Odor Control
Tracking the Source of Odors

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Introduction

* Offsite odors are one the more noticeable effects facilities have on nearby communities

* Odors can be attributed to:
  1. Normal Operations
  2. Excess Emissions
  3. Incidents
Odor Causes

1. Normal Operations
   * Odorous product or feedstock

2. Excess Emissions
   * Fugitive Emissions
   * Turnaround
   * Poor Housekeeping Practices

3. Incidents
   * Spills
   * Releases
   * Poorly Maintained or Insufficient Control Equipment
Community Impact of Odors

* In 2014, LDEQ has received ~503 odor complaints to date
* LDEQInspectors investigate every complaint received
* When SPOC receives an unusual number of odor complaints, LDEQ Emergency Response (ER) will investigate
Unpermitted air emissions or incidents
  * LAC 33:III.501.C.4 – “The source shall operate in accordance with all terms and conditions of the permit.”

Nuisance Odors
  * LAC 33:III.2901 – “Limit on Odorous Substances at or beyond Property Lines”
  * Various regulations prohibit “a nuisance, or a danger to public health and safety”

City Ordinances
  * Odor ordinances
  * Operating licenses
# Identifying the Source of Odors

<table>
<thead>
<tr>
<th>Factors</th>
<th>Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complaint Details</td>
<td>Specific Location &amp; Times</td>
</tr>
<tr>
<td>Weather Conditions</td>
<td>Wind Speed, Direction &amp; Cloud Cover</td>
</tr>
<tr>
<td>Duration</td>
<td>Constant or Transient</td>
</tr>
<tr>
<td>Intensity</td>
<td>Local or Area</td>
</tr>
<tr>
<td>Odor Characteristics</td>
<td>What does it smell like? Used to identify potential compounds</td>
</tr>
<tr>
<td>Industries</td>
<td>What is nearby? Incidents in the area? What type of industries? Potential for odors to travel offsite?</td>
</tr>
<tr>
<td>Air Monitoring &amp; Analysis</td>
<td>What compounds are detected?</td>
</tr>
</tbody>
</table>
Odor Wheels (Compost)

From Rosenfeld, et. al
Water Science & Technology Vol 55 No 5
pp 345–357
Types of Air Monitoring Equipment

- “Handheld” Monitors
  - 5 Gas Meter, Jerome Meter
- Canister Samples
  - Grab Samples
  - Regulated Samples
- Mobile Air Monitoring Lab (MAML)
- LDEQ Ambient Air Station
Monitoring Considerations

* Impact to the Environment & Human Health
* Type of Analysis (Compounds Present)
* Equipment Detection Limits
* Mobility
* Location
* Duration
* Cost
On 4/3/13 Orleans, Jefferson, St. Bernard & Plaquemines Parish EOCs received >100 odor complaints beginning at 1:30am

LDEQ ER & USCG Initiated Investigation
- Facilities, River Traffic, Reported Incidents
- Followed the Odor
- Variable winds, max 25 mph and rain made it difficult to isolate origin of the odor
- Sulfur Odor very present and detected by DEQ
- Air monitoring by DEQ ER throughout response showed no detections for VOCs, SO₂, H₂S within community and where noticeable odors were observed
Chalmette Refinery
WTF Flare Line Spill

- Chalmette Refinery discovered a spill from a pipeline leak at ~7am
- Leak was secured at 7:45am
- Chalmette Refinery notified LDEQ of a waste water spill at ~8am
- Simultaneously Chalmette Refinery was flaring a large amount of SO$_2$
Spill was determined to be flare condensate.

Analysis showed released material was below Reportable Quantity (RQ) for H$_2$S and Benzene.

Contained 245ppm of mercaptans.

