Invisible Odor Control

Combining Public Athletic Fields with Nutrient Equalization Basins and Hidden Odor Control Systems

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01 Background and Purpose

Background

- Alex Renew Wastewater Resource Recovery Facility (WRRF) in City of Alexandria Va.
- Plant already had a centralized 200,000 cfm scrubber complex for the WRRF
- This work added a Nutrient Management Facility (NMF)
  - 18 mgal primary effluent flow equalization

Image provided by FX FOWLE.

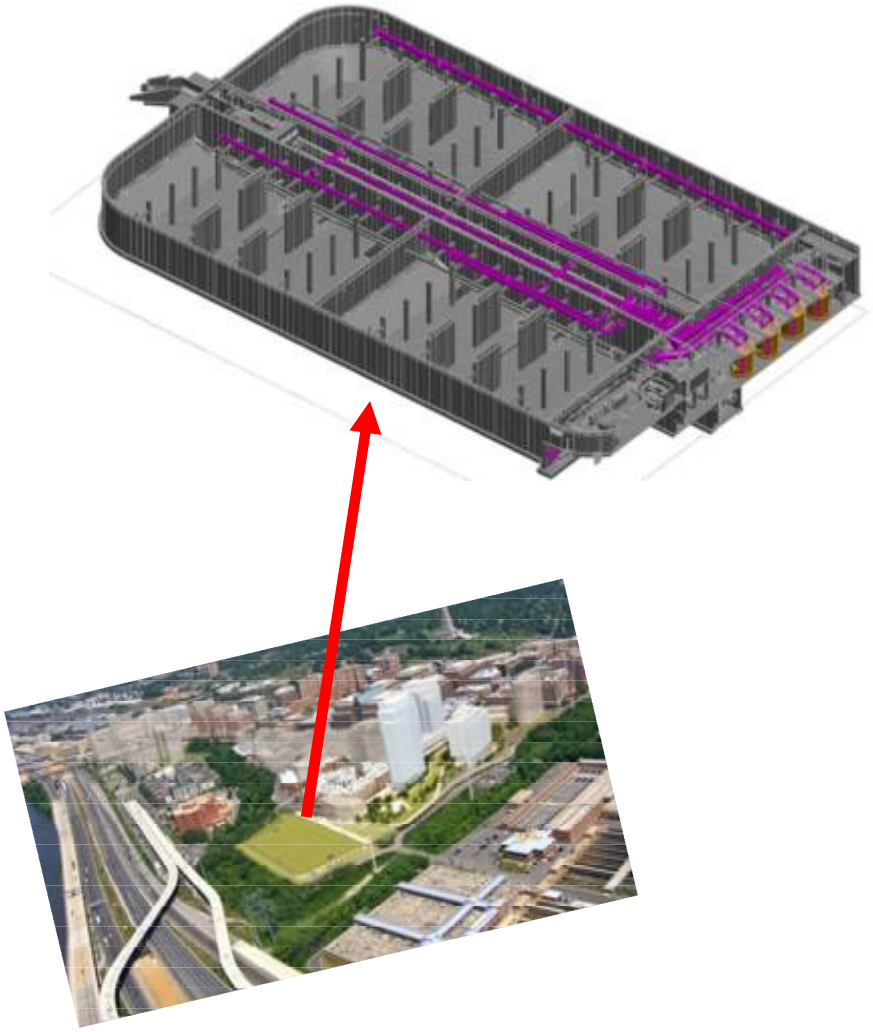
NMF

- Site is just west of WRRF
- 18 mgals of tankage to store primary effluent
- Allows diurnal nutrient peak shaving and more consistent feed to biological treatment processes
- An athletic field is provided on top of the NMF for public use
  - Incorporates a hidden odor control system

View looking West

NMF

- 4 NMF Tanks
  - 18 mgals
- 60,000 cfm odor ventilation with 4 carbon scrubbers
  - 3 ACH on ½ full tanks
  - 300 fpm capture velocity on makeup air openings
- SST air pipe inside tanks
  - Rigidly supported against buoyancy
- FRP air pipe outside tanks
- Each carbon unit fitted with dedicated VFD driven fans



02 Odor Characterization

Odor Characterization was based on field data from existing primary settling tanks

- Sampling data
  - Weir surface of primary effluent for H_2S and DT using flux hood
  - Odalog hung in primary weir house during August
  - Jug head space sampling to check max Henry's equilibrium concentration

- Resulting Design conditions
  - Average annual H_2S at 1 part per million (ppm) with occasional sustained summer peaks to 5 ppm and potential short-term peaks of up to 20 ppm.
  - Mixtures of methyl mercaptan, dimethyl sulfide, and other potential organic based reduced sulfur compounds totaling less than 1 ppm.

