Electrical and CO_2 Stunning, Handling, and Determining Insensibility in Pigs and Sheep, 2nd Edition

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Humane Slaughter Act

All animals are rendered insensible to pain by a single blow or gunshot or an electrical chemical, or other means that are rapid and effective

All Methods of Stunning

Definitely Conscious

- Remains standing
- Head or body right reflex
- Voluntary vocalization
- Spontaneous blinking (do not confuse with nystagmus)
- Eye pursuit
- Response to threat test-No touching

(Terlouw, et al., 2016)

If any one of these indicators is present, the animal is conscious.

All Methods of Stunning

- Definitely unconscious – Brain dead
- Absence of corneal reflex to touch
- Absence of eyelid reflex to touch
- Absence of rhythmic breathing (do not confuse with gasping)

(Terlouw et al., 2016; Verhoeven, et al., 2016)

All Methods of Stunning

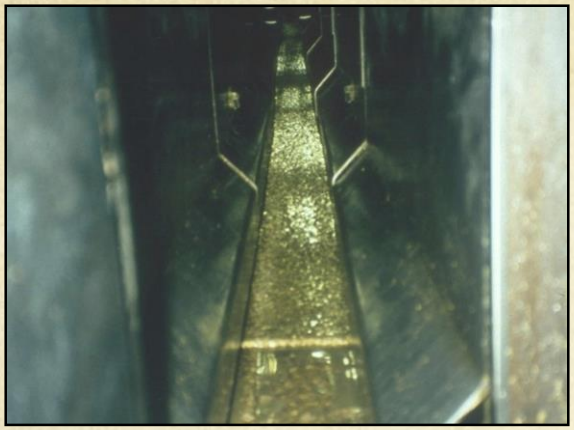
- Situations where a second shot application of the electric stunner prevents return to sensibility.
- Weak corneal reflex
- Eyelid reflex
- Rhythmic breathing
- All indicators of definite consciousness must be absent.

All Methods of Stunning

- Before invasive dressing procedures start after bleeding
- All indicators of definite consciousness and definitely unconscious or brain dead must be absent

Trouble Shooting Handling

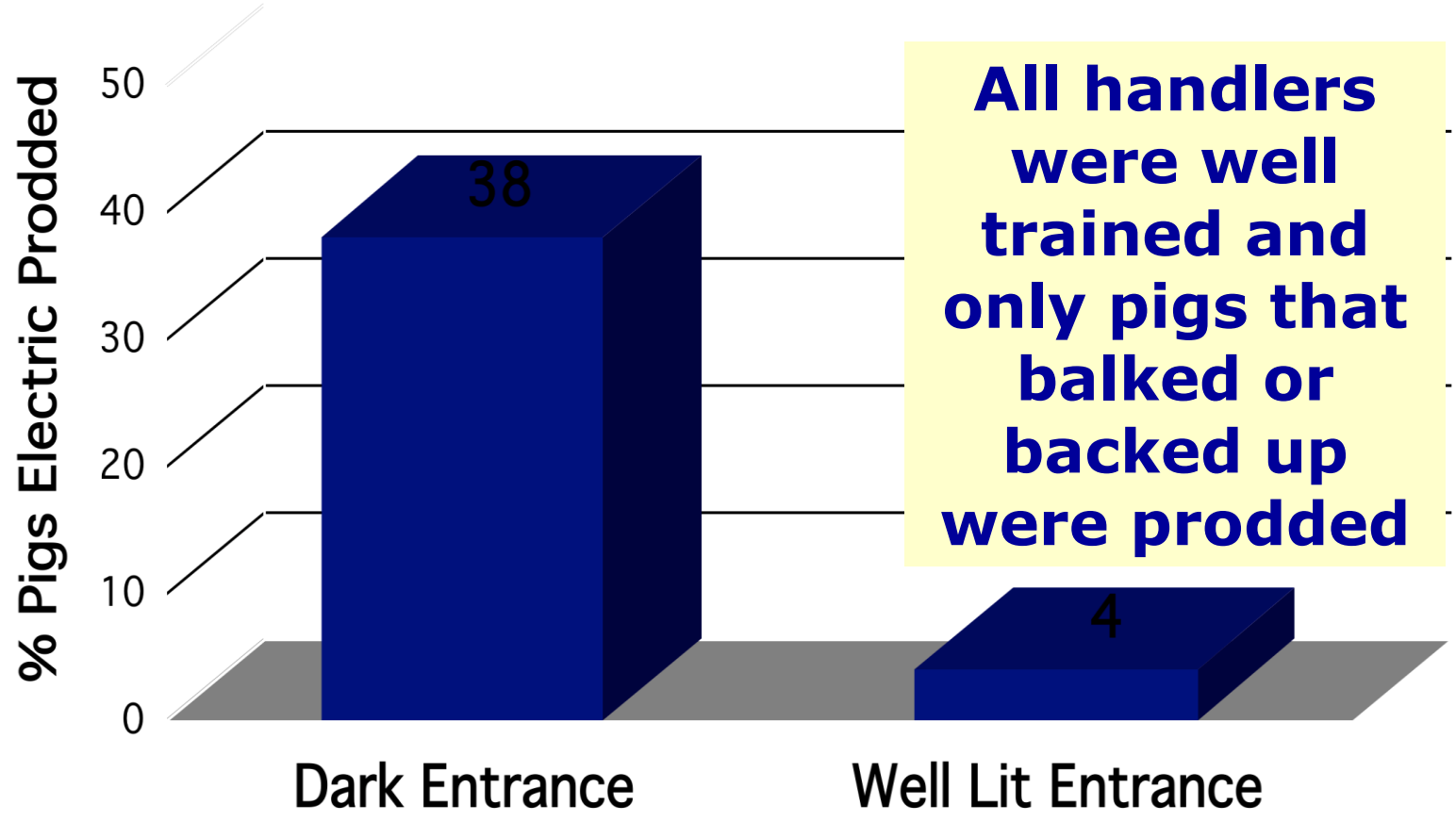
1. Distractions that cause balking
2. Slick floor causes agitation
3. Facility design problem
4. Employee training issue
5. Lame pigs
6. Pens not walked on the farm



