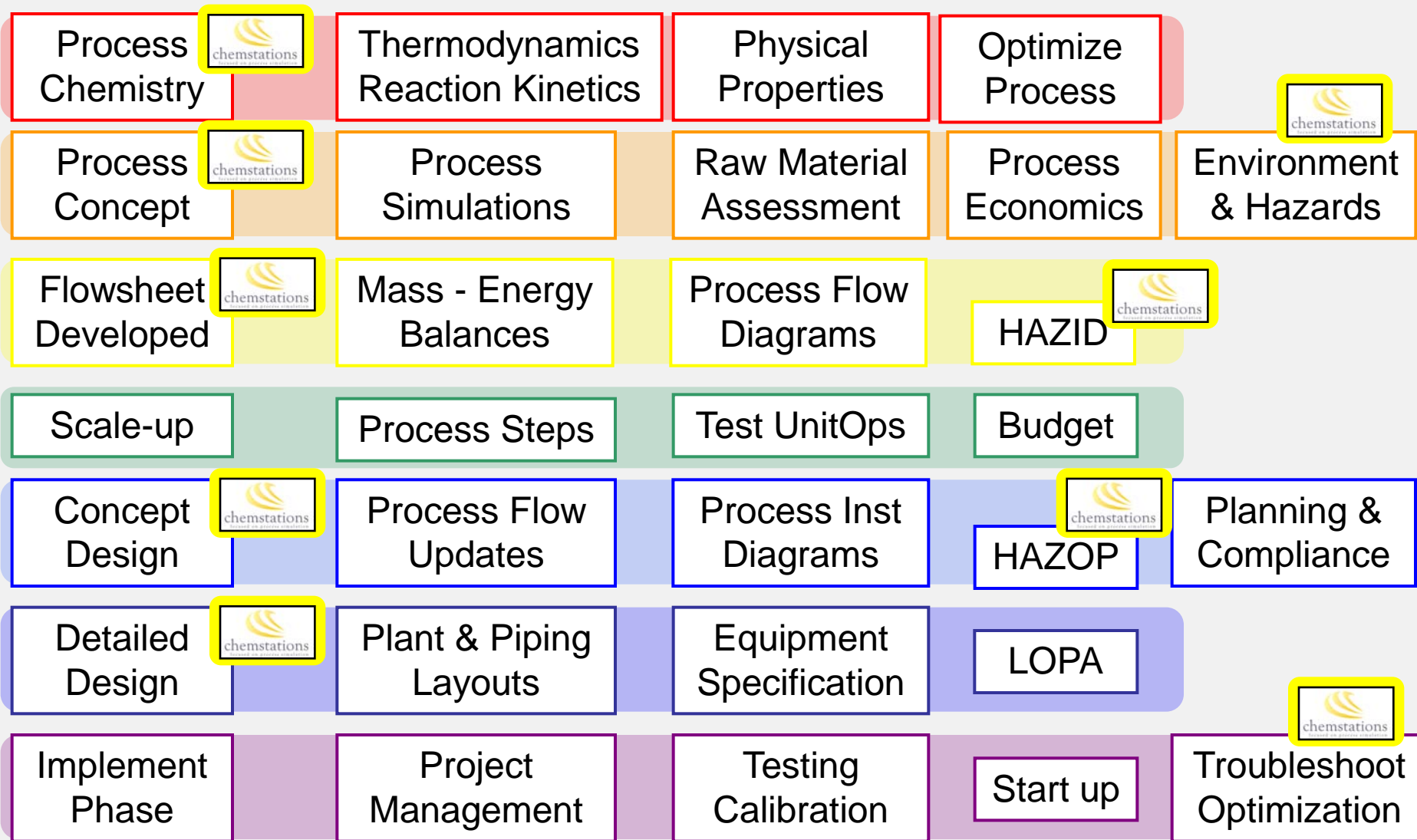
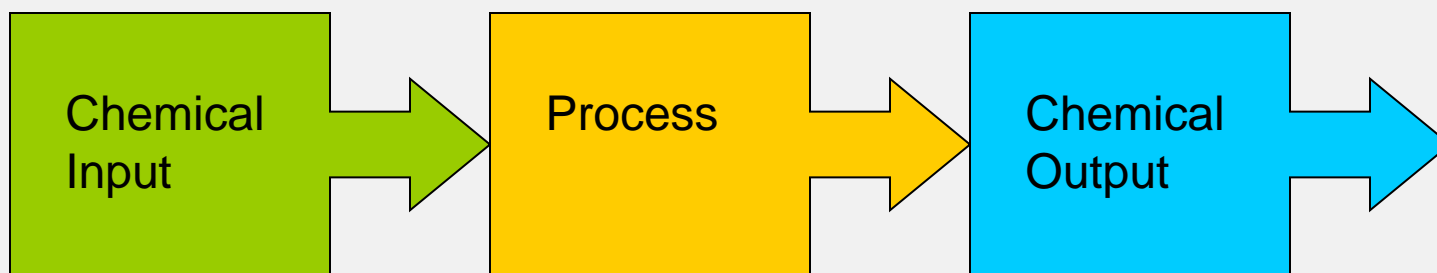


