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# *Auditing animal welfare and making practical improvements in beef-, pork- and sheep-slaughter plants*

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## Abstract

*A welfare audit that utilises numerically scored, animal-based outcome measures has been used successfully by McDonald's and other restaurant companies for over ten years. In 2010, audit data from two restaurant companies indicated that all 30 of their North American plants rendered 95% or more of the cattle insensible with a single shot from a captive-bolt gun. Eight pork plants that used electrical stunning placed the tongs correctly on 99% or more of the pigs. All animals were insensible prior to hoisting. In 32 beef plants, the percentage of cattle vocalising in the stunning area was 5% or less. In 94% of the beef plants and 86% of the pork plants, none of the animals fell during handling. The worst falling score was 2% in two of the plants. High standards were attained by making simple changes. To improve welfare, plant managers did the following: improved stunner maintenance; installed non-slip floors in stun boxes and unloading ramps; and trained employees. To reduce balking and improve animal movement, the following modifications were made: illumination of dark race entrances; moving of lamps to eliminate reflections; reducing equipment noise; stopping employee yelling; installation of solid sides on races or shields to prevent animals from seeing activity outside the facility; and the elimination of air blowing in the faces of approaching animals. Employees were trained to use behavioural principles of animal handling such as the point of balance and the flight zone. The five numerically scored outcome measures in this audit are critical control points that can detect a variety of problems. They are: i) the percentage of animals stunned effectively with a single application of the stunner; ii) the percentage of animals falling during handling must be 1% or less to pass; iii) the percentage of pigs or cattle vocalising (moo, bellow, squeal) in the stun box or while entering into the stun box must be 5% or less to pass (vocalisation scoring is not used for sheep); iv) the percentage of animals moved with an electric goad; and v) the percentage of animals rendered insensible before hoisting must be 100% to pass an audit. An animal is scored as either silent or as a vocaliser and whether stunned correctly with a single application or not stunned correctly. The audit also contains a list of banned practices that will result in an automatic failure. To maintain improvements in handling, 23 plants have installed video cameras that are monitored by auditors viewing the footage over the internet. These external auditors perform numerical scoring at random times throughout the day. Video auditing over the internet is an important new tool for improving welfare.*

**Keywords**: *animal welfare, auditing, handling, slaughter, stunning, vocalisation*

## Introduction

Welfare audits conducted by major customers have shown that there have been great improvements in the stunning and handling of animals at US and Canadian beef and pork slaughter plants. These improvements are due to both the audit programmes of major restaurant chains and the increased humane slaughter enforcement by the USDA (US Department of Agriculture) veterinary inspectors. Before the customer auditing programmes started in 1999, only 30% of the plants were able to render 95% of the cattle insensible with a single shot (Grandin 1997, 1998a). In 2010, data obtained from two restaurant companies indicated that all 30 of the beef plants they audited for stunning were able to accomplish this. In 77% of the beef plants, 99 to 100% of the cattle were rendered insensible with a single shot from a captive-bolt gun. In eight pork plants that used electrical stunning, the tongs were placed in the correct position on 99% or more of the pigs. Vocalising during stunning and handling was also reduced drastically. Baseline data collected before the auditing started indicated that the average percentage of cattle that vocalised (moo or bellow) was 7.7% and the worst plant had 32% of the cattle vocalising due to excessive pressure from a restraint device (Grandin 1997, 1998b). In 2010, audit data collected by third party auditors in 32 beef plants showed a huge improvement. Ninety-seven percent of the US and Canadian beef plants had 3% or less of the cattle vocalising. The worst score was 5%. A kosher plant that used an upright restraint box had a 2% vocalising score. In contrast to this a survey conducted in a beef plant in France indicated that 25% of the cattle vocalised in a restraint device (Bourquet *et al* 2011).

