Pollution Pathway Analysis and Best Management Practices Development

Wayne S. Holt
Environmental Director
Atlantic Marine Florida, LLC
For
Northeast Florida Chapter
Florida Association of Environmental Professionals

Pollutant Sources and Loading

- Pollution Pathway Analysis
  - A systematic method to characterize sources of pollutants and estimate their loading.
  - PPA can be used to estimate potential impacts.
  - PPA can be used to develop Best Management Practices (BMPs) to manage impacts.
  - PPA can be applied to any type of discharge.
    - Stormwater
    - Process waters

Pollutant Sources and Loading

- PPA is a set of analytical tools, that when properly applied can:
  - Identify the major sources of pollutants.
    - By Pollutant Type
    - By Discharge Area
    - By Generating Process (Source)
  - Prioritize pollution control efforts.

Pollutant Sources and Loading

- Benefits of Pollution Pathway Analysis
  - Identifies methods to reduce or eliminate the discharge of pollutants of concern.
  - Evaluates effectiveness and economic feasibility of pollution control measures prior to implementation.
  - Increases your ability to set and meet environmental and compliance goals.
  - Establishes the foundation for the development of BMPs or other pollution control processes.

Pollutant Sources and Loading

- Pollution Pathway Analysis
  - Three steps:
    - Identify sources of pollutants (By: Source, Pollutant Type, or Discharge Area).
    - Estimate potential loading of pollutants.
    - Determine potential pathways of pollutants to the environment.

Pollutant Sources and Loading

Stormwater Pollution

- Difficult to characterize in terms of source, quantity, transport, and impact.
- Monitoring information is often is inconsistent and not informative.
- Pollutants tend to be a “moving” target (here today, gone tomorrow).
- Typically there is no mechanism for identifying and managing stormwater pollution sources and their associated impacts. What is the solution?

