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Materials Accounting

Spring Conference 2024

Introduction

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- EHS Consultant for 12 years
- TURP for ~ 6 years

1 – What is Materials Accounting?

2 – Why Production Units Matter

2a – Emissions v.s. Byproducts

3 – Class Activity

4 – Wrapping Up

What is Materials Accounting?

TUR Planner Materials Accounting

From TURP training slides

QUALITATIVE

STEP 1: Process Mapping
- Identify processes
- Define WHERE inputs enter
- Define WHERE outputs leave
- Chemical pathway analysis

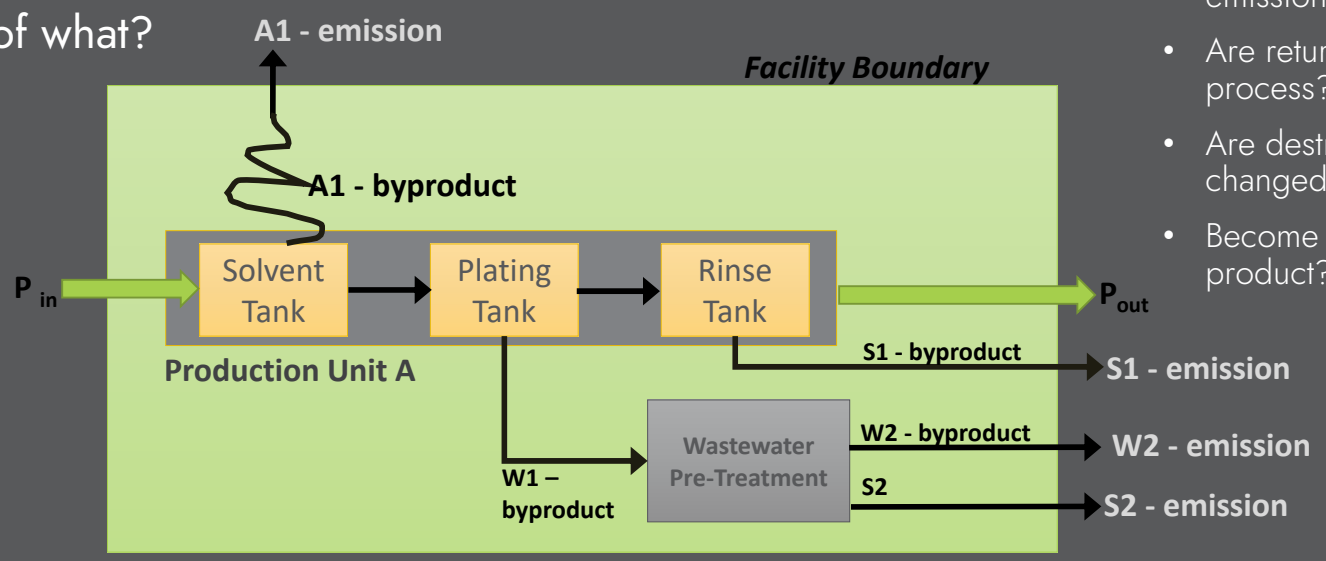
QUANTITATIVE
(this module)

STEP 3: Materials accounting
- Define HOW inputs are used
- Define HOW outputs leave
- Define prices/volumes
- Identify losses

STEP 2: Production Unit Info
- Identify PURPOSE OF TOXIC
- Identify PRODUCT
- Identify PRODUCTION UNIT
- Identify UNIT OF PRODUCT

TUR Planner Materials Accounting

- What goes in vs what goes out
  - In what?
  - Out of what?

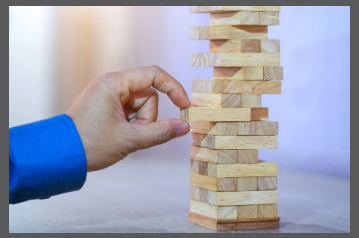


Byproducts that…

- Become emissions?
- Are returned to the process?
- Are destroyed or changed?
- Become your product?

