Update of APHIS 3-D Projects: Depopulation, Disposal, Decontamination

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USDA APHIS

Veterinary Services

Euthanasia Philosophy and Considerations

- *Animal Sparing Modalities* APHIS strives to ensure that minimal depopulation is executed and that animal sparing modalities (such as vaccination) are used where appropriate and permissible

- *Euthanasia* is the transitioning of an animal to death as painlessly and stress-free as possible, giving all due consideration to its experience.

- *Mass depopulation* is a method by which large numbers of animals must be destroyed quickly and efficiently with as much consideration given to the welfare of the animals as practicable, but where the circumstances and tasks facing those doing the depopulation are understood to be extenuating.

Some Diseases or Situations Requiring Depopulation

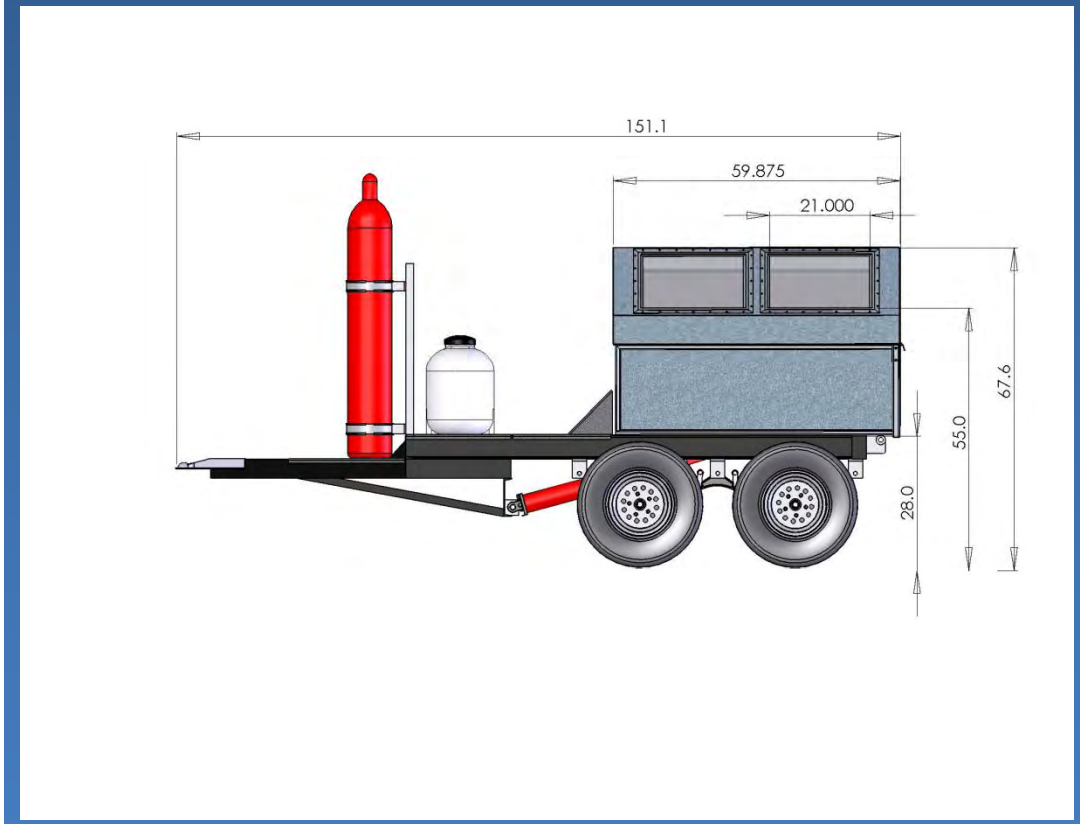
- Biological:
  - Exotic Newcastle Disease
  - Highly Pathogenic Avian Influenza
  - Foot and Mouth Disease
  - Classical Swine Fever
  - African Swine Fever
- Toxicological contamination
  - Dioxin, Organophosphates
- Radiological contamination
  - ^{90}Sr, ^{131}I
- Natural disasters
  - Flooding, Hurricanes
  - Building Collapse