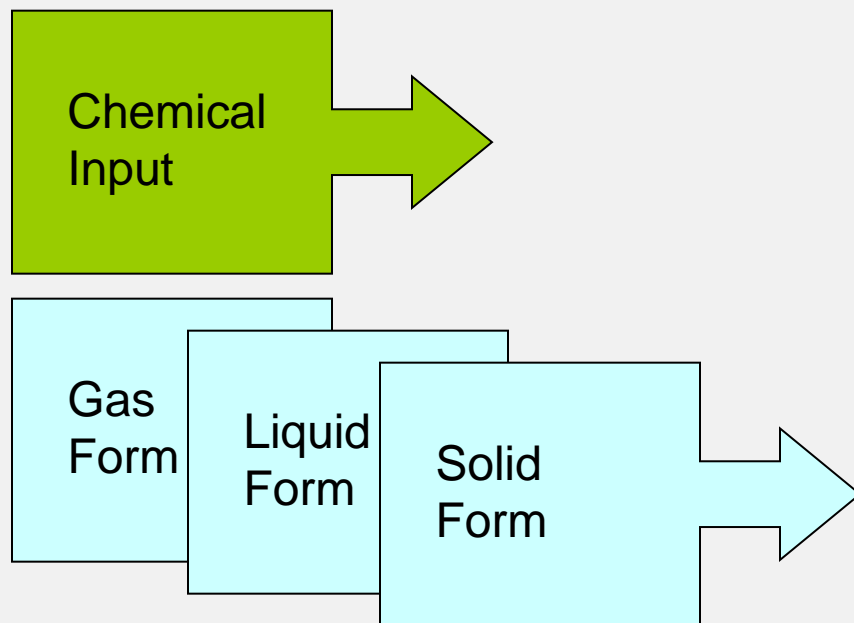
**PROCESS DEVELOPMENT
DESIGN SPECIFICATION**



- Chemical processes that originate from a laboratory all have the following features.



- The Input and output issues for scale up are usually dictated by the physical state of the material SOLID, LIQUID or GAS
- The process issues can be many and varied and relate to the demands and constraints surrounding the chemical reaction, purification and subsequent work up.



Issue
Physical Form
Quantity
Alternative states
Stability
Toxicity
Flammability
Common Impurities
Corrosive

- Each physical state requires consideration against a series of potential issues.
- This in turn will impact on plant, process, engineering and design.

