SWINE CARCASS DISPOSAL EVALUATION

using

Air Curtain Incinerator System, Model T-359

December 19 - 20, 1994

Pilot Point, Texas

U.S. Department of Agriculture/Texas Animal Health Commission
Cooperating

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INTRODUCTION

The risk of an epizootic disease spreading from one country to another country continues to concern animal health officials, farmers, producers, and consumers. Livestock disease outbreaks can adversely affect the industry in an area by easily reversing gains in production achieved after years of work and investment. Animal diseases spread in many ways. Some diseases are so insidious that veterinary health managers may not be able to react until after the disease is well established over a wide area. The history of animal disease outbreak events associated with ease of international travel and transportation requires detailed emergency preparedness plans to diagnose, control, and eradicate these diseases before they can spread throughout the entire susceptible species.

Past experience with disease outbreaks in livestock has demonstrated the need for carcass disposal methods that are safe, fast, complete, and environmentally acceptable. Some of the more traditional methods used for the disposal of diseased animal carcasses include: on-farm burial, composting, open burning, burial in public garbage landfills, and rendering. Some of these methods have been very useful for disposing of small numbers of animal carcasses. Their use for the disposal of large numbers of carcasses may result in an increased disease risk to other livestock producers in an area. The short term savings from these methods can easily result in an increased cost later on, which could have been reduced or eliminated if the right techniques had been used initially

Composting is a method that has gained a lot of attention in recent years; It provides a very promising option for disposing of small numbers of diseased animal carcasses. In large herds or flocks, composting should be carefully considered because of the potential risk of disease spread by wild and feral animals.

If well planned and rehearsed emergency preparedness programs are not implemented when epizootics occur, the environmental and cost consequences may be disastrous. International and domestic markets would embargo animals and products from infected areas. Producers and international consumers would likely be the most affected during a major disease occurrence.

The purpose of any disease eradication program must be clearly understood by all who are involved. To effect and execute established eradication policies requires detailed planning and completion if the work is performed properly. To expect field animal health personnel to learn by doing is to assume that the activity is unimportant. There is nothing simple about the proper disposition of diseased and condemned herds in either large-scale emergency programs or less dramatic long-term programs. Planning and training for disposal programs including hands-on experience, is as important as training for those that perform diagnosis and epidemiology. One of the primary reasons for performing this complete process is to train and expose others to euthanasia and disposal procedures not previously utilized.

The U.S. Department of Agriculture, Animal & Plant Health Inspection Service and the Texas Animal Health Commission cooperate in the National Swine Brucellosis and Pseudorabies eradication programs. All swine producing states are cooperating with USDA to completely eradicate swine Brucellosis from herds by the end of 1996. In most states a surveillance and testing program is used to locate and eliminate infection, Blood samples are taken from mature swine during the marketing or slaughtering process and shipped to state/federal diagnostic laboratories. State-of-the-art computerized tests are used to diagnose brucellosis in swine. These diagnostic laboratory tests are almost identical to the test used in detecting brucellosis in cattle. When a positive diagnosis for Brucellosis is found the state involved verifies the test results and places a quarantine on the herd. Usually herd owners agree to accept whole herd depopulation with indemnity and start again with new stock. The Swine Brucellosis infected herds from the Dallas/Ft. Worth, Texas area provided an excellent opportunity to obtain incineration disposal information and data using the Air Curtain Incinerator System. These swine herds were primarily garbage feeders with multiple owners involved on several premises. The infected swine herds were collected and moved to the disposal site using contract animal transporters.

Brucellosis is a contagious disease primarily affecting cattle, pigs, sheep, goats, and dogs.

Brucellosis (Bangs) is caused by bacteria of the genus Brucella. The disease is characterized by abortion, sterility in breeding animals, lameness, and weak newborn. The disease is prevalent in most of the world. Brucellosis in swine is caused by B suis and also occurs in other domestic animals and man. Epidemics of human brucellosis have been reported among packing-house workers, veterinarians, and cattleman, with the usual source being infected swine or cattle. Blood from infected animals also can carry the bacteria. During the slaughtering process blood and body fluids become aerosolized and unless protective gear is worn the bacteria could enter the body via the nasal passages, eyes and open cuts. Packing-house workers who process swine are required to wear gloves, masks and goggles to prevent the entry of the bacteria into the body. Humans who suffer symptoms that may be brucellosis related should contact their doctor and let them know that they have been working around livestock. There are no known cases where brucellosis has been shown to pass from human to human.