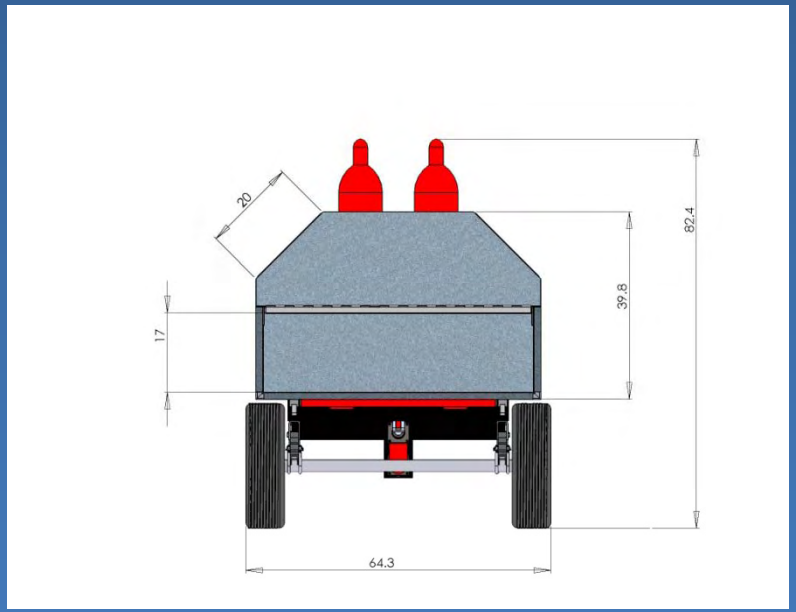
Poultry Depopulation

Modified Atmosphere Killing (MAK) Trailer for the Mass Gassing of Poultry University of Georgia, Athens

- Funded by APHIS Animal Care HPAI funds
- Portable gassing system for small flocks
- Stainless steel construction
- Transport by half-ton vehicle
- Dynamic top loading
- Dumping capability for easy removal
- Disinfection capability
- Steady-state maintenance of gas concentration
- CO_2 (40-50%) ± N_2
- CO_2: loss of consciousness – 20s; Death 4m

MAK Trailer Side and Rear View

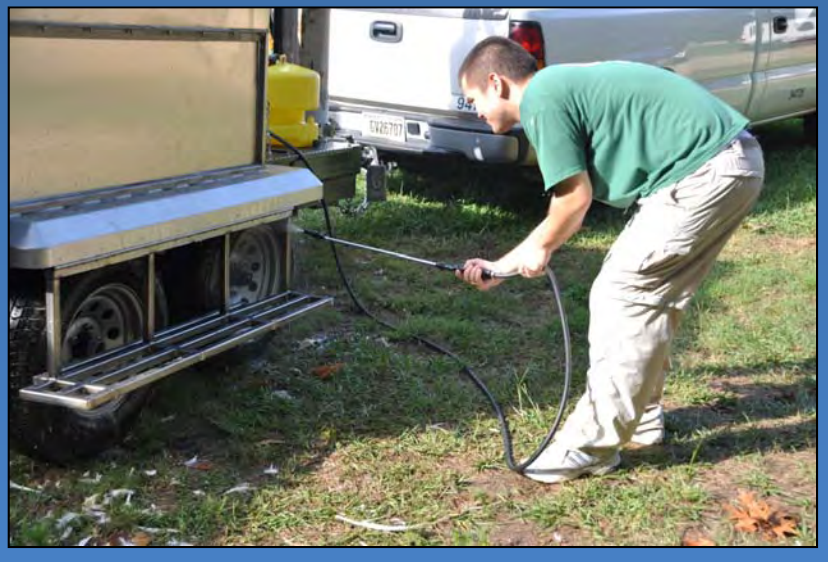




MAK Trailer

MAK Trailer Controls

MAK Trailer Operation



Water-Based Fire-Suppression Foam

- Minimal Contact with Birds
- Minimal Personnel (3-5 workers)
- Rapid Depopulation
- Reduces Aerosolization/Dust
- Disinfectant Property?
  - Research Pending
- Composting Synergism
- Fire-fighting Foam Type A
- Environmentally Safe

