TUR PLANNING BEST PRACTICES

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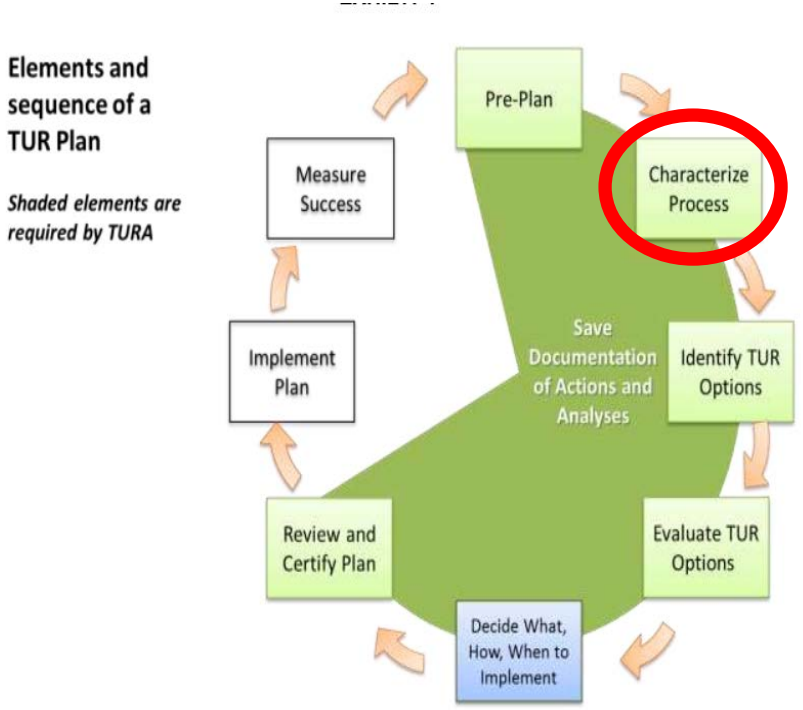
PLANNING OVERVIEW

- The Planning process is designed to be flexible and readily adapted to the unique circumstances at each facility.
- For some companies, chemicals or production processes, the TUR Plan may include relatively limited analyses, particularly after the initial planning year. In other situations more extensive research, analysis and documentation will be required.

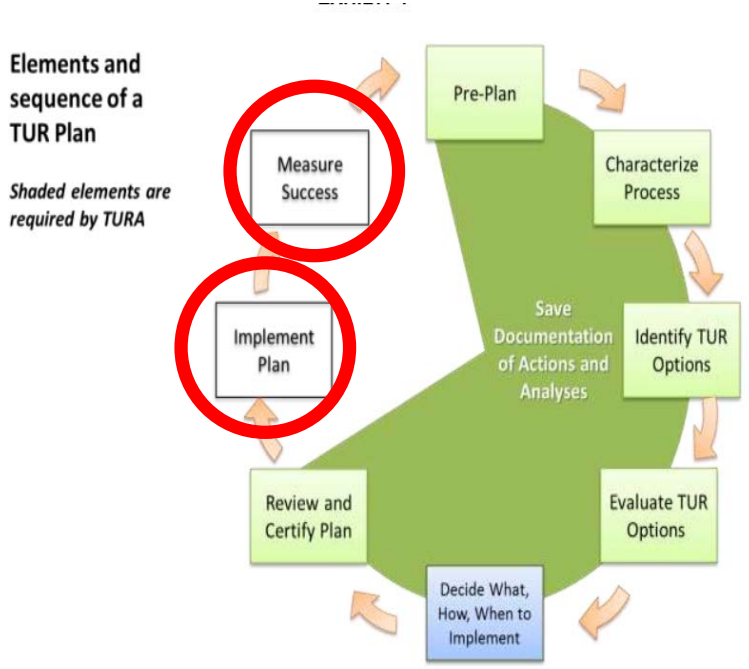
TUR BEST PRACTICE TOPICS

- CHARACTERIZE PROCESS
  - PRODUCTION UNIT
  - UNIT OF PRODUCT
  - PURPOSE OF THE CHEMICAL
  - ACCURATE MATERIALS ACCOUNTING



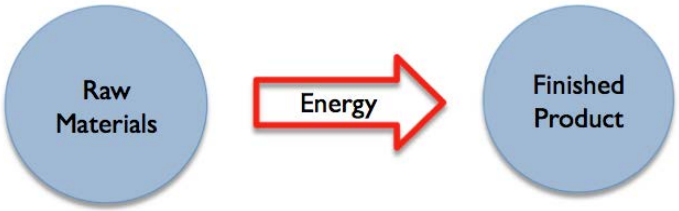
TUR BEST PRACTICE TOPICS

- MEASURE SUCCESS
  - PLANNING RATIO METRICS
- MANAGEMENT STRATEGIES FOR TUR OPTION IMPLEMENTATION



PRODUCTION UNIT & UNIT OF PRODUCT

- A MEASURE OF PRODUCTION OUTPUT FOR EACH PRODUCTION UNIT



1. HOW MANY PRODUCTS PRODUCED?
2. WHAT IS THE PRODUCTION PATH?
3. HOW MANY PRODUCTION UNITS TO COVER THE FACILITY ??

PRODUCTION UNIT
UNIT OF PRODUCT (UOP)

- UNITS THAT ARE MEASURABLE / MEANINGFUL
- NORMALIZATION OF DATA TO ADJUST FOR LEVEL OF PRODUCTION OUTPUT
- PRACTICAL TO MEASURE

PLANNING RATIOS

- M-P-OU/ UOP
- BYPRODUCT/ UOP
- EMISSIONS/ UOP

WHICH OF THESE DO YOU FIND MOST INFORMATIVE?

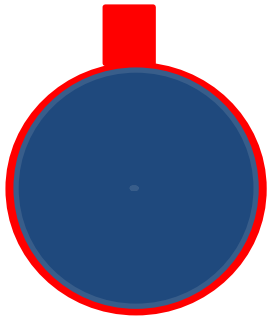
REQUIRED IN ALL PLANS

Unit of Product – Casting Example

PROCESS: POLYESTER RESIN CONTAINING STYRENE MONOMER IS POLYMERIZED AND MOLDED INTO BALLS (BOWLING BALLS, ECT.)

UOP = PLASTIC BALLS

UNIT OF MEASURE = Weight



- What weight was being used for planning?

Weight of STYRENE monomer in resin cast.
COMMENTS?

Planning Ratios – Casting Example

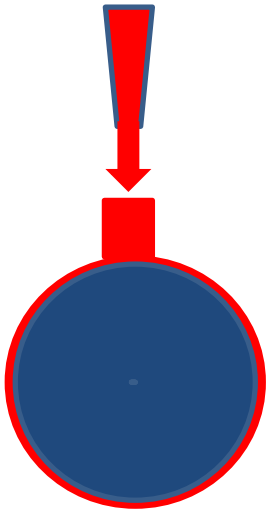
- WHAT HAPPENS TO RATIOS USING THE WEIGHT OF STYRENE MONOMER AS THE MEASURE OF PRODUCTION?

1. QUANTITY M-P-OU = UOP

2. RATIO OF M-P-OU / UOP = 1

ALWAYS

Casting Example
Materials Accounting



34 WT PERCENT STYRENE MONOMER RESIN KICKED WITH CATALYST FOR POLYMERIZATION TO PRODUCE POLYESTER SHAPES

1. INJECTION/MIXING LINE IS FLUSHED OUT AT END OF RUN AND "KICKED" WITH CATALYST TO CURE RESIN AND DISPOSE AS NON-HAZARDOUS SOLID WASTE.

