

David Crawford

Valley Craft



Minimizing Phosphorus Discharge and Reducing Energy Use Valley Craft

David Crawford

Advisor: Paul Pagel

Minnesota Technical Assistance Program



UNIVERSITY OF MINNESOTA

Driven to DiscoverSM

Company Overview



- Produces a wide array of material handling equipment
 - Hand trucks, trailers, carts, and hydraulic drum handling devices
- Produces a variety of storage equipment
 - Cabinets, flat files, desks, and trash bins



Motivations for Change

- Stricter phosphorus discharge limitations
- To help reduce the nutrient loading in waters in and beyond Minnesota



Reasons for MnTAP Assistance

- Proactively seek means to reduce phosphorus discharge
- Explore alternative, low-phosphorus and no-phosphorus pretreatment options
- Investigate other energy and cost saving options

Approach

- Located sources of phosphorus
- Established a baseline for the current wash system
- Researched and evaluated alternative pretreatment chemicals
- Tested chemicals to ensure the quality of pretreatment was upheld
- Made recommendations based on findings



Evaluating the Problem

- Determined how much phosphorus is used
 - Purchasing records
 - Material Safety Data Sheets
 - Chemical manufacturer
- Calculated how much is discharged
 - Quarterly wastewater test results
 - Daily average wastewater flows
- Compared current discharges with regulations



Determining Quality of Pretreatment from the New Chemicals

- Quality to be as good as, or better than the current pretreatment
- Tested panels cut at Valley Craft and treated with each pretreatment option.
 - Attempted to avoid batches of defective parts, wasted chemicals, and production delays

Testing

- Used panels pretreated in Valley Craft's washer as a control group
- Tested the adhesion and corrosion resistance of each chemical
 - Cross-hatch adhesion testing
 - Forward and reverse impact testing
 - Salt spray testing