Welfare Considerations
CO_2 vs. Water-Based Foam

- Compare Technologies as Applied under Field Conditions (Tenting with Minimal Handling)
- Comparable Times to Death
- Death by Anoxia

  - CO_2 by chemically induced intoxication

  - Foam by mechanically induced anoxia
- Similar Behavioral Responses
- Cortisol Concentrations (indirect stress measurement) - comparable for both methods

Two Current Foam Systems in Use

- University of Delaware (KifCo) High Expansion Foam System

- North Carolina Department of Agriculture Medium Expansion Foam System

Univ. of Delaware (KifCo)
High Expansion Foam System

- Water Source
- High Expansion Foam
- Reel System
- Foam Delivery Cart
- Operator Rides Cart

KifCo System Operation

- Cart Delivery System Pulled through House
- Foam Concentrate Pumped into Fan Driven Generator
- Adds Some Moisture to Litter

North Carolina Department of Agriculture Medium Expansion Foam System

- Component Assembly with Pump Incorporated
- Trailer Mounted
- Reservoir Water Supply
- Hose Delivery System with Specialized Nozzle
- Medium Expansion Foam

N.C. Dept. of Agric. System Operation

- Hoses Pump from External Locations or Doors
- Foam Delivery Driven by Water Pressure
- Water Availability Rate-Limiting
- Adds Moisture to Litter

CAFS: compressed air foaming systems
Texas A&M University in development

- Funded by APHIS Animal Care HPAI funds
- Minimal water use
- May prove effective for caged layers (Phos-CheK Foam)
- Disinfection (Chlor-A-Foam)

CAFS Foamed Layer Cages

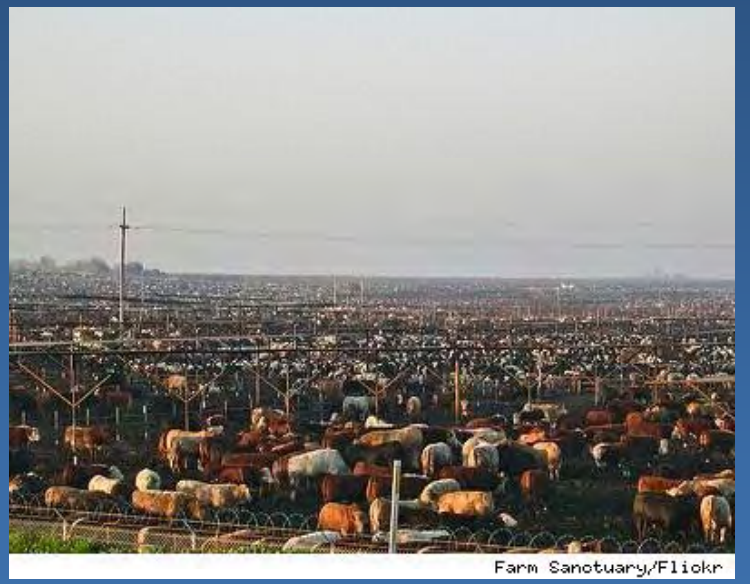
CAFS Disinfection Demos

Generic Disinfectant Study

- Evaluate efficacy of generic disinfectants
- Bleach, citric acid, etc.
- Test on wood, concrete, metal
- Test select FAD pathogens

Cattle Depopulation Challenges

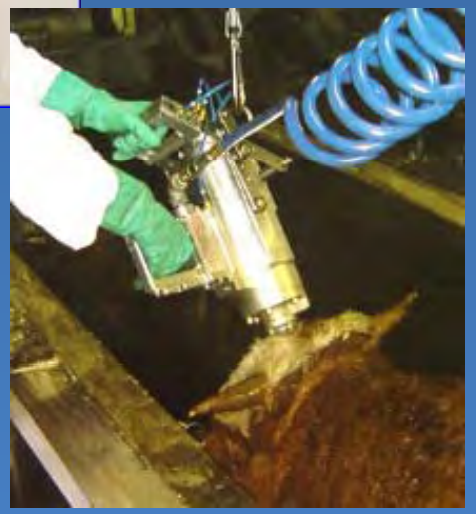
- Vast numbers
- Multiple husbandry systems
- Issues with handling and restraint
- Issues with disposal



