EU Reference Centre
for Animal Welfare *Pigs*

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In this review, alternatives to the permanent confinement of sows during farrowing and lactation are described and the likely outcome of the alternative systems on animal welfare including piglet mortality. Further, an overview is given on national legislation and voluntary label schemes in various EU countries where permanent confinement is banned.

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1 Executive Summary

Alternatives to the conventional farrowing crates for indoor keeping can be divided into two principally different pen types. Systems with **partly solid floor** that allows the sow to divide the pen area into functional zones, and for provision of nest materials enabling sows to carry out net-building behaviour in a more natural way. The other system is pens with **fully slatted floor**, where sows are unable to divide the pen into functional zones, and where allocation of nest materials as straw is difficult due to the risk of clotting the slats and the slurry system. Within these two different pen systems either zero confinement or temporary confinement can be practiced. Zero confinement can also be achieved by keeping sows outdoor in a larger fenced paddock with voluntary access to a farrowing hut positioned in the paddock. In the following we describe alternatives to the permanent confinement system and the likely outcome of the alternative systems on animal welfare including piglet mortality. Further, an overview is given on national legislation and voluntary label schemes in various EU countries where permanent confinement is banned.

2 Introduction

2.1 Terminology

Farrowing housing for sows can differ regarding the time sows are confined in a crate. In conventional farrowing crates the sows are *permanently confined* from the introduction until the end of lactation without the possibility to turn around. Other farrowing housing systems also include a crate, but in these systems sows are confined only temporarily for a certain period around parturition and early lactation. These systems will be termed *temporary confinement* in the following. In some farrowing housing systems, sows are kept loose with zero confinement from introduction to the end of lactation (Goumon et al., 2022). In the following we will use the term *zero confinement* for these systems.

2.2 Background

Confinement of sows during farrowing and lactation has been a widespread practice world-wide since the 1970s. Confinement of sows requires less space and work investment, as manure handling is significantly facilitated by placing a slatted floor behind the sow and automatic handling of manure and urine under the floor. Although confinement provides beneficial effects from the point of management and labour, confinement during farrowing and lactation impacts negatively on sow welfare since confinement prevents most behavioural expression including species-specific nesting behaviour and piglet directed maternal behaviour (see EURCAW-Pigs "Review on farrowing housing and management"). EFSA (2007) concluded through a risk analysis that *"housing of farrowing sows in crates … severely restrict their freedom of movement increasing the risk of frustration"*. In 2022, a new scientific report from EFSA also concluded that *"Lactating sows can be offered more behavioural freedom by housing them in farrowing pens, as opposed to farrowing crates, without increasing pre-weaning piglet mortality"*. Recently, a transnational citizens' initiative in the EU has collected 1.4 million signatures for a ban on cage keeping of animals "End the Cage Age", including confinement of farrowing and lactating sows. Based on this, in June 2021, the EU commission

decided to prepare a proposal for a legislative amendment to the EU directive on animal welfare. The proposal may contain a final ban of permanent confinement of sows during farrowing and lactation.

3 Piglet survival

In the 1970s, piglet mortality in the *permanent confinement* systems seemed to be at the same level (Pedersen and Ingvartsen, 1981) or even lower (Robertsen et al.,1966) than in *zero confinement* systems (14% and 15 % of total born in both systems with 10 and 9 weaned piglets per litter, respectively). Later, piglet mortality was compared between herds with *permanent confinement* and herds with *zero confinement* in countries where *zero confinement* had become a widespread practice either due to a ban as in Sweden (Gustafsson, 1983; Bäckstrøm et al. 1994) and Switzerland (Weber et al. 2007) or due to a tradition of keeping sows free-range as in the UK (O'Reilly et al., 2006; Kilbride et al., 2012). Mortality in these studies varied from around 14-18% of total born with 10-12 total born pigs. None of these studies showed a difference in piglet mortality between herds with *permanent confinement* and *zero confinement*. These studies have in common that prolificacy of the sows at the time of data sampling was relatively low compared to the highly prolific sows used today in many larger herds.

Based on expert opinions and more recent studies including several on highly prolific sows, EFSA (2022) concluded that *zero confinement* is likely to increase mortality from approximately 14 % to 18 % of liveborn piglets if pen sizes are in the range between 4.3 to 6.3 m^2.