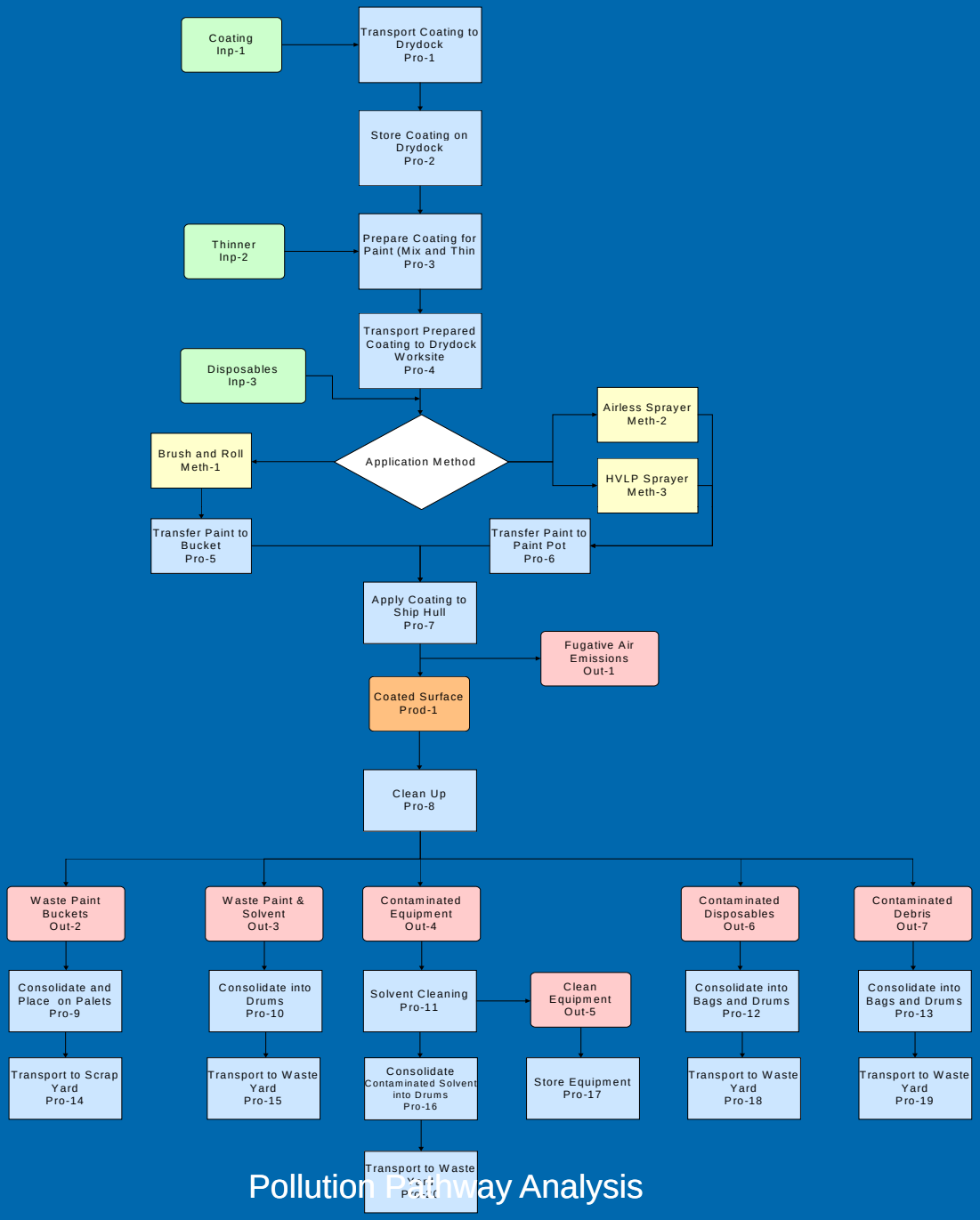
Pollutant Sources and Loading

- Sources of Pollutants
  - Facility Operational Sources
    - A series of processes performed in a specific sequence necessary to obtain a specific result.
  - Non-Facility Operational Sources
    - Sources of pollutants derived from sources occurring outside of the facility.

Pollutant Sources and Loading

- Source Identification
  - List the Operations & Locations.
  - Flowchart the processes for each operation.
  - Identify the potential sources of pollutants for each processes and/or for each pollutant.

Coating Application in Floating Drydock



Pollutant Sources and Loading

TITLE: Pollution Pathway Analysis - Operation/Process and Pollutants

DATE: 7/15/2002 TIME: 5:14:27 PM PG: 1 OF 1 PGS

Operation: AF Coating Application

Processs: Application of coating using airless sprayers

Location: Drydock

Emission point: Spray gun

Material Inputs: Antifoulant Coating containing cuprous oxide and other metals

Description of Process Resulting in Emissions: Spray painting results in significant amounts of overspray particulates that contain metals. These particulates can deposit on the facility where they are exposed to rainfall.

Pollutants Generated: Copper and other metals.

Comments: Average transfer efficiency of airless sprayers on ship's hull is 50 to 75 percent. This means 50 to 25 % to the total volume of the paint sprayed is lossed as overspray.

COMPANY: Austin Environmental Consulting, Inc. CREATOR: Dana Austin

Pollutant Sources and Loading

- Estimate Pollutant Loading by Source
  - It is necessary to “prioritize” sources of pollutant(s) of concern.
  - This will identify which sources should be evaluated/controlled.
  - Eliminates the consideration of non or insignificant sources.

Shipyard Stormwater Pollution Process Sources

	Processes and Operations that are the Primary Contributors to Stormwater Water Pollutant Loading					
	Out of Doors Blasting - Preconstruction Primer	Out of Doors Blasting - Removal of Existing Coating	Out of Doors Spray Painting - Exterior Hull	Welding, Burning & Cutting	Metal Grinding	Rolling Stock Operations
Inorganics						
TBT	U	S	U	U	U	U
Copper	U	S	S	M	U	U
Zinc	S	S	S	S	S	S
Nickel	U	S	S	S	S	M
Lead	U	U	U	U	U	M
Iron	S	S	U	S	S	U
Manganese	U	U	U	S	S	M
Chrome	U	U	S	S	S	M
Magnesium	U	U	U	S	S	M
Aluminum	U	U	U	S	S	U
Organics						
Oil/Grease	U	U	U	U	U	S
Petroleum Fuel	U	U	U	U	U	S
VOC	U	U	U	U	U	U
Others						
Particulate	S	S	S	S	S	M

Notes:

S = Significant Contributor to Stormwater Pollutant Loading

M = Maybe a Significant Contributor to Stormwater Pollutant Loading

U = Unlikely or Insignificant Contributor to Stormwater Pollutant Loading

Pollutant Sources and Loading

- Methods to Estimate Pollutant Loading
  - Mass balance equations.
  - Published Pollutant Emission Factors.
  - Characteristic Knowledge of Operations and Processes.