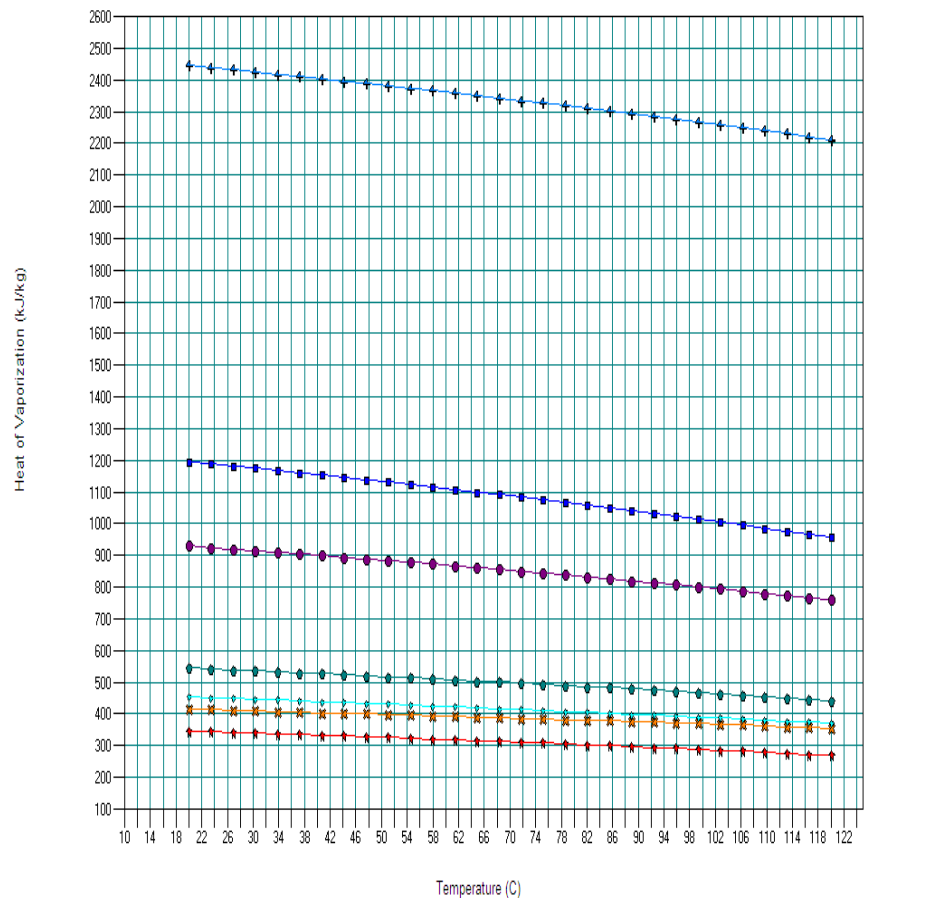
Chemical Input SOLID

Issue
Physical Form
Quantity
Alternative states
Stability
Toxicity
Flammability
Common Impurities
Corrosive



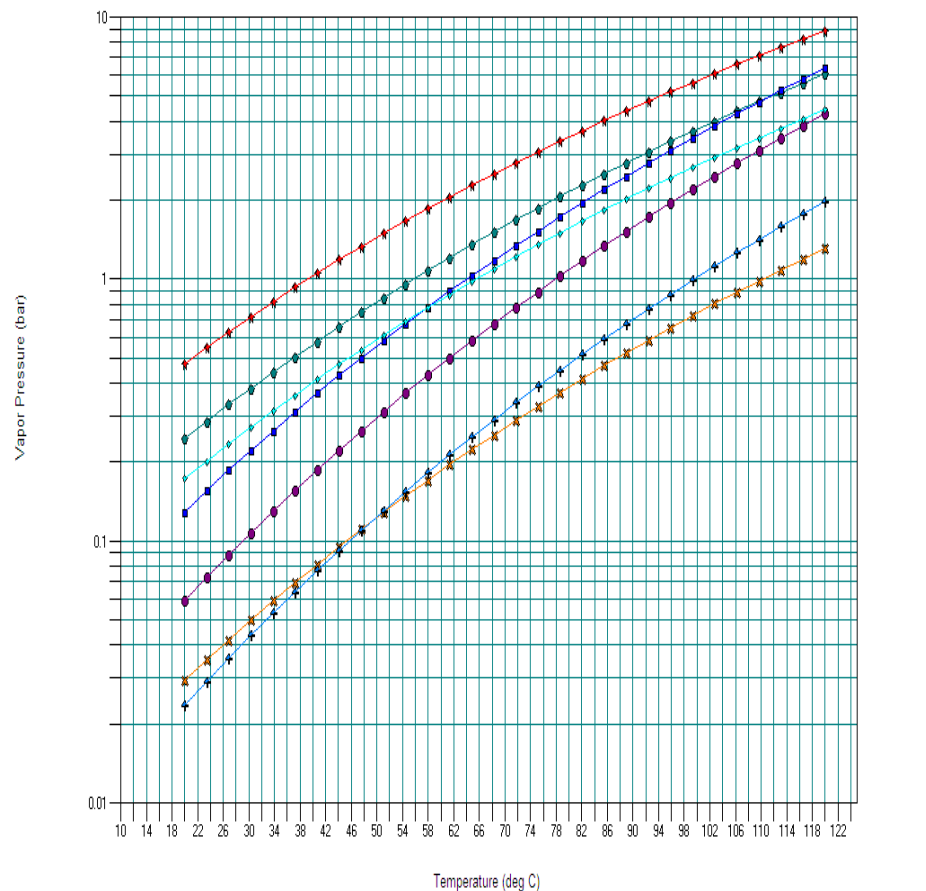
Issue	Considerations	Impact
Physical Form	Prills, chips, crystals, flakes, turnings, briquettes, polymers, dimers, chain length, bridging, angle of repose, particle size distribution	Material Handling equipment Equipment selection Materials of construction Lifting equipment Milling, pre breaking Equipment cleaning Static control Reaction profile Reaction stalling Reaction initiation/completion Charge order

