Session A: Process Characterization:
A Fundamentals Session

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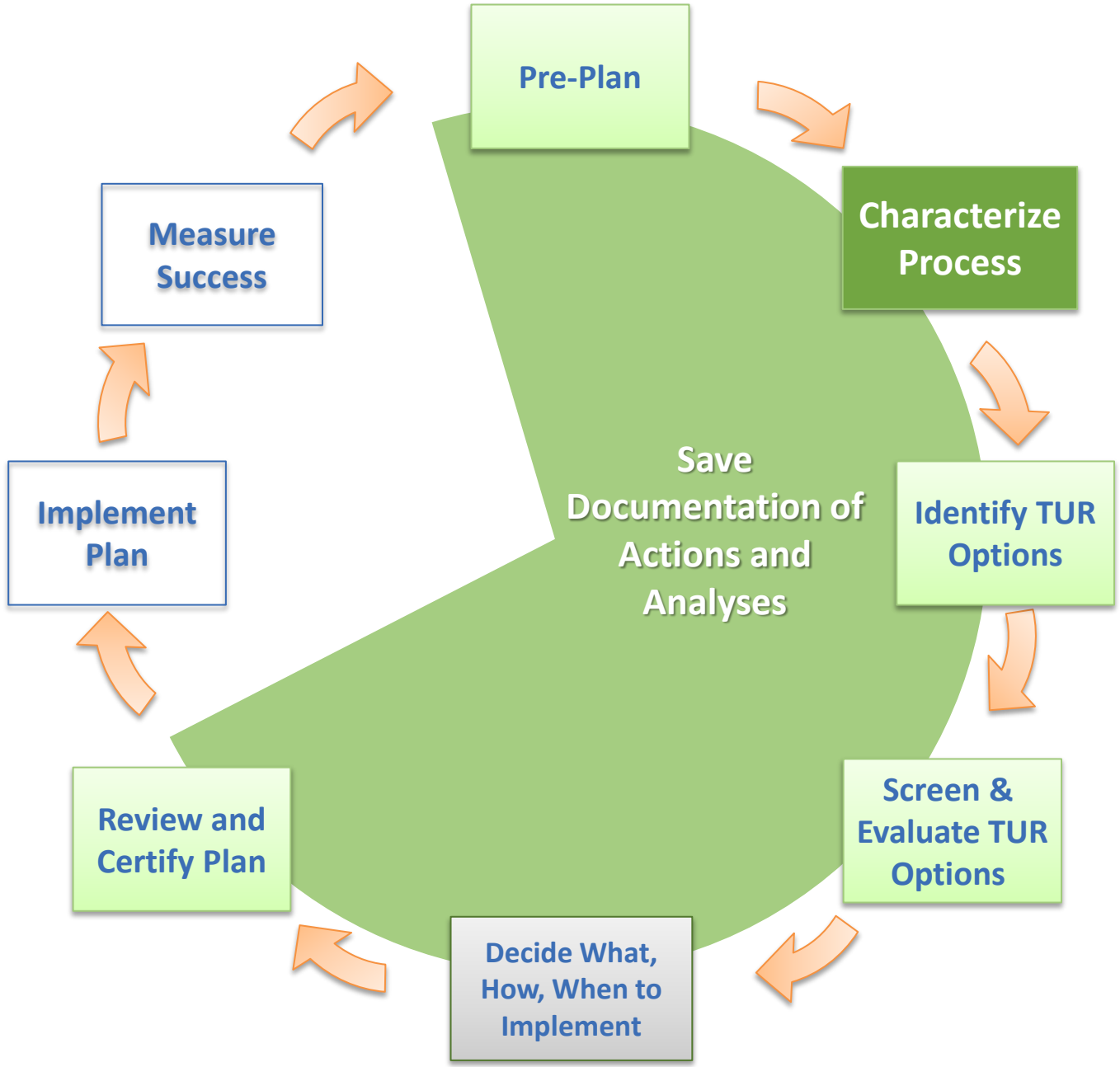
Overview

Requirements for process characterization under TURA

Best practices

Discussion



- **Production Unit(s) Description**
  - Units of product
  - Process, inputs, and outputs of each stage
  - Purpose chemicals serve
- **Process Mapping**
  - Visual representation of production units
  - Show chemical movement into, through, and out of production unit including storage, treatment, recycling
  - Chemical pathway analysis

- **Materials Accounting**
  - Determine amounts of toxic used
  - Amounts generated as byproduct, treated or recycled on-site, or released as emissions
- **Toxics Use Characterization**
  - How and why the toxic(s) are used
  - Qualitative estimate of toxics costs: Key cost components, relative importance

Why Do Process Characterization?

Pinpoints where wastes originate

Highlights the true costs of toxics

Helps to identify TUR opportunities

Provides basic unit of analysis for TUR

Process Characterization

My take on the value of this process

Why Do Process Characterization?

(besides the fact that you have to)

- Learn a whole lot about something
- Get to ask a bunch of questions
- Helps to really get your head around what is going on
- It sets the fundamental base for everything else you will do for TUR Planning
- It gives you credibility

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Process Characterization

My take on the value of this process

Why Do Process Characterization

- It provides an opportunity to see the plant in a different way
- Gives you an opportunity to talk to people
- Gives you an opportunity to address other regulatory issues
- Gets you away from your desk

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Production Unit Information Required in Each Plan (310 CMR 50.44)

For **each covered toxic chemical**, include

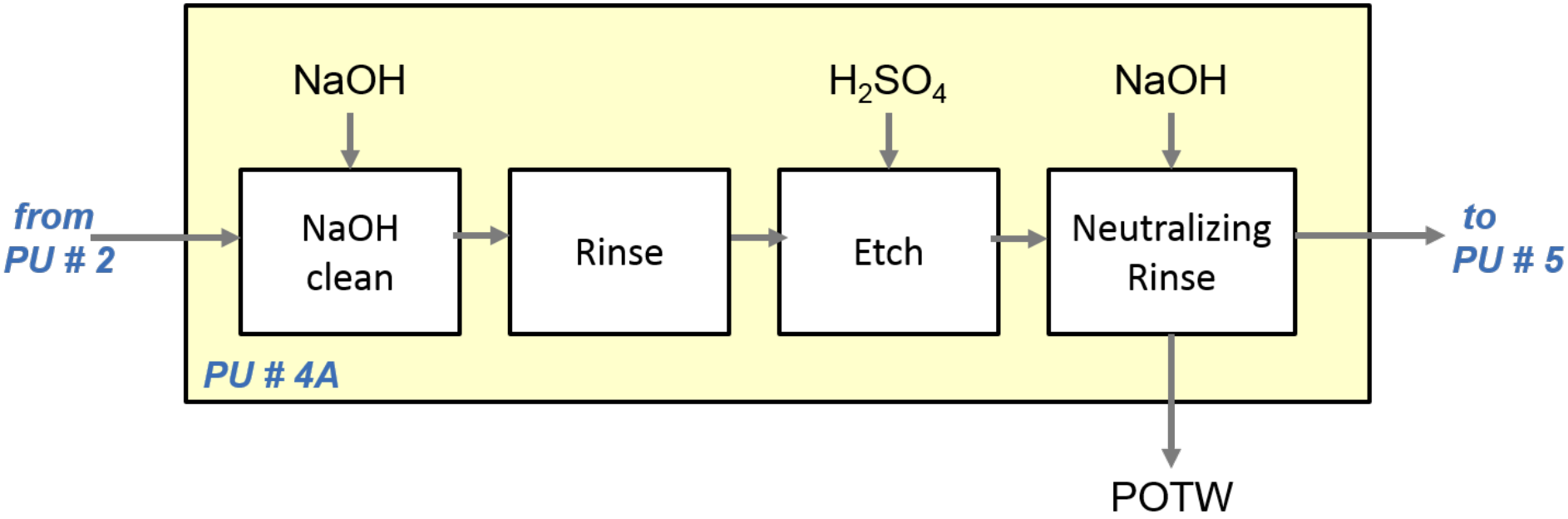
(see page 20-25, TUR Planning Guidance Doc)

- Description of the specific **Purpose** of the chemical (include the function it serves)
- **Unit of Product** and metric for measuring the amount
- **Process Flow Diagram**
- **Material** use, byproduct, transfer and release **Accounting**
- The quantitative or qualitative **Cost of Toxics**

Production Unit

"A process, line, method, activity, or technique or a combination or series thereof, used to make a product“

Process or group of processes regarded as a distinct entity for the purpose of TUR planning



Unit of Product

Unit of Product and metric for measuring the amount

- Must be same as that used in Form S reports
- Allows facility to assess the effectiveness of its TUR planning
- Normalizes data to account for fluctuations in production

