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Dewaxing Bulding Containment

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Kensing Dewaxing Building Containment

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Kensing Sponsor: Ms. Kate Krull

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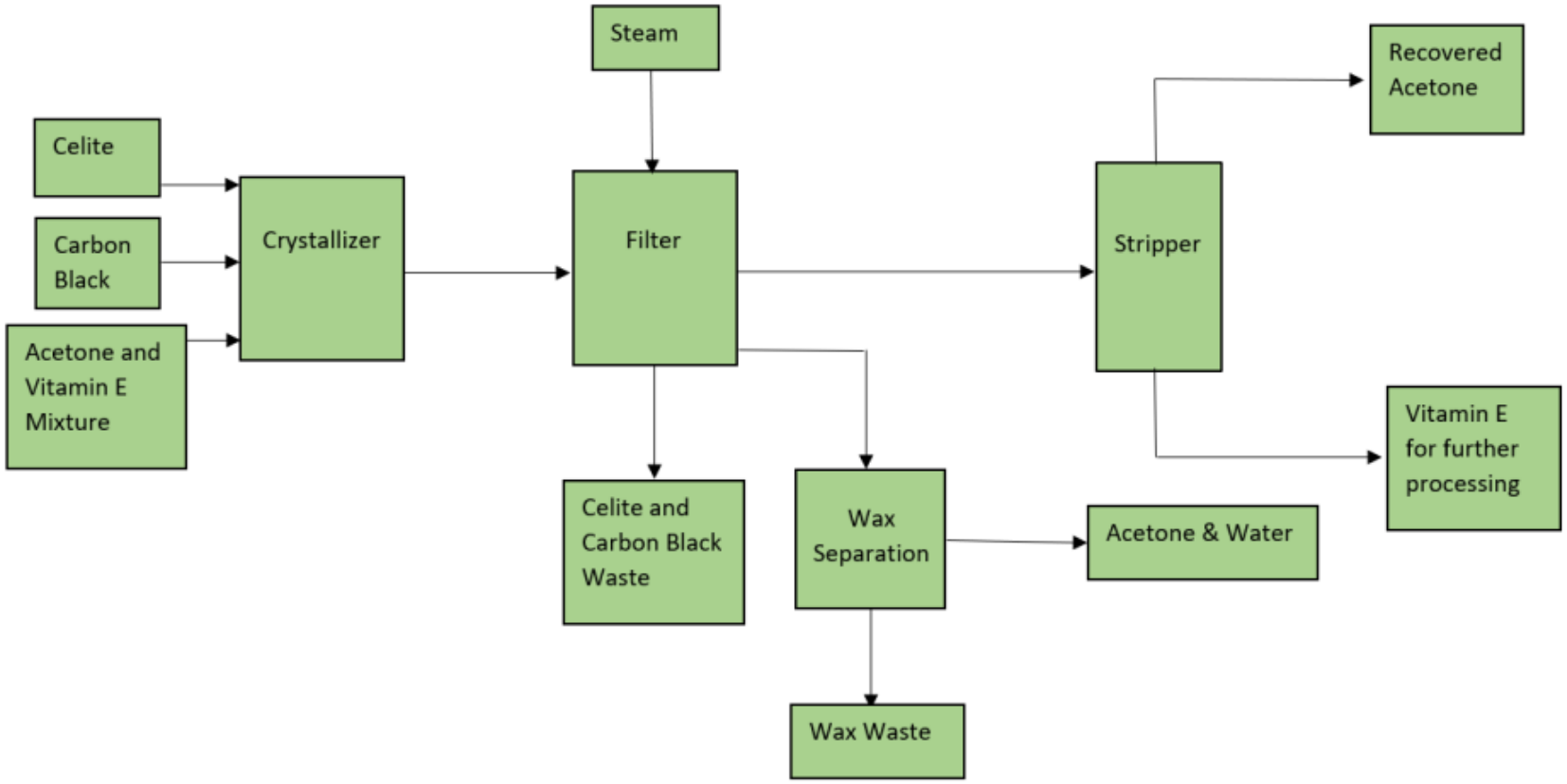
Background

Kensing Solutions

- Located in Kankakee, Illinois
- Site was purchased in 2021
  - From BASF
  - Kensing Founded
- Manufacturer of Consumer Products
  - Vitamin E
  - Anionic surfactants, phytosterols, and specialty esters