ENVIRONMENTAL ASSESSMENT

The Texas Natural Resource Conservation Commission (TNRCC) , is responsible for the Air Quality Program in and around the Ft. Worth, Texas area. They were contacted concerning the test incineration of swine using the Air Curtain Incinerator System, Model T-359. Specific environmental information was provided to a TNRCC representative during the site evaluation and review. The farm owned by Mr. Bill Schindler, 1901 North US. Highway # 377, Pilot Point, Texas was selected as the test site. The farm is used primarily for growing crops such as small grains, soybeans, corn, hay and sod. There were no cattle, horses, swine, domestic animals or wild animals and birds observed on the farm. TAHC and USDA representatives completed a detailed survey of the farms and ranches surrounding the proposed incineration site. The adjacent farms had no large concentration of animals on them. There was one adjacent farm approximately 2½ miles [4 km] north of the incineration site. There were no environmentally sensitive wetlands or ponds of water on the farm or around the incineration site. There were no streams or large drainage ditches on the farm. A large reservoir and recreational body of water, Lake Ray Roberts, is located approximately 5 miles [8 km] west of the farm and test incineration site.

The selected incineration site is located approximately ¾ mile [1.2 km] off Highway # 377, 3 miles [4.8 km] north of the town of Pilot Point, Texas. The farm is completely fenced with locked gates into the property. The fencing and security gates were a primary consideration when selecting the farm as a site for the animal carcass disposal incineration test.

The TAHC contacted the local Denton County and town of Pilot Point, Texas environmental representatives and discussed the planned test disposal project. The county and town provided their verbal approval and requested the names of qualified project representatives.

INCINERATION EQUIPMENT UTILIZED

The Air Curtain Incinerator System, Portable Model T-359, is a completely self-contained unit designed to destroy trees and other wood materials in a safe controlled burning process. The unit is powered by a diesel engine that drives a 15,000 CFM [425 m^3] centrifugal caged fan. Air is forced out of a patented distribution manifold. The 5 foot [1.5 m] manifold sections can be adjusted from 15 to 35 feet [4.50 m to 10.50 m] depending on the size of the incineration pit. Air speed can be adjusted up to 165 MPH [265 km/h] by regulating engine RPM's depending on the need. The air flow is forced across the top and angled downward into the trench or pit. The 165 MPH [265 km/h] air curtain swirls into the pit increasing combustion efficiency and the burning rate because of the increased oxygen being fed to the fire and the greater air turbulence. The process tends to confine the resultant smoke under the air curtain until it is completely consumed by the intense temperatures.

The process provides 4-6 times faster burning rate than with an open fire and using less fuel. No auxiliary fuel source is needed once the fire is started and the air curtain is operating. One additional equipment operator is required to add wood to the pit or trench. This can be accomplished by simply dumping additional wood into the burn area. Temperatures produced in the burn area, depending on the fuel source, range from 1,800° F - 2,800° F [980° C - 1,540° C]. Fuel sources such as coal, hard woods, and injected fuel oil would generate significantly higher burn temperatures. The 360 degree air rotation in the burn trench or pit results in an increased oxygen flow and creates an afterburner effect. This effect is like an exhaust scrubber on a emissions smokestack. The forced air increases oxygen to the burn area much like the old blacksmith forge used to super heat metals for shrinking and reshaping. The recalculating air under the top air curtain provides enough time for organic compounds to be completely burned with very little smoke or ash escaping into the air above. The capability for adding additional fuel during the incineration process is critical for maintaining high burn temperatures.

This evaluation and other test of the air curtain incinerator system has provided the following distinct advantages over open burning or normal incineration of large and small animal carcasses:

High incineration efficiency
Low cost carcass disposal
Portability of air curtain incinerator, Model T-359
Rapid incineration of animal carcasses
Reduced emissions such as smoke and ash
High heat temperatures forced up and away from equipment and operators
Environmentally acceptable
Complete disposal of carcasses
Destruction of pathogenic organisms