Further, EFSA (2022) emphasises a large range of uncertainty in mortality both for the *permanent* and *zero confinement* system, which among other things reflect high impact of management on mortality. For example, the mortality rate is likely higher during a transition period from one system to another, since neither the sows nor the management practice are yet adapted to the *zero confinement* conditions. Thus, the mortality in *zero confinement* systems may be comparable to a badly performing farm with *permanent confinement*. Also, according to the expert opinions and scientific literature, increasing pen size to a minimum of 7.8 m^2, with an available area of 6.6 m^2 for the sow, will likely result in similar mortality rates for *permanent* and *zero confinement* systems (EFSA 2022).

On top of this, prolificacy of sows play a large role for mortality. High prolific sows give birth to more piglets of lower birth weight and thus piglets are more susceptible to risk factors for death (Baxter et al. 2020). Most sow lines are selected based on production in *permanent confinement* and the genetics that perform well in one environment may not necessarily do so in another environment. A recent study (Kobek-Kjeldager et al., 2020b) with highly prolific sows (average of 17 liveborn piglets) showed that piglets from *zero confinement* compared to *permanent confinement* had a 1.6 times higher risk of dying, regardless of whether the sow nursed 14 or 17 piglets. In comparison, the risk of dying was 2.0 times higher in litters with 17 versus 14 piglets. Thus, mortality seems to be affected at least as much by large litters as by the housing system, as also indicated by Weber et al. (2009). With increasing litter size the proportion of small and weak piglets increases and so does the risk of sows being depleted from energy (Baxter et al., 2020). The combination of weaker piglets and an energy depleted sow likely puts piglets at a higher risk of being crushed in an indoor *zero confinement* system. Thus, during the transition from *permanent* to *zero confinement*, attention to the choice of genotype may be as important as the choice of housing (Baxter et al., 2018). A genotype with lower litter size will in general, irrespective of housing system, likely contribute to improved survival of piglet as

emphasised by EFSA (2022). Therefore, a way to reduce mortality rate in *zero confinement* would be to increase the weight on survival traits in breeding programs, and ensure that future genetic evaluation and selection take place under *zero confinement*.

4 Legislation and welfare label schemes

So far, five European countries have introduced an actual ban on permanent confinement systems. These countries are Sweden, Norway, Switzerland, Austria and most recently Germany. The wording of the legislation differs between these countries in terms of the condition and duration under which a shorter period of *temporary confinement* is allowed. In the national legislation of Sweden, Norway and Switzerland *temporary confinement* is only allowed under certain conditions where sows e.g. need medical treatment and/or the sow shows signs of aggression after farrowing. In contrast, the legislation in Austria and Germany allows *temporary confinement* for a few days around farrowing. All countries have minimum space allowance ranging from 5 to 7.5 m^2, and all require some part of the floor to be solid, although with different minimum space requirements. Also, each country has sharpened the demand for nesting materials beyond the current requirements in the EU legislation. A summary of the legislative measures in the five European countries is showed in Annex 1.

In addition to national legislation, there are also several national welfare label schemes demanding alternatives to the *permanent confinement* (Sørensen and Schrader, 2019). Below are some examples.

Denmark: The Danish Governmental label "Better Animal Welfare" (https://bedre-dyrevelfaerd.dk) : Level 1 and 2 allow *temporary confinement* for respectively 4 and 2 days, while Level 3 demands *zero confinement* with farrowing and lactation taking place outdoor in a paddock with free access to huts. The latter includes the Danish organic label (Ø-mærket).

Germany: In Germany, the premium level of the German Animal Welfare Federation demands production with *zero confinement* in farrowing pens with at least 7.5m² (https://www.tierschutzlabel.info). A second label in Germany is the NEULAND® label, which also demands *zero confinement* in pens of at least 7.5 m² from 2027, (https://www.neuland-fleisch.de).