Process Development PPD (Heat of Vaporization)



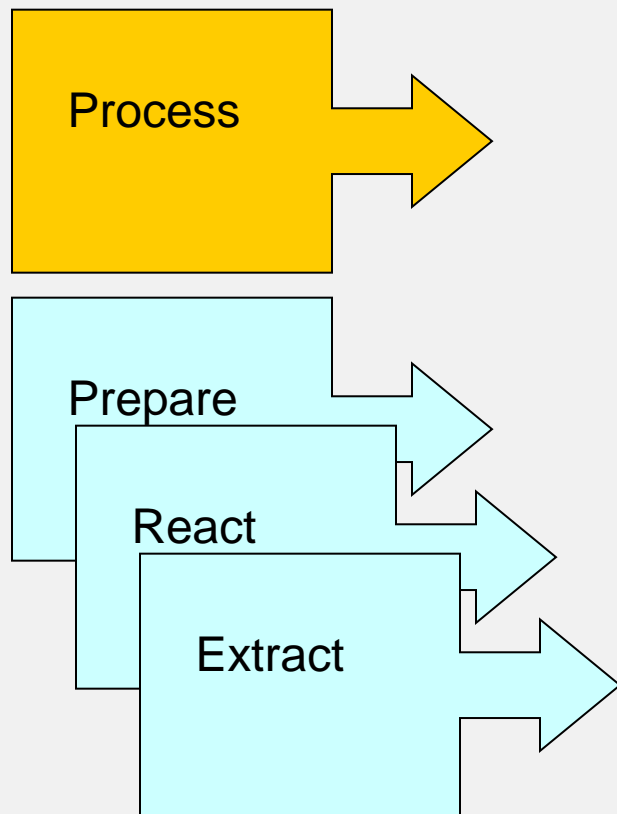
♦ Dichloromethane ♦ Acetone ■ Methanol ● Ethanol ♦ Tetrahydrofuran
x Toluene + Water

Process Development PPD (Vapor Pressure)



♦ Dichloromethane ♦ Acetone ■ Methanol ● Ethanol ♦ Tetrahydrofuran
x Toluene + Water

The reaction stage typically has a large impact on engineering design. However, other areas, although less challenging, can have a major impact.



Issue
Mixing
Solvation
Heating/Cooling
pH Adjustment
Reaction
Distillation
Phase separate
Crystallise
Filtration /Slurry/ wash
Dry