Brief breakout Discussion:

- Share examples of a complex process for which determining the best unit of product is challenging
- What were some of the options you considered?
- What did you end up choosing and why?
- Need volunteer(s) to post into chat once back with the large group

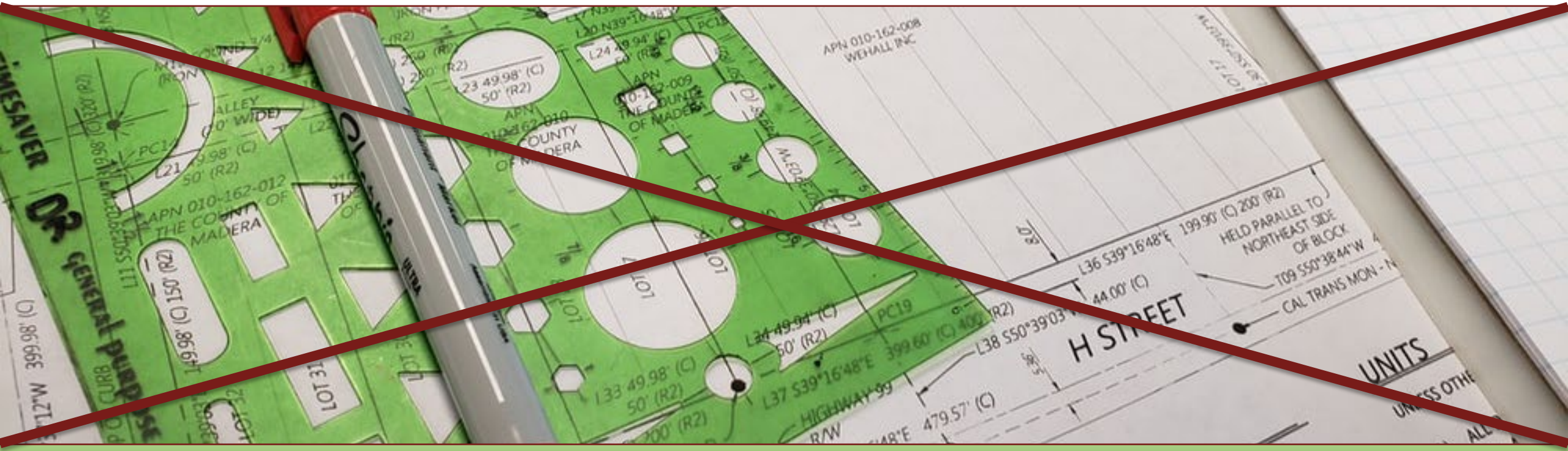
Material Accounting

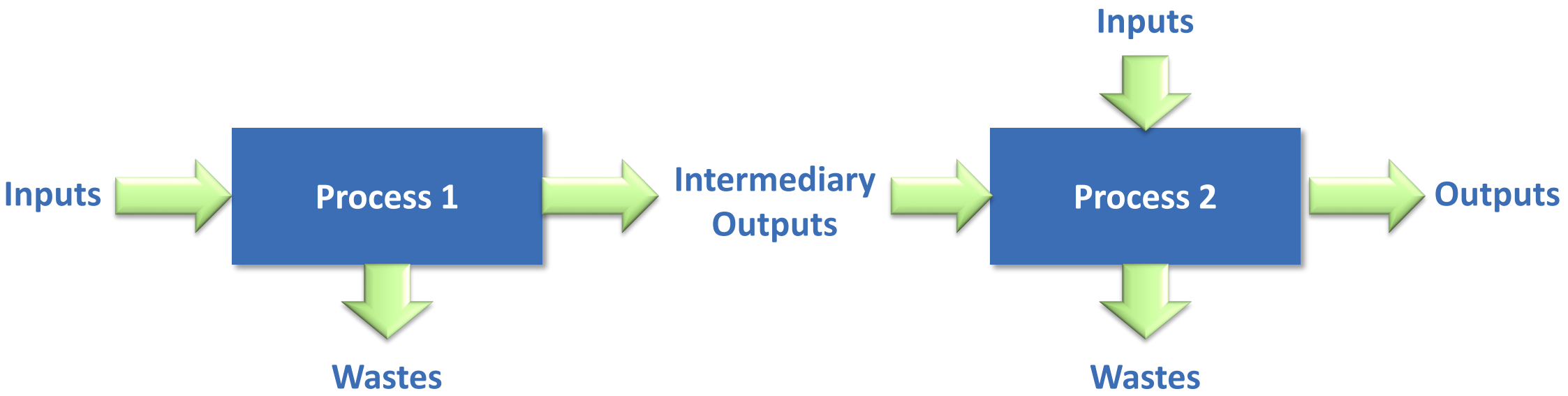
- Must describe the source of data, methods used to determine the amounts reported and any assumptions made
- For each production unit, must include:
  - Byproduct and emissions from all portions of materials handling
  - Use in production unit
  - Transfer and storage of final product
- Byproduct generation must be allocated among production units if covered toxic used in more than one
- Must be revised for each Plan update (and Form S report)
- Necessary for determining the full cost of using each covered toxic

What is a Process Flow Diagram?

Schematic depiction of essential processes required to operate the plant.

Tells nothing about physical layout of the operations – they are <u>not</u> floor plans.





Inputs	*Outputs*
Chemicals	Product
Labor	Scrap
Knowledge	Heat
Time	Pollution
Energy	Packaging Waste
Capital	
Materials	

Why Use Process Flow Diagrams?

Provides shared, explicit structure for:

- How you seek data
- How you turn data into applicable, understandable information
- How you use it to make conclusions

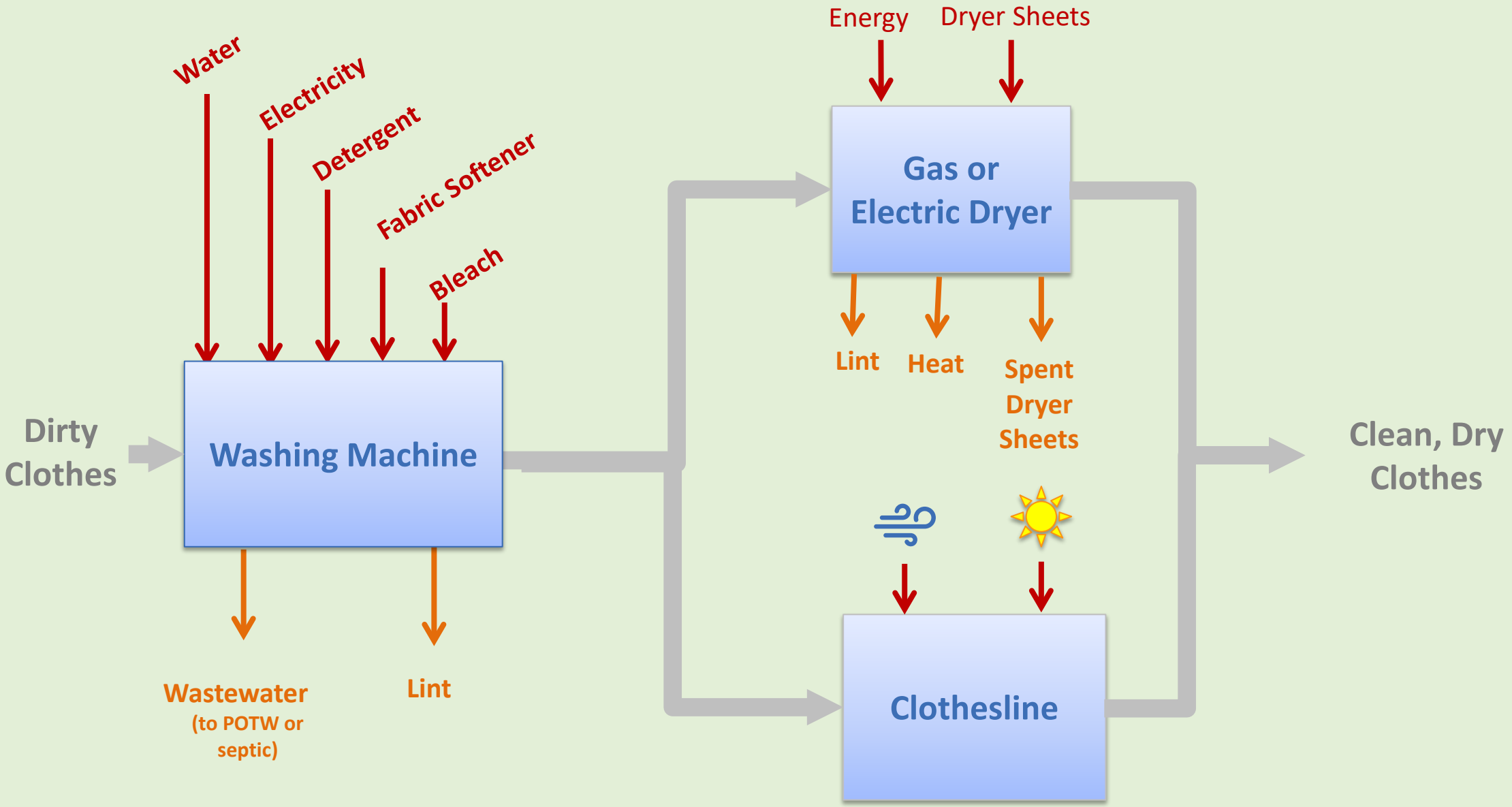
Shows where toxics enter and leave

Builds understanding of costs of processes

Enables assignment of costs to activities

Helps you identify options

Provides a visual document that facilitates improvements


Water
Electricity
Detergent
Fabric Softener
Bleach
Energy
Dryer Sheets
Gas or
Electric Dryer
Lint
Heat
Spent
Dryer
Sheets
Dirty
Clothes
Washing Machine
Clean, Dry
Clothes
Wastewater
(to POTW or
septic)
Lint
Clothesline

