National Animal Welfare Advisory Committee

Evaluation of the Code of Welfare: Pigs

2021

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Project background

This report describes NAWAC's evaluation of the 2018 version of the code of welfare for pigs (the Code) to identify changes required to ensure that the minimum standards will protect the welfare of pigs in accordance with the purposes of the Animal Welfare Act. In considering these matters, NAWAC has evaluated good practice, available technology, and scientific knowledge. The report includes feedback from stakeholders, a summary of NAWAC's previous relevant advice, and a summary of relevant literature and expert advice.

The need for a review of all codes of welfare was identified by an animal advocacy hui held by the Associate Minister of Agriculture in Auckland in June 2018. The hui was an opportunity for people to come together and have a constructive dialogue about the animal welfare issues that mattered to them. Four focus areas were identified and incorporated into a framework for action on animal welfare. One of the focus areas is to strengthen the codes.

In addition, the livestock sector met on 15 August 2018 to identify gaps and opportunities to improve the animal welfare system in New Zealand. The Farm to Processor Animal Welfare Forum identified three key areas of work, which included a review of the farm animal codes of welfare. A review of the Code was established as an action arising from the Primary Industry Chief Executives' Animal Welfare Forum held in Wellington in December 2018 and reported to NAWAC in October 2019.

In November 2020, The High Court ruled that the standards for farrowing crates and mating stalls for pigs were unlawful and invalid, and the urgency for review of the Code was promoted. The New Zealand Animal Law Association released a report "Farmed Animal Welfare Law in New Zealand" in February 2021, which identified standards in several codes it believes require review.

A NAWAC subcommittee was formed to review the animal welfare performance of available farrowing and mating systems and identify those systems that align with the requirements of the Animal Welfare Act 1999. The subcommittee formulated a Terms of Reference and embarked on a series of farm visits and meetings with expert speakers (both in person and by videoconference). The subcommittee undertook a Five Domains analysis of a range of farrowing and mating systems to guide their thinking in the recommendation of new standards to replace those declared unlawful.

The balance of the Code was reviewed by a joint NAWAC/MPI/industry working group. The working group was tasked to bring a reviewed document to NAWAC for their consideration alongside the new standards developed by the subcommittee. This approach allows a comprehensive package of amendments to be proposed to all the standards for pig welfare.

In line with NAWAC's direction, the code is being reviewed with specific focus on the following:

- Good practice, available technology, and scientific knowledge
- The need for any regulations including section 183A(2) transitions or exemptions
- Positive welfare and sentience
- Assurance programmes
- On-farm killing
- Emergency management and preparation
- Selective breeding.

This report should not be considered to represent NAWAC's final view, as a draft code of welfare has yet to be publicly notified

Key documents

Strategies

New Zealand's Animal Welfare Strategy – Animal welfare matters[1]

Key points:

- It matters how animals are treated – it matters to the animals and it matters to us. We have responsibilities toward animals in our care and animals affected by our activities.
- Using animals is acceptable as long as it is humane.
- Science is a critical part of New Zealand's animal welfare infrastructure and provides a secure foundation for animal welfare policy and developing animal welfare standards.
- Some practices and technologies in use may be outdated and there are opportunities to adopt less harmful practices and technologies and to invest in research and development to support improvements (e.g. environmental enrichment).
- Animal husbandry is key. Knowledge, skills and behaviour of stock people are integral to the standard of welfare.

Primary Sector Roadmap - Fit for a better world: Accelerating our economic potential[2]

The vision of the Primary Sector Council and MPI for the future of New Zealand's primary industries. Key points:

- New Zealand has a unique story to tell the world about its safe, high-quality food and fibre products. Our reputation for integrity underpins it all.
- Our primary sectors have the opportunity to extract greater value across the value chain, by being responsive to evolving consumer wants and needs, and by being smarter and more innovative than our global competitors.
- Achieving our sustainability goals requires a focus on the health of our soil, plants, animals and people.
- We will support businesses to manage future disruptions without compromising animal welfare or environmental standards. We will encourage the sector to prepare for future challenges, including climate change adaptation, managing disruptions to supply chains, and responding to changing consumer preferences.

[1] Ministry for Primary Industries (2013). *Animal Welfare Matters: New Zealand Animal Welfare Strategy.* https://www.mpi.govt.nz/dmsdocument/3963-Animal-Welfare-Matters-New-Zealand-Animal-Welfare-Strategy
[2] Ministry for Primary Industries (2020). *Fit for a better world – accelerating our economic potential.* https://www.mpi.govt.nz/about-mpi/our-work/fit-for-a-better-world-accelerating-our-economic-potential/

Select Committee and legal outcomes

Judicial Review of the code of welfare for pigs[3]

The High Court ruled in November 2020 that the standards on farrowing crates and mating stalls for pigs were unlawful and invalid.

This required NAWAC to review current science and international best practice and regulation of farrowing and mating systems for pigs to provide evidence-based advice on these systems to the Minister responsible for animal welfare.

Regulations Review Committee: Recommendations for Codes of Welfare[4]

In 2016, the Regulations Review Committee considered a complaint regarding the code of welfare for layer hens. While the grounds of the complaint were not upheld, they made some recommendations for NAWAC to consider for all codes.

They recommended that terminology used in code reports must be consistent with the Animal Welfare Act 1999 and should not use concepts or terms that are not based on those in the Act. For example, the terms “essential” or “non-essential” behaviour do not appear in the Act. The Act requires that animals be provided with the “opportunity to display normal patterns of behaviour”, which the committee suggested to mean that animals must be able to “display a reasonable range of behaviours that are beneficial to the animal.”

Primary Production Select Committee[5]

SAFE presented a petition with 112,844 signatures to Parliament on 15 March 2018 calling for a ban on the use of farrowing crates in pig farming. MPI and NAWAC provided separate written and oral responses to the Committee.

The Select Committee reported in March 2021 that the subject matter of the petition has been directly addressed by the High Court. The Committee believes that any farrowing system needs to strike the appropriate balance between the needs of the sow and the needs of piglets. They believe that pig farmers should always be striving to implement industry best practice standards, as set out in the code of welfare for pigs.

[3] *The New Zealand Animal Law Association v The Attorney-General* [2020] NZHC 3009.
[4] Complaint about Animal Welfare (Layer Hens) Code of Welfare 2012 (14 October 2016). https://www.parliament.nz/en/pb/sc/reports/document/51DBSCH_SCR71235_1/complaint-about-animal-welfare-layer-hens-code-of-welfare
[5] Petition of Debra Ashton for Save Animals From Exploitation (SAFE): End the use of farrowing crates. https://www.parliament.nz/resource/en-NZ/SCR_108201/8b46e6ff06ee1e3284cf66284c07753533e635ea

Operational Research

Sustainable Outdoor Farrowing Systems for New Zealand[6]

The aim of this study was to quantify the level of piglet deaths in outdoor farrowing systems in New Zealand, describe when and why they occur, and identify the operational and management systems associated with higher piglet survivability.

Twelve different hut systems were analysed with no difference in piglet mortality observed between A-Frame, A-Frame Modified and for Boxshape huts.

The average live-born piglet mortality for outdoor pig farms reported in the study was 16.7%. This is higher than the 11.9% industry average reported for farrowing pens with crates. One system where sows farrowed in crates and were moved outdoors into huts after one week had a lower mortality than predicted by litter size. Another farm reported a mortality rate of only 3.4%, but litter sizes on this farm were much smaller than industry averages.

The study found that the number of live-born piglets is positively correlated with live-born mortality rate, with an increased risk of death of 2.9% per additional piglet born alive. It is also positively correlated with the number of piglets weaned - an additional 0.56 piglets weaned for each additional live-born piglet.

Overall, farmers reported that good staff are a key to success.

Sustainable Farming Fund Project 11-042: Loose Housed Farrowing Pens[7]

This project focused on farrowing systems and compared the conventional farrowing crate to short-term crating around farrowing. Over a 12-month period, 332 sows farrowed in the temporary crates and 278 in conventional farrowing crates, providing a robust dataset. The comparison of the two farrowing systems showed that:

- Fewer pigs were weaned from the temporary crating system due to higher average pre-weaning piglet mortality rate - 11.32% versus 6.14% for the temporary crates and conventional crates respectively.
- The numbers weaned from the pen system are lower than in the conventional crates but are acceptable when considered against the context of the NZ industry average.
- Piglets weaned from the temporary crating system were on average 0.17kg heavier than those weaned from conventional crates.

The report notes that “Good operators, skilled staff and appropriate management are important and have a significant influence upon the success of any system. The design of the system may not be as consequential to productivity as the management and overall husbandry. The most important aspect of making a new systems work lies with observation, identifying any compromises, and implementing solutions.”

[6] Sustainable Outdoor Farrowing Systems for New Zealand. MPI Technical Paper No: 2018/12. https://www.agriculture.govt.nz/dmsdocument/28017/direct

[7] Chidgey K, Barugh I, Morel P (2014) *Loose housed farrowing pens.* Sustainable farming fund project 11-042. Massey University, Palmerston North, New Zealand.

NAWAC & MPI Documents

Codes review timeline[8]

In its published timeline for reviewing all codes of welfare NAWAC advised that the following aspects will need particular consideration:

1. Assurance programmes,
2. Killing / emergency killing,
3. Positive welfare and sentience,
4. Emergency management and preparation,
5. Selective breeding (where relevant).

NAWAC Opinion on animal welfare issues associated with selective breeding[9]

NAWAC considers it unethical to knowingly use animal breeding programmes that produce animals whose physical, health and behavioural needs are compromised by their genetic status.

The code of welfare for pigs currently contains no information on breeding. NAWAC has agreed to add a breeding section to codes where relevant.

NAWAC's animal sentience statement[10]

Animal sentience was explicitly recognised in the Animal Welfare Act 1999 via an amendment in 2015. The National Animal Welfare Advisory Committee (NAWAC) understands animal sentience to mean that animals have emotions, feelings, perceptions, and experiences that matter to them. These can be negative (such as pain or boredom) as well as positive (such as pleasure or comfort).

NAWAC have agreed to review the codes of welfare with animal sentience in mind, adding information and best practices that promote positive welfare.

Statements in the Painful Husbandry Procedures code of welfare[11]

Since 2005, NAWAC has stated in the Code of Welfare: Painful Husbandry Procedures that:

- Painful husbandry procedures should be looked upon as transitional management practices. While such procedures may be seen as necessary at present, operators and farm industries are encouraged to further develop management systems and breeding programmes which do not require them to be performed routinely.
- It is therefore important to only undertake procedures likely to cause pain and distress when they are necessary. Greater justification is required for more invasive procedures, which are more likely to cause pain and distress.

[8] https://www.mpi.govt.nz/dmsdocument/39998-Timeline-for-reviewing-codes-of-welfare
[9] NAWAC Opinion on animal welfare issues associated with selective breeding (2017) https://www.mpi.govt.nz/dmsdocument/17053-NAWAC-Opinion-on-animal-welfare-issues-associated-with-selective-breeding
[10] https://www.mpi.govt.nz/animals/animal-welfare/national-animal-welfare-advisory-committee/animal-sentience-their-emotions-feelings-and-experiences-of-life/
[11] https://www.mpi.govt.nz/dmsdocument/1443-Painful-Husbandry-Procedures-Animal-Welfare-Code-of-Welfare

- Aligned with a justification for the procedure, the operator must consider farming methods and systems which would reduce the need to routinely perform painful procedures (i.e. deal with the factors underlying the problem). In addition, techniques for minimising the discomfort, pain or distress caused to the animals, and whether it is necessary to always treat all animals in that way, have to be considered.

This is relevant to procedures such as tail docking and teeth cutting in the Code.

2018 regulations – items not progressed[12]

Some of the proposed animal welfare regulations that MPI consulted on in 2018 were not progressed.

For pigs, a proposed regulation requiring manipulable material did not progress. This is because "there was a strong lack of clarity for regulator and industry on the best way to meet this requirement."

The suggested use of straw from the Pigs Code of Welfare 2010 presented significant compliance issues for the industry in slatted systems, particularly around animal hygiene and labour. The existing minimum standard is difficult to meet in a meaningful way due to uncertainty about requirements and lack of evidence of welfare benefits as sows continue to be maintained in farrowing crates.

A transitional arrangement was considered, but without certainty about the end-point requirement, this was considered unfeasible.

MPI committed to work with the industry to progress ongoing research around implementing such a requirement in New Zealand farming systems. It was considered an important behaviour for a farrowing sow and was noted as an area for future regulation.

[12] https://www.mpi.govt.nz/dmsdocument/18989-Animal-Welfare-Appendix-Three-Proposals-that-will-not-progress-at-this-time

Literature & expert advice

In considering standards for farrowing and mating systems, the NAWAC pigs subcommittee sought expert advice, and reviewed the relevant literature, for key topics related to pig welfare. This process of expert advice and review of relevant literature was further extended to the work done by the code working group. NAWAC wishes to thank all the experts and contributors who shared their knowledge with the Committee.

The following sections combine literature reviews with the evidence presented by expert speakers, industry representatives from NZPork, and NAWAC's view of the science. Summaries of these discussions, as well as various submissions made to NAWAC during the pre-consultation phase of the code review, are included in a later section of this report.

The review of the literature was compiled by MPI's animal welfare science team. The EBSCO Discovery service was used to search for articles; this service searches across MPI's academic science journal subscriptions as well as major journal indexing databases CAB Abstracts and ProQuest SciTech Premium. MPI is a member of the NZ Interlibrary Loan Scheme so any articles not available full text on Discovery, or from other sources, were supplied by the MPI Digital Librarian from New Zealand and overseas library collections. Papers were also received from expert speakers, gathered by NAWAC members, and submitted by industry and advocacy groups.

This review does not attempt to provide an exhaustive summary of the literature and expert advice related to every section of the code. The aim is to provide an evidence base for the topics and questions most discussed by the code working group and NAWAC subcommittee to date.

In addition to this review, NAWAC analysed farrowing crate and mating stall scenarios using the Five Domains Model as an analytical tool. The Five Domains Model focuses on the affective state of an animal and was designed to facilitate the assessment and grading of animal welfare impacts in a systematic, structured, comprehensive, and coherent manner focussing not only on factors which can compromise welfare, but additionally those which can ultimately improve levels of welfare (Mellor et al., 2020). The Five Domains analysis can be accessed online.

In New Zealand, there are approximately 27,000 breeding sows across just under 100 farms, producing over 600,000 pigs per year, almost exclusively for the domestic market. Approximately 55% of farms farrow sows indoors, and 45% outdoors. Around 60% of the pork consumed in New Zealand is imported.

NAWAC's deliberations on the current use of farrowing crates

The farrowing crate was introduced in the 1960's with the intention of reducing piglet mortality and to make the most efficient use of housing space. In a crate the sow cannot turn around and her standing and lying movements are more controlled. This physical confinement is one way to reduce the risk of crushing piglets.

Documented disquiet with confined animal housing systems dates to the same period (Harrison, 1964). In response, the 'Brambell Report' was commissioned by the British Government. The report recommended that all animals have the freedom to 'stand up, lie down, turn around, groom themselves and stretch their limbs' – recommendations still

relevant to farrowing crates. These recommendations evolved into the Five Freedoms, which in turn form the basis of the physical, health and behavioural needs defined in New Zealand's Animal Welfare Act 1999.

Since the 2005 code, it has been NAWAC's view that many features of farrowing crate systems fail to meet the purposes of the Animal Welfare Act. These concerns relate to the restrictions placed upon the sow and the lack of opportunity to display many of the normal behaviours that normally occur between sow and piglet. In addition, increasing evidence suggests that the use of the farrowing crate can have a negative impact on piglets.

During its deliberations, as NAWAC has reviewed the scientific literature describing systems for managing sows and piglets at farrowing, this position has been reinforced.

The following section provides a summary of the scientific literature that NAWAC has considered for the questions:

- What are normal patterns of behaviour for a farrowing sow and her piglets?
- How important is nest building?
- What impact does the crate have on pig welfare?

Having reviewed the literature and consulted with experts, NAWAC considers that providing opportunities for normal nesting behaviour is required to meet the physical, health and behavioural needs of pigs.

The two critical features that would need to be provided in indoor farrowing environments to allow the sow to express nest building behaviour are:

- Enough space for the sow to turn around and undertake nest seeking behaviour, build a nest, meaningfully interact with piglets, and have separate dunging and lying/nesting areas.
- Adequate nesting material, of a suitable type to manipulate and enough to give the sow a sense of nest completion, with suitable flooring to contain the material.

It is NAWAC's view that these essential features preclude the current use of farrowing crates where sows are confined before nesting behaviours commence, and which fail to provide meaningful nesting materials.

In a letter from NZ Pork to NAWAC defending farrowing crates, it was submitted that the "physical, health and behavioural needs of animals are not uniform or consistent, and they will change in response to an animal's situation and environment. For this reason, there will inevitably be periods where animals experience a degree of stress or less-than-optimal welfare, despite our best efforts to provide for their needs." In addition, it was stated that there are trade-offs in any system; and the positives (in terms of health & hygiene) of the crate may outweigh the negatives (in terms of behavioural restriction).

NAWAC would agree with some of these points; all farming systems have their costs and benefits to animals, and an animals' welfare can vary by situation and environment. However, NAWAC considers that situation-related negative affective states that are clearly linked to housing type – such as the stress, frustration and pain associated with crates – do not have to be inevitable. They can and should be avoided wherever possible.

Sows will spend around 20% of their year in farrowing systems. This is not insignificant, and it is critical that her welfare is protected, in addition to the welfare of her piglets. It is a requirement of the Animal Welfare Act 1999 that opportunities to display normal patterns of behaviour must be provided, as well as providing for animals' physical and health needs.

What are normal patterns of behaviour for a farrowing sow and her piglets?

The behaviour of sows and piglets has been well studied. In the 1980's, observational experiments were carried out on domestic pigs living in semi-wild environments by Stolba & Wood-Gush (1989) near Edinburgh, and Jensen (1986) in Sweden.

They found that the maternal behaviour of the sow can be divided into six phases:

- nest site seeking,
- nest building,
- farrowing,
- nest occupation with the piglets,
- social integration of the young,
- and weaning.

Jensen (1986) described nest site seeking behaviour occurring within 2-3 days of farrowing, during which heavily pregnant sows became restless, separated from their group, and wandered several kilometres to find a suitable spot to build a nest.

Nest building behaviour occurs during the last 24 hours of pregnancy, reaching peak intensity 12 to 6 hours before farrowing. The sow will root a hollow in the ground, collect grass, leaves and branches and carry them in her mouth to the nest. Here she will spread the material, maintaining a hollow in the centre with pawing and rooting movements. The more suitable the material and nest site, the sooner nest-building can be completed (Damm et al., 2000; Jensen 1986; Thodberg et al., 1999; Wischner et al., 2009).

Sows show a clear preference for a nest site with solid walls (Baxter, Andersen, & Edwards, 2018) and will select sites that allow them to maintain vigilance for approaching threats (Stolba & Wood-Gush, 1989).

During farrowing, oxytocin levels increase to promote uterine contraction for piglet expulsion and let-down of colostrum (Castrén et al., 1993). Sows do not lick the new-born young, but may stand up to inspect their offspring, making nose-to-nose contact before rooting the nest to move piglets out of the way (Jensen, 1986). This usually occurs early during farrowing, most often after the first piglet is born, and is often followed by a prolonged phase of several hours when she is less responsive to the subsequent piglets born.

Nose-to-nose contact facilitates mother-offspring bonding (Portele et al., 2019). Piglets recognise the odour of their mother within the first day of life and recognise her vocalisations by three days old. Separation results in distress vocalisation and searching behaviour to re-establish contact (Telkanranta & Edwards, 2018).

Jensen (1986) observed that during the first few days after farrowing, sows spent up to 90% of their time in the nest. Nursing bouts are initiated regularly at 20 to 40-minute intervals (Baxter, Andersen, & Edwards, 2018). Piglets coordinate the initiation of nursing bouts, compete to establish a teat order, and rest together for warmth.

In the Jensen study (1986), sows began to leave the nest between 2 and 8 days after farrowing, and the piglets will reliably follow after 7 to 10 days. Once the piglets followed the sow to the foraging area, the nest was abandoned, and the sow and piglets would re-join the main group.

Piglets will begin rooting within one week of birth (Petersen, 1994) and will learn foraging behaviour from the sow. The sow will begin to increase her foraging range and feed intake,

and restricts suckling, encouraging the piglets to forage independently. Piglets play and socialise with other litters, and they spend increasing amounts of time away from the sow in piglet foraging groups (Baxter, Andersen, & Edwards, 2018).

Piglets are fully weaned by around 14 - 17 weeks (Jensen, 1986), and the sow comes back into oestrus soon afterwards.

How important is nesting behaviour?

The Animal Welfare Act 1999 sets a requirement for all persons in charge of animals to provide the opportunity to display normal patterns of behaviour – as appropriate to the "species, environment, and circumstances of the animal." It is relevant therefore to consider whether nest building and nesting are behaviours that are relevant and meaningful to the sow, within the context described in the Act.

It has been argued that the "current" pig of 2021 living in a fully housed environment is different from the domestic pigs from studies conducted in the 1980's. Their genetics, circumstances and environment differ, and therefore they may no longer have strong motivations to display behaviours associated with nesting.

The transition to a domestic phenotype is often associated with a heightened response threshold for specific behaviours or the modification of the rate of behavioural and physical development, however there is very little evidence that domestication has ever removed an entire behavioural repertoire from any animal – if there are changes, they are generally quantitative, not qualitative (Price, 1999).

Aligned with this, it can be observed that sows with 2021 genetics in New Zealand that are kept outdoors exhibit nest-building behaviour, although the pattern of nest-building can vary substantially by individual.

Sows about to farrow are highly motivated to build a nest and this behaviour is both internally and externally motivated. It is the combination of the right stimuli at the right time that determines whether successful and complete nest-building can occur (Jensen & Toates, 1993; Wischner et al., 2009).

Physiologically, nest building in sows is under hormonal control. A major rise in PGF2α, subsequent increase in circulating prolactin, and a decrease of progesterone are internal triggers for nest building behaviours to begin (Castrén et al., 1993; Algers & Uvnas-Moberg, 2007).

The external environment also has a role in controlling nest building behaviour. While an initial increase in activity (including walking, nosing and rooting) is largely triggered by internal factors, the pattern and extent of gathering and arranging nest material is also dependent on feedback from the nest site and other external stimuli (Jensen,1993).

This combination of internal and external motivation means that the performance of nest building behaviour remains valuable to sows even if a pre-built nest is provided for her (Arey, Petchey, & Fowler, 1991) and even if she is kept in a situation that prevents many of the movements required for nest building. In an indoor pen, sows have been reported to attempt to perform nest-site seeking by pacing on average a total of 30km within a $5m^2$ space in the lead-up to farrowing (Baxter, 1991).

While the restricted space and barren environment of a conventional crate means that it can be difficult to observe the more complex aspects of nest building behaviour, an increase in activity and restlessness is still reliable: experimental models have been developed to predict farrowing time by placing accelerometers on crated sows (Cornou & Lundbye-Christensen, 2012; Oliviero et al., 2008).

Preventing the full expression of nest building behaviour has a significant impact on the welfare of sows. Interrupting nest building has been shown to be related to hypothalamic pituitary adrenal (HPA) axis activation and an increase in plasma cortisol (Damm et al., 2003). Behaviourally, the performance of abnormal redirected nest building behaviour, such as bar biting and pawing at floors, is increased in barren crates as compared to pens with manipulable material (Cronin et al., 1994; Lawrence et al., 1997; Damm et al., 2003; Yun & Valros 2015; Yun et al., 2015; Edwards et al., 2019).

These abnormal, repetitive, redirected behaviours, in combination with physiological measurements, indicate that the sows are highly motivated to nest build and that they are likely experiencing frustration from that behaviour being thwarted.

