Appendix 9D

Fireball Equations

Appendix 9D : Fireball Equations

Fireball equations used:

Fireball Equations based on Crossthwaite

D = 58M^.3333	D = Fireball Dia m M = mass in Fireball (te)
T = 4.5 M^.333	M<= 37 te T = Fireball Duration (s) M = mass in Fireball (te)
T = 8.2 M^.167	M > 37 te T = Fireball Duration (s)

Emissive power q = 235 p^0.39 based on saturated vapour pressure

P = Vessel burst pressure (MPa)
Config F = (R^2 x X^2) / (R^2 + X^2) ^1.5
R = Fireball radius (m)
X = distance from source (m)
Transmis Tatm = 1-0.0565 ln(X-R)
Outdoor Radiation I = q x F x Tatm
Indoor Radiation Ii = 3150 x (R^2/X^2)-150
Probit Y = -14.9+2.56*LN(V)
Y = Probit for fatal response
V = thermal radiation dose (kW/m2)^1.33 s
If V >= 3000 then Y = 8
100% fatalities assumed within fireball

The above equations were incorporated into a spreadsheet model which calculated 50% fatality levels and provided data for the RiskProf lethality file.
The 50% fatality distance corresponds to the Fireball radius with 100% fatality assumed at lesser distances. Fatality rates among the exposed population are calculated from Riskprof's lethality files based on the probit function for the actual distance involved. The percentage of fatalities will be 100% up to the fireball radius, 50% at the radius and correspondingly less as the fireball radius is exceeded.