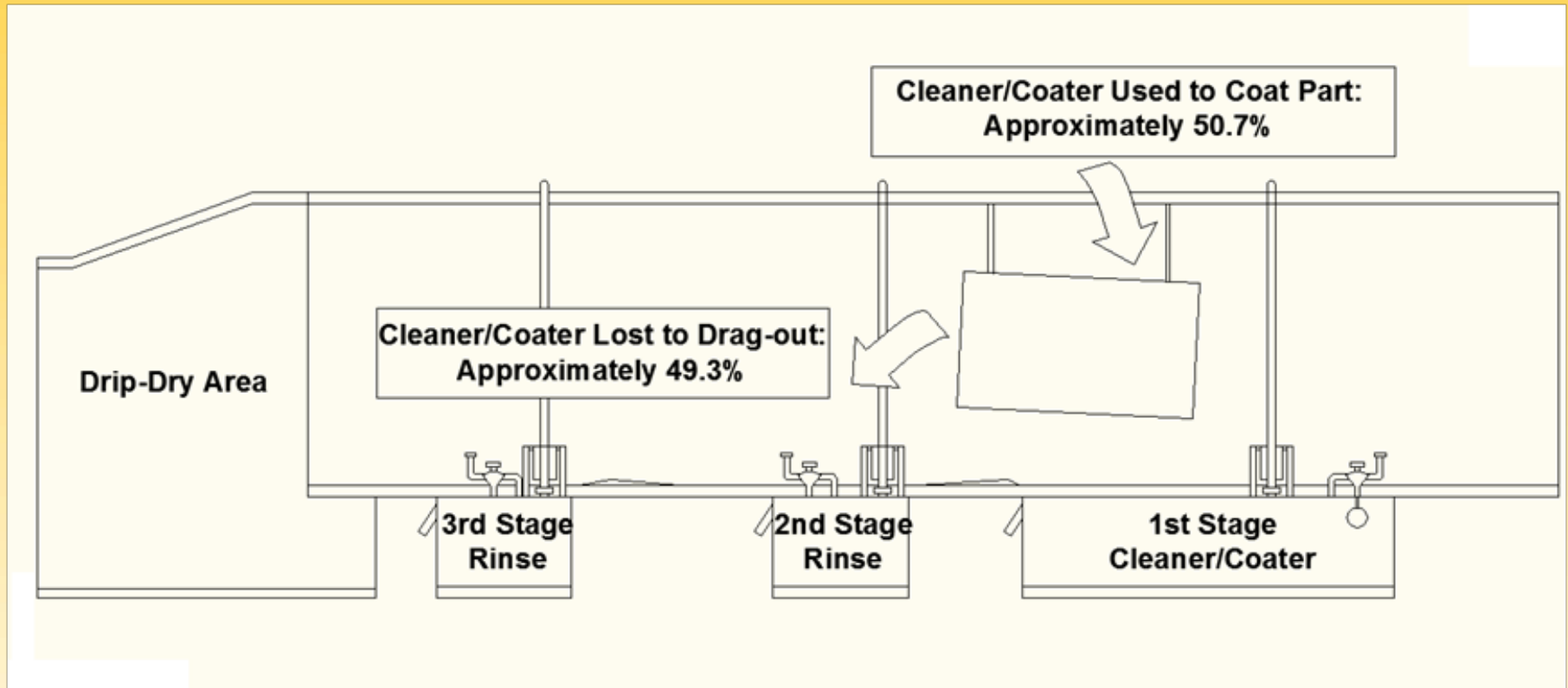


Determining the Chemical Use

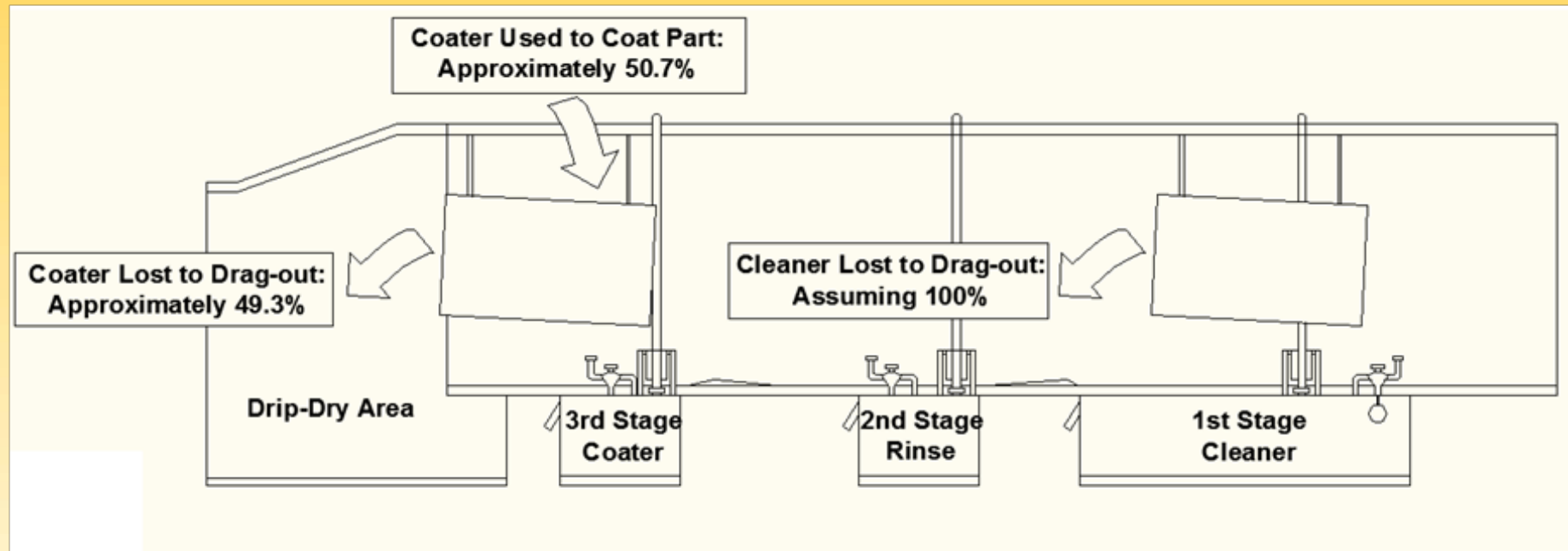
- Different pretreatment chemicals run at different concentrations, in different stages, and serve different purposes
- Needed to define how the chemical would be consumed
- Used a simple mass balance of the current chemical



