



69th St. WWTP Work Order Task Oxygen Plant System Replacement



TACWA Presentation



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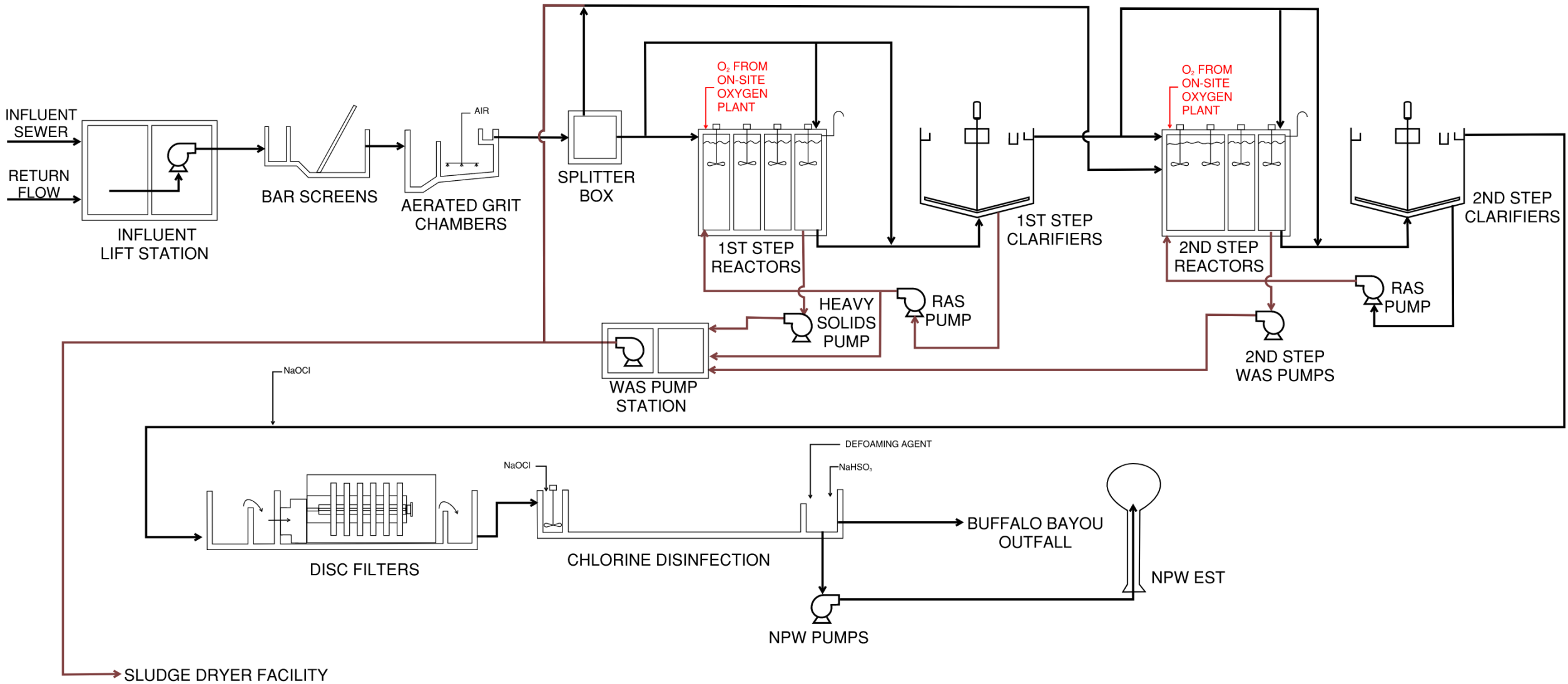
Presentation Outline

- I. Introduction/Background
 - A. 69th St Plant Operation
 - B. Age/Condition of Existing Oxygen Plant
- II. Oxygen Plant Replacement Options
 - A. Pipeline, LOX, On-site generation (SOE/SOG)
 - B. Cryo vs. VPSA
- III. Other Considerations
 - A. Oxygen Demand
 - B. Site Civil and Electrical Requirements
 - C. Equipment Pre-Procurement Challenges
- IV. Project Status and Next Steps
 - A. Proposed Solution
 - B. Schedule