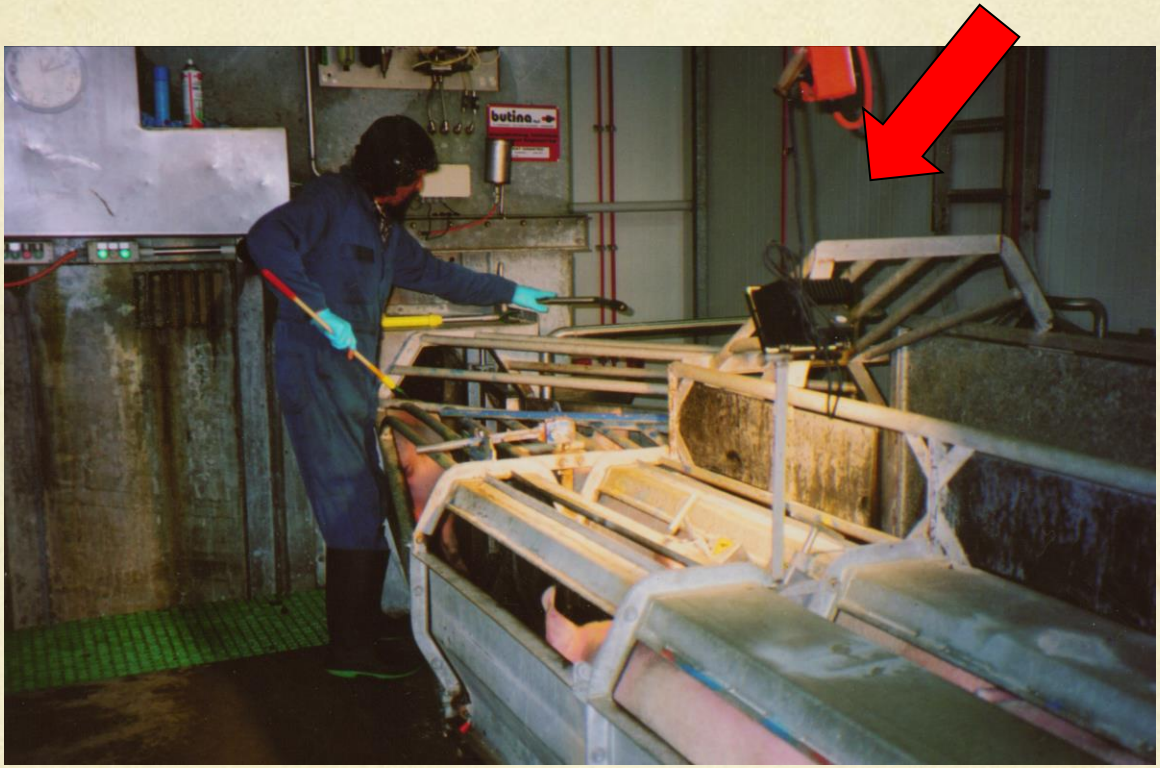
Most Common Distractions

1. Reflections on water or metal
2. Air blowing towards approaching pigs
3. Moving people or equipment
4. Chute entrance too dark
5. Visual cliff in conveyor restrainer

Electric Prod Use on Pigs Was Reduced By Adding Lighting at the Restrainer Entrance



Indirect Lighting Works Best



This lamp is pointed in the same direction as the pigs

Pig Baulking at Metal Strip

Quiet handling in the stunning chute

= 10 %

less PSE

	Blood Lactate
Aggressive Handling	**25 mmol/L**
Quiet Handling	**4 mmol/L**

Benjamin et al., 2001

Humane Slaughter Regulations 9 CFR.313.2

- Driving livestock “minimize excitement and discomfort”
- “Any use of such implements (referring to electric prods or other driving implements) which, in the opinion of the inspector is excessive, is prohibited”

Big Question: When Does Tapping Become Beating?

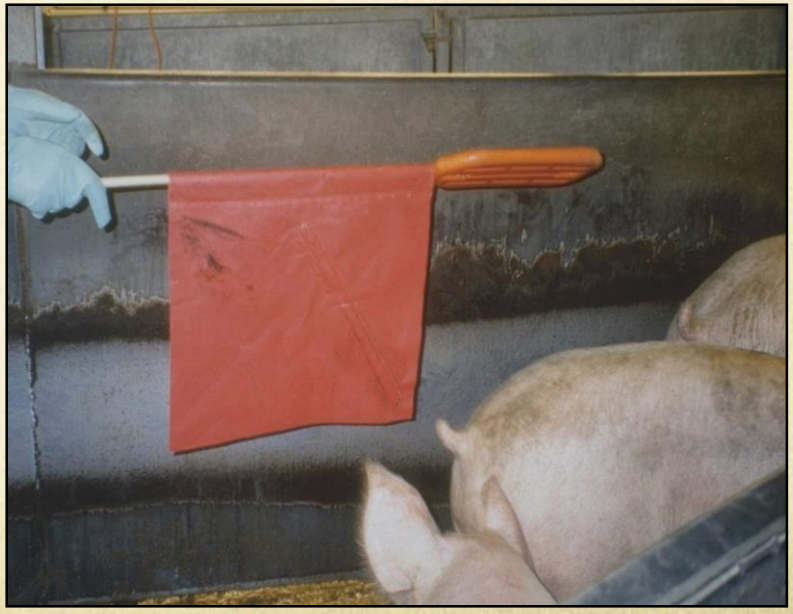
- Video “Proper Use of Livestock Driving Tools with Temple Grandin”

- Demonstrates hitting an empty corrugated cardboard box. When it starts to crush, tapping has become beating.