Allowing nesting behaviour for the sow has benefits for piglets. Sows can attempt to nest build by pawing and nosing the ground even in restricted environments (Jensen, 1993; Lawrence et al., 1993; Cronin et al., 1994; Yun & Valros, 2015) and any fragmented nesting behaviour that does occur can extend closer to farrowing or even continue during farrowing (Jensen 1993; Damm et al 2003; Andersen et al.; 2014; Hansen et al 2017), which means that piglets are at higher risk of crushing. Passive behaviour at farrowing is preferable, as it reduces the risk of accidental crushing and decreases the duration of farrowing.

There is evidence for better suckling success for piglets shown by greater IgG levels from colostrum when the sow is able to nest build (Yun & Valros, 2015).

Providing straw for nesting that also acts as deep bedding (15-20kg of straw) reduces skin lesions and soft heel/toe erosions in piglets, compared to providing sparse bedding and especially compared to slatted or concrete floors alone (Westin et al., 2014). While skin and hock lesions in piglets are not always clearly associated with production loss, Westin found that deep bedding was correlated in higher piglet weights at weaning by up to 0.33kg.

Nesting material in the farrowing pen can also support the behavioural and physiological development of piglets. Piglets will begin rooting within one week of birth (Petersen, 1994). By keeping nesting material available to the piglets post-farrowing, re-directed foraging behaviour that can be damaging (e.g. to the sows teats, pen fittings, or littermates) can be reduced (Telkanranta & Edwards 2018; Lewis et al., 2006). Piglets reared from birth in more complex environments (outdoor systems) have been found to perform more exploration, more rooting, more social play, more consumption of solid feed, less belly-nosing, less fighting and less teat-directed activity, all before weaning; and indoors, piglets with access to a tray of peat, replenished daily, have been shown to perform more foraging activity and gain more weight (Telkanranta & Edwards 2018).

While introducing manipulable material to the farrowing environment brings new challenges to be managed by staff (e.g. in terms of biosecurity and disease control, or in spending more time cleaning), NAWAC has been advised that allowing for nesting behaviour can be beneficial for the farmer, too. NAWAC spoke to experts in Norway and Sweden who have worked with loose sows for a number of years. In Sweden, educational material quoting the

experience of farmers routinely using straw at farrowing notes that the sows can “take care of farrowing themselves”, enabling “a calm night’s sleep” (for the farmer), as well as making the sows more docile and easy to handle. The time involved in handling straw is suggested to be offset by fewer health interventions to help sows farrow.

One of the risks of loose farrowing systems that allow nesting behaviour is that because the sow has greater freedom of movement, the risk of accidental crushing of piglets increases, but providing for meaningful nest building behaviour may mitigate some of that risk. Positive maternal behaviours such as nose contact with piglets, pre-lying vocalisation, behavioural responses to piglet distress calls, and restlessness when piglets are removed are increased when the drive for nest-building is satisfied (Andersen et al., 2005, Jarvis et al., 2005, Yun et al. 2014, Swan et al 2021., Bolhuis et al., 2018, Westin 2014), while positive maternal behaviour has been shown to be negatively correlated with the risk of piglet crushing (Andersen et al., 2005).

Minimum Standard 10(h) in the 2018 code of welfare for pigs required that facilities built after 2010 provided manipulable material to sows in crates, but this may not have resolved the deficit since it is not clear whether satisfactory nest building can be performed by sows while restricted in crates. Industry experts therefore questioned whether Minimum Standard 10(h) was meaningful for improving welfare.

There have been studies that show that elements of nesting behaviour could potentially be provided for in a crate. For example, giving a sow a hessian sack over the crate has been shown to have positive effects which may have been due to the feeling of enclosure for the sow (Cronin & Amerongen 1991). Lucerne or straw in crates has been recommended as a cost-effective strategy for welfare and production gains (Doyle et al. 2018).

However, access to space (to turn around, choose a nest site, and place materials) is increasingly shown to be a core aspect of nesting behaviour. Several studies have compared the value of space vs. material for nesting sows. Jarvis et al (2002) studied whether pituitary-adrenal activation in farrowing gilts was more elevated in crates due to the lack of space or lack of straw and considered that higher levels of physiological stress was related more to lack of space. Yun et al. (2014) studied the differences in nesting behaviour and welfare in three treatments and found that sows with access to space and plenty of nesting material showed “vigorous and abundant” nesting behaviour, and that non-confinement of sows contributed to an increase in behaviour compared to crated sows.

In a review by Tuttyens (2005), straw is found to be a suitable nesting material – “superior or more attractive enrichment devices are few”. However, given that sows in semi-natural conditions will build nests out of a variety of materials, Tuttyens suggests that nests made of straw as well as other materials (like branches) may be more effective in reducing the motivation to nest-build.

Andersen et al. (2014) similarly considered crated and penned sows when provided with 2kg of chopped straw per day, and found more bar biting and restlessness before farrowing, and ‘quick flops’ after farrowing, in crated sows. They concluded that provision of 2kg of chopped straw does not compensate for the lack of space in the crate.

Hansen et al. (2017) observed the behaviour of loose and confined sows when both groups were given larger amounts (1kg/day) of long-stemmed straw in a rack and found significant differences in nesting behaviour, with the loose-housed sows performing longer bouts of

nesting behaviour. They suggested that since walking is part of nest-building behaviour in sows, this could be the main reason for the behavioural differences observed.

Bolhuis et al. (2018) investigated the effects of loose vs. crated housing and the provision of alternative nesting material and found that both loose housing and the provision of alternative nesting materials affected prepartum sow behaviour and resulted in less activity during parturition. They suggested that the effects of housing and of nesting material were additive.

Regarding suitable materials for nest building, Swan et al. (2018) reviewed material types for nest building and found that sows appeared to benefit from newspaper, although straw had a more positive effect on piglet survival. The sows in the study were confined in crates, and it may be that newspaper was used more by sows because it was less likely to fall through the slats than straw or wood shavings.

Rosvold et al. (2019) found that loose-housed sows with access to straw or peat engaged in more nest building behaviour than sows in the control treatment, but that straw elicited the most complex nest building behaviour.

NAWAC considers that providing sows with the opportunity to express nesting behaviour before farrowing is both relevant and meaningful for the sow and can also contribute to the success of her subsequent litter. The following would need to be provided to allow for normal nest building behaviour:

- Enough space for the sow to turn around and undertake nest seeking behaviour, build a nest, meaningfully interact with piglets, and have separate dunging and lying/nesting areas.
- Adequate nesting material, of a suitable type to manipulate and enough to give the sow a sense of nest completion, with suitable flooring to contain the material.

What impact does the farrowing crate have on animal welfare?

The use of farrowing crates is contentious. Farrowing crates are used in 55% of the NZ industry to manage sows giving birth and while they have young piglets. They prevent the sows from moving freely, including turning around, for 4-5 weeks at a time. Heated creep areas are provided to allow optimal temperature control for piglet comfort and growth.

Prior to their introduction, farrowing and lactating sows were housed indoors in straw bedded pens, outdoors in straw yards or outdoors in paddocks in pasture-based systems. Farrowing crates provided a hygienic environment for sows and litters while making management as easy as possible.

In an early pre-consultation meeting held in December 2020[13], NZ Pork gave the NAWAC pigs subcommittee a presentation on farrowing crate systems, stating the positive aspects as follows:

- Piglet & staff protection while the sow farrows and lactates
- The differing temperature needs of piglets and sows are met
- Greater opportunity to cross-foster piglets

[13] https://www.mpi.govt.nz/dmsdocument/43780-Review-of-pig-crates-meeting-summary-16-December-2020

- All pigs are protected from weather extremes
- Animal handling is easier and there are more opportunities for positive human-animal interactions
- Control of parasites and disease is improved
- Improved environmental management
- Smaller space footprint and less feed needed reduces land use and carbon footprint
- Lower total cost of production.

Sows are usually confined in a crate from several days before farrowing until piglets are weaned. As discussed above, confinement before farrowing prevents sows from performing normal nesting behaviours. In contrast, lactating sows in pens have the possibility to exercise freedom of movement, interact more with their environment and piglets, and perform a greater repertoire of behaviours (Chidgey et al., 2016).

Physiological indicators

Confinement in a crate and the prevention of a range of behaviours that are meaningful to the animal are associated with HPA axis activation and stress in the sow (Lawrence et al., 1994; Jarvis et al., 1997) as well as oral/nasal stereotypies (Damm et al., 2003) .

Cortisol levels have been shown to be elevated in sows on the first day of crating (Cronin et al., 1991). More recently, increases in plasma cortisol when sows are subjected to prolonged confinement have been demonstrated (Jarvis et al., 2006). Oliviero et al. (2008) found no significant difference in plasma cortisol between crated and penned sows with access to straw during the pre-farrowing period. Blood sampling began one week after sows had been introduced to the crates, so there may have been physiological adaptation. Changes in physiological stress measures can be challenging to interpret over periods of time as the HPA axis has the capacity to activate many mechanisms that protect the animal's homeostasis.

Cortisol should not be used as a welfare indicator to assess stress in isolation since, apart from being under strong homeostatic control, it may be elevated by excitement and arousal as well as frustration and anxiety. Farrowing is likely to be associated with elevated stress hormones irrespective of the nature of the housing, and many hormonal changes (oestrogens, prolactin, prostaglandins) occur in the sow during this period. However, when considering physiological indicators with behavioural indicators, the evidence suggests that being confined in a crate leads to greater levels of stress and frustration in the sow.

Increased physiological stress measures as lactation progresses may reflect the lack of control that the sow has over whether her piglets can suckle when confined in a crate – a sow will normally exhibit behavioural control over suckling events, by initiating fewer nursing bouts, reducing milk availability and encouraging piglets to forage as lactation progresses in order to conserve reserves for the next litter (Cronin et al. 1991; Baxter et al., 2018).

Physiological stress around the time of farrowing increases the risk of compromising the welfare of both the sow and the piglets because elevated levels of stress hormones can interfere with the oxytocin release and so may reduce the strength of uterine contractions and impede colostrum let down.

In some studies, the duration of farrowing was on average 90 minutes longer in crated sows compared to penned sows with straw bedding, and lower oxytocin levels and an increased risk of stillbirth were observed (Gu et al., 2011; Oliviero et al., 2010). In addition, farrowing time is longer as litter size increases; average farrowing times increase from around 2 hours for litter sizes of 10 piglets to more than 6 hours for litter sizes of 16+ (Oliviero, Junnikkala & Peltoniemi, 2019).

Farrowing is an inherently painful event (Ison, Clutton, Di Giminiani, & Rutherford, 2016). Recent evidence has linked confined farrowing to an increased observation of behavioural pain indicators (straining, tail flicking, leg placement), suggesting that confined sows may experience more pain during farrowing (Nowland et al., 2019); this could be due to lower levels of oxytocin. Plasma cortisol levels were also increased in sows that took longer than five hours to farrow.

Impact on piglets

The farrowing crate environment also affects the piglets. NAWAC consulted with one expert from Sweden who strongly linked loose housing to piglet welfare and performance, stating that “the purpose of using farrowing pens is not to improve sow welfare. Free farrowing and access to nesting material improves sow health and welfare, and thereby piglet welfare and performance is improved through reducing farrowing time and still births etc.”

Apart from a reduction in stillbirths, lactating sows housed in pens have been shown to have longer suckling periods, fewer fights at the teat, and piglets more consistently suckled during the time that the sows were releasing milk (Pedersen et al., 2011). Piglets tend be heavier at weaning in loose systems, possibly associated with better access to the udder and higher sow feed intake (Pedersen et al., 2011; Chidgey et al., 2015; Nowland et al., 2019; Kinane et al. 2021). Loose housed sows had fewer teat injuries at 21 days post-farrowing (Ceballos et al., 2020).

The farrowing crate restricts sow-piglet interactions, and there is more sow-piglet nose contact in free farrowing pens, which may be of importance to the development of piglets (Portele et al. 2019). Sows in farrowing crates are less responsive to piglet screams during the first 3 days after farrowing (Thodberg et al., 2002) and show less vocalisation and investigation towards their piglets in the first day (Cronin et al., 1996). Sows that have more space were more protective towards their piglets (Andersen et al., 2014).

Impact on sow health

The restrictions imposed by a farrowing crate are associated with reduced fitness, and cardiovascular and muscular strength (Pedersen, Malmkvist & Andersen 2013) as well as limb and body lesions.

In 2009 Kilbride et al. collected data from lactating sows across 89 farms in England. They found that the prevalence of limb and body lesions in crated sows was higher than in outdoor sows with either soil or deep bedding as their lying areas. Conditions of calluses, capped hocks and limb wounds increased as the proportion of slatted floor in the crate increased and the quantity of bedding decreased, and the risk of bursitis was proportional to the time that sows spent in farrowing crates.

The slatted flooring used in crate systems has been associated with lameness. Calderón Díaz et al. (2014) compared locomotory ability and lameness scores between gestation and

farrowing. They found that, regardless of the flooring type where sows were housed during gestation, fully slatted floors in farrowing crates had detrimental effects on claw health.

Mastitis-metritis-agalactia (MMA) is a painful condition and is the most common disease of sows during lactation affecting both sow and piglet performance. The condition is multifactorial in origin including bacterial infections, endocrine imbalances, malnutrition, lack of exercise, mycotoxins, hereditary predisposition, stress, environmental factors and management. New Zealand veterinarians have advised that the incidence of MMA is greater when sows are housed on solid concrete floors.

A review of sow welfare (EFSA, 2007) found that loose housed sows in indoor systems with solid flooring in the nesting area had a lower incidence of MMA than those housed in crates with slatted floors. Experts in the management of loose housed sows advised that MMA can be managed by providing a good diet, opportunities to exercise, clean bedding, and attending to hygiene (e.g. disinfecting pens between uses).

Risk of savaging

Savaging (piglet-directed aggression from the sow), has been associated with neophobia, stress hormones and failure to adapt to restrictive farrowing environments and the risk of its occurrence is greater for gilts than for multiparous sows (Baxter, Andersen & Edwards, 2018). Some authors (Chen, et al., 2008) suggest that the trigger for savaging is associated with the endocrine events of parturition, and that risk is mostly related to maternal experience.

New Zealand industry experts advised NAWAC that savaging is a rare behaviour. As well as the factors mentioned above, they attributed savaging to painful conditions such as mastitis, as the gilt/sow associates piglet suckling with discomfort. They advise that dietary change such as provision of straw and high-fibre diets can reduce savaging behaviour, but that intervention by stockpeople is most effective to minimise or prevent piglet injury or death if savaging behaviour begins. This is easier and safer for the stockperson when the sow is crated and may involve use of tranquilisers or muzzles.

Cross-fostering

Cross-fostering is a common management practice on New Zealand pig farms because the number of piglets born alive may exceed functional teat numbers. This is in part due to very large litter sizes as genetic selection has trended to hyperprolificacy, but loss of functional teats through physical damage and mastitis can also contribute. Hand-rearing or artificial rearing of piglets is generally unsuccessful and not commonly used so cross-fostering to a sow with more functional teats than piglets can ensure survival of the excess piglets.

Confinement of the sow in a farrowing crate allows for easier cross-fostering. While there is opportunity to foster in free farrowing systems such as outdoor systems when the piglets are newborns, this becomes more limited as piglets grow older.

NZ Pork presented five general approaches to cross-fostering used in New Zealand:

- **Cross-foster to even up litter size** 6-24 hours after birth (after they get their mother's colostrum, keeping as many on their own mother as possible). E.g. one litter of 14 and another of 10 gets evened out to two litters of 12 by taking the largest two piglets from the litter of 14.

- **Make up litters of small piglets** by collecting the smallest new-born piglets and placing them on a newly farrowed sow. The foster sow's litter is taken and spread between other new-born litters.
- **Shunt foster** when you have more piglets than viable teats - 'excess' piglets from across several litters are placed with a recently farrowed sow (4-8 days post-farrowing) and her piglets are placed with a sow being weaned at around 21-days.
- **Create new litters** of "fall back" piglets. 6-9% of piglets fall back (fade) around 3-5 days after birth and once there are sufficient for a new litter (10-12 piglets), they piglets are moved to a foster sow which may be newly weaned, or which may have their litter shunt fostered.
- **Hold back small piglets** at weaning. Runts are held back at weaning and placed on a foster sow who feeds them for another week before weaning.

Fostering requires a high level of stockpersonship to be successful. Very early cross-fostering may reduce colostrum uptake while fostering too late may increase fighting amongst piglets and disrupt suckling episodes. Piglets may not suckle regularly, develop facial lacerations from competition at the udder, and there may be no improvement in weaning weights (Baxter et al., 2013). The prolonged lactation of the foster sows may reduce body condition (Baxter & Edwards, 2018). While it is possible to perform cross fostering in outdoor systems, it must be done early (limiting fostering options) and it requires a high level of skill to do it safely.

Housing sows in farrowing crates has benefits for stockpeople as it makes animal handling easier and improves worker safety. Irrespective of the system used, there needs to be some arrangement whereby sows needing veterinary treatment can be restrained appropriately to protect worker safety, and to facilitate husbandry procedures for piglets without disturbing the sow. Many of these issues can however be overcome by designing for these options in farrowing systems.

NAWAC's deliberations on alternative indoor farrowing systems

The next phase of NAWAC's deliberations were focused on the ability of any indoor farrowing systems to provide for animals in a way that allows them express behaviours that are meaningful to them.

NAWAC considered:

- What are the key features of systems to house farrowing sows and piglets?
- Does a shorter period of crating meet the purposes of the Act?
- Won't more piglets die if farmers cannot use farrowing crates?
- Can a smooth transition be achieved without compromising pig welfare?

The following analysis of current scientific knowledge and good practice was supported further by a Five Domains analysis of farrowing systems which can be accessed here: www.mpi.govt.nz/animals/animal-welfare/national-animal-welfare-advisory-committee/nawac-review-of-pig-crates/

In the proposed code of welfare for pigs, NAWAC is presenting two options for Minimum Standard 10 for public comment.

NAWAC recommends an outcome-based standard that will require the use of free farrowing systems. Most importantly this standard will require adequate space and resources to allow the sow and her litter to express normal behaviours that matter to them, while providing safe areas for the piglets.

It could be argued that short term confinement for farrowing (up to 72 hours), as a means to protect the neonatal piglets, provided the sow has been given opportunity for nesting before the onset of parturition, and sufficient space for the balance of time that she is suckling her piglets, may comply with the requirements of the Animal Welfare Act.

While free farrowing is NAWAC's preferred option at this stage for Minimum Standard 10, the draft Code is presenting two options for discussion. As outlined above, it is NAWAC's view that it is essential that the sow has the opportunity to express nesting behaviours during farrowing (i.e. space, freedom to move, and appropriate nesting materials).

It can however be argued that a brief period of restraint, once these behaviours have been satisfied, may provide a means to protect the newborn piglets until they are recovered from birthing. Industry veterinarians gave strong representations during pre-consultation that crating a sow after the nesting behaviour is complete is not a practicable solution, since, in their view, there are currently no effective technologies for determining the onset of parturition. Furthermore, as either a standard or regulation, NAWAC considers it would be difficult to ensure compliance. Nevertheless NAWAC decided that this option should remain on the table for further discussion during the next phase of consultation.

NAWAC is satisfied that both proposed options comply with the purposes of the Animal Welfare Act and is seeking public input on both options in order to determine the minimum standard necessary to ensure the physical, health and behavioural needs of sows and piglets are met.

What are the key features of systems to house farrowing sows and piglets?

NAWAC's view is that, as the primary users of the system, the needs of the sow and piglets should come first. As Baxter (2011) stated: "It is not unreasonable to suggest that agricultural practices in livestock farming systems should be based on the biological needs of the animals involved."

The design of free farrowing systems (Baxter et al 2011; Pedersen et al 2013) should provide:

- Space
    - Enough for separate nesting, dunging and feeding areas; a lying area apart from the nest to allow sow to separate herself from piglets and control nursing; area separate from nest to allow sow and piglets to leave nest when they would naturally
    - A space at least 2m length in the nesting area, add 50cm in length and +40cm in width to allow for ease of turning and lying laterally
    - At least 4.9m^2 total to allow nest-site seeking
- Flooring
    - Non-slip and minimally abrasive e.g. rubber matting or plastic-coated metal
    - Slight gradation of floor away from nesting area for drainage

    - Separate slatted area for hygiene

- Comfortable nesting area for sows and piglets
    - Solid flooring to allow for nesting material or malleable (earthen) for digging and rooting
    - For thermal comfort, deep bedding 10-12cm or rubber matting with high thermal resistance
    - At least 2kg of long-stemmed straw (or alternative substrates with similar properties) for carrying and manipulating behaviour; add other materials like branches to ensure a feeling of nest completion
    - 3 solid walls, ideally dark walls to simulate burrow
    - Assistance for sows to lie down without contacting piglets i.e. sloped walls or bars

- Piglet creep
    - A heat source
    - Covered to keep heat in
    - Substrate on the floor or rubber mat for lying comfort
    - Accessible to stockpeople from the walkway

- Social interaction
    - Contact between piglet litters for social behaviour– at least vertical bars between pens wide enough for nasal contact

The minimum space allowance for farrowing pens in Sweden is 6m^2 total of which 4m^2 must be a lying area, and in Norway is 6.7m^2 with some overseas experts recommending an area greater than 7.5m^2 as optimal.

A range of free farrowing systems are used internationally. The website www.freefarrowing.org provides photos and summaries of different farrowing systems.

Does a shorter period of crating meet the requirements of the Act?

Temporary crating systems allow the sow to be confined for a much shorter period - until piglets are more mobile - after which the sow and litter share a pen.

Some temporary crate systems can be built using a similar spatial footprint as a conventional crate. In pre-consultation, New Zealand pig veterinarians have indicated that this makes them a promising option in terms of practicality and economic impact.

NAWAC has concerns however that some commercial systems do not provide sufficient space and hence result in poorer outcomes for piglets and advises caution.

Temporary crating still requires a period of confinement for the sow, even if it is much shorter, and therefore may have many of the same impacts to the physical, health and behavioural needs of sows and piglets during the critical early days of life as discussed above: from preventing normal nesting and maternal behaviour, to increased farrowing time and health problems.

According to Baxter, Andersen & Edwards (2018): “The device designed to control the influence of the sow in piglet survival (i.e., the crate) can be somewhat counterproductive by

increasing the risk factors associated with stillbirth, exacerbating negative maternal behaviours, and masking positive ones."

Experts in Sweden and Norway, where crates have been prohibited (with some exceptions) since 1994 and 2000 respectively, emphasised the importance of moving directly to full loose housing systems. In their experience, farmers who transitioned to 'semi-confinement' – or to small pen spaces that allowed just a bit more movement, but no separate nesting/dunging areas - experienced higher piglet losses that were not buffered by the benefits of allowing for normal maternal and nesting behaviour.

An expert in the UK noted, with regards to pens that feature temporary crating, that "If you have made the investment in these systems, and want obvious benefits around lactation performance then you want to let them out – unless you have a particularly problematic sow, there is no reason to keep them in."

While NAWAC's preference is at this stage for full free farrowing systems, the Committee has presented two options for public discussion, one of which allows for 72 hours of crating after nesting. NAWAC wishes to invite public comment on both options.

Won't more piglets die if farmers cannot use farrowing crates at all?

New Zealand industry benchmarking data presented to NAWAC describes pre-weaning piglet mortality as 15–25% on outdoor farms and 8–13% for sows farrowing indoors in crates. The term preweaning mortality describes deaths from wide ranging causes including stillborn, runts that fail, piglets that suffer hypothermia or disease, as well as accidental overlays and injuries from trampling.