TITLE: Pollution Pathway Analysis - Mass Discharge Estimate

Process: AF Coating Application

Estimated Material(s) Usage: 4,000 gallons AF coating applied per year @ 16.9 lbs/gallon = 67,600 AF lbs/year.

Material Composition: 50% by wt cuprous oxide, 20% by wt. zinc oxide.

Emission Calculations:

Average annual transfer efficiency of airless paint spraying at shipyard = 60%
Average annual overspray of AF coating = 40%

Therefore:
67,600 lbs of AF Coating X 40% overspray = 27,040 lbs/year of AF Coating Overspray.

Stormwater Discharge Calculations:

Assume 50% of overspray generated is retained on the facility.
Assume 10% of overspray on facility is lost to stormwater annually.

Therefore:
27,040 lbs/year AF overspray X 50 % retained X 50% cuprous oxide content X 10% lost to stormwater = 6,76 lbs cuprous oxide discharge from AF Coating application process annually.

Stormwater Mass Discharge Estimate:

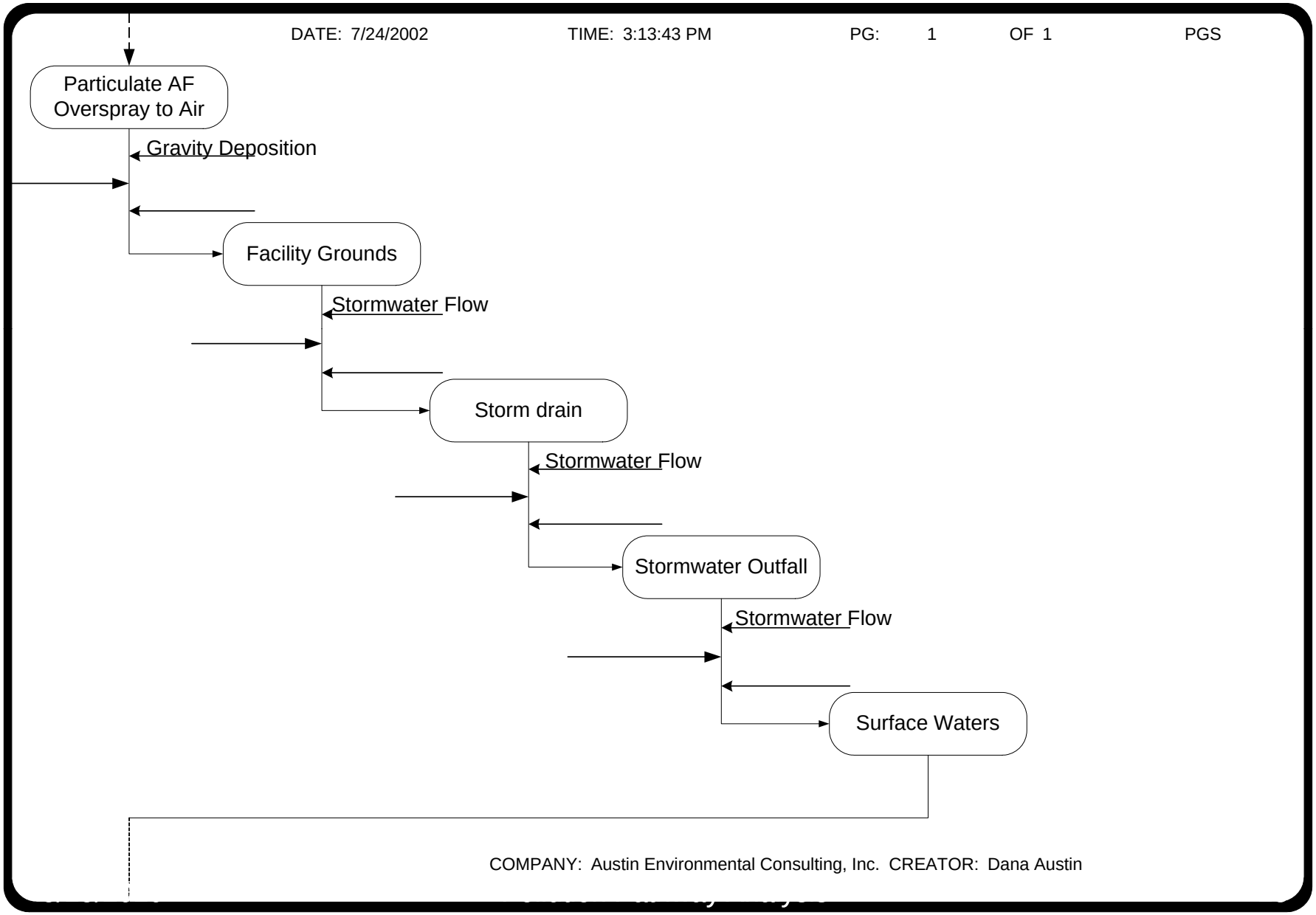
Estimate stormwater mass discharge loading for Cuprous Oxide from AF coating application = 676 lbs

