

# Project 18: Dust Suppression and Water Tank

Matthew Baquet, Roger Freibert, John Meibaum, Himchan Song, Alexander Townsend, and Gabrielle Triche



## Background and Objectives

- Oxbow Calcining LCC, currently operates two reclaim hoppers where green petroleum coke is dumped for calcining. When the coke is dumped, a plume of dust is emitted
  - Design and implement an automatic dust suppression system for two hoppers
- Oxbow operates a 100,000 gallon water tank fed by two wells on site. Water is used for yard dust suppression, firefighting reserve, and cleaning hoses.
  - Design and replace existing fill system with an automated water supply system which meets usage needs

## Key Engineering Specifications

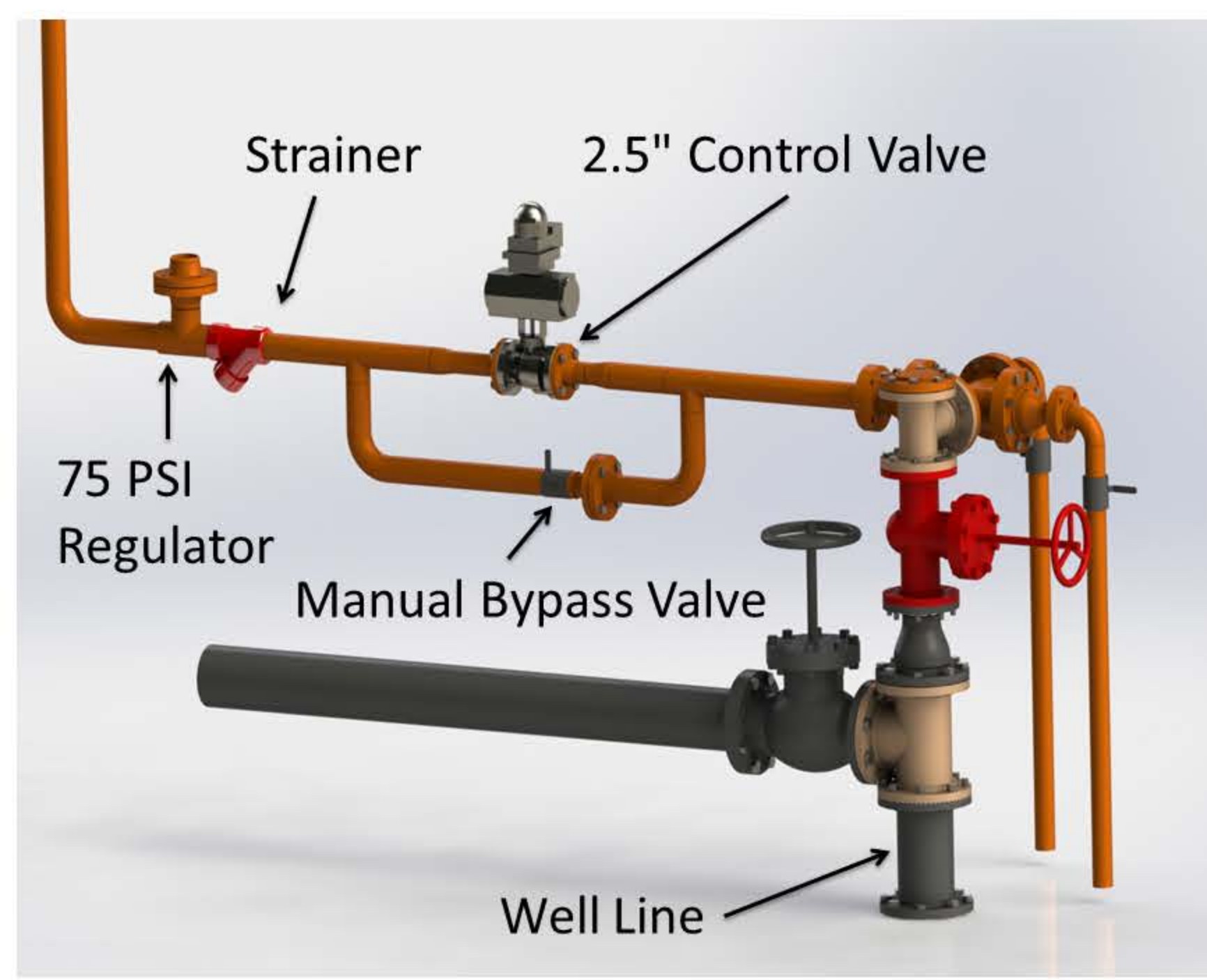
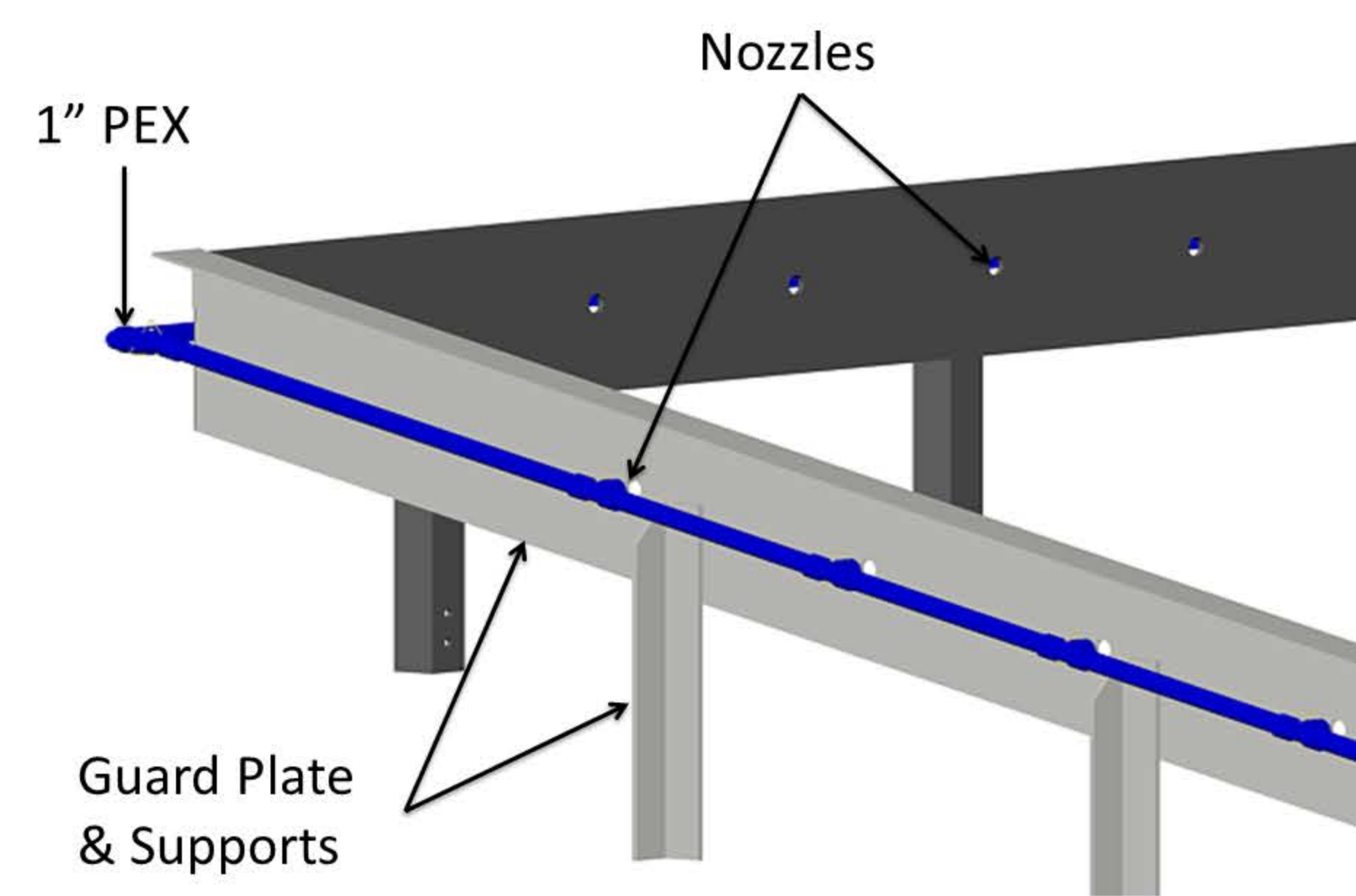
- ### Dust Suppression
- Reduce dust plume opacity by at least 50%
  - 10-100 microns optimal water droplet
  - Amount of water to be delivered equal to 1% load weight, 12-26 gallons
  - Spray covers 90% of hopper area
- ### Water Tank
- 75 psi operating pressure
  - Fill rate greater than 2 times usage rate, 80 gpm
  - Initiate flow at 88.6% full, terminate flow at 91.8% full
  - Display full level at 89.5% full, low level at 77.4%
- Budget: \$70,000