TUR Planner Materials Accounting

- The goal: Balance!
  - In – out = 0



- Question: Can you have balance, but still be incorrect?

Imprecise?

Reduce chemical usage and employee risk, but also costs!

All about you!

INHALE
Direct buy from departments

INJEST
Leftover inventory from previous year

First pain point:
Where are you receiving your data from?

INJECT
Staff bring in on their own

ABSORB
Purchasing Dept. Records

Why Production Units Matter

Common Example: You!

- Facility Description:
  - Your digestive system
  - Purchase Foods
  - Produce Nutrients
    - Reportable Material: Higher Hazard Substance

Materials accounting complete! Right?

One v.s. Many

Would food loss via coughing be easier to identify one way or another?

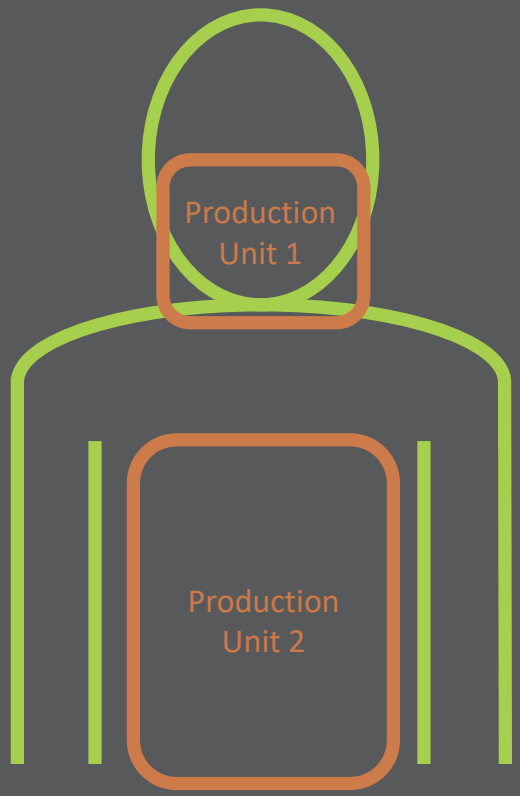
What if you have additional reportable materials, like HCl?

On-Site Waste Treatment?

Class Activity 1: Intro

Applicability Screening: What matters?

Let's do activity 1 as a class!



Result using purchase records?

Result using usage logs?

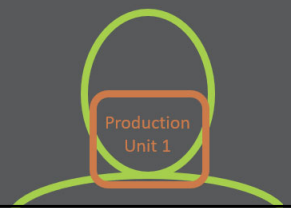
Class Activity 1: Part 1

- Production Unit 1
  - Description: Food is brought into the PU, and crushed to reduce particle size.
  - System inefficiencies can result in losses from crushing via spitting and coughing. These losses are discarded as waste.
  - The Line Supervisor estimates 5% of material ingested is lost.

  - Create PU1 flowchart, identify byproducts and emissions – 10,000 lb Nutrient purchased in food

Processed vs manufactured vs otherwise used?

Need to identify each per PU!



