Module 2: Exercises: Systematic TPS

Problem 1
How do we evaluate the thermal risk of a process?

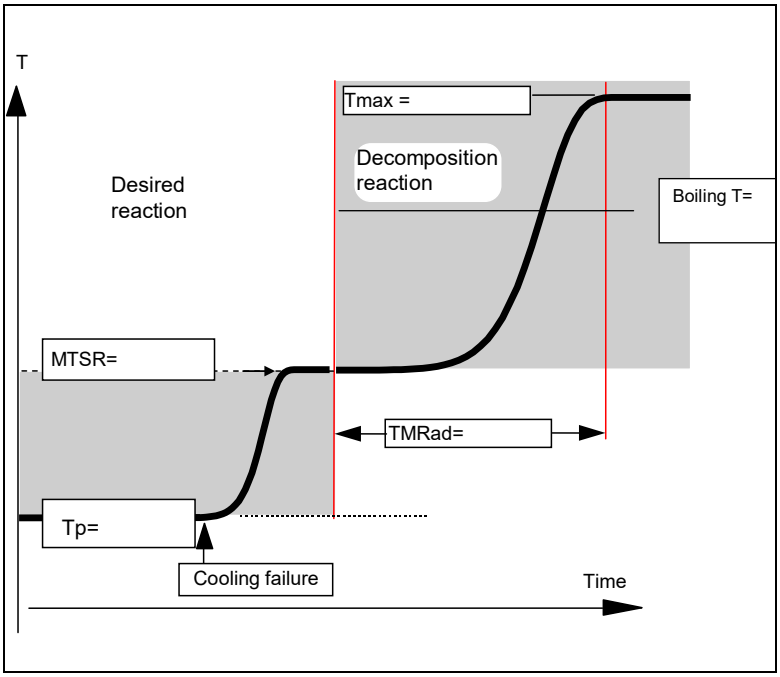
Problem 2
What is the thermal risk linked with a decomposition having a decomposition energy of 200 kJ/kg (c'p of the reaction mass 1.8 kJ/(kg·K)) and a TMRad of 24h at 100°C?

Problem 3
Estimate the TMRad at 80°C knowing that the TMRad is 8h at 120°C.

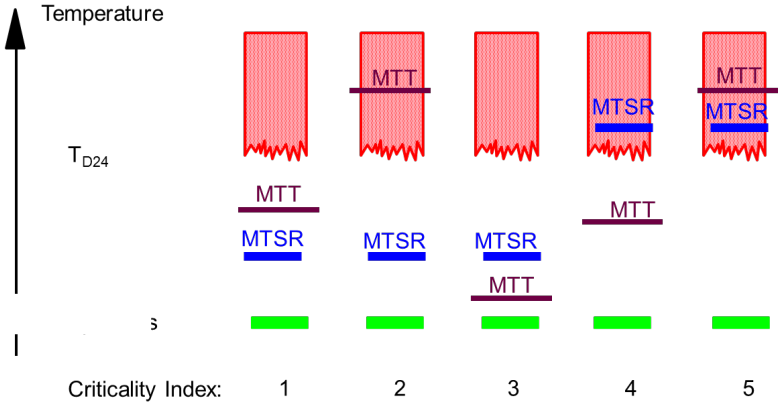
Problem 4
A reaction is performed in a batch reactor at 30°C. The solvent is toluene which has an atmospheric boiling temperature of 110°C. In case of a cooling failure the maximal temperature increase due to the reaction will be 50°C. From this temperature on, under adiabatic conditions, 13 hours are required to reach the maximal rate of the decomposition reaction. The decomposition reaction is exothermal and has an energy of 550 kJ/kg. The specific heat capacity of the reaction mass is 2000 J/(kg·K).

Questions:

A. Fill in the cooling failure scenario



B. Which criticality class is associated with this process?



C) How could the safety of the process be improved?