From TURA Planning Guidance

(12-23-19 rev)

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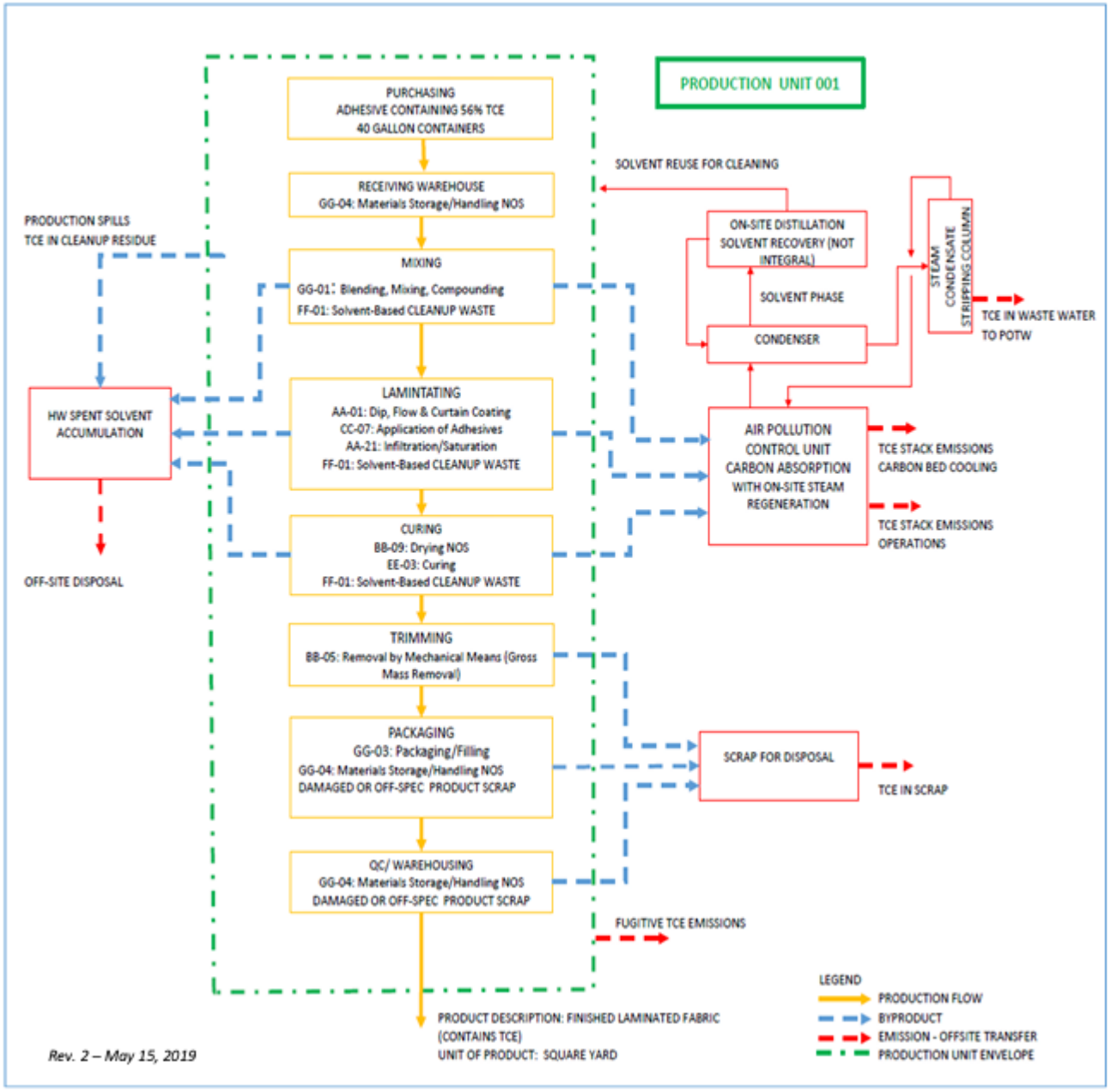
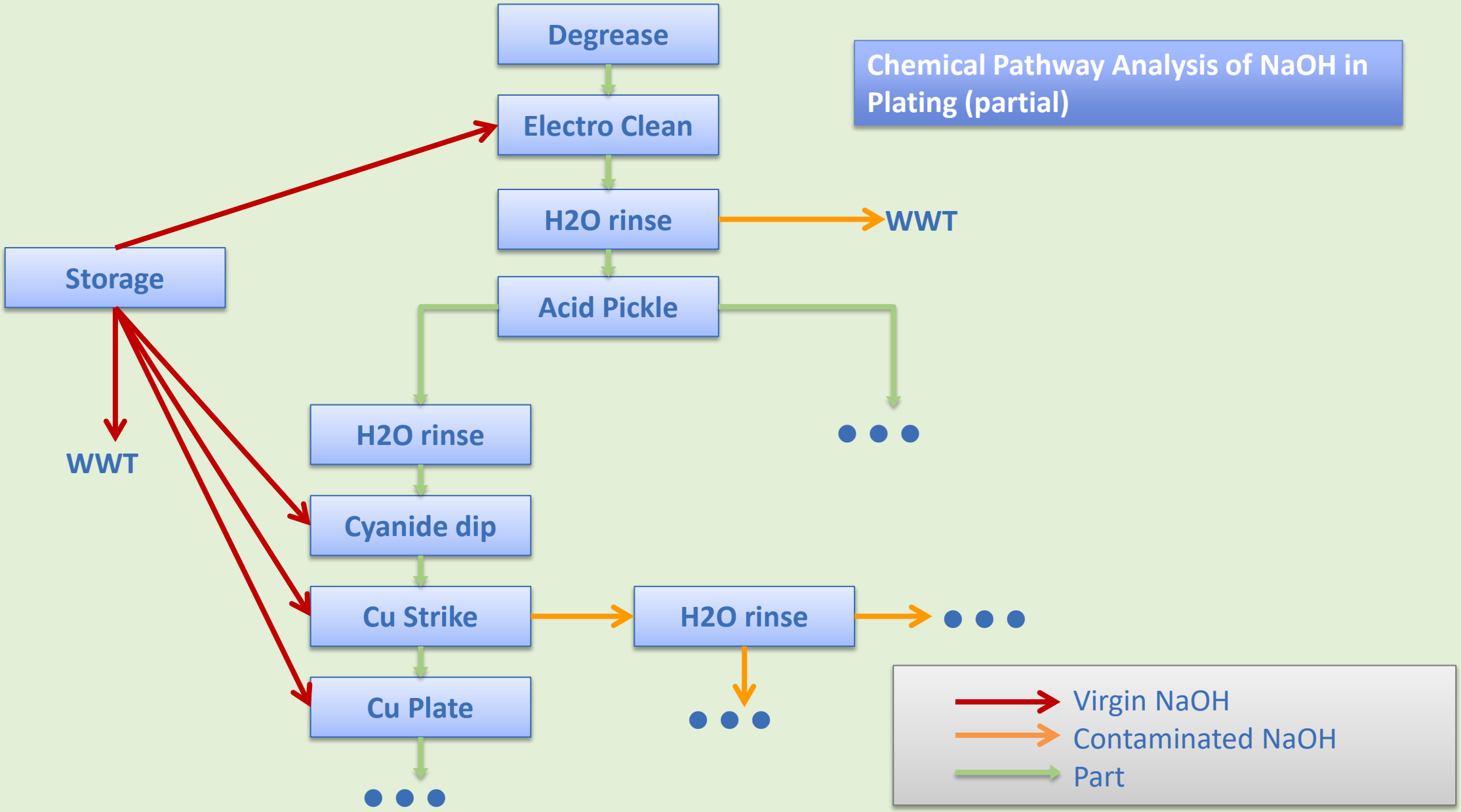
EXHIBIT 2 - Process Flow Diagram Exemplar: Trichloroethylene (TCE) Use in Production Unit 001