The Netherlands: The Dutch private welfare concept "Beter Leven keurmerk" has three levels, with the first level as the predominant product in supermarkets. Level 1 allows *permanent confinement*, level 2 allows *temporary confinement* for maximum 5 days and a pen size of at least 6.5 m², level 3 (incl. organic) allows *temporary confinement* for 3 days (if organic *zero confinement* is demanded) and a pen size of 7.5 m² indoor and 2.5 m² outdoor as minimum.

5 Indoor alternatives to permanent confinement

5.1 Pens with partly solid floor

This pen type is designed in a way that improves sows' possibility to display species-specific behavior and for dividing the pen into functional areas e.g. for resting, eating and dunging (Pedersen et al., 2013). Pens with partly solid floor and *zero confinement* reduce the impact of several of the risk factors for sow welfare

identified for the *permanent confinement* system (EFSA, 2022). A pen design with partly solid floor allows for allocation of nesting materials, and thus for the sow to perform nesting behaviour with functional materials (Westin et al., 2013; 2015a). Sows get more space for undisturbed resting and for postural changes. They get sufficient space for turning around and can take a few steps within the pen to divide the pen into functional zones. Moreover, the sow can move away from those piglets who are massaging the udder to stimulate milk production. The absence of bars around the sow during nursing will improve piglets' access to the teats, and thus reduce risk of teat fighting.

The division of the pen into functional zones not only allows sows to leave the nest for defecation. In addition, a study by Malmkvist et al. (2012) showed that at increasing room temperature sows increasingly spent time on the slatted floor during daytime, and despite increased signs of heat stress, the feed intake of the sows and piglet growth were largely unaffected, and the solid floor was largely kept un-soiled. This example indicates that to some extent it may be easier to mitigate the negative consequences of heat stress otherwise seen on milk production and piglet growth when sows are permanently confined (Prunier et al., 1997).

To establish functional zones, the pen size should according to EFSA (2022) be at least 6.3 m^2, with an available sow area of 4.9 m^2. The width of the pen should preferably be sufficient for the sows to stand crosswise in the pen (> 2.0 m). If the pen is too narrow, feces may end up in the feed through or on the solid floor. Too narrow pens can also lead to increased mortality (Cronin et al., 1998). The area of the pen with solid floor should be longer than a sow length (>2.3 m) in order to ensure that the pigs are born on the solid floor. The exact width and length are difficult to provide since the size of sows varies between breeds and age, and depends on the specific production methods used in each herd, e.g. feeding rate and age at first conception.

If the pen size is above 6.3 m^2, it is possible to wean the piglets by moving the sow out and leaving the piglets in the pen they are born in (See Fig 5.1.1B). This reduces weaning stress (Colson et al., 2012), facilitates post weaning growth (Winters et al., 2022) and play behaviour indicative of positive welfare (Amorin Franchi et al., 2022). Pigs can remain in the farrowing pen until 30 kg or until slaughter depending on the pen size. This production system is often used in Norway, where the use of *zero confinement* has been common practice for more than 20 years.

In pens larger than 8.0 m^2, with an available area for the sow of 6.9 m^2, sows are able to establish a barrier between the nest and the feeding/defecation area and are able to turn around in both areas. At this pen size the negative consequences for piglet mortality also seem to be reduced (EFSA, 2022).
Besides the provision of sufficient space, certain design criteria must be met to reach the full welfare potential. Ample amounts of nesting material, such as straw or similar materials, must be provided to stimulate the expression of nesting behaviour (Westin et al. 2015a), to minimize the risk of hypothermia in pigs at birth (Pedersen et al. 2016), to reduce the incidence of skin lesions on the pigs' front knees (Westin et al. 2015b), and to meet the need of both sow and piglets for foraging materials (e.g. Telkänranta et al., 2014).