COMPANY: Austin Environmental Consulting, Inc. CREATOR: Dana Austin

Pollutant Sources and Loading

- Pollution Pathways
  - How does the pollutant get to the environment?
    - Physical pathways
    - Transport mechanisms
  - Each step in the pathway must be identified.

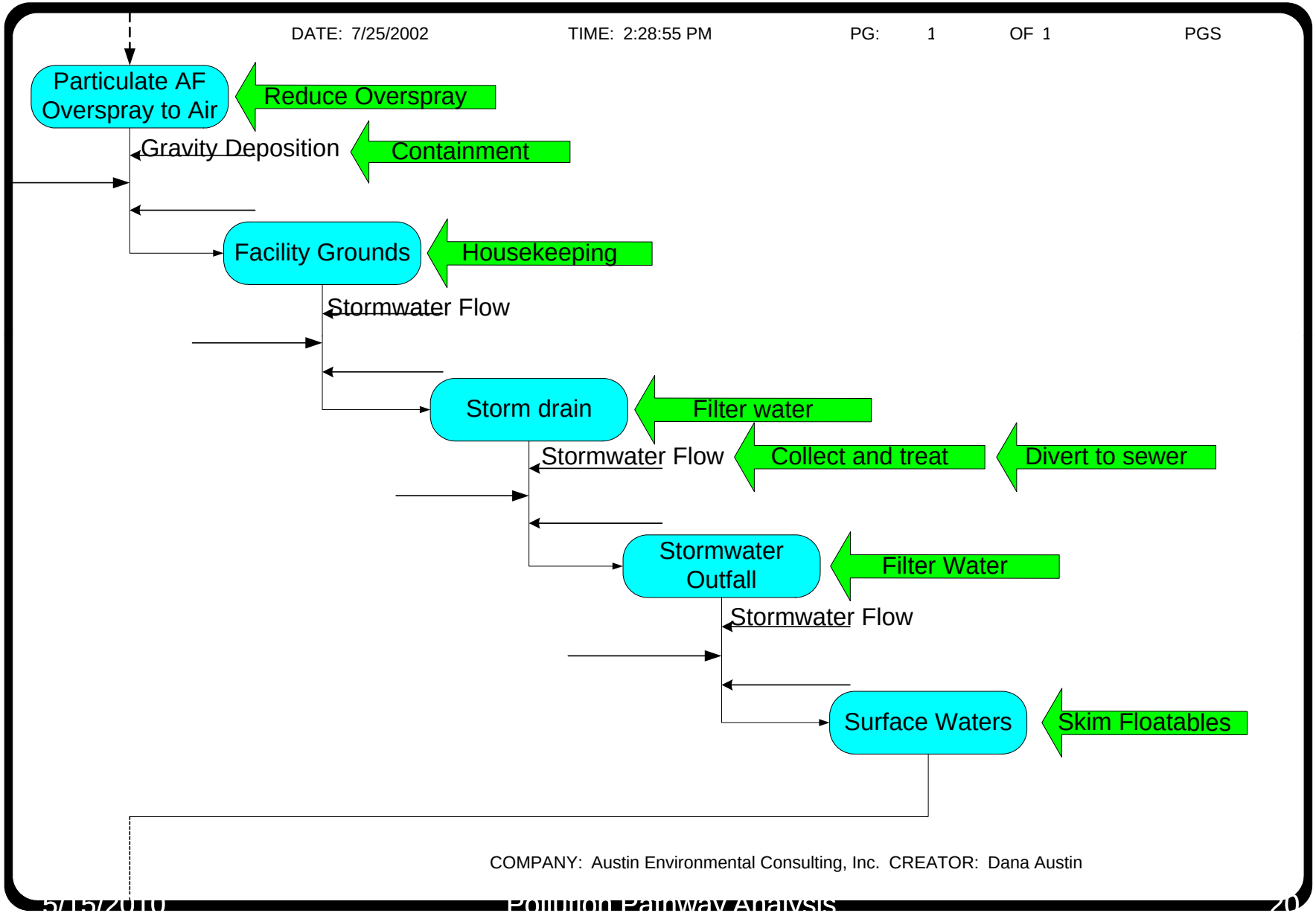
TITLE: Pollution Pathway Analysis - Pathway Identification