Training Employees

1. Flight Zone Principles
2. Point of Balance
3. No Yelling
4. Move Pigs in Small Groups
5. Fill Crowd Pen Half Full
6. Get Electric Prods Out of People's Hands

Use Alternative Driving Aids



Trouble Shooting Electric Stunning

1. Excessive electric prod use due to distractions
2. Stunner settings
3. Employee training
4. Wand ergonomics
5. Line speed
6. Poor bleeding

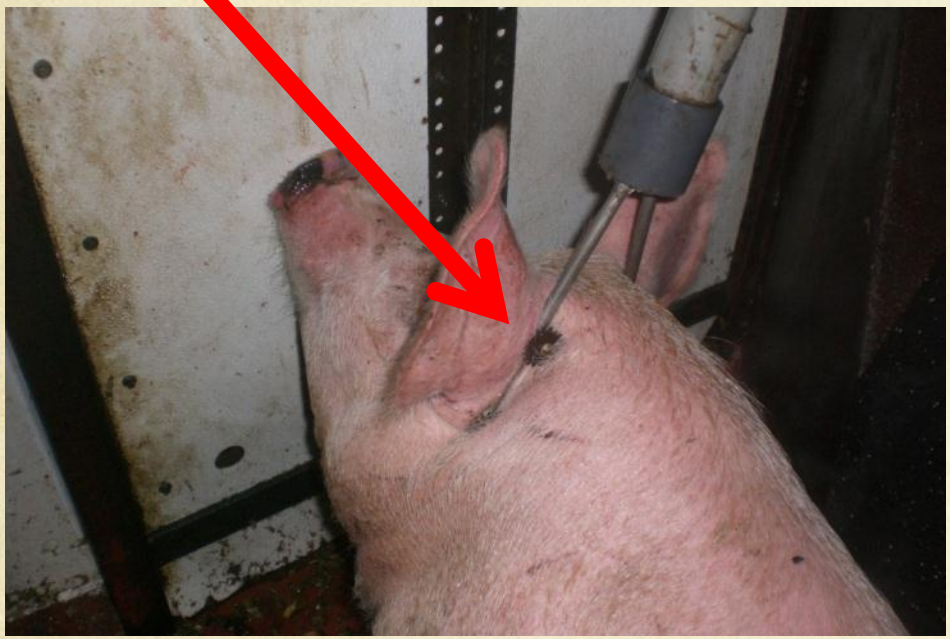
Both sides of restrainer must run at the same speed

Two Types of Electric Stunning

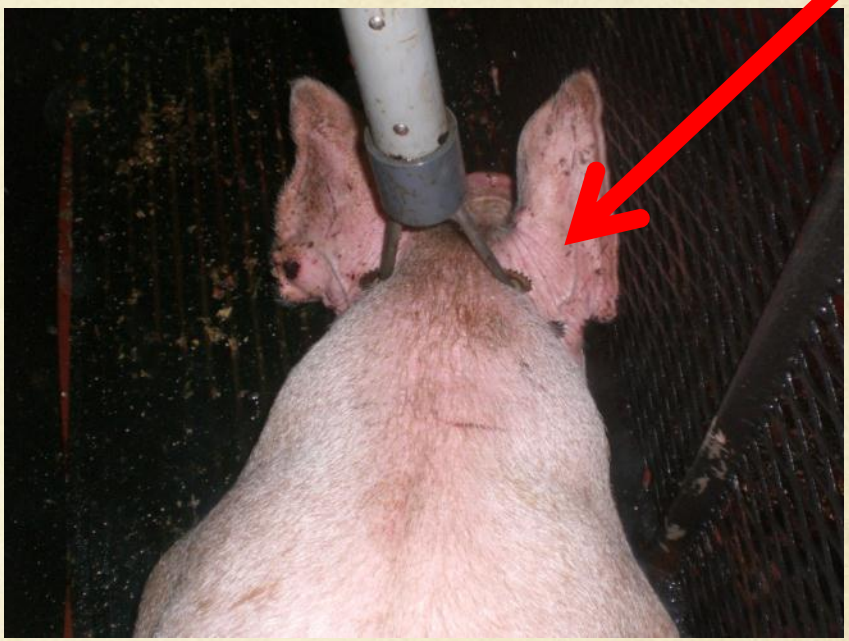
- Head Only – Must bleed within 15 sec.
- Cardiac Arrest – Must bleed within 60 sec.

Head Only Reversible Stun Correct Position

The extended wand tips and extra star wheels (spurs) assure correct stun wand contact with brain



Locate wand as close to the ear as possible, in the thin crevice. Note that this wand has two sets of star wheels for small and large pigs



Longer, wider wand tips help to facilitate secure contact on the head of larger pigs

Credit: Erika L. Voogd

For pigs larger than 200 pounds, extend wand tips to assure correct stun wand contact

Extended tips with extra star wheels. Stainless steel star wheels (spurs) conduct better than carbon steel

Credit: Erika L. Voogd

Procedure for Small Plants

After head only stunning, apply electrode to the heart to prevent return to sensibility