During the pre-consultation phase of the code review, pig farmers and NZ Pork experts and representatives shared on several occasions their significant concerns that removing or restricting farrowing crate use would result in higher piglet mortality, in particular from trampling and layovers. Their estimates varied from 18,500 to 60,000 additional piglet deaths per year (Rae, 2020; Catley 2021). While the basis of these estimates is unclear, the underlying concern for piglet mortality is valid as piglets are highly vulnerable during the neonatal period. Modern sows are large (300kg+) and hyperprolific, giving birth to many (up to 20) small piglets weighing approximately 1-2kg each. The piglets have poor thermoregulatory control at birth and are susceptible to chilling and must compete with siblings to establish a teat order and obtain colostrum quickly, while avoiding being crushed by the sow's movements.

Piglet mortality is expected and is in fact an evolutionary strategy for species survival. Overproduction of offspring at birth allows for 'insurance' offspring if survival conditions are good, while sows need make little investment in piglets that die early when survival conditions are poor (Baxter & Edwards, 2018).

As discussed by Mellor (2012), birth 'in the wild' is hazardous. It is normal for a proportion of newborn and very young animals to die. That said, the decision to domesticate farm animals brings with it an ethical obligation to apply science-based strategies to reduce suffering and mortality rates. Mellor concluded that "matters should not be made worse, for example by adopting questionable breeding objectives, and positive neonatal outcomes should be

promoted by conscientiously deploying the most effective and practicable care methods available in each circumstance."

A review by Mellor & Stafford (2004) suggested that the major welfare risks in terms of affective states for newborns are likely to be breathlessness, hypothermia, hunger, sickness, pain, and separation anxiety (abandonment/mismothering). This aligns with the discussion by Baxter & Edwards (2018) who suggested that least concern can be given to piglets who never gain full consciousness; some concern to piglets who develop full breathing but descend quickly into hypothermia (and hence reduced awareness); and significant concern to piglets who develop full breathing, are not hypothermic, but suffer deaths from hunger, injury or disease.

More than half of preweaning mortality in piglets occurs within the first three days of life, and 80%+ within one week (Marchant et al., 2000; Olsson et al., 2019; Edwards & Baxter, 2018). This was supported by the results of the Pro-SAU project in Austria (Heidinger et al., 2018) which found that confining the sow for several days could reduce piglet mortality but confining for longer than four days did not offer further advantages.

Preweaning mortality can be widely variable between farms. In a report on UK farms, the proportion of deaths attributed to low viability and starvation varied from 2 to 30% while those associated with crushing by the sow varied from 29 to 58% (Kilbride et al 2012). Weak or hypothermic piglets are more susceptible to crushing as they are less likely to respond to sow movements.

There is varied literature available for preweaning mortality rates at an international level. Some have inherent inaccuracies arising from the interval from farrowing until the time of inspection, and methods to characterise and describe the causes of death. The table below (Table 1) presents data from selected studies to allow NAWAC to form a view on the variation in mortality rates between systems.

Criteria for inclusion were:

- Publication since 2000
- Data was from commercial herds or animals kept in a way intended to simulate commercial conditions
- Data allowed a comparison of mortality rate between farrowing in conventional crate and alternative systems
- Mortality rate was reported to weaning (not just the first few days).

Table 1: Summary for each publication included in the search criteria including: pen type, space provided, nesting material availability, live-born mortality rate, results of the statistical analysis of mortality comparison reported by author, and other risk factors for mortality

Study	System	Total space	Nesting material	Born Alive	Stillborn (av. no. per litter)	Crushed (av. no. per litter)	Other death (av. no. per litter)	N (litters unless specified)	Live-born mortality rate (%)	Result	Other risk factors for mortality identified by author
Chidgey, Morel, Stafford & Barugh 2015[B]	Temp crate	5.85m^2	N	13.01	1.1	-	-	394	**10.2**	Significantly higher mortality in temp crate	Sow parity Temp crates novel to staff
	Crate	3.84m^2	N	13.14	1.2	-	-	338	**6.1**		
Morel & Barugh 2018[B]	Outdoors	4.3 – 5.76m^2	Y	12.3	1.00	-	-	25,911	**16.7**	Significantly higher mortality compared to industry average in crates (11.9)	Litter size Staff skill
Cronin, Lefébure & McClintock 2000[AE]	Loose pen	~8m^2	Y	10.7	0.7	-	-	66	**15.5**	No significant difference	Uncovered creep area Shed temperature Draughts
	Crate	-	-	10.7	0.8	-	-	80	**17.5**		
Morrison & Baxter 2013[AE]	Loose pen	8.64m^2	Y	11.2	0.7	-	-	143	**14.9**	No significant difference	Season Shed temperature
	Crate	3.75m^2	N	10.8	0.6	-	-	145	**13.5**		
Nowland, van Wettere, & Plush 2019[A]	Temp crate	- (360)	N	11.6	0.2	-	-	70 sows	**10.3**	No significant difference	-
	Crate	- (360)	N	11.3	0.4	-	-		**12.4**		
Condous et al 2016[B]	Temp (7d closed at farrowing)	6.02m^2	N	12.9	0.8	1.10	-	40	**15.1**	Significantly increased mortality if sows loose during farrowing	Lack of nesting material Maternal behaviour Pen design
	Temp (3d, closed at farrowing)	6.02m^2	N	12.2	0.7	1.68	-	20	**17.2**		

	Temp (7d open at farrowing)	6.02m²	N	12.5	0.7	1.85	-	40	**19.6**	No significant difference if sow confined during farrowing	
	Temp (3d, open at farrowing)	6.02m²	N	12.1	0.7	2.37	-	20	**30.9**		
	Crate	4.08m²	N	11.9	1.1	1.19	-	60	**15.6**		
Hales et al 2014[B] (Herd A)	Loose pen	5.4m²	-	15.1	1.6	-	-	275	**14.2/16.7**	Significantly higher mortality in loose pens both before and after litter equalisation Recorded as pre/post fostering mortality	Litter size Pen size Sow parity
	Crate	3.4m²	-	15.2	1.5	-	-	68	**12.6/8.2**		
(Herd B)	Loose pen	5.2m²	-	15.4	1.6	-	-	238	**15.8/11.4**		
	Crate	4.0m²	-	15.6	1.4	-	-	268	**12.1/7.0**		
(Herd C)	Loose pen	6.3m²	-	14.7	1.2	-	-	222	**11.7/7.1**		
	Crate	4.1m²	-	14.8	1.4	-	-	297	**10.7/5.2**		
Weber et al 2007[AE]	Loose pen	5-12m²	Y	11.0	0.6	0.62	0.78	18,824	**12.9**	No significant difference	Litter size Sow parity Season Pen size
	Crate	-	-	11.0	0.7	0.52	0.89	44,837	**12.7**		
Weber et al 2009[AE]	Loose pen	5.1-8.6m²	Y	11.0	-	0.64	0.72	44,278	**11.8**	No significant difference compared to industry average for crates	Litter size Season Sow parity Pen size
KilBride et al 2012[A]	Outdoors	-	-	11.0	-	-	-	2,143 total	**12.8**	No significant difference between systems	Litter size Sow parity
	Temp crate	-	-	11.0	-	-	-		**11.4**		
	Loose pen	-	-	11.0	-	-	-		**10.9**		
	Crate	-	-	11.0	-	-	-		**11.7**		
King, Baxter, Matheson &	Kennel and run	9.5m²	Y	13.24	-	-	-	753 sows	**15**	Significantly higher mortality in crates than	Inter-parity system consistency (previously
	Temp crate	4.5m²	Y	12.46	-	-	-		**16**		

Edwards 2019[CE]	Crate	4.5m²	Y	12.39	-	-	-		**19**	both kennel and run and 360s	crated sows need to adapt to loose housing)
Stabenow & Manteuffel 2002[A]	Temp crate	5m²	N	12.2	-	-	-	361	**16.9**	No significant difference to crate data in Germany at the time (16.4)	Piglet weight Sow health
Ison, Wood & Baxter 2015[AE]	Loose pen	- (PigSAFE)	Y	9.83	0.64	-	-	10	**16.5**	No significant difference	-
	Crate	-	Y	12.72	0.64	-	-	11	**17.3**		
Ceballos et al 2020[D]	Temp (4d)	4.0m²	N	14.4	1.6	-	-	185	**27.8**	Total mortality significantly higher in temp (4d); no significant difference between crate and 7d	Farm facilities Temp crate novel to staff and sows Husbandry procedures Anti-crush bars/walls Maternal behaviour
	Temp (7d)	4.0m²	N	13.8	1.2	-	-	161	**23.9**		
	Crate	4.0m²	N	14.5	1.1	-	-	177	**25.9**		
Zhang et al. 2020[B]	Loose pen	4.8m²	Y	8.7	0.9	0.9	-	8	**19.6**	Significantly higher mortality in loose pens	-
	Loose pen	4.8m²	N	10.3	1.1	0.6	-	8	**17.1**		
	Crate	4.8m²	N	9.8	0.8	0.1	-	8	**7.5**		
Kinane, Butler & O'Driscoll 2021[A]	Temp crate	5.5m²	N	14.6	-	-	-	46 sows	**16.0**	No significant difference	Time of day when opening crates Lack of individual attention to the sow Sow parity Inter-parity system consistency (previously crated sows need to adapt to loose housing)
	Crate	4.6m²	N	14.8	-	-	-		**14.4**		

Analysis of this data identifies several trends:

- Data and methodology are highly variable
- Of the 16 papers that met the inclusion criteria:
  - Nine found similar mortality rates between loose housing/temporary crates and conventional crates (denoted with [A])
  - Five found significantly increased mortality associated with loose housing/temporary crates [(B)]
  - One found significantly reduced mortality associated with loose housing [(C)]
  - One found significantly higher mortality compared to conventional crates if temporary crates are used for 4 days but not 7 days [(D)]
- Six papers compared conventional crates with 'well-designed' loose housing pens (i.e. pens larger than $5m^2$ and with nesting material), and none reported a statistically significantly higher piglet mortality than conventional crates [(E)]
- Increasing litter sizes and higher sow parities were the most identified risk factors associated with increasing piglet mortality.

NAWAC acknowledges that this comparison is simplistic and that the large variations between husbandry methods and pen types account for much of the variation between studies. Furthermore, individual sow performance will also vary (Andersen et al., 2005), confounding interpretation.

Glencorse et al. (2018) completed a meta-analysis of mortality in farrowing crates vs. pens and found that the relative risk of pre-weaning mortality was 14% higher in farrowing pens, but that the actual number of piglets weaned was unaffected by housing design. This was likely to have been due to cross-fostering practices, which are not well-documented in many papers. While some relatively recent studies of large commercial datasets such as Weber et al. (2007, 2009) and Kilbride et al. (2012) were not included in the meta-analysis due to their inclusion criteria, it did include some older studies featuring experimental loose systems.

The New Zealand industry reports higher preweaning mortality in outdoor farrowing systems than in crated indoor systems. This contrasts with UK data reporting that piglet mortality in outdoor systems is similar to piglet mortality in crates. For example, in 2020, average outdoor herd pre-weaning mortality was reported as 12.41%. compared to the indoor herd average of 12.17%. While there is some concern that outdoor statistics do not accurately reflect the situation as farrowing areas may not be fully and regularly inspected, it is not clear why New Zealand outdoor farms perform differently, given the many similarities of our industries. Some difference may be attributed to slightly smaller litters (approximately 0.9 fewer piglets born per litter in the UK).

The project "Sustainable Outdoor Farrowing Systems for New Zealand" (Morel & Barugh, 2018) identified litter size and farm management/skilled staff as key factors for reducing piglet mortality on New Zealand farms, and NAWAC encourages further work to reduce piglet mortality.

NAWAC acknowledges that there will be a higher risk to piglet survival if loose farrowing systems are adopted, but can see no reason why pre-weaning mortality rates should exceed current losses in outdoor systems used by 45% of the New Zealand industry today - with mortality rates reported to vary from 15% to 25% between farms. NAWAC asserts that

careful design of the pen systems, alongside greater consideration for selecting pigs with positive maternal characteristics, should mitigate this risk over time.

NAWAC also acknowledges that any move away from crated farrowing systems for indoor pig farms will present a range of challenges for stock people who may need new and different skills. Removing or restricting the crate as a tool for people to use means that staff must adapt to a very different farrowing environment. Offering training and extension services to support pig farmers who choose to transition to a new farrowing system will be essential. Where free farrowing systems have been tested in the UK, there is evidence that piglet mortality reduces as staff gain experience - as demonstrated by the work of the PigSAFE Project (2012, Figure 1:

Figure 1: Effect of staff experience on live-born mortality (PigSAFE Project, 2012)

Can a smooth transition be achieved without compromising pig welfare?

NAWAC acknowledges that there are many barriers to a reduction in farrowing crate use, which must also be considered against the context of wider changes that NAWAC is proposing to other standards in the code (space allowance for grower pigs, provision of manipulable materials, and weaning age) for which there are also many barriers. NAWAC is however of a view that these changes will be transformational for the industry, ensuring that pork production becomes aligned with the Animal Welfare Act 1999, acceptable to New Zealanders and consumers, and 'future-proofed.'

NAWAC strongly supports initiatives between government and industry to establish a research base to support a transition. For example, projects investigating the use of nesting materials in the New Zealand context, and the development of design guidelines for New Zealand farmers building free farrowing pens, would be useful. With potentially only five years to transition, projects need to be underway as soon as possible.

NAWAC has concerns that current genetic selection traits are a potential barrier to change. Managing larger litters is easier when farmers can use farrowing crates. NAWAC acknowledges that genetics companies have focused on balanced trait selection to increase piglet survivability, teat number and sow mothering ability as well as litter size, but remains concerned that the emphasis is to increase productivity rather than for traits that may

improve animal welfare. NAWAC considers it unethical to knowingly use animal breeding programmes that produce animals whose physical, health and behavioural needs are compromised by their genetic status.

NAWAC also notes that a barrier to transition relates to the industry's need to compete with pork imported from countries whose systems would not meet New Zealand animal welfare standards and hence that have lower production costs and may also receive government subsidies. Approximately 60% of the pork consumed in New Zealand is imported.

Although NAWAC's responsibility is to advise on animal welfare, the committee has concerns that this unfair competition will limit the rate at which farmers may be able to transition their farms to operate free farrowing systems and so supports country of origin labelling that provides local consumers with accurate information.

To protect sow and piglet welfare during the transition period, NAWAC recommends that Regulation 26 is amended to require manipulable (nesting) material for all sows in all systems - not just for farms built after 2010. There are safe materials that can be used in fully slatted systems today, such as hessian sacks.

NAWAC notes that the maximum transition time available to farmers is potentially up to 10 years if an extension is sought to Regulation 26. NAWAC anticipates that some farmers will leave the industry, or switch to only finishing pigs, rather than transition their farrowing system. In these cases, there may be a risk to animals if they are kept in aging facilities (with little incentive to invest into maintenance and improvements) during the transition period, especially if the transition period is extended. NAWAC recommends that the transition should be managed in a way so that farmers who do not intend to attempt to transition their farrowing sheds can end their farrowing operations as soon as is reasonable.

NAWAC's deliberations on mating stalls

In 2010, NAWAC noted that there are welfare benefits to housing sows for a period in stalls between weaning and mating, namely in terms of avoiding aggression and injuries from mixing sows. At that time, dry sow stalls were being phased out, and the period for stall use was reduced from four weeks to one week, and only for the purposes of mating.

The Committee signalled that further change was needed, stating that NAWAC "wants to see indoor housing systems shift to those in which the sow is not confined in a stall at all, including for mating."

In considering the use of mating stalls for artificial insemination of sows, NAWAC has consulted with industry experts and reviewed available science. NAWAC is of the view that the use of stalls to confine sows for up to one week for the purpose of artificial breeding does not meet the purposes of the Act as this period of confinement is unnecessary for the procedure to be successful. It is NAWAC's view that they be managed in a group housing system.

NAWAC proposes that while sows may be temporarily restrained in mating stalls for the purposes of mating by artificial insemination, they must not be *housed* this way. Sows must be released as soon as practicable once the artificial insemination procedure is complete.

Provided that the group housing of sows is managed in line with the requirements of the Code, there should be no reason to keep a sow in a mating stall for any longer than a few hours at a time. The proposed standard allows for up to a maximum of 3 periods of temporary restraint per oestrus cycle.

The following section provides a summary of the scientific literature and expert opinion that NAWAC has considered in making its recommendations:

- What are normal patterns of behaviour for sow around the time of oestrus?
- How are oestrous sows managed during the week after weaning?
- How are sows mated in farming systems?
- How long should sows be restrained for mating?

What are the normal patterns of behaviour for a sow around the time of oestrus?

When observing commercially bred sows kept in semi-wild conditions, Stolba & Wood-Gush (1989) found that the animals formed small social groups of 1-4 sows with piglets. In 31% of observations the animals were grazing, in 23% they were walking and nosing the ground, and in 21% they were rooting.

Each member of the group carried leaves and grass to create a comfortable lying area at the communal nesting site and used a dunging area away from this sleeping area. There was very little aggression overall, and when observed, it was associated with the delivery of food. However, threatened pigs could simply move away from the aggressor.

Within a social group of sows, social relationships are formed and maintained in a hierarchy. Often the mature sows are dominant over sub-adults and juveniles. During the period when sows have weaned piglets and are becoming oestrous, the group is joined by a boar, who assumes dominance over all members of the group.

In stable groups with sufficient space, dominance relationships are maintained through threat and display, with subordinate animals being able to move away, rather than by physical aggression (Rault, 2017). Hierarchy within a group of unacquainted sows is usually settled within a few hours to a few days. Space at that time is important to allow subordinate sows to escape threats.

When sows near oestrus, social activities change with behaviours including snout contacts between sows, ano-genital sniffing, flank nosing and female-female mounting (Pedersen, 2007). The presence of a boar, as well the presence of other oestrous sows, stimulate onset of oestrus. When oestrous or ‘in heat’ the sow becomes receptive and will stand to allow mounting.

How are oestrous sows managed during the week that they are mated?

Once piglets are weaned, sows will come back into heat within days. Dry (non-lactating) sows and gilts are generally kept in group housing systems. It is important that dry sow housing systems allow the opportunity for sows and gilts to display normal behaviour and that aggression is minimised.

In the current code, sows can be confined in a stall for up to seven days at this time to facilitate mating. NZ Pork reported to NAWAC in late 2020 that around half of indoor farmers use mating stalls in this way, while others use a variety of options, most commonly group pens with varying sized groups.

NAWAC evaluated several mating system scenarios using the Five Domains approach, and the analysis can be accessed here: https://www.mpi.govt.nz/animals/animal-welfare/national-animal-welfare-advisory-committee/nawac-review-of-pig-crates/. NAWAC found, using this analysis, that outdoor systems generally perform better in terms of welfare.

EURCAW-Pigs have released detailed information to improve the welfare of sows in group housing (available online[14]). Focus should be placed on improving the mixing of unfamiliar animals; reducing competition for resources; increasing satiety in restrictively fed sows; and improving climatic and resting comfort.

NAWAC has proposed a requirement in Minimum Standard 9 (Behaviour) of the draft code to provide for adequate opportunities to retreat from other pigs post-mixing.

How are sows mated in farming systems?

In New Zealand mating is most commonly done by artificial insemination, with some use of boars for natural mating.

There are two options for artificial insemination (AI). Many sows are inseminated by conventional AI in which semen is deposited via a catheter at the opening of the cervix. The alternative procedure is known as Post-Cervical Artificial Insemination (PC-AI) in which a secondary catheter is introduced that extends through the cervix into the top of the sow's uterus. The latter method allows a smaller dose of semen to be introduced which provides benefits where superior sire lines are being marketed.

The Pigs Improvement Company (PIC) Sow and Gilt manual for service recommends for conventional AI that sows in heat should be identified, moved to stalls with a boar in the alleyway in front, given two hours to settle down, and then inseminated. The sows should stay in contact with the boar for 2 hours after insemination for best results.

For PC-AI, it is recommended that sows on heat should be moved to stalls, the boar should be removed (to allow the cervix to relax), and the sows should be left for 30 minutes. They can then be inseminated. Boars should then be brought back into the alleyways in front of the stalls after insemination for an hour or two.

Good practice when performing AI is to inseminate sows on the day they are first observed to be in heat, and to repeat every day until they no longer display the standing response. This means sows are usually inseminated 2 or 3 times per oestrus cycle. Generally, gilts will be inseminated at 12h intervals and sows at ~20-24h intervals.

Some New Zealand farmers use free access or self-catching stalls. These are set up as a series of stalls in a group housing area. The stalls open into a communal area shared by the sows. The rear gate on the stall is in the 'open' position by default. When a sow enters the stall, the gate shuts behind the sow to prevent other sows from entering. There is a manual

[14] https://www.eurcaw.eu/en/eurcaw-pigs/dossiers/group-housing-and-mixing-of-sows.htm

locking mechanism that can be operated by a stockperson to lock/unlock all stalls at once, as well as for each individual stall. If the gate is not locked, then the sow can exit the stall at any time by backing up, which causes the gate to lift open. The rear gate will be designed so that a stockperson can reach through it to perform AI.

Some farmers will inseminate sows in small pens rather than in stalls, and this is possible even when they are still in groups – although in these cases they are limited to using conventional AI. The sow's reliable behaviour of standing while oestrous is utilised here by farmers, as weight applied to her back and flanks will simulate the boar and she will not move during the procedure. Although less common, outdoor systems enable natural mating where the sows can mix with the boars in large paddocks. In other cases, farmers will run a boar with a group of sows to ensure that any sows that fail to conceive and return to oestrus will be mated.

How long should sows be restrained for mating by artificial insemination?

NAWAC has a view that artificial insemination is a routine husbandry practice that may be undertaken by competent operators and following industry good practice. As such there may be a need for temporary restraint to carry out an AI procedure safely and effectively for both sow and stockperson. It is accepted that animals under the care of humans are routinely subject to husbandry procedures, during which they must be mustered, handled and restrained. NAWAC has therefore proposed standards for the use of mating stalls when artificially inseminating pigs that limit restraint to that required for the procedure.

NAWAC is aware of two main arguments for allowing mating stall use for up to seven days. One is that, as discussed in the code report for pigs (2010), confinement is considered by some to achieve an overall better welfare outcome for all sows through satisfying needs such as access to food and water, avoidance of injury from other sows, and the ability to give sows the individual attention they may require.

It is possible to provide care, food, and water without the use of a mating stall. Regarding the avoidance of injury, there is a risk of injury and stress to sows from group housing, especially if they are mixed with unfamiliar individuals after farrowing. While there is not a lot of information available that focuses on the welfare risks to sows during the weaning-mating period specifically, there is plenty of guidance available for pig farming systems to improve the welfare of sows in group housing generally.

NZPork veterinarians also proposed the argument that it is preferable to confine sows during the mating period since AI involves multiple inseminations, so keeping the sow in the stall for the entire period avoids multiple handling events and unnecessary acute stress events on the sow, which could impact her fertility. However, Turner, Hemsworth & Tilbrook (2005) reviewed the available evidence for stress impacting on sow fertility and found no support for the idea that acute stress disrupts oestrus and ovulation. They proposed that "reproduction in female pigs is resistant to the effects of acute or repeated acute stress or acute or repeated acute elevation of cortisol even if these occur during the series of endocrine events that induce oestrus and ovulation. Furthermore, while reproductive processes in some individuals are compromised, reproduction in a proportion of female pigs appears to be resistant to the effects of prolonged stress or sustained elevation of cortisol."

Rault et al. (2014) found, in contrast, that sows housed in groups at weaning and regrouped after insemination experienced higher stress than sows housed in individual stalls at weaning and housed in groups after insemination. 7% fewer sows were successfully inseminated within 5 days after weaning compared to sows housed in a stall. They recommend that further research is needed to "identify underlying mechanisms to reduce variability, manage aggression and sexual behaviour, optimize estrus detection, and assess reproductive performance in group-housed weaning systems."

NAWAC proposes that while sows may be temporarily restrained in mating stalls for the purposes of artificial insemination, they must not be *housed* this way. Sows must be released as soon as practicable once the artificial insemination procedure is complete.

