

**Odor control using chemical dosing, coupled with odor monitoring electronic noses on an aeration basin at a WWTP**



# Brief Intro

- Co-Authors/Project Team Members:
  - HRSD's Amanda Kennedy and Jeff Layne
  - Kruger's Sharon Paterson
  - Odotech's Thierry Page, Phillip Micone
  - US Peroxide's Paris Neofotistos, George Deshinsky
- Technology Overview
  - USP's Peroxide Regenerated Iron Sulfide Control (PRI-SC<sup>®</sup>)
  - OdoTech's OdoWatch<sup>®</sup>
- HRSD's Evaluation
  - Application/Case History

# Liquid Phase Odor Control

- US Peroxide's PRI-SC<sup>®</sup>
  - Peroxide Regenerated Iron Sulfide Control
  - iron salts (either  $\text{FeCl}_2/\text{FeCl}_3/\text{FeSO}_4$ ) are added as the primary sulfide control agent in the upper reaches of the collection system
  - Then hydrogen peroxide ( $\text{H}_2\text{O}_2$ ) is added at specific points downstream to “regenerate” the spent iron ( $\text{FeS}$ )
  - The regeneration step effectively oxidizes the sulfide to elemental sulfur and in the process “frees up” the iron for subsequent sulfide or phosphorus control further downstream

# Odor Monitoring Technology

- The OdoTech, Inc., OdoWatch<sup>®</sup> system is comprised of three main components
  - eNoses
    - MOS Sensors
  - Weather station
    - Davis Vantage Pro
  - PC System & Software
    - HP PC system hardware
    - Microsoft Windows PC operating system
    - Internet Explorer, OdoWatch<sup>®</sup> 3.11, AERMOD



# eNoses

- The eNose is comprised of
  - 16 MOS (Metal-oxide semiconductor) sensors
    - Wide spectrum responses (non-specific)
  - Air sample pump
  - Cooling fan
  - Wireless RF communications



# Weather Station

- Measures
  - Temperature
  - Humidity
  - Atmospheric pressure
  - Solar radiation (used to determine mixing height and stability class)
  - Wind direction
  - Wind speed