Current Chemical Usage



Chemical Usage for Potential Set-Up



Chemical Usage

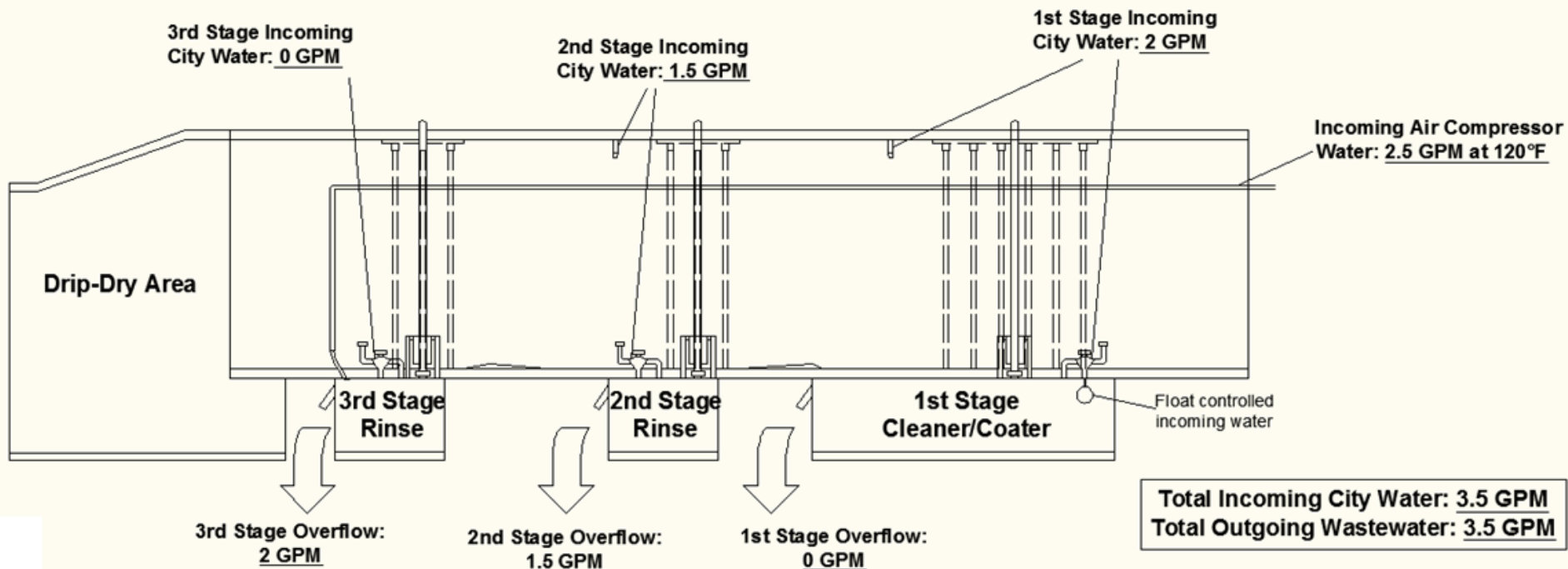
Assumptions and Conclusions

- Cleaners separated from coaters will lose chemical due to drag-out
- Chemical use is directly proportional to its concentration
 - Adjustments must be made when considering cleaners
- The decreased concentration of the new chemicals compensates for increased unit price
- Savings achievable from switching chemicals