NEGOTIATIONS WITH PROPERTY OWNER FOR INCINERATION SITE

Representatives from the TAHC and USDA scheduled meetings with Mr. Bill Schindler concerning the use of his property for the carcass disposal test site. Mr. Schindler is a well respected farmer and community leader in the area. Mr. Schindler's willingness and cooperative support for the project provided significantly toward the success of the test. During the negotiations Mr. Schindler expressed concern about liability responsibility in the unlikely event a major accident occurred during the test carcass disposal incineration project. He expressed concern about being held responsible for any accident that might occur on his property during the test. A simple "hold harmless" document was prepared for signatures of all interested parties. This document provided Mr. Schindler with the necessary hold harmless" security that was necessary to proceed with the project. Mr. Schindler made the following special equipment and other items available for a reasonable cost in support of the test project:

Incineration Site
Wheeled Front-end Loader With Operator
Motorized Pressure Spray Rig, (For Cleaning, Washing, & Disinfection of Trucks, Trailers, and Digging Equipment)
Water Transport Equipment
60 Foot [18 m] Flat Bed Tractor Trailer, (For Observation and Paper Processing Area)
Diesel Fuel
Fire Wood, (Fuel for Incineration of Carcasses)
Security for the area and also for TAHC and USDA owned supplies and equipment
Emergency cellular telephone contact point

ANIMAL IDENTIFICATION, APPRAISAL AND INDEMNITY

Prior to relocation and disposal, swine herds are identified, tagged and tested. When swine herds are found to be positive for brucellosis infection the infected swine herd is independently appraised, identified and tagged. USDA pays the animal owners the appraised fair market indemnity value after the disposal process has been completed.

Claims for indemnity for swine destroyed because of brucellosis must be presented on USDA indemnity claim forms on which the owner must certify that all animals covered are not subject to any mortgage. Indemnity will only be paid after such claim has been approved by the Area Veterinarian in charge or by a designated agency representative.

MEDIA COVERAGE, PUBLIC RELATIONS, AND DOCUMENTATION

Early in the planning process USDA and TAHC made a determination to document and use the swine collection, transportation, euthanasia and incineration of the swine carcasses to train Veterinary Medical Officers (VMS), Animal Health Inspectors, and other animal health personnel. Project managers identified specific VMS's, Inspectors, Animal Health Technicians and other support personnel that were available to participate in the project. The TAHC Public Relations staff was asked to video tape and photograph the project with special emphasis on animal handling and euthanasia. The primary purpose for the video tape and photographs was to use it for the training of personnel that may need to use the procedures in future animal collection and disposal projects.

In rural communities such as in and around the Pilot Point, Texas area, local farmers, ranchers and news media types become very interested in operations of this Type. The TAHC public affairs contact was asked to prepare a fact sheet explaining the complete disposal process for interested individuals and the news media. Several regional and local newspaper reporters asked permission to interview personnel and photograph the operation. Television and news media personnel were granted permission to visit the site with a required understanding of all biosecurity steps and procedures upon entry and exit of the premises.

Agriculture Canada's Chief Veterinary Animal Health Official requested permission to visit and participate in the disposal process. USDA's Veterinary Services and the Agriculture Canada's Veterinary Services cooperate very closely in emergency disease activities. Improved and cost effective animal carcass disposal procedures in both Canada and the Unites States are becoming more and more necessary as animal disease outbreaks occur. The Agriculture Canada representative participated fully in all activities during the incineration test. It was very nice to have our neighbors from Canada visiting and participating in the process.

BIOSECURITY STEPS AND PROCEDURES

During the planning process the potential for accidental exposure and spread of the Brucella bacteria to humans and animals was carefully considered. The veterinarians, inspectors, and other technical personnel handling the swine were required to wear protective clothing such as, disposable coveralls, boots, rubber gloves, goggles and masks to avoid exposure to body fluids and tissues. It is extremely important that all good sound bio security procedures be followed during the handling and disposal process. The specific precautions listed below were used to minimize the risk of disease spread:

1. The euthanasia and incineration site was carefully selected within natural security and fenced property. Access farm roads to the disposal site, locked gates, and adjacent farm land could easily be secured and observed during the process.

2. Farm road access gates were maintained for security and cleaning and disinfection (C&D) purposes. All live animal haul trucks and other vehicles entering and leaving the area were cleaned and disinfected before leaving the area. All used protective wear was carefully collected and bagged for incineration. Boot bathes with proper scrub brushes were maintained for those entering and leaving the secured area.

3 No visitors or other unauthorized personnel were allowed to enter the area unless they were outfitted with proper protective clothing. Only well-trained and essential personnel were allowed to participate in the, handling, euthanasia, and incineration process.