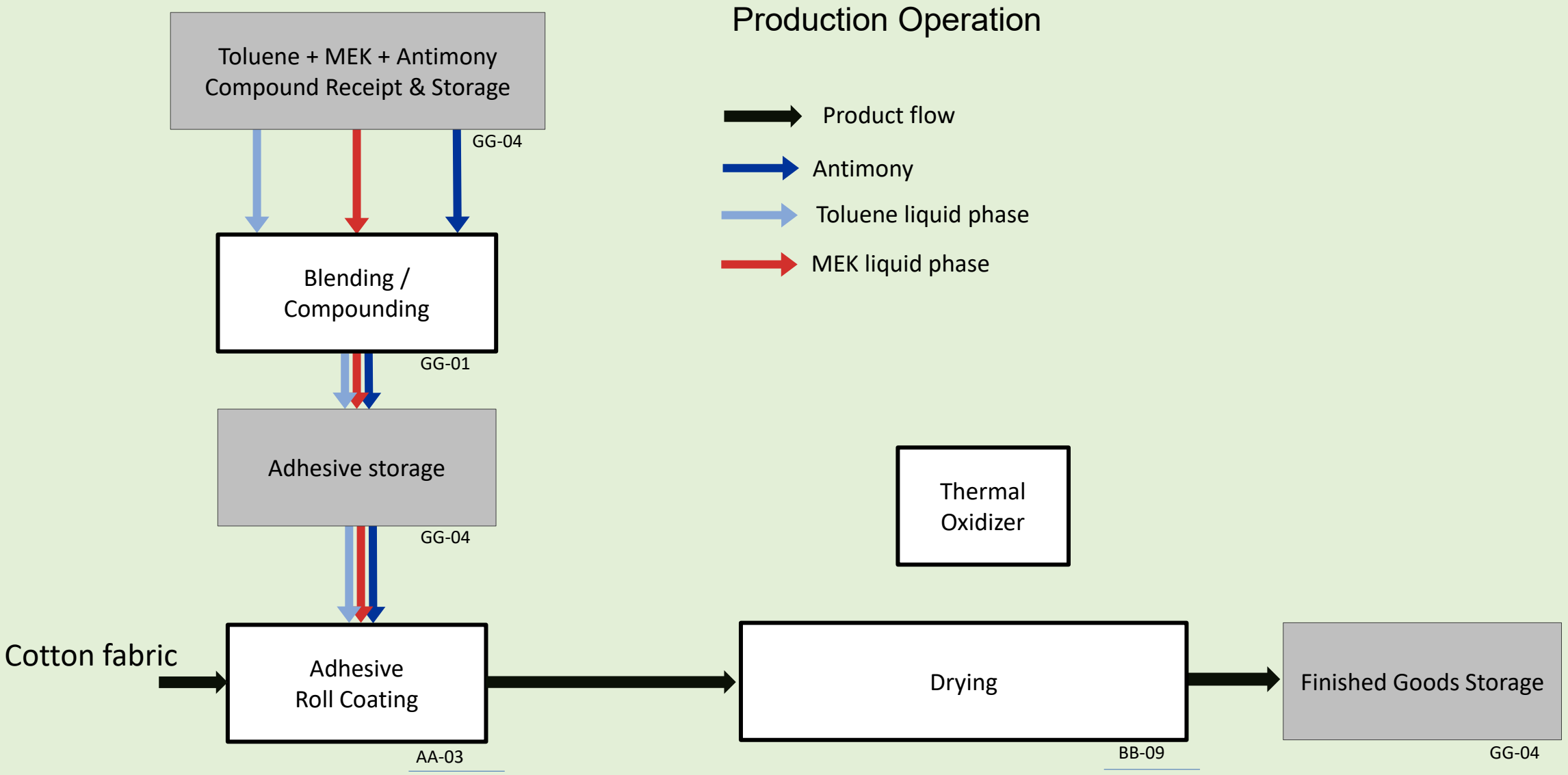
Chemical Pathway Analysis

- Identifies flow of specific chemicals (toxics), byproducts, or emissions, through processes
- Traces flow of toxics through process flow diagram
- Helps identify potential environmental emission points or safety problems

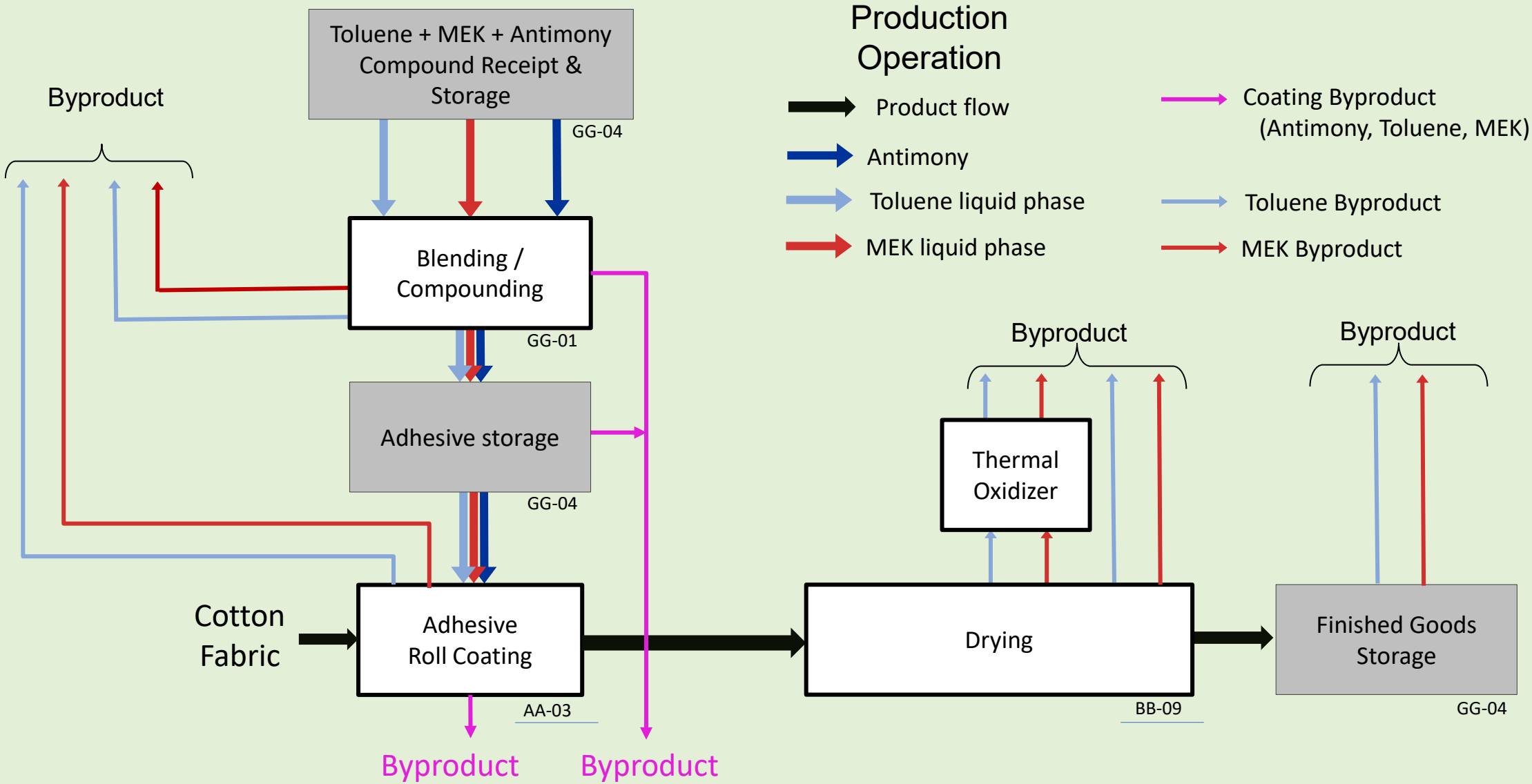
Chemical Pathway Analysis of NaOH in Plating (partial)