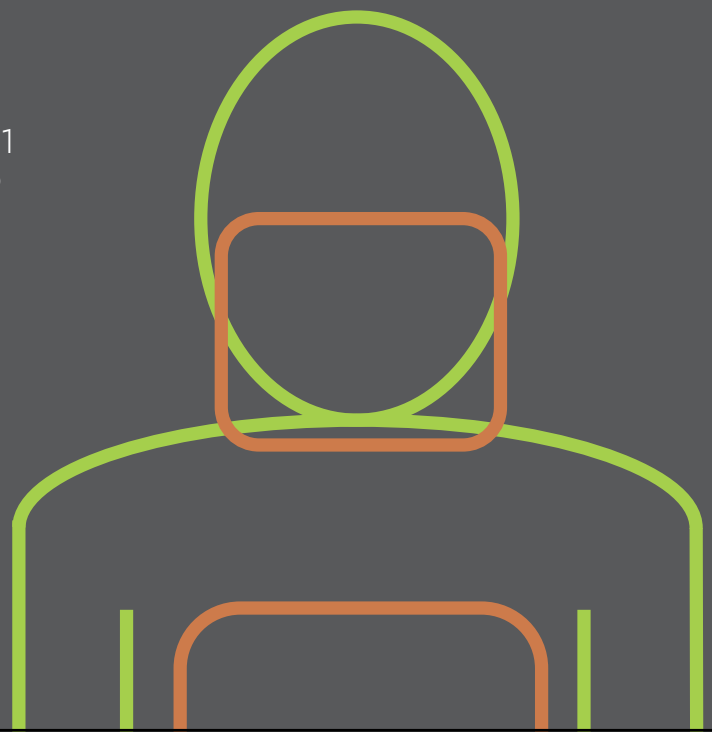
Class Activity 1: Part 2

Byproducts:

- Losses from inefficiencies
- Transfer out of PU1 prior to transfer to PU2

Emissions:

- Losses from inefficiencies



Facility byproduct

v.s.

PU Byproduct

We Interrupt Your Regularly-Scheduled Programming

Emissions? Byproducts?

Emissions v.s. Byproduct

Section 1: Facility-Wide use of Listed Chemical

1310732
a. MA DEP CAS #

SODIUM HYDROXIDE
b. Chemical Name (Dioxin should be in grams, decimal points may be used)

Facility-wide use of chemical identified in a. Enter the total amount (Report amounts in pounds for all chemicals except Dioxin. Report Dioxin in grams) for each applicable category. **NOTE:** 'Generated as byproduct' (item f.) means all waste containing the listed chemical before the waste is handled, transferred, treated, recycled or released. Please refer to the reporting instructions before completing this section.

0
c. Amount Manufactured

0
d. Amount Processed

469489
e. Amount Otherwise Used

469489
f. Amount Generated as Byproduct

0
g. Amount Shipped In Or As Product

.96
h. Production or Activity Ratio

Section 2: Materials Balance and Other Reporting Anomolies

The amount of a chemical that goes into a production unit generally equals the amount that comes out as waste or product. If the total amount of a chemical used (the sum of c, d & e) generally equals the sum of the amount shipped in or as product and generated at byproduct does not approximate this "materials balance". Questions a-e list the common reasons why there may not be a materials balance. If your chemical is not in materials balance, enter the pounds in the relevant section. Enter 0 if the section is not relevant or if the chemical is in materials balance.

0
a. Amount of Chemical Recycled OnSite

0
b. Amount of Chemical Consumed Or Transformed

0
c. Amount of Chemical(Product) Held In Inventory

0
d. Amount of Chemical Compound

0
e. Other Amount

Section 5

Quantity of the Toxic Chemical Entering Each Environmental Medium On-site
5.1-2 Air Emissions ☑ check if not applicable

5.1 Fugitive or non-point air emissions (pounds/year)

5.2 Stack or point air emissions (pounds/year)

5.3 Discharges to Receiving Streams or Water Bodies ☑ check if not applicable

Total Release (pounds/year)

Section 6

Transfers of the toxic chemical in wastes to off-site locations

6.1.A Total Quantity Transferred to all POTWs ☐ check if not applicable

2370
6.1.A.1 Total Transfers to all POTWs (pounds/year)

6.2 Total Quantity Transferred to all other Off-site locations (for treatment, disposal, recycling, energy recovery etc., excluding amounts sent to POTWs) ☑ check if not applicable

6.2.A Total Transfers (pounds/year)

