

# 10. Discussion and Safety Margin Analysis

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## 10.1 ASET Interpretation

The analysis reveals that untenable conditions develop at the exit location after 5.5 seconds. The critical failure mode is **Temperature**, which reaches its tenability limit first among all evaluated criteria.

This ASET value must be compared with the Required Safe Egress Time (RSET) calculated from evacuation modeling to assess overall building safety:

### Safety Assessment Required

**Required Condition:**  $ASET > RSET + \text{Safety Factor}$

NFPA 101 and ISO/TR 16738 recommend maintaining a safety margin of 1.5-2.0 times RSET to account for uncertainties in:

- Occupant response time variability
- Fire growth rate uncertainties
- Model prediction accuracy
- Evacuation flow variations

## 10.2 Model Limitations and Uncertainties

### FDS Model Uncertainty Factors:

- **Grid resolution:** Coarse grids may under-predict peak temperatures and over-predict smoke dilution ( $\pm 20\text{-}30\%$  typical uncertainty)
- **Combustion modeling:** Simplified chemistry and soot formation models introduce uncertainty in CO and visibility predictions
- **Turbulence modeling:** LES subgrid-scale models affect mixing and transport predictions
- **Radiation modeling:** Gray gas assumption and angular discretization affect radiative heat transfer accuracy
- **Input parameters:** Fuel properties, HRR curves, and boundary conditions contain inherent variability