BY-PRODUCT = OFF-SITE TRANSFER = EST. WEIGHT X 34%

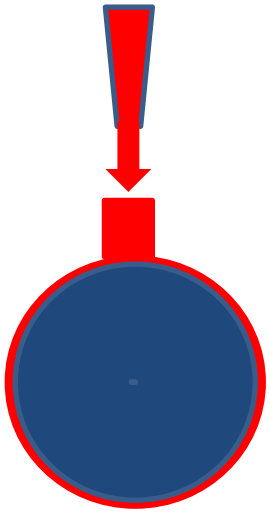
OFF-SITE TRANSFER – CHANGED TO EST. WEIGHT X 0.1%

2. AIR EMISSIONS = 0.3% OF USAGE FROM PARTIAL PRESSURE AND VOLUME DISPLACEMENT CALCULATION

CHANGED TO PUBLISHED EPA EMISSION FACTOR = 1.5% FOR CLOSED MOLDING OF POLYESTER

Casting Example
Materials Accounting

34 WT PERCENT STYRENE MONOMER RESIN KICKED WITH CATALYST FOR POLYMERIZATION TO PRODUCE POLYESTER SHAPES



3. SPRUE NECK IS CUT OFF AND THE BALL IS MACHINED/POLISHED TO SHAPE GENERATING WASTE SOLIDS

   NOTHING REPORTED

CHANGED TO REMOVED WEIGHT X 0.1%

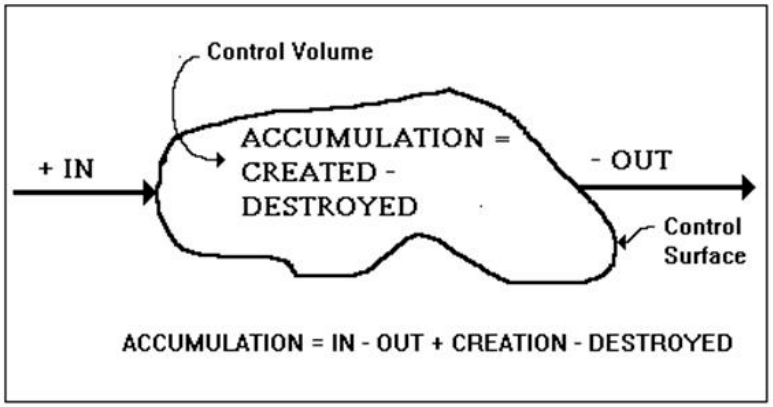
4. SHIPPED IN PRODUCT

   NOTHING REPORTED

CHANGED TO PRODUCT WEIGHT X 0.1%

Materials Tracking Data – Is a Guess Good Enough?

- CLOSURE FOR THE MATERIAL BALANCE ??
  - "KNOWNS"
    - QUANTITY
      - MEASUREMENT ACCURACY
    - COMPOSITION
      - ACCURACY
      - SAMPLE REPRESENTATIVENESS
  - UNKNOWNS/ESTIMATES
    - ESTIMATION METHODS
    - WHEN TO GET DATA INSTEAD OF GUESSING?



ADJUSTMENTS TO INVENTORY

- SOLVENT PURCHASES AT COATING FACILITY WITH ON-SITE SOLVENT RECYCLING EXCEED AMOUNTS DISCHARGED TO AIR AND WASTE WATER BY 30%.
  - PLANNER ADJUSTS SOLVENT INVENTORY YEARLY IN FORM S - SECTION 2
  - OVER TWO CONSECUTIVE YEARS THE AGGREGATE AMOUNT OF ADJUSTMENT EXCEEDS SOLVENT STORAGE CAPACITY, YET TANKS < 1/3 FULL.

WHERE DID THE SOLVENT GO?

ADJUSTMENTS TO INVENTORY

- TANK INVENTORY RECORDS – MONTHLY
- FLOW TO PROCESS – METERED & RECORDED
- AIR EMISSIONS – STACK TESTING AND CONTINUOUS MONITORING
- WASTE WATER – MONTHLY SAMPLES
- SOLVENT RECOVERY SYSTEM –

  SOLVENT LOST AS CHEMICAL UNDERGOES TRANSFORMATION REACTION WITH WATER IN SOLVENT RECOVERY SYSTEM.

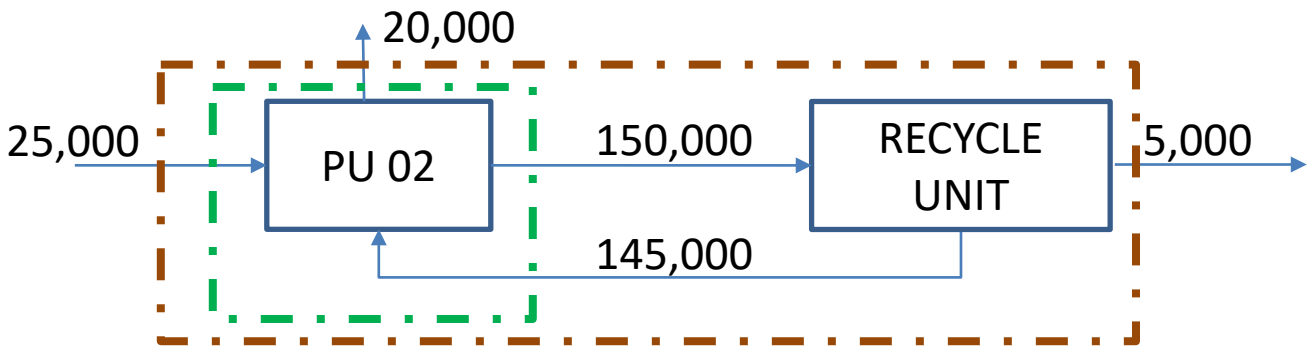
POTENTIAL TO REDUCE NEW MATERIAL USAGE BY 30% !!

Know Your Boundaries

Description of Sample Process: *Each year, 25,000 lbs of virgin chemical plus 145,000 lbs of recycled chemical are added to the process (inputs). Each year 20,000 lbs of byproduct are released to the air and 150,000 lbs of spent chemical is drummed and brought to the on-site recycling unit. The recycling unit generates 5,000 lbs of hazardous waste. The quantities in the diagram show the yearly amounts of byproduct produced and materials processed. Because this is on-site non-integral recycling, the 145,000 lbs of recycled chemical is not counted towards facility-wide use, but is counted toward chemical use at the production unit level.*

For this example of a company performing Non-Integral On-Site Recycling, the Form S, Section 1, would be filled out as follows:

c. Manufactured: 0
d. Processed: 0
e. Otherwise Used: **25,000**
f. Generated as Byproduct: **175,000**
g. Shipped in or as Product: 0*



DON'T ASSUME THINGS ARE ALWAYS RUNNING AS USUAL

- BY-PRODUCT VS. OFF-SITE TRANSFERS
  - BYPRODUCT = WASTE SHIPPED, RIGHT?

"QUIET" SLUDGE INVENTORY ACCUMULATION IN WASTE TREATMENT CLARIFIER AND SLUDGE TANK

MAKE THE MEASUREMENT YOU MIGHT BE SURPRISED WHAT YOU FIND!