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Mixing
Solvation
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pH Adjustment
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Phase separate
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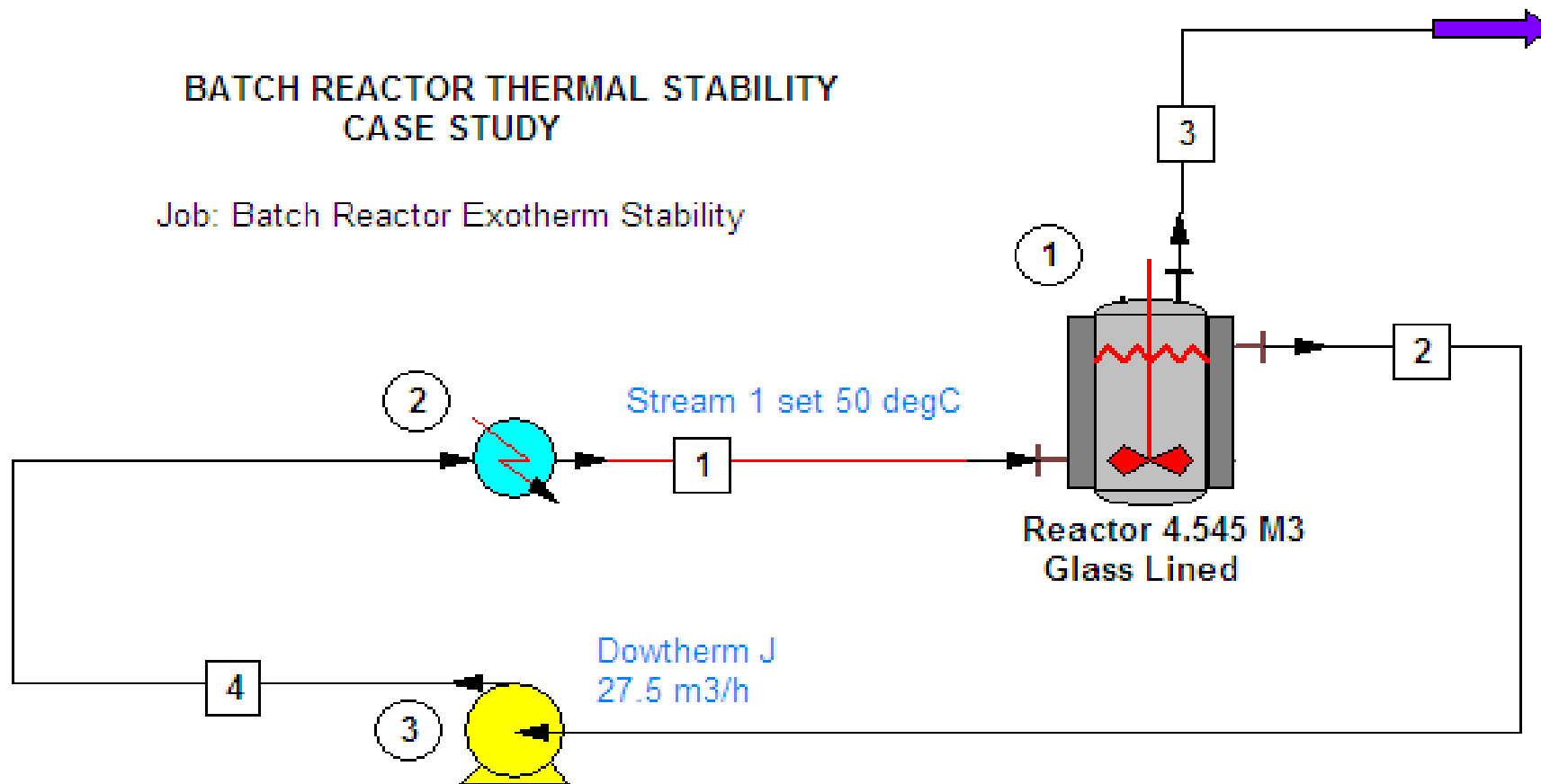
Issue	Considerations	Impact
Reaction	Kinetics Reaction stalling Reaction run away Exotherm Endotherm Critical parameters Safe control Sampling Scale up concerns Reflux/ evaporation Off gas Catalysts Homogeneity Phase Change	Cooling design Heating system design Temperature control system Instrumentation & control Addition rate profile Vessel design Agitation and Mixing Safety system design Emergency relief Blowdown design Safe sampling systems Condenser design Scrubbing systems Catalyst handling Catalyst recovery Catalyst storage