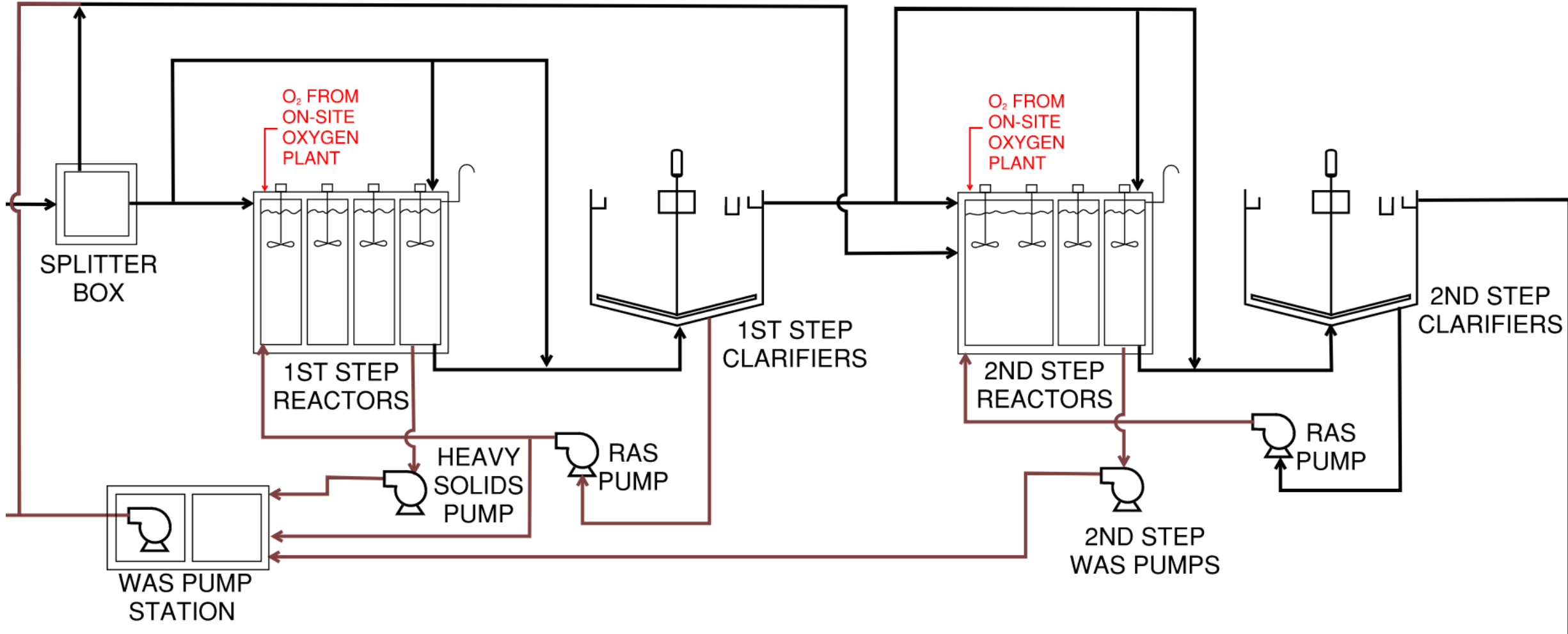


Background and Oxygen Demand

Overall Plant PFD



Overall Plant PFD



Background

- Two 160 TPD cryogenic oxygen (cryo) plants (installed 1980)
 - Produces 99% pure oxygen, 98+% uptime
 - Only 1 of 2 cold box and 2 of 3 compressors operational
 - 2022 Air Products report recommends \$11.3M improvements to existing system
- 600-ton LOX Tank and vaporizers near end of service life
 - LOX Tank is back-up to oxygen generation system (approx. 3 days of storage)
- \$57,000+ per day to truck in LOX when unit is down
- Oxygen plant replacement as highest priority for 69th St.
 - Recent oxygen system downtime and insufficient LOX led to ammonia excursions
 - Air Products believes that unexpected downtime will occur more frequently



Oxygen Plant Replacement Options

Procurement Options

— Sale of Gas through Pipeline

- Construction of a pipeline from a large-scale production facility directly to 69th St WWTP
- Long-term contract with a single Vendor
- Prohibitive from both a cost and schedule standpoint
 - Route from the nearest production facility would be about 4.5 miles and cross 41 parcels

