK, the default situation is that kill-traps are required to meet welfare approval standards. But there are some long-standing exemptions in the case of break-back traps or snap traps used with rats and mice and also mole traps. That has resulted in double standards in trap welfare in the UK. I will be finishing my talk by telling you about a proposal we have been making about a certification scheme which, based on the conversations we were having yesterday, looks like it could potentially form a component of a EU wide certification scheme in the future.

Kill traps, referred to as spring-traps in the UK as they are powered by a spring, they are widely used for killing of small and medium-sized mammals. There are a few examples here. The key species are grey squirrels, rabbits, stouts, weasels, rats, mice and, also not in the pictures, mink and moles. So they said spring-traps are legally required to meet welfare approval standards, but break-back traps for rats and mice and all the mole traps are exempt from that. You might wonder how these double standards arose. I am going to take you back to the 1950s when the spring trap legislation was first introduced, along with the double standards.

In 1950, the Committee on Cruelty to Wild Animals produced a report. In that, they concluded that all spring- traps should be welfare regulated in the UK. However, on the subject of rats they said the following: “The rat is regarded as one of the greatest animal pests… It is also a menace to public health… For these reasons its control and destruction are essential…” And without any proper data, they concluded that break-back traps for rats and mice involved no unnecessary suffering. And there is that phrase again, “unnecessary suffering”, which causes so many problems, I think. Also, just for completeness, I will tell you what they said about moles: “We have had no evidence that mole trapping causes unnecessary suffering, except that one organisation mentioned that they had been given to understand that the spring of the ordinary type of mole traps was too weak to kill instantaneously”. And again, without any data or evidence, they concluded there was no need to make any special recommendations of welfare standards regarding mole trapping.

Three years after this report, the Pests Act was implemented making it an offence to use a spring trap that was not approved but exempting traps that were specified as adapted solely for the destruction of rats, mice, and other small ground vermin. And then four further years on, the Small Ground Vermin Traps Order defined these exempted traps as break-back traps used with rats and mice, and mole traps. So there has never been any welfare testing for these traps. 60 years on, the exemptions still remain, and it is really difficult to think why that should be, particularly given two things: First of all, traps used with other species with similar cognitive and emotional complexity do require approval, and some other traps which are used with a range of species do require approval if they are going to be used with rats and mice. So I guess a utilitarian view might tolerate lower welfare standards for animals considered very numerous, very dangerous pests. And if we look at the wording of the report in 1951, that must

be why these exemptions were made. But modern ethical thinking on animal welfare says that basically welfare concerns should not depend on the species involved. They should not depend on whether the species is considered to be a pest or vermin or too numerous. So there is no need for the double standards.

So we got interested in this area and started looking at the variety of unregulated traps that are available. There has really been a proliferation of designs, I think because of the lack of regulation. I do not know if you recognise any models there? The top two rows are rat traps, the bottom two rows are mouse traps. There are some traditional wooden Tom-and-Jerry type traps over at the top right-hand corner. Then, there are others traps made of metal and others made of plastic. I will just show the mole traps as well because something similar has happened with them. There are 3 main styles of mole trap used in the UK, and multiple brands have made their own versions. Something I noticed with both the break-back traps, and the mole traps is that there seems to be a huge variation in the strength of the traps, just from feeling them. It was the first thing that struck us.

I do not know if you have seen this before. This is a game-keeper's gibbet where he is demonstrating his mole-trapping prowess by hanging dead moles on the fence. I do not know whether this is supposed to tell the moles where to go. A big pile of rats here.

These three species I have been talking about they are probably the majority of animals killed in traps in the UK. A recent study on moles showed that kill-trapping is now actually the preferred option for control of moles on British farms, and amenities now that strychnine poison is no longer available for moles. Hallelujah!

The welfare impact of exemption is likely to be great on the basis of the numbers involved. So where do we go from here? We began by looking at how regulated traps are welfare tested in the UK. That is all other spring-traps for all other species, and those traps that are used for multiple species including rats and mice. They are tested by an organisation called the Animal and Plant Health Agency, or APHA, who are an executive agency of our government, department DEFRA (Department for Environment, Food and Rural Affairs). They do killing trials, similar to those that Bruce was describing, but the standard for passing those tests is quite low. At least 80% of 12 animals need to reach irreversible unconsciousness within 5 min, or the 300 sec that Bruce talked about. That standard has been lifted from the Agreement on International Humane Trapping Standards. So although there is regulation it could be better. And, of course, it is not for rats and mice.