Firearms at Distance Project
Kansas State University

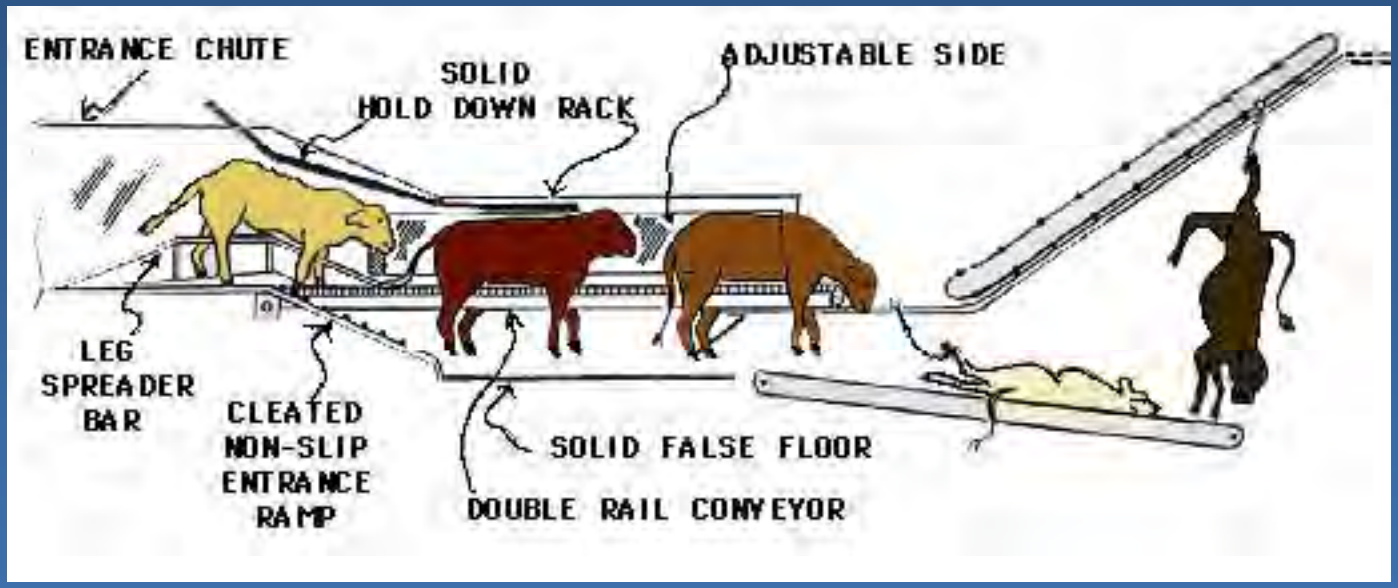
- Determine caliber
- Determine ammunition
- Criteria at 30ft of distance
- Pilot project complete in 2011
- Next stage live animal testing
- Noise suppression?

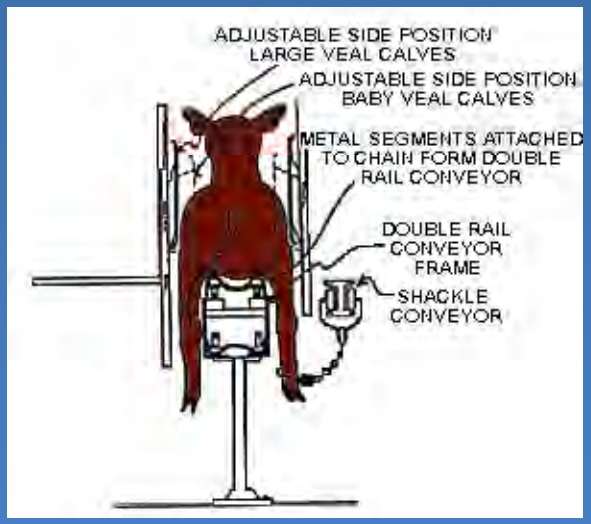
Validation of Portable Pneumatic Captive Bolt Device for the Mass Depopulation of Cattle
Iowa State University (beef) and
Western University of Health Sciences (dairy)