- FACILITY USES ARTICLE EXEMPTION
  - "WE RECYCLE EVERYTHING"
  - "IT COULDN'T BE MORE THAN 0.5 POUND RELEASED"
- RE-EVALUATION
  - AIR FILTERS DISCARDED EVERY 2-YEARS
  - TESTED DIRTY UNIFORMS SENT FOR DISPOSAL

ACTUAL > O.5 POUND

PRODUCTION UNIT CHARACTERIZATION

Examine how and how much of each “covered toxic” is manufactured, processed, or otherwise used

PROCESS CODES AND PROCESS FLOW DIAGRAMS

Production Process Step Information For This Production Unit

i. Enter the production process codes to identify the process steps that involve TURA-reportable chemicals as an input, output or throughput. (See the reporting guidance document for the list of production process codes and instructions on when a given code needs to be listed.)

1. BB-02 Process Code	2. BB-04 Process Code	3. _____ Process Code	4. _____ Process Code
5. _____ Process Code	6. _____ Process Code	7. _____ Process Code	8. _____ Process Code

CODES LISTED ON FORM S BUT NOT SHOWN ON THE PROCESS FLOW DIAGRAM IN TUR PLAN

PROCESS CODES

Group 1: Processes Typically Used by Facilities that Make and Process Objects or Provide Services

Group 2: Production Processes Typically Used by Facilities that Manufacture and Process Chemicals

Group 3: Miscellaneous Processes that could be used by any facility

GROUP 1 - Make and Process Objects

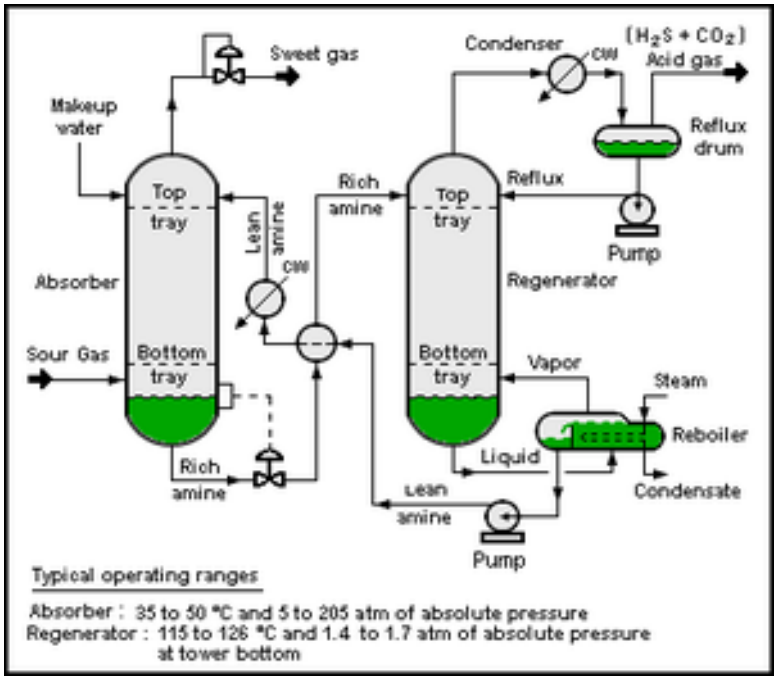
- **Coating & Painting Processes (AA-01 to 04)**
- **Printing Processes (AA-05 to 11)**
- **Plating Processes (AA-12 to 17)**
- **Processes that penetrate surface layer (AA-18 to 19)**
- **Processes that add material throughout the mass of a product (AA-20 to 22)**

GROUP 1 - Make and Process Objects

- **Processes that remove material from product (BB-01 to BB-09)**
  - **Cleaning**
  - **Chemical**
  - **Mechanical**
  - **Heat**
- **Product Molding/Forming (CC-01 to CC-06)**
- **Bonding/Joining (CC-07 to CC-13)**

GROUP 2 – Manufacture/Process Chemicals

- **Separation / Refining (DD-01 to DD07)**
- **Chemical Reactions (EE-01 to EE-11)**



Group 3 Misc. Processes

- **Production Equipment Cleaning**
  - **Solvent (FF-01)**
  - **Aqueous (FF-02)**
  - **Mechanical (FF-03)**

May be a separate process or an activity associated with an otherwise listed process.

Group 3 Misc. Processes

- **Materials Storage/Handling**
  - **Blend/Mix (GG-01)**
  - **Particle Size Reduction (GG-02)**
  - **Packaging/Filling (GG-03)**
  - **Other (NOS) (GG-04)**
    - Use for storage and handling processes that generate losses such as spills or evaporative losses

Group 3 Misc. Processes

- **Treatment of Process Water**

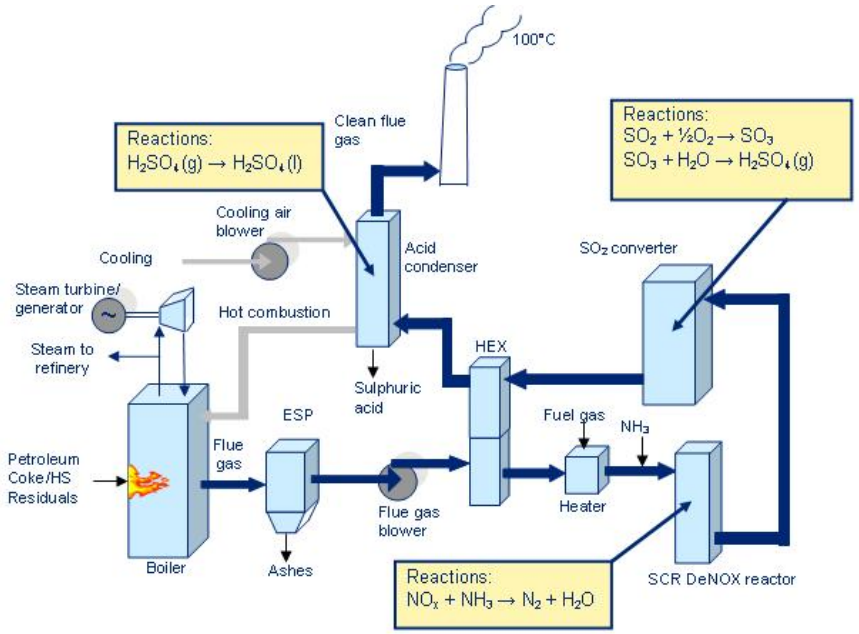
  (HH-01 to HH-03)
- **Refrigeration/Temperature Control**

  (II-01 to II-03)
- **Power Generation (JJ-01)**

  Note: use an FF code for equipment cleaning associated with power production and a HH code for treatment of cooling or boiler water

