



# Materials Accounting

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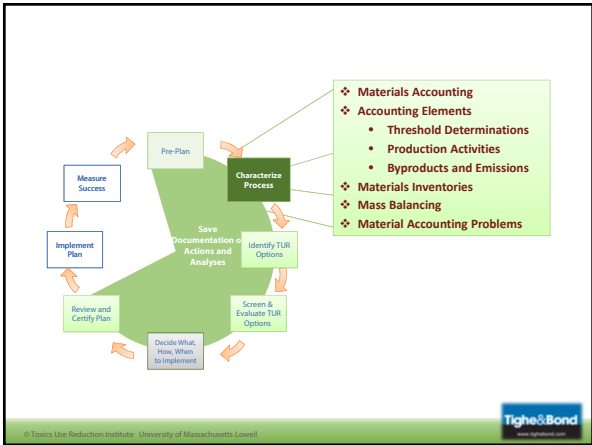
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## From DEP - TUR Plan Deficiencies: Chemicals Used

### PURPOSE

**TOTAL AMOUNTS & AMOUNTS PER UNIT OF PRODUCT** used, generated as byproduct, and released

**BYPRODUCT FATE:** amounts released on-site, treated on site and off-site, recycled on-site and off-site, reused onsite, disposed of on-site and off-site

**EMISSIONS TO EACH MEDIA:** amounts released on-site, disposed on-site, transferred off-site, and treated, recycled and disposed of off-site to air, surface water, ground water, and land

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## DEP TUR Plan Deficiencies: Chemicals Used

- Chemical use / byproduct / emissions per unit of product
- Byproduct fate details
- Emissions to media details



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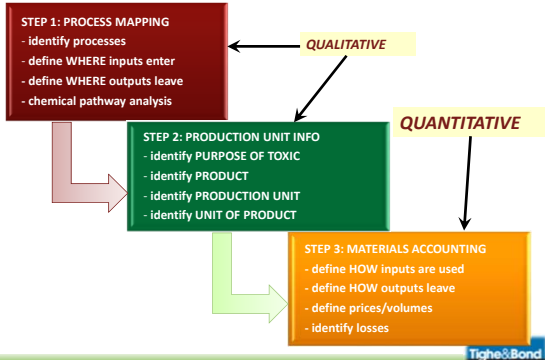
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## What's Involved?



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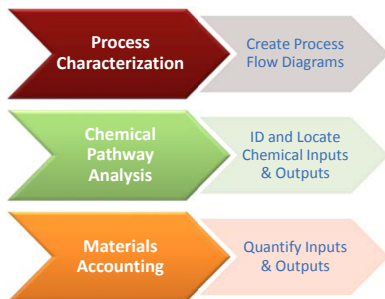
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## Definitions – Materials Accounting



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**SARA Title III, TRI**

- Inventory of Releases to Environment

**TURA**

- May require additional analyses/monitoring from Production Unit

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**TURA Plan: Material Accounting Requirements**

**Threshold Determinations**

- Manufactured, processed, and otherwise used


**Production Activities**

- Determination of “unit of product”

**Byproducts and Emissions**

- Definition of “byproduct” and “emission”

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**TURA Thresholds**

**Manufactured and Processed**

- 25,000 lbs

**Otherwise Used**

- 10,000 lbs

**Higher Hazard Substances**

- 1,000 lbs


**PBTs**

- varies

**Specific Rules**

- Mixtures
- Compound Categories
- On-site Reuse/Recycle
- De Minimis Exemption (1.0% or 0.1% for carcinogens)

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## Sources Of Chemical Use Data

Toxic Chemical Procurement (Purchasing)	Toxic Chemical as Inventory	Toxic Chemical Reuse/Recycling
<ul style="list-style-type: none"><li>Raw Material Purchasing Records</li><li>Vendor Invoices</li><li>Transfer Records (between facilities)</li></ul>	<ul style="list-style-type: none"><li>End-of-Year Inventory Records</li><li>Storage/Warehouse Record</li><li>Sources of Material Loss (leaks, evaporation, theft etc.)</li><li>Production Run Data, Batch Tickets, etc.</li></ul>	<ul style="list-style-type: none"><li>Disposal records/Recycling Logs</li></ul>

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## Unit of Product

A measure that reflects the *level of production* associated with use of toxic OR generation of toxic as a byproduct