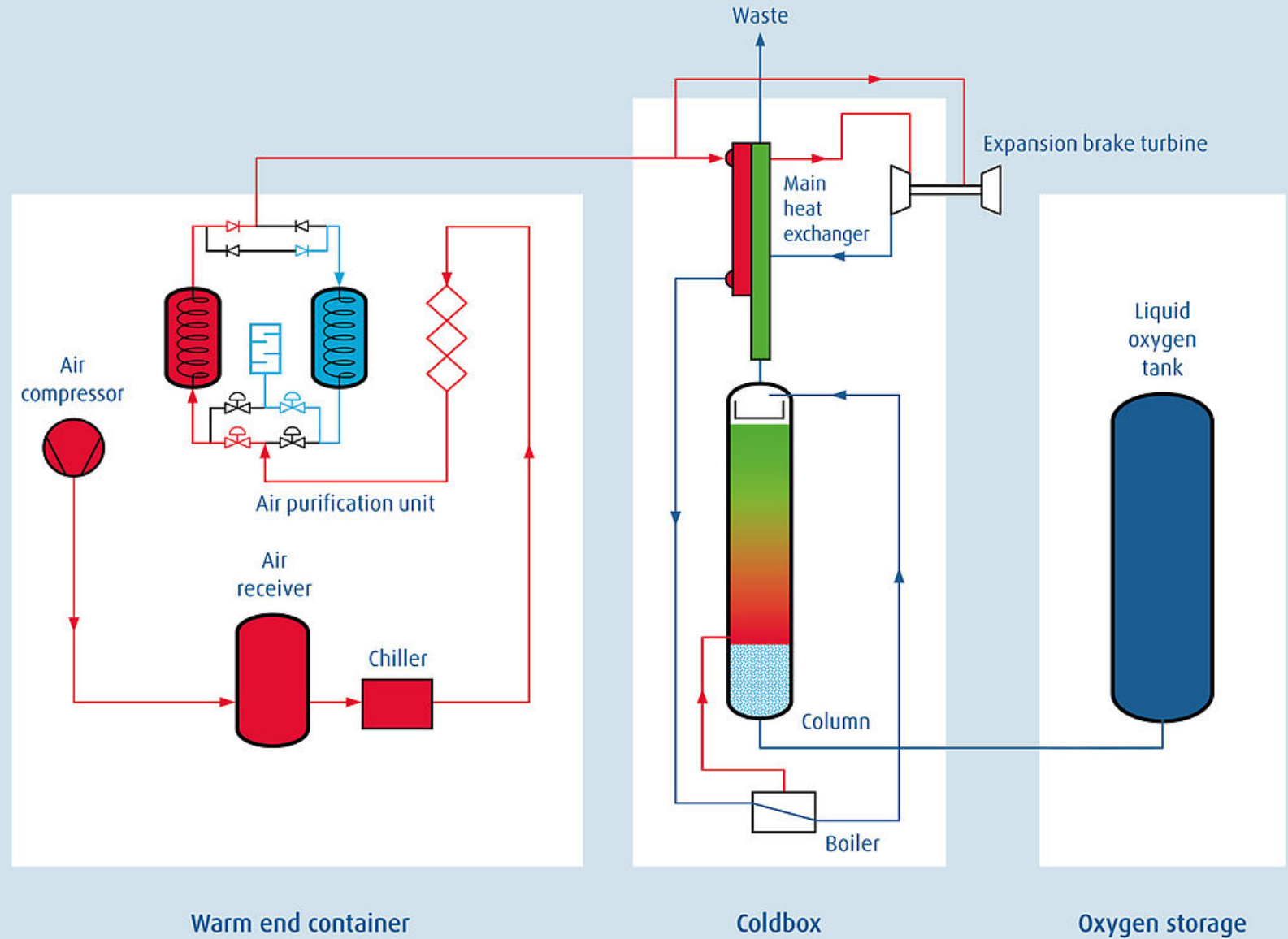
- Exclusively using trucked-in liquid oxygen (LOX)
- Prohibitive from a cost standpoint
 - Cost >> other alternatives over a 20-year life cycle

