ODOUR MANAGEMENT ON SUEZ ENVIRONNEMENT’S COMPOSTING SITES

Jean-Luc MARTEL, Pascal DAUTHUILE, Elena SENANTE

CIRSEE – SUEZ ENVIRONNEMENT

PERUGIA ISWA BEACON CONFERENCE  10/05/06
SUEZ ENVIRONNEMENT, activity branch of SUEZ, supplies services and equipment essential to life and to the protection of the environment in the fields of:

- WATER
- WASTE

By contributing to the sustainable development of its clients, municipalities and industries.
The Suez Environnement Group has a cross-disciplinary approach.

The numerous odour sources: activities map

- **Waste water**
  - Pumping stations
  - Waste water treatment plants
  - Sludge storage
  - Road haulage: tanker lorries

- **Waste collection**
  - Road haulage

- **Composting/Methanization MBT**
  - MSW: Municipal Solid Waste; Green Waste, Bio-waste
  - ICW: Industrial and Commercial Waste
  - Hazardous Waste (which have their own transport and treatment procedures)
  - Recovery of sludge by addition of bulking agents and stabilization
  - Recovery of GW and BW by composting or methane treatment
  - Spreading compost as an amendment

- **Sludge and waste storage and treatment**
  - Landfills

- **Thermal treatment**
  - Sludge thermal drying
  - Incineration: MSW, ICW, Hazardous waste, Sludge (bottom ash)

(1) Spreading pasty sludge has become more and more difficult since the end of the 90ies

10/05/2006
Odour management on Suez Environnement's composting sites
ISWA BEACON PERUGIA
An odour is…

… the **SENSATION** that results when olfactory receptors in the nose are stimulated by particular chemicals in gaseous form.

It is very difficult to assess a sensation!!!

…so we use techniques to quantify and qualify this sensation

An extra difficulty is that odours cannot be added:

\[ \text{Odour A} + \text{Odour B} \neq \text{Odour A + B} \]
SE Strategy for Odours Management

- Setting up residents committees

- Assessment of the olfactory nuisance of the site and its impact on the environment (dispersion modelling)

- Determination of the acceptable emissions level on the site

- Application of design and treatment good practices, implementation of operation good practices
Our SE approach to anticipate the impact: determination of the acceptable emission level on site.

Characteristics of the source (height, emission limits)

MODELLING

No olfactory nuisance at the resident’s doorstep
The main composting reactors

- Natural ventilation
- Natural ventilation with turning
- Forced ventilation
- Forced ventilation with turning

**Open reactors**
- Turned windrows
- Ventilated boxes
- Ventilated piles
- Corridors

**Closed reactors**
- Containers
- Covered piles
- Tunnels

10/05/2006 Odour management on Suez Environnement’s composting sites ISWA BEACON PERUGIA
The main composting processes

<table>
<thead>
<tr>
<th>Reception</th>
<th>Mixing</th>
<th>Open reacteurs ou</th>
<th>Screening</th>
<th>Curing/Storage</th>
</tr>
</thead>
<tbody>
<tr>
<td>+ Aeraulics</td>
<td>+ Deodorization + Treatment of Effluents</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The main composting processes: Reception, Mixing, Open reacteurs ou, Screening, Curing/Storage, + Aeraulics, + Deodorization, + Treatment of Effluents.
EXAMPLE: The LUR BIZIA composting site, France
Odour management: stakes

- Twenty odd houses within 1km
- A hilly relief in a rural area
- Frequent variations in atmospheric conditions
- An immediate opposition to the « sludge facility »
- The support of local administrations in compensation for a commitment not to produce any olfactory or visual nuisance
Odour management : technical solution

GOAL : absence of olfactory nuisance in the close environment

ELABORATION OF THE SOLUTION in this context :

- Modelling the impact of the odour flows emitted by the production centre

IMPLEMENTATION OF THE SOLUTION in this context :

- Management of the process in the reactor, confinement, collection and treatment of all odorous air
- Canalized emissions of collected and treated odorous airflows fixed to 800 OU/m³ maximum *

(Local reglementation after modelling carried out by EOG an independant study office)

* : the odour concentration in UO/m³, number of dilutions after which the odour is detected by 50% of the panel

Standard CEN 13725
Confinement of the production center:
1. Isolation of the sludge reception area
Confinement of the production centre:
2/ isolation of the building
Confinement of the production center:

3/ Collection of the ambient air

23068 Lyonnaise des eaux - Site de Bardos - Schéma aéraulique

10/05/2006 Odour management on Suez Environnement’s composting sites

ISWA BEACON PERUGIA
Confinement of the production center

4. Process management

collection of the air emitted by the reactors
ODOUR EMISSIONS measurements at the reactor level: sampling points

Fermentation boxes

Convective air

Composting boxes

Process air
<table>
<thead>
<tr>
<th>Compound</th>
<th>Sampling method</th>
<th>Analytical method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ammonia</td>
<td>Acid bubbler</td>
<td>Colorimetry (with indophenol) for NH₃&lt;150mg/L</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Distillation + acidimetry (French Standard Method NF T 90-015-1) for NH₃&gt;150mg/L</td>
</tr>
<tr>
<td>Amines</td>
<td>Acid bubbler</td>
<td>GC – NPD (Nitrogen Phosphorus Detector)</td>
</tr>
<tr>
<td>Aldehydes and ketones</td>
<td>DNPH solution bubbler</td>
<td>HPLC coupled with UV detector</td>
</tr>
<tr>
<td>Sulfur compounds</td>
<td>Tedlar bag</td>
<td>GPC – electrochemical detector</td>
</tr>
<tr>
<td>Volatile fatty acids</td>
<td>Activated carbon cartridge</td>
<td>Desorption with 1mL CS₂. GC – FID (Flame Ionization Detector)</td>
</tr>
</tbody>
</table>
The compounds detected were divided into two categories:
- Ammonia, amines and aldehydes and ketones: the peak emissions took place very early in the cycle (days 1-3).
- Sulfur compounds and volatile fatty acids: the peak emissions appeared late in the convective air (days 8-12).
Main Odorous compounds emitted and Relative contribution to the overall emissions

