**Criteria for Rapid Phase Transition (RTP)**

1. The system involve two liquids, which contact one another. RPTs are very difficult to achieve when a cold, volatile liquid contacts a hot, solid surface.
2. From one theory of RPTs, the threshold hot-liquid temperature is equal to the homogeneous nucleation temperature, Tsl, of the colder liquid. This temperature is a characteristic value for any pure liquid or liquid mixture and can be measured in independent experiments or estimated from theory. From another RPT theory, the threshold temperature is approximately the hot fluid temperature at the onset of stable film boiling.

(A corollary, often appended to the second RPT criterion, is that RPTs are more difficult to achieve as the temperature of the hot liquid increases beyond the threshold temperature. For very high hot-liquid temperatures, some external pressure pulse or shock becomes necessary to initiate an RPT.)

1. The cold liquid must be pre-fragmented at the inception of the RPT. The pre-fragmentation allows an escalation of small RPTs to a larger, coherent explosion. In the time period when fragmentation is taking place, the system is in stable film boiling with each cold liquid mass enveloped by a vapor film. The escalation phase then involves the (1) collapse of the vapor film (from an initiating shock) and (2) boiling of the cold liquid fragments in the same time scale as the initiating trigger event.

Notes:

Criteria 1 and 2 suffice to achieve small, laboratory-sized RPTs.

Criterion 3 is needed for large-scale, coherent RPTs.

A reasonable approximation for Tsl of the colder liquid is, Tsl = Tc [(0.11Pr) + 0.89], where Tc is the critical temperature, Pc is the critical pressure, and Pr = P/ Pc.