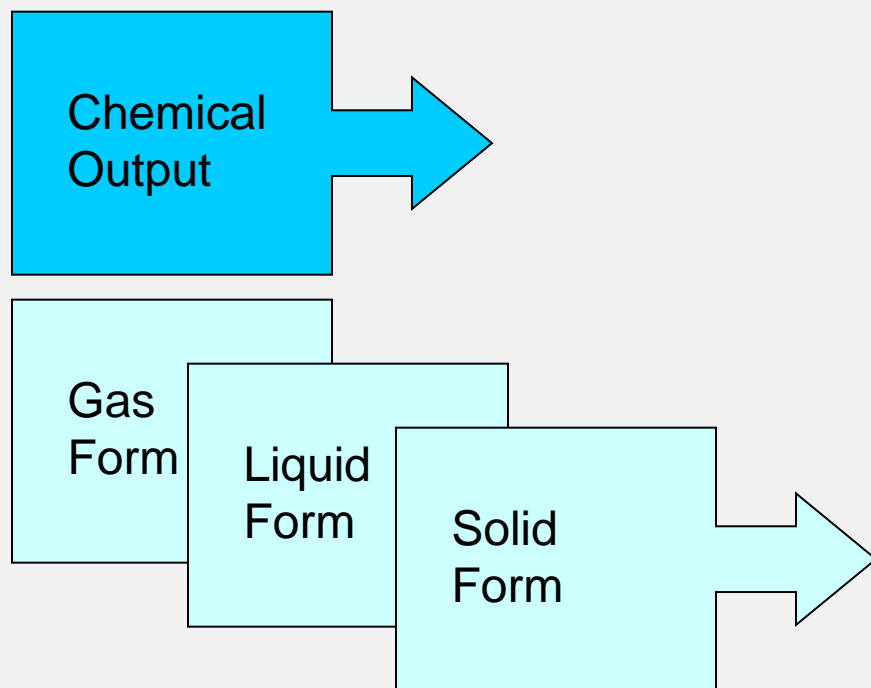
JOB : Batch Reactor Exotherm Stability



BATCH REACTOR THERMAL STABILITY CASE STUDY

Job: Batch Reactor Exotherm Stability





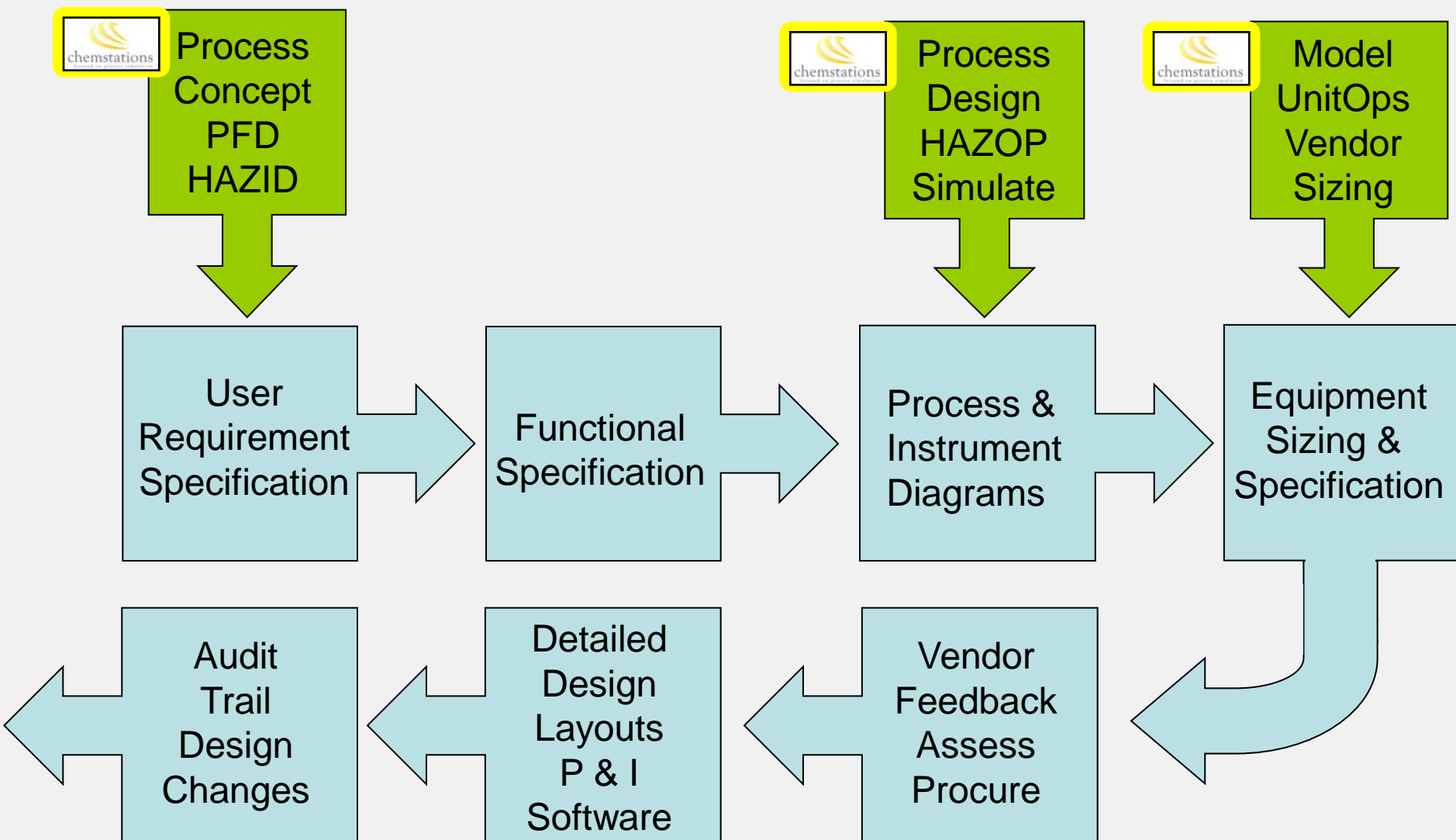
Issue
Physical Form
Quantity
Alternative states
Stability
Toxicity
Flammability
Common Impurities
Corrosive

Essentially the same as “Chemical Input”, each physical state requires consideration against a series of potential issues.