The solid floor should be insulted to improve thermal comfort of both sow and piglets. If insufficient nest materials are provided, heating the birth site during the peri-parturient period can serve as an alternative means to reduce the risk of hypothermia at birth and thus of neonatal death (Malmkvist et al, 2006). After

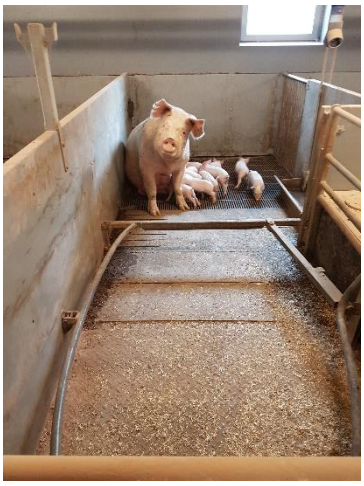
piglets have suckled colostrum, a heated creep area separated from the sow can be used to lead piglets away from the danger zone near the sow, and thereby reduce risk of crushing (Marchant et al., 2001; Morello et al., 2019). In addition, the creep provides a thermal comfortable resting area for the piglets.
In order to support the sows to lie down slowly and thus reduce the risk of crushing, sloping walls can be established in the nesting area of the solid floor. Sows prefer to lean against walls during lying down in contrast to lying down along rails placed low above the floor (Damm et al, 2006). By designing the pen with sloping walls (See Fig 5.1.1A) in the nest area it is possible to stimulate the sow to rest and nest-build in the area with solid floor, nest material and/or floor heating. The sloping walls further ensure that the pigs can hide behind the lower part of the sloping walls when sows lay down and thereby avoid being crushed (Pedersen et al., 2013).

Since sows prefer to build their nest isolated from other sows, the slatted floor area can further be made unattractive as a resting/nesting area by establishing open partitioning to neighboring pens. This makes the slatted area unattractive both socially and thermally. In addition, sows prefer to defecate outside the nest and away from the feed (Andersen et al., 2011). If the feed trough is placed on the transition to the slatted floor or on the short side of the slatted floor area, the sow can move away from both the nest and the feed through when defecating on the slatted floor.

To reduce the sow's motivation to build a nest in the slatted floor area, rails can be positioned approx. 20 cm above the floor. This will further secure the piglets from being crushed against the wall if the sow lies down in this area. In pens designed according to these principles, and being 7.4 m^2, more than 80 % of the sows were building a nest and giving birth to the piglets on the solid floor (Malmkvist et al., 2012).

When sows nest on the solid floor the likelihood that manure and urine are positioned on the slatted floor is higher, and thus the risk of pen fouling and poor hygiene is lower. A prerequisite for the solid floor to be kept clean is that all the above-mentioned design criteria are used in combination with sufficient space, good ventilation and room temperature, as they together control the animals' choice of zones for different behaviors. To further facilitate a clean floor, a sloped floor or a short floor section with minimal drainage (3-5 %) could also be used.

Temporary confinement can be performed in this pen type, if the pen is equipped with an adjustable bar (Fig 5.1.1C, www.freefarrowing.org). The adjustable bar can be moved towards the sows during the periparturient period, and later moved towards the creep area to open the entire pen area for the sow after a few days.


A ***B*** ***C***

*Figure 5.1.1: Examples of pens with partly slatted floor and zero confinement (**A**, © Cecilie Kobek-Kjeldager), pens with partly slatted floor, zero confinement and designed to raise piglets until slaughter (**B**, © Hanne Kongsted, AU), and pens with partly slatted floor and temporary confinement (**C**, © www.freefarrowing.org)*

5.2 Pens with fully slatted floor

This pen type is typically around 4-6 m^2, with a fully slatted or drained floor. Due to the lack of solid floor, piglets must have access to a heated creep area with solid floor separated from the sow to comply with the EU Directive on farrowing accommodation stating that "*A part of the total floor, sufficient to allow the animal (here piglets) to rest together at the same time, must be solid or covered with a mat, or be littered with straw or any other suitable material*". As for pens with partly solid floor, the creep area provides a secure zone, where piglets are safe from being stepped on or crushed by the sow during her postural changes.

Since this pen type is usually less than 6.3 m^2, the sow cannot divide the pen into functional zones. In addition, the uniform floor prevents the sows from being able to thermoregulate by seeking out cooler or warmer floor surface. The pen, however, still allows the sow to turn around and for postural changes but limits the possibilities of using nesting materials such as straw or similar organic materials. However, ropes, strips of paper or a jute sack can be assigned as nesting materials to give some relief for the motivation for nest building (Bolhuis et al., 2018, Swan et al., 2018). Often, this pen type is used in combination with *temporary confinement* by having adjustable bars for confinement (Fig 5.2.1).