— On-site Generation

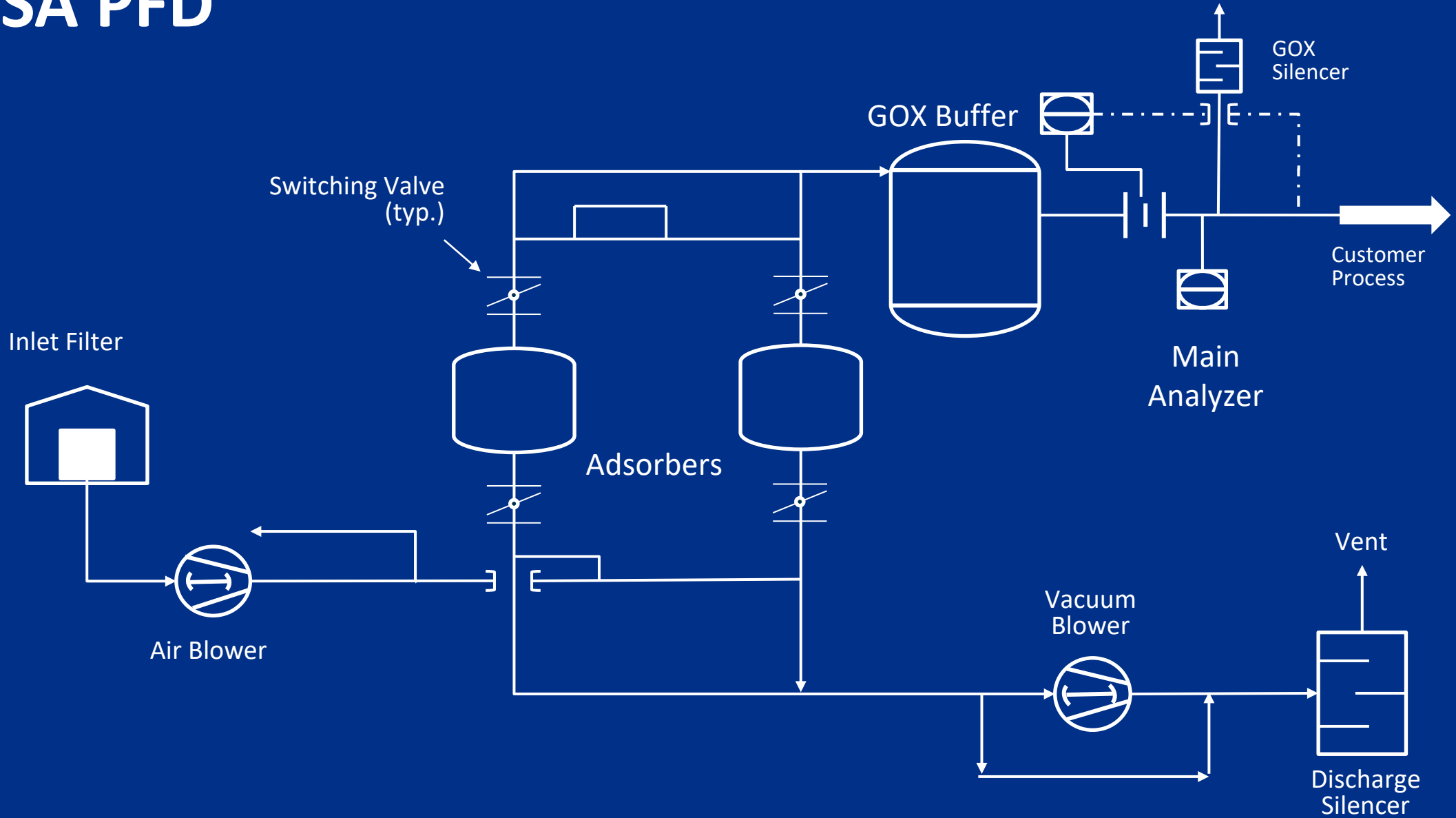
- Purchase or rent the necessary equipment which will be located City of Houston Property

— LOX-Only (truck delivery)

Cryogenic Oxygen Plant PFD



VPSA PFD



Cryo vs. VPSA

Cryogenic Units

VPSA/VSA Units

Pros

- Higher oxygen purity
- Onsite LOX generation

- Simpler to operate and maintain
- Lower Pressure Compressors
- Modular design
- Faster installation
- Faster cooldown/start times (~30 min)
- Newer Technology

Cons

- Loud compressors, with a lot of vibration
- Requires additional cooling
- Need to defrost every 4-5 years
- Older technology
- More complex to operate
- Longer cool down/ start times (~0.5-3 d)

- Louder PD Blowers, with more vibration
- Lower oxygen purity
- No on-site LOX generation

Sale of Gas vs. Sale of Equipment

— Sale of Gas (SOG)

- Oxygen generation equipment is housed on City site
- Owned and operated by the Vendor.
- Guaranteed uptime (typically >98%).
- A long-term (20-y) D/B/O/O contract w/ Vendor
- Separate D/B/B contract for all other aspects

— Sale of Equipment (SOE)

- Owned by the City.
- City can enter into a 3rd party O&M agreement w/ Vendor to run the plant
- City is ultimately responsible for long-term maintenance
- Direct purchase of the oxygen system, and separate D/B/B contract for all other aspects