Pollutant Sources and Loading

- Pollution Pathways
  - PPA can identify where in the “Pathway” the pollutant can be “blocked” from entering the environment.
  - Pollution Pathway Analysis can be used to determine where Best Management Practices can be “most effectively” applied.

TITLE: Pollution Pathway Analysis - Pathway Identification - BMP Map



BMP Development

- BMP Development using PPA can be:
  - Developed as General BMPs
    - By Pollutant Type
    - By Source (Operation/Process)
    - By Discharge Area
  - Adapted into Specific BMPs
    - To achieve set goals
    - Costs (pollutant quantity removed per $)
    - Implementation Feasibility

BMP Development

- BMP Elements
  - BMP Goals
    - What do you want to achieve (Goal).
    - Where are you starting from (Baseline Metrics).
    - Process Milestones (Progress Status).
    - Time Schedule to reach the Goal.

BMP Development

- **The <u>Goal</u> drives the BMP development**.
- Example:
  - Zero discharge of copper from AF coatings application.
    - Brush and roll all hull coatings.
    - Use 100% containment when spraying.
  - 50 % reduction in overspray.
    - Use of “wind controls” when spraying.
    - Use of equipment with greater Transfer Efficiency.
    - Training program for Painters.

BMP Development from PPA

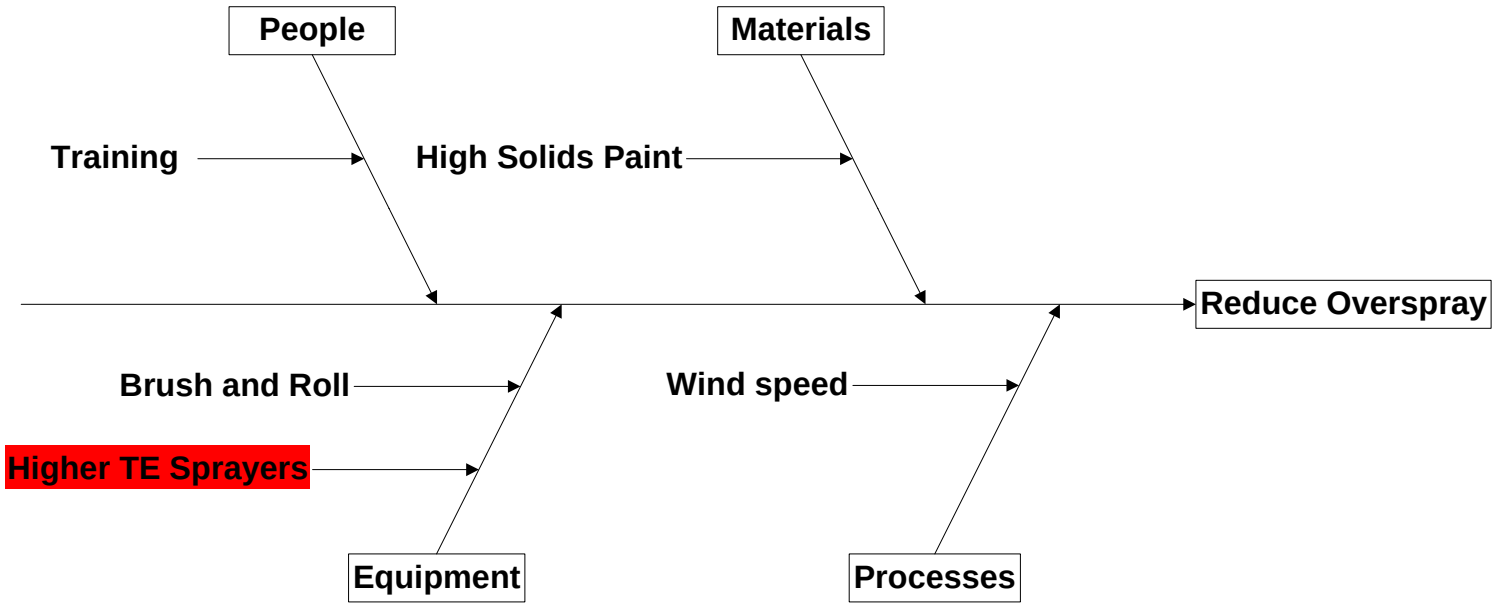
- Establish Goal of BMP
  - Compliance with Regulatory Standard.
  - Company Environmental Policy.
  - Percentage reduction in pollutant loading.
  - Community concerns.
  - Risk Assessment.