We decided to begin our work on the unregulated traps by looking at mechanical performance of traps as a proxy for welfare performance. Obviously, that is not the whole story, as Bruce was saying, it is all about the way a trap is set, about the body strike location and a lot of other things as well. But we thought, this would be a good way of looking at a large number of traps, just to see what kind of variation there was in the traps on the market at the moment, or a few years ago when we did it. So we measured two mechanical forces which are commonly used as proxies for welfare performance in traps. The first one is impact momentum which is measured in Newton sec. Impact momentum is basically the power with which the striking bar hits an animal when the trap is triggered. It causes physical damage to the skull or vertebrae, blood vessels, organs and nervous system. Traps that crush the skull, as Bruce was saying, are considered to be the most efficient and humane. Ideally, a trap will strike the correct anatomical location with enough impact momentum to cause cranial or upper vertebrae fracturing rendering animal immediately insensible.

The other force that we measured was clamping force, measured in Newtons. That is the gripping force that the trap produces once it has made contact with the animal. The clamping

force acts to crush and keep an animal in a trap, potentially causing asphyxiation or occlusion of blood vessels, and can increase damage if the animal struggles after it has been caught.

In case you were wondering how we made these mechanical measures: We collaborated with the impact engineering lab at Oxford University to produce two aluminium jigs. You can see one of them here. This is testing a mole trap actually. Unfortunately, I did not have a picture with a break-back trap. Our problem was that we had a huge range of different sizes and designs of traps. We needed to test the mechanical performance using very delicate electronic equipment. So for the impact momentum, we used a dynamic load cell, the tiny brass object in there. And for clamping force, we used a static... [unrecognizable] The data was collected by the load cells and transmitted directly to a computer which recorded them. The idea of the jig is to provide a substrate that the track can be triggered on to which then compresses the load cell evenly. So you get a repeatable result.

Here are the results for the impact momentum and clamping force for the break-back traps. Along the bottom, you got impact momentum and on the y-axis clamping force. There are two things to take away from this figure, hopefully. Firstly, both forces varied enormously for each of the species. So we look at rats first of all. The weakest rat trap is down here. The strongest rat trap is up towards the right-hand corner there. All the other rat traps are somewhere inside the polygon. And if you look at the impact momentum and clamping force on the two axes, you can see that both those forces varied several times between the weakest and the strongest traps. Impact momentum varied 6 times from the weakest to the strongest mouse traps and 8 times for the rat traps. The clamping force varied 5.5 times for mouse and 4.5 for rat traps. The other important thing to notice is that there is an overlap between the weakest rat traps and the strongest mouse traps. That is quite a cause for concern given the difference in size between the two species. This means that there are people out there selling traps for killing rats which are weaker than some of the mouse traps available.

Now of course, this does not tell us anything about the actual welfare impact. It is possible, based on these data, all those traps would pass welfare approval tests using killing trials. Or it is possible that all of them would fail. But what it tells us is that there is significant room for improvement.

We also looked at two features of break-back traps. First of all the spring type. We identified four different kinds of spring type. First of all the peg-spring, which is a bit like a closed-peg spring, here in the top left hand corner. Below that, a double-peg spring. In the top right, something we called a pull-spring. It is a kind of classical spring that attempts to pull the two halves together. And finally, one that we dubbed the jaw- spring, that is a bit like a jaw muscle that wraps around the jaws of the trap and pulls the trap shut. We also looked at the opening angle of the trap when it is in the set position. Our sample of break-back traps ranged from a small angle like this one on the left right through to 180° as in a kind of traditional, wooden style Tom-and-Jerry trap. With a trap on the right, the striking bar has to travel through 180° to come into contact with the other side of the trap. I think, we already mentioned that the impact momentum is the more important of the two forces in terms of a quick kill. We found that the impact momentum was stronger where the opening angle was greater, and where the trap had a double-peg spring.