Evaluation and Recommendations

- Reached out to 4 vendors to evaluate SOE vs. SOG
- Determined SOE option is better in the long term
 - Significantly lower life cycle costs
 - More security
- Pre-Procurement of Equipment with separate General Contract for Site Preparation, Installation, and Electrical
 - More than 50% of total project cost is oxygen system equipment
 - Expedited schedule

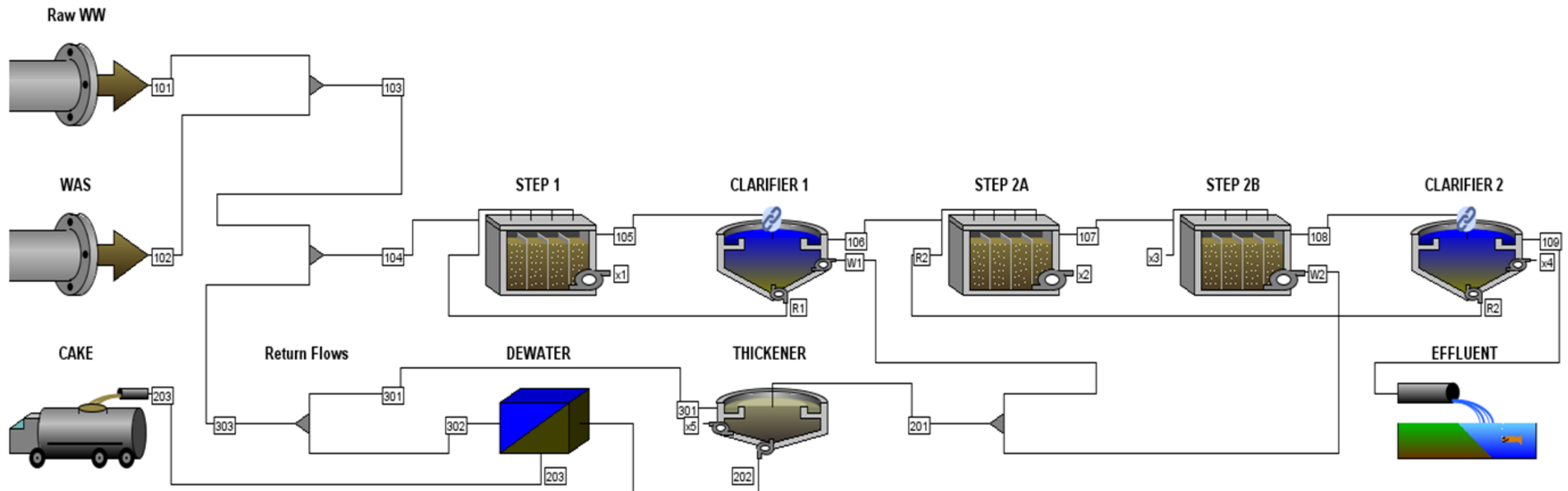


Other Considerations



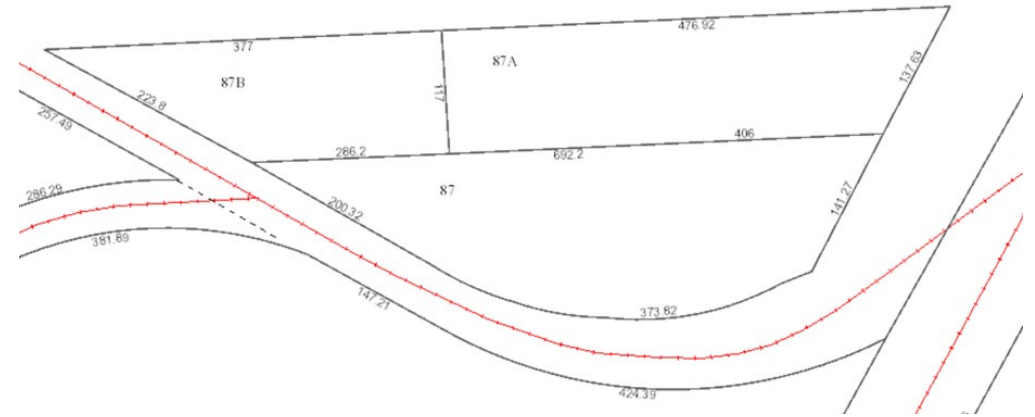
Oxygen Demand

- Created GPS-X models
- Modeled oxygen demand is **200 TPD contained oxygen** at peak loads
- City made decision to provide 100% equipment redundancy