KENSING™ [1]

Dewaxing Building Process



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Building Layout

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Secondary Containment

- Crystallizer and Filter tanks remove waxes from the vitamin E stream
- Spills flow onto floor and then into a trench system
- The trench system is plugged and emptied manually into a tote for disposal
- Roll up doors are opened, and acetone vapors allowed to dissipate

Problem

- Vitamin E stream is thinned with acetone
- History of spills
  - Average of one per year
  - Varying levels of lost material
- No automated response – safety issue
- Acetone is a hazardous chemical

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Spill Issues

- Liquids
  - Trenches
    - Waste leads to process sewer
  - Acetone in wastewater
    - Fines from the city
- Secondary Containment must be improved
  - Quicker response
  - Complete removal of material
  - Safe

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Problem Statement

Problem Definition

- Current system
  - Catches spills late
  - Hazardous conditions
- Spill remediation system
  - Catch spills quickly
  - Eliminate flammable atmosphere
  - Remove spill material

Design Objectives and Constraints

- Objectives
  - Remove spilled acetone from dewaxing building
  - Cost-effective
  - Safe
  - Easily accessible
  - Relatively simple to use
  - Feasible
- Constraints
  - Vapor concentrations below 15% LEL
  - No material can enter the process sewer or wastewater to the city
  - Material not be reworked for GMP
  - Components must not react with acetone

Functional Requirements

- Containment
  - All spilled material
- Removal of all vapors
- Quickly Deployable
  - Minimize time allowed for vaporization
- Spill Size
  - Ranging from leaks to 1000 kg of fluid

Codes and Standards

- Disposal of acetone waste
  - RCRA
  - Clean Water Act
- Code of Federal Regulations
  - Standard for existing sources
    - Maximum of 20.7 ppm per day
    - 8.2 ppm monthly average
- Clean Air Act
  - Acetone vapors exempted
- OSHA
  - Maximum 8 hr. exposure period
    - 1,000 ppm
  - Immediate danger to health
    - 2,500 ppm or 10% LEL

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Design Alternatives

Design Alternatives

- Absorbents or absorbent trays
  - Bags of absorbent
  - Kept on site
- Pump/Tank System
  - Pump and piping
  - Outdoor storage tank
- Current System
  - Opening roll up doors
  - Pump into tote

Evaluation of Alternatives

Design Matrix				
Design Decisions	Design Elements			
	Price	Safety	Ease of Use	Functionality
Solution				

- Rated on scale of 1-10
- Price
  - Capital and lifetime costs
- Safety
  - Worker and process
- Ease of Use
  - Complexity
- Functionality
  - Satisfies all functional requirements

Design Matrix

Design Matrix					
Design Decisions	Design Elements				
Systems	Price	Safety	Ease of Use	Functionality	Totals
Absorbents	6	5	7	7	25
Pump/Tank	2	9	8	9	28
Current	10	1	7	6	24