Vogel et al., 2010

Insulate the stun box to prevent grounding during stun

Truck rubber mats on floor and wall.
Coated metal gate

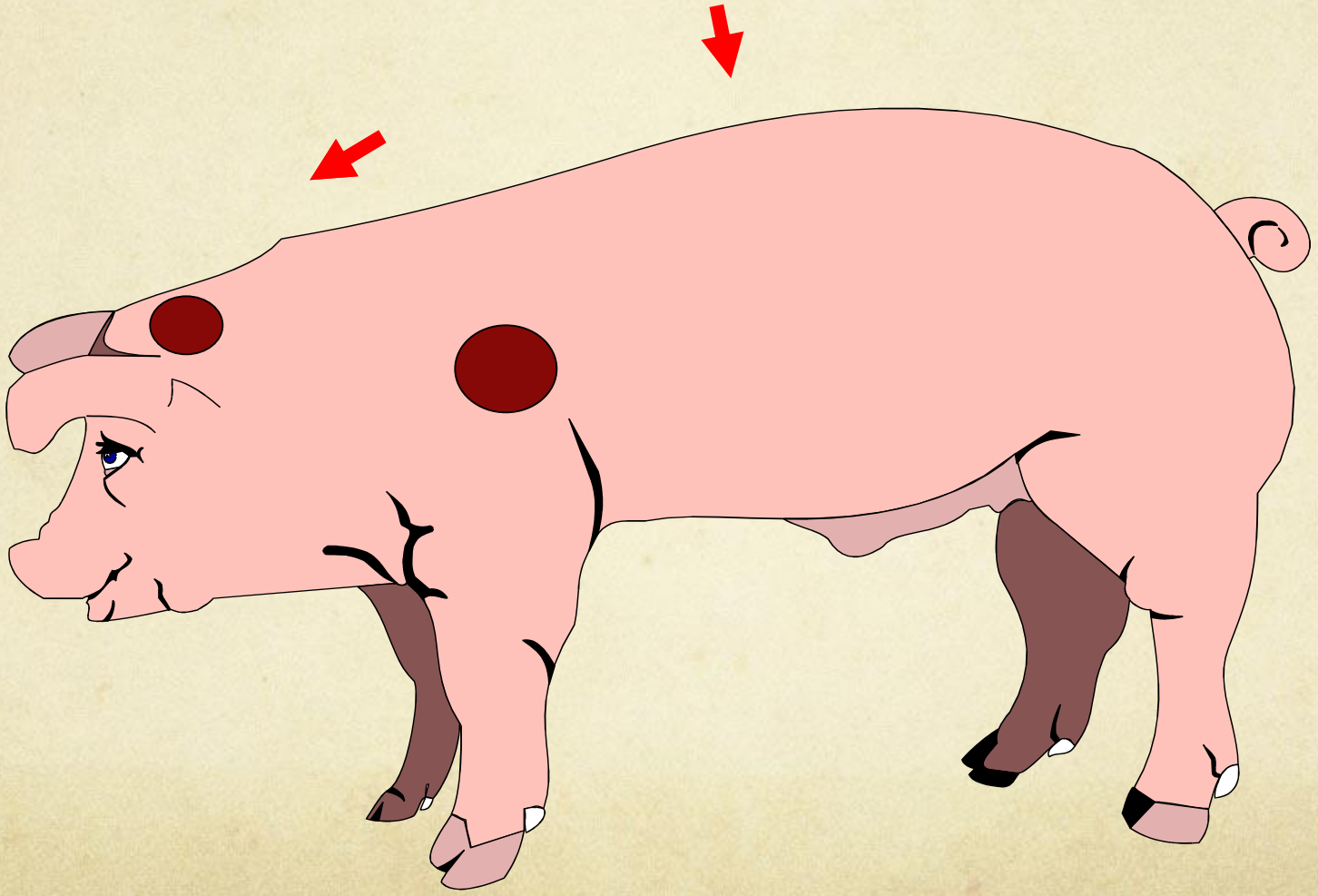
Plastic lining in stun box area to insulate electrical current

Credit – Erika L. Voogd

Head to body cardiac arrest stunner

- In small plants, many pigs that are head only stunned regain sensibility because the hoist is very slow. A simple solution to the problem is to apply the stunner to the head first and then apply it a second time to the chest to stop the heart (photograph courtesy of Erika Voogd)

Incorrect Head/Heart Saddle Stunner Placement



Electrodes must be positioned so the current goes through the brain

Location of Pig Brain

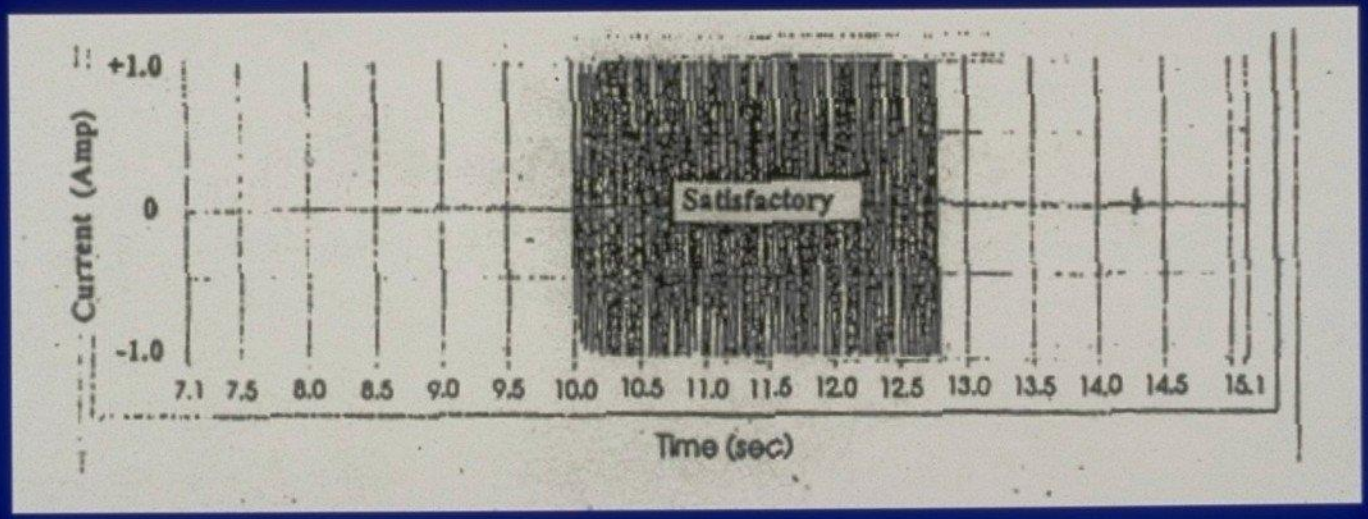
EEG brainwaves used to determine that a proper stun induces a grand mal epileptic seizure