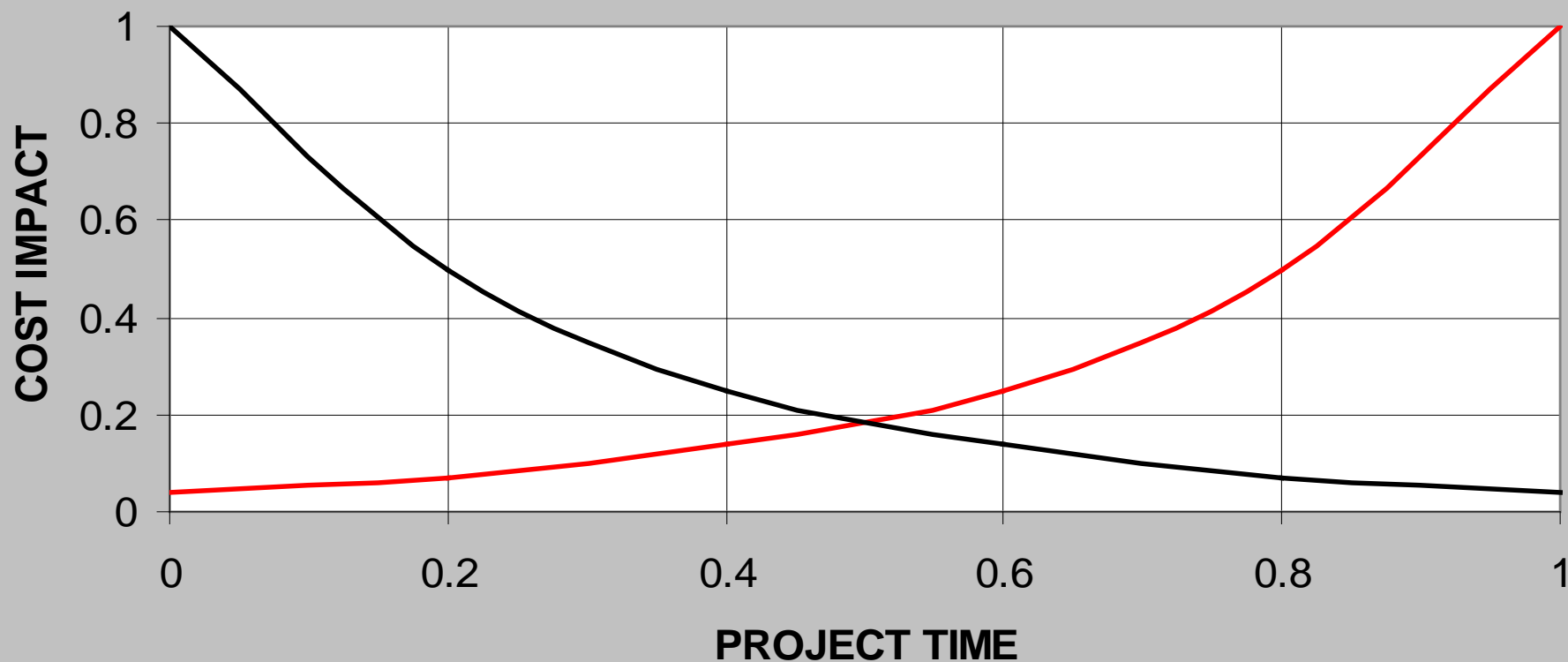
Chemical Output SOLID

Issue
Physical Form
Quantity
Alternative states
Stability
Toxicity
Flammability
Common Impurities
Corrosive