Proportion of mass flow of each compound compared to total mass flow of odourous compounds detected

**Process air: Campaigns 1, 2, 3**

- **Campaign 1**
  - Ammonia: 7%
  - Amines: 7%
  - Aldehydes and ketones: 2%
  - Methylmercaptan: 2%
  - Ethylmercaptan: 2%
  - Dimethylsulfide: 1%
  - Hydrogen sulfide: 1%
  - Volatile fatty acids: 89%

- **Campaign 2**
  - Ammonia: 6%
  - Amines: 1%
  - Aldehydes and ketones: 1%
  - Methylmercaptan: 3%
  - Ethylmercaptan: 1%
  - Dimethylsulfide: 1%
  - Hydrogen sulfide: 1%
  - Volatile fatty acids: 91%

- **Campaign 3**
  - Ammonia: 4%
  - Amines: 1%
  - Aldehydes and ketones: 3%
  - Methylmercaptan: 2%
  - Ethylmercaptan: 1%
  - Dimethylsulfide: 1%
  - Hydrogen sulfide: 1%
  - Volatile fatty acids: 90%

**Convective air: Campaigns 1, 2, 3**

- **Campaign 1**
  - Ammonia: 97%
  - Amines: 1%
  - Aldehydes and ketones: 1%
  - Methylmercaptan: 1%
  - Ethylmercaptan: 1%
  - Dimethylsulfide: 2%
  - Hydrogen sulfide: 2%
  - Volatile fatty acids: 1%

- **Campaign 2**
  - Ammonia: 1%
  - Amines: 2%
  - Aldehydes and ketones: 91%
  - Methylmercaptan: 1%
  - Ethylmercaptan: 1%
  - Dimethylsulfide: 1%
  - Hydrogen sulfide: 1%
  - Volatile fatty acids: 6%

- **Campaign 3**
  - Ammonia: 7%
  - Amines: 1%
  - Aldehydes and ketones: 1%
  - Methylmercaptan: 1%
  - Ethylmercaptan: 1%
  - Dimethylsulfide: 1%
  - Hydrogen sulfide: 1%
  - Volatile fatty acids: 90%
Impact in terms of odours

<table>
<thead>
<tr>
<th>Compound</th>
<th>Ammonia</th>
<th>Amines (TMA)</th>
<th>H₂S</th>
<th>Me-SH</th>
<th>Et-SH</th>
<th>DMS</th>
<th>Aldehydes &amp; ketones (Acetaldehyde)</th>
<th>VFA (Propionic acid)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Threshold Odour Concentration</td>
<td>0,4</td>
<td>0,00116</td>
<td>0,012</td>
<td>0,0034</td>
<td>0,0021</td>
<td>0,003</td>
<td>0,10</td>
<td>0,53</td>
</tr>
</tbody>
</table>

Relative contribution to the overall odours
Odour dispersion modelling

5 OU/m³ percentile 98% $\rightarrow$ < 800 OU/m³ at the source

(Local regulation following the modelling study carried out by EOG)

10/05/2006 Odour management on Suez Environnement’s composting sites ISWA BEACON PERUGIA
Odour treatment:
Main technologies

- Scrubbers
  - Acid
  - Caustic
  - Bleach

- Biofilters
  - Mineral
  - Organic

- Other technologies
  - Ozone
  - Active Carbon
  - Cold plasma
  - Photocatalysis
  - RTO
The odour treatment:
Odour treatment implemented at Lur Bizia

- 2 identical treatment lines in parallel
- Chemical and biological treatment in 3 stages

Air to be treated

Bleach-caustic scrubber stage  Biofiltration stage  Acid scrubber stage

Air to be treated

10/05/2006  Odour management on Suez Environnement’s composting sites  ISWA BEACON PERUGIA
The odour treatment:
Odour treatment implemented at Lur Bizia

Bleach-caustic scrubber stage

Biofiltration stage

Acid scrubber stage
Odour treatment – Example of performance criterion: odour concentration

**Compounds removed:**
- COV
- Sulfur Compounds (refinement)

**Global Removal Rate in OU:** > 97%

**Acid scrubber stage:**
- Process air: 130,000 OU/m³
- Convective air: 7,500 OU/m³
- Ambient air kitchen: 2,300 OU/m³
- Ambient air fermentation: 3,400 OU/m³

**Compounds removed:**
- Ammonia
- Amines

**Bleach – caustic scrubber stage:**
- Compounds removed:
  - Sulfur compounds
  - Ammonia and amines (refinement)

**Biofiltration stage:**
- Process air: 7,100 OU/m³
- Convective air: 9,900 OU/m³

**Ambient air kitchen:**
- 3,400 OU/m³

**Ambient air fermentation:**
- 7,500 OU/m³

**Process air:**
- 130,000 OU/m³
Respectful approach of the environment and of the residents:

- Limitation of the odorous emissions at the source
- Choice of the appropriated process
- Canalization and treatment adapted to the local situation
A common approach to all SUEZ ENVIRONNEMENT’s activities

Absence of odour nuisance at the resident’s doorstep

- Sewage treatment
- Sludge valorization
- Waste management