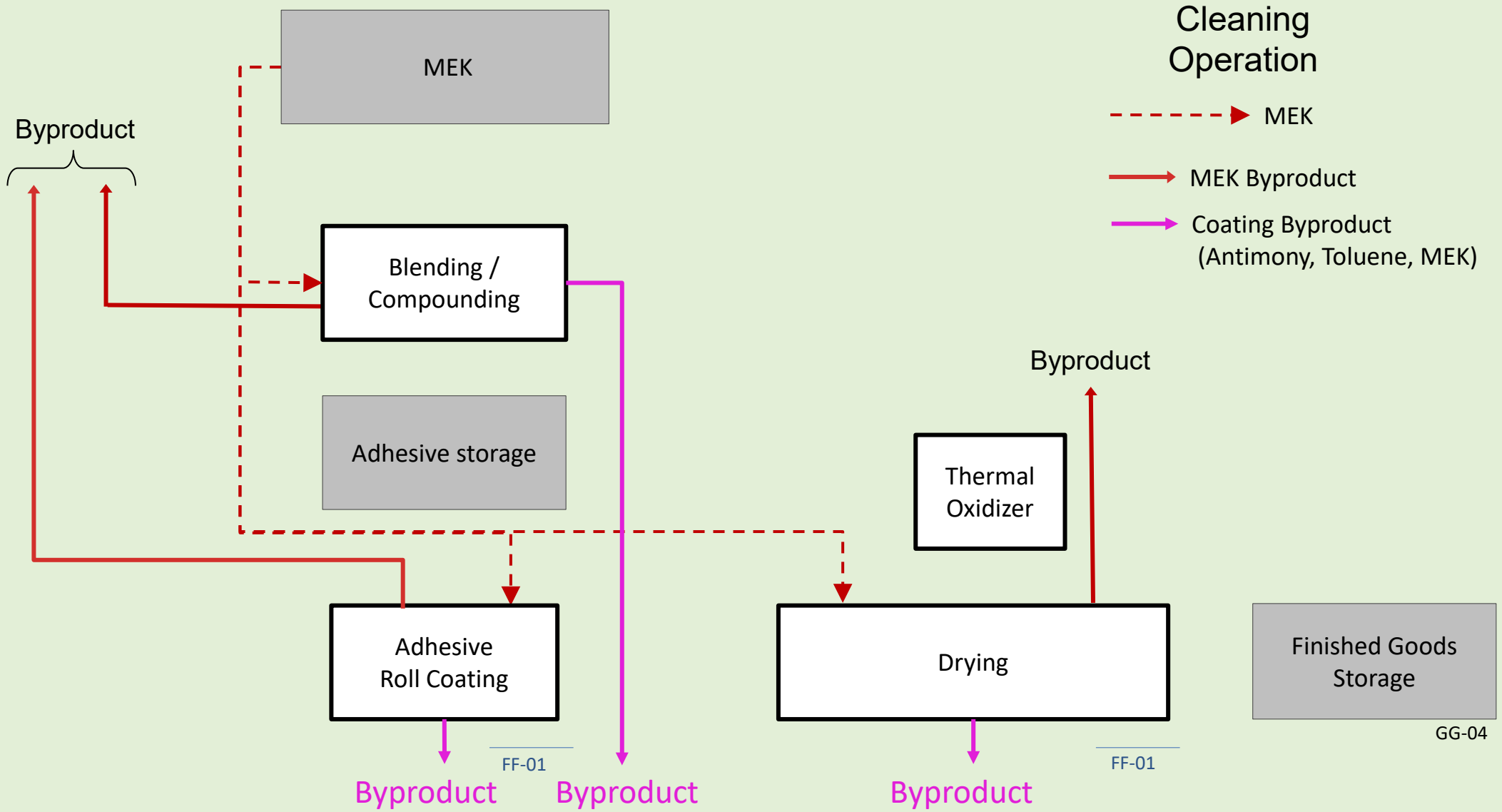
Fabric Coating with Solvent Adhesive Process



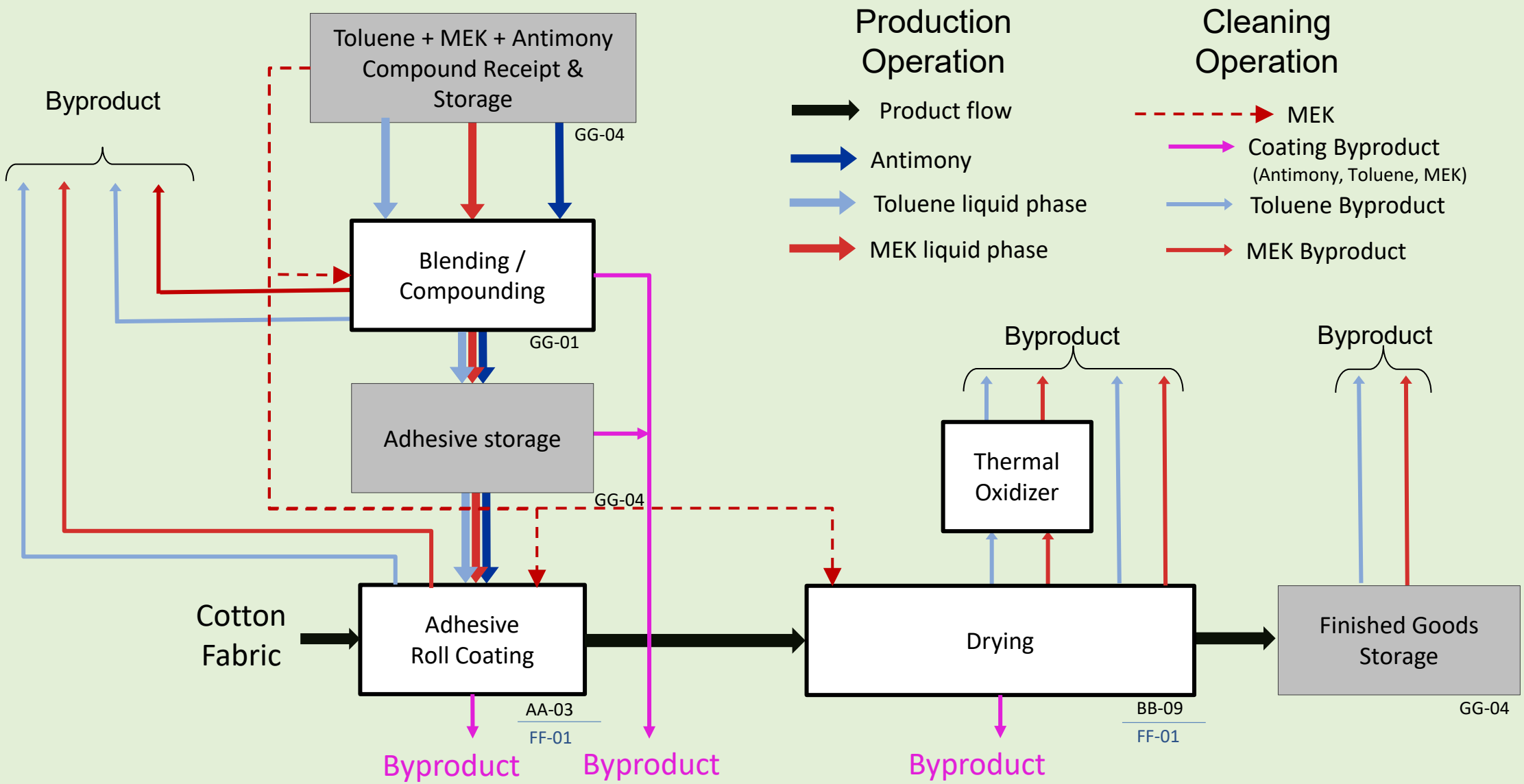
Fabric Coating with Solvent Adhesive – Byproducts



Fabric Coating Equipment Cleanup



Fabric Coating with Solvent Adhesive – Process and Clean-up PFD



For Each Production Unit, PFDs Must:

Show all the steps in each production unit

Show the point(s) at which toxic(s) enter and leave the production unit

Include fate of byproduct: waste treatment, recycling, transfer or release

Include production unit number

Exhibit 1: Checklist of Items in the Physical Plan

4	**Description of each production unit in which a covered toxic is used that includes:**	310 CMR 50.44
	Process Flow Diagram, a visual representation of the movement of covered toxics into and out of the facility that includes	310 CMR 50.44(1)
	• For First plans: date it was prepare) • For Plan Updates with production process changes : date it was updated • For Plan Updates without production process changes: date it was reviewed	
	• The number assigned to the production unit in the Form S(s) submitted with the plan summary	310 CMR 50.44(1)(b)
	• Each step in the manufacturing process including waste treatment and recycling. The specific production steps must be consistent with the list of processes included in the Form S(s) submitted with the Plan Summary, it can be more detailed. (Note the production unit includes material storage prior to use and product storage prior to shipment.)	310 CMR 50.44(1)(a)
	• The steps in the process where each covered toxic enters the production unit	310 CMR 50.44(1)(c)
	• The steps in the process where each covered toxic leaves the production unit as byproduct	