We found that impact momentum was weaker when the opening angle was smaller and when the trap was powered by dual [unrecognizable] spring. Now, obviously there are all sorts of things in between those two, and you could not go out to buy a trap with a double peg spring and a 180° opening angle and be certain that you got the strongest trap on the market, because

it could be made with poor materials. But what we found was a general trend that those two design features could be better.

These are similar results for the mole traps. The three different designs, each have their own polygons. You can see that the two forces varied significantly between the Duffus, the Scissor and the Talpa traps. Within each trap type which is shown by a separate polygon, the traps made by different manufacturers also varied very significantly. The weakest to the strongest mole trap varied 7 times in terms of impact momentum and 4 times by clamping force.

I will just briefly skate across this. This is another study we did with moles. I just wanted to mention that we have done a post-mortem and x-ray study with 50 moles that have been killed by mole trappers. We found that none of them had any damage to the skull or to the vertebrae, not even the backbone. There were several of the moles that looked like this, as if folded in half at the point where the trap struck them. When their bodies were examined in detail and the x-rays were done, there was no damage to the bones. It was just soft-tissue damage. It does occur to me that mole-trappers might think they are doing a good job, but unfortunately from the design of it none of the mole traps hits the skull or the upper vertebrae.

We found wide variations in the performance of traps for each of the three species. Given that rats are about 20 times heavier than mice, the overlap between the traps for the two species is a particular concern. And we concluded that there is significant scope to reduce the welfare impact of all the unregulated traps. So the exemption from regulation seems to have led to a neglect of welfare standards. Given the scale in terms of trapping, in terms of the numbers of animals in the UK, the wide range of unregulated traps available and the doubts over their humaneness, there seems to be a strong case for blanket welfare approval standards. Actually, approved traps ought to be better all round. They ought to be more effective as well as more humane. There is no evidence from our study, because we looked at this that they need to be more expensive. We found no relationship between the price of a trap and the mechanical power of the trap. Only for one type of mole trap, there was a pattern where the stronger the trap the more expensive it was.

The UK legislation is unlikely to change soon to correct this double standard. I am just backtracking a little bit. In 2004, the EC proposed a European Trapping Directive which was then withdrawn in 2012, about two weeks before our paper on mechanical testing came out, sadly. About four years ago, the UK law commission were challenged to reform the whole of wildlife law in the UK, because it is a big mishmash of different acts that have been amended over and over again. They invited proposals in a consultation exercise for improvements, and I proposed improvements to do with trapping welfare and how unregulated traps should be regulated. In the draft bill, they made no mention of that. So that was not going to happen. But actually the reform of wildlife law has now been abandoned because of Brexit anyway.

In 2006, the UK Animal Welfare Act came out and made it an offense to cause unnecessary suffering and that specifically also applies to a wild animal held in a trap, although it is intended largely for domesticated animals. I would argue that in the spirit of the original pests act surely all traps should meet equivalent standards. So we came up with an idea for what I termed at the time “a voluntary trap approval scheme” – I am wondering now if it should be “trap certification scheme” – which would act as a carrot rather than a stick. So there would be an incentive hopefully for manufacturers to get their traps tested to be ahead of the game and market their traps on welfare grounds. I propose the voluntary scheme would be based entirely on the existing scheme in the UK that exists for regulated traps. The traps would be submitted by the manufacturers to APHA for testing. Approval would be based on killing trials using time

to irreversible unconsciousness, and the manufacturers would pay, as they already do for the regulated traps.

Traps that pass the standards could be marketed as having passed welfare tests, the APHA standards. They could not be marketed as approved, as only the minster can approve traps on the recommendation of APHA based on their tests. As I mentioned briefly when Bruce was speaking, there is the potential for multiple tiers of approval as was suggested by Talling and Inglis, and that is how it is used in NZ. Just for interest, these are the tiers that Talling and Inglis suggested. They go right down to 30 sec, and the least strict standard goes up to 5 min.