- The odor control system was designed to be able to treat these odors by providing the following performance parameters:
  - 99% reduction on H_2S odors.
  - 90% reduction in overall odors as measured by detection threshold following odor panel analysis using the American Society for Testing and Materials (ASTM) E679-04 standard method.

03 Design Layout Details

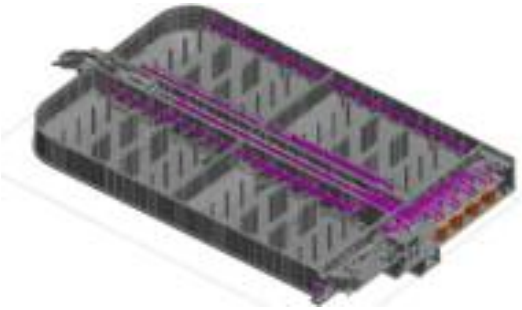
Process Overview

- 4 parallel dual bed carbon units
- Dedicated VFD driven fans
- Particulate screens before each fan
- Access to top of carbon via side doors
- Remote exhaust stack to promote stack dispersion away from the athletic field

View looking West

Top of the Field

Odorous air collection ductwork is fitted with dampers and flow monitoring



Fan inlets with particulate filters

14 foot dual bed carbon units with dedicated fans

Carbon bed pressure monitoring

Fans protected by pressure differential

Side entry for carbon change outs

Top access above carbon

- Dual exhaust with dampers
- Removable grating
- Large door access to outside

Top access

- Monorails to handle super sacks

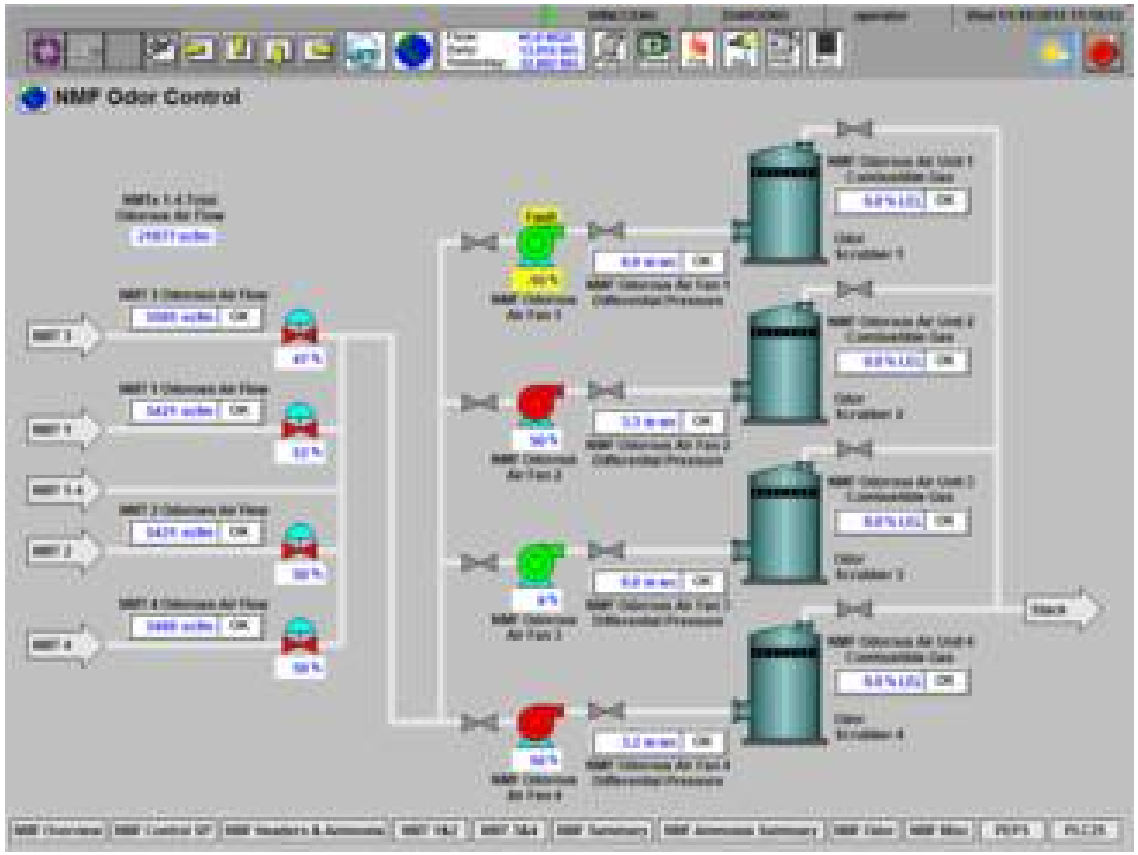
04 Carbon Change Out Plan

Carbon change outs

- Single use “high capacity” carbon blend
  - To remove H_2S and low level organic odor compounds
- Estimated change out projected for 3 to 4 years
- Each bed has a VFD fan so if 1 of the 4 is down for change out the others can treat more flow
  - 3 at 20,000 vice 4 at 15,000 cfm
  - Also allows owner to turn down during low odor periods and save horsepower
- Access doors have drive up access for Vac trucks parked just outside
  - Each carbon vessel can hold approx. 925 cubic ft of carbon

05 I&C Details

Instrumentation and Controls



06 Dispersion Modeling Verification

Dispersion Modeling

- To ensure the remote stack height was adequate