- Funded by USDA APHIS National Veterinary Stockpile and DHS Science & Technology Division
- 2011 - 2013
- Evaluate beef and dairy cattle
- Auto-pithing by air injection
- Ensures high fatality rate
- Carcass removed by side-drop stanchion
- Future use of center-line conveyor system

Portable Center Line Conveyor (unfunded future project)



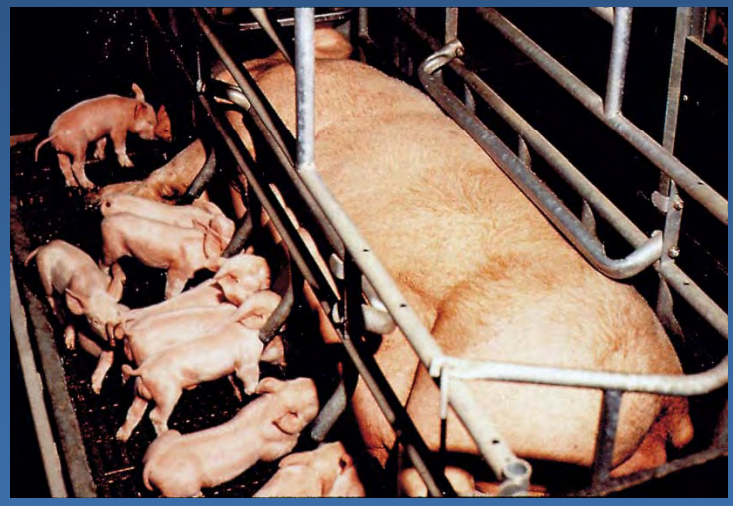


Validation of the Cash (pistol grip) Special Extended Captive Bolt for the Depopulation of Small Cattle Herds Oklahoma State University

- Funded by USDA APHIS National Veterinary Stockpile and DHS Science & Technology Division
- 2011 - 2013
- Small herds, remote locations
- Improved fatality assurance

Swine Depopulation Challenges

- Vast numbers - but integrated
- Vast numbers of animals in transit (~625,000 daily)
- Fewer husbandry systems
- Issues with handling and restraint
- Feral swine



Cash Pistol-grip (Accles & Shelvoke) Captive Bolt for the Mass Depopulation of Swine

- Stocking in NVS
- Determining need now
- Supplied as kits
- Include extended bolt for cattle
- Store minimal loads a sites
- IDIQ contract for sustaining load supply

Meat Processing Systems, Inc. (MPS)
Mobile Electrocution Unit for the
Mass Depopulation of Swine

- Unit can be taken to site for depopulation
- Estimated 600 swine/hr processing speed
- High assurance of fatality
- Safeguards for worker safety
- NVS plans to view and evaluate 2011
- NVS has set planned for purchase of 2 units
- US maintenance and repair contracts feasible
- Will need to retrofit for US market

MPS Unit

MPS Electrodes and Control Unit

On-Farm Gassing for the Mass Depopulation of Swine North Carolina State University

- Develop on-farm and mobile methods for gas depopulation of swine
- Funded by USDA APHIS National Veterinary Stockpile and DHS Science & Technology Division
- 2009 - 2012
- Use CO_2 in the form of dry ice and liquefied gas
- Test mixtures of CO_2 and N_2 for welfare performance
- Perform animal welfare assessment studies of technology
- Perform time and motion studies for efficient swine movement

Generation and Supply of CO_2 Gas

Sublimation of Dry Ice into Bladder

Liquid CO_2 Supply

Inlet Pipe

Buried Pipe (heat sink)
Outlet Pipe

Bladder Valves and in-line Fan Pump used with Sublimation of Dry Ice

CO_2 Gassing Chamber and Results

Liquid CO_2 Depopulation using a 20 yd^3 Dumpster Normally used for Movement to Rendering