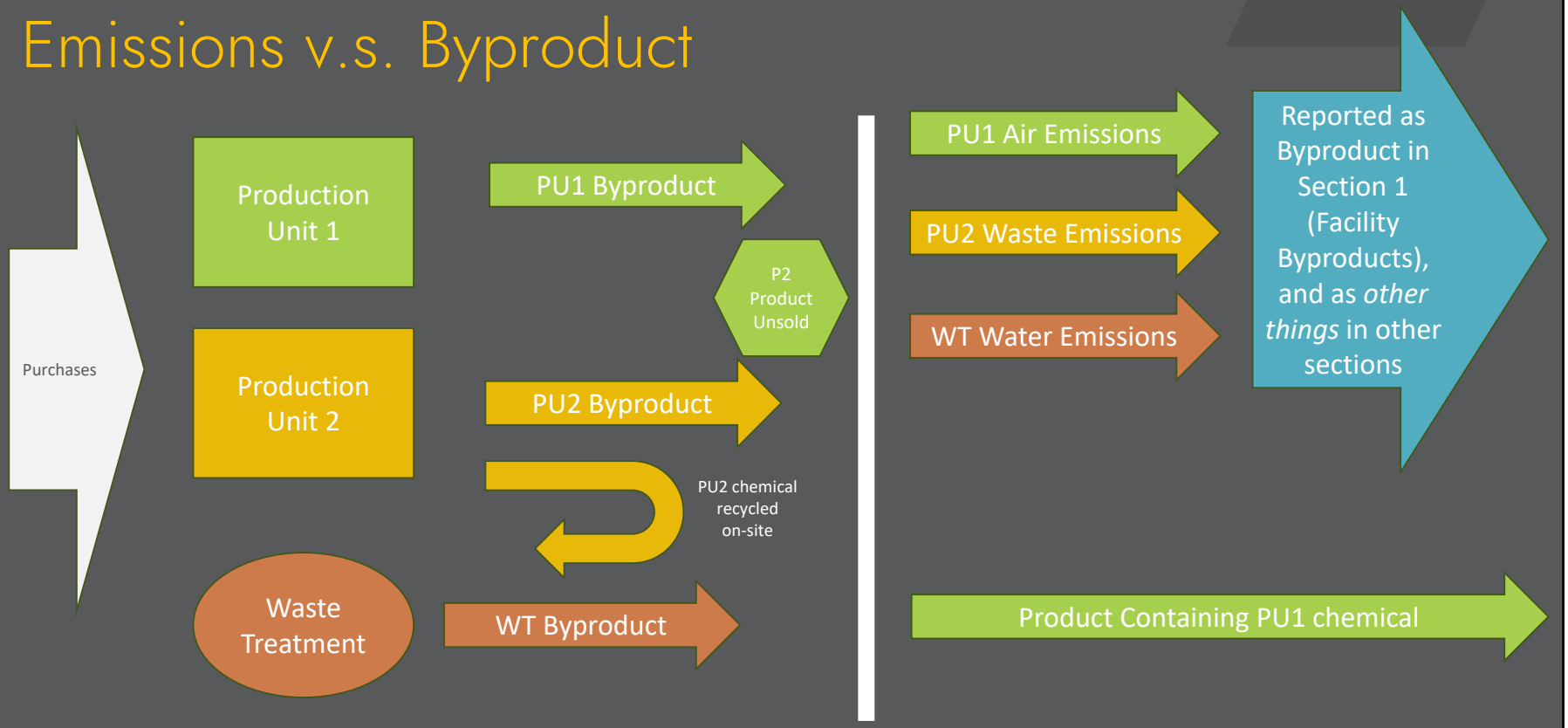
Section 8

Production Related Waste Managed.

Etc.

"Emission", "Discharge", "Transfer", "Managed"

Emissions v.s. Byproduct

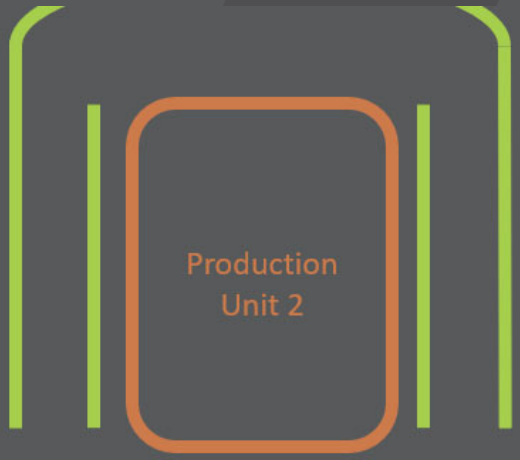


These are some examples of many options!