BMP Development from PPA

- AF Coating Overspray Example
  - Goal: Reduce copper loading from AF application overspray by 50%
    - Ways to Increase Transfer Efficiency
      - Don’t paint on windy days.
      - Use better application techniques (training).
      - Wind screens to reduce wind speed.
      - Use HVLP sprayers

TITLE: Pollution Pathway Analysis - BMP Evaluation - Reduce Overspray

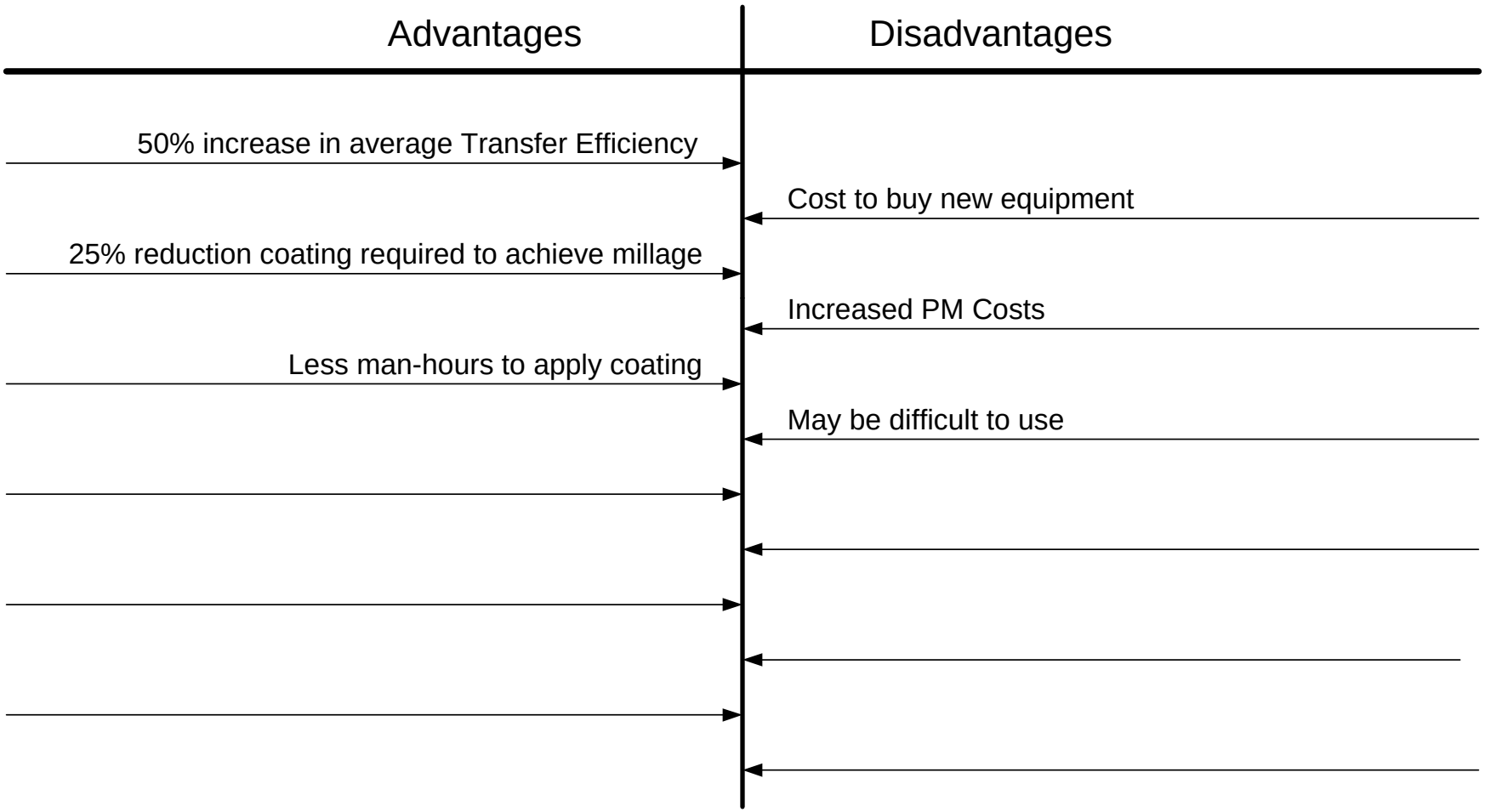
DATE: 7/25/2002 TIME: 2:25:47 PM PG: 1 OF 1 PGS



