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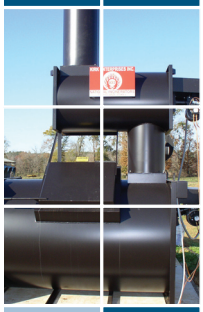

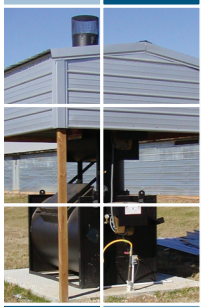

How Much Does That Incinerator Cost?

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To protect natural resources and provide biosecurity for farms, dead poultry must be collected often and disposed of properly. In Texas, poultry carcasses are only allowed to be buried in a major die-off and if the number of dead birds exceeds 0.3 percent per day of the total farm inventory. Incineration—defined as the thermal destruction of carcasses aided by auxiliary fuel such as propane, diesel or natural gas—is one of the common and acceptable methods of routine disposal.

When purchasing a new incinerator or retrofitting an existing one, consider both the short-term and long-term costs. The rising price of fuel increased the cost of incineration. Alternatives to incineration include composting the carcasses, disposing of them at a permitted landfill or storing them temporarily before routine pick-up by a rendering service.

Typical costs

Costs are categorized as:

- Capital expenditures, which include the cost of the incinerator and its installation and structural costs
- Fixed costs that are known and will not change, such as the cost of obtaining air quality authorization from the Texas Commission on Environmental Quality by registering for a permit-by-rule with a form PI-7
- Operating costs of labor, fuel and maintenance

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Capital expenditures

The total installation cost for an incinerator at a poultry operation can range from $7,000 to nearly $20,000, excluding interest on invested capital. The interest rate should reflect either the rate paid for borrowed capital or the rate at which the producer's own capital could be invested in an alternative long-term financial instrument as an opportunity cost. In Texas, funding may be available through the Texas State Soil and Water Conservation Board or the U.S. Department of Agriculture's Natural Resources Conservation Service.

Fixed costs – Air Quality Authorization

In Texas, all incinerators are required to have air quality authorization from the Texas Commission on Environmental Quality. Most poultry incinerators are authorized with a permit-by-rule with a form PI-7 under Title 30 of the Texas Administrative Code §106.494, while others may obtain authorization with a standard permit or an individual permit. The environmental quality commission has a list of poultry incinerators that meet the air quality requirements on its Web site at http://www.tceq.state.tx.us/permitting/air/nav/air_agdocs.html. More information on air quality requirements in Texas is available from the Air Permits Division at 512-239-1300 or http://www.tceq.state.tx.us/nav/permits/air_permits.html. As of May 2008, the registration fee for a poultry incinerator is $100 or $450, depending upon the size of the operation.

Operating costs

Several factors affect the total operating cost, including:

- Labor cost or the amount of time and skill necessary to operate the incinerator
- Fuel cost which can vary within a given year
  Figure 1 shows the typical fuel costs from November 2007. Table 1 lists the manufacturers' data on the consumption of fuel and compares the different units' rate of consumption.
- Maintenance costs, including replacement of the grates, controls and burners, and re-bricking the interior with high temperature bricks
- Interest cost, either as the rate paid for borrowed funds or the rate that the producer's funds would earn in a short-term financial instrument as an opportunity cost

The fuel cost is generally the largest operating expense. A typical six-house broiler operation in East Texas spent about $3,600 for fuel in 2007. However, the amount of fuel needed to burn 100 pounds of carcasses depends on the incinerator. Manufacturers' data for 26 different incinerators are shown in Table 1. Data on fuel consumption were obtained from information provided to the Texas Commission on Environmental Quality by the manufacturers and verified through phone calls and e-mail correspondence with manufacturers.

Not included is interest on the energy cost. To include an interest charge on the fuel cost, use this formula: fuel cost x (1 + i/100). At 7 percent interest, this would equal: fuel cost x (1 + .07). For example, calculate the propane cost of $36.40 for Incinerator A at 7 percent interest rate for a year later: $36.40 x (1 + .07) = $38.95.