For both beef and pork, the percentage of animals that fell down during handling was also greatly reduced. In 1996, when baseline data was collected in six plants, two plants had 12 and 8% of the animals falling down. Three plants had 0 to 0.5% falling. In 2010, falling was scored in 32 beef plants and 22 pork plants. Ninety-four percent of the beef plants and 86% of the pork plants had no animals falling. The worst falling score was 2% in two of the plants. Both the stunning area and the unloading ramp were included in the falling score. The year 2010 was also excellent in ensuring that all the pigs and cattle were insensible before they were hoisted to the rail. Twenty-two pork plants and 32 beef plants rendered all of the animals insensible before hoisting to the bleed rail. In the beef plants, 81% of the beef plants (26 out of 32) used electric prods on 5% or less of the cattle. Of 22 pork plants observed, electric prods were used on 5% or less of the pigs in 17 plants.

## Materials and methods

### Description of the Numerical Scoring System

To pass a restaurant audit, a plant must receive an acceptable score on all five of the numerically scored core criteria. A brief summary of the auditing system is shown below. It is described in more detail in (Grandin 1998a, 2010b,c). In each plant, 100 animals were scored. The complete American Meat Institute auditing system is available online at www.animalhandling.org.

*1 Percentage of animals rendered insensible with one application of the stunner*

For captive-bolt stunning, 95% or more of the animals must be rendered insensible with a single shot. For electric stunning, the electrodes must be placed correctly on 99% of the animals to ensure that the current is passed through the brain.

*2 Insensibility audit*

To pass the audit, 100% of the animals must be rendered insensible before they are hoisted to the rail or invasive procedures are started. Criteria for determining insensibility are described in Grandin (2010a,b) and Gregory (2007).

*3 Percentage of cattle or pigs that vocalise (moo, bellow or squeal)*

Vocalisation is scored in the restrainer, the stun box, and while entering the stunning areas. It must occur in only 5% or less of the animals. For cattle where a head-holding device is not used, the score has to be 3% or less. Each animal is scored on a per animal basis as either vocal or silent. Vocalisation is correlated with physiological measures of stress (Dunn 1990; Warriss *et al* 1994; White *et al* 1995; Weary *et al* 1998). Vocalisation scoring is not used for sheep.

*4 Percentage of animals that fall*

This is scored throughout the entire facility including the stun box, the races, and unloading ramp. A score for a fall occurs if the animal's body touches the floor during handling. The score must be 1% or less of the animals. Stun boxes that are designed to make conscious animals fall down are an automatic audit failure.

*5 Percentage of animals moved with an electric goad*

For cattle and pigs, an excellent score is 5% or less. OIE guidelines state that electric goads should not be used on sheep, horses, or infant animals (OIE 2009). This is scored on a per animal basis: moved with an electric goad or not moved with one.

*6 Acts of abuse*

Any act of abuse such as dragging non-ambulatory animals, deliberate slamming of gates on animals or poking sensitive parts of animals results in an automatic audit failure.

## Results and recommendations

### Simple improvements enabled most plants to pass their animal welfare audits

In most plants, expensive modifications and complete renovations of the stunning area and lairage were not required to pass the audits. The recommendations that are given in this paper are based on the author's experience and data collected by the author in over two hundred slaughter plants in North America, South America, Europe, Asia, Australia, and New Zealand. Greatly improved employee training was the first thing that was required. The training programmes in most plants included the following basic instructions.

• No yelling, screaming, and whistling. People yelling at livestock is very stressful (Waynert *et al* 1999).

• The flight zone and the point of balance principles are used for moving animals in a quiet manner. These methods are described in detail in Grandin (2007, 2010a). Handlers also need to be taught not to stand where approaching animals can see them. Many animals may refuse to move forward if they see people ahead.

• Move small groups of cattle and pigs in separate bunches. Quiet handling will require handlers to do more walking as they will have to make more trips to the lairage to move small groups to the stunning area. The crowd pen (forcing pen) that leads to the single-file race should be filled only half full so that animals have room to turn. There is a species difference with sheep as they should be moved in one continuous flow and in larger groups if necessary.

• People should not routinely carry electric goads (prods). A flag or some other non-electric device should be a person's primary livestock moving tool. In 2010, most plants audited by a customer had only one electric goad that was kept in a convenient location near the entrance to the stunning box or restrainer. It was only picked up to move an occasional stubborn animal and was then put away. Most plants have completely banned electric goads for unloading trucks and moving animals out of the lairage or stockyards. In some plants, electric goads are also banned in the crowd pen that leads to the single-file race. Some people who are concerned about animal welfare have recommended that electric goads should be banned completely. The author does not recommend this because she has observed many cases where a stubborn animal was moved with abusive methods such as hard hitting or poking in sensitive areas. A



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short shock from the electric goad is preferable to hard tail twisting. After the electric goad is used, it must be put away because people who constantly carry electric goads tend to use them all the time.