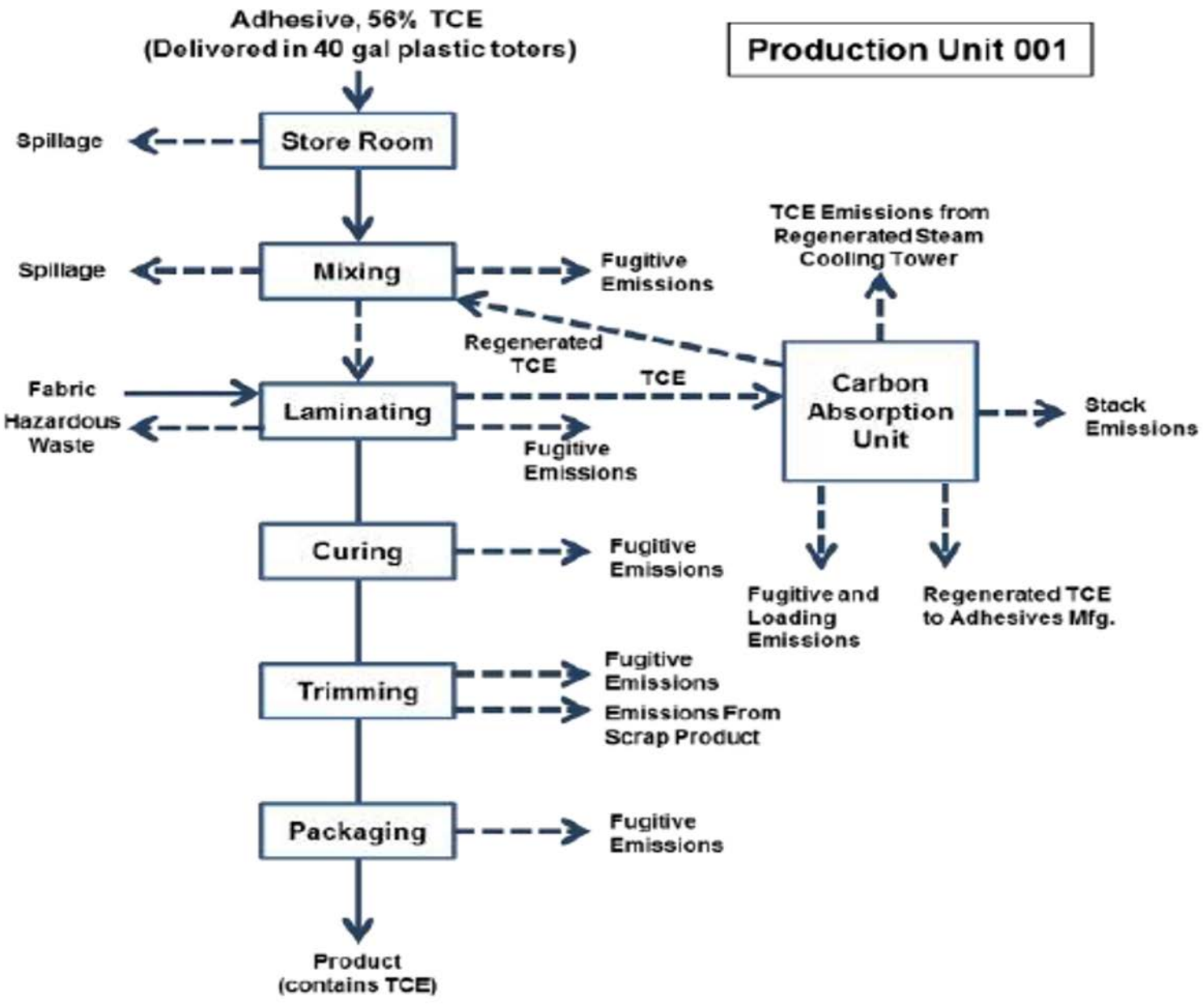
PRODUCTION UNIT CHARACTERIZATION

Examine how, how much, and at what point in the production process byproducts are generated and released to the environment.



PROCESS CODES AND PROCESS FLOW DIAGRAMS

1. SHOW CODES FOR EACH STEP IN PROCESS
2. SHOW EACH POINT WHERE LISTED MATERIAL IS M-P-OU
3. SHOW EACH POINT WHERE BY-PRODUCT IS GENERATED
4. SHOW EACH POINT WHERE EMISSIONS ARE RELEASED


Production Unit 001
Adhesive, 56% TCE
(Delivered in 40 gal plastic toters)
Store Room
Spillage
Mixing
Spillage
Fugitive Emissions
TCE Emissions from Regenerated Steam Cooling Tower
Regenerated TCE
TCE
Fabric
Laminating
Hazardous Waste
Fugitive Emissions
Carbon Absorption Unit
Stack Emissions
Curing
Fugitive Emissions
Fugitive and Loading Emissions
Regenerated TCE to Adhesives Mfg.
Trimming
Fugitive Emissions
Emissions From Scrap Product
Packaging
Fugitive Emissions
Product
(contains TCE)

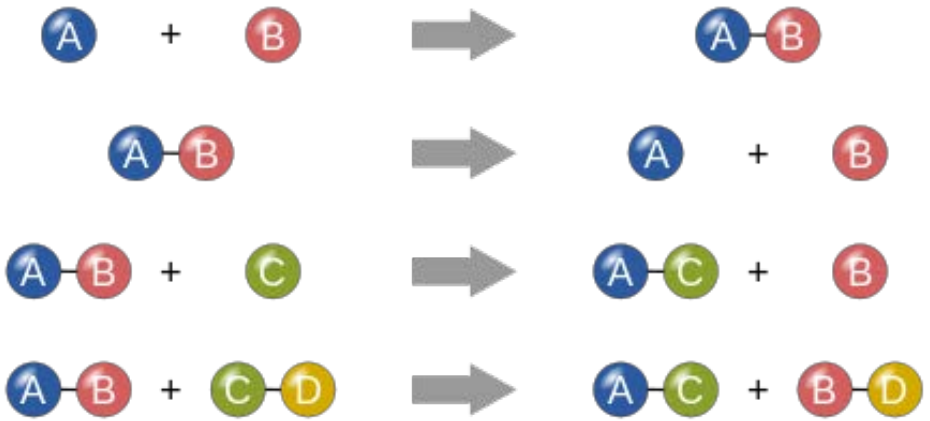
PRODUCTION UNIT BY-PRODUCT

- Develop understanding of:
  - How/why *by-product is being* generated (along with good product)?
  - How/why non-product is being generated (bad product)?
- Which by-products are released?

PURPOSE OF THE TOXIC

CHEMICAL REACTION AND SELECTIVITY

- **PROCESSED REAGENT**
- **MANUFACTURED PRODUCT**
- **MANUFACTURED CO-PRODUCT**



PURPOSE OF THE TOXIC

PROCESSED OR MANUFACTURED CHEMICAL TO PRODUCE PROPERTIES OF FINISHED PRODUCT

- FLUID RHEOLOGY
- MECHANICAL
- ELECTRICAL
- PHYSICAL
- CHEMICAL STABILITY
- ETC…

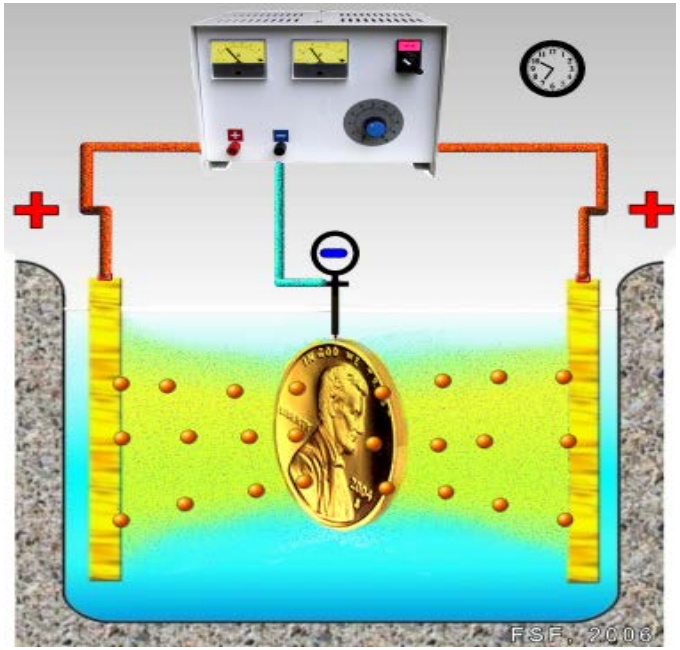
PURPOSE OF THE TOXIC

OTHERWISE USE - CLEANING FOR REMOVAL OF "DIRT"

- WHAT IS THE CONTAMINANT?
- HOW DID THE DIRT ENTER THE PROCESS?
- TOLERANCE OF DOWN STREAM PROCESS/CUSTOMER?