Minimum Stunner Amperage Settings

1.25 amps for pigs

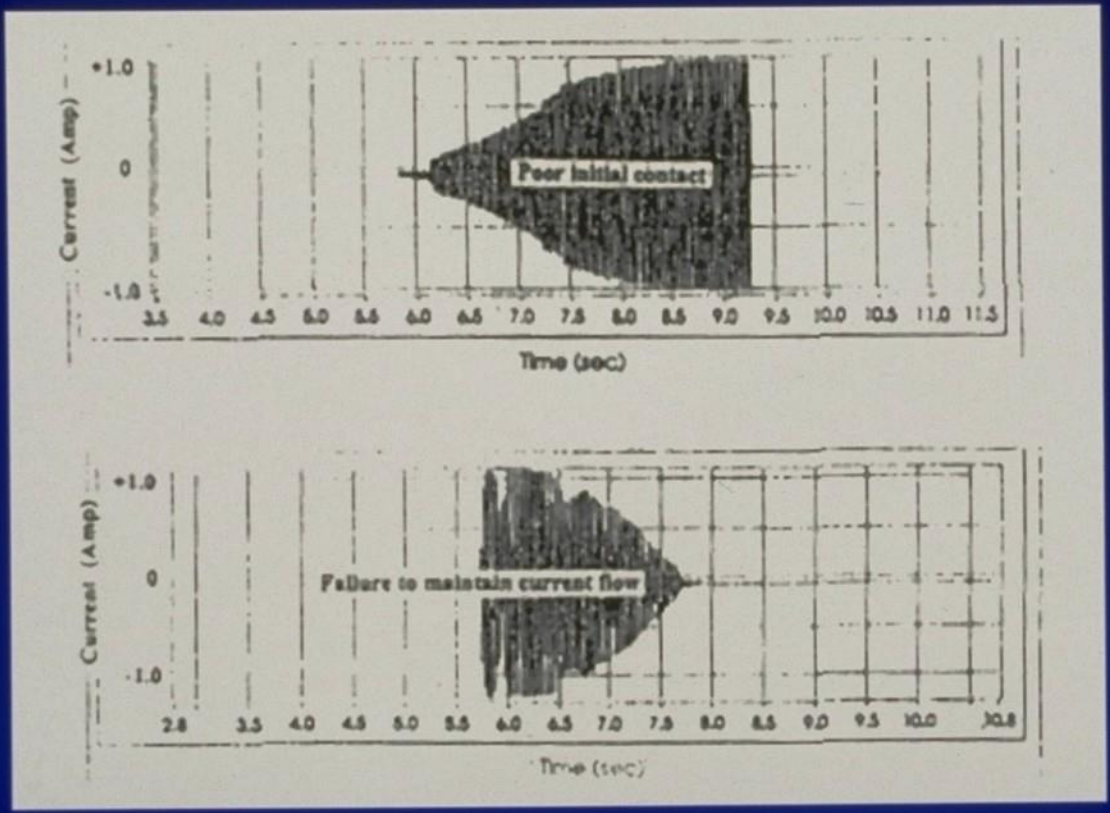
1.00 amps for sheep and cattle

Waveform of a good stun where the animal receives the full intensity and duration of the current