Roll-off of Dumpster

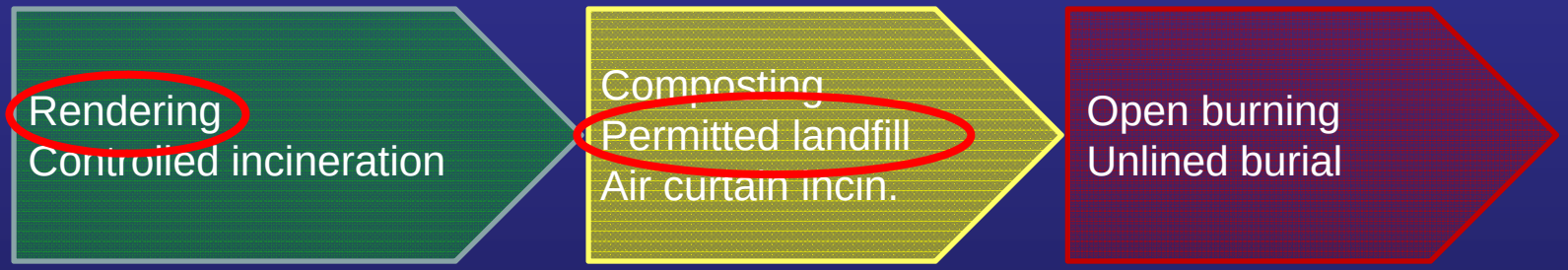
Runway for Loading Pigs

Prepping for Gassing

Gas Manifold

Gassed Pigs

Disposal Options for the US



Disposal Capability Gaps

- **Risk-Related Disposal/Treatment Projects:** validates effectiveness of treatment/disposal processes on pathogens and identifies exposure pathways during the process
  - Rendering – APHIS/EPA collaboration delivery December 2011
  - Composting – Completed (U. Delaware HPAI, Canadian Food Inspection Agency FMD)
  - Permitted Landfill - gap
  - Fixed Incineration - gap
  - Open Burning - gap
  - Unlined Burial – partially completed (U. Saskatchewan)
- **Disposal/Treatment Technology Development:** development of transportable disposal technologies and regionalized treatment/disposal strategies (e.g., use of rendering plants and permitted landfills).
  - Transportable Gasifier – DHS/EPA collaboration delivery ?
  - Logistical Infrastructure – DHS/APHIS collaboration delivery mid 2013
- **Disposal/Treatment Technology Feasibility Studies:** involves performing cost/benefit analyses of the most commonly-available mass animal mortality treatment/disposal technologies, including long-term and indirect costs such as future environmental clean-up liability.
  - Partially completed by USDA, UK DEFRA - gap

Fugitive Emission Study In Rendering Facilities

- Renderers essential to disposal
- Must contain pathogens
- Determine points for escape
- Focus on cleaning effort
- Hope to develop ISO standards
- Return plants to normal ops

Composting Validation for FMD and HPAI

- University of Delaware – HPAI
- CFIA - FMD
- Validated pathogen destruction
- Option for disposal for FADs

The University of Saskatchewan Official Preferred Logo

UNIVERSITY OF SASKATCHEWAN

Canadian Food Inspection Agency

Unlined Burial Study

- Evaluate unlined burial pits
- Partially completed
- Determine environmental threat
- Preliminary conclusions:
  - Groundwater contamination
  - Soil contamination

Portable Gasifier

Reduces carcasses to ash through an iterative burn

Strategic Infrastructure Pilot Project

- Safely move biomass to nearest rendering plant or permitted landfill
- Disposal may be outside of control zone and across jurisdictional lines
- Standards/permit system to enable safe inter-jurisdictional transport of biomass
- Expand to a nationally-acceptable system
- Leverage existing partnerships (Multi-State, SAADRA) and plans (Secure Egg Supply, Secure Milk Supply)


QUESTIONS?