4. The area in and around the incineration site was carefully inspected during the day and at night for domestic dogs and cats as well as wildlife.

CLEANING, WASHING, AND DISINFECTION (C&D) PROCEDURES REQUIRED

Control of all movements (e.g. of equipment and personnel) was given a high level of priority during the diseased animal carcass disposal process. A cleaning, washing, and disinfection plan was prepared by the project leaders prior to implementing the animal collection and disposal process. All project participants were briefed and issued cleaning, washing, and disinfection guidelines for equipment and personnel before entering the incineration area. Trucks, cars, and other vehicles not needed in and around the disposal area were required to park in designated areas to avoid the possibility of spreading disease organisms. A Phenol based disinfectant formulation was used to disinfectant vehicles, equipment, tools, trailers, gates, restraint chutes, euthanasia devices, rubber boots, and contaminated soil. The following daily C&D procedures were required to prevent The possible spread of the organism during and after the operation:

1. Live haul transport trucks drivers and crew members were required to observe and participate in all established biosecurity procedures. Project participants, truck drivers and crew members were required to wear disposable coveralls, hats, gloves, boots, and mask during the loading, off-loading, and handling of animals. Used and contaminated disposable biosecurity clothing items were placed in double plastic bags for incineration. Reusable protective wear items were placed in double plastic bags for removal from the site and proper laundry procedures. These items were all collected and bagged at the entrance biosecurity check point for proper disposal and laundry.

2. Upon completion of the project, equipment such as front end loaders, heavy digging equipment, live-haul trucks, hand tools, incineration equipment, and animal restraint equipment was pressure washed (1,500 psi [105 kg/cm^2]) to completely remove soil, manure, and other contaminated materials prior to disinfection.

3. One application of disinfectant was sprayed to the top layer of soil in and around the off-loading and euthanasia area. After an application of disinfectant approximately three inches [7.60 cm] of top soil was removed and placed in the incineration pit prior to filling in the trench/pit.

HUMANE EUTHANASIA METHOD USED

Considerable time and effort was given by the TAHC and USDA in selecting the proper euthanasia device to be used during the operation. Chemical, electrical and mechanical euthanasia stunning methods were considered for use on the swine. The mechanical captive bolt was chosen as the

euthanasia procedure for the operation. The captive bolt is similar to the devices used in large swine slaughtering plants and is approved as a humane method of slaughtering animals. The captive bolt minimizes the risk of injury to handling and euthanasia personnel. The captive bolt stunning instrument is a skull penetrating rod type device using measured charges of gunpowder caps. Any captive bolt device used must be of the type and size when activated will immediately render animals in total uniform unconsciousness. The stunning operation is an exacting procedure and requires a well trained and experienced operator. He or she must be able to accurately place the stunning instrument at locations on the head to produce immediate unconsciousness. The operator must choose the correct detonating charge with regard to kind, size, and sex of animal. This is especially important knowledge to know when euthanizing large male and female swine in the 500 pound [225 kg] and higher weight range. Barbiturates, (Sleepaway) was available to use on small animals and also on large sows or boars in the 500 to 800 pound [225 to 360 kg] weight range if necessary.

INCINERATION TRENCH/PIT SITE SELECTION AND PREPARATION

The site selected for digging the incineration trench/pit is very important. The type of soil conditions, underground water table, biosecurity potential, and prevailing wind direction should be carefully considered prior to selecting a digging site. Incineration trench/pits locations should not be selected in high water table areas and where sandy soil type conditions exist. The maintenance of good vertical trench/pit walls and the minimum entry of underground water into the burn area provides for higher incineration temperatures. Trench/pit digging sites should also be selected where proper biosecurity measures can be maintained. The size and shape of the incineration trench/ pit has been found to be critical for emission control, especially during fire start up and the addition of fuel and animal carcasses to the burn area. Prevailing wind direction should be carefully calculated in order to prevent unnecessary emissions and safety of equipment and operators. Trench/pit dimensions recommended by the equipment owner are 35 feet long × 8 feet wide × 10-15 feet deep [10.60 m long × 2.40 m wide × 3.00 m - 4.50 m deep]. The trench/pit walls should be vertical for optimum rotation of the air curtain. The trench/pit length can vary depending on the size needed and the number of animal carcasses to be incinerated. The Model T-359 air distribution 5 foot [1.50 m] manifold sections can be adjusted in 5 foot [1.50 m] sections up to 35 feet [10.60 m] depending on the need. The length of the trench/pit should preferably be about 1 foot [30 cm] shorter than the length of the distribution manifold (6 inches [15 cm] each end) to eliminate smoke around the edges of the manifold. The width of the trench/pit is a very critical dimension. If the trench/ pit becomes too wide (distance from distribution manifold to opposite wall) the efficiency of the air curtain is affected, and air blows across and out instead of down into the trench/pit where air circulation occurs. Depending on the soil type conditions and amount of trench/pit wall cave-in during loading, the incineration trench/pit may remain within tolerable dimensions for a few days or several burn days. On the second day of operation minor wall cave-in was observed in the trench/ pit. Soil fill-in adjustments were made in and around the manifold to prevent smoke emissions. The depth of the trench/pit should be deep enough to provide for efficient maximum air curtain circulation in the burn area. The more efficient the air curtain circulation is the possibility exist for hotter burn temperatures.