Waveform of a correct stun. Neville Gregory 2001

Waveform of bad stuns

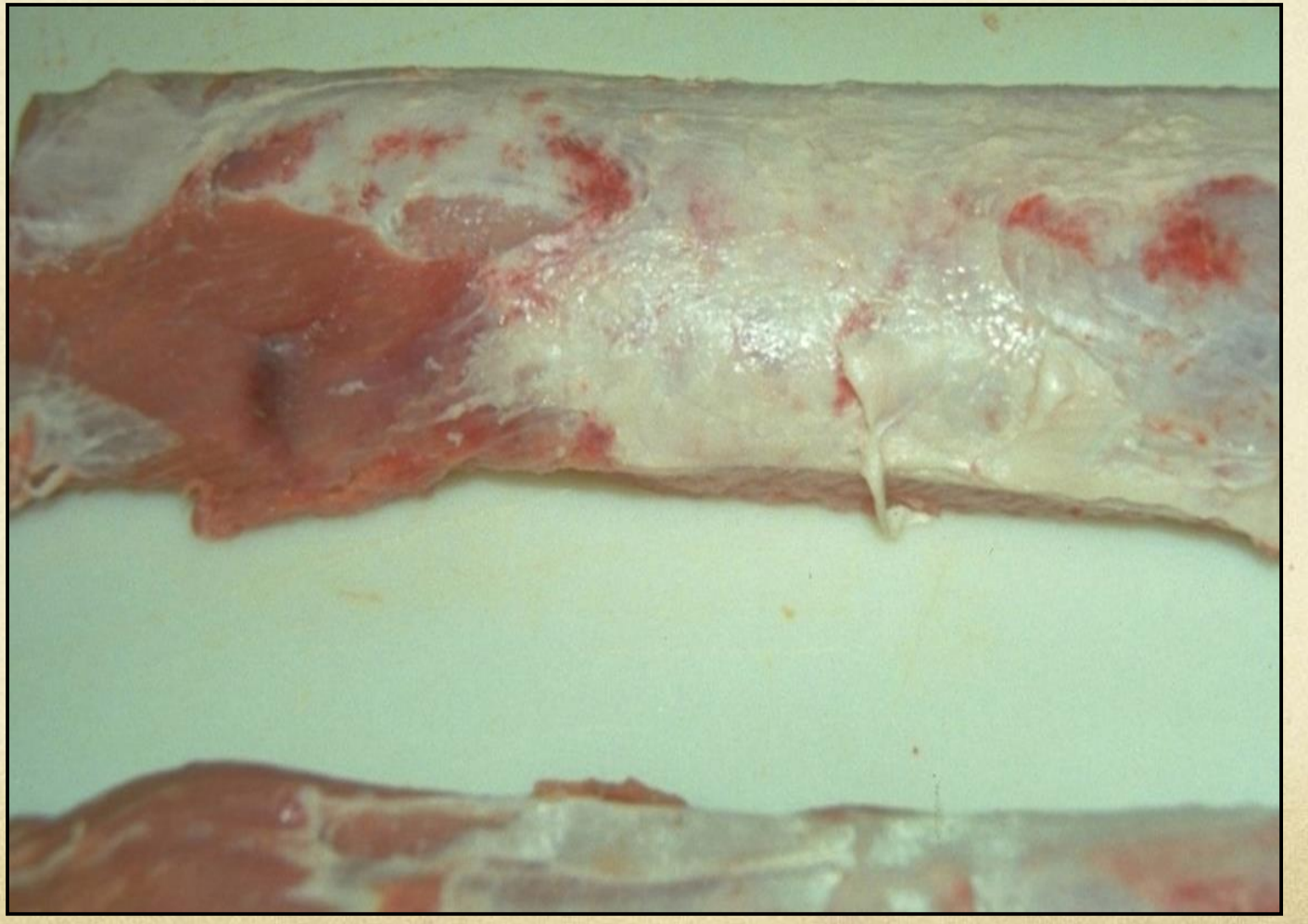


Poor contact with the animal

Interrupted current (double stunning) and poor contact

Waveforms of poor stuns - Neville Gregory 2001

Blood Splash Caused By Poor Electric Stunning



Center Track Restrainer

May have less blood splash than a V Conveyor because there is less pressure on the body

Electric Stunning Troubleshooting Blood Splash (manual and automatic)

1. Sliding wand during the stun
2. Hot wanding
3. Frayed wires inside the cords
4. Corroded switches
5. Water in switches or cords
6. Dirty electrodes
7. Animal grounds out through restrainer
8. Hold Down pushing down on the animal
9. One side of restrainer runs faster

Blood splash trouble shooting

Automatic Electric Stunners

Properly Stunned Insensible Pigs

Righting Reflex in a Fully Sensible Pig

Picture not from U.S.

Differences in Reactions of Insensible Animals

- Nystagmus (vibrating) eye must not be confused with natural spontaneous blinking. Nystagmus is permissible after electric or CO_2 stunning. It must be absent after captive bolt.
- Gasping like a fish out of water must not be confused with true rhythmic breathing. Gasping is permissible after electric or CO_2 stunning. It must be absent after captive bolt.
- Corneal Reflex must be completely absent after captive bolt.

Interpreting Eye Blinks in Electrically Stunned Pigs

Under plant conditions, avoid touching the eye with fingers. Watch for normal blinks which look like blinks on a live pig. The following are not blinks:

1. Nystagmus – vibrating eye or lid
2. Eye clenched shut – pops open
3. Opens when touched but does not close

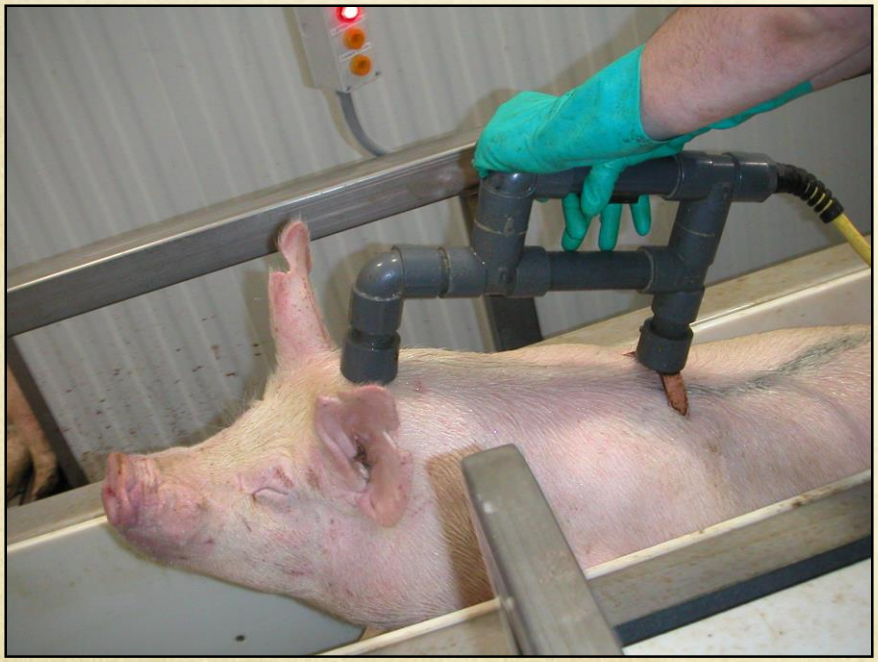
In captive bolt stunned cattle, nystagmus is a sign of a possible poor stun

Troubleshooting Return to Sensibility Signs in Electrically Stunned Animals

1. Insufficient amperage
2. Poor bleeding
3. Poor initial contact that results in insufficient time
4. Interrupted current which results in insufficient time
5. Wrong placement on the head
6. Stunning-to-bleed interval too long with head only stunning