Figure 5.2.1: Example of a pen with fully slatted floor and possibility for temporary confinement (© www.freefarrowing.org)

6 Outdoor alternative to permanent confinement

The most extensive form of *zero confinement* can be achieved by keeping sows outdoor in a paddock with free access to farrowing huts in which the sow typically rests and gives birth to her offspring. In this system, sows are moved to a paddock 7-10 days before expected farrowing and remain there until the piglets are weaned. Preferably, each sow is given access to an individual paddock at least the week before and after farrowing to allow sows to isolate themselves. Outdoor farrowing is seen in some organic productions and other animal welfare schemes, e.g. in the UK and DK. Some countries have national regulations on the size of the paddock. For example, a common paddock size ranges from 300-1000 m^2 per sow, depending on the number of days per year the paddock is being occupied by a lactating sow. Paddocks should preferably be rotated regularly between batches of farrowing. Rotation maintains tree/grass cover which reduces risk of ground water pollution and soil destruction. In addition, rotation also reduces risk of infection and nematode transmission between batches.

The outdoor keeping of sows presents good prerequisites for achieving high animal welfare for both sows and piglets. For instance, sows and piglets can move and forage over a much larger area than when kept indoor. Sows can exhibit functional nesting behaviour and other types of maternal behavior (Schild et al., 2020). Access to the outdoor area ensures that the hut is kept clean as both sows and pigs move out and away to defecate and urinate. The sow can withdraw herself from the pigs and thereby gradually reduce access to the teats for the piglets, whereby a gradual weaning takes place over a longer period (Damm et

al.2003). The gradual weaning may further be encouraged through piglets' early interest in other food sources than sow milk facilitated by social learning from mother to offspring or from older piglets (Figueroa et al., 2013; Oostindjer et al., 2011). In addition, the possibility to socialize with piglets from other litters can easily be accommodated. Early socialization is known to provide piglets with social skills at an age where aggressive behaviour is less likely to occur (Kutzer et al., 2009; Petersen et al., 1989). Also, the enriched environment pre-weaning stimulates play behaviour with positive effects on piglets' social skills post-weaning (Martin et al., 2015). In short, the enriched environment stimulates the expression of species-specific behaviour. Further, good health seems to be achieved as evidenced through a much lower use of antibiotics than in more intensive systems (Nielsen et al., 2021). An important aspect to ensure good health is proper and double fencing. This reduces the risk of infectious diseases such as African Swine Fever spreading from e.g. wild boars.