PURPOSE OF THE TOXIC

OTHERWISE USE – PROCESSING AID



“PIXIE DUST THAT MAKES IT WORK”

PURPOSE OF THE TOXIC

RAW MATERIAL CONTAMINANT "ALONG FOR THE RIDE"

Antimony

IF SO WHAT IS THE PURPOSE OF THE PRIMARY MATERIAL ?

EXAMPLE PURPOSE OF CHEMICAL STATEMENT IN 2014 PLAN UPDATE BY GENERAL PRACTICE PLANNER

“THE SOLVENT IS USED TO MAKE MEMBRANE.”

COMMENTS?

Management Strategies for TUR Implementation

TUR PLAN COMPLETENESS CHECKLIST

- Management Policy
- Employee Notification
- Plan Scope – Covered Toxics, Production Units & Options For Implementation
- Production Unit Process Characterization
  - Purpose of Covered Toxic
  - Unit of Product
  - Process Diagrams
    - PROCESS STEPS WITH COVERED TOXIC
    - POINTS GENERATING BY-PRODUCT & EMISSIONS
  - Materials Accounting
    - PLANNING RATIOS
  - TUR Options Technical & Economic Evaluations
- Certifications
- Plan Summary

Facility-Wide: Plan Summary

- Form Submitted to MassDEP
  - Projected Changes in Use and Byproduct
  - Review of New Options: Considered, Selected for Implementation
  - Review of Prior Options Selected but Not Yet Implemented.
  - Certifications by Management & TUR Planner

Massachusetts Department of Environmental Protection
Bureau of Waste Prevention – Toxics Use Reduction Report

Plan Summary Form

A separate form for each covered toxic is required.

2009
Planning Year

Facility Name

MassDEP Facility ID Number

A. Facility-Wide Data

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.

SULFURIC ACID
A.1 Chemical Name

7664939
A.2 CAS #

Two Year Projected Changes (Total lbs.):

Use: 1000
A.3 Use

Byproduct: 0
A.4 Byproduct

A.5 Is this chemical used only in wastewater treatment?

- ☐ Yes – skip to Section C.
- ☐ No – go to Section B.

B. Options Considered & Selected to Implement

B.1 Options Considered

ALL

B.2 Options Selected to Implement

NONE

MANAGEMENT COMMITMENT

- INCREMENTAL TUR WITH NEW PRODUCT DEVELOPMENT/DESIGN
  - EVERY NEW PRODUCT DESIGNED TO ELIMINATE USE OF TOXICS OR ELSE FACE REVIEW WITH VICE PRESIDENT TO EXPLAIN WHY NOT.

MANAGEMENT COMMITMENT

- INVESTMENT IN PRODUCT RESEARCH
  - DRIVEN BY MARKET STRATEGY TO MEET DEMAND FOR GREENER SUPPLY CHAIN
    - AVOIDING DISFAVORED COMPONENTS/ INGREDIENTS:
      - LEED CERTIFICATION / GREENER BUILDING
      - EU REACH / ROHS
      - CALIFORNIA EPA
    - RECYCLED MATERIAL CONTENT

MANAGEMENT COMMITMENT

- INVESTMENT IN PRODUCT DEVELOPMENT
  - TESTING IN OFF-LINE PILOT
  - TESTING ON SINGLE PRODUCT LINE

PRODUCTION UNIT RELOCATION

- SUBCONTRACT FILLING OPERATION TO ANOTHER STATE AND SHIP PACKAGED PRODUCT TO MA
- SHIFT SINGLE PRODUCT LINE OPERATION TO SISTER PLANT IN ADJACENT STATE
- RELOCATE COMPONENT OPERATION OUTSIDE COUNTRY; CONTINUE FINAL ASSEMBLY IN MA

MANAGEMENT CONTROL

- RESTRICTED ACCESS TO COVERED TOXICS
  - WHY DO YOU NEED MORE?
  - WHAT ARE YOU USING THIS FOR?

COST OF SCRAP

- VALUE STREAM MAPPING
  - UNDERSTANDING COST OF SCRAP (COST OF GOODS NOT SOLD) WITH INVESTMENT OF MATERIALS, LABOR AND CAPITAL AT EACH STEP IN PRODUCTION PROCESS
    - FAILED COMPONENTS
    - FAILED ASSEMBLIES
    - LOST BATCH / REWORK
    - PROCESS HANDLING ATTRITION

REDUCING SCRAP

- SCRAP EVALUATIONS
  - STUDY WHERE SCRAP IS GENERATED
  - INVESTIGATE WHY PRODUCT FAILS TO MEET SPECIFICATION AND IS CONSIDERED SCRAP
  - EXPLORE THE MARKET FOR LOWER GRADE PRODUCT
  - APPROACH OF CHECKING COMPONENT QUALITY BEFORE INTEGRATION INTO PRODUCT

DON'T DISCOUNT STORAGE LOSSES

- SCRAP INVESTIGATION FOUND 25% OF SUBSTRATE SENT FOR RECYCLING
  - 10% PRODUCT TRIM
  - 20% COATING QC REJECT
  - 70% FORK TRUCK DAMAGE TO ROLLS

NOW THAT IS DRIVING TUR !!

REDUCING SCRAP

- SCRAP PREVENTION
  - CHECKING COMPONENT QUALITY BEFORE INTEGRATION INTO PRODUCT (GOOD SCRAP !!)
  - PREVENTIVE MAINTENANCE ON PROCESS EQUIPMENT
  - INVESTMENT IN PROCESS CONTROL

LEVERAGING TUR INTO CHANGE

- PROCESS SAFETY
- PROCESS MODERNIZATION
- NEW PRODUCT INTRODUCTION
- FACILITY RELOCATION

TUR PLAN CASE STUDY

TUR PLAN CASE STUDY

- READ THE DOCUMENT AND REVIEW THE PROCESS DIAGRAMS
- NAMES AND QUANTITIES HAVE BEEN REDACTED
- USING THE CHECKLIST
  - WHAT IS MISSING?
  - WHAT ELSE?
  - WOULD YOU SIGN THE CERTIFICATION?

Facility-Wide: Plan Scope

- o Process and product description(s)
- o Unit(s) of product
- o Chemical name and CAS number of each “covered toxic” (reportable chemical) used in the production unit(s)
- o The procedures used to identify potential TUR techniques

  Each TUR option identified and whether it:

  - o Will be implemented OR Is still under evaluation
  - o Will not be implemented

- o The projected reduction in pounds of use and byproduct for each “covered toxic” for which one or more TUR options will be implemented. CHANGE IN USE BYPRODUCT

PLANNING RATIOS

PROCESS	MPOU/UOP	BYPRODUCT/UOP	EMISSION/UOP
PU01 – PPC MFG CAUSTIC			
PU01 - PPC MFG PHOSPHORIC			
PU03 - CPPC MFG CAUSTIC			
PU04 – KILNS NAPHTHALENE			
PU05 – QUARRY NAPHTHALENE			
PU06 – STEAM NAPHTHALENE			
PU07 – LIMESTONE, LIME PPC MFG LEAD			