• It is recommended that employees are trained to time bunches of animals. Cattle and pigs will follow the lead animal and move more easily into the single-file race, if it is partially empty before the next group is brought into the crowd pen (forcing pen). The crowd pan should become a 'passing-through' pen. The animals should pass through the crowd pen and into the single-file race without stopping. This promotes following. If the crowd pen is filled when the single-file race is full, the animals tend to turn around because they cannot enter a full race. After they have turned around it will become much more difficult to induce them to enter the race.

### Simple methods to improve captive-bolt stunning

• Careful maintenance of the captive-bolt stunner is very important. Poor maintenance was a major cause of captive-bolt failure (Grandin 1998a). The stun guns must be completely serviced every day. In the US, many plant managers purchased a test stand that can be used to determine that the captive bolt is hitting with sufficient force (Grandin 2005).

• Store cartridges for captive-bolt stunners in a dry location such as an office. Cartridges stored in a damp location may be less effective (Grandin 2002).

• A non-slip floor in the stun box is essential. Animals become agitated when they slip. A diamond plate steel floor often becomes slippery. To improve footing, 2-cm diameter steel rods can be welded to the floor of the stun box in a 30 × 30 cm square pattern. This stops small, rapid, sideways slips that cause cattle to constantly move and not stand still.

• Pneumatic stunners must have a sufficient air supply that is filtered and lubricated. The compressor has to be big enough to maintain the manufacturer's recommended air pressure when the stunner is shot many times in rapid succession. The author has observed plants that had an excellent maintenance programme for the captive-bolt gun, but the air compressor had been neglected. Problems with the air compressor resulted in poor stunning. One common problem is an undersized compressor. Air accumulator tanks must not be used as a substitute for a larger compressor. An air accumulator tank will not maintain adequate pressure if the stunner is shot many times in rapid succession.

### Simple methods to improve electric stunning

• Audit for the correct placement of the electrodes so that the current flows through the brain. The brain has to be in the current path to induce an epileptic seizure and render the animal insensible (Croft 1952; Lambooij 1982; Lambooij & Spanjaard 1982). Placement of the tongs on the animal's neck is not acceptable.

• A good bleeding technique is essential. Problems with signs of returning to sensibility were reduced in pigs when the bloodflow was increased (Grandin 2001a).

• Bleed the animal within 15 s when head-only reversible stunning is used (Lambooij 1982; Blackmore 1984; Wotton & Gregory 1986).

• When animals are stunned in groups on the floor by the head-only method, problems with animals returning to sensibility can be reduced by applying the electric tongs to the chest after the initial head stun (Vogel *et al* 2010). This method eliminated rhythmic breathing, spontaneous natural blinking, righting reflex, and eye tracking (Vogel *et al* 2010). This simple two-stage method is an easy way to fix a serious welfare problem in smaller plants that stun pigs or sheep in groups on the floor.

### Methods to improve pig handling in gas-stunning systems

Unfortunately, some of the most serious problems with gas stunning are expensive to fix. One of the most common problems observed by the author is an undersized machine: the handlers overload the gondolas in order to keep up with the line. There is no simple, cheap method to fix this. A larger machine with greater capacity will be required. The author has observed an extra pig being forced into each gondola with an electric goad because the line speed had exceeded the capacity of the machine. This resulted in the pigs being forced to jump on top of each other. With the newer gas stunning machines, where the pigs are handled in small groups, it will be possible to reduce or eliminate electric goad use. When a new machine is being purchased, the group-handling system that eliminates the single-file race is strongly recommended. The author has also observed problems with the automation of the push gates which result in pigs being knocked over and scraped along the floor. To prevent pigs from being knocked over automated push gates can be equipped with a hand control. The gate advances only when a person pushes the button. The author has improved the handling of pigs into group $CO_2$ machines by equipping the system with hand-operated buttons to control the movement of the gates. After the pigs are moved up to the $CO_2$ machine, an automatic control returns the gates to the start position. This puts it in position to bring up the next group of pigs.