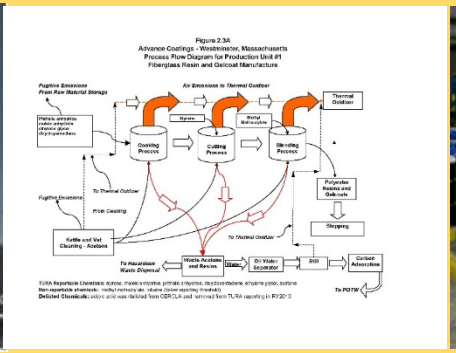
Checklist: More on Process Characterization

✓	**An organized compilation of TUR Plan documents/sets of documents** *(Check off all elements that have been incorporated into your physical TUR Plan)*	**Regulatory Citation**
	• The steps in the process where each byproduct becomes an emission released to the environment or transferred offsite	
	• The points in the process where each covered toxic leaves the production unit as product	
	The unit of product as listed on the Form S(s) submitted with the plans summary	310 CMR 50.44 (3)
	The purpose served by each covered toxic used in the production process-	310 CMR 50.44 (4)

Process Characterization

Creating Process Flow Diagrams

Some practical experience.



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How Do You Do Process Characterization?

How do you go about it?

Do some pre-site visit research – read, website, industry search, image search, materials from the plant.

Have an opening meeting with Plant Manager/ Production Manager/Ops Manager/Maintenance Mgr/EHS Mgr

- Ask for a verbal description of the process – and ask some basic questions: What is the product? How do you track this?
- Review the previous description in the Plan – make sure it is representative and determine if things have changed.

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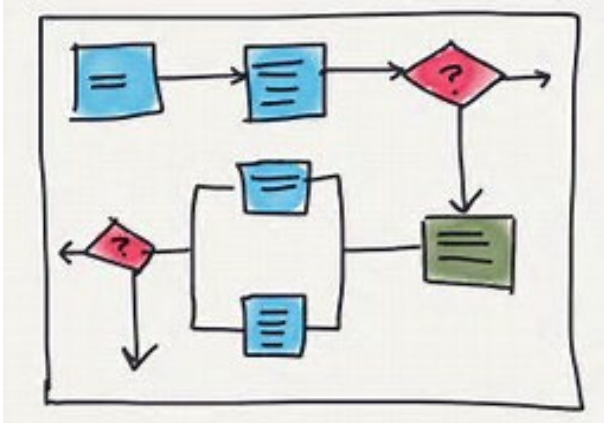
How do you go about it?

Make a Sketch and Make a List of Issues

Write things down, draw pictures, write down questions. Try to get a basic block sketch of the process.

- Where does the discharge go?
- Are there any product losses?
- How does the operator know how much to add - meter, pH, level, operator judgement, etc.?
- What happens to off-spec product?



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How do you go about it?

The Walk Around

Do a walk-around

- Start at the beginning of the process where raw materials come in and proceed through the end (perhaps a co-worker can come with you?)
- Identify points/steps where utilities (water, fuels etc.) and process materials are entering or leaving process

You already know what to look for:

- Fugitive, Point, and Area emissions to all media
- Byproduct flows to pollution control units
  - fume scrubbers
  - wastewater treatment
  - on-site recycling
  - etc.
- Leaks, spills, evaporative losses, maintenance activities

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How do you go about it?

The Walk Around

Take pictures, draw sketches, ask questions

Pay close attention to:

- How materials are being handled
- How many times materials are being handled
- Manual or automatic transfers, pumps, timers, regulators, monitors
- Raw material and product contamination
- Open or closed vessels, containment, control devices
- Odors, visible emissions or vapors (or not )
- Labeling and signage
- People wearing safety equipment

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The Walk Around

How do you go about it?

Not so good

Pretty good

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How do you go about it?

The Walk Around

- Be curious
- Ask questions about what you see in an attempt to really understand the process
- At this point, you are not trying to solve anything - just gathering data
- Try to talk to operators, maintenance staff, I&C tech, process engineers, etc.

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Pulling it Together

Process Flow Diagrams Use Existing Data

- Operational Data
- Piping diagrams
- Operating manuals
- Workflow diagrams
- Architect's plans

Do Not Re-Invent The Wheel!

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Pulling it Together

Process Flow Diagram

Get	Get the details on the chemical volumes, concentrations mixtures etc.
Make	Make sure the calculations are good – document how you came up with the numbers and look for consistency with other reporting. Use actual measured data whenever you can.
Maintain	Maintain a supporting spreadsheet of calculations
Cultivate	Cultivate a good reviewer or two – someone who can verify the numbers and someone who can verify the process flow.
Use	Use the MassDEP checklist and regulation to make sure you have all the components

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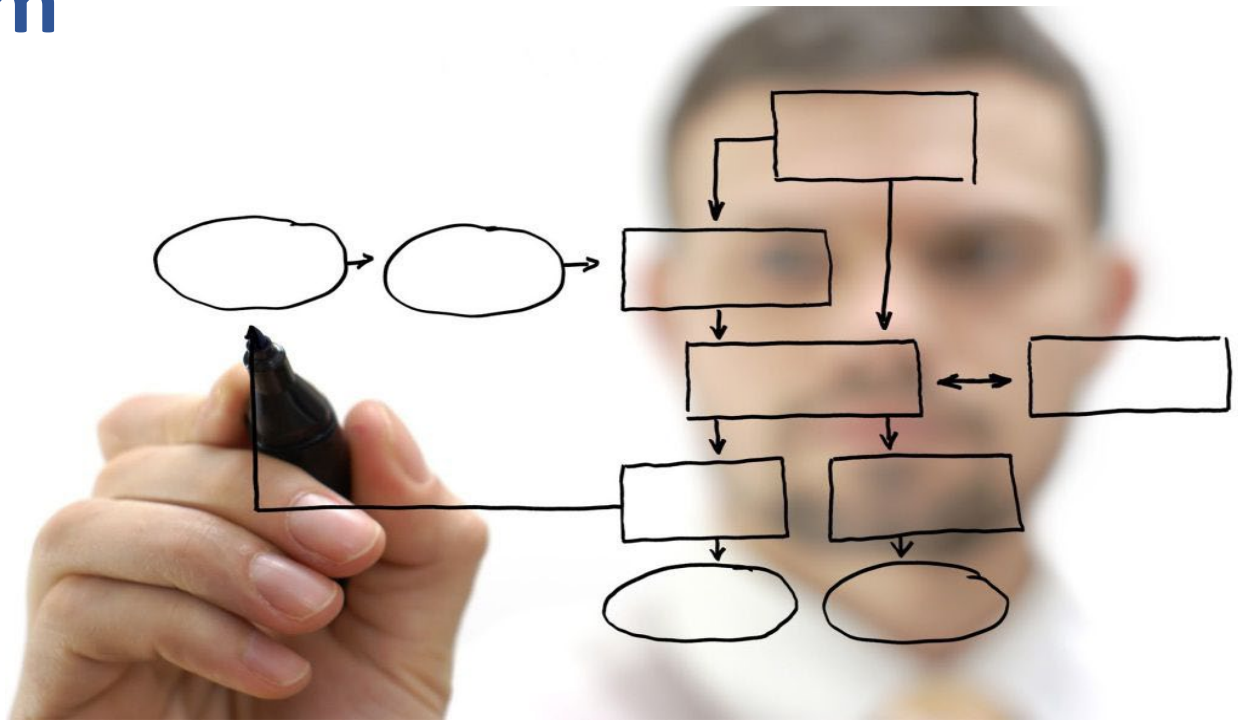
Pulling it Together

Process Flow Diagram



Sketch the PFD out by hand or use a drawing program.

Process Flow Diagram (use the checklist!)