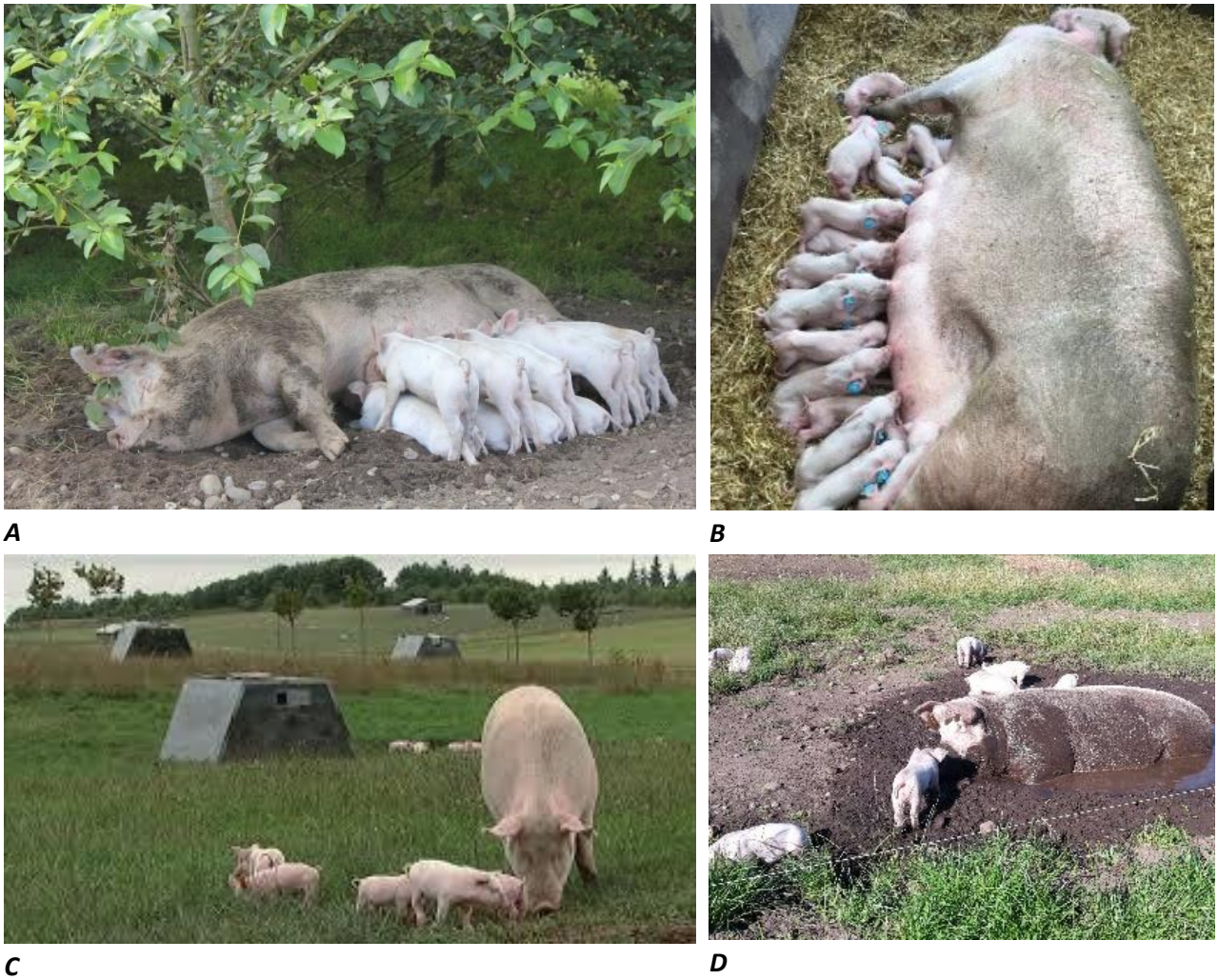
6.1 Hut design

There are many different types of huts on the market. The most common hut type is the A-framed hut (see Fig 6.2.1C). The size of these are 4-5 m^2, and they typically contain no specific features inside. The hut must be littered with a thick layer of straw or similar material (approx. 15-30 cm) to provide plenty of nesting materials and a soft and thermally comfortable nesting area for both sow and piglets, particularly during cold seasons. In addition, huts must be well insulated and with the possibility of ventilation to ensure a thermally comfortable climate inside. Outside, the possibility to seek shadow must also be present in order to avoid sunburn and heat stress (Schild et al., 2018). Shade can be established by trees, and/or devices mounted on the outside of the hut. When the outside temperature exceeds 16 °C, a mud hole should be established so allow pigs to thermoregulate through wallowing (Bracke et al., 2011). To protect piglets from extreme weather conditions and predators, piglets can be kept inside the hut until they are about 7-10 days. This can be done by attaching a forecourt to the hut or by setting up a step board that the sow, but not the newborn piglets, can pass. Step board/forecourt is then removed around day 7-10 after farrowing.

Huts must be designed to facilitate surveillance and human management to care for sow and piglets. There are a few designed huts on the market with improved accessibility e.g. through a separate man-entrance that protects the care-taker during management. These may also be equipped with protection rails/sloping walls on the side to protect piglets from being crushed and even provide a separated creep area for the piglets that can be heated with electricity or gas (Malmkvist and Pedersen, 2022).

6.2 Pig breed

The outdoor production is challenged by high piglet mortality, among other things as a result of the use of conventionally bred sow lines that are selected for large litters under *permanent confinement* conditions (Rangstrup-Christensen et al., 2018). These give birth to more piglets than the sow can care for. When highly prolific sows are used, surplus piglets must be cared for by nurse sows to avoid high mortality rates (Baxter et al., 2020). Such management procedures are however difficult to implement in the outdoor system and do not meet the IFOAM organic principles of health and care (https://www.ifoam.bio/why-organic/shaping-agriculture/four-principles-organic). Therefore, production with outdoor farrowing should consider the use of less prolific breeds to facilitate good welfare (e.g. Schild et al., 2020).