### Methods to improve animal movement

When animals move through a facility easily the use of electric goads can be greatly reduced or eliminated. Electric goad use is one cause of elevated vocalisation scores (Grandin 2001b). To facilitate animal movement, distractions in the facility must be eliminated. Lighting is critical. Simple changes in lighting will often result in animals moving more easily. Animals may balk and refuse to move if they can see distractions ahead of them such as moving people and machinery (Grandin 1996; Bourquet *et al* 2011). The author has improved the movement of both cattle and pigs by experimenting with a portable electric light and large pieces of cardboard. Below is a list of easy changes that make it possible to reduce electric goad use and reduce the percentage of animals that are difficult to move.

### Lighting changes

• Animals may refuse to enter a dark place. Illumination of stun boxes, restrainers, and race entrances with indirect lighting will attract animals as animals tend to approach a more brightly illuminated place (Van Patten & Elshof 1978; Grandin 1982, 1996; Tanida *et al* 1996). Installation of a lamp at the entrance of a centre-track conveyor restrainer system reduced vocalisation from 8 of the cattle to 0% (Grandin 2001b). Vocalisation was reduced because there was less use of the electric goad. In a pig plant, installation of a lamp at the race entrance reduced electric goad use on the pigs from 38 to 4%. To improve animal movement, experimenting with a portable lamp to illuminate dark stun boxes and race entrances is strongly recommended.

• Eliminate reflections on wet floors and shiny metal. To locate problems with reflections, a person should walk through the race at the animal's eye level. From this animal's eye view, distractions such as reflections or moving people or equipment can be observed. Sometimes moving a ceiling lamp will eliminate a reflection on either a shiny metal surface or a wet floor and will improve animal movement. Experiments can be conducted with portable lights and by moving or covering ceiling lamps.

• Any reflective surfaces on shiny stainless steel equipment should be dulled.

• Sunbeams that shine in alleys and races should be blocked. Animals will often refuse to walk over a sunbeam or a shadow. Often the time of day will have an effect, for example, a sunbeam may cause a handling problem in the morning, but no problem in the afternoon.

### Block vision of distractions

• Install solid shields so that the animals do not see people ahead. In several plants, the entry of cattle into the race or into the stunning restrainer was improved by installing a shield so that the approaching animals could not see the person who was moving the animals ahead.

• Animals should not be able to see out onto the slaughter floor. When a head holder is used, the approaching cattle must not be able to see people or the activity on the slaughter floor through the head opening. They should only see a lighted opening. A solid wall should be installed one meter in front of the head opening.

• Solid sides on the races and crowd pen will usually improve animal movement because they block distractions. The author recommends experimenting with large pieces of cardboard or thin plywood to determine the best location for solid panels. Thin materials that flap, such as lightweight plastic, must never be used. Materials that flap and move will often cause balking and stop animal movement.

### Air movement affects animal movement

Air that is blowing directly in the faces of approaching animals will often cause the animals to stop. Air draughts must not blow through the stun box door into an approaching animal's face. Curtains of air at a stun box entrance will often increase electric goad use.

### Reduce equipment noise

A survey of 34 abattoir lairages indicated that sound from handling systems was high ranging from 80 to 90 dB (Weeks *et al* 2009). There is a definite need for quieter equipment to be engineered. Hissing air should be eliminated either by installing muffling devices on the airlines or by piping the exhausts outside. Sudden noises and intermittent high-pitched noise (Talling *et al* 1998; Lanier *et al* 2000) will startle animals.

### Restraint device problems

Pigs are more likely to squeal if one side of the V restrainer conveyor moves faster than the other side. Both conveyors should move at the same speed. Restraint devices should be equipped with pressure controls that will automatically limit the maximum amount of pressure that the device can apply. Animals will also remain calmer if the parts of the device that press against them move with a slow, steady motion. A sudden jerky motion tends to cause animals to become agitated. A high percentage of cattle or pigs vocalising (moo, bellow, or squeal) in a restraint device is often due to either excessive pressure or sharp edges (Grandin 1992). Vocalisation will often occur the moment that some part of the device presses against the animal's body (Grandin 1998b; Bourquet *et al* 2011). When this occurs, it is an indicator that there is a problem that needs to be corrected. Grandin (2001b) found that vocalisation in cattle was reduced from 23% to zero after pressure applied by a head-holding device was reduced. In several plants, loud vocalisations by cattle stopped after sharp edges were removed. Sometimes a very small sharp edge will cause the animal to vocalise. To minimise vocalisation, animals should be either stunned or ritually slaughtered within 10 s after a head-holding device is applied. The author has also observed that animals tolerate body restraint better than head restraint (Grandin 1992). Holding a bovine's head too long in a head-restraint device will cause vocalisation.