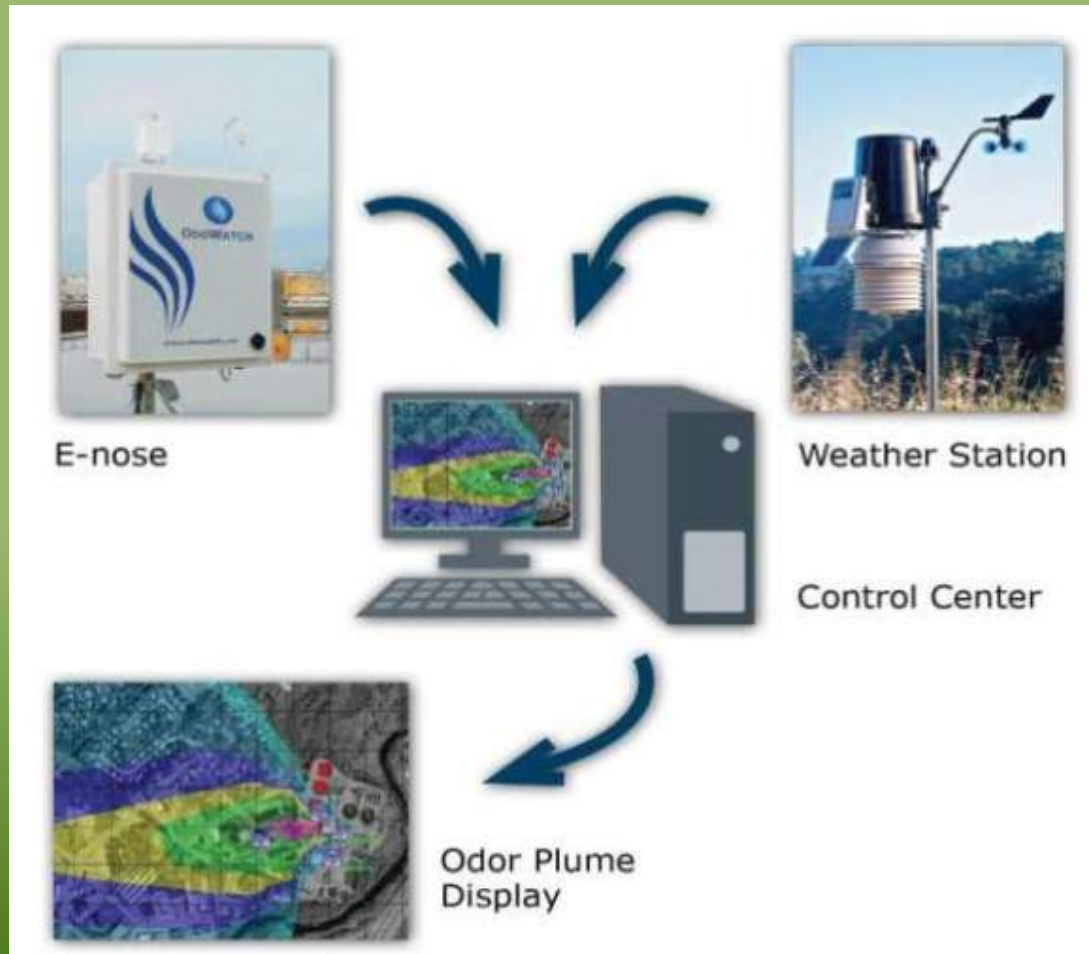


# PC System & Software

- “Control Center” couples the real time eNose odor unit concentrations with the on-site weather data using AERMOD (Air Quality and Transport Modeling) dispersion modeling software results that feed into OdoWatch<sup>®</sup> 3.11 to create and display the real time odor plumes

# OdoWatch® Odor Monitoring Technology

*The Odor Monitoring & Management Solution*





# OdoWatch<sup>®</sup> 3.11 Software Display

- Weather Data
- Electronic Data
  - OU/m<sup>3</sup> Concentration Data, Sensor Flow Data
- Alert Data
  - Self set alert points
  - Email communications when set level of odor concentration has been exceeded
- Plume
  - Image of odor based upon AERMOD results