COMPANY: Austin Environmental Consulting, Inc. CREATOR: Dana Austin

TITLE: Advantages and Disadvantages - Low Pressure High Volume Paint Sprayers

DATE: 7/25/2002 TIME: 2:37:22 PM PG: 1 OF 1 PGS



COMPANY: Austin Environmental Consulting, Inc. CREATOR: Dana Austin

BMP Development

- BMP Elements
  - Background Information
    - Pollutant(s) of Concern
    - Processes/Operations
    - Significance - Goal
  - Description of Best Management Practice
    - What are you going to do.
    - When are you going to do it.
    - How are you going to do it.
    - Where are you going do it.
    - Who is going to do it.

BMP Development

- BMP Elements
  - Monitoring
    - What are you going to measure.
    - How will you measure it.
    - When are you going measure it.
  - Reporting
    - What are you going to report.
    - How are you going to report it.
    - When are you going to report it.

Shipyard Stormwater Best Management Practices
Antifoulant Coating Application

1) BMP 001: Antifoulant Coating Application
2) References:
   a) PPA-1-AF Coating Application Form.
   b) PPA-2-AF Coating Application Chart.
3) Background: Application of antifoulant coating systems to the exterior underwater hull of ship is a process commonly performed in the facility. Antifoulant coatings commonly contain high levels of inorganic copper and zinc, typically cuprous oxide and zinc oxide. Application of the coating to the ship's surface is accomplished using airless paint spraying equipment. During the spraying process and significant amount of coating "overspray" is generated. This overspray can settle on to facility surfaces where it can be exposed to rainfall. This results in increased levels of copper and zinc loading to the facility's stormwater discharges.
4) Best Management Practice: AF coating will be applied to ship's hull using equipment or methods that have an annual average transfer efficiency of 75% or greater. This can be obtained through the use of HVLP sprayers, worker training, restrictions on painting at high wind speeds greater than 15 mph, use of containment in the area of spray painting, paint application using bush and rollers, and others means.
5) Monitoring and Reporting: AF coating application transfer efficient will be calculated for work performed in the facility on a quarterly basis and reported annually, on July 31, to the local water board.
6) BMP Goal(s): The Goal of this BMP is achieve an average annual AF coating application transfer efficiency of 75% or greater, within 36 months.

   Progress milestone goals for average annual AF transfer efficiency are: 60% TE by the end of the first year, 70% TE by the end of the second year, and 75% TE by the end of the third year.

Pollutant Sources and Loading

- Summary
  - BMP development using PPA
    - Can target specific pollutants, sources or pathways.
    - Adaptable to the varying facility environment.
    - Can reduces effort spent on implementing controls on sources that are not significant contributors.
    - Can be measured to determine practicality of implementation and cost effectiveness.
    - Can effectively reduce the facility's impact on the environment.

- The Quiz: Why is this ship famous?