The incineration trench/pit can be dug using a variety of back-hoe type hydraulic digging equipment. Portable front end type tracked loader/digging equipment or portable grade all equipment using 3-yard [2.3 m^3] buckets can be used. A portable hydraulic backhoe with a 1-yard [0.76 m^3] bucket was used to dig the trench/pit for this location. The back-hoe type digging equipment is recommended in digging geometrically acceptable trench/pits. The back-hoe type equipment usually has a 2-3 yard [1.5 m^3 -2.3 m^3] front-end loader bucket on the front *and* this can be used to load fuel and animal carcasses in to the incineration trench/pit.

Earth trench/pits have been used in several evaluations of the air curtain incinerator system to examine their feasibility. However, above ground semi-permanent of even permanent pits of rock, using (CR-6) crushed concrete or concrete, etc., could be used. Above ground trench/pits could be used in areas where the water table is high and rock or crushed stone is available.

OPERATING EXPENSES

The USDA and TAHC mutually shared in the expense of this incineration test project. The swine restraint chute (knock box) used in the swine euthanasia process was modified to provide an added measure of safety for support personnel and those involved in relocating and securing animals. during the depopulation procedure.

All expenses incurred during the incineration test were carefully tabulated to determine the operational costs. The largest single expense of the operation was lease of the Air Curtain Incinerator System, Model T-359. The fuel (fire wood) was purchased from a local firewood vendor and delivered to the site for a contracted price. Animal carcass and fuel (fire wood) was added to the trench/pit using a large farm tractor with a 3-yard [2.30 m^3] front-end loader bucket. This equipment was also used to assist in set up and take down of the Air Curtain Incinerator forced air metal distribution pipes. Cost for the front-end loader equipment and operator was previously agreed upon between the equipment owner and project leaders. The following actual cost breakdown for the 3 day operation includes protective wear for participants and visitors.

PROJECT COST

Site Prep., Cover Up, Equip Setup, Equip. Take Down, etc.	$1,700.00
Site Rental	650.00
Air Curtain Incinerator (3 Days) Includes operator*	7,500.00
Diesel Fuel	300.00
Protective Wear	2,400.00
Lumber, Plywood and 2 × 4 × 8 [lumber: 5 cm × 10 cm × 240 cm]	135.00
Fire Wood and Delivery, 66 Ricks [circa 40 m^3]	3,960.00
Truck Rental, 2 Ton, 4 days	250.00
Animal Transportation	4,640.00
Chute/Knock Box Modification	1,285.00
Misc. Supplies	225.00
TOTAL	$ 23,045.00**

* *Includes Equipment Transportation, Lodging & meals, 5 days for two people*
** *Does not include Per Diem or Transportation for USDA and TAHC participants*

SMALL TOOLS, EQUIPMENT AND SUPPLIES

The tools, equipment and supply items listed below were assembled prior to the incineration disposal test. The items were removed from temporary storage and relocated to the site in a rental 2½ ton cargo van. The cargo van was equipped with lockable cargo doors, one rear 7 foot [2.13 m] roll up door and one 3 foot [91 cm] wide swing side door. The cargo doors made distribution of supplies and equipment less difficult: and provided a locked secure storage area for all items used during the project. All equipment and supply items not used during the project were returned to TAHC Area Field Office after the project was completed. The list below may not be all inclusive and could be changed to accommodate large or small animal disposal projects.