Map



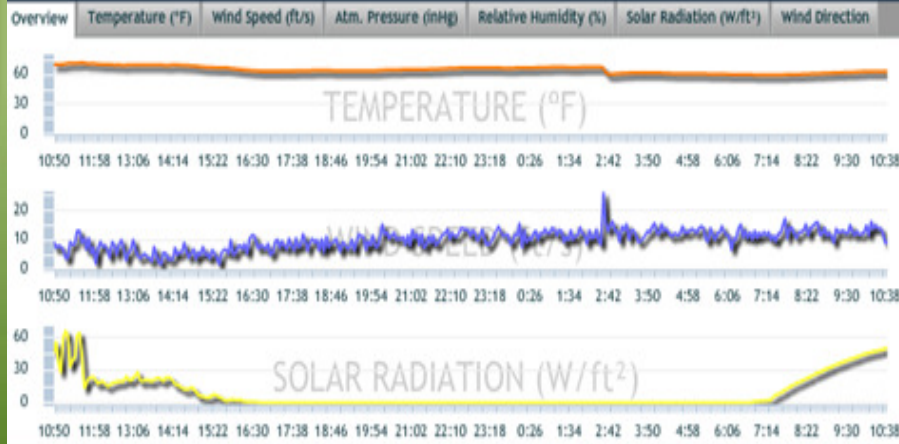
Events

Data

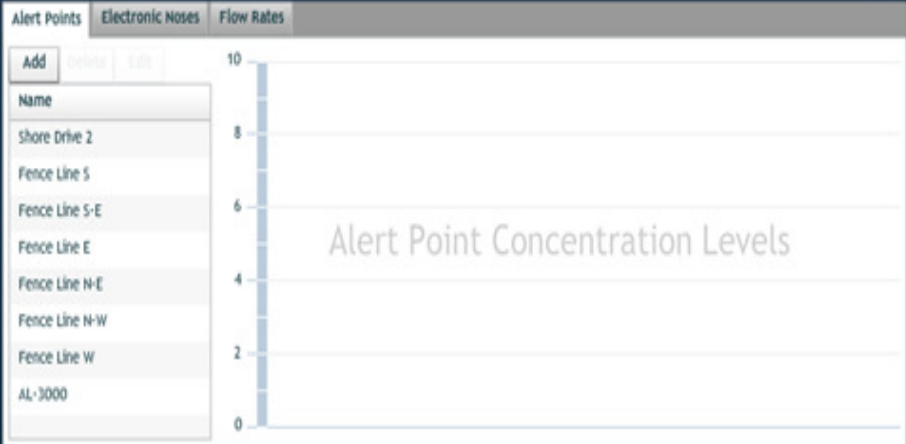
Events for: Virginia Beach C-E Plant

Start Date	End Date	TYPE	Description	Name
Tuesday, Nov. 16, 2010	Tuesday, Nov. 16, 2010	2C	Low alert point threshold exceeded Fence Line N-W 2.00	Fence Line N-W
Tuesday, Nov. 16, 2010	Tuesday, Nov. 16, 2010	2C	Low alert point threshold exceeded Fence Line N-W 2.00	Fence Line N-W
Tuesday, Nov. 16, 2010	Tuesday, Nov. 16, 2010	2C	Low alert point threshold exceeded Fence Line N-W 2.00	Fence Line N-W
Tuesday, Nov. 16, 2010	Tuesday, Nov. 16, 2010	2C	Low alert point threshold exceeded Fence Line W 2.00	Fence Line W
Monday, Nov. 15, 2010	Monday, Nov. 15, 2010	20	Low alert point threshold exceeded Fence Line N-E 2.00	Fence Line N-E
Monday, Nov. 15, 2010	Monday, Nov. 15, 2010	20	Low alert point threshold exceeded Fence Line N-E 2.00	Fence Line N-E
Sunday, Nov. 14, 2010	Sunday, Nov. 14, 2010	201	Low alert point threshold exceeded Fence Line N-W 2.00	Fence Line N-W
Sunday, Nov. 14, 2010	Sunday, Nov. 14, 2010	201	Medium alert point threshold exceeded Fence Line W 6.00	Fence Line W