Provided that the group housing of sows is managed in line with the requirements of the Code, there should be no reason to keep a sow in a mating stall for any longer than a few hours at a time, up to a maximum of 3 times per oestrus cycle.

NAWAC's deliberations about other standards in the Code

The above discussion has focussed on the development of the proposed new standards providing for farrowing and mating sows.

With respect to the wider code review, NAWAC established a working group to consider the balance of the document. The working group was comprised of NZPork representatives, farmers nominated by NZPork, pig veterinarians, NAWAC representatives, and representatives from MPI.

During a series of videoconference and in-person workshops they discussed and proposed changes to update the standards in the Code. This version of the draft code was presented to NAWAC. NAWAC acknowledges the efforts of the working group in assisting with preparation of the draft for consultation.

NAWAC considered the draft from the working group and has proposed several further changes. In the following sections, the relevant science is described supporting the proposals for changes to standards relating to opportunities to express normal behaviour patterns, space allowances for growing pigs, provisions for feeding dry sows, weaning age, and on-farm killing.

Opportunities to display normal patterns of behaviour for all pigs

Domestic pigs in a semi-natural environment spend about 52% of the daylight period foraging (rooting and grazing) and another 23% in locomotion (Stolba & Wood-Gush, 1989).

Pigs kept in barren pens have little to do except eat and sleep. This can result in boredom and frustration due to thwarted foraging and exploring behaviours (Bracke, 2018).

The OIE Terrestrial Animal Code states that animals should be provided with an environment that provides complexity, manipulability and cognitive stimulation to foster normal behaviour (e.g. exploration, foraging such as rooting, biting and chewing materials other than feedstuffs, and social interaction), reduce abnormal behaviour (e.g. tail, ear, leg

and flank biting, sham chewing, bar biting and apathetic behaviour) and improve their physical and mental state.

European Directive 2001/93/EC states that pigs must have permanent access to a sufficient quantity of material to enable proper investigation and manipulation activities, such as straw, hay, wood, sawdust, mushroom compost, peat or a mixture of such, which does not compromise the health of the animals.

In a 2014 review, the European Food Safety Authority (EFSA, 2014) determined that pigs need manipulable materials to satisfy a range of intrinsic behavioural motivations for exploratory and foraging behaviours. When materials are absent or inadequate, exploratory motivation is frustrated. Abnormal manipulation of other pigs and pen fittings increases, play behaviour reduces, and skin lesions and tail biting increases.

EFSA (2014) also considered risks to hygiene and pig safety of introducing manipulable material. It acknowledged a risk of health problems associated with ingestion of mycotoxins, and there was some evidence that bedding material could increase the risk of mycobacterial infections. It was however noted that a review by Tuyttens (2005) identified beneficial effects of straw on pig health from a reduction in movement disorders, claw damage and other leg injuries, as well as reduced influenza A infection, fewer stomach and intestine disorders and the reduced mortality rates of pigs and piglets.

EFSA made several recommendations for use of artificial materials, such as used newspaper, cardboard and empty plastic bottles and canisters. Materials must be hygienic and safe, and consideration needs to be given in indoor systems when using easily destructible materials, such as ropes, branches, or long straw, to the increased risk of problems with manure systems, which might have indirect effects on animal welfare by decreasing hygiene and air quality. Additionally, if long-lasting manipulable materials are used for several groups of pigs, they must be easily cleaned to avoid disease transmission between batches. These were considered to be risks that could be avoided by proper and adequate management. Finally, if long-lasting manipulable materials are used during several pig batches, it is important to ensure that the materials are easily cleaned to avoid disease transmission between batches.

There is abundant information available on what effective environmental enrichment means for pigs. A review by Van de Weerd and Ison (2019) summarised the necessary characteristics:

- **Investigable** – so that pigs can explore the material with their nose and mouth
- **Manipulable** – so that pigs can change the material's location, appearance and structure
- **Chewable** (deformable, destructible) - so that pigs can manipulate the material by biting and chewing
- **Edible** (with an interesting texture, flavour or smell) - so that pigs can ingest the material (on top of their regular feed).

Van de Weerd and Ison (2019) state that most types of particulate substrates incorporate these characteristics when provided as bedding (covering the floor area) or when provided in racks or dispensers.

While single, fixed objects like chains and ropes attached to the pen have not been associated with a reduction of abnormal behaviours like tail biting, recent papers have shown that a variety of different objects with different characteristics, swapped out daily, may reduce abnormal behaviours and increase daily weight gains (Chou et al. 2020). The authors found that the average enrichment cost of this method was less than 2 Euros per pig.

Wallgren, Lundeheim & Gunnarsson (2020) investigated the impact of straw on pig and pen hygiene and found that in the majority of observations (>90%) pigs were found to be clean in either 'extra straw' or 'control' (small amounts of straw) pens. Where there was a treatment effect, pens with more straw resulted in cleaner pigs. It was suggested that this was because the straw on the solid area of the pen helped differentiate the lying (solid) and dunging (slatted) areas for the pigs.

Industry experts in New Zealand expressed their view to NAWAC that pigs kept in groups (indoors and outdoors) are already able to show normal patterns of behaviour, including social encounters, eating and drinking, resting, play behaviour, vocalisation, and thermoregulatory behaviours and were resistant to change. Providing a range of enrichment materials for manipulation poses some challenges in some indoor production systems.

The recommended best practice for the use of rooting material such as straw, that has been in place since 2010, has not been widely implemented. Pig veterinarians have advised their preference for using fully slatted floor systems to drain effluent on the basis that they see these as most hygienic. They also have concerns about biosecurity risks when materials are brought into pens. Fully slatted floor systems are not compatible with provision of significant amount of materials such as straw, accordingly any requirement to provide bedding materials or materials such as sawdust would require an upgrade of effluent systems. This would be a major undertaking requiring renovation and new infrastructure.

The code working group considered it would be difficult to implement any requirement that pigs carry out rooting behaviour, because outdoor pigs are often nose-ringed to prevent that behaviour as a requirement of some local territorial authorities. They did however consider it feasible to meet a standard that required that pigs be able to express 'oral behaviours' or 'manipulating objects with the snout', since nose rings do not prevent pigs investigating with their snouts.

Recent observations by Bracke (2018) suggest that fixed-point objects such as a branched metal chain that pools onto the floor (not a hanging chain) can also provide opportunities for pigs to simulate rooting behaviours.

Accordingly, NAWAC is proposing a requirement for materials (straw, sawdust etc.) or objects (ropes, chains, blocks of wood, etc) that do not block effluent systems and can be provided hygienically. NAWAC believes that this standard could be implemented immediately. The use of enrichment in the sector is unknown although it was suggested anecdotally that most farmers already use toys and other objects.

To enable the opportunity for normal patterns of behaviour for all pigs, NAWAC has specified several new behaviours in Minimum Standard 9 (Behaviour), including nest building, chewing (things other than feed), manipulating objects with the snout, interactions with other pigs, and investigation of the environment.

Space for weaner and grower pigs

NAWAC is concerned that current space allowances for weaner and grower pigs as described in the 2010 code do not fully provide for the needs of the pigs. In 2010, NAWAC stated:

"NAWAC believes more space is required to provide for all pigs movement and social needs and has therefore included a recommended best practice and other statements within the code encouraging farmers to provide more space."

NAWAC continues to have a view that weaner and grower pigs should be provided with additional space and is also recommending some changes to the method for calculating available area.

The code working group discussed proposals around space extensively. Specifically, two options were considered: a proposal from the Farm to Processor Animal Welfare Forum Report (k = 0.0335) and the previous recommended best practice (k =0.047). An agreement on space allowance was not reached, with industry representatives preferring the status quo, while NAWAC/MPI members noted that NAWAC's statements from 2010 would preclude that option. More space in grower pig sheds was considered to be extremely expensive to create, as it involves building more floor space. Alternatively, a decrease in numbers of pigs could achieve the same outcome but would reduce farmer income and was considered unacceptable. Moving and mixing pigs more often to obtain lower stocking densities was discussed, but this has adverse welfare outcomes of its own.

NAWAC has carefully considered the science available to describe space allowance, and remains of the opinion that allowances should increase. Two options for increased space are presented in the draft code. NAWAC is satisfied that both options comply with the purposes of the Animal Welfare Act and is seeking public input on both options in order to determine the minimum standard necessary to ensure the physical, health and behavioural needs of the pigs are met.

The area for static space allowance for pigs is calculated from metabolic liveweight using the model equation: Area (m^2) per pig = k x liveweight $^{0.67}$ where k is a constant. The formula gives an indication of the 'footprint' of a pig that is lying down (without sharing space with another pig) and generally applies under conditions where the environmental temperature is less than 25 degrees C. More or less space is provided by changing the value of k.

A k value of 0.019 represents the static space (area occupied when the pig is not moving) for a pig lying sternally (on its belly) while a k value of 0.047 represents a pig recumbent on its side (Petherick, 1983).

The minimum value for k under New Zealand regulations is 0.03. This is the space allowance observed by Edwards et al. (1988) for optimal economic performance on slatted systems.

Based on the minimum standards of the 2010 code, Regulation 25 of the Animal Welfare (Care and Procedures) Regulations carries a $3,000 penalty. It states that every person in charge of grower pigs must ensure that, at all times, each pig has an unobstructed floor space in which it can lie down of no less than the area calculated using the following formula: $a = 0.03 \times b^{0.67}$ where a = minimum area and b = liveweight in kg.

The regulation defines unobstructed floor space as including "unobstructed feeding or dunging floor space." MPI advises online that this can include the feeding area, dunging area, and the wet area in front of the troughs. It cannot include the hospital area, troughs themselves or any area a pig cannot physically lie on.

An EFSA (2005) opinion was that the minimum space allowance should be k=0.036 for pigs up to 110kg where ambient temperature will not exceed 25C. For pigs larger than 110kg or where ambient temperature is likely to exceed 25C, 0.047 should be used. These calculations allowed for separate lying and dunging areas, but not space for engaging in social interactions, or providing space to escape aggression.

Gonyou et al. (2006) described that a k value between 0.032 and 0.035 would provide for optimal growth. Subsequently the value of the constant has been widely debated in terms of whether space allowances based on that level provide for the welfare of pigs.

Averós et al. (2010) recommend a threshold k-value of 0.039 for pigs housed on slatted floors and 0.072 for non-slatted floors, based on differences in lying behaviour. They suggested that pigs' opportunity to rest was compromised at a higher k value than the level at which growth performance is reduced.

A review by Whittaker, van Wettere & Hughes (2012) regarding space requirements to optimise welfare and performance concluded that, in general, increased space is likely to reduce aggressive interactions and total skin lesion score and decrease physiological indicators of stress such as free plasma cortisol concentrations. Quantifying space requirements from the literature was problematic because studies varied widely in group size and management. The reviewers also noted that much of the research was dated and did not allow for the increased size of the modern pig.

There is an interaction with the quality and complexity of the space available, which can be another way to allow more opportunities for normal behaviour. In addition, there is an interaction with temperature: pigs require more space when the room temperature exceeds their thermal comfort zone (Spoolder et al. 2012).

Scollo et al. (2014) found little overall difference in behaviour between pigs kept at k = 0.03 and 0.047 and no difference in physiological stress indicators. However, pigs kept at 0.03 sat more often and had more total skin lesions. They also identified differences in their learning processes and hypothesised a stress-induced alteration to neural structures for spatial learning and memory.

It may be the case that the difference between 0.03 and 0.047 is insufficient to represent a meaningful difference to pigs, i.e. both may be poor options. Fu et al. (2016) evaluated three k values: 0.045, 0.067 and 0.090, noting that space allowances should not restrict lying behaviour for pigs in any treatment. Behaviours differed significantly. At k = 0.045 pigs spent more time drinking water and showing negative social behaviours; had the highest number of lesions associated with fighting; had more manure on the body; and were more likely to have an abnormally high body surface temperature. At k = 0.067 pigs showed the most positive social behaviours. The authors concluded that 0.067 was optimal.

Space provided for growing pigs must allow them to express a wide range of their normal patterns of behaviour, not just lying down. Spoolder et al. (2012) proposed that, for pigs to cope with their housing conditions, they need sufficient static space (occupied by the body of

the pig), activity space (for movement to different areas of the pen and behaviours relating to these), and interaction space (for appropriate social behaviour).

NAWAC consulted with an expert at Wageningen University, who summarised the information available on different k values as:

- Below k = 0.072, pigs on solid floors will lay down less
- Below k = 0.047, not all pigs can lie laterally at the same time without overlying
- Below k = 0.039, pigs on slatted floors will start to lay down less
- Below k = 0.034, growth is reduced
- Below k = 0.030, economic performance is impacted

NAWAC acknowledges the proposition by industry experts that use of a k value of 0.03 still allows for generous space early in a production cycle, and is managed by removing groups of pigs as pigs grow so that available space approaches the minimum only as pigs reach the end of each production phase (e.g. weaner-grower, grower-finisher).

This is demonstrated in Figure 2 provided by NZ Pork at a code working group meeting on 8 April 2021, who described in some detail the management of growing pigs to ensure that currently regulated space allowances are met. The figure describes how the k value changes during the growing cycle of pigs in a typical New Zealand “two-stage system”. The system is based on a 20 week production cycle in a barn that is stocked at weaning (4 weeks old) and half the group removed at nine weeks. There are two periods of 1-2 weeks just before the group is split and again before the end of the production cycle when pigs are 20 weeks old that the theoretical value of k drops towards the allowed level of 0.03:

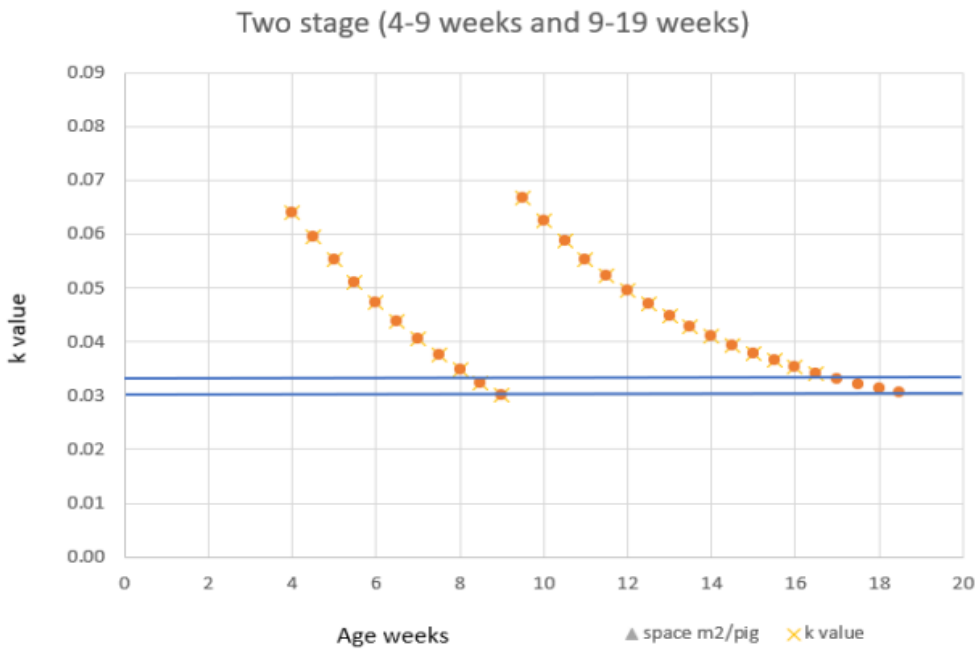

Figure 2: Model estimations of the variation in k value (calculated from available area and metabolic liveweight) for growing pigs from four to 20 weeks in a typical New Zealand two-stage system (i.e. group split at 9 weeks of age to provide additional space)

NZ Pork representatives were strongly of the view that any discomfort from the two short periods of overcrowding were more than compensated by the periods where there was ample space, and strongly opposed any change to space allowances.

They advised NAWAC in a working group meeting on 8 April 2021 that in their opinion:

- k = 0.03 is supported by science to provide for welfare
- k = 0.03 matches other countries' codes
- A k value of 0.03 represents the space available for a very short period of the growing cycle; for the great majority of time, a greater space allowance is provided
- Additional space can compromise ventilation and temperature provision in many systems
- More space across the growing cycle is extremely expensive to create
- At a k value proposed in early drafts (k = 0.047), it would simply not be feasible for commercial pig farming to continue in New Zealand.

Internationally, Australia has the same minimum space requirements as New Zealand. England and Ireland require slightly lower minimum space allowances than New Zealand. Both specify the minimum unobstructed floor area for pigs within specific weight ranges, rather than using a calculation. Norway has a similar approach.

NAWAC had extensive discussion on space allowances and k values, and considered the proposition put forward by the industry experts that the period of over-crowding could be traded off against the earlier understocking. NAWAC remained of the view that the scientific evidence is such that space allowances need to be increased, understanding that any increases will result in an impact across the pork industry.

NAWAC is seeking feedback on two options for increased space allowance. These are based on k values of 0.047 or 0.072 but are being presented as tables for weight ranges.

NAWAC considers that expressing a minimum space allowance using a k-value is unintuitive, and that k-values should be used to generate tables that display a minimum m^2 per animal at different weights instead.

The tables have been generated using weight ranges modelled after the standards for pigs in the United Kingdom. The highest weight in each range was used in the calculation Area (m^2) per pig = k x liveweight $^{0.67}$ to generate the minimum m^2 measurement; that result was then rounded to the nearest $0.5m^2$. For the category 85kg+, a value of 110kg was used to calculate the m^2 requirement.

NAWAC has also found the current minimum standard & associated regulation relating to the areas to be included in calculations are unclear. NAWAC is proposing that the minimum area for growing pigs should refer to space for lying, movement and social needs, and should not include the dunging area, feeding areas and troughs, wet areas around drinkers, or the hospital pen. NAWAC recommends further research into changes in pig behaviour (not just lying) at different k values/stocking densities.

NAWAC understands that this change would likely need to be achieved via a transitional regulation under section 183A(2) of the Animal Welfare Act, as there are reportedly no feasible or practical alternatives currently available, and not to do so would result in an unreasonable impact on the pork sector. In addition, it is likely that achievement of these space allowances across the industry may be hampered by the need to transition from

farrowing crates. The Committee proposes that a replacement for Regulation 25 is developed for space for grower pigs under the transitional provisions of the Act.

Hunger in dry sows

NAWAC has concerns that feeding management strategies for dry sows, while meeting their nutritional needs, may not provide for their gastrointestinal satiation.

Pigs have been bred for efficient growth, resulting in an increase in appetite. Food is commonly restricted to gestating sows as excessive weight gain and obesity can lead to reproductive problems (D'Eath et al., 2018).

Dry sows are typically fed their entire ration once or twice a day. A recent study found that modern hyperprolific sows are fed less than half of what they would choose to eat if fed ad-libitum (Read et al., 2020).

Sows' behaviour suggests they are hungry when fed restricted diets. They show increased activity and foraging-related oral behaviour like sham chewing, bar-biting, excessive drinking, and increased competition/aggression (Read et al., 2020; Whittaker et al., 1999). Anticipation and ingestion of food causes a short-term positive feedback, but if the meal is not satiating, unfulfilled motivation results in continual attempts to forage (D'Eath et al., 2018).

Lack of bulky or high-fibre food for restricted-fed sows, gilts and boars is associated with prolonged pain from stomach ulcers (D'Eath et al., 2018). One study (Herskin et al., 2016) found that 67% of pigs at slaughter showed signs of gastric pathology, and permanent access to straw reduced ulcerations.

Increasing fibre content and therefore the bulk of the diet appears to reduce abnormal oral behaviour and activity (Whittaker et al 1999); it can reduce ghrelin levels and reduce excessive water consumption (Jensen et al., 2015). This suggests some alleviation of hunger through high fibre diets.

However, questions remain as to whether sows continue to experience metabolic hunger, even if bulky diets can give the opportunity to chew and give better gut-fill (Lawrence et al., 1988). If that is the case, the breeding goal may need to be evaluated to ensure welfare compromise is reduced.

International standards focus on providing sows with a diet that satisfies their hunger and their need to chew, via the provisions of bulky or high-fibre diets. The OIE requires that "pigs should be fed a diet with the intention of minimising the occurrence of gastric ulcers (e.g. increasing dietary fibre or reducing crude protein)."

There is an interaction with thwarted foraging behaviour. According to an EFSA review (EFSA, 2007a), because pregnant sows and boars are fed restrictively with a high energy food, which takes them a very short time to eat, the time spent exploring and foraging in relation to feed ingestion is very limited. This gives rise to a state of high foraging motivation which, in the absence of suitable manipulable material, leads to abnormal behaviours. Bergeron et al. (2006) found that a low fibre, high-concentrate diet that required little food-searching and chewing behaviour resulted in unfulfilled motivations to perform normal

foraging activities, leading to increased abnormal repetitive redirected behaviour (including licking, bar-biting and sham-chewing/vacuum-chewing).

The code working group discussed a proposal to lift a current Recommended Best Practice (that pigs should be given enough bulky or high fibre feed to satisfy hunger) into a Minimum Standard.

The working group noted that while high fibre diets can contribute to satiation, high fat diets can achieve the same thing, and so the wording of the standard now specifies “slow energy release feed” rather than high fibre feed, but retains the requirement for feed to be bulky. The issue of hunger in pigs fed a restricted diet was also discussed with pig veterinarians who were of the view that the carefully nutritionally formulated diets widely used across both indoor and outdoor industries provide well for their nutritional needs.

The application of the standard was discussed. Both dry sows and boars can be fed restricted diets, and so the standard applies to any pig that is on a restricted diet.

NAWAC has particular concerns that once a day feeding strategies for dry sows results in negative affective states associated with hunger.

To ensure that the physical, health and behavioural needs of dry sows are met, NAWAC proposes a new minimum standard that pigs that are on a restricted diet must be given sufficient bulky, slow energy release feed to satisfy their hunger. In addition, new example indicators describe indicators of hunger in pigs, and a recommended best practice for high fibre/bulky feed is retained for all pigs.

Tail docking

The Painful Husbandry Procedures code of welfare requires that all painful procedures should be justified, and their harmful consequences minimised. NAWAC has long maintained that painful husbandry procedures like tail docking should be viewed as transitional, that operators should consider farming methods and systems that would reduce the need to routinely perform painful procedures, and that pain relief should be used where possible.

NAWAC would like to see a reduction in the use of tail docking as a prophylactic procedure against tail biting. This was discussed in some detail with the code working group and the farmers in the code working group advised that tail docking is an unpleasant task and if it wasn’t necessary, it would stop. The industry position is that tail docking remains necessary to prevent tail biting outbreaks, which are overall a worse outcome.

Tail docking of piglets is routinely performed on many New Zealand pig farms to reduce the incidence of tail biting behaviour and the resulting tail damage.

Regulation 52 requires that, for piglets under 7 days old, docking must be done by a competent person; it must be done with a clean sharp cut. For pigs over 7 days, the procedure is vet only and pain relief must be used.

Aside from the acute pain suffered from the procedure itself, tail docking may contribute to long-term pain from neuromas observed in docked pigs at slaughter (Herskin, Thodberg &

Jensen, 2015). EFSA (2007b) also considered that stump pain and phantom pain could be experienced.

NAWAC would like to see husbandry methods developed to minimise harmful impacts. The Painful Husbandry Procedures Code recommends the use of a hot iron for tail docking as surgical techniques cause a greater risk of bleeding and infection and cause considerably more pain. Sutherland et al. (2007) showed that hot iron cautery reduced the acute physiological stress response in piglets compared to cutting with clippers. Both techniques are reported being used in New Zealand and in the event that tail docking is required, NAWAC would prefer the use of a hot iron method.