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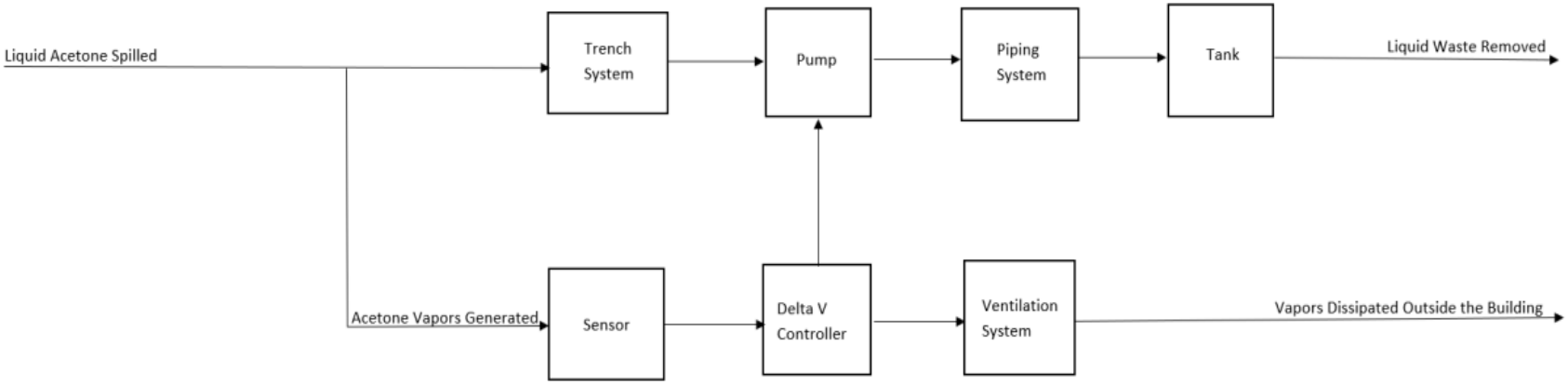
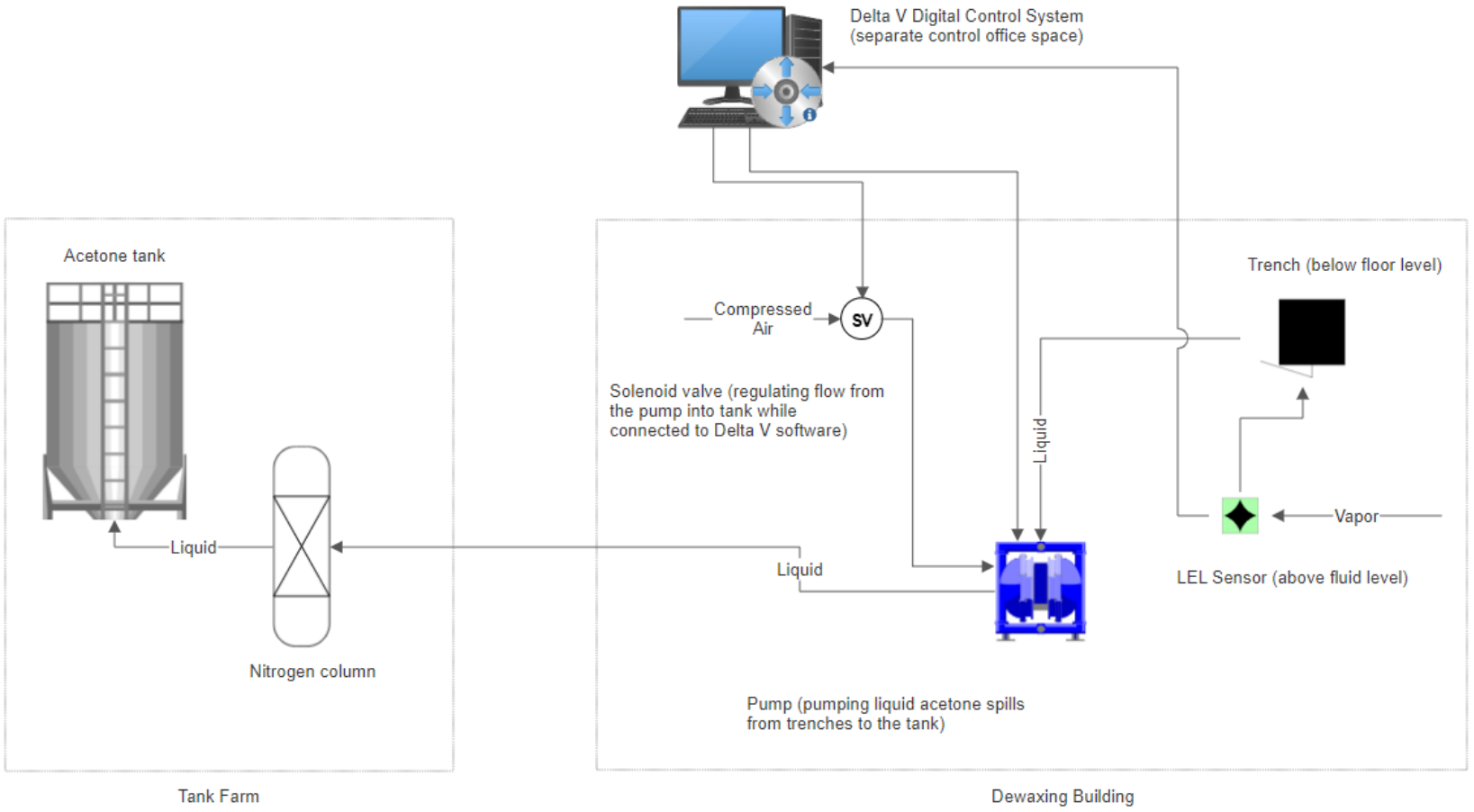
Final Design