  - Balance between ensuring odor control and aesthetics of an oversized exhaust stack next to the belt way
- Checked stack exhaust velocity and height required to prevent odors on the athletic field and nearby high rise buildings

Dispersion Model Set Up

- Exhaust stack 100 feet south east of the new tanks
- Needed to do stack optimization check

Selected an odor criteria consistent with other applications

- 99.9% compliance
  - 5 D/T 1-hour impact goal
- Consistent with past WRRF design which does not receive odor complaints
- Reasonably conservative compared to what others have done

TABLE 2
Selected Odor Goals and Criteria in the United States for Municipal Treatment Facilities

Location	Offsite Standard or Guideline	Averaging Time and/or Frequency
Bay Area Air Quality Management District (San Francisco Bay Area), Calif.	5 D/T	Applied after at least 10 complaints within a 90-day period
Brightwater (Seattle, Wash.) WWTP	5 D/T	5 minutes
Cincinnati (Ohio) WWTP	7 D/T	3-minute average, 99% compliance
Colorado	8 D/T (Scentometer)	Field measurement sustained
Dublin San Ramon Services District, Dublin, Calif.	4 D/T	1-hour, 99% compliance
Fairfax, Va.	7 D/T	1 hour, 100% compliance 3 minutes, 99% compliance
James River Plant, Hampton Roads Sanitation District, Virginia Beach, Va.	5 D/T, 1-hour 10 D/T	1 hour, 99.9% compliance 3 minutes, 99.9% compliance
Kentucky	7 D/T (Scentometer)	Field measurement
Massachusetts	5 D/T	1 hour
Missouri	7 D/T (Scentometer)	Field measurement
Nevada	9 D/T	1 hour
New Jersey	5 D/T	5 minutes or less
Orange County, Calif.	15 D/T	3 minutes
San Diego WWTP	5 D/T	5 minutes, 99.5% compliance
Virginia Initiative Plant, Hampton Roads Sanitation District, Virginia Beach, Va.	2 D/T, 1-hour 7 D/T, 3-minute	1 hour, 100% compliance 3 minutes, 99.9% compliance
Wyoming	7 D/T	—