Despite tail docking, tail biting behaviour can still occur to a greater or lesser extent in any housing system. Zonderland (2010) found that a hanging/limp tail is a predictor of tail biting damage. Tail biting behaviour can escalate into an 'outbreak', where there are multiple victims per pen or the behaviour spreads through the entire shed.

The causes of tail biting outbreaks are multifactorial. Reviews like Zonderland (2010) and EFSA (2007b) have identified the following risk factors:

- **Lack of enrichment –** where pigs are kept with little stimuli, they still have a strong motivation to explore. With little else to do, the exploration is directed to penmates (and pen fittings). Enrichment material can help prevent tail biting, but it should be manipulable, chewable, and destructible; 'toys' and objects like chains have not consistently been associated with preventing tail biting (though the novelty of introducing new toys can help interrupt an outbreak that's already underway).
- **Existing damage –** Once the skin is broken, biting damage tends to get worse for the victim and increase the risk of an outbreak.
- **Learned behaviour –** the reaction of a bitten pig can vary from reluctant moving away through to vigorous and loud aggression – the excitement (even if socially negative) may serve as a reward stimulus which could encourage more biting. Pigs are visual learners and can learn biting behaviour from observing others.
- **Poor climate control –** Heat stress, cold stress, and sudden draughts
- **Poor air quality**
- **Poor health & nutritional deficiency**
- **Fighting –** Subordinate pigs with restricted access to resources may bite others out of frustration or because they have an increased motivation to explore to find resources. Pigs at the feeder with tails exposed may be an easy target.
- **High stocking density**
- **Genetics** – the mechanism is not clear, but floppy-eared breeds like Landrace have been suggested to be more likely to bite. Biting is associated with breeding for increased lean tissue growth.
- **Gender** – male pigs are more likely to be biting victims.

Tail biting damage from an outbreak is significant and painful for the pigs, hard to stop once it starts, causes economic damage and can make farmers feel like they have 'lost control' (Zonderland, 2010).

Internationally the research and guidance to support a phase-out of tail docking is thorough, but implementation has been slow. The EU has produced many guidance documents to support EC Directive 2008/12/EC, which prohibits routine tail docking (though tail docking is still widely performed across the EU). These resources include:

- www.farewelldock.eu
- European Commission guidance and videos – "Cutting the need for tail docking" https://ec.europa.eu/food/animals/welfare/practice/farm/pigs/tail-docking_en
- EURCAW-Pigs dossier, fact sheet and recommendations on tail biting https://www.eurcaw.eu/en/eurcaw-pigs/dossiers/tail-biting-and-tail-docking.htm
- EUWelNet online training "Understanding environmental enrichment and tail docking requirements for finisher pigs in accordance with EU Directive" http://pigstraining.welfarequalitynetwork.net

EURCAW-Pigs experts advised NAWAC that tail docking cannot simply be stopped overnight. Farmers need support from advisers, veterinarians and similar professions (ideally independent from official inspectors, to establish trust). Steps to reduce tail docking on a farm may include:

- Eliminate tail lesions – get as close to zero as possible by closely observing pigs and reducing risk factors.
- Start docking longer and start with a few pigs only. Practice managing pigs with longer and longer tails.
- Have experts on hand to provide emergency consultation and support for tail biting outbreaks.
- Have farmers establish tail-biting 'first-aid kits' (a set of novel enrichment objects like ropes, straw, toys and large feed pellets).

NAWAC acknowledges that the welfare impact of a tail biting outbreak is significant for pigs, and that prohibiting tail docking immediately may result in a worse welfare outcome than currently. Nevertheless, NAWAC considers that imposing a painful insult on 100% of pigs in a group in order to protect, what is generally (apart from an outbreak) a small percentage from additional pain, is difficult to justify.

NAWAC considers that the industry must work towards eliminating the need for docking, and so a minimum standard has been included in the code to require farmers to implement measures to prevent tail biting behaviour. The standard is in a new section that provides more information on tail biting.

In combination with other proposed changes to standards in the Code around behaviour and space, NAWAC expects that the need to dock piglets' tails routinely will reduce. NAWAC encourages industry and MPI to undertake research and develop guidance material to end routine tail docking of piglets in New Zealand before the Code is next reviewed.

Other painful husbandry procedures

As noted above, NAWAC has a view that that painful husbandry procedures need to be justified and only carried out if necessary. In this regard, NAWAC had further discussions on the procedures of teeth cutting, tusk trimming, castration and nose ringing.

In the draft Code, NAWAC is proposing a new recommended best practice to phase out painful husbandry procedures.

The docking of pigs' tails and castration of pigs were regulated via the Animal Welfare (Care and Procedures) Regulations 2018. The cutting of teeth and application of nose rings or clips were regulated via the Animal Welfare (Care and Procedures) Amendment Regulations 2020[15]. NAWAC submitted in general support of these regulations when they were put in place, and consequential amendments have already been made to the code of welfare for pigs as a result of these regulations. In addition, NAWAC's general view on the use of painful husbandry procedures, the use of pain relief, and justification for these procedures, is available in the Code of Welfare: Painful Husbandry Procedures.

Teeth cutting

Piglets are born with their deciduous canines and third incisors ("needle teeth") fully erupted. These teeth can be used as weapons when competing with littermates for teats, and cause lacerations to piglets' faces or to the udder of the sow, which are then prone to infection. To reduce this damage, the needle teeth of piglets can be cut using either an electric grinder or side-cutting pliers. Only the tip of each tooth should be removed to prevent exposure of the innervated pulp chamber and reduce the risk of infection. Pain mitigation strategies for teeth clipping have not been reported in literature (Sutherland 2015).

Veterinarians advised that this practice is already falling out of common practice in New Zealand. Several decades ago, it was routine on almost all farms; today, less than half of farmers would routinely cut the teeth of piglets. For those that do not routinely perform the procedure, farmers will still clip the teeth of piglets that they observe are competing for a teat and causing injuries - they estimate 5% of piglets will have their teeth clipped but only where there is evidence of damage or infection.

NAWAC is satisfied that Regulation 56D and consequential amendment to the Code that came into force on 9 May 2021 is in line with good practice, scientific knowledge, and available technology. It limits the performance of teeth cutting to piglets under 4 days old and requires that the person who is performing the procedure must be experienced with, or have received training in, the correct use of the method being used. NAWAC expects that the routine performance of teeth clipping will continue to fall and encourages improved management techniques for piglets and sows to avoid the need for routine teeth clipping.

Tusk trimming

Boars grow tusks that present a safety hazard to other pigs and stockpeople, and tusks that grow too long can fracture and cause tooth abscesses and infections. Therefore, tusks are often trimmed to protect animal and human safety.

Industry veterinarians advised that while the end of the tusk itself is not innervated, if it is trimmed too short, the nerve can be exposed. Leaving 2cm above the gum line is good practice and would prevent painful outcomes for the boar.

NAWAC is satisfied that Regulation 56D and consequential amendment to the Code that came into force on 9 May 2021 is in line with good practice, scientific knowledge, and available technology. It limits the performance of tusk trimming to those who are experienced with, or have received training in, the correct use of the method being used. It requires that obstetrical wire or a saw suitable for the purposes of dentistry is used. NAWAC is satisfied

[15] Read about the regulations here: Guide to the Animal Welfare (Care and Procedures) Regulations | MPI | NZ Government

that as long as the person performing tusk trimming leaves at least 2cm of tusk above the gum line, pain relief would not be required.

Castration

Surgical castration of male piglets is performed routinely in many countries to avoid boar taint. However, piglets are not routinely castrated in New Zealand; instead they are slaughtered before they reach sexual maturity to reduce the occurrence of boar taint.

NAWAC has retained a recommended best practice that surgical castration should not be performed.

Nose ringing

Pigs display many oro-nasal behaviours such as rooting in the ground. Nose ring or clips are inserted into the snouts of pigs to discourage pasture damage from rooting. It makes digging uncomfortable for the animal, although they can still forage in surface vegetation or leaf litter.

NAWAC has concerns around the use of such devices as it discourages the pig from behaviours using its mouth and nose – behaviours acknowledged to be important to pigs. As the primary purpose is to prevent behavioural expression without apparent benefit for the animal, NAWAC discourages the procedure.

However, NAWAC acknowledges the practical constraints of managing pigs in an outdoor environment and recognises that local bodies often impose regulations on pig farmers to manage environmental damage and so agreed with the regulations implemented to control the procedure.

The draft code allows nose rings or clips to be used for animal management purposes.

Lameness

Lameness is a health and welfare problem in pigs and especially common in sows; it results in physical pain and behavioural changes (Temple et al., 2018). Lame pigs are unfit for transport.

The prevalence of lameness in sows has been reported as: 8.8% in Finland, 9.7% in Belgium, 13.1% in Norway, 15% in Denmark, and 16.9% in England. The prevalence of foot lesions at slaughter in cull sows has been reported in various international studies at between 59% to 88% (Heinonen et al., 2006). Similar information about prevalence of lesions is not available in New Zealand.

Causes of lameness are varied and can include trauma, laminitis, osteochondrosis, arthrosis, infectious arthritis, or foot lesions including footrot and overgrown claws (Dewey et al., 1993; Heinonen et al., 2006)

Risk factors for sows include: housing on slatted floor compared to solid floor with bedding, or outdoors on soil; large pens; high stocking density; season (more likely to be lame in winter); and higher parity (Willgert et al., 2014).

Untreated lame sows are more passive than healthy sows or lame sows given pain relief. They move less, explore less, and spend more time in contact with the walls, perhaps trying to avoid other sows (Kurrika et al., 2017). Increased lying time on hard surfaces is further

associated with wounds on the hind feet and hocks, urogenital infections, and weakness; lame sows may not be strong enough to compete for food (Hainonen et al., 2006).

NAWAC has concerns about the management of gait abnormality and lameness in particular in sows during the mating period in indoor systems. While some of this may be associated with their close confinement for farrowing with consequent lack of exercise and loss of physical fitness, and may be ameliorated by a change to free farrowing systems, NAWAC suggests that the industry should consider ways to reduce this problem.

NAWAC has accepted the changes from the working group that insert several new references to lameness in the Code in Part 7: Disease and Injury Control. In addition, NAWAC has emphasised the need for pain relief, with a new statement that "Pigs are sentient animals and it is important that, if they are suffering from a painful condition (such as lameness), steps are taken to minimise the pain."

Weaning age

The 2010 code permits piglets as young as 21 days old to be weaned from the sow while recommended best practice is for them to be at least 28 days old. Current New Zealand industry practice, generally based on batch farrowing systems, is to wean piglets from 21-28 days of age with an average weaning age of 25 days. The code working group recommended that weaning age should remain at a minimum of 21 days, as in the 2010 code, however NAWAC is proposing that the minimum age at weaning be increased to 28 days.

Piglets are naturally weaned at around 14 - 17 weeks (Wood-Gush & Stolba, 1989; Jensen, 1986).

According to a review by Edwards, Turpin & Pluske (2020):

- Data suggest that weaning at less than 25 days carries increased health risks, particularly where prophylactic antibiotic use is restricted.
- Early weaned piglets show greater signs of impaired welfare by vocalisation, disrupted rest patterns and unwanted behaviour like bellynosing.
- Later weaned piglets are better able to adapt to the postweaning environment in terms of social structure, nutrition and health challenges.
- When weaning early, production gains in terms of piglets weaned per sow per year are offset by production losses in terms of reduced average daily gain.

The time of weaning also affects piglet physiology and immunology. Piglets weaned prior to 28 days of age had reduced feed intake and body weight and a weakened immune response (Robert et al., 1999).

EU Directive 2001/93/EC states that no piglet shall be weaned from the sow at less than 28 days. The average weaning age in Sweden and Norway is 33 days. The OIE Terrestrial Animal Code states that piglets should be weaned at three weeks or older, unless otherwise recommended by a veterinarian for disease control purposes.

A review by EFSA (2007) found that early weaning before four weeks affects piglet gastrointestinal processes causing diarrhoea and weight gain retardation. Weaning at 3 weeks causes belly nosing, frustration and injuries due to chewing at pen mates. They

recommended that weaning of piglets should not be carried out before they have a significant feed intake from creep feed and not before 4 weeks of age.

NAWAC considers that the available evidence supports an increase in weaning age to protect the physical, health and behavioural needs of piglets. NAWAC is proposing that the minimum age at weaning should be 28 days.

On-farm killing

If pigs are killed on farm, it must be done in line with the Animal Welfare Act. It is an offense to kill an animal in such a manner that the animal suffers unreasonable or unnecessary pain or distress.

The code working group had an extensive discussion on this standard, noting that the requirements for piglets are different from the standards for calves (which prohibit the use of blunt force trauma except for emergency situations).

The code working group proposed that the use of manual blunt force trauma can meet the minimum requirements of the Act if an upper weight limit is set. 15kg was proposed. In addition, they included use of a non-penetrating captive bolt gun as a humane method and recommended best practice. They discussed alternative methods for on farm killing and agreed that a secondary killing method such as pithing be used in some circumstances.

NAWAC also has concerns about the use of blunt force trauma for euthanasia of pigs up to weaning and agreed that this standard be amended but proposes an upper weight limit of 5kg. NAWAC also has concerns about the imperative for having a secondary killing method where firearms or captive bolt guns are used, and also have a view that code standards need strengthening on this point.

The 2018 Code lists the methods of humane destruction as follows:

- Pigs up to weaning: a blow to the frontal region of the skull, sufficient to fracture the skull, followed by bleeding out
- Grower, finisher and adult pigs:
    - use of a captive bolt pistol, held against the head at the point of intersection of a line between each eye and the opposite ear; or
    - shooting with a rifle directed at the same site, but held several centimetres away from the head; or
    - shooting with a 12-gauge shotgun, loaded with buckshot, directed behind an ear from a distance of 20 centimetres toward the opposite eye.
- Large pigs: the skulls of large pigs are very dense so a captive bolt may not penetrate the skull. A shotgun or rifle is the preferred method.

Piglets

It is common on New Zealand farms to use manual blunt force trauma to kill piglets. This is carried out by administering a heavy blow to the head in one of two ways:

- Hold the animal by the back legs and deliver a firm blow to the back of the head with a blunt instrument, e.g. an iron bar or hammer.

- Hold the animal by the back legs and swing it through an arc to hit the back of its head with considerable force against a solid object.

The code working group noted that this standard is different from the standards for calves (which prohibit the use of blunt force trauma except for emergency situations). However, piglets are anatomically different to calves; the science for piglets must be examined separately.

The following table summarises the findings of major reports methods for killing piglets:

AVMA Guidelines for Euthanasia 2020	**Blunt force trauma -** meets the definition of euthanasia, namely causing minimal distress with rapid loss of consciousness; but there is some 'uncertainty of success', and in these cases the method must be repeated. The AVMA encourages those using manual blunt force trauma to actively search for alternatives.
	Non- penetrating captive bolt - recommended to kill suckling piglets. A non-penetrating captive bolt causes loss of consciousness and death by severe concussive force applied to the forehead of the piglet. When used in appropriately sized and aged pigs, a secondary step to ensure death (like bleeding out) is unnecessary.
	Barbiturates – Suitable for piglets. Vet only.
	Carbon dioxide – may be suitable for small groups of neonatal piglets, but parameters of the technique need to be optimised.
Humane Slaughter Association	**Blunt force trauma –** an effective, humane method of killing neonates if carried out by a properly trained and competent operator. Only suitable for piglets up to 5kg in weight. Because of the dependency on the skill of the operator and accuracy of the blow, only recommended for emergency situations.
	Non- penetrating captive bolt - an alternative method that delivers a more controlled percussive blow to the head and does not require the procedure to be followed by a killing method. Important to support the head of the piglet on a hard surface for maximum energy transfer.
OIE Terrestrial Animal Health Code Chapter 7.6	**Non-penetrating captive bolt –** suitable for neonate pigs up to a maximum weight of 10kg.
	Carbon dioxide – considered suitable for neonatal piglets but it is likely to cause a period of distress in the animals before they lose consciousness.
	Lethal injection – suitable for small numbers of pigs; restricted to veterinarians.
EFSA: Welfare of pigs at slaughter	**Blunt force trauma –** suitable on-farm method for piglets <5kg in weight. Lack of skilled operators, operator fatigue and poor restraint, wrong choice of the tool to deliver the blow can lead to incorrect application of blow to the head.

	Non-penetrating captive bolt – A pneumatic non-penetrating captive bolt gun powered to deliver a kinetic energy of 27.7 J (120 psi) provides immediate and irreversible loss of consciousness and brain death in piglets up to ~10kg.

Piglets are not currently slaughtered using carbon dioxide in New Zealand and there is no interest in adopting this method. Given that the code requires 'rapid insensibility', the method would not meet current standards.

Casey-Trott et al. (2013, 2014) found that a non-penetrating captive bolt gun caused 100% of piglets under 3 days of age to be rendered immediately insensible without return to insensibility. For piglets between 3kg – 9kg, a non-penetrating captive bolt gun caused immediate, sustained insensibility until death in 98.6% of animals.

It is NAWAC's view that the working group recommendation for a 15kg weight limit for blunt force trauma was too high. In line with recommendations from the Humane Slaughter Association and EFSA, the proposed weight limit has been lowered. A maximum weight of 5kg for the use of manual blunt force trauma is proposed.

Adult pigs

The code working group recommended that pithing should be allowed as an alternative to bleeding when using a captive bolt gun, and that using a firearm should not require a mandatory follow up method (but should still require a competent operator and follow-up to confirm death).

The following table summarises the findings of major reports on methods for killing pigs:

AVMA Guidelines for Euthanasia 2020	**Free bullet -** When properly conducted using the appropriate firearm, euthanasia by gunshot produces immediate loss of consciousness and rapid death.
	Penetrating captive bolt - Use of well-maintained PCB guns with ammunition appropriately selected for the size of the animal is acceptable with conditions. Death following use of the captive bolt gun is commonly achieved but is not assured depending upon bolt length and depth of the frontal sinus in mature sows and boars. Therefore, secondary steps to ensure death (e.g., a second application, exsanguination, pithing) should be applied as necessary.
	Barbiturates – Can be used for sows, boars and grower-finishers; restricted to veterinarians.
	Carbon dioxide, nitrogen, nitrous oxide, and argon - typically not practical in farm situations, and have greater application for pigs weighing 31.8 kg or less, rather than grower-finisher pigs or sows and boars.
Humane Slaughter Association	**Free bullet –** A rifle or shotgun can be used. For very large pigs and exotics, it is recommended that where possible, they are destroyed by use of a shotgun (12, 16 or 20 bore). When using a shotgun, the muzzle should always be held from 5-

	25cm away from the animal's head. Unless the carcass is to be used for human consumption, there is no necessity for it to be bled following shooting with a free-bullet weapon or shotgun.
	Penetrating captive bolt - Captive-bolt stunners can be used on most pigs, but it is recommended that the heaviest cartridge available for the equipment is used, and that in all cases the animal is either bled or pithed immediately to ensure rapid death.
OIE Terrestrial Animal Health Code Chapter 7.6	**Free bullet –** Suitable for pigs. The correct cartridge, calibre and type of bullet for the different species age and size should be used.
	Penetrating captive bolt – Suitable for pigs (except neonates). Pithing or bleeding should be performed as soon as possible after the shot.
	Lethal injection – Suitable for small numbers of pigs; restricted to veterinarians.
EFSA: Welfare of pigs at slaughter	**Penetrating captive bolt -** The impact of the bolt on the skull results in brain concussion and immediate loss of consciousness. The animals may not die immediately, so should be followed by bleeding or pithing. Large boars are more difficult to stun using this method as the sinuses in the forehead are well developed and the brain is deeper in the head than in other pigs; they are preferably killed by use of a free-bullet firearm.
	Free bullet - Pigs are generally shot at close range with handguns (< 10 cm) or shotguns (at a distance between 5 and 25 cm). When used properly, this method is quick and requires minimal or no restraint of the animal. The ammunition for a handgun should have a minimum calibre of .32 inches, generate a minimum muzzle energy of at least 200J and use round-nose, lead bullets to facilitate penetration and distortion. Boars and sows may require a 0.30 calibre bullet when using a rifle. For older pigs and exotic breeds, a shotgun is recommended.

NAWAC considers that, where pigs are killed on-farm via free bullet or captive bolt, a secondary method to confirm death must be used. This could be either bleeding out or pithing. It remains critical that people killing pigs are competent with the methods that they choose and that the equipment they use is well-maintained.

Given the international context of African Swine Fever and the impact of Covid-19 on supply chains, the code working group also discussed emergency 'destocking' methods. The industry is confident that, though it would be labour-intensive, the emergency destocking of a pig shed could be done in line with the code of welfare as well as biosecurity response plans.

Experts consulted

The subcommittee visited seven farms featuring a variety of farrowing systems.

They met (including by videoconference) with the following experts:

- Pig farmers
- NZ Pork representatives
- Pig specialist veterinarians
- SPCA representative
- NZVA representative
- Senior Researcher specialising in pig welfare and behaviour at Scotland's Royal Agricultural College
- Professor of Swine Production Medicine at the University of Pennsylvania
- Professor of Ethology (specialising in maternal behaviour) and researcher (specialising in pig welfare) from the Norwegian University of Life Sciences
- Genetic Services Manager at the Pig Improvement Company (PIC)
- Genetics experts and a housing expert from the Danish SEGES Pig Research Centre
- Representative of the Federal Ministry of Food and Agriculture in Germany
- Researcher (specialising in nest-building behaviour) and Associate Professor (specialising in pig health and welfare) from the Swedish University of Agricultural Sciences
- Representatives from Compassion in World Farming and Humane Society International
- Representatives from the New Zealand Animal Law Association
- Global Farm Animal Advisor for World Animal Protection
- SAFE representative
- Researchers and contributors to the EURCAW-Pigs project
- Senior Scientist at Wageningen
- Landia representative

Written advice or reports have also been received from the Pig Farmers Group Steering Committee, the Swiss Federal Department of Home Affairs, the European Commission via MFAT, FAI farms, a representative of Sunpork Australia, state-level regulators in Australia, and a New Zealand researcher with expertise in piglet slaughter and painful procedures.

NZ Pork also provided several written statements on their position.

An expert in the Five Domains model from the Animal Welfare Science and Bioethics Centre (Massey University) facilitated a workshop and provided advice to support NAWAC's work on their Five Domains analysis.

A record of meetings, and a copy of the Five Domains analysis, is available online: https://www.mpi.govt.nz/animals/animal-welfare/national-animal-welfare-advisory-committee/nawac-review-of-pig-crates/

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Summary of recommendations from stakeholders during the pre-consultation phase

Report for the Farm to Processor Animal Welfare Forum

A report written in response to a meeting by the livestock sector to identify gaps and opportunities to improve the animal welfare system in New Zealand.

This project was established as an action arising from the Primary Industry Chief Executives' Animal Welfare Forum held in Wellington in December 2018.

The Farm to Processor Animal Welfare Forum and MPI were tasked with examining the codes of welfare to review the application of current standards within the Codes. Each code will be examined to determine whether they:

- Are up to date;
- Adequately reflect our expectations of what we think is best practice; and
- Can be more effectively communicated and implemented.