Explanation of columns in Table 1

Incinerator capacity: Weight of carcasses that can be loaded at one time

Throughput: The rate at which carcasses are thermally destructed

Fuel consumed by the incinerator: The amount of fuel used to incinerate 100 pounds of birds

Cost of fuel: The fuel consumed by the incinerator and the price of fuel as reported in Figure 1.

Table 1 shows the cost to incinerate 100 pounds of carcasses can range from $1.30 to $34.60. Ask the manufacturer for references to determine how much fuel is likely to be consumed each year.

Typical Fuel Costs (November 2007)

Diesel	National average	$3.457/gal or $24.87/MMBtu
	BTUs per gallon	139,000

Source: American Automobile Association
http://www.fuelgaugereport.com/index.asp

Propane	National average	$1.655/gal or $18.18/MMBtu
	BTUs per gallon	91,000

Source: Energy Information Administration
http://tonto.eia.doe.gov/oog/info/twip/twip_propane.html

Natural Gas	National average	$0.0075/scf or $7.270/ MMBtu
	BTUs per scf	1,026

Source: Energy Information Administration
http://tonto.eia.doe.gov/oog/info/ngw/ngupdate.asp

+MMBtu – million BTUs
BTU – British Thermal Unit

Figure 1. Average fuel cost for diesel, propane and natural gas in November 2007.

Table 1. Comparison of fuel costs of various incinerators based on capacity, throughput, fuel consumption and fuel cost. (Source: Texas Commission on Environmental Quality public records and e-mail and telephone communications with manufacturers)

Incinerator	Incinerator Capacity (pound)	Throughput (pounds per hour)	Fuel Consumed by Incinerator			Cost of Fuel to Incinerate 100 pounds of Carcasses Based on November 2007 Fuel Prices		
			Diesel (gallons per 100 pound)	Propane (gallons per 100 pounds)	Natural gas (standard cubic feet per 100 pounds)	Diesel (cost per 100 pounds)	Propane (cost per 100 pounds)	Natural Gas (cost per 100 pounds)
A	200	75		22	1949		$36.40	$14.50
B	200	75		25	2209		$41.40	$16.50
C	250	50	6.1	9.3	828	$21.10	$15.50	$6.20
D	250	100	1.2	1.6		$4.10	$2.60	
E	300	65		7.6	668		$12.60	$5
F	300	80 - 100	6-7.5	6-7.5	400-500	$20-$25	$9.90-$12.40	$3-$3.70
G	400	55	5.9	7	709	$20.40	$11.60	$5.30
H	400	85		5.8	511		$9.60	$3.80
I	400	100		16.5	1462		$27.30	$10.90
J	400	130		16.9	1499		$28	$11.20
K	500	100	6	6	400	$20.70	$9.90	$3
L	500	100	8-10	10-16	1000-1500	$27.60-$34.60	$16.60-$26.50	$7.50-$11.20
M	500	150	5.3	6.7-10.7	667-1000	$18.40	$11-$17.70	$5-$7.50
N	500	150		12.6	1100		$20.80	$8.20
O	500	150	1	1.3		$3.50	$2.20	
P	500-600	165	6	9	900	$20.70	$14.90	$6.70
Q	600	175		12.6	1114		$20.80	$8.30
R	700	80-130	1.2	1.8		$4.20	$2.90	
S	750	125		7.32	644		$12.10	$4.80
T	800	200		8.5	755		$14.10	$5.60
U	900	80-130	1.3	1.9		$4.40	$3.20	
V	1000	200	0.6	0.8		$2.10	$1.30	
W	1100	165		6	527		$9.90	$3.90
X	1500	80-130	1.5	1.9		$5.10	$3.10	
Y	2300	250		6.6	579		$10.90	$4.30
Z	3000	250	0.64	0.83		$2.20	$1.40	

Proper maintenance will keep the incinerator functioning properly and longer. Incinerators usually last about 7 years, but an incinerator that is not properly maintained may not last even 5 years, while a well-maintained incinerator might last 10 years or more. Ask the manufacturer for the costs of replacement items and a timetable for making those replacements. Most incinerators include primary and secondary burners, a chamber, control panels and grates to hold the carcasses, as illustrated in Figure 2. Some units require the ash to be removed daily.

