Equations for final rise of a bouyant plume

Neutral-Unstable

$$dh = 1.3 \frac{F}{u\ u^{*2}}$$

Stable (windy)

$$dh = 2.6 \left(\frac{F}{us}\right)^{(1/3)}$$

Stable (calm)

$$dh = 5.3 \frac{F^{1/4}}{S^{3/8}}$$

Bouyancy Flux ($L^4\ T^{-3}$)

$$F = \frac{g\ Qh}{pi\ Cp\ r\ T} = 3.7\times10^{(-5)}\ Qh$$

$$\text{constant} = \frac{[m^4/s^3]}{[cal/s]}$$

F = 3.7E-05 Qh (cal/sec)
F = 2.6E-06 Qh (btu/hr)
F = 7.6E-07 Qh (watts)

Heat Emission (cal/s)

cal/sec = 0.07 btu/hr
watt = 0.2931 btu/hr

BlueSky ~ 35×10^9 btu over 6 hour burn duration
Average = 6×10^9 btu/hr = 1760 Mw

Stability (T^{-2})

$$S = \frac{g}{T}\frac{dO}{dz}$$

References

Arya, S.P., 1999, Air Pollution Meteorology and Dispersion, Oxford University Press, New York, 310 p.

Briggs, G.A., 1969, Plume Rise, U.S. Atomic Energy Commission, TID-25075, NTIS, Springfield, VA, 81p.