In summary, the report on the pigs code identified the following feedback:

Issue	**Risk & priority**	**Proposed approach**
The use of nose rings, clips or wires	Risk to animals = Low to medium. This is a low priority area for review.	Investigate the effect of having inserted nose clips/rings on pig behaviour, with a focus on whether pigs experience ongoing pain post-ringing (after healing from the initial procedure).
Manipulable material for sows pre-farrowing	Risk to animals = Medium. This is a high priority area for review, including clarification.	It is recommended that Minimum Standard No. 10(h) be brought into line with the EU, which requires manipulable material to be provided to sows pre-farrowing **only** if it is feasible for the effluent/slurry system to accommodate used material. Clarity is needed on what counts as manipulable material i.e. a definition
The use of farrowing crates	Risk to animals = Low to medium	The proposed approach is to await the judicial review findings.
Pre-weaning piglet mortality in outdoor and loose indoor farrowing systems	Risk to animals = High	Provide good practice information for producers regarding farrowing

		management. Update stockperson training materials
Mating stalls / mating bails	Risk to animals = Low, providing other factors are accounted for	The proposed approach is to await the judicial review findings.
Space allowance for grower pigs	Risk to animals = Low, providing other factors are provided to maintain acceptable welfare outcomes	An amendment to the Code/ Regulations to adopt a similar approach to the standard required in Canada (k=0.0335)
Specific health issues (tail biting, shoulder sores, flank biting, rectal prolapses, pain and distress)	Risk to animals = Medium to high	Trigger levels (intervention levels) could be brought into PigCare™. Lesions are already evaluated but specific guidance would assist in evaluating prevalence and severity.
Aggression in social groups	Risk to animals = Low to medium	PigCare™ – include trigger levels for body injuries.
Poor nutrition	Risk to animals = High	Education required for non-commercial pig keepers
Emergency humane destruction / humane slaughter	Risk to animals = High	Education to pig keepers and to commercial farmers. Guidelines for on-farm emergency humane destruction to be reviewed and updated if required. Upcoming review of stockperson training material offers an opportunity to amend the training guide
Inadequate facilities	Risk to animals = Medium to high	Education required for non-commercial pig keepers in particular. NZPork Free Range Guidelines have been provided for inclusion on the NZ Lifestyle Block website, however the smallholder guidelines (less technical) need updating.
Tail docking of piglets	Risk to animals = Low to medium	The information featured in the England Code regarding measures that may manage tail biting and therefore minimise the need to dock piglets' tails is useful. Providing this summarised guidance information to pig farmers would be beneficial. This can be carried out by NZPork.

Lack of enrichment material for indoor pigs	Risk to animals = Low to medium.	The use of enrichment (e.g. bedding material, enrichment objects) in the commercial sector is unknown. This could be captured in PigCare™ or via survey of NZ producers.
High litter sizes	Risk to animals = Medium.	Ensure replacement gilts are selected based on having at least 14 apparently functional teats. Foster sows should also be selected based on having functional and accessible teats. Good practice guidelines for weaning under 28 days of age should be followed to optimise piglet health and survival.

NZ Pork

NZ Pork representatives were members of the code working group.

They were not members of the group that specifically considered farrowing and mating systems (which was done by a NAWAC pig subcommittee).

NZ Pork were consulted by the pig subcommittee. NZ Pork submitted a report on industry progress against NAWAC's 2016 recommendations, presented to the NAWAC subcommittee, met with the subcommittee several times, wrote to NAWAC in February 2021 and made written submissions.

NZ Pork facilitated several farm visits for the subcommittee. The primary focus of these farm visits and the subsequent discussions held with NZ Pork experts was to obtain information to support development of new standards for farrowing crates and mating stalls, while also developing a broader knowledge of pig farming systems.

The animal welfare specialist employed by NZ Pork also assisted the subcommittee undertaking the Five Domains assessment. This allowed New Zealand derived information to be included in this assessment and acted as a conduit for obtaining additional specific information from the pig veterinarians where the subcommittee required.

NZ Pork pre-consultation with farmers

NZ Pork reviewed components of early drafts of the Code (excluding MS 10 and 11 being considered by the subcommittee) and circulated a draft to farmers. NZ Pork wishes to note that the timeframe for farmers to review feedback was very short (13 days).

The key feedback was as follows:

- Minimum Std 1: Standard OK, but question whether formal training is relevant for all farming situations e.g. semi-commercial.

- Minimum Std 6: Housing and equipment (Space) – two options in draft code for discussion. One has a minimum K of 0.047 and one has the requirement of ≥0.0335.

  Option A requires 56% more space. Most pigs have more space for most of their growing cycle as they grow within a pen: it is only in the last few days that space allowance approaches the minimum. If there is an increase in the space allowance by over 50% that means that almost all NZ farms should decrease their pigs sold by 50%. If progressed this will require a regulatory impact statement. This should include the effects on the wider supply chain: feedmills, abattoirs, boning rooms, independent butchers, premix plants, grains purchased, vets, nutritionists etc.

- Minimum Std No. 8: Air quality – Ammonia levels reduced to 20ppm from 25ppm in current Code. There is no objection to this change. One issue relates to how this would be accurately measured. It is possible to obtain a different reading in the same pen. It would need to be measured and interpreted carefully – possibly via taking multiple measurements and calculating an average. Time of day, temperature etc. can influence a reading.

- Minimum Std No. 9: Behaviour – Two options presented for rewritten Min Std. Description of normal behaviours has been revised in both. Requirement for manipulable material added in both.

  Depending on the final wording, it is likely that this amended standard (and possible regulation) will have economic consequences. If this is so, then the impact will need to be assessed.

  There was feedback from farmers that the minimum standard could be modified to say that a combination of materials should be provided e.g. to mix up items that can be chewed, pushed around, hanging, different textures etc.

- Minimum Std No. 12: Managing boars – New requirement that boar pens must be sited and constructed to allow the boar to hear, smell and see other pigs.

  Are all three required at all times (see, hear, and smell)? This needs to be clearer. What happens if someone only owns one boar? Does this imply someone cannot keep a single pig (male or female)?

  Delete mention of tethers – make relevant to all pigs.

- New section on Selection and Breeding added; no MS (yet), just RBP. Feedback was that it requires peer review by geneticist.

- Minimum Std No.16: Painful husbandry procedures – NAWAC advises all painful procedures should be viewed as transitional. Requires discussion. Why has tail docking been separated out of painful husbandry procedures?

- Minimum Std No. 19: Management of Health and injury – Requirement in MS for sick/injured pigs that can't otherwise cope to be moved to a separate recovery pen. Support this.

- Minimum Std. No 20: Emergency humane destruction – New requirement proposed by NZPork that an upper weight limit is required for on-farm euthanasia by way of a blow to the head. Support this. Some discussion was had on pithing. The feedback was that pithing should be permitted, preventing the need to exsanguinate. It provides confidence that the captive bolt/ bullet has not just gone into the frontal sinus and confirms death.

  Pithing is an acceptable method in the FMD destruction operational plan. The Commercial Slaughter Code says that the only means to render an animal dead is via exsanguination which infers that pithing is not effective. References to pithing in the Commercial Slaughter Code will need to be addressed also if changes are made to the pig code in this regard.

  Pithing is a useful option when euthanising pet pigs – considering the aesthetics of bleeding out a pet when owners are present etc.

- New Minimum Std. No 22: Welfare Assurance System – Requirement for each commercial pig farm to implement a quality assurance programme that provides documented procedures to ensure compliance with Min Standards.

  Some questions raised included why only commercially farmed pigs? What is the definition of commercial pig farm? Is an internal QA programme acceptable as long as it meets the requirements of ensuring compliance with minimum standards?

Veterinarians

The New Zealand Veterinary Association (NZVA) has a policy on farrowing crates, available online[16].

In addition, a group of specialist pig veterinarians submitted information to NAWAC. In summary, they stated that:

- We represent a group of veterinarians who have consulted to over 90% of commercial pig farms in New Zealand for the past two decades. We consult to all types of farms including outdoor farms, indoor farms with farrowing crates, indoor farms with farrowing pens and with combi-pens. We have access to, and we benchmark the performance data of our client herds, directly taken from their recording software. We consequently cannot mis-represent the data, the facts or the interests of any pork industry sector or type of housing. Consequently, we believe we are amongst the least biased of skilled professionals in this debate.
- The main conflict of interest that we have is our desire for the NZ pork industry to survive this NAWAC review, and we have a vested interest in that occurring.

[16] https://nzva.site-ym.com/page/policyfarrowing

- We propose that any change in Minimum Standards should cater for the use of new technologies that are yet to be identified and researched and which provide a superior welfare outcome to those currently under consideration.
- Piglet mortality, often as the result of severe physical trauma, is a serious welfare issue that cannot and should not be ignored, discounted or uncoupled from the overall effects of any farrowing system on the sow. Common causes of piglet mortality that are more frequent with increased sow mobility, such as being trampled or crushed, are associated with injury to and haemorrhage from internal organs, limb fractures and suffocation. Many of these deaths will be associated with unreasonable pain and distress.
- Piglet mortality on New Zealand farms using conventional farrowing crates is between 11-13% (12.6% in NZ in 2019). As was concluded by NAWAC in 2016, we believe that this system provides the best overall welfare outcome for both the sow and her piglets, for the following reasons:
    - No other system, that does not utilise sow confinement during the critical parts of lactation has yet proved capable of consistently achieving such low piglet mortality under commercial conditions. For this reason, well over 90% of commercial pig farms in the world use confinement systems;
    - Studies measuring sow welfare (e.g. cortisol levels) in crated versus free systems do not provide clear evidence of sow welfare compromise when confined. Some cortisol-based studies conclude confinement is less stressful than loose-housing while others conclude the opposite or show no difference;
    - Multiparous sows that have experienced confinement during previous lactations show no aversion to being introduced to a farrowing crate;
    - Normal behaviour of the sow in every type of farrowing system is to nurse her piglets hourly until they are weaned. The sow very quickly develops a routine of nursing and resting and will spend the vast majority of her time at rest in every type of farrowing environment.
- Piglet mortality on New Zealand farms where sows farrow outdoors (in huts) or indoor but in pens with no sow confinement of the sow is 18-22% (19.6% in NZ in 2019). This level of mortality is similar to outdoor and pen farrowing systems in other countries.
- That piglet mortality in pen systems is too high to justify the greater mobility of the sow is evidenced by:
    - A lack of uptake of such systems globally whenever attempts have been made to adopt such systems. Some large producers around the world with a desire to differentiate their production system have trialled confinement-free farrowing pens of various designs, often under the guidance of researchers in the field. None to our knowledge have been able to achieve what they consider to be acceptable piglet survival under commercial conditions;
    - Countries (e.g. Denmark) that previously financially incentivised farmers to install confinement-free farrowing pens have removed such incentives due to concerns over the high piglet mortality occurring in these systems and a reluctance of banks to finance them. Supermarkets in countries like the UK have failed to give indoor penned systems the welfare premiums that outdoor farms achieve;

    - Researchers who claim they can achieve piglet mortality rates without confinement that approach those achieved in confinement systems have only achieved this in highly resourced research settings for certain periods of time with small numbers of pens, small sample sizes, and an amount of staff supervision and other controls and technologies that are unsustainable in a commercial situation;
    - No country in the world completely bans confinement of sows during the farrowing period. Those countries that only allow limited periods of confinement of lactating sows (e.g. Switzerland, Sweden, Norway) either protect their market from imports or heavily subsidise their farms, or both, enabling their farmers to remain profitable despite high piglet mortality rates - typically 18%+ in small farms. Germany has recently given its farmers 15 years to move to reduced confinement and offered substantial funding to assist farmers to transition. New Zealand neither protects nor subsidises its farmers.
- Farms with temporary crating (Combi-crates , open-out crates, etc.) achieve piglet mortality rates that approach those achieved in conventional farrowing crates. Typically, this is around 15% although this is influenced by the design of the system and the period of confinement applied. More recent designs, enhanced stockperson experience and greater sow experience with these systems all tend to improve results achieved;
- We recognise the concerns around confining the sow for “more time than is necessary” within the bounds of what such an ill-defined and potentially subjective qualification may mean. We unequivocally and unreservedly advocate for confinement of sows within the farrowing pen in indoor pig housing systems over the critical neonatal period (0-5 days) as the benefits of this confinement as measured in the lives of multiple sentient animals far outweighs any perceived or real inconvenience experienced by the sow. As a system, farrowing crates are being challenged around the world now more than ever. This is a reality and one that has resulted in the expenditure of considerable resources to find a better system. The only alternative system that has achieved some acceptance, as evidenced by change or proposed change, is the Combi-crate in which the welfare of the piglets is protected while confinement of the sow is limited only to the level essential to afford the majority of this protection. If research and advanced technology were successful in identifying a confinement-free system with comparable piglet welfare and superior sow welfare we would embrace this;
- If change in New Zealand is inevitable, as it may be due to forces unrelated to animal welfare; the Combi-crate provides for the best net welfare of both the sow and the piglet amongst the current alternative options.
- Slatted floors are essential to maintain hygiene and health (mastitis, piglet diarrhoea, etc.) in an indoor farrowing system.
- The enrichment value of manipulable material is of greater importance to the sow than the ability to build a nest per se. We maintain an open mind about the need to provide the sow with access to manipulable material around the time of farrowing if demonstrable benefits to the sow and piglets can be shown, but not if there is

detriment to sow or piglet health (e.g. mastitis incidence, inability to use best ventilation and drainage systems for pig health and welfare, etc.).

- The modern genetically improved commercial sow is far removed from her wild ancestors, as are her needs.
- We reject the anthropomorphic comparisons made by opponents of the pork industry. These are seldom appropriate for a species that thinks and behaves differently to humans. Modern sows in particular are passive and idle, and gravitate toward activities that are routine, safe, and predictable. The most important natural behaviour of all mammals is the protection of their young and many behaviours and instincts instilled by nature prioritise this outcome as do modern production facilities.
- Societal perception and expectations of current farrowing systems are based on a portrayal of the system that is inaccurate and biased. The general public deserves to know and understand the real facts regarding modern pig farming systems.
- The NZ government and MPI are inconsistent in the pressures and expectations placed on the pork industry. Expectations around carbon footprint, antibiotic use, workplace health and safety and perceived sow welfare are conflicting and need to be resolved. Requiring sows to be loose-housed during lactation would increase the industry's carbon footprint, increase antibiotic use, and present an increased health and safety risk for farm workers.
- It would be ethically and morally inconsistent for the NZ government and regulators to require changes to farrowing systems in New Zealand, whatever the perceived animal welfare benefits, if this leads to direct substitution of New Zealand born and raised product by imported pork that is currently being produced by farms in countries that operate under welfare conditions that would be illegal in New Zealand (>60% of pork consumed in New Zealand is currently imported.)

SPCA

NAWAC sought early feedback on the code of welfare from several animal advocacy organisations. Summary of the SPCA recommendations:

Good practice: SPCA would respectfully suggest that NAWAC re-evaluates its interpretation of section 10 of the Act, especially in relation to what constitutes 'good practice'. In SPCA's view, it is not acceptable to afford farmed animals with a lower standard of care than other classes of animal and that setting minimum standards at a point below which suffering is unacceptable does not constitute 'good practice' as required by the Act. Consequently, the majority of the suggestions made here relate to moving current example indicators and recommended best practices into minimum standards.

Minimum Standard 1 (Stockmanship): Amend to require all individuals working with pigs to possess the ability and knowledge needed to maintain the health and welfare of the animals, rather than maintaining this as a collective responsibility. The standard should include a requirement for formal training of staff, and that staff undergoing training are supervised by fully trained staff.

Minimum Standard 2 (Feed): Replace 'adequate' with 'sufficient' in part (a), along with a requirement for the food provided to be suitable. In part (c), replace 'resolve the issue' with

‘improve its condition or else the animal must be destroyed humanely’. Two additional standards: the first requiring feeder space and number of feeders to be appropriate to the number and size of animals being fed; and the second relating to daily checking of automatic feeding systems and ensuring that their design, placement, and operation minimises intimidation, bullying and aggression.

Minimum Standard 3 (Newborn Piglets): Require regular monitoring of sows following birth to ensure that their teats are in good condition and that the sow is producing milk and allowing piglets to suckle (move EI to MS). In addition, move current RBP into MS, noting that in most situations, including outdoor farrowing this requirement would be relatively easy to deal with.

Minimum Standard 4 (Water): Address competition for access. Amend to: “All pigs and piglets must have uncompetitive access to a freely available supply of clean, fresh drinking water, at all times, that is sufficient for their daily needs and not harmful to their health. Competition or the location of the water points must not prevent any pigs from having access to the water, which needs to be provided at a temperature that does not inhibit drinking.”

Minimum Standard 5 (Shelter Outdoors): Require shelter to be warm and dry in part (a). Require area in (b) to be draught free. Require that the shelter allows for easy inspection of all pigs and is constructed in a way that minimises the risk of disease, injury and stress. Require bedding material in cold weather.

Minimum Standard 6 (Housing & Equipment): Require that the space provided allows pigs to stand freely and lie down in part (b). Increase the space allowance to RBP. Require that the area in part (cb) is draught free in addition to dry. Specify a minimum light intensity of 50 lux at pig shoulder height. Require that flooring is non-slip and adequately drained. Require a ventilation monitoring system with back-up power supply and alarm. Require electrical fittings to be out of reach of pigs. Prevent pigs from having access to toxic materials. Ensure staff are trained to monitor and manage ventilation and temperature. Ensure alarm systems and firefighting equipment are regularly tested and that there is a backup power supply. Require additional space and hiding areas to be provided when pigs are regrouped following separation.

Minimum Standard 7 (Temperature): Suitable bedding material should be provided for pigs of all ages. Daily monitoring of pig behaviour would help to avoid the risk of heat and cold stress affecting the animals. The current example indicators covering the protection of pigs from temperature fluctuations and providing alleviation of overheating should be incorporated into the MS.

Minimum Standard 8 (Air Quality): Ammonia levels should not be allowed to reach 25ppm, let alone exceed them. The minimum standard should be amended to remove ‘exceed’ and replace with ‘reach’. This would reinforce the statement that *“…an ammonia level over 25ppm will cause eye and nasal irritation…”*

Minimum Standard 9 (Behaviour): All of the current RBPs should be incorporated into the MS. In addition, the EI’s relating to daily monitoring of vocalisation, etc should also be included in the MS. The existing standard should explicitly refer to nest building for sows as one of the example normal behaviours.

Minimum Standard 10 (Managing Interactions Between Sows and Piglets): Given the judicial review ruling, SPCA put forward 3 main points to consider:

- Farrowing accommodation and space allowances: SPCA does not support the use of 'crated pens' or the use of 'temporary crating'. SPCA accepts that free-farrowing systems will take up more space. The space must be sufficiently large to allow the sow to move comfortably and lie down in a natural position, while also providing separate areas for feeding, dunging and resting to occur. In addition, with the exception of the dunging area, the rest of the enclosure should have solid floors to support good foot health.
- Provision of bedding and nesting material: it is vital that the code requires the provision of sufficient, suitable bedding material throughout the period of housing in the farrowing system, as well as additional material for nest building at least 2 days prior to the expected farrowing date.
- Achieving a well-managed transition: a managed transition to free-farrowing systems will be needed to prevent a mass exodus from occurring. If a mass exodus does occur, then the future viability of the industry may well be at stake, with the result that the majority of New Zealand's future pork supply could come from countries with far lower animal welfare standards, which we have no control over. There are several avenues which could be explored. These include tax write-offs for new infrastructure, low or no-interest government loans, extended depreciation thresholds and timeframes for capital expenditure and reduced compliance costs for new building consents. In addition, Resource Management Act conditions for pig farms could be reviewed, with a view to encouraging more free-range farming in marginal areas of the country. Consequently, SPCA strongly recommends that a cross-government group, comprising of officials from the Ministry for Primary Industries, Inland Revenue and the Ministry for the Environment is formed, with a mandate to determine a low-impact pathway for the transition away from farrowing crates and mating stalls.

Minimum Standard 11 (Managing Dry Sows): Require sows to have enough space to move and lie freely, with a separate dunging area and the provision of suitable and sufficient bedding material.

Minimum Standard 12 (Managing Boars): The welfare of boars must not be overlooked. Require space allowances for exercise, in addition to existing requirements. Space allowances should provide for separate dunging, lying and feeding areas. Prevent boars from being kept in isolation. They should be kept in small, compatible groups with sensory and environmental enrichment.

Minimum Standard 13 (Handling): Part (a) should be extended to include piglets. In addition, when picking up a piglet, one hand should be used to support the animal beneath the chest. Amend part (b) to include.

Minimum Standard 14 (Moving Pigs): Include piglets as well as pigs. SPCA disagrees with current wording around electric prodders. Restrict their use to situations where there is a risk to human life or to that pig in question. Include standards to: avoid unnecessary mixing of pigs; avoid separating stable groups; require pigs being moved on foot not to be forced to proceed at a pace that will cause exhaustion, heat stress or injury; and require pigs with illness or injury not to be moved unless it is in their best interest. Move RBPs around the use of dogs, and moving pigs through alleyways, to MS.

Minimum Standard 15 (Weaning): Move EI for recently weaned pigs to be kept warm, have access to palatable food and readily available clean water, and for the smallest pigs or runts to be individually cared for, to MS. Raise minimum weaning age to 23 days with the RBP remaining at 28 days.

Minimum Standard 16 (Elective Husbandry Procedures): There is a need for the industry to shift away from its reliance on tail docking as the only solution to the problem of tail biting. Amend the MS to prevent tail docking from being used as a routine husbandry procedure. If performed, remove no more than one half of the tail between 24 and 36 hours following birth. Pain relief should be RBP. Farmers should be encouraged to develop a plan for phasing out tail docking completely. Require manipulable material to reduce the need for tail docking. Do not permit surgical castration. Limit to ear notching to within 72 hours of birth. Tusk trimming should be done using appropriate restraint or sedation and above gum level.

Minimum Standard 17 (Pre-Transport Selection): All pigs selected for transport must be healthy, able to support their weight on all four limbs and able to walk unaided, unless a signed veterinary certificate is provided. Sows within six weeks of their expected farrowing date must not be selected. Sows which have farrowed within 48 hours or who are lactating must not be selected. Pigs must be moved from their housing and loaded into the transport vehicle in a single operation. Stocking densities must be adjusted to minimise heat stress. Mixing of unfamiliar animals must be avoided. Pigs must not receive more than two tattoos before being transported to slaughter.

Minimum Standard 18 (Management of Health and Injury): Explicitly reference piglets where appropriate, as well as pigs. Part (a) should be amended to require all pigs to be checked at least once a day, and to check for welfare concerns, not just ill-health or injury. Part (b) should be amended to refer to welfare concerns. Require documentation of daily checks. Require prompt and humane destruction of animals not responding to treatment. Require signs of ill-health, injury, poor welfare or the spread of disease to be acted on immediately. Require preventative action to be taken. RBPs (a), (c), (e), (f), (g) and (h) should be moved into MS. RBP (d) should be incorporated into MS (d).

Minimum Standard 19 (Emergency Humane Destruction): Move all EI's into the MS.

The SPCA also has a position statement on pigs[17].

World Animal Protection

NAWAC sought early feedback on the code of welfare from several animal advocacy organisations. World Animal Protection only accepts crate-free farrowing and lactation and believe that New Zealand is well set up to endorse free farrowing options due to the abundance of outdoor farms and sows who have valuable and transmissible experience with outdoor farrowing.

Summary of the World Animal Protection recommendations:

- The section on behaviour is in most need of strengthening regarding farrowing crates, breeding stalls, environmental enrichments, and systems designed around the behavioural needs of pigs. Not just due to the changes in relation to farrowing

[17] https://www.spca.nz/advice-and-welfare/article/pigs

crates and breeding stalls, but in relation to environmental enrichment and systems designed around the behavioural needs of pigs.