- Highly odorous reduced sulfur chemical used in natural gas as an odorizer (~3ppm)
**Odorous Reduced Sulfur Chemicals**

<table>
<thead>
<tr>
<th>Compound</th>
<th>CAS No.</th>
<th>Reporting Limit PPBV</th>
<th>Character</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydrogen Sulfide</td>
<td>7783-06-4</td>
<td>5.00</td>
<td>Rotten eggs</td>
</tr>
<tr>
<td>Carbonyl Sulfide</td>
<td>463-58-1</td>
<td>5.00</td>
<td>Pungent</td>
</tr>
<tr>
<td>Methyl Mercaptan</td>
<td>74-93-1</td>
<td>5.00</td>
<td>Rotten cabbage</td>
</tr>
<tr>
<td>Ethyl Mercaptan</td>
<td>75-08-1</td>
<td>5.00</td>
<td>Rotten cabbage</td>
</tr>
<tr>
<td>Dimethyl Sulfide</td>
<td>75-18-3</td>
<td>5.00</td>
<td>Decayed vegetables</td>
</tr>
<tr>
<td>Carbon Disulfide</td>
<td>75-15-0</td>
<td>2.50</td>
<td>Vegetable sulfide</td>
</tr>
<tr>
<td>Isopropyl Mercaptan</td>
<td>75-33-2</td>
<td>5.00</td>
<td>Skunk</td>
</tr>
<tr>
<td>tert-Butyl Mercaptan</td>
<td>75-66-1</td>
<td>5.00</td>
<td>Skunk</td>
</tr>
<tr>
<td>n-Propyl Mercaptan</td>
<td>107-03-9</td>
<td>5.00</td>
<td>Cabbage</td>
</tr>
<tr>
<td>Ethyl Methyl Sulfide</td>
<td>624-89-5</td>
<td>5.00</td>
<td>Sulfurous, garlic</td>
</tr>
<tr>
<td>Thiophene</td>
<td>110-02-1</td>
<td>5.00</td>
<td>Sweet</td>
</tr>
<tr>
<td>Isobutyl Mercaptan</td>
<td>513-44-0</td>
<td>5.00</td>
<td>Skunk</td>
</tr>
<tr>
<td>Diethyl Sulfide</td>
<td>352-93-2</td>
<td>5.00</td>
<td>Sharp, garlic</td>
</tr>
<tr>
<td>n-Butyl Mercaptan</td>
<td>109-79-5</td>
<td>5.00</td>
<td>Skunk</td>
</tr>
<tr>
<td>Dimethyl Disulfide</td>
<td>624-92-0</td>
<td>2.50</td>
<td>Putrid, decayed vegetables</td>
</tr>
<tr>
<td>3-Methylthiophene</td>
<td>616-44-4</td>
<td>5.00</td>
<td>Sharp, pungent</td>
</tr>
<tr>
<td>Tetrahydrothiophene</td>
<td>110-01-0</td>
<td>5.00</td>
<td></td>
</tr>
<tr>
<td>2,5-Dimethylthiophene</td>
<td>638-02-8</td>
<td>5.00</td>
<td></td>
</tr>
<tr>
<td>2-Ethylthiophene</td>
<td>872-55-9</td>
<td>5.00</td>
<td></td>
</tr>
<tr>
<td>Diethyl Disulfide</td>
<td>110-81-5</td>
<td>2.50</td>
<td>Rotten cabbage</td>
</tr>
<tr>
<td>Dimethyl Trisulfide</td>
<td>3658-80-8</td>
<td>2.50</td>
<td></td>
</tr>
</tbody>
</table>

- Source of many complaints received in LA
- Common with petroleum/hydrocarbon processing
- Odor threshold is below detection limit of most equipment
Detection Limits for Sulfur Compounds

