AR No. 3

Insulate Cookers

Recommended Action

Insulate the two can cookers with two-inch fiberglass batted insulation covered with a foil jacket for protection.

Assessment Recommendation Summary			
Energy (10^6Btu)	Cost Savings	Implementation Cost	Payback (years)
116	$540	$345	0.6

Background

Currently the two can cookers have no insulation and are releasing a large amount of heat into the plant. By adding insulation the majority of this heat will be contained and result in a reasonable savings.

Anticipated Savings

The existing energy loss (E_0) can be found from:

$$E_0 = [U_0 \text{ x } ((A_{C1} + A_{C2}) \text{ x } (T_S - T_A))] \text{ x } H$$
$$= [2 \text{ Btu/ht-}^oF\text{-ft}^2 \text{ x } ((245 + 180) \text{ ft}^2 \text{ x } (180\text{-}10)\ ^oF)] \text{ x } 1{,}344 \text{ hr/yr}$$
$$= 125.7 \text{ x } 10^6 \text{ Btu/yr}$$

where

U_0 = Existing Heat Transfer Coefficient: 2 Btu/hr-^{o}F-ft
A_{C1} = Area of Larger Cooker: 245 ft^2
A_{C2} = Area of Smaller Cooker: 180 ft^2
T_S = Surface Temperature of the Tanks: 180 ^{o}F
T_A = Ambient Temperature: 70 ^{o}F
H = Annual Operating Hours: 1,344 hr/yr

The Energy loss after 2 inches of fiberglass batted insulation and a foil jacket (E_1) can be found from:

$E_1 = [U_1 \times ((A_{C1} + A_{C2}) \times (T_S - T_A))] \times H$
$= [0.16\ Btu/hr\text{-}^oF\text{-}ft^2 \times ((245 + 180)\ ft^2 \times (180\text{-}70)\ ^oF)] \times 1{,}344\ hr/yr$
$= 10.1 \times 10^6\ Btu/yr$

where

U_1 = Proposed Heat Transfer Coefficient
$= 1/(1/U_0 + 1/R)$
$= 1/(1/2 + 1/0.17)$
$= 0.16\ Btu/hr\text{-}^oF\text{-}ft^2$
R = Insulation R-Value
= Thermal Conduction/Inches of Insulation
$= (0.34\ Btu\text{-}in/ft^2\text{-}hr\text{-}^oF)/2\text{-}in)$
$= 0.16\ Btu/ft^2\text{-}hr\text{-}^oF$

The energy savings (ES) can be found from:

$ES = (E_0 - E_1)$
$= (125.7 - 10.1) \times 10^6\ Btu/yr$
$= 115.6 \times 10^6\ Btu/yr$

The cost savings (CS) can be found from:

$CS = ES \times \$4.6924 / 10^6\ Btu$
$= 115.6 \times 10^6\ Btu/yr \times \$4.6924 / 10^6\ Btu$
$= \$540/yr$

Savings Summary				
Source	Quantity	Units	Energy 10^6Btu	Cost $
Natural Gas	1,156	Therms	116	$540

Implementation Cost

In addition to the two inches of fiberglass batted insulation, a foil jacket will be necessary for protection. The cost of the insulation and the jacket used below include installation. The implementation cost (IC) can be found from:

$IC = (A_{C1} + A_{C2}) \times [(\text{Insulation Cost}) + (\text{Cost of Jacket})]$
$= (245 + 180)\ ft^2 \times [(\$0.50/ft^2) + (\$0.05/ft^2)]$
$= \$345$

The savings will pay for the implementation cost in 0.6 years.