By gathering all of the data, a producer can make an educated determination of the total cost of an incinerator. An example worksheet for sizing incinerators and calculating associated costs is provided, as is a blank worksheet to estimate the cost of an existing incinerator or the planned purchase of one.

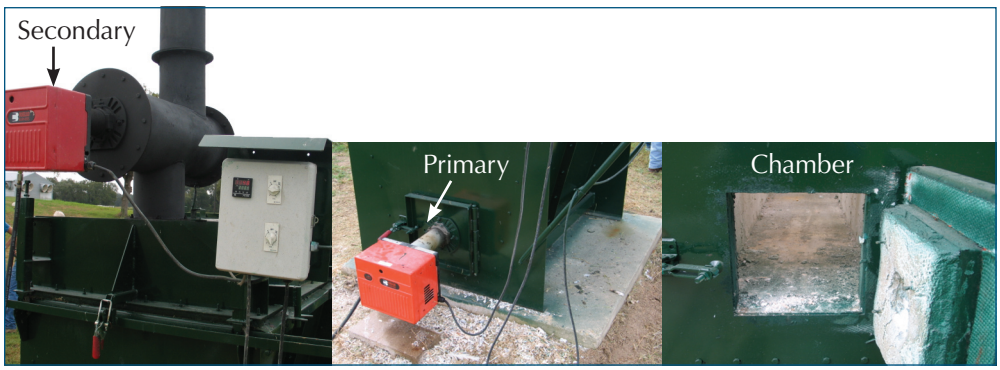

Figure 2. From left: Secondary burner, primary or main burner and combustion chamber.

Sizing the Incinerator and Calculating Associated Costs

In addition to comparing fuel costs, know the size of incinerator the operation requires.

Step 1: Calculate the weights of carcasses based on a daily mortality rates of 0.15 percent and 0.3 percent for full-sized birds.

If the mortality exceeds 0.3 percent per day, the mortality is considered catastrophic by Texas law and incineration is not a feasible means of disposal.

Minimum weight planned for daily carcass disposal = maximum number of birds x market weight x 0.15 percent

Maximum weight planned for daily carcass disposal = maximum number of birds x market weight x 0.30 percent

Step 2: Calculate the hourly rate required to dispose of the birds based on running the incinerator a maximum of 11 hours per day.

Minimum burn rate (pounds per hour) = minimum weight planned for daily carcass disposal (pounds per day) ÷ 11 (hours per day)

Maximum burn rate (pounds per hour) = maximum weight planned for daily carcass disposal (pounds per day) ÷ 11 (hours per day)

Step 3: Determine how many incinerators are required, based on the hourly throughput of the incinerator, to meet the minimum disposal requirement.

The total hourly burn rate must be greater than the minimum burn rate calculated in Step 2. If using one incinerator, the total hourly burn rate is the same as the hourly burn rate; if more than one incinerator is installed, total hourly burn rate is the sum for all incinerators.

Step 4: Determine the number of times the incinerator will need to be loaded to incinerate the planned daily mortality.

Minimum number of loads planned = minimum weight planned for daily carcass disposal ÷ capacity of the incinerator

Maximum number of loads planned = maximum weight planned for daily carcass disposal ÷ capacity of the incinerator

Step 5: Determine the annual mortality to be disposed of with the incinerator.

Number of houses x birds per house x average weight of birds x percent mortality loss x number of flocks per year

Step 6: Determine the capital cost of the equipment, interest on investment and fixed costs.

Step 7: Estimate annual operating cost for fuel.

Annual mortality ÷ 100 x fuel required to burn 100 pounds of carcasses x current price of fuel

Step 8: Estimate the annual labor cost to load the incinerator.