<table>
<thead>
<tr>
<th>Compound</th>
<th>AreaRae</th>
<th>Jerome</th>
<th>MAML AA Analyzers</th>
<th>ASTM 5504-12</th>
<th>EPA TO-16</th>
</tr>
</thead>
<tbody>
<tr>
<td>H2S</td>
<td>0.1 ppm (100 ppb)</td>
<td>4 ppb</td>
<td>0.4 ppb</td>
<td>5 ppb</td>
<td>NA</td>
</tr>
<tr>
<td>SO2</td>
<td>0.1 ppm (100 ppb)</td>
<td>NA</td>
<td>0.4 ppb</td>
<td>NA</td>
<td>3 ppb ^</td>
</tr>
<tr>
<td>VOC*</td>
<td>0.1 ppm (100 ppb)</td>
<td>NA</td>
<td>0.01 ppm **</td>
<td>NA</td>
<td>.2 - 25 ppb ***</td>
</tr>
</tbody>
</table>

*Benzene is included as VOCs, **detection limit is for NMOC, *** VOCs have varying detection limits in ppb range.
^ Detected as a TIC (Tentatively Identified Compound)
Odor Threshold vs Detection Limits
Reduced Sulfur Compounds

- Hydrogen Sulfide
- Methyl Mercaptan
- Ethyl Mercaptan
- Dimethyl Sulfide
- Isopropyl Mercaptan
- tert-Butyl Mercaptan
- n-Propyl Mercaptan
- n-Butyl Mercaptan
- Dimethyl Disulfide
- Dimethyl Trisulfide

**ASTM 5504 Reporting Limit (ppbv)**

**Odor Threshold (ppbv)**
Federal Exposure Guidelines for Sulfur Compounds

<table>
<thead>
<tr>
<th>CDC ATSDR MRLs</th>
<th></th>
<th></th>
<th></th>
<th></th>
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<tr>
<td>*CDC ATSDR MRL</td>
<td>HYDROGEN SULFIDE</td>
<td>Inh.</td>
<td>Resp.</td>
<td>Acute</td>
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<td>Acute</td>
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*Exposure Durations:
- MRLs are derived for acute (1 - 14 days)
- Intermediate (>14 - 364 days)
- Chronic (365 days and longer)

**EPA NAAQS** = Federal Ambient Air Quality Regulations

**CDC ASTDR MRLs** = Federal Exposure Guidelines

<table>
<thead>
<tr>
<th>Sulfur Dioxide</th>
<th>Time</th>
<th>Level</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>primary</td>
<td>1-hour</td>
<td>75 ppb</td>
<td>99th percentile of 1-hour daily maximum concentrations, averaged over 3 years</td>
</tr>
<tr>
<td>secondary</td>
<td>3-hour</td>
<td>0.5 ppm</td>
<td>Not to be exceeded more than once per year</td>
</tr>
</tbody>
</table>

No EPA NAAQS for H2S
Hurricane Isaac flooded the area with up to 12 feet of water.

Parish officials brought in additional temporary drainage pumps.

On 9/11/12 workers at temporary pumps station experienced nausea, headache, eye and respiratory inflammation, and strong offensive odors.

LDEQ ER and State Police responded.

As pumps were turned off, $\text{H}_2\text{S}$ readings declined.

Incident raised awareness of previously unknown hazard.
Difficulties During Odor Investigations

- “Normal” Odor vs Nuisance Odor
- Subjective
- Vague complaints from citizens
- Vague incident reports from industry
- Difficult to quantify
- Difficult to determine source
- Often not from a permitted emission point
- Multiple contiguous facilities
Communicating with the Community During Odor Incidents

Lessons Learned

* Problems
  * Louisiana has many neighborhoods and major metropolitan areas in close proximity to industrial activities
  * Odors commonly misperceived to be indicative of toxic chemical releases
  * Potential health effects not understood by or communicated to impacted communities

* Solutions
  * Up to date, clear communication of information
    * Hotline setup by Responsible Party (RP), press releases
  * Additional community monitoring
    * Data compared to exposure guidelines
503 complaints have been received by LDEQ 1/1/2014 - 10/28/2014

Need for better incident reporting and communication with DEQ regional office

Air monitoring data is the only quantitative information available to satisfy community concerns
Questions?

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