Toxics use reduction *must* be normalized against the level of production

Select a measure of facility production that closely reflects activities involving toxics

**REMEMBER:** it's a unit of **PRODUCT**, not of toxics use!

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## Determining Unit of Product

### Fundamental Elements

- In general non-physical measures are less accurate than physical measures
- The more closely the UOP is related to chemical use/byproduct, the more accurate the measure
- Most firms chose UOP from **available data**. Not implementing complicated database systems
- Poorly correlated UOP is where there is random relationship between chemical use/waste and production

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## Determining Unit of Product

### Data Sources for Unit of Product

- Product Shipment Records
- Product Specifications
- Invoices to Customers (accounts receivable)

### Considerations Issues Complications

- What Correlates Best to Toxics Use?
- Are There Complexity Factors?

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## Determining Unit of Product

Identifying a well correlated UOP will be easiest in cases where:

- Few uses of a chemical at the site
  - *The greater the number of uses the more difficult to find a measure of production that correlates with the waste stream containing the chemical*
- Little variation in the product: variation in product types (surface area, geometric shapes or substrates) makes selecting a UOP more difficult
- Little change in the process: processes that are constantly changing make measurement from year to year more difficult

Also: To find a suitable UOP– (1) draw PFD w/chemical path; (2) collect time consistent data (i.e. chemical use vs. SF); (3) test relationship of inputs/variables (linear regression)

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## Determining Unit of Product : Perfect World vs. Real World

### Perfect World:

- We can measure final product as we want and we can create any new database system to measure our UOP
- Our process has very little change and our product has little variation (same shape, size, configuration)
- We use our chemical only in one process

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## Determining Unit of Product : Perfect World vs. Real World

### Real World:

- Companies chose UOP they believe to be most suitable to their production process
- Most suitable means not practical to measure square foot of every part produced
- It results in a not well correlated UOP
- It's easier for them to get sales dollars or labor hours
- Influencers such as labor rates or material costs may increase sale dollars, but disconnected from chemical use or byproducts
- Inconsistent quality of materials accounting data will make byproduct, emission, and UOP estimates difficult

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## Typical Units of Product

Form S Cover Sheet lists these unit of product possibilities	Example units of product	Example toxics use per unit of product
Area	sq. ft., sq. yard, sq. meter	lb (of toxic) per sq. ft.
Labor hours	Hours	lb (of toxic) per hour
Kilowatt - hours	kWH	lb (of toxic) per kWH
Length	ft, meters, yards, miles	lb (of toxic) per ft
Number	number (of units)	lb (of toxic) per number (of chairs, of jars, etc.)
Volume	gal., litre, cu. ft., board-feet	lb (of toxic) per gallon
Weight	lb, kg, ton, (metric) tonne	lb (of toxic) per ton
Dollars	\$ [use only if nothing else works!]	lb (of toxic) per \$ (of revenue)

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## Determining Unit of Product

- "Measuring TUR in Metal Intensive Industries" – Hazardous Waste & Hazardous Materials vol. 11, number 2, 1994
- "Measuring Progress in TUR and Pollution Prevention"- Mass TURI/OTA/MADEP – Technical Report No.30 – 1996
- "Developing and Using Production Adjusted Measurements of Pollution Prevention" – EPA National Risk Management Research Lab – September 1997, and Project Summary November 1997

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## Refresh your memories

- 5 minutes for a quick “quiz”

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## Byproducts

“**Non-product outputs** of toxic or hazardous substances generated by a production unit, before handling, transfer, treatment or release. Otherwise used substances shall be counted as byproduct when they leave a production unit.”

- Outside production unit boundary = Byproduct

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## Emissions

- “A release of a toxic or hazardous substance to the environment or a transfer of a toxic or hazardous substance in waste to an off-site location”
- Emissions include:
  - Air (Point and Fugitive)
  - Water (POTW, NPDES, Storm)
  - Hazardous and Solid Wastes
  - Off-Site Recycling
- Outside facility boundary = Emission

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## Byproduct/Emissions

- **Measurement of Byproduct and Emissions**

- **Materials as Byproduct/Emissions**

- Waste Transport Manifests and Invoices
- Media-specific Environmental Reports
- POTW, NPDES, APSR/SSEIS, Biennial Waste Report
- Toxics Release Inventory Reports
- Spill/Release Reports