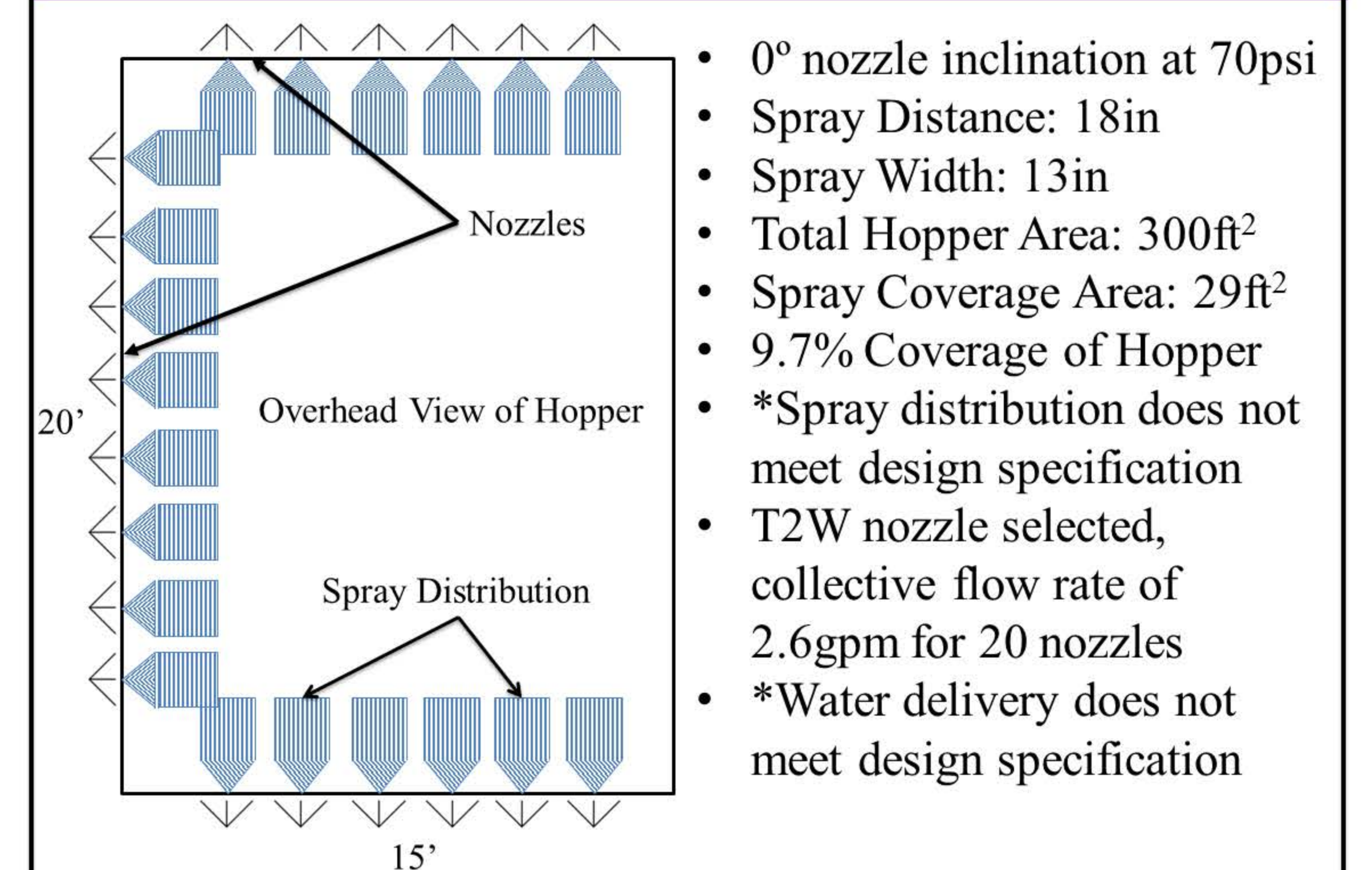
Hopper



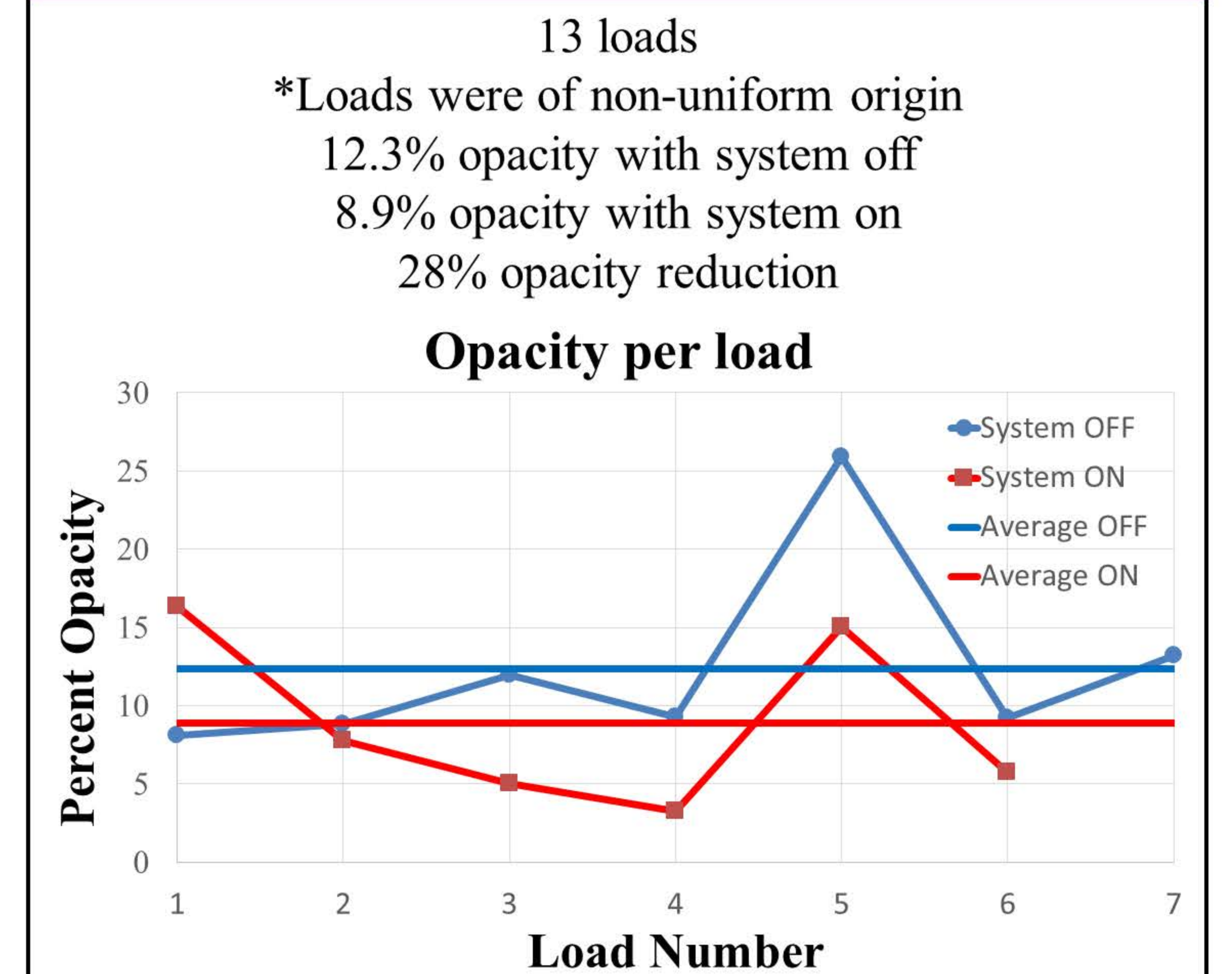
Water Tank



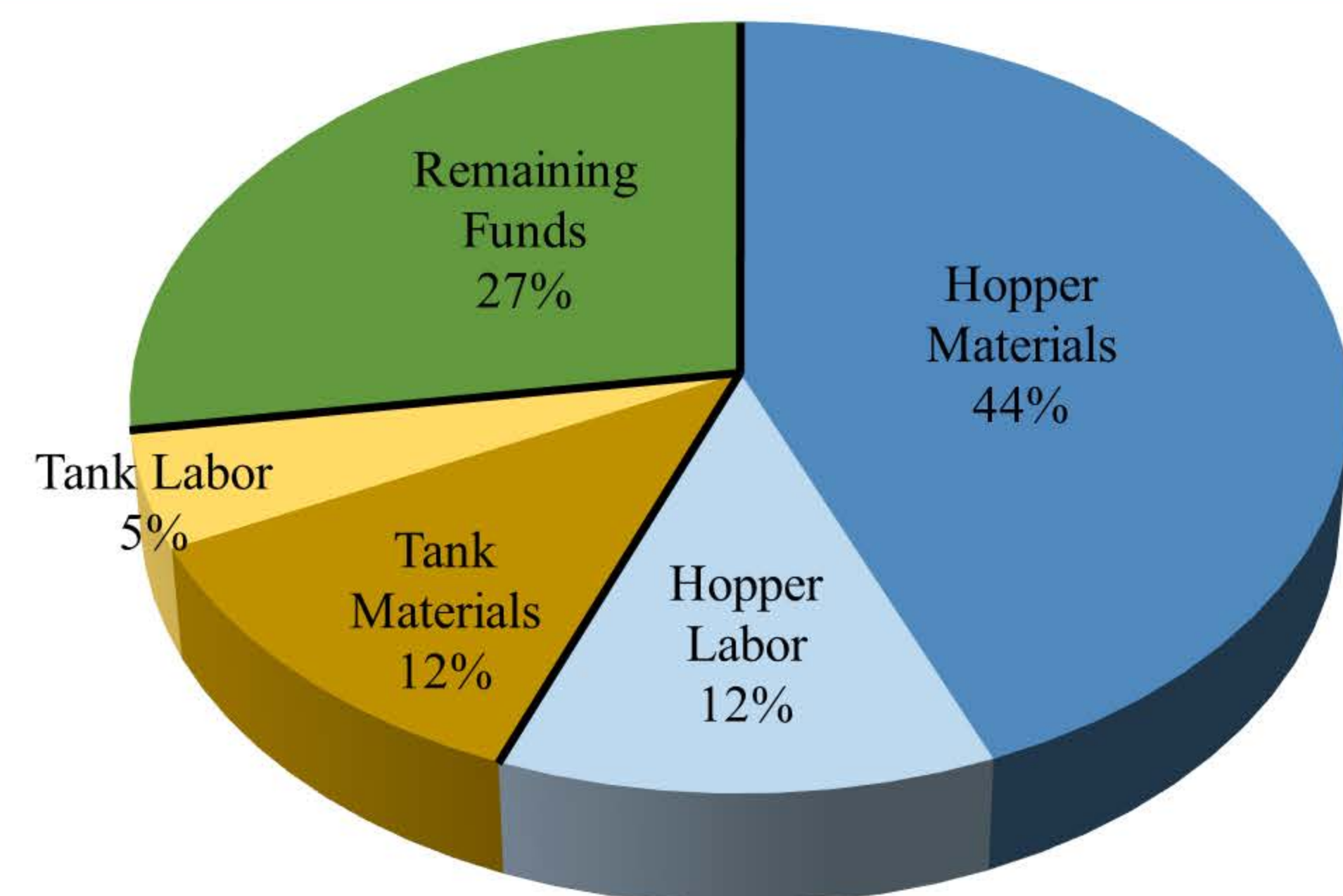
## Nozzle Spray Distribution Results



## Opacity Results



## Budget: \$70,000



## Testing Methods

- ### Dust Suppression
- Subassembly Testing: Nozzle testing to determine spray distribution
  - System testing to ensure sensors, regulator, valves, and nozzles work
  - Loaders will dump at least 10 loads total, half with the system on and half with the system off. Dust plume opacity will be measured by EPA certified emissions observer and photographs of emissions will be analyzed using MATLAB to determine opacity
  - Success will be achieved if the difference in plume opacity is reduced by 50% or greater with the system in operation
- ### Water Tank
- Loop tests will be performed for all PLC outputs. Outputs will be forced on to check panel and field wiring.
  - Pressure transmitter scaling will be verified by filling tank to full level and reading return signal on PLC program.
  - The theoretical fill rate of the water tank is 175gpm, and will be validated by timing the fill rate from 88.6% to 91.8%
  - Success will be achieved if the control system maintains at least 88.6% full but not greater than 91.8% full

## Water Tank Results

- Pressure transmitter correctly measures water level.
- PLC program successfully controls open/close of valve as well as turning on high/low lights.
- Average time to fill 5% (4,800 gallons): 27 minutes
- Confirmed calculated fill rate: 178 gpm
- Design criteria achieved