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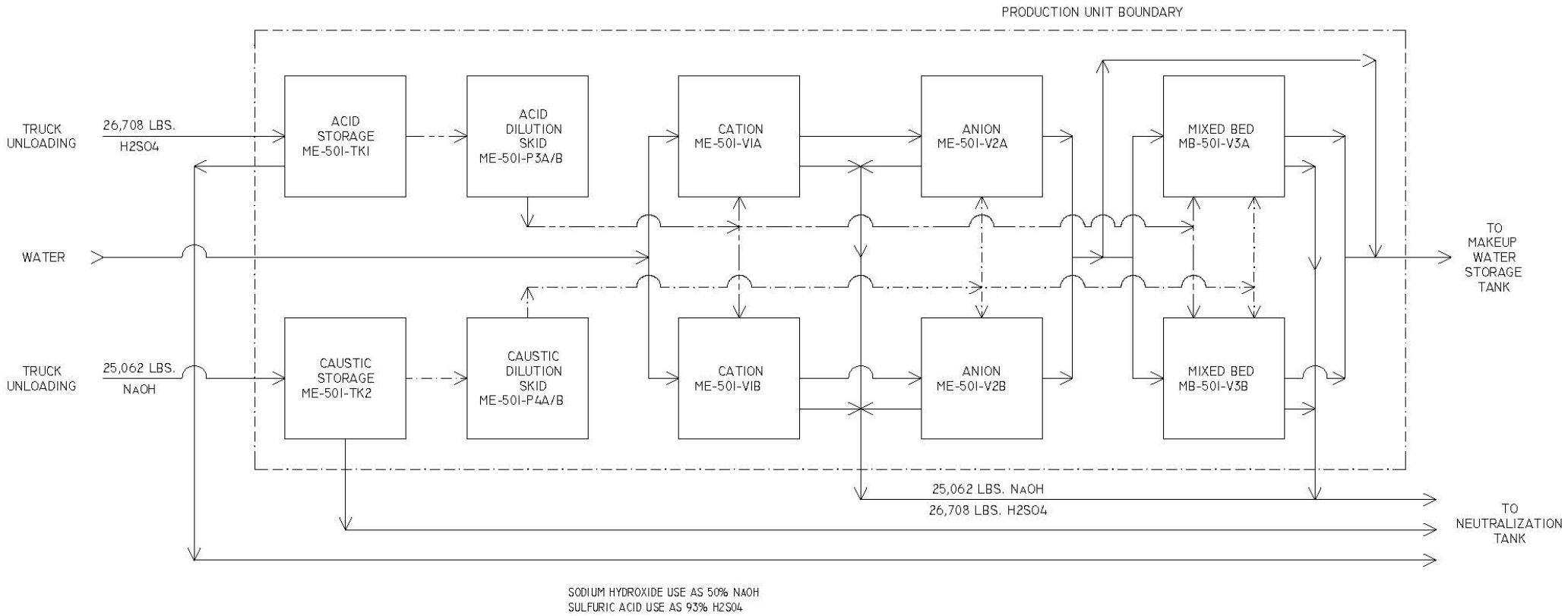
Pulling it Together

2021 PROCESS FLOW DIAGRAM
PRODUCTION UNIT #001 - DEMINERALIZATION



DATE	REVISED BY
07/21/22	RCC
10/26/20	RCC
06/18/18	RRZ
07/06/16	RRZ

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RRZ				06/21/12	NONE

PROCESS FLOW DIAGRAM

DWG.NO. 0900-2A

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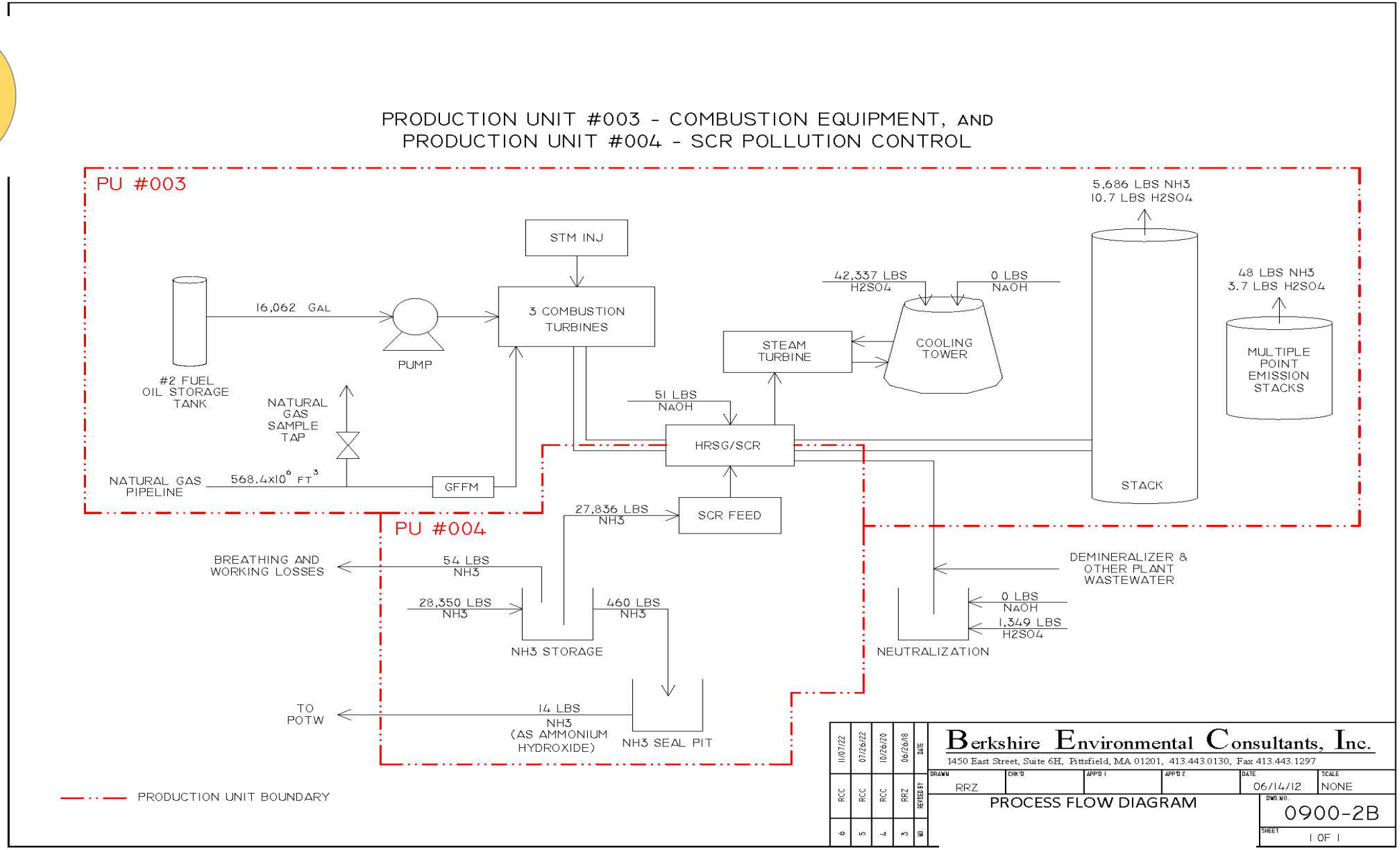

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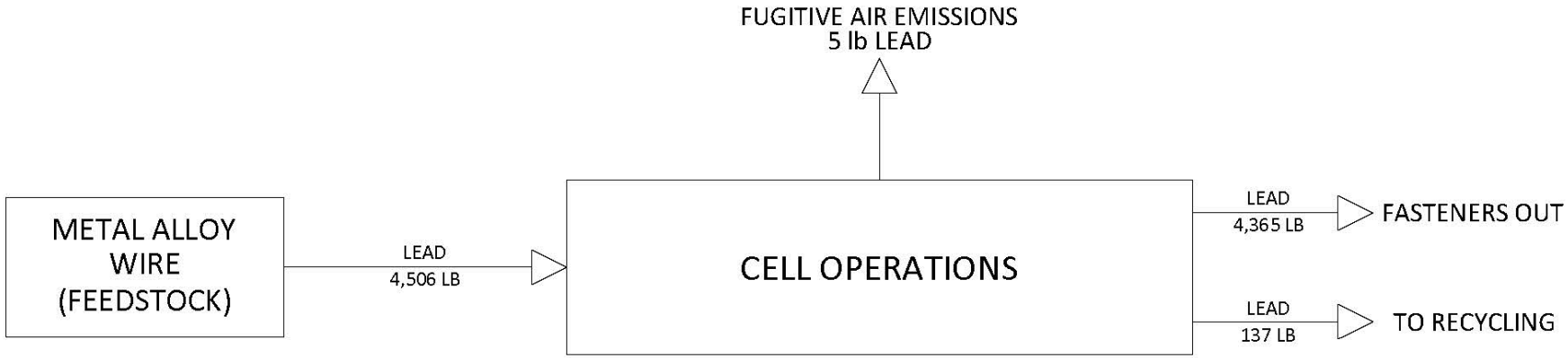
PRODUCTION UNIT 003
FASTENER MANUFACTURING PROCESS