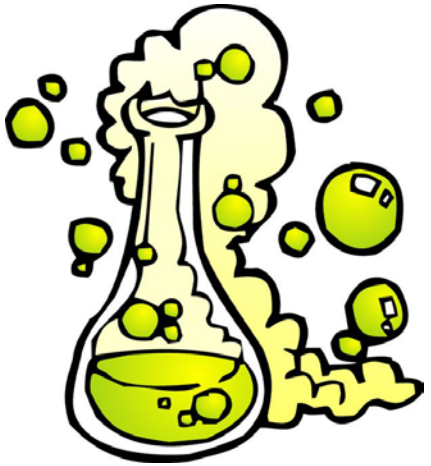
PROCESS CHARACTERIZATION

- DESCRIBED PURPOSE OF COVERED TOXICS

DO WE REALLY

KNOW THE FUNDAMENTAL

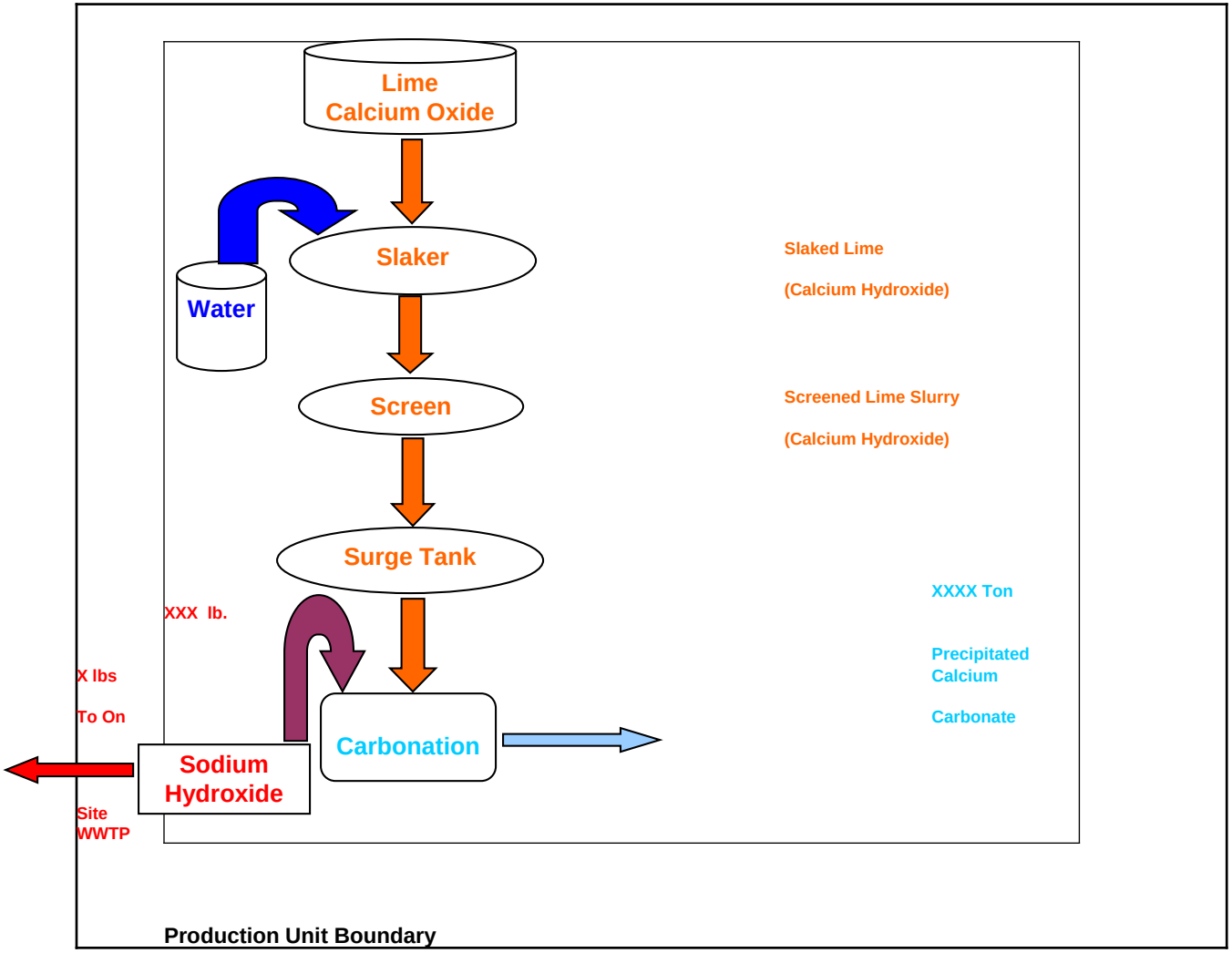
CHEMISTRY?



PROCESS CHARACTERIZATION

- PRODUCTION UNIT PROCESS STEPS WITH COVERED TOXICS

- POINTS GENERATING BY-PRODUCT & EMISSIONS



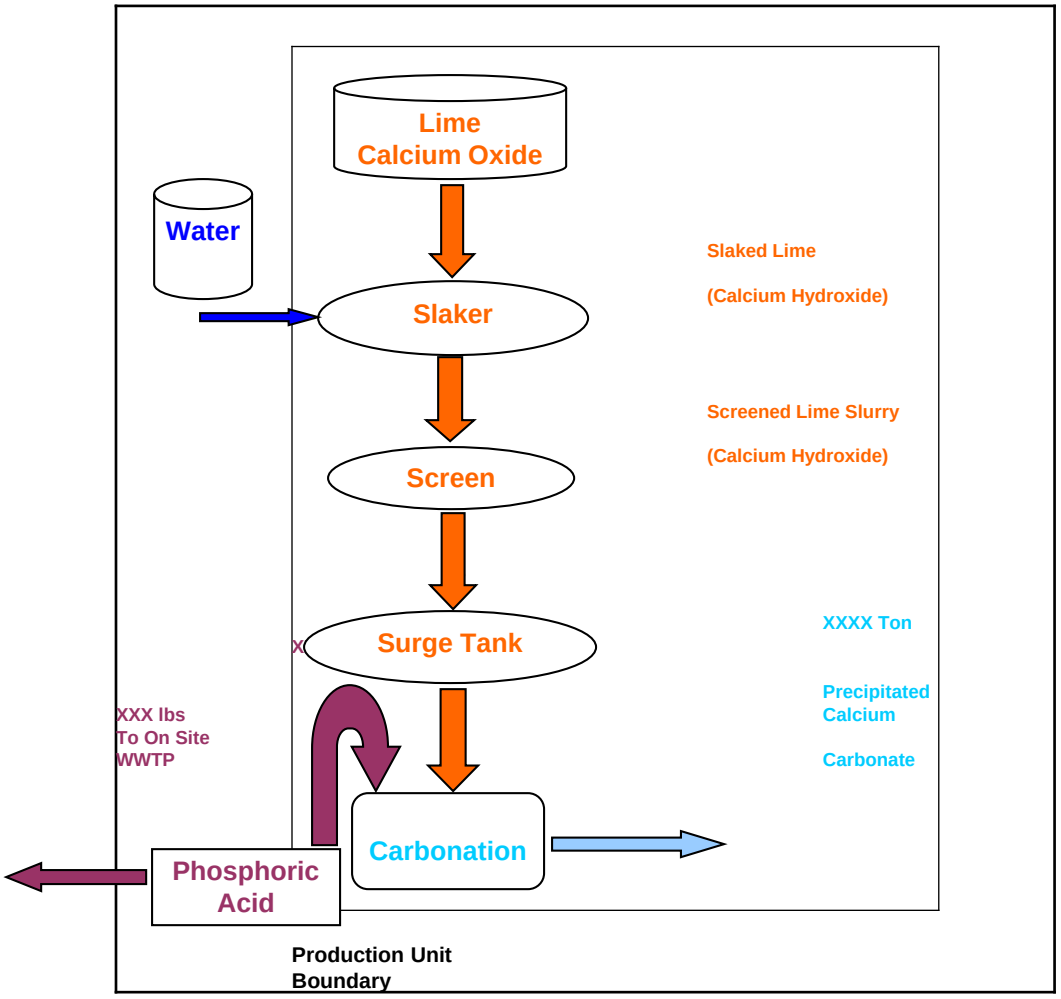
Production Unit 001

Precipitated Calcium Carbonate Manufacturing

Chemical Used: Sodium Hydroxide

Unit of Product = 1 Ton of Precipitated Calcium Carbonate

Total Amount Used:	XXXXXX lbs
Total Amount per Unit of Product	XXlb/Ton
Total Byproduct Produced	X lbs
Total Emissions	X lbs