Now, back to the show!

Class Activity 1: Part 3

- Production Unit 2
  - Description: Crushed food particles are transferred into PU2. Chemical processes extract nutrient from particles. Nutrient is packaged for transfer. Waste is sent to waste treatment. System was not designed with emergency backflow discharge; can not throw up.
  - IT informs you that a ransomware attack resulted in a loss of all records of quantity of nutrient packaged for shipment.



Hmm. Something is missing…

- Create PU2 flowchart, identify byproducts and emissions

Class Activity 1: Part 3

Byproducts:

- Packaged nutrient
- Discharge to waste treatment

Emissions:

- None

Prompt for the class: does byproduct include shipped off-site as product for reporting?

Missing data: ransomware attack resulted in loss of packaged nutrient quantity! (This happened to a client of our, kinda)

Class Activity 1: Part 4

- Industrial Discharge Permit requires semi-annual sampling.

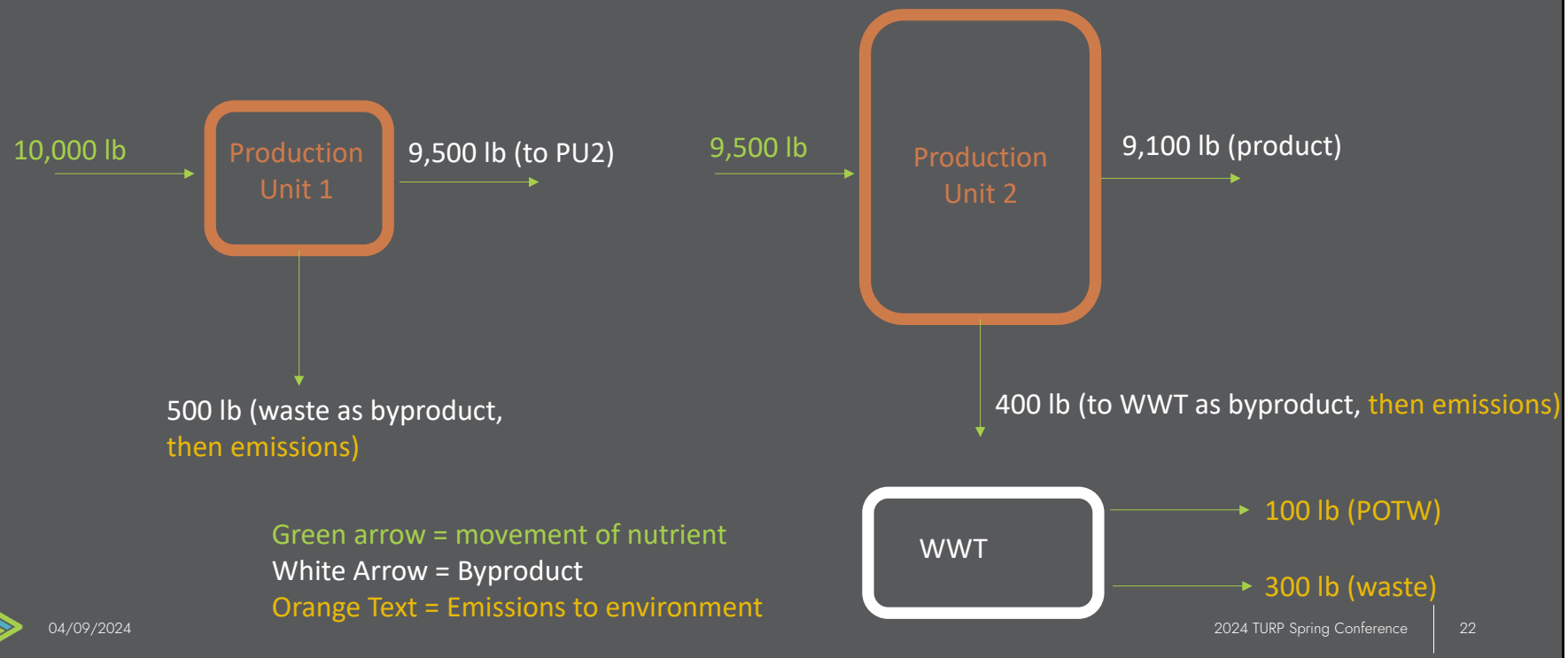
- Sludge:
  - 4 tons disposal
  - Average nutrient concentration = 3.75% by weight
- POTW Discharge
  - 100,000 gallons discharge
  - Average nutrient concentration = 1.2×10^{-2}% by weight