Weather



Event Based Information





OdoWATCH



Log Out

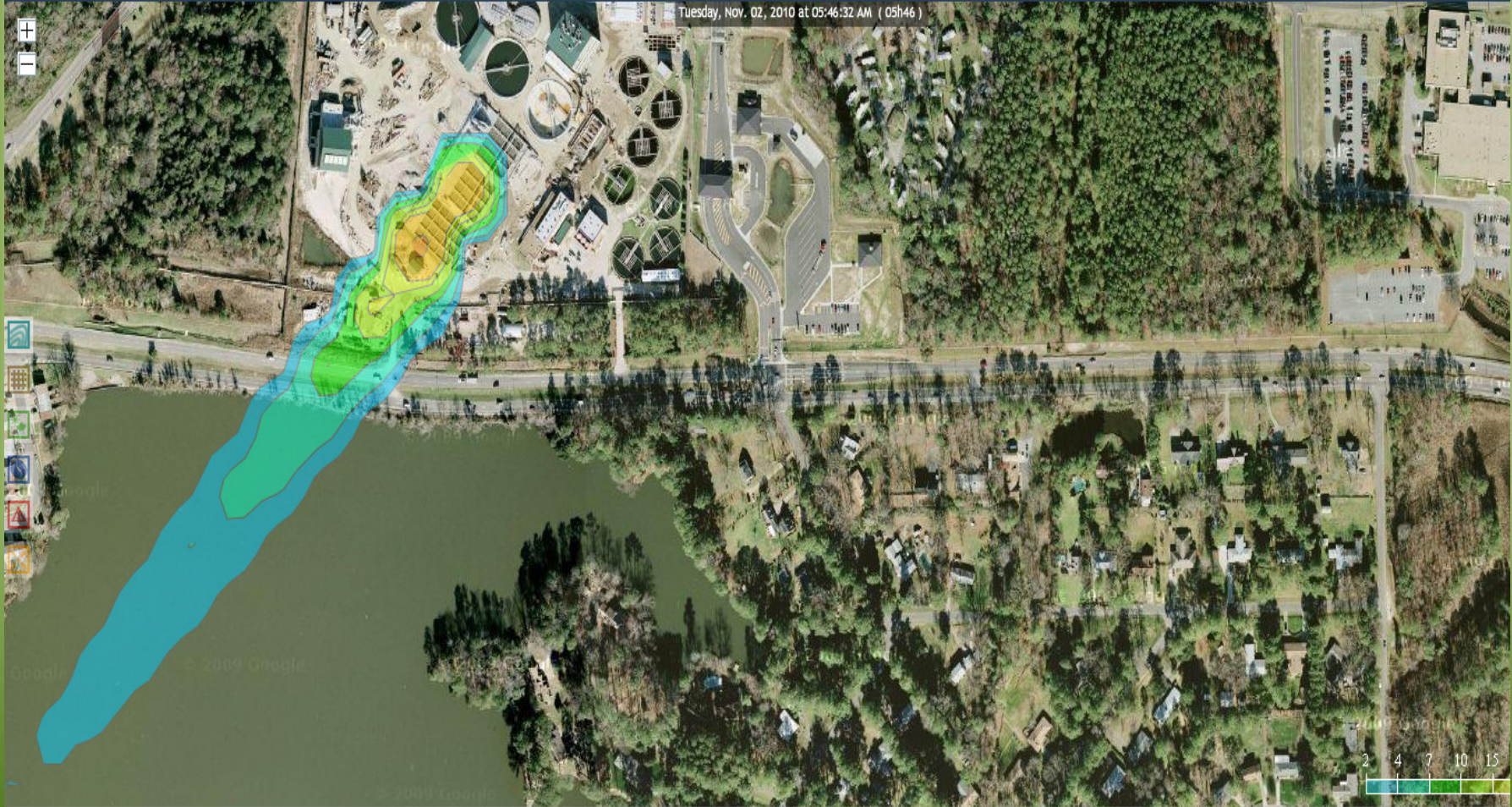
11/02/2010 05:48 Confirm

Current Monitoring Mode: Odor



Map

Tuesday, Nov. 02, 2010 at 05:46:32 AM ( 05h46 )



# HRSD Installation

- HRSD's Chesapeake-Elizabeth Plant
  - 24 MGD secondary treatment facility
  - No primary clarifiers
  - Sulfides in solution RWI 6-12 mg/l
  - Offsite odors from uncovered portion aeration basin and odor complaints
- PRI-SC<sup>®</sup> successfully piloted Aug-Sept. 2009
  - Cut the odor in half (52% reduction DT)
  - Significantly reduced or eliminated offsite odors
  - No odor complaints since started seasonal (April-November) PRI-SC<sup>®</sup> application in 2010



HRSD Chesapeake-Elizabeth WWTTP

# PRI-SC<sup>®</sup> @ HRSD



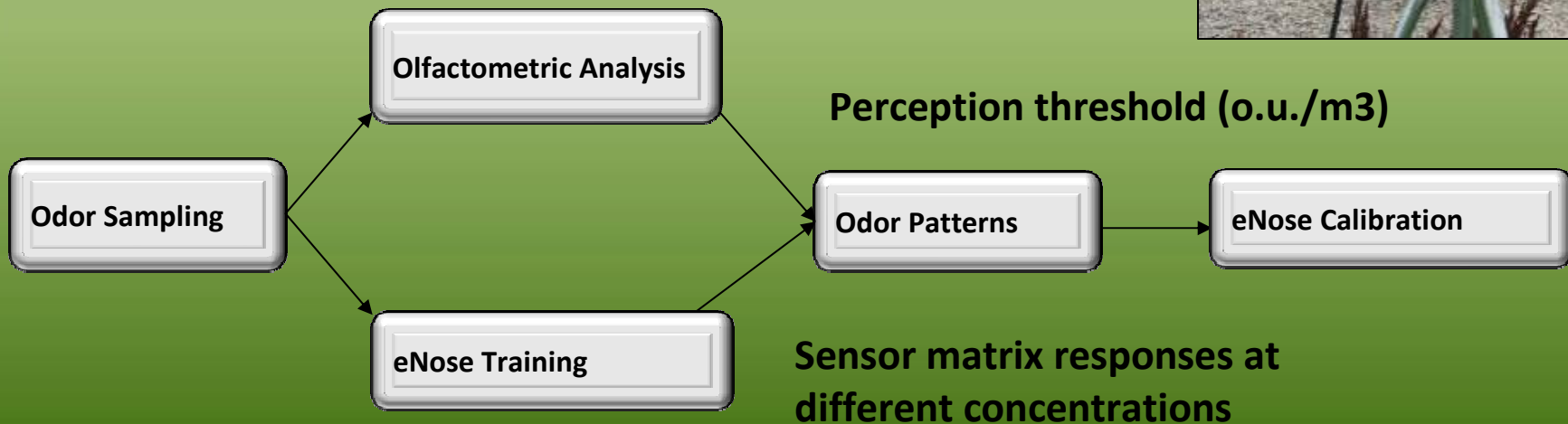
# HRSD Installation

- Oct. 1<sup>st</sup> 2009 OdoWatch<sup>®</sup> system online
  - 3 eNoses & weather station on the aeration basin
  - “the Control Center” in CE library
  - Wireless RF data transmission ~ line of site
- eNose calibration
  - Air/odor samples & odor panel analysis
  - Start-up calibration Sept. `09
  - Re-cal w/ & w/o Peroxide Aug. 2010