Annual mortality ÷ capacity of incinerator x labor hours per load x labor cost

Step 9: Obtain maintenance costs from the manufacturer.

Step 10: Calculate annual operating costs including interest charges.

Add together the values from Steps 7 through 9 and multiply by 1+ i (i = .07) for the total annual operating costs.

Step 11: Determine the lifespan of the incinerator and calculate annual capital costs.

Example: Poultry operation with six conventional broiler houses and 20,000 birds per house. The market weight of the birds is 5.5 pounds. Average bird weight is 3 pounds. Typical mortality loss is 0.3 percent. The facility has 6.5 flocks per year.	
Step 1: Calculate the weights planned for daily mortality rates.	
Minimum weight planned for daily carcass disposal	= 120,000 birds x 5.5 pounds per bird x 0.15 percent = 990 pounds of carcasses/day
Maximum weight planned for daily carcass disposal	= 120,000 birds x 5.5 pounds per bird x 0.3 percent = 1,980 pounds of carcasses/day
Step 2: Calculate the hourly rate required to dispose of the birds based on running the incinerator a maximum of 11 hours per day.	
Minimum burn rate = 990 pounds of carcasses per day ÷ 11 hours per day = 90 pounds per hour **Maximum burn rate** = 1,980 pounds of carcasses per day ÷ 11 hours per day = 180 pounds per hour	
Step 3: Determine how many incinerators are required based on the hourly throughput of the incinerator. *For this scenario, only one incinerator is needed if the hourly throughput is between 90 and 180 pounds per hour.*	
Option 1: Select **Incinerator U** with an hourly throughput averaging 105 pounds per hour and a capacity of 900 pounds.	***Option 2:*** Select **Incinerator J** with an hourly throughput averaging 130 pounds per hour and a capacity of 400 pounds.
Step 4: Determine the number of times the incinerator will need to be loaded to incinerate the planned daily mortality.	
Minimum number of loads is 990 pounds per day ÷ 900 pounds per load = **1 to 2 loads per day** Maximum number of loads is 1,980 ÷ 900 pounds per load = **2 to 3 loads per day**	Minimum number of loads is 990 pounds per day ÷ 400 pounds per load = **2 to 3 loads per day** Maximum number of loads is 1,980 ÷ 400 pounds per load = **4 to 5 loads per day**
Step 5: Determine the annual mortality to be disposed with the incinerator.	
Annual mortality	= 6 houses x 20,000 birds per house x 3 pounds per bird x 3 percent x 6.5 flocks per year = **70,200 pounds of carcasses per year**
Step 6: Determine the capital cost of the equipment from a local distributor, 5 percent interest charge on invested capital, and fixed costs for installation and obtaining the permit.	
Estimated cost: $18,000 installed with permit + $900	Estimated cost: $9,000 installed with permit + $450
Step 7: Calculate annual operating cost for fuel. Annual mortality ÷ 100 x fuel required to burn 100 pounds of carcasses x current price of fuel	
Using propane, the fuel required is 1.9 gallons per 100 pounds 70,200 pounds ÷ 100 x 1.9 gallons x $1.655 per gallon = **$2,207 per year**	Using propane, the fuel required is 16.9 gallons per 100 pounds 70,200 pounds ÷ 100 x 16.9 gallons x $1.655 per gallon = **$19,634 per year**
Step 8: Calculate the annual labor cost to load the incinerator. Annual mortality ÷ capacity of incinerator x labor hours per load x labor cost	
70,200 pounds ÷ 900 pounds per load x .5 hours per load x $10 per hour = **$390 per year**	70,200 pounds ÷ 400 pounds per load x .5 hours per load x $10 per hour = **$878 per year**
Step 9: Obtain annual maintenance costs from the manufacturer.	
Estimated cost: **$300 per year**	Estimated cost: **$300 per year**
Step 10: Calculate annual operating costs. Add together the values from Steps 7 through 9 and add 7 percent interest (i) charge on the total.	
= ${2,207 + 390 + 300} × (1+0.07) = **$3,100**	= $19,634 + 878 + 300 + 1,457 = **$22,269**
Step 11: Determine the lifespan of the incinerator and calculate annual capital costs.	
Lifespan is estimated to be 7 years Capital cost per year with interest or finance cost = $18,900 ÷ 7 years = **$2,700** **Total estimated annual cost** $2,700 + $3,100 = $5,800	Lifespan is estimated to be 7 years Capital cost per year with interest or finance cost = $9,450 ÷ 7 years = **$1,350** **Total estimated annual cost** $1,350 + $22,269 = **$23,619**

