

## ANIMAL WELFARE

**Title:** The Adoption of Captive Bolt Technology for On Farm Euthanasia of Swine – **NPB #08-167**  
(Concurrent project: #09-196; Original project #06-165, PI: Ms. Jennifer Woods)

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### Scientific Abstract

Captive bolt technology is an appropriate method for euthanasia for swine (NPB, 2009), however it is recommended that only captive bolt guns designed for on-farm euthanasia should be used as other products may only stun the pig and may require a secondary step, such as exsanguination or pithing to achieve death. Therefore this project was conducted to;

- 1) To evaluate the anatomical features that determine the effectiveness of captive bolt technology for humane euthanasia of pigs throughout their production life;
- 2) Determine the traumatic brain injury due to direct damage to the brain from the application of the Cash Euthanizer system, which is the first commercially available system designed specifically for on-farm euthanasia utilizing captive bolt technology.

The CASH Euthanizer unit is a heavy duty cartridge propelled captive bolt device with interchangeable muzzle assemblies. The unit provides a non-penetrating captive bolt muzzle for piglets, and a variety of penetrating bolt assemblies for pigs ranging from large nursery to adult swine.

For phase one of the project, determination of the force required to penetrate the skull plate and sinus cavity, 42 pig heads representing two different skull shapes and three genetic backgrounds were gathered from four different farms. The heads were allocated into seven different weight classes, equally representing both male and female.

An Instron Universal Testing Machine 4502 was utilized to determine the static force required for penetration of the skull. The non-penetrating head was designated for the 2 -3 kg and 7.5 – 10 kg weight classes, while the remaining five weight classes utilized the penetrating captive bolt rod. Analysis for each head included weight, bolt type (non-penetrating head or penetrating bolt), recorded pressure at skull penetration and recorded pressure at sinus penetration.

As expected, static force required to penetrate the skull/sinus plate increases significantly as the pig matures, ranging from 0.074 to 7.254 kg/mm<sup>2</sup>. This provides the basic information necessary to design a captive bolt system for on-farm euthanasia for the US swine industry. However, to fully evaluate a specific captive bolt system (i.e manufacturer/model) a high-speed penetration test should be conducted utilizing skulls of the target species/size with representative speeds and bolt mass.

For Phase two, the level of brain damage inflicted by the Cash Euthanizer was determined by application of the captive bolt device in accordance to manufacturers guidelines, to cadavers representing the seven weight categories of pigs. Application location was in accordance to the targeting recommendations from the *On-Farm Euthanasia of Swine-Options for the Producer (NPB, 2009)*.

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The degree of damage to the skull and depth of penetration was documented utilizing dorsal and lateral radiographs. Skulls were dissected to determine the location of penetration and the primary regions of the brain (cerebral cortex, thalamus, cerebellum, pons, medulla and sinus areas) were scored for traumatic brain injury and presence of hemorrhaging.

Dissection of the brains showed that when utilized in a penetrating bolt configuration the placement of the Cash Euthanizer needs to be higher on the forehead of the animal than with traditional penetrating captive bolts. This higher positioning will achieve maximum overall TBI and result in greater impact to regions of the brain necessary to ensure cessation of heart and respiratory function.

The preliminary results demonstrate that captive bolt technology is sufficient to induce significant brain trauma in regions necessary to cause cessation of heart and respiratory function. This supports the use of the Cash Euthanizer as an effective single step method for the euthanasia of pigs from 2 kg's up to 200 kgs and recent improvements to the Cash Euthanizer System (addition of a more powerful cartridge) by the manufacturer should ensure a humane euthanasia for even the most mature of swine.