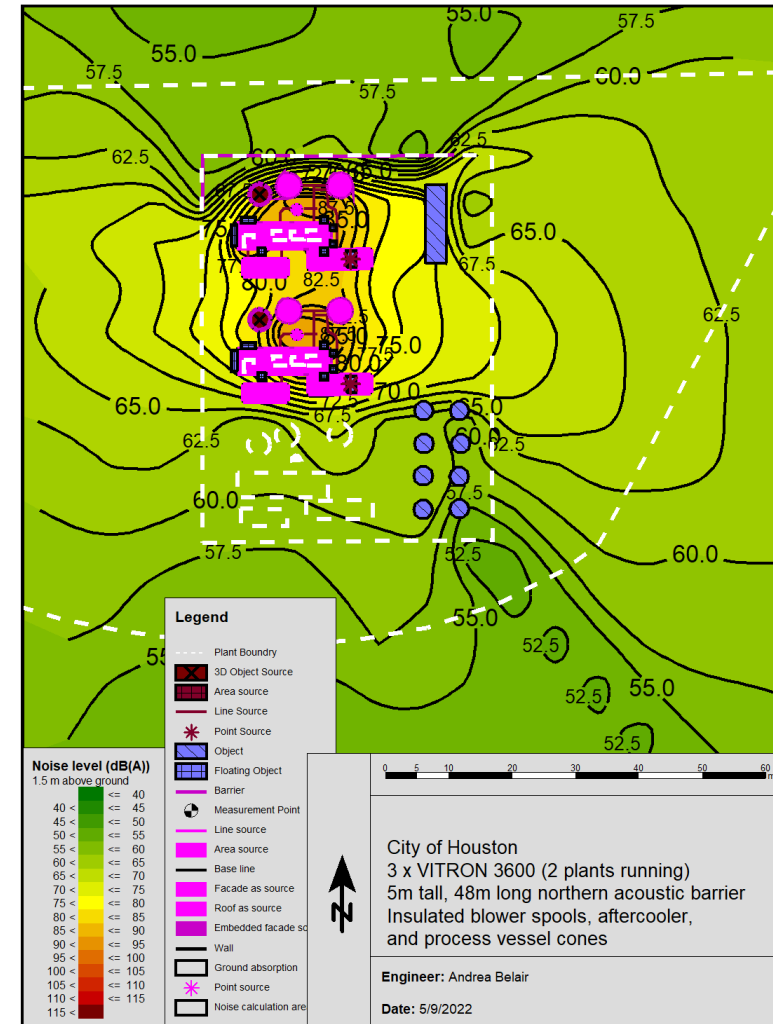
Site Civil Considerations

- The Armour Dr site includes 3 separate parcels that need to be platted
- The site elevation is outside of the 500-y floodplain (23.2 ft)
- Additional impervious area will require stormwater infrastructure
- Minimize space to reserve portion of property for other uses
- Railroad crossing coordination



Noise Concern

- The non-residential noise limit is **68 dB(A)**, measured from the property line
- VSA/VPSA sound pressure: 85-113 dB(A)
- Equipment approx. 50 ft from property line
- 15-ft tall noise barrier may be sufficient to reduce sound to meet the ordinance
- Conservatively estimate noise wall will surround the oxygen generation units





Power Supply

— Existing Electrical

- 2 main 12.47 kV switchgear feeder breakers connect to the existing oxygen plant
- 2,400 V and 480 V power distribution equipment is in poor condition

— Proposed Plan

- One 12.47 kV circuit can serve existing plant, other circuit will be used to start-up and test proposed plant
- Additional circuit will be brought over to the new plant for full redundancy
- All System Suppliers are well within the capacity of a single 12.47 kV circuit



Equipment Pre-Procurement Challenges

— Scope split between the VPSA System Supplier and General Contractor

- Off-loading
- Electrical Equipment
- Equipment installation

— Extended Warranties

- VPSA System Supplier does not fabricate the individual pieces of equipment and can only provide standard warranty on the entire system

— 3rd Party O&M

- Determining whether the Plant Staff, Supplier, or 3rd Party will operate

— Coordination between Contracts

- Field services
- Delivery time



Project Status and Schedule



Project Status

- Working with the City's Strategic Procurement Division to issue a Request for Proposal (RFP) for the oxygen system equipment
 - Best Value Bid
 - Incorporates cost and non-cost factors in scoring
- Beginning final design on site and electrical improvements



Questions?