In summary, the proposed voluntary scheme would result in more effective and more humane traps. It would highlight this issue of double standards which I am sure the public is not aware of. It would offer the public a choice and give them the opportunity to demonstrate their demand for high welfare lethal traps. There should be a potential cascade effect occurring amongst suppliers, so that they would only stock approved traps and edging out the non-approved traps. Once the approved traps are in place, or a few certified traps are in place, the future legislative change might become more straightforward and less of an obstacle. The welfare impact could be huge because of the numbers involved.

My work is sponsored by the RSPCA, Humane Society International and the Elinor Patterson Baker Trust. That is it.

A.2.8 Susanne Hein | German Environment Agency | 3T - Tiered Trap Testing Approach at the German Environment Agency

As you heard, this will be the last talk before the coffee break. It will be quick, I promise.

We negotiated for almost a year with the authorities until we got the design granted that we finally can use in the lab. We already heard yesterday from Erik that we do the testing in accordance with the Infectious Diseases Protection Act of the Federal Republic of Germany. State authorities can mandate to perform a pest control procedure. And if they do so, the respective pest control operators may only use products and methods that were allowed by us before and listed according to §18 of the IDPA. If I talk about “the list”, it is always the list of §18 of the IDPA. This is a voluntary process though. Manufacturers can apply to get their product listed according to §18.

So what we developed is a tiered trap testing approach. The design is basically subdivided into three main parts. We start with a technical-mechanical analysis of the properties of a trap. Then, we have a no-choice test which has a conditioning phase included, and the last one is a choice tests. There are three steps, and at each point, the test will be aborted if the trap will not meet the criteria. If the trap passes all these different steps, in the end, it will be approved according to §18. I will get into detail for every single step now.

The first step is the technical analysis of the properties of a trap. We are here obviously talking about mechanical traps. There are other traps, like drowning traps for example or electrical traps, which we cannot test the technical properties for. What we want to do at least is measure the clamping force and the impact momentum at best, as we just heard from Sandra, and collect as much data as possible from different traps to determine the threshold. This step is optional at the moment because we do not have these data right now. Once this threshold is determined, the mechanical traps that are applied for testing at our facility will need to meet these criteria. It has got to be a threshold of Newton or Ns, and the trap has to meet it, and if not, the testing is

already over. With this, we want to make sure that only traps that are really technically capable of killing a regular mouse will proceed further with the test.

This first step right now is more of a theoretical step. What we do now as a first step is the conditioning phase included in the no-choice test. We have a no-choice test during which we test the humaneness of the traps, to which I will come next. And we always have a setting-in phase for the animals because they need to get used to the new surroundings. For mice, it is only 7 days, but for rats it is 14 days because they are very, very neophobic. During this setting-in phase, we kind of condition the animals to the traps. We use really attractive bait and practically teach them that everything else but the trap is not worth looking at. We also chip the animals with RFID transponders. I do not know if all of you are familiar with this technique. It is a passive integrated transponder. Via an antenna and a reader station, you can measure each time this chip has passed the antenna to measure the amount of visits of an animal. Each chip has an individual number. So we know exactly which individual visited a trap, how often or if at all. The criteria in this part is that we need at least 90% visitors of all animals of the group. It looks like this: We have a platform onto which we place the trap, a snap-trap in this picture, this is the antenna I was talking about, and this is the reader. Once a mouse or a rat enters this area, which is practically the triggering area, the antenna recognises the chip placed into the neck of the animal, reads it, and the visit is noted by this reader, which you can later on read onto a computer and just put it into an excel file. We get customised antennae, so that this reading range is really small and really narrow, so that only the triggering area of the trap here is going to be read. The idea behind this is that once an animal enters the trap and puts their head into the "correct" spot, the antenna registers this. By this, we want to make sure that the trap is really attractive enough for the animals. If we condition them to go to the traps, visit them, and we still do not have 90% of the animals' visit them, then, honestly, it will be no good in the field.

If the trap passes this step, we go on to the actual no-choice test during which we test the humaneness of traps. We chose criteria according to the AIHTS standards and the publication of Talling and Inglis. We decided to have two categories, A and B, and that we are measuring the time span until irreversible unconsciousness of the individuals. For category A, at least 80% need to be irreversibly unconscious within 30 sec and 90% within 60 sec. And for category B, it is at least 80% in 60 sec and at least 90% in 120 sec. We lowered the last span from 180 sec to 120. The idea was that we want to start with these two categories, but as soon as there are three traps listed according to category A, we do not need category B anymore. The long-term goal is to only have traps listed according to category A.