Emissions:

Sludge – 300 lb

Waste Water – 100 lb

Class Activity 1: PU Final Flowchart



Green arrow = movement of nutrient
White Arrow = Byproduct
Orange Text = Emissions to environment

Pulling it all together!

Real(ish) World Example

- Scenario:
  - You are the new facilities/EHS/security manager at a metal finishing facility.
  - Your predecessor has conducted annual TRI/TURA applicability screening for several years, however the facility has never been determined to be reportable.
  - Now, it's your turn!

General Process Description

- Receive both articles and metal stock to be worked prior to finishing.
- All parts go through a wash step prior to anything else.
- Manufactured parts are cleaned in a vapor degreaser.
- Clean parts are plated.

Note: as the facility has never prepared a TURA report in the past, you do not have a prepared flowchart to crib off of.

Group Work!

- Information supplied:
  - Metal and Finish chemistry records that accounting supplied your predecessor last year.
  - Material SDS records from last year (production manager insists no recipe changes have occurred since last year).
  - And…
  - That's it! Should be all you need. Right?

Before We Review…

- Anyone have examples where acquiring information from your colleagues or clients is like this?

- Is there a difference between purchase records and usage records?
  - Each table come up with two examples of what could impact calculations depending on information received.

Purchase v.s. Usage

- Straight usage records are usually harder to come by.
- Purchase records may not tell the entire story.

- Data points that affect USAGE v.s. PURCHASE:
  - Leftover inventory from previous year used in current year
  - Inventory purchased in current year not used until next year.
  - Purchased but wasted (spills, losses, etc).
  - Usage records may only be usage in a particular scenario, but miss other uses in a facility.

Generally, using purchase records for calculations are more conservative than usage records.

Screening Results

Product Code Desc	Total	Copper	Manganese	Chromium	Nickel
304 PART	8	0	0	2	1
304 FINISH	150	0	3	30	17
304L PART	43	0	1	9	5
321 PART	16	0	0	3	2
321 FINISH	525	0	11	100	63
347 FINISH	5,951	0	119	1,131	774
A2 PART, Tool	1,058	0	11	58	3
AISI-D2 PART, Tool	24	0	0	3	0
AM-350 FINISH	48,750	0	609	8,288	2,438
Ampco 940 PART, Tool	245	236	0	1	6
Brass PART, Tool	104	88	0	0	0
Inconel 625 FINISH	22,994	0	115	5,289	13,337
Inconel 718 FINISH	16,576	0	58	3,481	9,117
	Totals:	325	927	18,393	25,761

Which category to compare for each?

Which are reportable?

What other ways could we break this apart?

Congrats on TURA-tude!

- Time to report for Nickel!
- Get that plan going!

- But…

- Think about the Process Flow Diagram for the Production Unit.
  - Does the class have any more questions?

Receive both articles and metal stock to be worked prior to finishing.

All parts go through a wash step prior to anything else.

Manufactured parts are cleaned in a vapor degreaser.

Clean parts are plated.

"It was fine last year!"