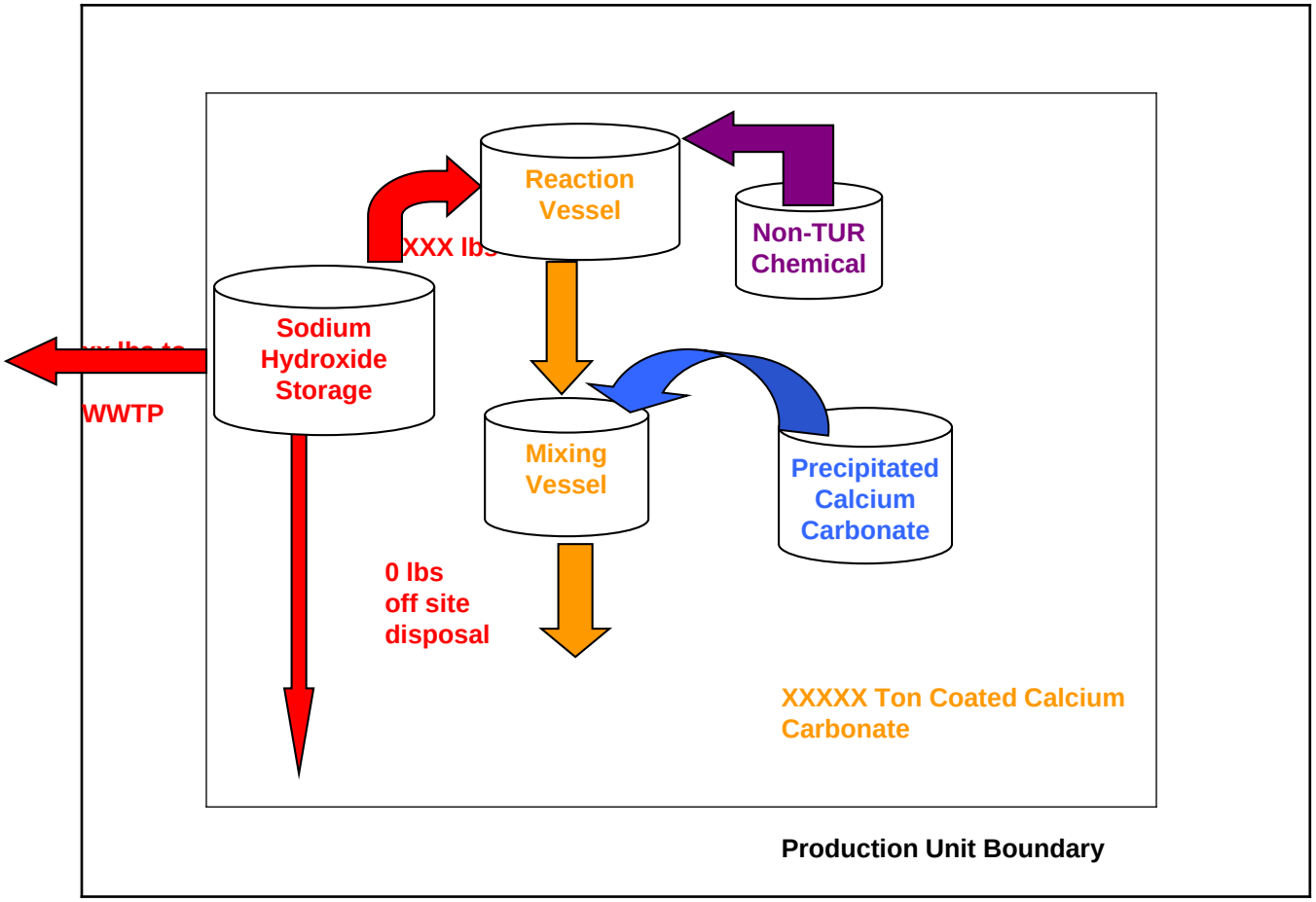
Production Unit 001

Precipitated Calcium Carbonate Manufacturing

Chemical Used: Phosphoric Acid

Unit of Product = 1 Ton of Precipitated Calcium Carbonate

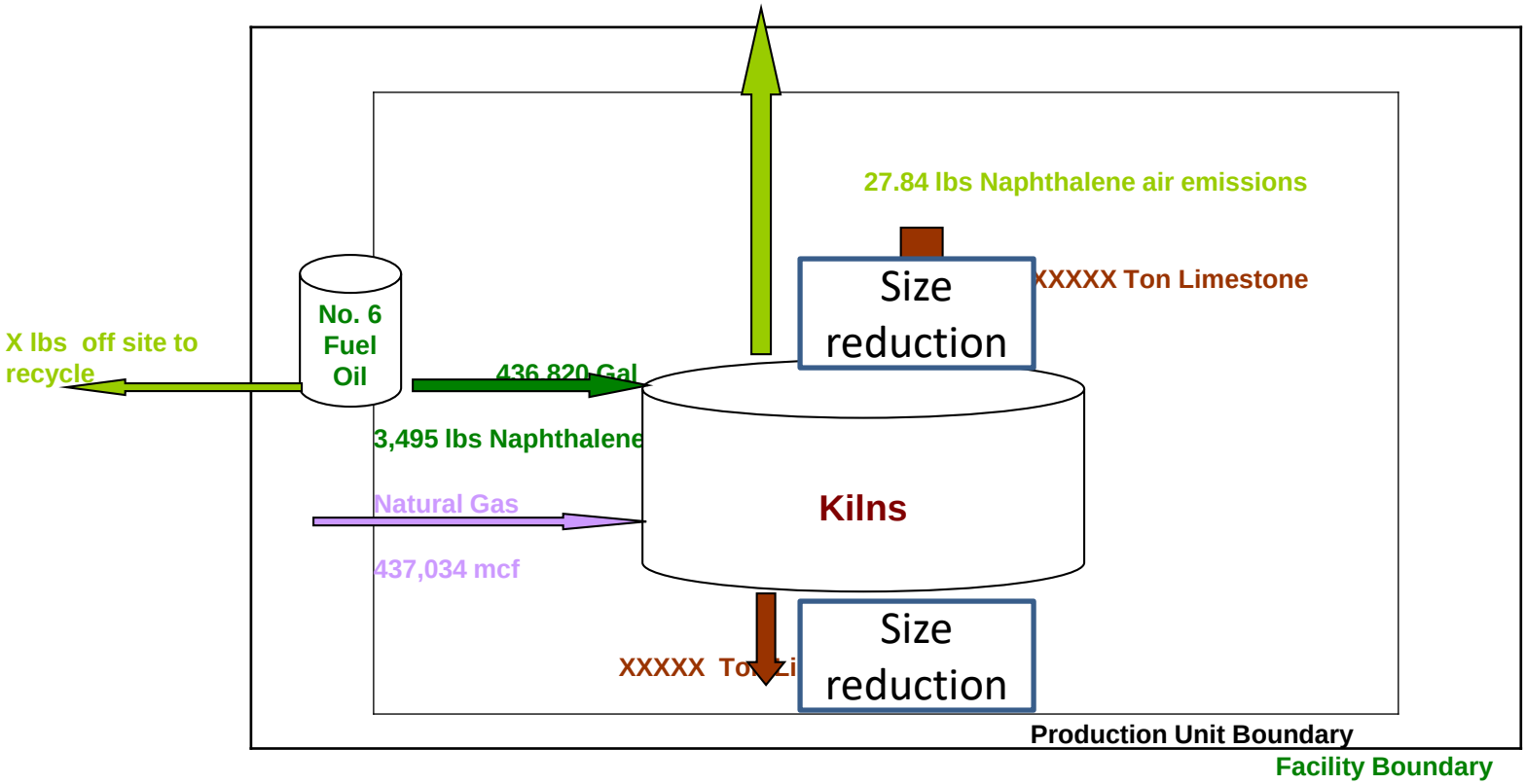
Total Amount Used:	XXXX lbs
Total Amount per Unit of Product	XX lb/Ton
Total Byproduct Produced	XXX lbs
Total Emissions	0 lbs