# eNose Calibration



STANDARDS  
EN 13725  
ASTM E679-04





# PRI-SC<sup>®</sup> & OdoWatch<sup>®</sup> Project Goals

- Technology evaluations ~ do they work?!
  - Accuracy, reliability, overall performance
- Control the Odors
  - Minimize/eliminate the offsite odors
- Technology applications
  - PRI-SC<sup>®</sup> + OdoWatch<sup>®</sup>
  - Other HRSD wide applications

# Technology Evaluation Results

- The PRI-SC<sup>®</sup> & OdoWatch<sup>®</sup> technologies work
  - Both systems worked as described
- PRI-SC<sup>®</sup> 2009-2010
  - Significantly reduced dissolved sulfides (LaMotte)
    - 6-12mg/l raw influent to <1mg/l junction box 1
    - Mercaptans reduced (via “shake test”)
    - Gastech tubes 4-8PPM RWI to < 2PPM JB1
  - established sulfide control program goals @ JB1
  - dissolved sulfide 0.5 mg/l , Mercaptan < 2PPM

# Technology Evaluation Results

- OdoWatch<sup>®</sup> Monitoring System
  - Accurate 95% + of time on plumes/plume location
  - Based on field odor reality checks
    - Can be very accurate (ex. Feb. 4, 2010 plume check)
  - AERMOD stability class issue (902/602 phenom)
  - Odor units (OU/m<sup>3</sup>) “generally” accurate
    - Difficulty reconciling OU/m<sup>3</sup> between human nose plus field olfactometer (Nasal Ranger) & eNoses
- Both PRI-SC<sup>®</sup> & OdoWatch<sup>®</sup> Systems Reliable
  - Minimal 1-2% downtime
  - Did have some maintenance & repair



# Technology Application Results

- PRI-SC<sup>®</sup> concept + OdoWatch<sup>®</sup> technology
  - Controlling aeration basin odors
  - Some success to date marrying the two systems
    - Visual understanding of the relationship between chemical dosing-odor plume response
    - Learned the impact of the meteorological influences
    - Dosing optimization to plume control
  - With & W/O Peroxide field tests
    - liquid sulfides & mercaptan @ RWI & JB1
    - Jerome H<sub>2</sub>S, DTs (OU/m<sup>3</sup>), & RSC @ aeration tanks
    - OdoWatch<sup>®</sup> plume results

# Aeration Tank Odor Testing



# Odor Data

- Tested the open tank cells w/ & w/o Peroxide
- August 2009 PRI-SC<sup>®</sup> pilot
  - DTs 2400 and 580 cells 3 &4 w/o peroxide
  - DTs 1100 and 330 cells 3 & 4 w/peroxide
- August 2010 PRI-SC<sup>®</sup> season 1
  - DTs 4500 and 2200 cells 3 &4 w/o peroxide
  - DTs 1400 and 810 cells 3 & 4 w/peroxide
- 2009-2010 odor reduction 52-69%
  - CAS GC work reduced sulfur compounds
  - Methyl Mercaptan 400ppb to ND
  - Some residual odor low ppb sulfur compounds



Peroxide on  
6/29/2010 @  
7:00pm



Peroxide off  
6/30/2010 @  
7:00pm



# Technology Application Results

- Need to further understand and develop automated optimization strategy including OdoWatch<sup>®</sup> odor plume to PRI-SC<sup>®</sup> chemical dosing relationship. Also could set operating odor criteria (OU/m<sup>3</sup>) for dosing
- Other PRI-SC<sup>®</sup> applications in the collection system
- OdoWatch applications @ scrubber performance/plumes & process optimization, plant by plant odor evaluations
- Future odor control studies
  - Tool to generate study data
  - Real time odor dispersion modeling of processes
  - Justify capital odor improvement projects

# Other Observations

- Learned thru the OdoWatch<sup>®</sup>
  - Original dose profile ~ diurnal peaks/mass S-loading
  - Odor plumes ID'd over application during the day based daytime meteorological effect of plume rise & increased wind speed creating greater dispersion
  - OdoWatch<sup>®</sup> also ID'd under application of peroxide during the night causing increased plumes offsite
  - OdoWatch<sup>®</sup> as a tool to generate study data & perform odor dispersion modeling of processes could save significant odor study expenditures

# Other Observations

- Greater understanding of odors & the need to control them or not
  - Avoiding unnecessary controls
  - Putting the capital investment where it belongs
  - The potential cost of “not knowing”
- Proactive approach to “be a good neighbor” and a tool to meet odor control goals including HRSD’s odor policy

# “That’s All Folks”

- My Thanks!
- Questions?
- Safe Travels 😊