Note on MACCS-nn-PLHEAT output

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Note on MACCS-nn-PLHEAT output

MELCOR2 User Guide:

MACCS-nn-PLHEAT Enthalpy associated with release path index nn.

DOE-EH-4.2.1.4-MACCS2-Code Guidance:

Variable PLHEAT (Sensible heat rate of each plume segment in Watts)

Neither document provide formula for these variables.

Note on MACCS-nn-PLHEAT output

From the documentation of an another off-site consequence code:

Sensible heat is:

$$Q_{sens}^{steam} = w^{steam} \cdot c_p^{steam} \cdot (T - 37.8)$$

$$Q_{sens}^{air} = w^{air} \cdot c_p^{air} \cdot (T - 37.8)$$

$$Q_{sens} = Q_{sens}^{steam} + Q_{sens}^{air}$$

where:

w is the release flow rate

c_p is specific heat at constant pressure

T is temperature of release in ℃

At first, assume T is the temperature in the containment (CVH source volume for release)

Try to recalculate MACCS-nn-PLHEAT for one MELCOR simulation

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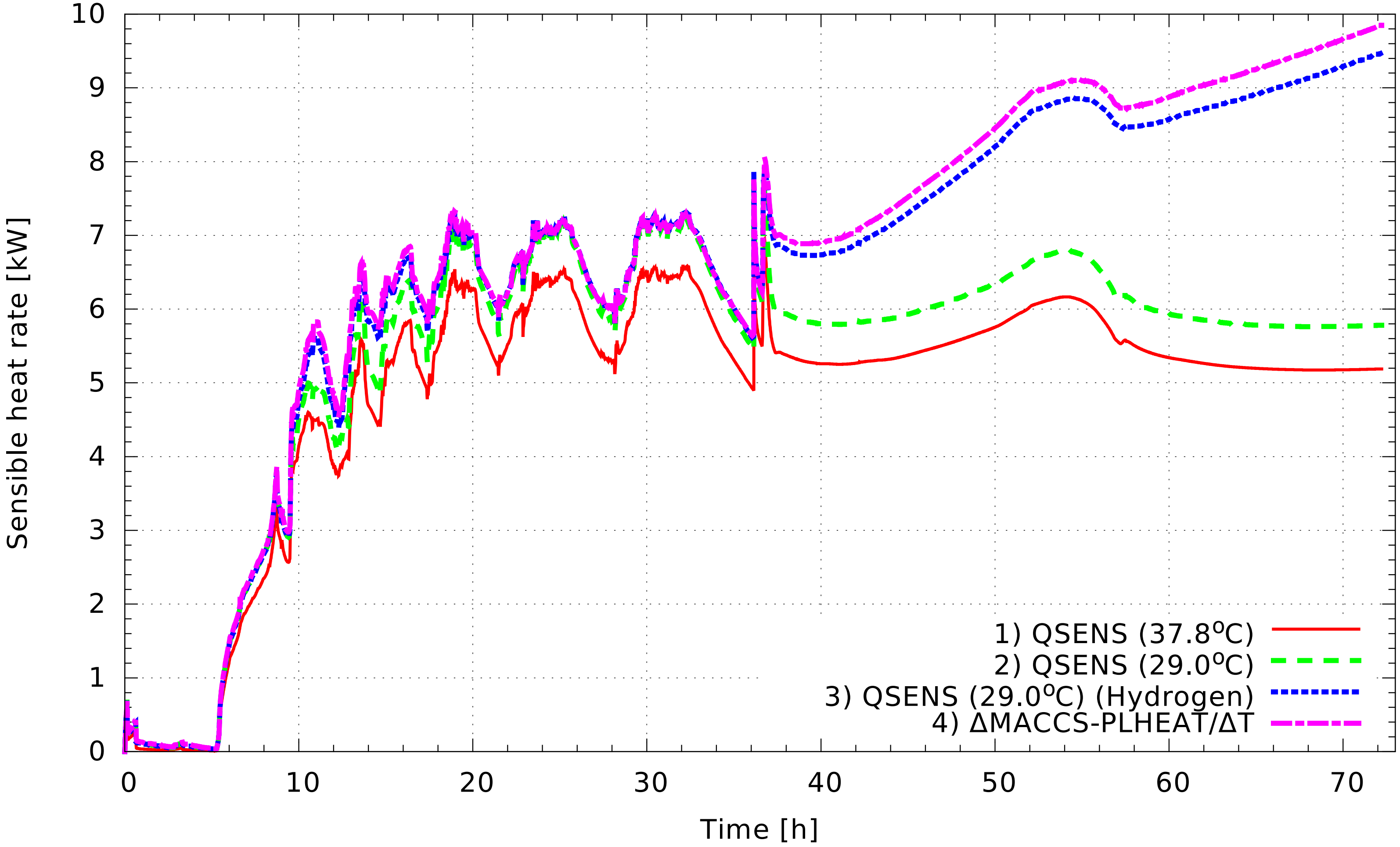