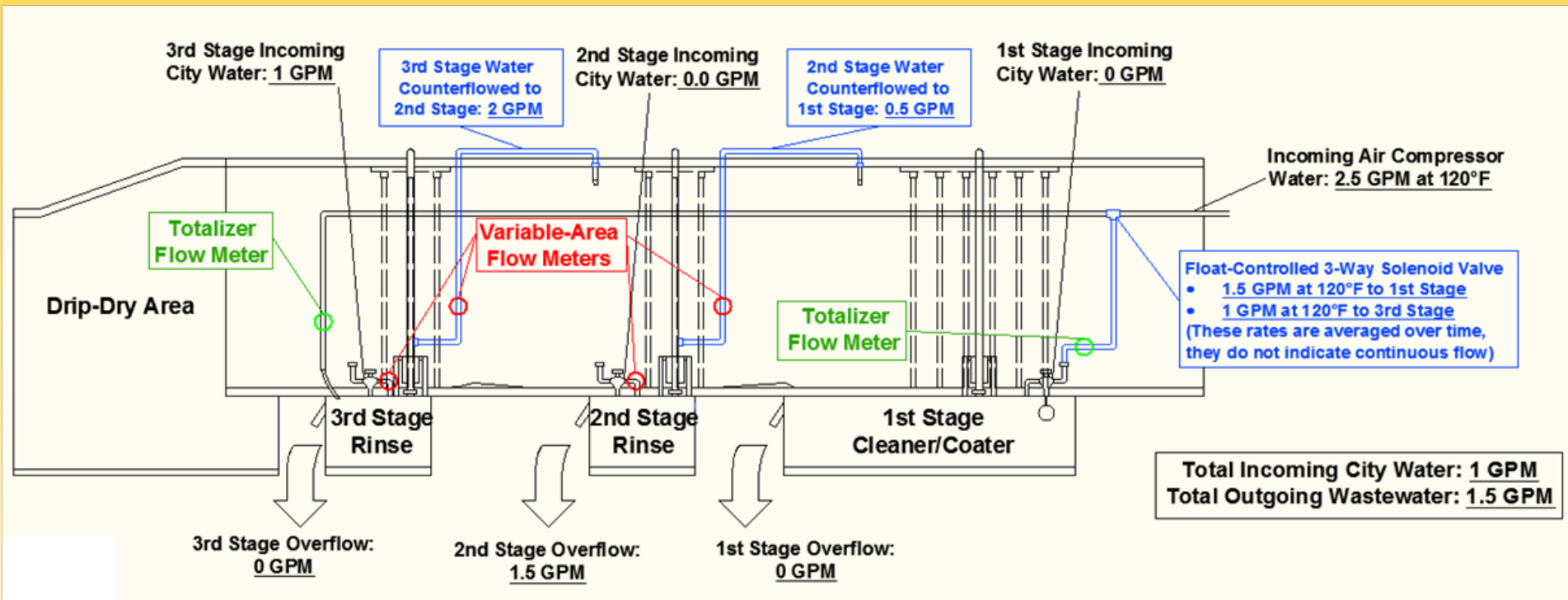
Recycling Water through Counter-Flowing

- Each rinse stage receives incoming water and discharges it as it overflows
- Counter-flowing water between stages reduces incoming and outgoing water
- Third stage supplied by air compressor coolant water entering at 2.5 GPM at 120°F
 - This heat could be better utilized in the first stage
- Developed a series of designs for different chemical set-ups
 - better water management, resulting in decreased water, wastewater, and heating costs

Current System



Proposed System – Combined Cleaner-Coater



System modifications are in blue

Additional Considerations

- Quality of Valley Craft's current cleaning and areas for improvement
- Necessity of using RO filtered water
- Purchase of a new, stainless steel 3-stage washer

Benefits

- Decrease in phosphorus discharge
- Decrease in chemical usage
- Decrease in water/wastewater usage
- Decrease in heating

Reduced Phosphorus Discharge (lbs/year)	Reduced Chemical Use (gallons/year)	Reduced Water Consumption (gallons/year)	Reduced Wastewater Discharge (gallons/year)	Reduced Heating (therms/year)	Cost Savings (\$./year)
408	1,630	238,300	208,140	25,500	\$33,860.00

Additional Projects

Compressed Air Leak Audit



Corrected Inaccurate Wastewater Billings

Inspected the Insulation of the Cure Oven



Determined Most Efficient Oven Temperatures to Cure Paints



Evaluated the Exhaust Rate and Purge Time of the Cure Oven

Personal Benefits

- Experienced working in an industrial setting – this was completely new to me
 - Learned how a variety of machines and tools work
- Developed researching skills
- Improved networking and communication skills
- Gained an appreciation for the knowledge that others have to offer



Only got hassled about being from Iowa a little

Questions?