- Management is concerned they now have new regulatory pressure and request a meeting to review your results.
- Just to be safe, you ask purchasing for ALL chemical purchases made in 20XX.
- You quickly assess total quantities purchased, and one material catches your eye:
  - Lenium GS: 160 gallons

Whoops!

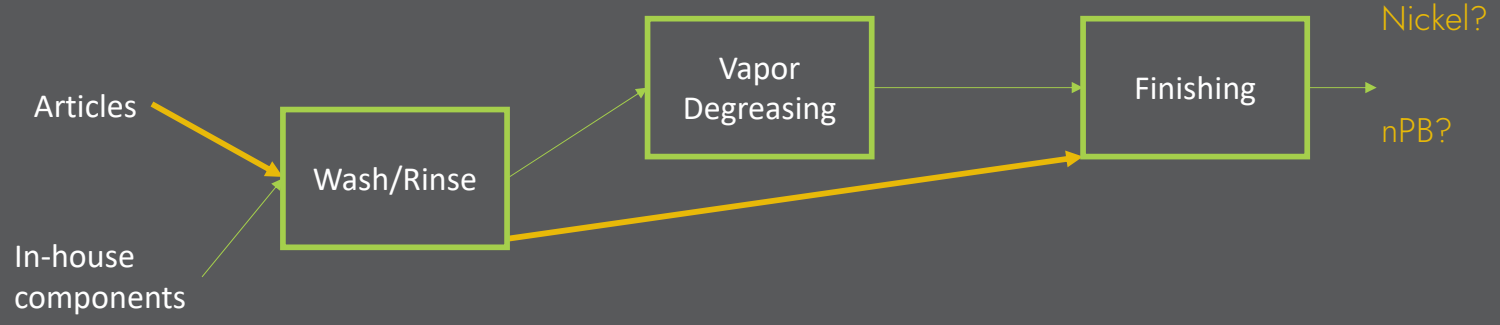
Production informed you they needed to do an additional cleaning of the vapor degreaser, something they never have done before.

"You never asked".

Deja Vu

- One Production Unit?

How does this affect Unit of Product?



Deja Vu

- Two Production Units?

In-house components → Wash/Rinse → Vapor Degreasing → Finishing →

How does *this* change Unit of Product?

Nickel?

nPB?

Articles → Wash/Rinse → Finishing →

Flow Diagram

- A section for each Production Unit containing the following information:
  - A process flow diagram showing the production unit number, how each TURA chemical moves through the process, how byproducts leave the production unit, and any facility emissions associated with the production unit.
  - The following data and description of how the data was calculated (be aware that byproducts and emissions are not the same thing):
    - The total amount of TURA chemical;
    - The total amount of TURA chemical per unit of product;
    - The total amount of TURA chemical byproduct;
    - The total amount of TURA chemical byproduct per unit of product;
    - The total amount of TURA chemical emissions; and
    - The total amount of TURA chemical emissions per unit of product.
  - The unit of product associated with the production unit;
  - A description of the purpose of each TURA chemical in the production unit;
  - The amount of byproduct (for each byproduct) treated, recycled, disposed of, or released on and off site.
  - The amount emitted (for each emission) for each environmental media the quantity treated, recycled, disposed of, or released on and off site.
  - The cost of use of each TURA chemical in the production unit.

Flow Diagram

For each material, open discussion:

- The amount of byproduct (for each byproduct) treated, recycled, disposed of, or released on and off site.
  - Where do you find this information (on and off-site)?
- The amount emitted (for each emission) for each environmental media the quantity treated, recycled, disposed of, or released on and off site.
  - Where do you find this information (on and off-site)?
- The cost of use of each TURA chemical in the production unit.
  - What aspects of operation can impact this value?

Remember, each of these needs a description and example calculations of how you got your solution!

Wrapping Up

Taking it Home

Group Discussion

1. What challenges do YOU have when preparing/reviewing your production units?
2. How have you overcome issues with data collection?
3. What takeaways are you planning on taking back to your process?

Thank you!

Open Discussion / Questions

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PEOPLE FOCUSED FUTURE