Production Unit 003

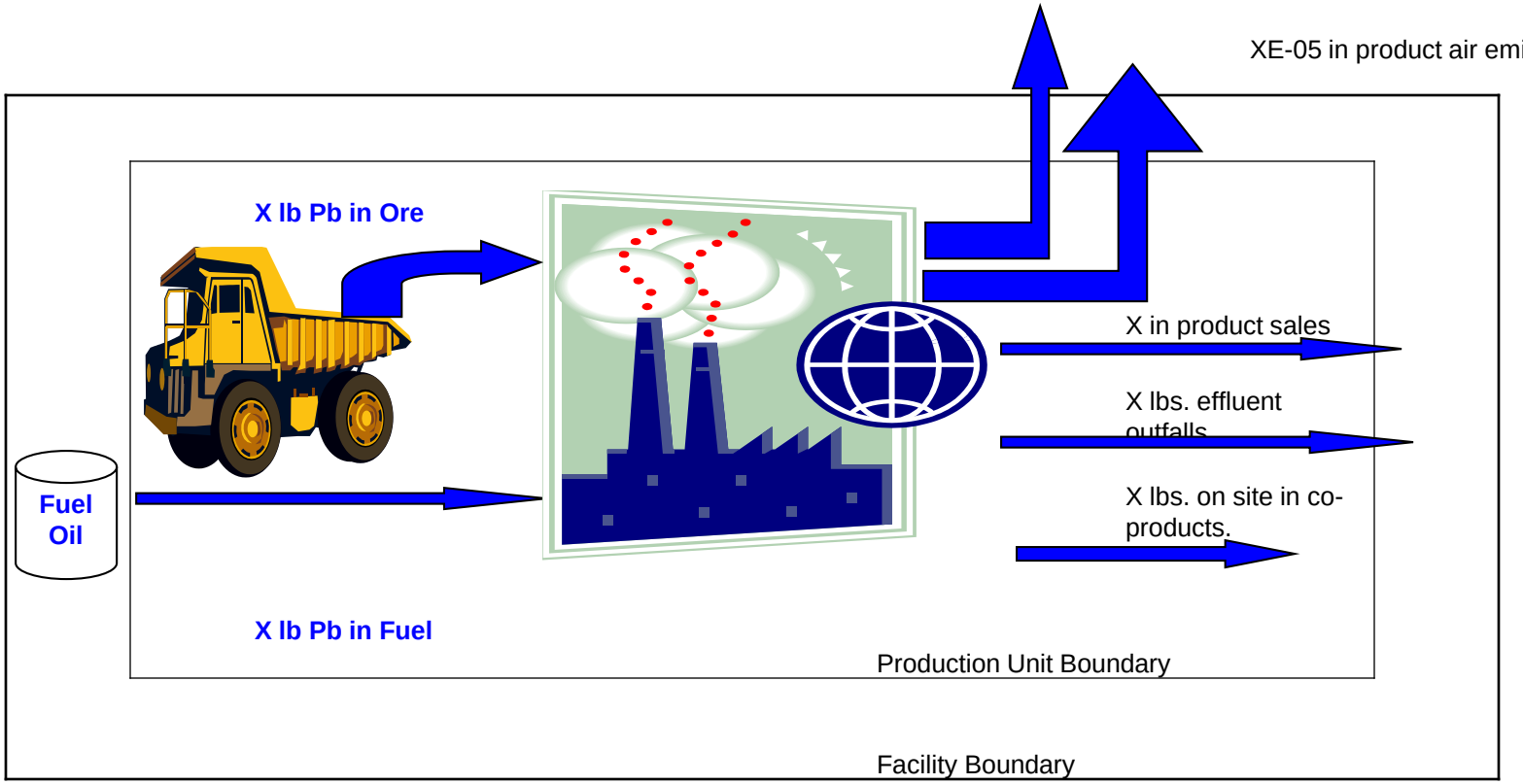
Coated Precipitated Calcium Carbonate manufacturing

Chemical Used: Sodium Hydroxide
Used as a chemical Processing aid in the manufacture of Coated Precipitated calcium Carbonate
Unit of Product = 1 Ton of Coated Precipitated Calcium Carbonate
Total Amount Used: XXXXXXlbs
Total Amount/Unit of Product: XXX lbs/Ton
Total Byproducts: xx lbs
Total Byproducts/Unit of Product: XXXX lbs/Ton



Production Unit 004
Lime Production

Chemicals Used: Napthaline in #6 Fuel Oil.
Classified as otherwise use
Unit of product = 1 ton of Lime
Total Amount Otherwise Used: 3,495 lbs.
Napthaline.
Total Amount per Unit of Product: xxxx lbs/Ton Naphthalene
Total Byproducts: 49.45 lbs Naphthalene.
Total Emissions: 49.45 lbs Naphthalene
Byproduct/Unit of Product : xxxx lbs Naphthalene/Ton
Emissions/Unit of Product: xxxx lbs
Naphthalene/Ton



Production Unit 007
Limestone, Lime, PCC Manufacturing

Chemicals Manufactured, Processed or Otherwise used: Lead/Lead Compounds	CAS #	
Lead/Lead Compounds are processed due Their natural existence in the Limestone ore.	xx	LBS
Lead/Lead Compounds in fuel are otherwise used as a result of fuel combustion.	xx	LBS
Lead is manufactured as PbO as a result of fuel combustion.	xx	LBS

PROCESS CHARACTERIZATION

- PRODUCTION UNIT PROCESS STEPS WITH COVERED TOXICS

- POINTS GENERATING BY-PRODUCT & EMISSIONS

TUR OPTIONS REVIEW

- TECHNICAL EVALUATION
  - DISCUSSION OF LIMITED OPTIONS
  - DID NOT IDENTIFY TUR OPTIONS PREVIOUSLY IDENTIFIED AND NOT IMPLEMENTED (ALTHOUGH WE DO NOT KNOW IF THERE WERE ANY).
- ECONOMIC EVALUATION
  - NO “APPROPRIATE” OPTIONS PASSED TECHNICAL EVALUATION

Facility-Wide: Plan Summary

- Form Submitted to MassDEP
  - Projected Changes in Use and Byproduct
  - Review of New Options: Considered, Selected for Implementation
  - Review of Prior Options Selected but Not Yet Implemented
  - Certifications by Management & TUR Planner

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