Table 1 - Potential Guidewords and Parameters for a Hazard and Operability (HAZOP) Study

Issued 24-Nov-2019

Potential Process Design Parameter ("Design Conditions")

	Continuous or Batch Operations							**Batch Operations**	
Guideword	Flow	Temperature	Pressure	Level (Interface)	Composition	State	Reaction	Time	Sequence
More	High Flow	High Temperature	High Pressure	High Level	High Concentration	Additional Phase	High Rate	Too Long	Step Too Late
Less	Low Flow	Low Temperature	Low Pressure	Low Level	Low Concentration	Loss of Phase	Low Rate	Too Short	Step Too Early
None	No Flow	Cryogenic	Vacuum Pressure	No Level			No Reaction	Not Started	Step Left Out
Part Of					Wrong Concentration		Incomplete Reaction		Part of Step Left Out
As Well As			High/Low P Interface	Liq/Liq Interface	Contaminants / Impurities	Contaminants / Impurities	Side Reaction		Extra Action in Step
Other Than	Reverse				Wrong Material	Wrong Material	Reverse Reaction		Step Backwards
	Misdirected Flow					Change of State	Wrong Reaction	Wrong Time	Wrong Action Taken

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Other possible parameters include:	Leak/Rupture (Heat exchanger Tube) Leak/Rupture (Vessel, Tank) Mixing Purging/Inerting Sampling, pH Static Charge Current Voltage
	<u>Node-specific</u> Startup/Shutdown hazards Emergency operations Special maintenance hazards (mechanical and/or electrical) Corrosion/Erosion hazards Special safety concerns (in addition to normal PPE)
	<u>Area-specific (across all nodes)</u> Global hazards (e.g., Corrosion under insulation, Grounding, etc.) Human Factors Facility Siting
	Approved for Academic Use Only: Author Bruce K. Vaughen, 2019