### Uniform floor surface improves movement

Animals will often balk and refuse to move across changes in flooring. For example, they may refuse to move from a concrete to a steel floor. Movement into a stun box with a steel floor will often be improved if all reflections from the steel floor are eliminated. Animals may also refuse to step on a steel floor that jiggles. Floors that animals walk on should be engineered so that they are stable and do not move. When new facilities are being constructed, animal movement will usually be improved if drains are placed outside of where the animals walk. Animals often refuse to walk over drain grates or steel drain covers.

### Fixing many small problems will greatly facilitate animal movement

The author has often observed that to greatly improve animal movement, many small improvements often have to be made. At one older large plant that processed cull Holstein dairy cows, the author made seven simple changes to improve animal movement and reduce both electric goad use



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and vocalisation. The seven things that caused balking and hindered cow movement were addressed as outlined below.

• Employees were trained to move smaller groups of cows and to fill the crowd pen half full. The electric goad was only used on cows that refused to move.

• Overcrowding of the crowd pen and pushing the cattle with the crowd gates was stopped.

• Sunbeams from a hole in the roof that shone in the crowd pen were blocked out. The cows had refused to step over the sunbeams.

• A light was installed on the dark restrainer entrance to facilitate cow entry.

• A curtain was installed in front of the restrainer to prevent cattle from seeing people walking in front of the restrainer.

• A hole in the side of the race-way was covered over to eliminate a sunbeam shining on the floor at the race entrance.

• A solid shield was installed in front of an employee who checked cattle identification. This prevented the cattle that were entering the single-file race from seeing them.

### Problems with animals that are difficult to handle

Some groups of cattle and pigs are difficult to move. Handling experiences on the farm have an effect on how easily pigs will move (Abbott *et al* 1997; Geverink *et al* 1998). Below is a list of on-farm factors that will make animals easier to move at the slaughter plant. There are several animal-handling problems that have to be addressed at the farm.

• The producer should walk through pens of (finishing/fattening) pigs every day in a different direction to get the pigs accustomed to moving quietly away from a person. Pigs that have never had a person walk through their pens on the farm are more likely to pile up or be difficult to move at the slaughter plant. The author has observed that when producers started walking through the pens, the pigs were easier to move at the plant and the use of electric goads was greatly reduced.

• Select breeding stock with good leg conformation. Some genetic lines of pigs have poor leg conformation that results in lame, difficult to handle animals.

• Cull breeding stock should be brought to the slaughter plant when they are still fit for handling and transport. Emaciated weak animals will have severe welfare problems.

• Reduce the use of beta-agonist feed additives, such as ractopamine, which are commonly used in the US and Canada but are banned throughout the EU and a variety of other countries. Some of these products may cause hoof cracking and subsequently, more non-ambulatory pigs and handling problems (Marchant-Forde *et al* 2003; Poletto *et al* 2009). The author has observed that reducing beta-agonist feed additives in pig feed has reduced downer non-ambulatory animals.

• When cattle on a ranch are handled on horseback, they should also be habituated to handling by a person on foot. Cattle that have never been handled by a person on foot may be dangerous and difficult to handle at a slaughter plant when they have their first experience of being moved by a person on foot.

• Cattle that have been repeatedly bitten by dogs on the ranch may be more likely to kick at handlers at the slaughter plant.

## Conclusion

Observant managers can often greatly improve animal welfare by better training and supervision of employees, and by better maintenance of stunning equipment. Often many small changes, such as non-slip flooring, changes in lighting and the addition of solid sides on races, can improve animal movement. This will make it possible to greatly reduce electric goad use.

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