Trouble shooting return to sensibility

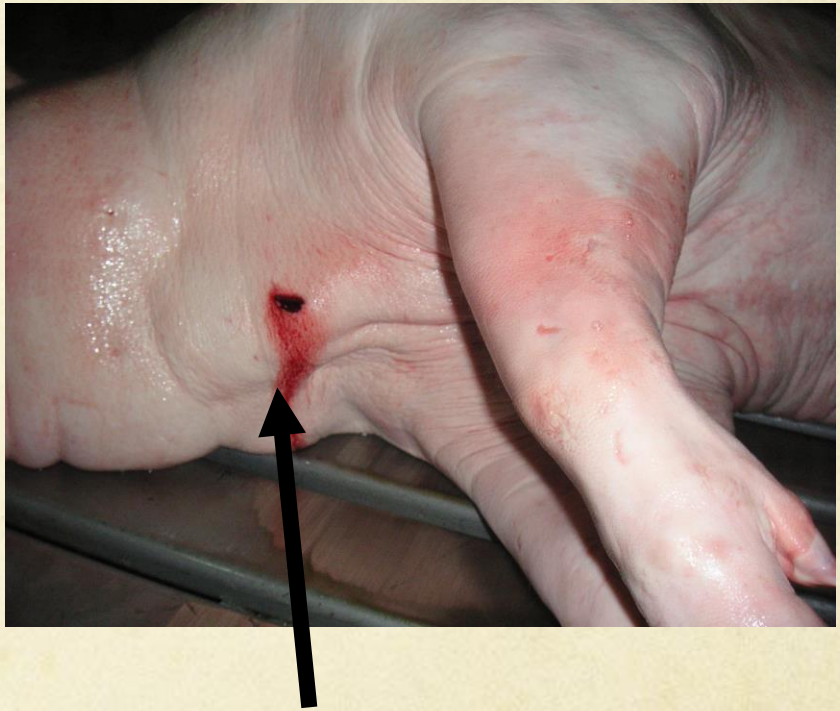
Improving Stun Wand Surface Area Can Increase the Stun Efficacy



Prone bleed may reduce blood splash because the stun to bleed interval is under 10 seconds