SPECIAL ITEMS

Bags, plastic, S, M, L
Battery, "C", "D"
Boot covers, plastic disp.
Boots, rubber, S, M, L ,XL, XXL
Boot bath tubs, rubber
Brush, gong, 20" [51 cm] handle
Buckets, utility pail
Captive Bolt Device, hand held
Cattle Chute, with headgate, portable
Communications Equip.
Coveralls, disposable S, M, L, XL, XXL
Diesel Fuel 300 gal. [1,136 liters]
Disinfectant, 1-Stroke Envir.
Euthanasia Solution, "Sleepaway"
Flares, warning, fire starting
Gloves, Exam. Vinyl, S, M, L, XL
Gloves, fabric, S, M, L, XL
Gloves, leather, S, M, L, XL
Goggle, plastic safety
Holder, hog Ring-o-matic
Lariat, 35' [10.60 m], quick release
Mask, nontoxic, SM
Prod, hot-shot 24" [610 cm]
Septisol solution, hand
Sprayer, hand held, 2 gal. [7.5 liters]
Sprayer, Shp. 50 gal. [189 liters]
Swine Chute, modified with headgate
Syringe, 5 cc, 10 cc, 20 cc
Telephones, portable, cell

GENERAL ITEMS

Axes
Bars, wrecking
Chairs, folding
Chain Saw, gasoline & electric
Containers, fuel & water
Coolers, water
Cups, paper
Electric Drill, portable
Fire Extinguishers
First Aid Kit
Flash Light, 2 cell
Generator, portable
Hammers, claw & sledge
Hose, 100 ft. [30 m]
Ladder, step 6' [1.80 m]
Nails, nos. 6-12
Portable toilet, rental
Pumps
Rope, nylon & hemp
Saws, hand & electric
Shovels
Snake bite kit
Table, folding legs, 6' x 32" [180 cm by 81 cm]
Tarps, plastic & canvass
Timbers, wood
Wire Cutters
Wrench Set, metric / SAE

INCINERATION EFFICIENCY FACTORS

Trench/Pit Air Circulation Test

After the incinerator equipment had been set up and the air discharge manifold placed. along side the trench/pit a simple visual test should be performed to observe the air flow rotation in the trench/pit. At this point the fuel had not been loaded into the trench/pit. A small amount of dry leaves and straw was placed in the bottom of the trench/pit: and the air discharge was set at 500 rpm's. During all test procedures the rolling action of the air current in the trench/pit was very evident. The leaves and straw were carried around inside the trench/pit exactly in a circular pattern. No leaves or straw would escape from the trench/pit after being trapped under the air curtain. After this test was performed and the air curtain is visible, it can be reasonably be assumed that the fuel (fire wood) can be loaded into the trench/pit for starting the fire.

Fire Start-up

This test and previous tests have shown that a fire with peak temperatures of approximately 1,800˚F [982˚C] can be reached in one hour using relatively dry wood, i.e., less than 30% moisture. However, 1 to 2 hours may be required to reach the same temperature when the wood moisture content is greater than 50%. It is suggested that small dry kindling along with small wood sizes no longer

than three to 4 feet [1.20 m] and 2 to 3 inches [5 to 8 cm] in width be placed on top of longer and larger wood to begin the fire. In all fire start-up operations diesel fuel was used to completely saturate the kindling and wood prior to adding the warning flare. A warning flare is suggested to start the fire for safety reasons. After about 15 minutes the fire combustion should be distributed across the trench/pit so that the air curtain incinerator fan can be started at low speeds, 200 to 500 rpm's. When the fire intensity has stabilized the air curtain incinerator fan speed can be gradually increased up to approximately 1,500 rpm's. The effects of forced draft air curtain incineration becomes noticeable in the trench/pit and visible emissions from the trench/pit are within tolerable limits. No visible smoke is observed at this time and only heat is being forced into the air above. At this point swine carcasses can be added to the incineration area.

Swine Carcass Incineration Rate

Swine carcass incineration rates were based on actual timed observations for total incineration at temperatures ranging from 1,800° F to 2,000° F [980° C to 1,100° C]. Carcasses weighing approximately 180 pounds [82 kg] were completely incinerated in 15 to 20 minutes at the above estimated temperatures. Air curtain incineration blower fan speeds ranged from 1,500 to 1,600 rpm's. A total of 504 head of swine carcasses, weighing 91,060 pounds [41,300 kg] was incinerated during the 3 days. of operation. The average actual incineration day was approximately 7 hours using 11 cords [40 m^3] of cut and split dry oak/gum firewood per 7 hour period. A very important factor observed during the incineration process was that carcass body fat added significantly to the incineration rate. It was observed that the small carcasses weighing less than 100 pounds [45 kg] were not incinerated as quickly as the carcasses with increased body fat. The body fat appeared to increase the incineration rate and provide higher burn temperatures.