A ***B***

C ***D***

Figure 6.2.1: Examples of sows kept in zero confinement by outdoor keeping on paddock with free access to huts. ***A****. Access to poplar trees in the paddock to provide shade, enrichment and uptake of nutrients to reduce loss.* ***B****. Inside a farrowing hut.* ***C****. A-framed huts on paddock.* ***D****. Access to wallow for thermoregulation (© AU)*

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Annex 1. Overview of national legislation in five European Countries that introduced a ban of permanent confinement

Country	Transition period		Min. space (m^2)	Min. solid floor (m^2)	Temporary confinement accepted	Criteria for nest materials sharpened	Link to legislation text
	New building	All					
Sweden	1988	1993	6 (7) in case of deep straw bedding)	4	Only in case sows show aggression OR during cleaning and treatments	Yes. Allocation of bedding material the week before farrowing to enable nest building	www.jordbruksverket.se
Switzerland	1997	2007	5.5	2.25	Only in case sows show aggression towards piglets OR in case of lameness (max 4 days)	Yes. Sufficient materials for the sow to be able to carry it in its mouth e.g. straw must be allocated days before farrowing (chopped straw and sawdust are not sufficient).	https://www.blv.admin.ch/blv/de/home/tiere/tierschutz Animal Protection Ordinance (AniPO) Article 50 (page 20) and Annex 1, Table 3 (page 96)
Norway	2000	2003	6 (min 1.8 m wide)	Sow must be able to lay on solid floor	Only in case sows being restless during/after farrowing (max 7 days)	Yes. Lying area must be solid with possibility to enable allocation of nest materials	https://lovdata.no/dokument/SF/forskrift/2003-02-18-175
Austria	2023	2033	5.5	1/3 of the floor must be solid. Max 5 % slatts	YES. Max 6 days around the critical period of farrowing (1 d before to 5 d after)	Yes. New buildings must enable allocation for nest materials	https://www.ris.bka.gv.at
Germany	2021	2036	6.5	Yes[a]	YES. Max 5 days	Yes, through a specified interpretation of the EU Directive	https://www.gesetze-im-internet.de/tierschnutztv/ Execution instructions: https://www.openagrar.de/servlets/MCRFileNodeServlet/openagrar_derivate_00050720/E-1-Ausfuehrungshinweise-Schweine-2022-10.pdf

EU Reference Centre for Animal Welfare *Pigs*

About EURCAW-Pigs

EURCAW-Pigs is the first European Union Reference Centre for Animal Welfare. It focuses on pig welfare and legislation, and covers the entire life cycle of pigs from birth to the end of life. EURCAW-Pigs' main objective is a harmonised compliance with EU legislation regarding welfare in EU Member States. This includes:

- for pig husbandry: Directives 98/58/EC and 2008/120/EC;
- for pig transport: Regulation (EC) No 1/2005;
- for slaughter and killing of pigs: Regulation (EC) No 1099/2009.

EURCAW-Pigs supports:

- inspectors of Competent Authorities (CA's);
- pig welfare policy workers;
- bodies supporting CA's with science, training, and communication.

Website and contact

EURCAW-Pigs' website www.eurcaw-pigs.eu offers relevant and actual information to support enforcement of pig welfare legislation.
Are you an inspector or pig welfare policy worker, or otherwise dealing with advice or support for official controls of pig welfare? Your question is our challenge! Please, send us an email with your question and details and we'll get you in touch with the right expert.

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- **Legal aspects**
  European pig welfare legislation that has to be complied with and enforced by EU Member States;
- **Welfare indicators**
  Animal welfare indicators, including animal based, management based and resource based indicators, that can be used to verify compliance with the EU legislation on pigs;
- **Training**
  Training activities and training materials for inspectors, including bringing forward knowledge about ambivalence in relation to change;
- **Good practices**
  Good and best practice documents visualising the required outcomes of EU legislation;
- **Demonstrators**
  Farms, transport companies and abattoirs demonstrating good practices of implementation of EU legislation.

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