- We fully agree with the following statement in the current code and recommend increasing the minimum space allowances to provide functional areas of eating, resting, activity and elimination behaviours: *"Based on emerging international research, NAWAC believes the current industry guidelines for space requirements need to be reviewed as 10-50% more space may be required to provide for all pigs' needs, depending on their level of activity and the thermal conditions."*
- Increasing evidence shows early weaning to be a false economy, since improvements in other key performance indicators outweigh the increase in piglets weaned per sow per year with early weaning, a 28-day minimum is recommended.
- Painful procedures including teeth reduction, tail docking and castration are coming under increasing scrutiny with a great deal of scientific evidence showing the detrimental impacts to pig welfare throughout their life on the farm. We applaud the New Zealand industry for raising pigs without castration and recommend an end to other painful procedures particularly tail docking and teeth reduction. In 2019, World Animal Protection set up the "3Ts Alliance"; a voluntary initiative consisting of global stakeholders from industry, academia, NGO and other sectors, who aim to address the issue of tail docking ("T"ail), teeth reduction ("T"eeth) and surgical castration ("T"esticles) to improve animal welfare standards in pig production. We have a LinkedIn page to share the outcomes of the 3Ts Alliance meetings as well as the latest information from industry publications, scientific knowledge and innovations relating to raising pigs with intact teeth, tails, and testicles.
- Finally, we encourage genetic selection for a better balance between welfare and economically important production traits. There is a worrying trend towards ever-increasing litter sizes with associated negative welfare impacts and could prove challenging to the adoption of crate-free systems for farrowing and lactation. The choice of very prolific sow lines will increase piglet mortality, especially in free farrowing systems where interventions to improve piglet survival, such as targeted supplementary heating and human assistance to obtain adequate nutrition, are more difficult. The use of breeds with fewer more robust piglets is the best strategy in these circumstances.

New Zealand Animal Law Association

NAWAC sought early feedback on the code of welfare from several animal advocacy organisations. Summary of the New Zealand Animal Law Association recommendations:

- **Provision of Adequate Nest-Building Material While Farrowing**: The Code does not adequately ensure that nesting material is provided to sows while farrowing. This is problematic, given that sows are highly motivated to use such materials, with nesting being a deeply ingrained behaviour in sows. In particular, the extent and type of material should be specified to provide clarity to farmers, and nesting material should be required to be provided to sows in farrowing systems constructed prior to 3 December 2010 (this is not currently the case).
- **Space:** Space in general is an issue for pigs. The Code does not provide sufficient space to account for pigs' movement so as to ensure that their behavioural needs are

met (including play, foraging and exploration). The intensive farming of pigs also leads to heightened aggression; increased skin lesions; increased incidence of negative social behaviour; higher stress levels; and more. NAWAC has recognised that pigs require more space and numerous scientific studies have confirmed this. The Code needs to be amended accordingly, such that more generous space allowances for pigs are made mandatory.

- **Lack of Clarity Regarding Shelter for Pigs with Access to the Outdoors:** Where pigs are housed outside adequate space should be provided in the shelter that is provided to them and there should be clarity in the Code regarding stocking densities for pigs kept outdoors – this is not currently the case, with such requirements having been made the subject of local government regulations that are difficult to find.
- **Providing for the Behavioural Needs of Pigs:** The Code fails to sufficiently provide for the behavioural needs of pigs, including in relation to play, foraging, rooting, exploration and wallowing. Pigs have a wide range of behavioural needs and these are not currently protected under the Code, with the Code only ensuring that pigs are able to exhibit a limited range of behaviours, including feeding, drinking, sleeping, dunging and urination, vocalisation, thermoregulation and social contact.
- **Premature Weaning of Piglets:** Pigs are weaned very early in commercial production, with a consequent impact on their physical health and behaviour. This aspect of the Code may need to be amended to ensure the needs of pigs are met.
- **Use of Elective Husbandry Procedures:** There are numerous elective husbandry procedures, which impact on the welfare of pigs. These include tail docking; the clipping and grinding of pigs' teeth; the use of nose rings, clips or wires; identification procedures that involve notching, tagging, punching or tattooing pigs' ears or bodies; tusk trimming of boars; and castration of piglets over the age of between two and seven days old. A number of these procedures (including tail docking and clipping/grinding of teeth) are only necessary due to the intensive conditions in which pigs are kept and may be ameliorated through the provision of environmental enrichment. Additionally, all of these procedures may cause pigs pain and a number do not require pain relief to be provided (e.g. use of nose rings, clips or wires; identification procedures; and clipping/grinding of teeth where pigs are under five days of age).
- **Use of Electric Prodders and Goads:** Regulation 48 of the Animal Welfare (Care and Procedures) Regulations 2018 (Regulations) allows for the use of electric prodders on pigs, which causes pigs stress and pain. While the regulation only allows for the use of such prodders where pigs are over 150kg, they do not ensure that such prodders are only used or one second at a time; that multiple applications should be adequately spaced; or that shocks should be discontinued if the animal fails to respond. It is also not a requirement of regulation 49 that goads not be used on the ears and nose of animals, despite these areas being sensitive.
- **Ventilation:** High levels of ammonia are permitted in indoor systems, which may be harmful to pigs. It is not a requirement of the Code that these levels be measured and monitored by farmers.
- **Lighting:** The Code currently allows pigs to be kept in total darkness for 15 hours a day, with a low artificial light of only 20 lux being required for the other 9 hours of the day. This may lead to higher levels of aggression due to a consequent inability of pigs to discriminate between familiar and unfamiliar other pigs.

- **Mixing of Pigs:** The Code provides insufficient provision for the mixing of pigs, which can lead to stress and aggression if not adequately managed. There are no minimum standards in relation to this welfare issue and this should be addressed.
- **Genetic Selection of Pigs for Their Environment:** Genetic selection in relation to pigs should be more thoroughly addressed in the Code. In particular, the Code needs to account for the physical, health and behavioural impact of genetically selecting pigs for high productivity. Such impacts include leg weakness; and clumsier, heavier sows that are more likely to lie on top of their piglets. Alternatively, genetic selection could be used as a means of reducing the need for farrowing crates through breeding for non-crushing sows with a greater maternal instinct; and genetically selecting for more robust piglets.
- **Welfare Assurance**: The Code currently includes recommended best practice, but no minimum standards, in relation to welfare assurance systems.

NZALA has concerns that a number of standards set by the Code in relation to the above are, or may be, inconsistent with the Animal Welfare Act 1999 (Act) (as has been established in relation to farrowing crates and mating stalls). For this reason, NAWAC should give particular consideration to the above matters, and whether they should be the subject of recommendations made under section 183A(2) of the Act. NZALA also recommends that all farming codes should be available on-farm and 'translated' into more legible and understandable summaries e.g. posters, pamphlets, handouts.

Uncaging New Zealand's Sows: Scrutinising Farrowing Crates[18]

A report by Professor Andrew Knight, published by SAFE in 2018. The report supported SAFE's submission to the Primary Production Select Committee to end the use of farrowing crates.

The overall recommendations were:

1. New Zealand's animal welfare regulations should truly reflect scientific evidence and best practice. Where reasonable doubt exists about potential animal welfare impacts on pigs, in recognition of their high degree of sentience, pigs should be given the benefit of that doubt.
2. The purposes of the Act are quite clearly stated as being to ensure that the physical, health, and behavioural needs of protected animals – including pigs – are met. Codes of Welfare and MPI regulations are created under, and are subordinate to, the Act. Hence, these should also comply with these stated purposes of the Act. These purposes should not be significantly sacrificed for reasons such as economic advantage, or to cater to the preferences of some producers for certain agricultural practices.
3. NAWAC recognises that "… confining of sows in farrowing crates for extended periods does not fully meet the obligations of the Act." Accordingly, the use of farrowing crates should be prohibited under a revised version of the Code and MPI regulations. Alternate housing systems should be required, that are designed in accordance with scientific evidence and best practice, to minimise piglet mortality.

[18] https://www.wellbeingintlstudiesrepository.org/houcfani/10/

4. The space allowances provided to sows must be sufficient to allow them to exercise their full range of bodily movements, and to exercise all of their natural behaviours. This should be reflected in a revised version of the Code and MPI regulations.
5. The manipulable materials provided to sows must also be of a sufficient nature and quantity to allow them to exercise all of the natural behaviours important to them, including nest building. In accordance with scientific evidence, materials preferred by sows must be provided, such as peat, compost, green branches and various wood chips. These requirements should also be reflected in a revised version of the Code and MPI regulations.

MPI & SPCA Complaints Data

An MPI Animal Welfare/NAIT Analyst/Coordinator was tasked to filter all of the complaints related to pigs received post 01 October 2018 (date to coincide with publication of the most recent Code) to 31 December 2020 and this was presented to NAWAC for their consideration.

The SPCA compliance team also presented NAWAC with a summary of all pig complaints received post 1 October 2018 to 31 December 2020 for their consideration.

Timeline of stakeholder engagement during the pre-consultation period

- **October 2019:** A report drafted by NZ Pork's animal welfare officer for the Farm to Processor Animal Welfare Forum was submitted to NAWAC. This report examined the code of welfare for pigs to determine whether the standards are up to date, adequately reflect best practice, and well implemented. This report was one of the key documents used to inform the code report and code working group.
- **30 September 2020:** NAWAC and MPI met with NZ Pork to inform them that a code review would soon be underway. NZ Pork agreed to identify working group members. NZ Pork submitted information on progress in animal welfare since 2016.
- **2 November 2020:** Outline of the proposed codes review process sent to NZ Pork.
- **1 December 2020:** NAWAC pigs subcommittee members identified.
- **4 December 2020:** NAWAC advised NZ Pork that the working group would not be drafting Minimum Standards 10 & 11; instead, a NAWAC subcommittee would draft those standards, and NZ Pork, farmers and veterinarians would have input as submitters and expert speakers. The balance of the code would be worked on by the code working group.
- **7 December 2020:** First code working group meeting. The members of the working group were: 2 pig farmers (one indoor, one outdoor); 2 pig veterinarians; 2 representatives of NZ Pork; A NAWAC member; and MPI staff members from the science, sector liaison, verification, and compliance teams.
- **15 December 2020:** Pig subcommittee convened and agreed on a Terms of Reference. Conflicts of interest registered. Agreed to post meeting summaries online.
- **16 December 2020:** The pig subcommittee invited NZ Pork to present to them at their first meeting. Attendees included NZ Pork staff, farmers and veterinarians.
- **16 December 2020:** Pig subcommittee meeting with expert speaker from SRUC.
- **17 December 2020:** Farm visit.

- **12 January 2021:** Pig subcommittee meeting with expert speakers from the Norwegian University of Life Sciences.
- **14 January 2021:** Farm visit hosted by NZ Pork.
- **15 January 2021:** The subcommittee met with NZ Pork, pig veterinarians and farmers to have a half-day "whiteboard session" sketching out proposals for farrowing crates and mating stalls.
- **19 January 2021:** Pig subcommittee meeting with expert speakers from the SEGES pig research centre in Denmark.
- **22 January 2021:** Pig subcommittee meeting with expert speaker from the German Federal Ministry of Food and Agriculture.
- **25 January 2021:** NAWAC wrote to NZ Pork to explain how it considers different viewpoints on animal welfare.
- **2 February 2021:** Farm visit hosted by NZ Pork.
- **2 February 2021:** NZ Pork responded with its views on animal welfare and farrowing systems.
- **10 February 2021:** Pig subcommittee meeting.
- **16 February 2021:** Second code working group meeting.
- **16 February 2021:** Meeting with expert speakers from the Swedish University of Agricultural Sciences.
- **18 February 2021:** Meeting with expert speakers from Compassion in World Farming and Humane Society International.
- **25 & 26 February 2021:** Five Domains assessment workshop with expert from Massey University. NZ Pork's representative was invited to attend all (10) follow-up meetings for the Five Domains analysis of farrowing crate and mating systems.
- **26 February 2021:** NZ Pork submits suggestions (via track changes) on the draft code (except for Minimum Standard 10 & 11).
- **9 March 2021:** NZ Pork and farmer representatives were invited to an expert speaker meeting regarding slurry system management.
- **10 March 2021:** NZ Pork shared an early draft of the code (except for Minimum Standards 10 & 11) with its farmers.
- **10 March 2021:** NZ Pork and farmer representatives were invited to an expert speaker meeting with expert from Wageningen University regarding space allowances and tail docking.
- **11 March 2021:** Pig subcommittee meeting with expert speaker from SAFE.
- **11 March 2021:** Pig subcommittee meeting with expert speaker from World Animal Protection.
- **15 March 2021:** Pig subcommittee meeting with expert speakers from New Zealand Animal Law Association.
- **16 March 2021:** Pig subcommittee meeting with expert speakers from EURCAW-Pigs.
- **18 March 2021:** Meeting between NZ Pork, pig subcommittee, and PIC expert speaker.
- **18 & 19 March:** Farm visits hosted by NZ Pork.
- **23 March 2021:** Third code working group meeting. Feedback that NZ Pork gathered from farmers was discussed.
- **6 April 2021:** NAWAC receives written advice from pig specialist veterinarians regarding farrowing systems.
- **6 April 2021:** Submission received from NZ Pork on health and safety in the pork industry.

- **7 April 2021:** NAWAC chair met with the Pig Farmers Group Steering Committee, an independent group of pig farmers, and heard their views on farrowing systems. Advised them of the code review process.
- **8 April 2021:** Fourth code working group meeting, on space allowances and normal behaviour.
- **15 April 2021:** The pig subcommittee met to hear the view of pig specialist veterinarians on farrowing and mating systems.
- **19 April 2021:** Submission received from World Animal Protection on piglet mortality.
- **21 April 2021:** NAWAC met to discuss the draft code, with significant discussion on Minimum Standards 6, 9, 10 and 11.
- **22 April 2021**: NAWAC chair met with NZ Pork to advise them of the discussion to date by NAWAC on Minimum Standards 6, 9, 10 and 11.
- **3 May 2021**: NAWAC videoconference meeting to discuss the draft code.
- **12 May 2021**: Stakeholders invited to comment on their input into the code report document.
- **13 May 2021**: NZ Pork wrote to NAWAC to state that representatives likely to be affected by the code were not adequately consulted.
- **17 May 2021**: Submission received from NZ Pork on space allowances.
- **18 May 2021**: Submission received from pig veterinarian on tail docking.
- **19 May 2021**: NAWAC agreed to progress the draft Code to public consultation.

In addition to these formal meetings, representatives of NZ Pork were in frequent contact with the NAWAC chair by phone.

Section 71 (1) (e) requires that, before recommending a draft Code for public notification, it must be satisfied that “representatives of the persons likely to be affected by the draft have been consulted about it.” NAWAC considers that the above process has met that requirement.

International trends

In most European countries, Australia, the United States and Canada, the use of farrowing crates is allowed in a manner equivalent to New Zealand (4 weeks after farrowing or more).

They are banned in Sweden, Norway and Switzerland due to concerns for sow welfare. There are some exceptions to allow confinement of sows in certain situations to protect piglet welfare. For example:

- In Sweden, regulations allow the sow to have restricted movement if they display aggressive or abnormal behaviour that could risk injuring piglets, but only during the piglets' first few days of life.
- In Norway, very restless sows may be confined for a maximum of seven days after farrowing.
- In Switzerland, the sow may be confined only in exceptional cases (e.g. leg weakness or the savaging of piglets) while giving birth.

Farrowing crates are also prohibited under regulations governing organic production. The European Union Council Regulation 1804/1999 on organic production of agricultural products states that "housing conditions for livestock must meet the livestock's biological and ethological needs and that "all mammals must have access to pasturage or an open-air exercise area or an open-air run".

The European Citizen's Initiative "End the Cage Age" launched in September 2018. It aimed to end the caging of over 300 million animals across the EU including layer hens, rabbits, pigs, quail, ducks, geese and calves. It closed one year later with 1.4 million signatures and became the first animal welfare Citizens Initiative to be accepted to the European Parliament for debate. On 15 April 2021 it was debated in a three-hour public hearing[19]. The EU Agriculture Commissioner promised to "work intensively" to implement the goals of the campaign. He noted that "Farmers should not have to support alone the costs of the transformation. As this is a societal demand, society should support our farmers." A response to the petition is tentatively scheduled for June 2021.

In 2020, Germany passed a bill to phase out conventional crate systems. Crates will be allowed for a maximum of five days around farrowing from 2035.

The legislation includes conditions to encourage producers to make plans to change practice and not hope for a postponement. For example, the producers will have to present a reconstruction plan three years after the legislation is in place. Producers who choose to stop their operations will have to inform the authorities in writing.

In March 2021, the Pig Husbandry (Farrowing) Bill[20] was introduced in the United Kingdom with the aim of prohibiting the use of farrowing crates. As at April 2021 it has yet to have its second reading.

In Austria and Denmark, large-scale projects comparing different farrowing pen systems have been completed recently.

[19] https://www.pig-world.co.uk/news/eu-agriculture-commissioner-backs-campaign-to-ban-farrowing-crates.html
[20] Pig Husbandry (Farrowing) Bill - Parliamentary Bills - UK Parliament

In Austria, sows may only be crated during the "critical phase of life" from 2033. The project Pro-SAU[21] (2018) evaluated farrowing systems using temporary sow crating and found that temporary crating is an effective measure to reduce piglet losses but entails considerably higher investment and labour costs. They recommended also that special focus be placed on pig breeding: breeding strategies only emphasizing litter size are "absolutely counterproductive."

In Denmark, 10% of all nursing sows must be accommodated in a loose housed system by 2021. To support this, the SEGES research centre built a research centre to test ten different pens and released a report in 2018[22]. The focus was on ease of use for staff, working conditions, injuries to animals, and hygiene; piglet mortality was not recorded. All systems had pros and cons – none scored highly in every area.

Significant research projects have been launched in the EU including "Farewelldock", with a project to end tail docking and tail biting on EU farms: https://farewelldock.eu/

EU Reference Centre for Pig Welfare[23]

In March 2018, the European Commission launched its first Animal Welfare Reference Centre.

EURCAW-Pigs is a consortium formed by the Wageningen Livestock Research (the Netherlands), the Friedrich Loeffler Institute (Germany) and the Department of Animal Science at Aarhus University (Denmark).

Outputs such as review documents, factsheets and other information are available on the centre's website.[24]

Review documents (including legal aspects, practical knowledge, inspiring examples and relevant training materials) have been produced on:

- Tail biting
- Farrowing housing
- Sow group-housing
- Transport & lairage

Factsheets have been produced on:

- Tail injuries & tail docking
- Lameness
- Enrichment materials
- Skin lesions
- Body condition score

21 https://www.dafne.at/prod/dafne_plus_common/attachment_download/2523f5fd3c1755c04e1f6666ab7a1fac/Pro-SAU_English_Summary.pdf

22 https://www.varkensloket.be/sites/default/files/inline-files/Erfaring_1803%20UK.pdf

23 https://ec.europa.eu/food/animals/welfare/eu-ref-centre_en

24 https://www.eurcaw.eu/en/eurcaw-pigs.htm

Regulations

Under section 71(1)(d) of the Animal Welfare Act 1999, NAWAC must indicate any matters that it considers should be dealt with by regulations under the Act.

NAWAC proposes the following regulations, or amendments to regulations:

- Regulations 26 and 27 of the Animal Welfare (Care and Procedures) Regulations 2018 set requirements for farrowing and mating stalls under transitional provisions. NAWAC considers that replacement regulations should be set after they expire (currently set for 18 December 2025), particularly if the new minimum standard results in a prohibition. The replacement regulations should reflect the final decision on the replacement standards for Minimum Standards 10 and 11.
- To protect sow and piglet welfare during the transition period, NAWAC recommends that Regulation 26 is amended to require manipulable (nesting) material for all sows in all systems - not just for farms built after 2010. There are safe materials that can be used in fully slatted systems today, such as hessian sacks.
- An amendment to Regulation 25 – Minimum Space for Grower Pigs would be required to match proposed changes to Minimum Standard 6. NZ Pork have indicated that changes to space requirements are impractical and cannot be implemented immediately i.e. there are no feasible or practical alternatives currently available. NAWAC considers that a transitional period of up to 10 years would be required (with the exact time period dependent on Regulatory Impact Assessment and feedback from consultation).
- A new regulation for weaning age should be developed to reflect the final decision on Minimum Standard 16 (Weaning). Depending on feedback from public consultation, NAWAC proposes that Minimum Standard 16(c) should come into force via transitional regulation, because the adverse effects of this change mean it may not be feasible or practical to implement immediately and because not to do so may result in an unreasonable impact on the sector.

Summary of suggested changes to the Code

Stakeholder feedback and suggestions are summarised in the following table and are organised by section of the code.

These are the assigned codes for the sources of suggestions/comments:

1. NAWAC
2. Animal Welfare Science Team MPI
3. Compliance / Verification MPI
4. Farm to Processor Animal Welfare Forum code review
5. NZALA, World Animal Protection, SPCA written feedback
6. Pre-consultation feedback from NZ pig farmers and feedback from NZ Pork

Code section	Source	Suggestion	Resolution
Purpose	6	Refer to other legislation	Included sentence as suggested
Background	1	Clearer wording around surgical and painful procedures	Redrafted
Part 2: Stockpersonship		-	
Introduction	1	Animal sentience should be covered	Added reference to animal sentience
Example indicators	2	Include reference to regulations	Added reference to regulations
Example indicators	1	Include reference to RBPs	Added reference
Example indicators	1	Code should be specified to be up-to-date	Done
MS 1 Stockpersonship	5	Require all *individuals* working with pigs to possess ability and knowledge as per current MS	Not changed – this MS across all farming codes is drafted to allow for staff training and specialisation. Added indicators for staff in training
MS 1 Stockpersonship	5	Require formal training of staff	May not be minimum required under the Act – e.g. staff can be competent from learning on the job. Added new RBP for farms only
MS 1 Stockpersonship	5	Require staff in training to be supervised	Included as an example indicator of meeting the MS for collective staff competency
MS 1 Stockpersonship	5	NZALA report suggests codes should be provided in a format that is legible and understandable e.g. poster, factsheets, etc	NZ Pork has always summarised codes for farmers and can do it for this revision
MS 1 Stockpersonship	6	Training information and EI's are too focused on farms – what about non-commercial operators	Balanced example indicators to refer to a variety of pig ownership situations. Removed 'sufficient number of personnel' – it's a repeat of the MS.
MS 1 Stockpersonship	6	Define 'competence' e.g. align with SPP regs	Definition drafted
General information	6	Update contact information for training org	Done
Part 3: Feed and Water			
Part 3	1	Swap water and food sections – water is the priority	Done
MS 2 Food	1, 2, 4, 5, 6	Hunger in gilts and sows Foraging behaviour is not a feed issue but a behaviour issue	Require the provision of a diet that satisfies hunger and their need to chew, via the provisions of bulky or high-fibre diets. Chewable items now recommended in MS 9.