Step 1: Calculate the weights planned for daily mortality rates.

Minimum weight planned for daily carcass disposal = _____ (number of birds) × _____ pounds per bird (market weight of birds*) × 0.15 percent = _____ **pounds of carcasses per day**

Maximum weight planned for daily carcass disposal = _____ (number of birds) × _____ pounds per bird (market weight of birds*) × 0.3 percent = _____ **pounds of carcasses per day**

(*Use average market weight for your own operation.)

Step 2: Calculate the hourly rate required to dispose of the birds based on number of hours the incinerator will run per day.

Minimum burn rate = _____ pounds of carcasses per day (minimum weight planned for daily carcass disposal) ÷ hours per day = _____ **pounds per hour**

Maximum burn rate = _____ pounds of carcasses per day (maximum weight planned for daily carcass disposal) ÷ hours per day = _____ **pounds per hour**

Step 3: Determine how many incinerators are required based on the hourly throughput of the incinerator.

Number of incinerators = _____.

Step 4: Determine the number of times the incinerator will need to be loaded to incinerate the planned daily mortality.

Minimum number of loads planned = _____ pounds per day (minimum weight planned for daily carcass disposal) ÷ _____ pounds per load (capacity of the incinerator) = _____

Maximum number of loads planned = _____ pounds per day (maximum weight planned for daily carcass disposal) ÷ _____ pounds per load (capacity of the incinerator) = _____

Step 5: Determine the annual mortality that is to be disposed with the incinerator.

Annual mortality = _____ (number of houses) × _____ number of birds per house × _____ pounds per bird (average weight of birds) × _____ percent (mortality loss**) × _____ number of flocks per year = _____ **pounds of carcasses per year**

(**Use average annual mortality loss for your operation. The book value of average annual mortality loss is 3 percent)

Step 6: Determine the capital cost of the equipment from local distributor, 5 percent interest charge on invested capital, and fixed costs for installation and obtaining the permit.

Capital cost of the equipment and fixed costs for installation = **$**_____ installed with permit

Step 7: Calculate annual operating cost for fuel.

Annual operating cost for fuel = _____ pounds (annual mortality) ÷ 100 × _____ gallons (fuel required to burn 100 pounds of carcasses) × $_____ per gallon (current price of fuel) = **$**_____ **per year**

Step 8: Calculate the annual labor cost to load the incinerator.

Annual labor cost to load the incinerator = _____ pounds (annual mortality) ÷ _____ pounds per load (capacity of incinerator) × _____ labor hours per load × $_____ per hour labor cost = **$**_____ **per year**

Step 9: Obtain maintenance costs from the manufacturer.

Estimated maintenance cost: $_____ **per year**

Step 10: Calculate annual operating costs. Add together values from Steps 7-9 and add percent interest (i) charge on the total.

Annual operating costs = {$_____ (fuel costs) + $_____ (labor costs) + $_____ (maintenance cost) = $_____} × (1+i) = **$**_____ **per year.**

Step 11: Determine lifespan of the incinerator and calculate annual capital costs.

Lifespan is estimated to be 7 years. Use actual number if known.

Annual capital cost = $_____ (capital costs from Step 6) ÷ _____ years (lifespan) = **$**_____

Total estimated annual cost

$_____ capital cost per year + $_____ annual operating cost = **$**_____

Acknowledgment

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