Once a trap has passed this step, we come to the final step which is the choice test during which we test the attractiveness of a trap under choice conditions. During this test, we have two groups of 10 individuals each for mice and rats as well. Once again, we measure the number of visits on a non-activated trap, because that was the compromise we had to make with the animal welfare authorities, because we were not allowed to do this on activated traps. Once again, we would chip the animals with RFID transponders and measure the visits and the number of animals visiting the traps. And with all the other measurements in the steps, we have done before we can agree on, once we measure that all the animals visited a trap and did not actually get killed during this test, but we can assume that it probably works because we did all the other tests before. Exposure to the traps will be 7 days for mice because they are very curious, and for rats it is 28 days due to their very strong neophobia. The criteria here is that we need at least 90% of all individuals visiting at least one trap, and this is compared to the criteria from biocidal products where we have at least 90% mortality in the choice tests. That is it already. Thank you.

B List of Participants

Table 2: List of Participants

Name	Affiliation	Country
Baker, Sandra	University of Oxford, Department of Zoology	UK
Benuszak, Johanna	French Agency for Food, Environmental and Occupational Health and Safety (ANSES)	FR
Berend, Klaus	European Commission	EU
Bombonato, Laura	ZAPI S.p.a.	ITA
Crezee, Maarten	Killgerm Benelux N.V.	BEL/NL
Cropper, Iain	Health & Safety Executive (HSE)	UK
De Villaines, Edme	Swissinno Solutions AG	CH
Delvaux, Vincent	European Commission	EU
Dressler, Eva	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety	GER
Ekström, Emil	Swedish Environmental Protection Agency	SWE
Endepols, Stefan	Rodent Resistance Action Committee (RRAC)/Bayer CropScience	GER
Ensch, Svenja	Environmental Agency Luxemburg	LUX
Fischer, Juliane	German Environment Agency	GER
Friesen, Anton	German Environment Agency	GER
Gaszczyk, Malgorzata	The Office for Registration of Medicinal Products, Medical Devices and Biocidal Products	POL
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Hall, David	PelGar International Ltd.	UK
Halle, Jochen	Killgerm GmbH	GER
Harrison, John	Syngenta	CH
Hein, Susanne	German Environment Agency	GER
Hogberg, Anna	Danish Agriculture & Food Council	DNK
Ilmarinen, Kaja	Health Board – MSCA Estonia	EST
Kjellberg, Hakan	Anticimex AB	SWE
Klute, Oliver	Biotec Klute GmbH	GER
Le Laidier, Gabriel	Swissinno Solutions AG	CH

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Mott, Henry	CEPA Europe	UK
Nielson Blom, Mie	Danish Agriculture & Food Council	DNK
Puschmann, Markus	Puschmann GmbH	GER
Rubbiani, Maristella	National Centre for Chemicals, Cosmetics, and Consumer Protection	ITA
Schmolz, Erik	German Environment Agency	GER
Schroeer, Daniel	Futura Germany	GER
Smolka, Susanne	PAN Germany	GER
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Spikkerud, Erlend	Norwegian Environment Agency	NOR
Straeten, Marcus	Anticimex GmbH & Co. KG	GER
Trigaux, Antoine	Belgagri SA	BEL
Tuusa, Tiina	Finnish Safety and Chemical Agency	FIN
Van Berlo, Boris	Federal Public Service Health, Food Chain Safety and Environment	BEL
Vashegyi, Ildiko	Babolna Bioenvironmental Centre Ltd.	HUN
Verwilghen, Frederic	CEPA Europe	BEL
Vorwerk, Axel	Federal Ministry for Environment, Nature Conservation and Nuclear Safety	GER
Walther, Bernd	Julius Kuehn-Institute	GER
Warburton, Bruce	Landcare Research	NZ
Wieck, Stefanie	German Environment Agency	GER
Wood, Mike	Rentokil Initial	UK
Zerfaß, Ilka	Federal Institute for Occupational Safety and Health	GER