An attempt was made during the test to load the trench/pit with two stacked layers of swine carcasses. When this test was tried the smoke and ash emissions increased rather dramatically. The observed problem was that the carcasses were too tightly packed in the center and too close to the trench/pit walls to allow tile air curtain to operate effectively. The trench/pit overload prevented the air curtain from penetrating down through the fire thus decreasing combustion and incineration.

During the incineration test split and cut up fuel was loaded into the front-end loader bucket and carefully dumped into the trench/pit in areas where fuel was needed. The front-end loader operator was asked to slowly dump the fuel in cooler areas as directed by the incinerator operator. During the incineration test cut up and split oak firewood stacked on pallets with plastic shrink wrap around the stacks was used. The use of shrink wrapped fuel did not require any manual handling. The pallets were picked up with special forks added to the front-end loader and moved above the trench/ pit and allowed to fall off the pallet as the load was tilted by the operator. The shrink wrap was quickly melted from the intense heat thus allowing the firewood to be carefully placed in needed areas.

Carcass Opening

Project leaders decided to perform a test to determine if opening up the swine carcasses would increase the incineration rate. 12 swine carcasses weighing approximately 250 pounds [113 kg] each were cut open to allow the inside organs to be immediately exposed to the high incineration temperatures. Recorded incineration times for 12 animal carcasses not opened, weighing approximately 250 pounds [113 kg], showed no significant incineration time decrease.

Continuous Incineration

Although an around-the-clock burn was never actually attempted during the test, it has been determined that the longer fire is blazing in the trench/pit, the more efficient it becomes allowing for a higher carcass incineration rate. The longest burn day was approximately 12 hours. When swine depopulation ended each day a large number or carcasses were made available for incineration into the night. When the remaining carcasses were added to the trench/pit at the end of the day a decision was made to lower the fan RPM's and let the incinerator system operate all night. Arrangements were made for several checks during the night to assure everything was operating properly.

No additional firewood was added to the trench/pit during the night. In all cases where the equipment was operated during the night the only remains in the trench/pit the next morning was a few hot burning. areas with no large visible carcass part in the area. The next morning fuel was added to the trench/pit which quickly started and was observed to be approximately 1,800° F [982° C] in 20 minutes.

It can be concluded that a minimum period of down time would allow for refueling and servicing the air curtain incinerator. The idea of continuous operation in an emergency could be achieved with shift workers and adequate lighting for *safe* operation during night periods. A two-or-three shift operation could be recommended if necessary and if personnel were available.

SAFETY CONSIDERATIONS

Prevailing Wind Direction

The high heat temperatures generated must be a safety consideration in all procedures using the air curtain incineration system. The loading of fuel and animal carcasses into the trench/pit must be carefully considered when choosing locations and loading methods. The trench/pit digging direction in relation to gusty winds must be carefully planned. Soil and items removed from the trench/pit could be positioned to break the wind direction away from equipment, fuels, and operator personnel.

Sound/Noise Emissions

The noise level in and around the air curtain incinerator blower and diesel engine is relatively low, however, operators must use caution in wearing sound protective devices in and around the equipment. The blower cage is insulated and the diesel engine has a muffler that reduces noise emissions.

Odor Emissions

The efficient operation of the equipment depends on the proper procedures and steps taken to follow the manufacturers recommendations to minimize smoke, ash, and incineration odor escaping from the incineration burn area. Very little if any carcass burning odor was detected during the incineration of animal carcasses.

Unauthorized Observers

Only authorized operating personnel and visitors should be allowed to be in around the equipment during the incineration procedure. Temporary fencing in and around the depopulation and incineration areas could be installed to keep observers at a safe distance.

Fire Hazards

The potential for accidental fire exist in and around any controlled burning operation. A fully brained safety officer must be involved during any procedure of this type. Planning for proper fire control and the availability of approved fire extinguishers must be considered and made available for use in the event of an emergency. Gusty winds that disrupt the air curtain could cause spot fires and without experienced observers and operators could cause extreme difficulty. Consideration should be given to involving local fire control officials in the event an emergency occurs.