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RCC				07/01/22	NONE

DWG.NO. FIGURE 2B

SHEET 1 OF 1

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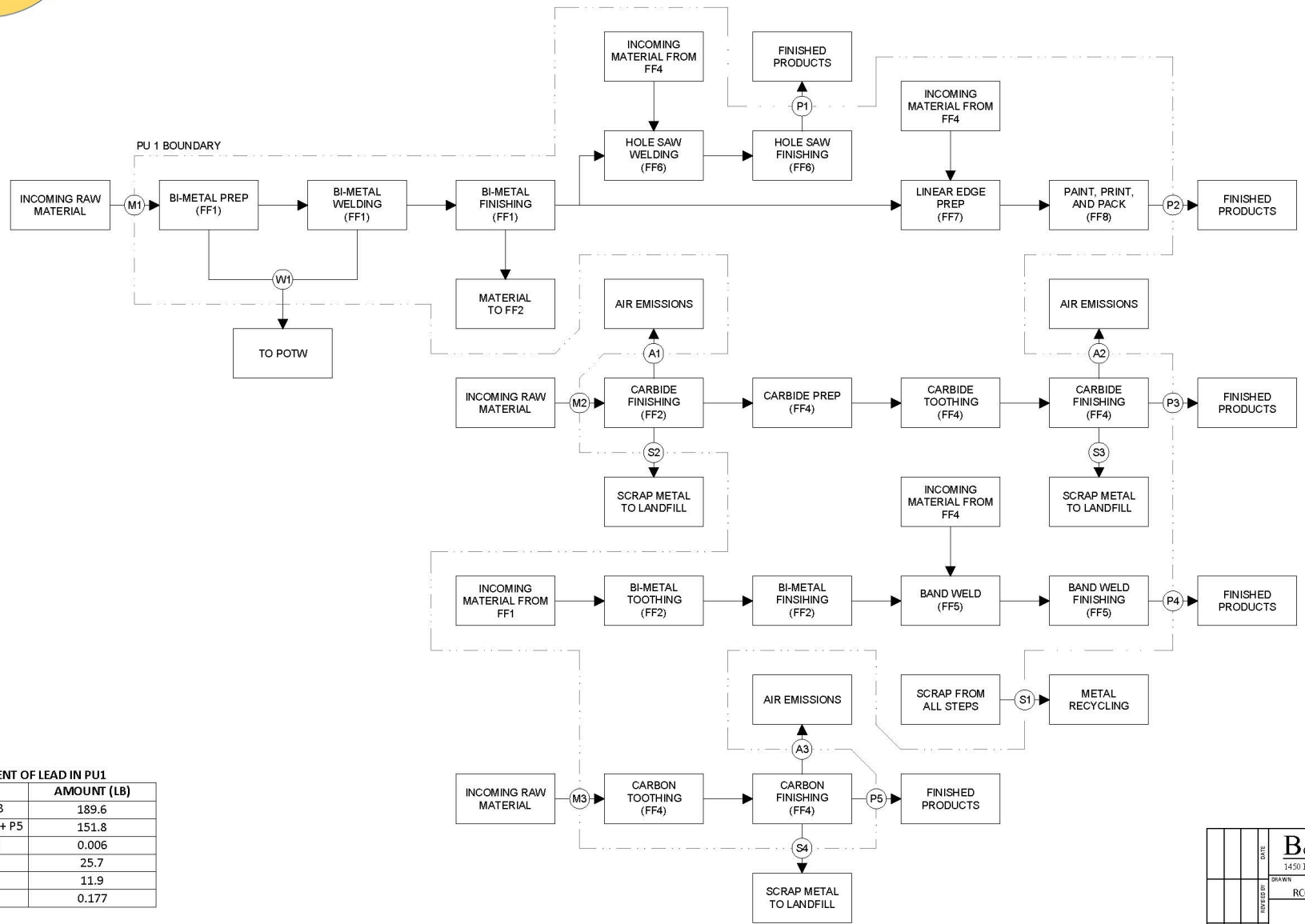
Pulling it Together

2021 TURA PROCESS FLOW DIAGRAM
PU-001: MOVEMENT OF LEAD



MOVEMENT OF LEAD IN PU1

FIGURE ID	AMOUNT (LB)
M1 + M2 + M3	189.6
P1 + P2 + P3 + P4 + P5	151.8
A1 + A2 + A3	0.006
S1	25.7
S2 + S3	11.9
W1	0.177

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RCC				07/01/22	NONE

DWG NO. FIGURE 1
SHEET 11

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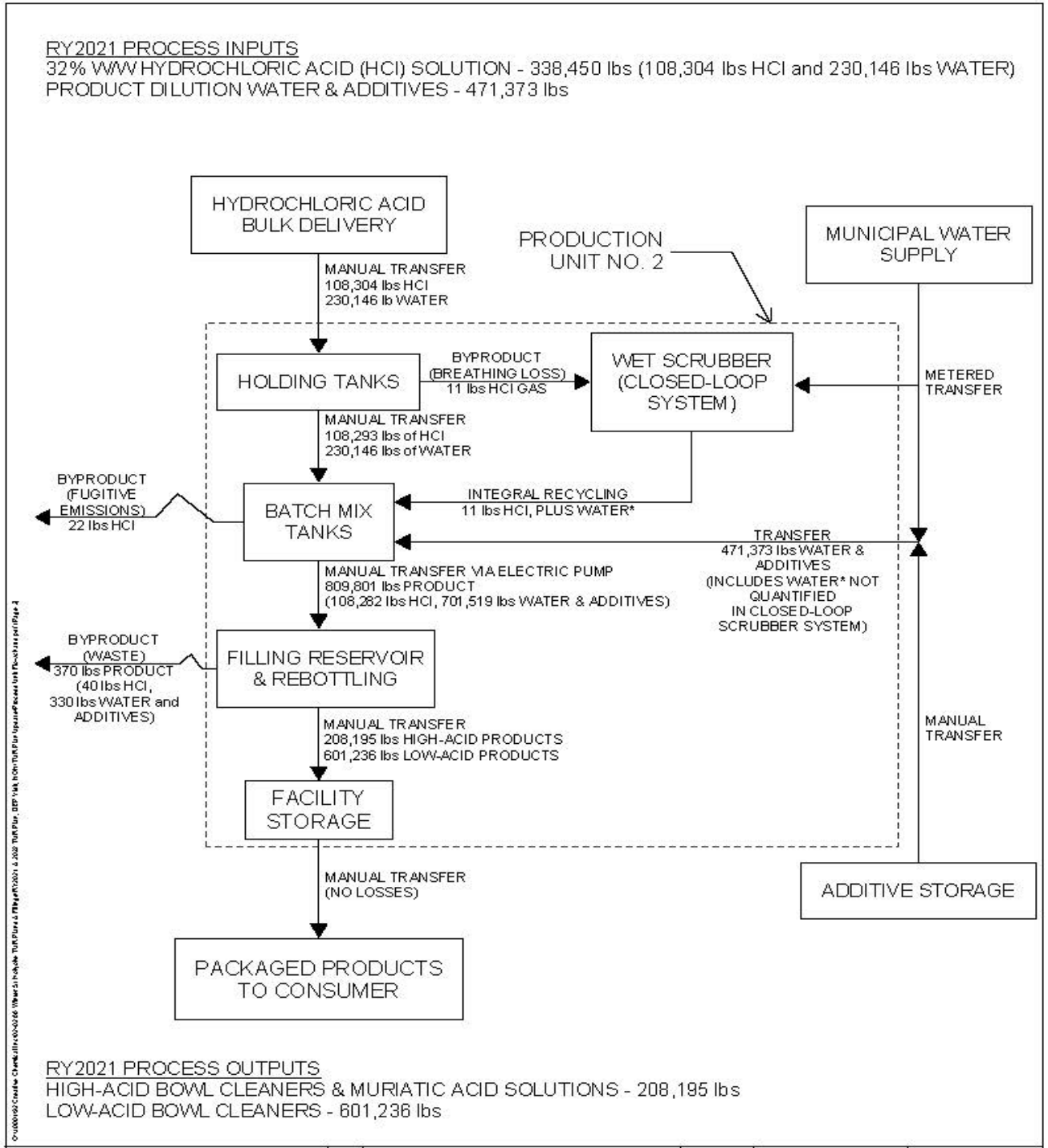

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Challenges

- Getting the process steps down. Deciding on the number of production units.
- Getting the correct information – for a variety of reasons
- Finding a really good reviewer
- Running out of time or rushing the process
- Simplifying
- Reminding myself that there are going to be changes

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Breakout Discussions – Tell a Story

What challenges have you faced when creating, updating or revising a PFD?

Does the stage in PFD development impact the challenges faced?

What changes were required?

Who did you enlist in your efforts to resolve discrepancies?

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