W1.78

Radiation Losses from Kiln Shell

1 Radiation loses from kiln shell, calciner, tertiary air duct, preheater and cooler are directly related to the surface temperatures and the area .

2 Surface temperatures are a function of conductivity of refractory used, type of coating in the burning zone of the kiln.

3 They are also dependent on the wind velocity.

4 Calculation of radiation losses.
Radiation losses in kcal/m^2/hr are expressed as;
$Q = 4.96 * A * \{(T_1/100)^4 - (T_2/100)^4\} * b$
Q = radiation loss in kcal/hr
T_1= absolute temperature of hot surface
T_2= absolute temperature of cold or receiving surface.
A = area
b = coefficient determined by blackness of surfaces and angle.

5 Total heat loss from a kiln shell can also be expressed as
$Q = \Sigma F * a * (ts - ta)$ where
Q = heat loss in kcal/hr
F = surface area of each section
ts = surface temperature of shell
ta = outdoor temperature
a = heat trsnsfer coefficient expressed as kcal /m^2 / hr
roughly $a = 3.5 + ts*0.062$

6 Following table furnishes values of *a* arrived at from above formula.

Table 1

Shell temp.	*a*			
^{o} c	Kcal/m^2h ^{o} c			
	Wind velocity m/sec			
	0	2	4	6
100	9.7	16.2	20	
150	12.8	17.15	21.7	
200	15.9	19.4	24	
250	19	22	26	
300	22.1	25.2	29	

7 Shell temperatures in kiln vary from inlet to outlet. They are also influenced by

the thickness of coating in the burning zone.
Typical values are furnished in the following table.

Table 2

Typical shell (surface) temperatures

location	description	Temperature ^{o} c
Kiln hood	Wet kiln	160
	Dry kiln	200
	Preheater kiln	230
	Calciner kiln	245
Kiln outlet	Light coating	365
zone	Medium coating	280
	Heavy coating	225
Burning zone	Light coating	360
	Medium coating	280
	Heavy coating	240
transition	Light coating	365
zone	Medium coating	280
	Heavy coating	225
Calcining zone	Without insulation	
lower		240
middle		220
upper		210
Preheater zone		
suspension	With insulation	140
preheater	Without insulation	210
Dry kiln	With insulation	130
	Without insulation	190
Wet kiln	With insulation	125
	Without insulation	185
Chain zone		
Dry kiln		140
Wet kiln		95
Feed inlet zone		
Wet kiln		80
Dry kiln		130
preheater		205