Evaluation of Biosolid Aerosols for *Staphylococcus aureus*

Charles P. Gerba
Patricia A. Rusin
Sheri I. Maxwell
John P. Brooks
Ian L. Pepper
**Staphylococcus aureus**

- Gram positive coccus
- Commonly found within nose of healthy people
- Can result in minor or major skin infections
- To date, no scientific data or epidemiological study has been published linking *S. aureus* to land application of biosolids
THE STAPHYLOCOCCUS STORY: ALLEGATIONS

- *S. aureus* is found in biosolids
- *S. aureus* from biosolids results in adverse public health affects
- *S. aureus* from land applied biosolids has resulted in deaths
- Irritant chemicals increase host susceptibility (no scientific evidence)
## Exposures to *Staphylococcus Aureus*

<table>
<thead>
<tr>
<th>Carriers</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Children</td>
<td>25</td>
</tr>
<tr>
<td>Adults</td>
<td>20–40</td>
</tr>
<tr>
<td>Physicists</td>
<td>50</td>
</tr>
<tr>
<td>Hospital Workers</td>
<td>90</td>
</tr>
<tr>
<td>Occurs in household dust</td>
<td>Not known</td>
</tr>
</tbody>
</table>
Biosolid
↓
M *Staphylococcus* Enrichment Broth
↓
Mannitol Salt Agar and Baird Parker Medium
↓

*Staphylococcus* confirmation:
- gram positive
- catalase positive
- coagulase positive
- slide coagulase positive
- resistant to polymyxin B
- cocci
**S. AUREUS RESEARCH AT THE UNIVERSITY OF ARIZONA**

- Samples collected from 14 sites across the United States, SW USA to East Coast
- Five sewage samples
- 23 different biosolid samples
- 27 aerosol samples from land application sites
TYPES OF BIOSOLIDS ANALYSED

Class B

- Anaerobic mesophilic digestion
- Aerobic mesophilic digestion
- Aerobic mesophilic digestion, lime
- Anaerobic mesophilic digestion, lime

Class A

- Thermophilic aerobic digestion
- Anaerobic thermophilic digestion
- Heat dried pellets made after anaerobic mesophilic digestion
- Heat dried pellets made from undigested sewage
- Heat dried pellets following anaerobic mesophilic digestion
- Heat dried pellets from mixture of undigested thickened primary and thickened waste activated sludge
- Composted aerobic pile
AEROSOL SAMPLES

- 2 m downwind of liquid spray biosolids
- 23 m downwind of hopper applying biosolids
- 29 m downwind of hopper applying biosolids
- 11 m downwind of truck unloading biosolids
- 2 m downwind of loading biosolids into hopper
Triplicate
Biosolids spreader is a point source for short distances (1m)

(Microorganisms aerosolized/meter) • (meters driven) =

Total microorganisms aerosolized
Tucson Operation

- 4,250 gal Betterbuilt® spray tanker
  - Traveling @ 3 mph
Mojave, AZ Operation

- Application Method – Slinger
  - Sling Biosolids – 60–90’
Solano, CA Operation

- Application Method – Hopper
  - Spread Biosolids
Unloading
Loading
S. aureus found in 3 of 5 sewage samples (60% incidence)

S. aureus never detected in 23 biosolid samples (8 Class A and 15 Class B) (0% incidence)

S. aureus never detected in 27 bioaerosol samples (0% incidence)

Limit of Detection less than 30 per 100 gram of biosolids
This study provides scientific evidence for the absence of *S. aureus* in land applied biosolids. It shows that biosolids are not a source of *S. aureus* human exposure. Therefore, biosolids cannot be a source of *S. aureus* infection in humans.
LATEST ALLEGATION

- Irritant chemicals increase host susceptibility to *Staphylococcus aureus* infections
- *S. aureus* ubiquitous

PURE SPECULATION

- No precedent for this phenomenon
- No documented evidence in the literature