Operational Methyl Bromide Recapture Systems

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## Summary – Emission Reduction

<table>
<thead>
<tr>
<th>Mass Emitted</th>
<th>Maximum Concentration</th>
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</thead>
<tbody>
<tr>
<td>Without Recapture 19.6 lbs</td>
<td>Without Recapture 16,000 ppm</td>
</tr>
<tr>
<td>With Recapture 4.2 lbs</td>
<td>With Recapture 500 ppm</td>
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</table>

=79% Reduction

=97% Reduction
Estimated Emissions

Assumptions:
- 40 ft. container with 40,000 lbs commodity
- 5,000 cubic feet fumigated space
- MeBr concentration of 4 lb/1000 cubic feet
- 20 lbs methyl bromide applied

Total Emission 4.2 lbs over 3-4 hours
D/FW International Perishable Treatment Center

Recapture system - left view

Recapture system - right view
Well-Pict Strawberries Watsonville, CA

Carbon adsorber canister containing 2,500 lb. activated carbon

Recapture system showing carbon canister, blower, and exhaust stack
George Bush International Airport, Houston

Treatment and Inspection building

Methyl Bromide Recapture System
System Schematic

- **Fumigation Chamber**
  - MB
- **Adsorber**
  - Air with MB
  - Carbon with 10% MB
  - Make-up carbon as needed
- **Desorber**
  - Air with <500 ppm MB
- **Thermal Destruction**
  - MB

**MB Production**

**Bromine Production**

**Located at fumigation facility**

**Located at carbon regeneration site**

- MB
  - \( \text{Br}_2 \)
  - HBr
Recapture System Development

Conducted under a Cooperative Research and Development Agreement with USDA-ARS and GFK Consulting, 1995-99

Lab and Pilot Work at ARS Lab in Fresno, CA with Dr. James Leesch

Mobile unit built by Tigg Engineering and tested at fumigation facilities on the East and West Coasts
Fumigation Procedure

- Container is in place and covered with tarp
- Introduce fumigant into tarped space, monitor concentration
- At the end of the fumigation period, open the tarp and begin recovery ventilation
- When concentration reaches target concentration (250-500 ppm) as indicated by detectors, switch to bypass ventilation
- When concentration reaches 5 ppm, cease ventilation and remove tarp and commodity
Concentration Profiles

- Fumigation period
- Begin Aeration
- Switch to bypass at 500 ppm
- ~5 ppm from fumigation bay
- ~1 ppm from adsorber exhaust
- Terminate aeration at 5 ppm

MeBr Concentration, ppm

Time, Minutes

Note log scale
Typical Fumigation - Assumptions

- 40 ft. container with 40,000 lbs commodity
- 5,000 cubic feet fumigated space
- MeBr concentration of 4 lb/1000 cubic feet
- 20 lbs methyl bromide applied
Estimated Emissions - Fumigation

- Leakage through tarp – 1.0 lbs (5%) estimated
- Absorbed onto commodity and packaging – 4 lbs estimated

Flowchart:
- Leakage through tarp
- Absorbed onto commodity and packaging
- Emissions directed to the right
Estimated Emissions

- Aeration
  (Recapture)

14.4 lbs to adsorber
Estimated Emissions - Aeration (Bypass)
Material Balance

0.4 pounds

4.2 pounds

15.4 pounds
Estimated Emissions

Assumptions:
- 40 ft. container with 40,000 lbs commodity
- 5,000 cubic feet fumigated space
- MeBr concentration of 4 lb/1000 cubic feet
- 20 lbs methyl bromide applied

Total Emission 4.2 lbs over 3-4 hours
Summary – Emission Reduction

**Mass Emitted**

- Without Recapture: 19.6 lbs
- With Recapture: 4.2 lbs

**Maximum Concentration**

- Without Recapture: 16,000 ppm
- With Recapture: 500 ppm

=79% Reduction

=97% Reduction