MS 2 Food	1	Add information regarding hunger in dry sows to GI	Done
MS 2 Food	1	Add lead indicators and description of these indicators for hunger e.g. stereotypy, sham chewing	Done. See EFSA review of welfare indicators and D'Eath et al. (2018) review for evidence.
MS 2 Food	6	Slow release feed like high-fat feed also addresses hunger	Added but kept 'bulky' to address need to chew
MS 2 Food	1	Do not delete RBP about bulky food – although other pigs may not be restricted in feed, they are still at risk of oral stereotypies	Amended to apply to all pigs
MS 2 Food	5	Replace 'adequate' with 'sufficient'. Also, food should be suitable.	Done – (a) now matches other codes Food is suitable if it meets (a), no need to specify
MS 2 Food	5	Failure of automated systems	Require checking as MS.
MS 2 Food	1	Meaning of 'monitored' not clear. Needs to specify physical checks. Increase frequency of checks to 2x per day	Added 'and physically checked' – not just electronic alerts. Increased frequency of checks
MS 2 Food	5	Competition at feeders. Require feeder space/number of feeders to be appropriate and that design/management minimises bullying and aggression	Competition already covered by (b) and expanded in EI. Note that MS's are outcome based and EI's describe how to assess
MS 2 Food	5	(d) should specify how to resolve the issue	Done – wording matches dairy code.
MS 2 Food	2	Align wording with more recent codes	e.g. "Minimise" metabolic disorders; "urgent" remedial action.
MS 2 Food	1	Body condition must not fall below 2. Set a maximum score.	Reworded
MS 2 Food	1	Add behavioural indicators of hunger including sham chewing and describe why the standard is in place in General Information.	Done
MS 2 Food	1	Remove "or excessive straw from eating the bedding" from final EI – straw is encouraged	Done
General information	4	Education required for non-commercial pig keepers regarding appropriate feeding levels for different	Add reference to NZPork's guidance for smallholders. NZ Pork to update and circulate.

		classes of pigs, appropriate diet composition, and body condition of pigs.	
General information	6	Remove “free range pork production”	Done
MS 3 New-born Piglets	1	Importance of colostrum not strong enough in intro	Clarified
MS 3 New-born Piglets	5	No requirement to monitor sows/piglets	Require action to be taken if piglets are not receiving milk – new wording – replaces MS 3b
MS 3 New-born Piglets	5	Move RBP to MS	May not be minimum required under the Act – as long as 3(a) is met
MS 3 New-born Piglets	2	Specify what is meant by substitute for colostrum	Done
MS 3 New-born Piglets	1	Add indicator – piglet facial lesions	Done. See Friedrich et al. 2020 – iceberg indicators
MS 4 Water	5	Competition for water	Already covered in EI; have specified in MS that water must be easily available (matching dairy code)
MS 4 Water	2	Failure of automated systems	Require checking and maintenance
MS 4 Water	5, 6	Add “physiological state of pigs” to introduction. Add appropriate flow rate for age and stage of pigs to EI.	Added physiological state. Added reference to flow rate in EI.
MS 4 Water	1	Add ‘sufficient’ to EI around competition to water – water must be easily accessible at all times. And another that may be an indicator of MS2(b): “Persons in charge understand the daily variations in water demand of their pigs” Make clear that pipes should not freeze in cold weather	Added
MS 4 Water	1	Feedback from vet that water through reticulation systems can be too hot	New EI drafted - During hot weather, drinking water temperature is maintained below x degrees C – vet suggests they are OK to 30 degrees Management of nipple drinkers for pigs (wattagnet.com)
Part 4: Shelter Including Housing Facilities			
Introduction	6	“Warm” in intro is redundant	Removed

MS 5 Shelter for Pigs Outdoors	3, 4	Education required for non-commercial pig keepers regarding appropriate shelter	Discuss application of Regulation 24 – can more outreach be done e.g. joint NZ Pork/MPI/SPCA education
MS 5 Shelter for Pigs Outdoors	5	Several wording changes to MS and associated reg	Asked for evidence that this minimum standard and associated reg is not working – not changed for now – open to more feedback at consultation
MS 5 Shelter for Pigs Outdoors	5	Provide that shelter allows for easy inspection and is built in a way the prevents injury. Require bedding material in cold weather	Included MS to prevent injury from housing – in line with chicken and dairy standards. Bedding already covered in EI – one example of how to meet (a).
MS 5 Shelter for Pigs Outdoors	5	Specify stocking density	Codes usually do not specify this – bottom line is that outcomes (food, behaviour etc) can be met
MS 5 Shelter for Pigs Outdoors	6	Remove MS (b). Unnecessary because if pigs are outdoors they are not in crates.	Keep overall concept of MS (b), as pigs need access to a dry area that is large enough etc if they are kept outdoors.
MS 5 Shelter for Pigs Outdoors	5, 6, 1	Clarify local government statement	Deleted. Not related to shelter, more about environmental regs. Not reasonable to list all local government rules here and keep them updated.
MS 5 Shelter for Pigs Outdoors	1	Add specific risks of outdoor temperature variation to intro	Done
MS 5 Shelter for Pigs Outdoors	1	Specify indicators of cold and heat stress	Added shivering and panting
MS 5 Shelter for Pigs Outdoors	1	Add EI re: hypothermia and hyperthermia – if any pigs in this condition are seen this is an indicator the standard is not meet	Done
MS 5 Shelter for Pigs Outdoors	1	Add EI regarding water pooling inside huts/arks	Drafted
MS 5 Shelter for Pigs Outdoors	1	Sentence about local govt regulations is confusing – is it even about shelter/temperature?	Deleted
MS 5 Shelter for Pigs Outdoors	1	Require means to regulate temperature	Added
MS 6 Housing Pigs Indoors	1, 2, 3, 4, 5	Space requirements need to be reviewed	NAWAC: 10-50% more space may be required to provide for all pigs' needs, depending on their level of activity and the thermal conditions.

			NZPork suggests aligning with Canada's standard (Pigs must be housed at a space allowance of k ≥ 0.0335) with several exemptions. SPCA: Lift MS to RBP World Animal Protection: Suggested replacing the formula with a table Not resolved: Suggested 2 minimum standards Formula/k values should be supported with more general information. Is the k value describing welfare outcomes, or the static space requirements of a pig? Revisited relevance of k value
MS 6 Housing Pigs Indoors	1	Change k value formula to a 'lookup table' based on k values of 0.047 and 0.072. Describe the area required more clearly	Two tables inserted. Ranges are based on the UK standard. Space is calculated using m2 = k x weight^0.67 The top of the weight range is used in each band and then the number is rounded to the nearest 0.05 At 85+, 110kg is used for the calculation
MS 6 Housing Pigs Indoors	6	Increasing space requirement impractical and requires Regulatory Impact Analysis	Noted – MPI informed
MS 6 Housing Pigs Indoors	4	Lesions, lameness and injury from housing	NZPork to bring trigger/intervention levels for lameness and injury into PigCare
MS 6 Housing Pigs Indoors	1	Evaluate 15% threshold – justification needed	Changed example indicators throughout to match AsureWel's 'severe' level for lesions in their illustrated protocol. "Pigs do not have severe lesions (>5cm in diameter), or body marks that cover more than 25% of the skin.". Later amended again – 25% too high; "Pigs, in general., do not have body marks."
MS 6 Housing Pigs Indoors	5	Require that pigs can lie in a natural position	Done

MS 6 Housing Pigs Indoors	4, 5	Raise lux level	Lux set at 40 - in line with EC Directive 2008/120/EC
MS 6 Housing Pigs Indoors	5	Move various EI's to MS including: Require floors to be non-slip and adequately drained; Require alarm and backup for ventilation system; require electrical fittings to be out of reach; prevent pigs having access to toxic materials; ensure staff are trained to monitor and manage equipment; alarm systems, emergency power supply and fire fighting equipment are regularly tested	These are example indicators of the Minimum Standard – already examples of what is required
MS 6 Housing Pigs Indoors	5	Requiring additional space and hiding areas to be provided when pigs are regrouped following separation, in order to minimise the risk of injury during hierarchy formation.	Added to MS 9 (Behaviour). Wording similar to EC Directive 2008/120/EC.
MS 6 Housing Pigs Indoors	5	2/3rds to 3/4s of the space must be bedded.	May not be minimum necessary to meet Act - recommended best practice for now
MS 6 Housing Pigs Indoors	5	The statement "at all times that they are not in farrowing crates or stalls" needs to be removed.	Clarified that this may need to be amended depending on outcome of consultation
MS 6 Housing Pigs Indoors	5	Add cleanliness EI	Done
MS 6 Housing Pigs Indoors	5	Align EIs with more recent codes	Added several more indicators (referencing indoor dairy housing)
MS 6 Housing Pigs Indoors	6	Clarify space formula applies to total space – remove 'lying'	Done
MS 6 Housing Pigs Indoors	1	Review lux and lighting period	Added lighting period RBP to match natural cycle
MS 7 Temperature	2, 3	High mortalities in poultry sheds happen due to ventilation system failures and the same thing can happen in pig systems	Used wording in the Transport Code i.e. "ventilation appropriate to maintain the body temperature within the normal range for the species"

MS 7 Temperature	5	Bedding material for all pigs to maintain temperature	May not be minimum required under the Act (e.g. if they are kept warm another way) – added as RBP
MS 7 Temperature	5	Require daily monitoring and require pigs to be protected from temperature fluctuations	Moved temperature fluctuations to MS as this is the outcome; the EI is the daily checking.
MS 7 Temperature	1	Amend last EI – misting can be negative in a humid climate. Lower temperature – sows have thermoneutral limit closer to 22.	Changed
MS 8 Air Quality	2, 5	Ammonia should not be allowed to reach 25 ppm. Pigs prefer areas at 10 ppm. Align code with other codes (see: 20 ppm in chicken code).	Change 'exceed' to 'reach'. Change to 20 ppm. Add RBP for 10 ppm.
MS 8 Air Quality	1	Lower ammonia level to align with horse code	Done – 15ppm
MS 8 Air Quality	6, 1	Difficult to measure ammonia accurately	Measurements should be taken and interpreted carefully. Added RBP to own device to read ammonia levels
Part 5: Behaviour			
Introduction	6	Amend introduction paragraph, remove reference to dry sow stalls and update last sentence of first para to match Select Committee statement re: 'reasonable range of behaviours'	Done
Introduction	1	Remove reference to 'reasonable range of behaviours', not clear what this means	Removed
Introduction	1	Remove "undesirable" behaviour from second para. The aggressions are adaptive and are only undesirable bc the systems and groupings we put the pigs in.	Removed
MS 9 Behaviour	1, 2, 5	Pigs must have the opportunity to display normal patterns of behaviour	Update list of normal behaviours. Pigs have evolved to root in forest soil using their snouts, mainly involving downward, floor-directed behaviour. Removed basic physiological needs such as eating, dunging (covered under other standards).
MS 9 Behaviour	1, 4, 5, 6	Pigs must have the opportunity to display normal patterns of behaviour. Concerns for pig welfare in	Require manipulable material for all pigs. NAWAC, NZALA, SPCA and World Animal Protection suggest material that can be dug/rooted.

		relation to boredom and frustration, inability to satisfy behavioural motivation.	This would require partially solid flooring. NZ Pork suggests using chains, wood logs etc that can be cleaned and fixed in place. 'Toys' such as chains or balls could be an *addition* to manipulable material like straw.
MS 9 Behaviour	2	Requirement to protect pigs from injury, pain and distress	Require intervention where undesirable behaviour causing pain and distress is detected
RBP 9 Behaviour	2	Toys lose novelty quickly	Suggest that toys are rotated to maintain novelty
RBP 9 Behaviour	1, 2	Suggest opportunities for positive welfare	Include wallowing area as RBP
MS 9 Behaviour	5	All RBPs moved to MS	RBP (a) suggested as MS. RBP (b) moved to MS+EI. RBP (c) may not be minimum required under Act. RBP (d) pigs not getting enough food is covered in Feed section. RBP (e) may not be minimum required under Act but added MS on hiding behaviour. RBP (f) as an "extra" for positive welfare and will stay RBP but materials to show normal pig behaviour is suggested as MS.
MS 9 Behaviour	6	Genetic selection recommendation should be in new section	Moved
MS 9 Behaviour	6	Minor changes to GI section	Done
MS 9 Behaviour	6	Impractical to specify 'rooting' as a behaviour: pigs outside are restricted from rooting via nose rings	Removed rooting as a specific behaviour but retained in RBP and keeping other oral-nasal behaviours
MS 9 Behaviour	6	A combination of materials could be provided e.g. to mix up items that can be chewed, pushed around, hanging, different textures etc.	MS 9 specifies 'a variety' of materials
MS 9 Behaviour	5	Pigs need more space at mixing	Added new standard – opportunities to retreat from other pigs – via extra space or visual barriers
RBP Behaviour	2	Mixing before transport is more relevant to pre-transport selection	Moved
RBP Behaviour	1	Not just monitor for aggression – reduce it	Changed
RBP Behaviour	1	Regarding the use of radios in sheds – is there actually evidence that this is positive?	Removed unless information is received to the contrary

Mixing	1	Add new section to address mixing of pigs	Drafted. Moved relevant draft MS and general information to this section. All EI's referring to lesions throughout code consolidated into this section.
MS 10 & 11	1	Not worked on by code working group – a NAWAC subcommittee redrafted these sections	See NAWAC's view above in literature summary which considered stakeholder views, previous documents, literature, expert advice etc.
MS 11	1	Dry sows need a minimum space	EI now specifies 2.5m^2 each if group housed – slightly higher than EU directive and see group housing review by Verdon et al. 2015
MS 11	2	Align with SPP	Added reference to transcervical reg
MS 12 Boars	5	Space allowances for boars sufficient to allow them to exercise. Space allowances should also provide for completely separate dunging, lying and feeding areas, similar to that provided for sows. Boars are not kept on their own or in isolation any longer.	EI specifies 6m^2 (in line with EU Directive 2008/120/EC). MS specifies that boars must be in contact with other pigs (at least can see or smell other pigs). Exercise recommended.
MS 12 Boars	6	6m2 too large. Remove space requirement	Space requirement not removed, changed to 5m^2 – in line with requirement for farrowing sows
MS 12 Boars	6	Requiring contact with other pigs implies pet pigs cannot be kept on their own	Moved requirement for social contact to RBP
MS 12 Boars	6	Restriction on tethering to apply to all pigs	Consolidated and moved to Housing section
MS 12 Boars	1	Needs to be clear that the new behaviour standard and other relevant standards apply to boars	Added information
Part 6: Handling and Husbandry Procedures			
New Section 6.1 Selection and Breeding	1, 5	NAWAC wants to standardise information available regarding selective breeding across codes since the selective breeding opinion	Include new section: information and RBP regarding selective breeding Unclear if minimum standards can apply to "future" animals For pigs, PICs do not necessarily set the breeding goals – information in code is therefore relatively limited, though concerns remain within NAWAC re: issues like litter size

MS 14 Handling	5	Part (a) doesn't include piglets. Piglets should be supported when being picked up.	Specified all pigs in (a) and added EI regarding support.
MS 14 Handling	1	14b makes it sound OK to pick up a fully grown pig by the back leg	Split into two, one for piglets and one for pigs
MS 14 Handling	1	Muzzles are being occasionally used – should be mentioned/addressed similarly to dogs.	Added wording form dog reg & code.
MS 15 Moving pigs	5	Apply to piglets throughout	Changed 14 (a). Other MS's are tied to regs and already apply to piglets.
MS 15 Moving pigs	5	Restrict prodder use completely, or to situations where human or animal life is in danger. Require they can only be used on muscled hindquarters.	Expanded RBP and guidance – MS needs to allow use in certain situations e.g. for human safety. re: muscled hindquarters, reg already requires this. Added to EI
MS 15 Moving pigs	5	Align with dairy code recs – only use for 1 second, discontinue use if it doesn't work	Done
MS 15 Moving pigs	5	Prevent unnecessary mixing, breaking stable groups, do not force pigs to move at a pace that will cause injury, and do not move injured pigs.	Mixing will sometimes need to be done; added to RBP. Added MS regarding conditions and speed – aligned with 'droving' standard and EIs in dairy code. Injured pigs being treated fits under 'health'.
MS 15 Moving pigs	5	Move dog + alleyways RBP to MS.	Alleyway RBP may not be minimum necessary to meet Act. Dogs are occasionally used but are trained for the purpose. Made clearer
MS 15 Moving pigs	1	More information around safe use of dogs. Strengthen RBP	New EI and reworded RBP
MS 15 Moving pigs	6	Add allowance to use prodders on pigs at slaughter premises	Not relevant on-farm. Included in commercial slaughter code.
MS 15 Moving pigs	6	Wording change to 14 (e) - easier to read	Amended
MS 15 Moving pigs	1	Move electric prodder use RBP to MS	Moved
MS 15 Moving pigs	1	Extend "pigs must not be whipped" standard – must not be beaten with pipes etc	Expanded
MS 15 Moving pigs	2	15 (c) and (d) say almost the same thing	Consolidated and added other sensitive areas as described in NZALA report

MS 16 Weaning	5	Suggestions to move to 23 days or 28 days.	Batch farrowing means many farmers are either weaning at 21 or 28 days. Include guidance on piglet socialisation/natural weaning age in intro.
MS 16 Weaning	5,1	Move EI's on recently weaned pigs being warmed and smallest piglets being individually fed into MS. Current MS too non-specific, almost meaningless.	Moved 2 EIs to MS to make it more specific; didn't move warm/feed standard because it would just be a repeat of other standards (which already apply).
MS 16 Weaning	1	Minimum weaning age to change to 28 days and change RBP accordingly	Changed
MS 16 Weaning	5	Add text to encourage 28 day weaning – recent research shows production benefits	MS changed
MS 16 Weaning	1	Add more EI's around behaviour	Drafted
Section 6.5 Elective Husbandry Procedures	2	Surgical and Painful Procedures regulations come into force May 2021 Align language with other codes	Changes drafted into the code to reflect regulations
MS 17 Elective Husbandry Procedures	4	Education needed on nose clipping/ringing regulation	NZPork will update and circulate good practice guidelines.
RBP 17 Elective Husbandry Procedures	1	Reflect NAWAC statement in SPP submission	New RBP that teeth should not be clipped or ground
MS 17 Elective Husbandry Procedures	5	Move surgical castration, ear notching, and tusk trimming RBP to MS	More information required – e.g. how often are these procedures done, why are they not done in line with RBP etc
MS 17 Elective Husbandry Procedures	5	Note that castration is not routinely performed i.e. only happens in exceptional circumstances or maybe pets.	Done
MS 17 Elective Husbandry Procedures	1, 5	Phase-out of all PHPs recommended	NAWAC has already stated this; copied to Introduction section.
MS 17 Elective Husbandry Procedures	5	Teeth clipping can be avoided through other practices	Added to General Information section
MS 17 Elective Husbandry Procedures	5	Add two EI's around managing risks leading to PHPs	Unsure this is suitable for EIs – may not reflect minimum required under Act – added an RBP

MS 17 Elective Husbandry Procedures	6	Consolidate (c) and (d)	Inserted this way via regulation, not changed
MS 17 Elective Husbandry Procedures	6	Specify tusk of 2cm should be left behind	Added
MS 17 Elective Husbandry Procedures	1	Make link to PHP code clearer & include text around justification	Done
MS 17 Elective Husbandry Procedures	6	Insert recommendation not to ring brachycephalic pigs	Added
MS 17 Elective Husbandry Procedures	2	Rename and align with SPP regs key messages	Done
MS 17 Elective Husbandry Procedures	2	Advice that pain relief is not necessary for tusk trimming (no nerve endings) as long as it's done above gum line. Not just about 'aggressive' boars.	Updated
Elective Husbandry Procedures	1	Move draft definition of 'competent operator' to definitions	Moved
New Section 6.6 Tail Docking	1, 2, 4, 5	Pain at the time of tail docking Ongoing pain in some pigs post-docking due to the presence of neuromas Tail docking is a preventative measure taken to avoid tail biting which may in some cases be managed through alternative (non-invasive) means NAWAC advises that all painful mutilations should be viewed as transitional	New requirement to consider management alternatives first – docking should not be routine (in line with EU standard) Education needed about pig behaviour and prevention of docking – include in code
New Section 6.6 Tail Docking	1	Add more general information about enrichment	Drafted
MS 19 Pre-Transport Selection	2	Align wording with Fit for Transport work	"are fit and healthy for the intended journey."
MS 19 Pre-Transport Selection	5	All pigs selected for transport must be healthy, able to support their weight on all four limbs and are able	Already provided for in the MS.

		to walk unaided, unless a signed veterinary certificate is provided to the contrary.	
MS 19 Pre-Transport Selection	5	Sows within six weeks of their expected farrowing date must not be selected for transport. Sows which have farrowed within 48 hours of loading or who are lactating must not be selected for transport.	Added EI and RBP. Sows not transported in last third of pregnancy – aligned with other animals
MS 19 Pre-Transport Selection	5	Stocking densities on transport vehicles must be adjusted to minimise heat stress. Mixing of unfamiliar pigs on the transport vehicle must be avoided	Noted for transport code.
MS 19 Pre-Transport Selection	6	Minor changes to EI wording	Changed
MS 19 Pre-Transport Selection	1	MS (c) should be more specific	Specified days before farrowing based on OIE Terrestrial Code Chapter 7.3
MS 19 Pre-Transport Selection	1	Make it clear that any shot to the brain requires a follow up method	Done
MS 19 Pre-Transport Selection	2	Received advice on fasting and water from pig transport expert	Added proposed MS and EI
Part 7: Disease and Injury Control			
MS 20 Management of Health and Injury	2, 3	Lameness is a painful health condition Lame pigs are unfit for transport Pig code is not well aligned with other species codes – very few references to lameness	New standard requiring stockpeople to be trained in prevention/identification/treatment of lameness Lift RBP to MS requiring lameness to be treated (or culled)
MS 20 Management of Health and Injury	5	Move first two EIs to MS	The MS requires this already and EI's are indicators
MS 20 Management of Health and Injury	5	Requirement for appropriate preventative action to be taken, to minimise the	Covered in 19 (a)

		likelihood or occurrence of health, injury and welfare problems.	
MS 20 Management of Health and Injury	5	A requirement for any signs of ill-health, injury, poor welfare or the spread of disease (such as excessive rubbing/scratching, lameness, claw lesions, leg injuries or visible abscesses) to be acted upon immediately.	Covered in 19 (a)
RBP 20 Management of Health and Injury	5	Raise (a), (c), (e), (f), (g), and (h) to MS.	Agree that (c), (e), (g) and (h) align with minimum requirements of Act and other codes. Moved to MS. (a) and (f) may not align with Act and remain RBPs
MS 20 Management of Health and Injury	5	Note AMR issue	Included in GI
MS 20 Management of Health and Injury	6	Changes to wording around a sick pen	Changed
MS 20 Management of Health and Injury	6	Lameness standard redundant, covered by 19(a)	Moved to EI
MS 20 Management of Health and Injury	2	After amendments, 19 (b) is redundant – has been split into two more specific standards	Removed
MS 20 Management of Health and Injury	6	Veterinary requirement is covered by 19(b) and normally where there is a significant issue the animal would be destroyed	Re-worded veterinary requirement in line with amended dairy code – vet advice must be sought, or animal destroyed for significant health issue
MS 20 Management of Health and Injury	2	The subject of the degree of pain exhibited by livestock and the need for pain relief is not well presented	Added information about pain relief and new EI.
MS 20 Management of Health and Injury	1	Indicators with 5% and 1% need more clear justification	Changed so that all pigs showing signs of disease are receiving treatment as appropriate
RBP 20 Management of Health and Injury	1	Address routine induction	Added RBP
GI 20 Management of Health and Injury	6	Concrete floors are risk factor for mastitis	Drafted

GI 20 Management of Health and Injury	1	Change reference to concrete floors – more around the bedding and cleanliness	Consulted with expert overseas and referenced EFSA 2007 report - changed
GI 20 Management of Health and Injury	2	Add key messages from prolapse reg	Done
Part 8: Emergency Humane Destruction			
MS 21 Emergency Humane Destruction	1	All on-farm killing sections to be reviewed	Done
MS 21 Emergency Humane Destruction	2	What are contingency plans for e.g. ASF	There is a national plan for response Emergency depopulation would be done by shooting animals
MS 21 Emergency Humane Destruction	5	Pigs should not be killed in front of each other	Added RBP
MS 21 Emergency Humane Destruction	5	Move all EI's to MS	All indicators already align to an MS with the exception of the equipment EI – moved to MS.
MS 21 Emergency Humane Destruction	5	Recommend avoiding blunt force trauma as inconsistency can lead to great suffering	Added RBP and info to GI
MS 21 Emergency Humane Destruction	6	Restrict blunt force trauma to piglets under 20kg	Moved to 15kg after discussion
MS 21 Emergency Humane Destruction	1	Drop max weight to 5kg based on HAS/EFSA	Done
MS 21 Emergency Humane Destruction	6	Add pithing as method to confirm death as well as bleeding	Pithing is an appropriate follow up method, in line with reviews - changed
Part 9: Contingency Planning			
	1	All codes to have a contingency planning / emergency management section	New section drafted
Part 10: Welfare Assurance System			

	1	All codes to have a welfare assurance requirement	Drafted, NZ Pork already well placed with PigCare. Amended after discussion to align with commercial slaughter code requirement.
	6	Can't be applicable to all pigs (e.g. pets)	Clarified – applies to commercial pig farms
	6	Add "where possible and appropriate, the recommendations for best practice…" in 22a	Unsure what 'inappropriate' RBPs would be, not changed