1) Q_{sens} calculated by equations from the previous slide, $w^{air} = w^{tot} - w^{steam}$, $c_p^{steam} = 1.8\,\mathrm{kJ/(kg\cdot K)}$, $c_p^{air} = 1\,\mathrm{kJ/(kg\cdot K)}$

2) Outside temperature 29 ℃ (in MELCOR CVH representing environment)

3) Hydrogen added, $w^{air} = w^{tot} - (w^{steam} + w^{hydrogen})$, $c_p^{hydrogen} = 14\,\mathrm{kJ/(kg\cdot K)}$

4) Numerical derivative of MELCOR MACCS-nn-PLHEAT

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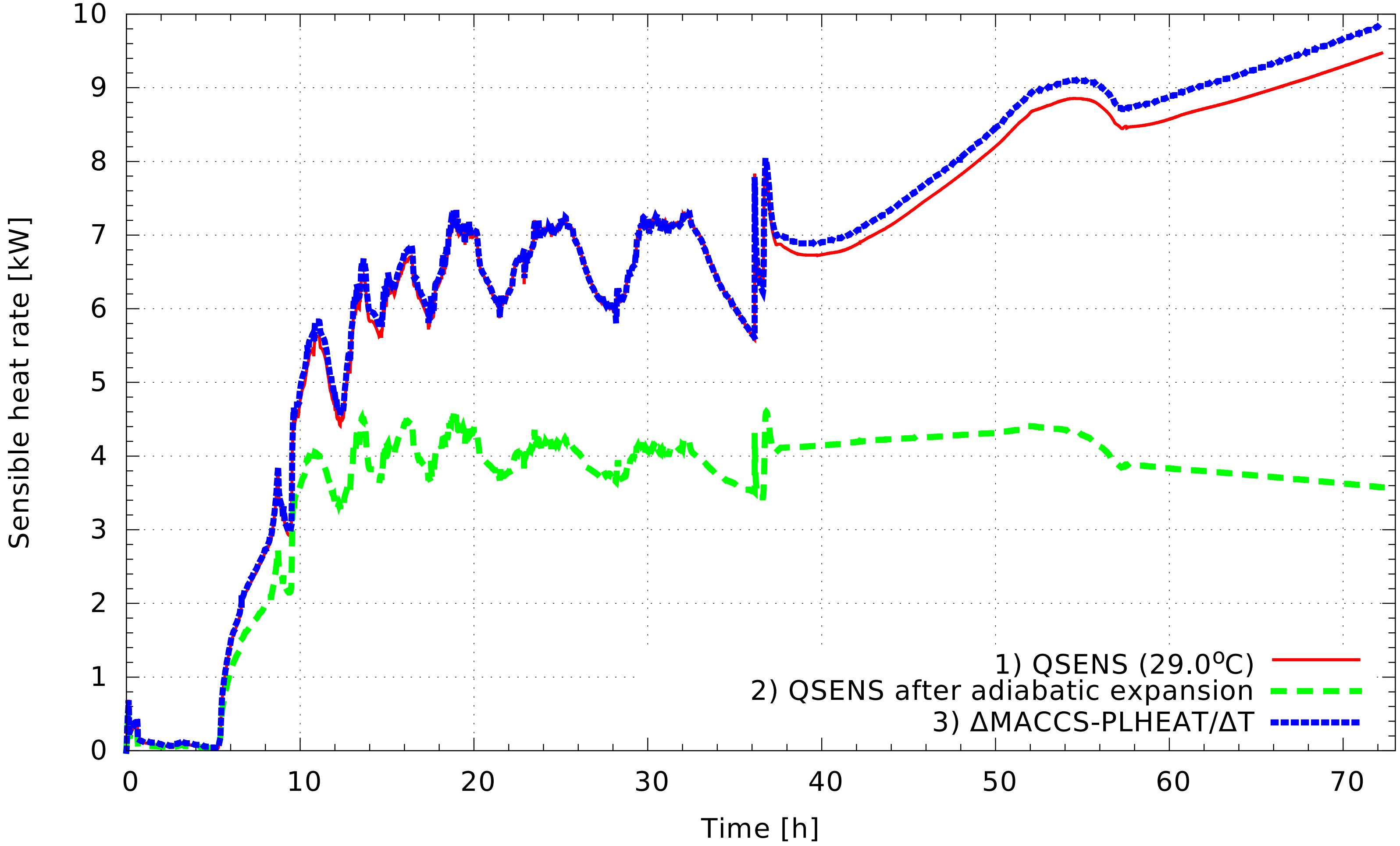

Assume that T should be the fluid temperature after release from the containment, T_{out} (in K), instead of temperature inside containment, T_{in} (in K).

Assume that escaping fluid undergoes adiabatic expansion from p_{in} to p_{out} with $\kappa = 1.4$:

$$T_{out} = T_{in} \cdot \left(\frac{p_{in}}{p_{out}}\right)^{\frac{1-\kappa}{\kappa}}$$