Block Diagram



Process Flow Diagram



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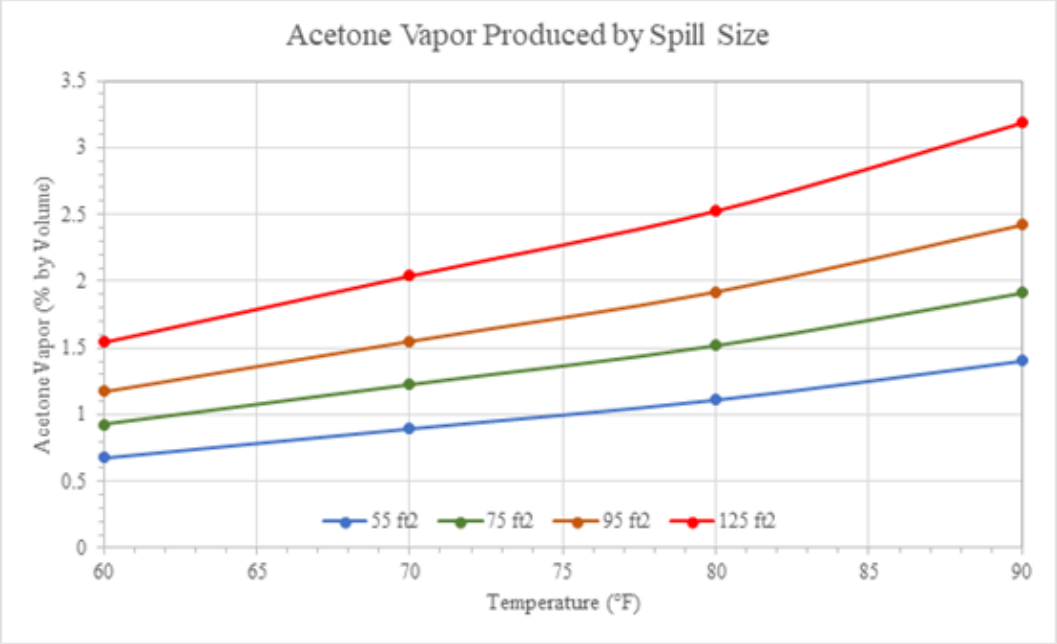
Design Validation

Ventilation System

- Existing Ventilation System
  - Flow Rate
    - 1752 ft^3/min
- Vapor concentration generated
  - C_{ppm}
  - Converted to % by volume
- Adequate for spills with solution



$$C_{ppm} = \frac{K * A * P^{sat} * 10^6}{Q_v * P * k}$$

Pump

- Fastest flow of spill
  - 200 kg/min or 66 gpm
- Grainger, Inc.
  - ARO
  - 90 gpm maximum
  - Stainless steel
  - Double diaphragm (PTFE)
  - Will not degrade Acetone
  - No accumulation

[3]

Other Materials

- Piping
  - 100 feet
  - Stainless Steel
- Tank
  - 4700 gallons
  - Stainless Steel
  - LDAR
- Sensors and Conduit
  - LEL
  - Solenoid Valve
- Plug
  - Brady SPC
  - PVC

[4]

[5]

Cost Estimate

Capital Costs

Item	Cost
Tank	$57,000
Piping and Labor	$15,000
Sensor	$20,000
Pump	$5,454
Plug	$257

Additional Costs

Item	Cost
Maintenance (every 5 years)	$20,000
Waste Removal (per spill)	$1,835

Total Cost (estimated 20-year lifespan)

Total	$118,000
Total + 10%	$130,000

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Conclusion

- Benefits of solution
  - Automated system (quick clean-up)
  - Safely
  - Minimized Waste and Cost
  - Easily maintained
- Recommendations
  - Protocols development
  - Backup ventilation system

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Q&A

Questions?

Image Resources

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