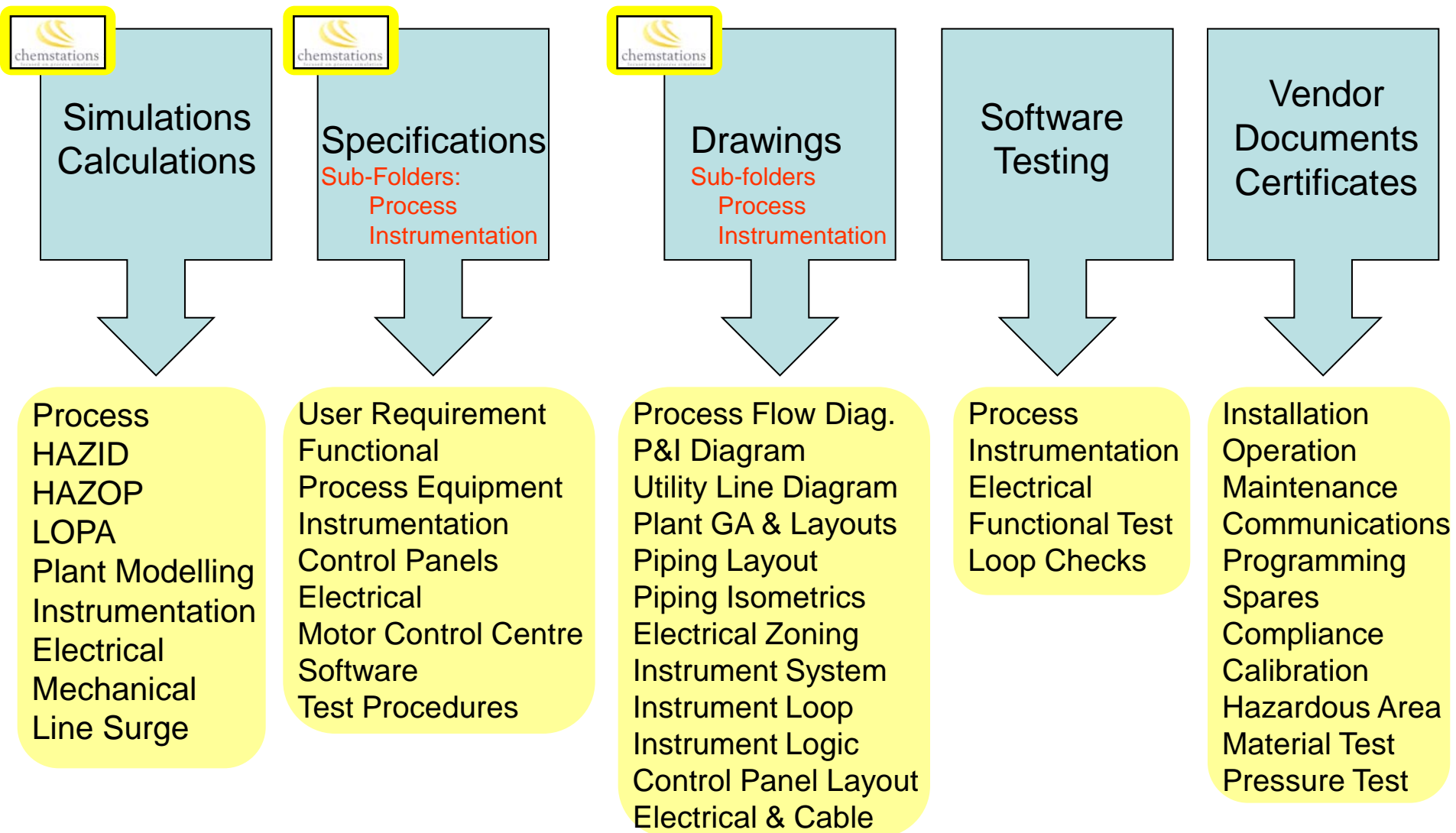
Issue	Considerations	Impact
Drying	<p>See crystal form</p> <ul style="list-style-type: none"> Temperature issues Vacuum Is drying required? Re use as a slurry Re dissolve in situ Choice of wash solvents Attrition Balling Milling PSD Isolation from water based system Oversize Homogeneity 	<ul style="list-style-type: none"> Temperature control system design Safety backup systems Dryer Design/ selection Heat transfer system design Agitation/mixing Milling requirement Packing requirement Sieving Dust categories Area Class



PROJECT COST IMPACTS



— Problem Discovery — Design Decisions



REQUIREMENT : UNIQUE DOCUMENT IDENTIFIER

1. DOCUMENT SECTOR e.g. Administration, Projects
2. CLIENT IDENTIFICATION
3. PROJECT IDENTIFICATION
4. DOCUMENT IDENTIFIER
5. DOCUMENT TYPE

CLIENT REF. PROJECT NO. DOCUMENT NO. DESCRIPTOR

AA.XXX.XXX.AAA

**ABSOLUTE KEY
TO
DOCUMENT CONTROL**

QUOTATIONS	QUO
REPORTS	RPT
CALCULATION	CAL
MINUTES	MIN
MANUALS	MAN