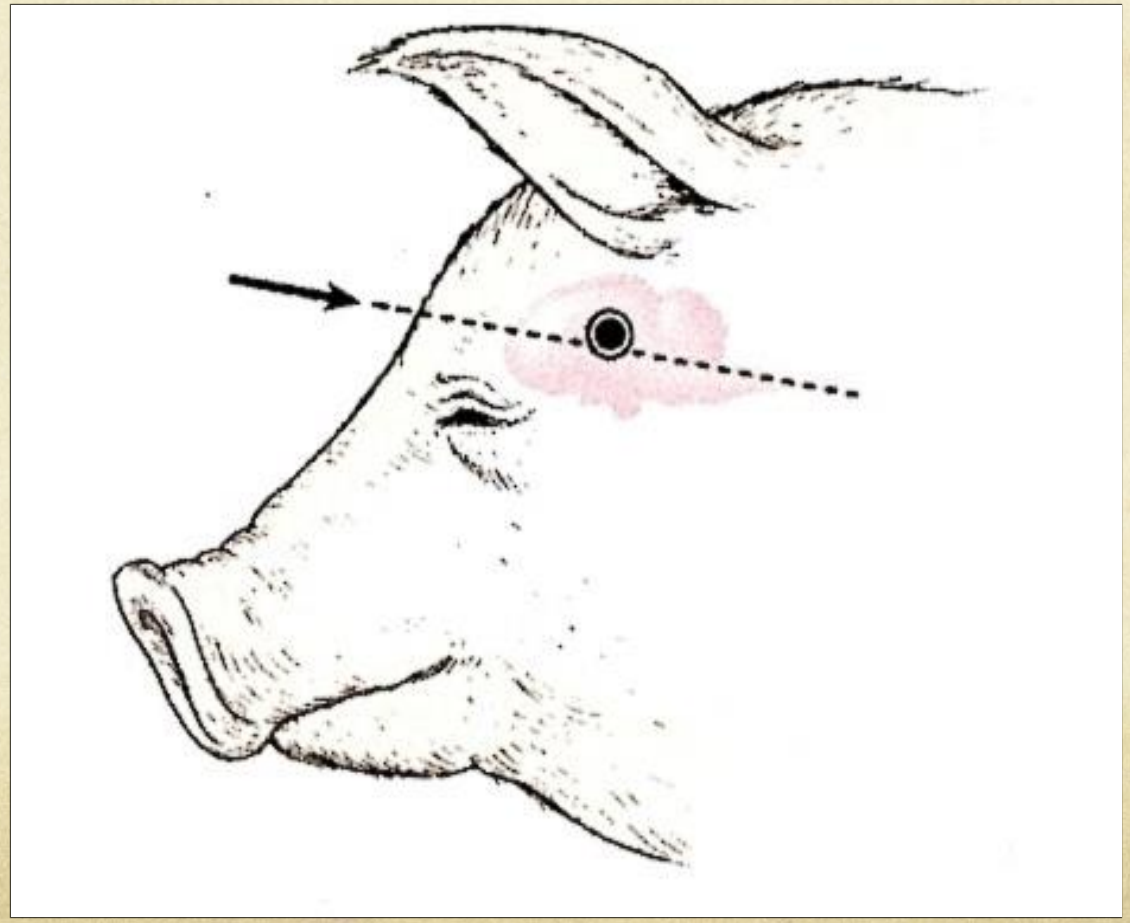
Bleeding

Good bleeding with high blood flow



Poor bleeding with small blood flow

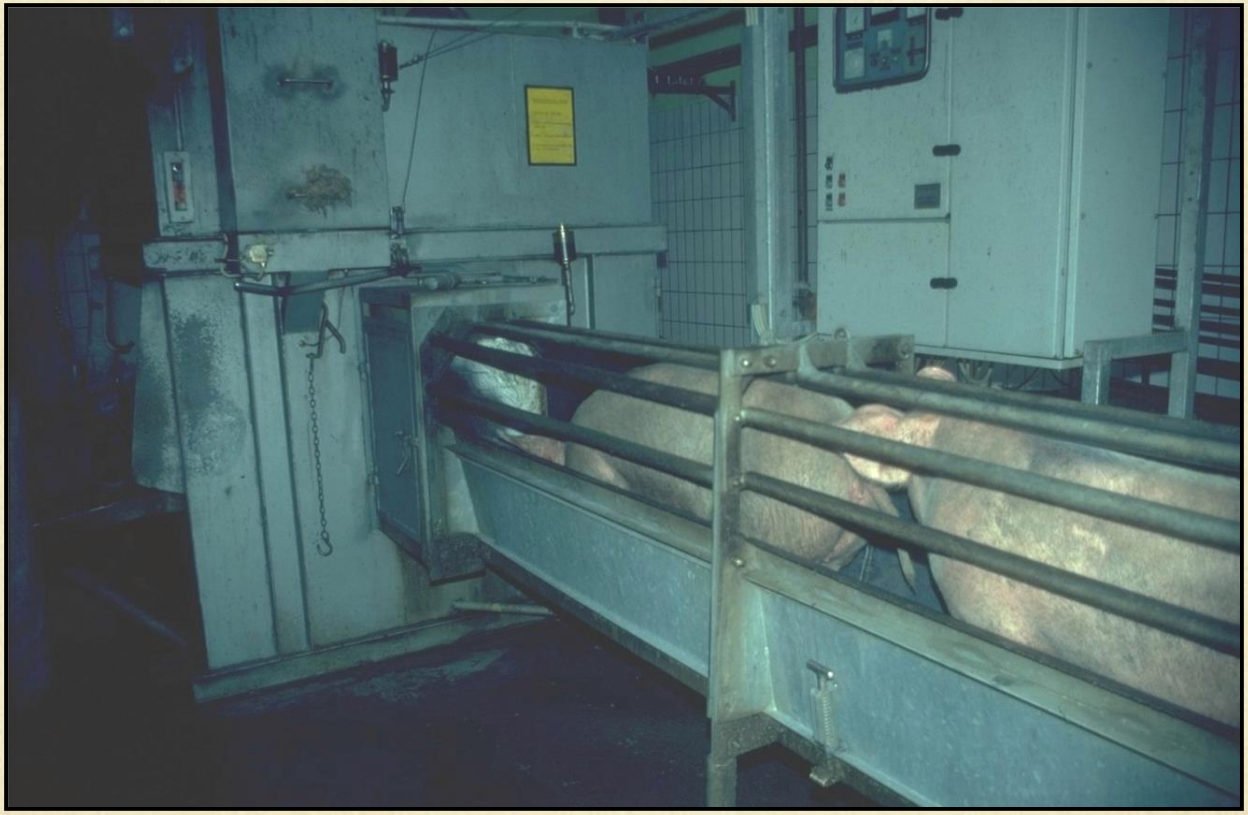
Correct position for shooting swine with a captive bolt or a firearm. Many old diagrams show a position that is too low (diagram by J.K. Shearer)



Captive Bolt Stunners for Non-Ambulatory Pigs are Often Neglected

- Store cartridges in a dry place and bring to the yards, a one-day supply of cartridges
- If the stunner has been used, it must be cleaned and serviced at the end of the shift

Genetics May Affect Pig's Reaction to CO_2



CO_2 Stunner

Low Stress Group Handling With CO_2

Best Practice:

Inspection port
on CO_2 machine
for observing
anesthesia induction

Control of forward movements of crowd gate by a person prevents overcrowding

CO_2 Pigs Limp and Floppy

Slight limb movements and gasping may occur

Order of Events During Return to Sensibility in CO_2 Stunned Pigs

	Average Time
Corneal reflex (touch eye)	42 sec
Rhythmic breathing	68 sec
Excitation	76 sec
Nystagmus (vibrating eye)	86 sec
Spontaneous natural blinking (don't touch)	93 sec
Conscious movement (righting reflex)	171 sec
Attempt to stand up	387 sec
These events are very variable	

Danish Meat Research Institute, Holst (2001)

CO_2 return to sensibility sequence

There is Zero Tolerance for Hoisting an Animal that is Showing Obvious Signs of Sensibility

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There is <u>Zero Tolerance</u> for :
Skinning, Scalding, Dehairing or Removal of any Body Part on an Animal that Shows <u>any</u> Sign of Partial Return to Sensibility

It MUST be brain dead

Signs of Brain Death

- No corneal reflex
- Do not use finger – must use pen
- Eyelash reflex – Touch eyelashes only
- No rhythmic breathing
- Do not confuse with nystagmus (vibrating eye)
- Do not confuse with grasping

Numerical Scoring System for Cattle Minimum Acceptable Percentages

Stunned with one captive bolt or gun shot	95%
Insensible	100%
Electric prod - Acceptable	25%
Electric Prod – Excellent	5%
Falling down	1%
Vocalizing	3%
Vocalizing with head holder	5%

NAMI
NORTH AMERICAN MEAT INSTITUTE

USDA/FSIS Robust Systematic Approach for Humane Slaughter Requirements

- Written Procedures – SOPs for staying in compliance, includes corrective action for a noncompliance
- Written Records of evaluations, internal NAMI audits, stunner maintenance log and employee training
- FSIS – Review of records and written procedure
- Is similar to a HACCP Plan

USDA/FSIS Definition of Egregious Inhumane Treatment

"An egregious inhumane treatment is any act or condition that results in severe harm to animals."

FSIS Directive 6900.2, Revision 2

Useful FSIS Sources on the Internet

- FSIS Compliance Guide for Systematic Approach to Humane Handling of Livestock, 2013
- Humane Interactive Knowledge Exchange (HIKE) Scenarios
- Humane Handling Enforcement Actions – List All Regulatory Actions
- Type titles into Google

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