DESIGNING A SYNTHESIS REACTOR FACILITY

Mike Clucas
Group Head Process Engineering
DPS
THE PROJECT
FRAMING THE DESIGN
• A qualified, commercial scale fully automated Synthesis Facility

• The facility is based on using a modified Neutsche Filter / Dryer as a chemical synthesis reactor

• This project has delivered a successful novel approach for commercial scale manufacture of the product in a safe, fully automated multiproduct facility
Project Drivers

EXISTING FACILITY

EHS

INDUSTRIALISE
THE SAFETY DRIVER
NEW SYNTHESIS PLANT
Facility Safety

A Basis Of Safety Approach
Having safety as a design driver

- Preliminary Hazard Analysis (PHA)
- HAZOP
- Containment
- Ergonomics
- ATEX Report and Drawings
- LOPA
- SIL
Basis of Safety

<table>
<thead>
<tr>
<th>CHEMICAL</th>
<th>HAZARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1</td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>!</td>
</tr>
<tr>
<td>B</td>
<td>☀</td>
</tr>
<tr>
<td>C</td>
<td>🎠</td>
</tr>
<tr>
<td>D</td>
<td>🎠</td>
</tr>
<tr>
<td>E</td>
<td>☀</td>
</tr>
</tbody>
</table>

| Step 2   |        |
| Reagent A|flammable|
| Reagent B|corrosive|
| Reagent C|acidic  |

| Step 3   |        |
| F        | flammable|
| G        | corrosive|

- Flammable
- Corrosive
- Acute Toxicity, Irritant, Sensitiser
- Acute Toxicity
- Sensitiser, Mutagen, Carcinogen, Reproductive Toxin
Hard Piped automated transfers from Tank Farm

Contained drum booth
Hard piped fixed IBC's
Automated transfers

Contained reagent addition system

Open and manual solvent transfers
Open solvent drum pumping PPE & RPE
Open reagent dispensing PPE & RPE

Chemical

A
B
C
D
F
G
H
I

Reagent A
Reagent B
Reagent C
Powder Sampling & Liquid Handling

New Synthesis

Automated & contained vessel sampler

Contained powder transfers

New Synthesis

- Automated solvent transfer system
- Sophisticated instrumentation for accurate & repeatable transfers
- Fully contained charging
Facility Safety

A Basis Of Safety Approach
Having safety as a design driver

- Fully Contained Charging, Bulk solvent and Liquid Waste Handling, Vent Header Design
- Recipe Controlled Vacuum swing Inertion and Collected, Abated Venting.
- Contained Potent Dispensing and Charging
- Fully contained, long term technically sealed solvent transfer and collection systems.
- Fully ATEX, PED and FM Global Compliance
- Relief Sizing to API520/521
THE INDUSTRIALISATION DRIVER
NEW SYNTHESIS PLANT
Basis of Design

- Design of a Synthesis Facility
- Safe Process
- 280l batch reactor
- 1 week batch cycle time
- Multiproduct and Fully Automated functionality
- Consistent and increased yield
Early Design

- PDF’s, Mass Balance and Batch Cycle calculation
- Engagement with Facility team
- Tech Transfer and Vendor Trials
- Proof of Concept – Key process scale-up parameters
- Equipment Selection - Neutsche Filter
THE REACTOR
NEW SYNTHESIS PLANT
• Operations take place in single vessel
• Automated CIP cycle
• Automated filter base lowering
• No lifting or manual handling required
Reactor Requirements

PRODUCT

SCALE

PROCESS
Reactor Selection

- EQUIPMENT
- DESIGN PARAMETERS
- FLEXIBILITY
- INNOVATION
THE NEW FACILITY
Thank You

Stephen Judd, Lead Process Engineer
Mike Clucas, Group Head Process Engineering
www.dpsgroupglobal.com