

458.401 Process & Product Design

04

Tracing Chemicals through the PFD

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04

Tracing Chemicals

Guidelines and Tactics

- Mixer: Two or more streams are combined to form a single stream
- Splitter: A single input stream is split into two or more output streams with **the same** temp., pressure, and composition as the input stream
- Shaded boxes on the PFD
- Designated as “m” and “s”, respectively

Tracing Primary Paths Taken by Chemicals

- Primary Chemicals
 - Chemical species identified in the overall block flow process diagram (those associated with chemical reactions)
- Primary Flow Paths
 - The paths followed by primary chemicals between the reactor and the boundaries of the process
- Tactics (Except for Chemical Reactors)
 1. Any unit operation, or group of operations, that has a single or multiple input streams and **a single output stream is traced in a forward** direction
 2. Any unit operation, or group of operations, that has **a single input stream** and single or multiple output streams is traced **backward** direction
 3. Systems such as distillation columns are composed of multiple unit operations with a single input or output stream. **Consider such equipment combinations as blocks** before implementing Tactics 1 and 2.

Example-01

For the toluene HDA process, establish the primary flow pathway for

- a. Toluene between the feed (Stream 1) and the reactor
- b. Benzene between the reactor and the product (Stream 15)

Figure E.5.1

Example-02

Establish the primary flow pathway for

- Hydrogen between its introduction as a feed and the reactor
- Methane between its generation in the reactor and the discharge from the process as a product

Envelope
method

Figure E.5.2(a)

System containing the fuel gas product in backward progression

System m:

the smallest system that can be found that contains the fuel gas product stream and has a single input

Figure E.5.2 (b)

System n:

System m + C-101 + E-102

We cannot determine which of ?? streams carry CH₄

Recycle and Bypass Streams

- Flow loop: either a recycle or a bypass stream
- Tactic 4: If the streams in a flow loop flow so that the flow path forms a complete circuit back to the point of origin, then it is a recycle loop
- Tactic 5: If the streams in a loop flow so that the flow path does not form a complete circuit back to the place of origin, then it is a bypass stream

Toluene Recycle Loops

Figure E5.3 (a)