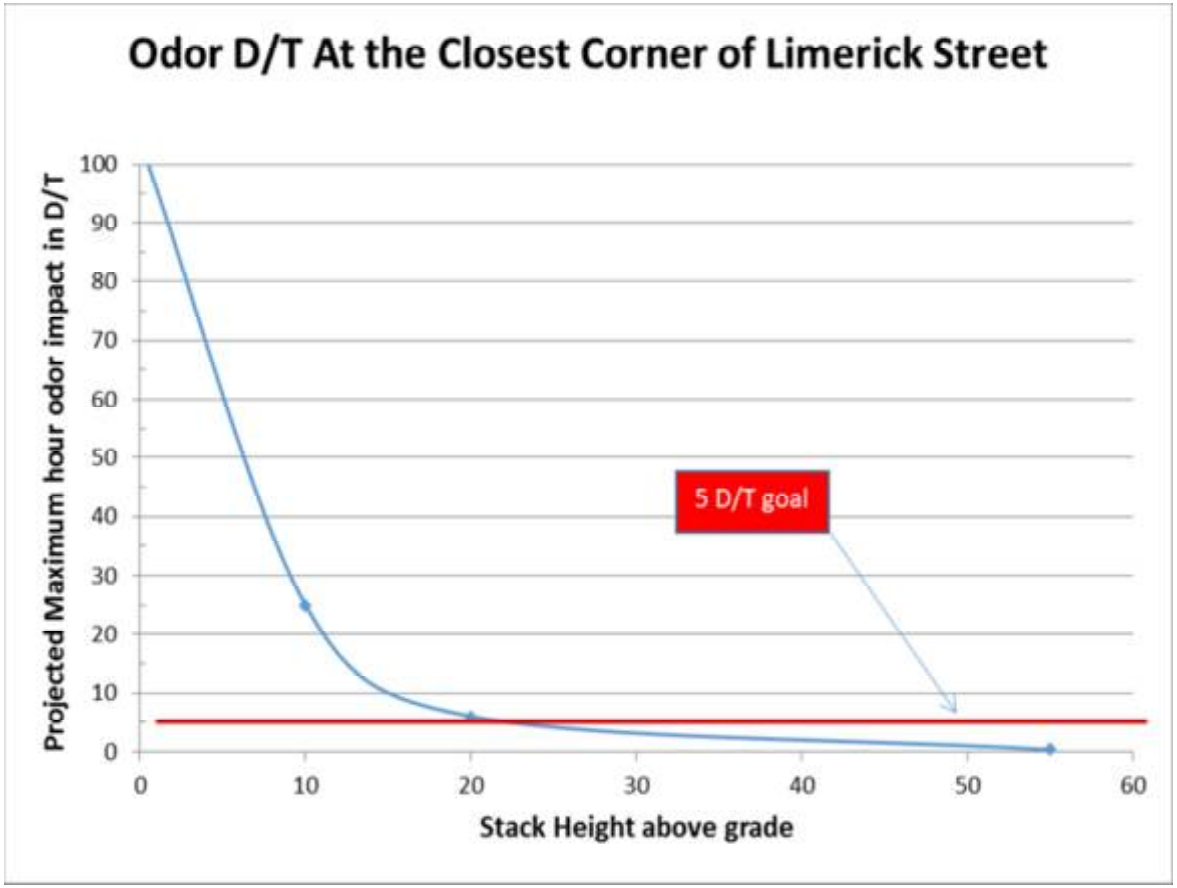
OU, odor unit.

Stack Height Evaluation

- Odor source strength at the stack
  - Assumed 300 DT in the exhaust air
  - Design required 90% reduction or 150 DT max
  - Used AERMOD with local MET data
    - Reagan Airport data

Stack height evaluation

- Stack evaluation showed that a 25 foot stack was needed
- 50 foot provided to stay above the athletic fields and ensure minimal impact risk



- No 5 D/T impacts predicted
- 1 DT impacts shown for perspective of potential initial impact zone

07 Conclusions

Conclusions

- The new NMF and related odor control systems have been constructed and tested showing they meet the required performance criteria.
- Although the facility is relatively new, to date no odor complaints have been received.
- The flexibility of the carbon systems with VFD driven fans has allowed AlexRenew to adjust the odor control systems to a lower power demand, saving cost, while still meeting the commitment to capture and treat odors preventing odor impacts to the public.

Questions?