Personal Injuries

No personal injuries during the entire operation were reported. Personal safety items such as hard hats, safety boots, and back protection devices were made available to all personnel who worked in and around the project. Local rescue and emergency medical personnel must be advised and made aware of the operation. First Aid Kits and other emergency medical items must be available for immediate use in the event of an emergency.

CONCLUSIONS

The following Conclusions are being made based on the results obtained testing the Air Curtain Incinerator, (ACI) Model T-359:

1. The ACI Model T-359 can incinerate *large* and small swine carcasses using cut and split seasoned firewood.
2. Incineration rates are acceptable and could range up to 40 tons [36 mt] of animal carcasses during a 10 hour day of operation.
3. Large numbers of animal carcasses could be incinerated using one or more ACI's at a single location.
4. Epizootic disease organisms and other animal disease organisms can be effectively eliminated using this disposal method.
5. The ACI Model T-359 can be quickly relocated to areas where needed in a short period of time.
6. The ACI Model T-359 can be operated using an in ground trench/pit or a prepared above ground level incineration pit.
7. The ACI Model T-359 can be set up or taken down for relocation or travel in less than 2 hours
8. Emissions during the operation of the ACI Model T-359 were negligible and very acceptable from an environmental standpoint.
9. Estimated incineration temperatures in excess of 2,500° F [1,375° C]. can be achieved.
10. Remaining residue after incineration appeared to be less than 1% in the trench/pit area. Inspection of incinerated ashes contained no visible bones or teeth.
11. Continuous 24-hour operation can he achieved if necessary.
12. The danger of uncontrollable burning using the ACI Model T-359 is considerably less than with other more common open incineration/burning procedures.
13. The ACI Model T-359 can be operated in rainy weather. Reports are that some rainfall or moisture enhances the incineration process.
14. Fuel and animal carcasses are relatively easy to add to the incineration trench/pit during operation using extended front-end loader type equipment.
15. In order to reduce the number of personnel required for operation of the ACI Model T-359 incineration equipment, consideration should be given to the use of platforms. conveyors, and other equipment for moving animal carcasses to the incineration area. Mechanical loading platforms, conveyors and other equipment would increase the safety factors for workers in and around the equipment.
16. To avoid the expense of cleaning, washing and disinfection of personnel in and out of the secure area, lunches, water, and sanitary facilities should be planned for operations of this type.
17. When possible project managers must be aware of and plan for all weather conditions. In the event of unexpected severe weather conditions alternate plans should be developed that would provide continuation with minimum problems for equipment and personnel.

RECOMMENDATIONS

The ACI Model T-359 is available for purchase for approximately $30,000 [circa $36,200 in 2002]. If purchased by Veterinary Services additional support equipment would have to be purchased. Storage for the support equipment and incinerator would have to be arranged for and maintained. Maintenance and equipment operators would have to be trained to assure operational availability. Transport equipment. such as proper hauling and transport vehicles would have to be purchased and properly equipped. The cost for equipment and standby operators may not be cost effective. When considering the technology and knowledge required for operation and maintenance of the equipment, proper trench/ pit construction, loading fuel and animal carcasses into the incineration area, and support equipment required, the only reasonable alternative would be to rent or lease this type of equipment with trained operators and maintenance personnel.

In lieu of purchase, it is recommended that a retainer type lease arrangement be considered between VS and the owner of the equipment used for the test to assure availability during any emergency disposal operation that might become necessary. The equipment owners would be receptive to some sort of negotiated retainer type contract arrangement to assure equipment availability in the event of an emergency.

In emergency animal disease outbreaks where animal carcass disposal methods such as open burning, burial, rendering, and composting cannot be utilized, the ACI method for high temperature incineration carcass disposal will provide an acceptable alternative for safely disposing of large and small animal carcasses.

It is also recommended that VS make immediate plans to test the ACI Model T-359 using turkey and chicken carcasses. Information and data should be collected to determine incineration time factors using poultry carcasses.

The combination use of coal and fire wood should be considered and tested using the ACI Model T-359 incinerator. Incineration time factors may considerably higher when burning coal/firewood during disposal operations. Poultry carcass moisture content and weight could affect incineration time factors while using the ACI Model T-359.

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* * * * *

NOTE:
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