**Be Consistent !**

- **Materials Reuse/Recycling**

- Recycling Records:
  - Recycler Invoices
  - Recycling Permits
  - Scrap Logs

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## Byproduct/Emission Measurements

**Use Existing Data Sources**

**Direct Measurements** - continuous and non-continuous  
(extrapolations from periodic monitoring)

**Engineering and Design Calculations**

**Best Engineering Judgment Estimates**

**Vendor specs**

**Documentation helps justify  
"Good Faith Effort"**

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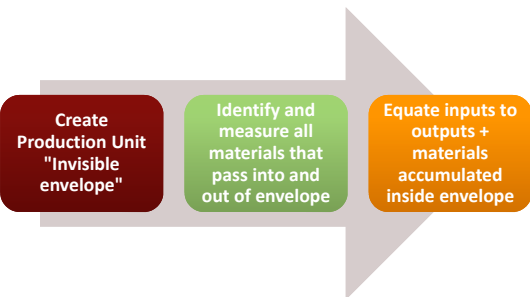
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## Mass Balances: Inputs = Outputs



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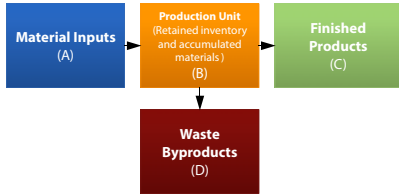
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## Mass Balancing

Material In = Material Out + Material maintained in Production Unit



$$A = (C + D) + B$$

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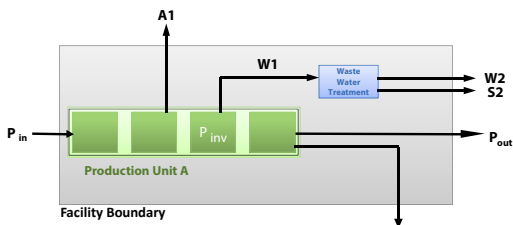
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## Byproduct vs. Emissions



Byproducts: A1 S1 W1  
Emissions: A1 S1 S2 W2

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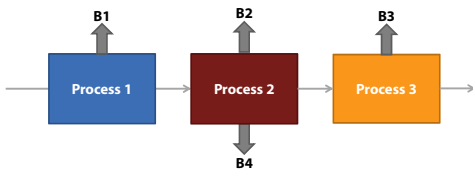
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## Byproduct Generation

Total byproduct is often the sum of numerous byproduct generation points:



$$B_{\text{total}} = B_1 + B_2 + B_3 + B_4$$

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## Why Don't the Inputs = the Outputs?

...(sometimes, they don't)

- Chemical is *non-integrally* recycled
  - Byproduct weight must be reported for *each use*

### Example:

10,000 lbs. of solvent is recycled 9 times after initial use

10,000 lbs. is used

100,000 lbs. is reported as byproduct

Compare this with *integrally* recycled!

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## Non-Integral Recycling

### RECYCLED ONSITE

- Each time onsite-recycled material is re-introduced as an input to the Production Unit
  - Adds to Production Unit level chemical use quantities
  - Does **not** add to facility-wide level chemical use quantities
- Thus, onsite recycling *will* result in a reduction of the facility-wide total usage number

### RECYCLED OFFSITE

- Each time offsite-recycled material is re-introduced as an input to the Production Unit
  - Adds to byproduct AND use
  - **Both** at Production Unit level
  - **And** at facility-wide level
- Thus, offsite recycling *will NOT* result in a reduction of the facility-wide total usage number

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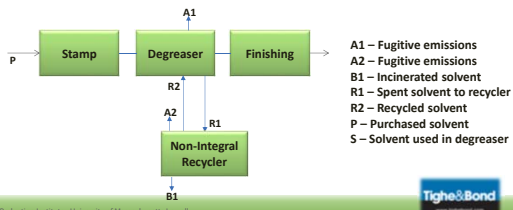
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## Problem 1: Byproduct Calculation

### Calculate the Total Byproduct and Emissions

Production Unit B is a vapor degrease operation. The company purchased 4,500 lbs. of TCE to operate this production unit for one year. The fugitive emissions from the degreaser (A1) were determined to be 20% of the amount of TCE used in the degreaser. The fugitive emissions from the recycler (A2) were determined to be 5.0% of the TCE sent to the recycler. The spent TCE sent from the degreaser to the recycler was 10,000 lbs for the year. The recycling process recovered 80% of the TCE that was sent to it.



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