

Structural and Commodity Fumigation/Fumigants

What and Why?

- What is the definition of a fumigant?
- Why Fumigate?

What is the goal of fumigation?

- Provide a high level of control of a variety of target pests regardless of their life stage, wherever they are located in the structure, container and product
- Provide this control without significant risk of contamination, reduced product quality, damage, non-target toxicity, or adverse environmental effects

What properties define a good fumigant?

Quality Desired

- Provide a high level of control of a variety of target pests regardless of their life stage

Property Needed

→ Broad-spectrum toxicity

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Properties Needed

- Good penetration...
- Small molecule
- High vapor pressure
- Low Sorption

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Properties Needed

- Low sorption
- Quick aeration
- Low reactivity
- Not corrosive if used properly
- Confineable
- Favorable environmental profile

What Is the Objective of a Fumigation?

Control the Target Pest to the Satisfaction of the Customer

- Control of Target Pests(s):
 - Up to 100% Control
 - All Life Stages (usually)
 - In Commodity, In Building
- Tolerances Not Exceeded
- No Health Issues
- Complete the Job on Time

Factors Affecting Dosage

Biological
factors

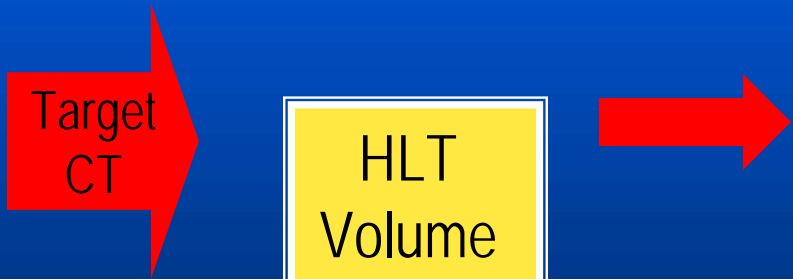
Site
factors

Pest Species
Pest Life Stages
Pest Control Goal
Temperature
Exposure Time

Target
CT

HLT
Volume
Loading

Lbs of
Fumigant per
1000 ft³



Fumigants for Today's Discussion

- Phosphine (PH_3), Methyl Bromide (CH_3Br), Sulfuryl Fluoride (SO_2F_2),
- PH_3 and MB primarily used for commodities, food industry fumigation and quarantine
- Vikane™ (SO_2F_2) gas fumigant (non-food commodity)
- ProFume™ (SO_2F_2) gas fumigant for commodity and food industry use
- Others (Not Covered)
 - CO_2
 - Chloropicrin (CCl_3NO_2)
 - Ethyl formate, cyanogen, Propylene Oxide, COS, Ozone

Methyl Bromide

- CH_3BR
- “Industry Standard” widely accepted
- Broad spectrum
- Colorless, Odorless, 3.3 times heavier than air
- Relatively fast acting, killing insects in a few hours
- Available as a liquid in a pressurized (60 psi) cylinders
- Available in various volumes
- Universal Tolerance
- Cost consideration

Sensitive Materials affected by Methyl Bromide

- Pets (including fish and birds)
- Seeds, bulbs, and live plants
- Rubber goods (natural latex)
- Articles containing Sulfur (creates odor)
- High fat content food (>6%)
- Charcoal

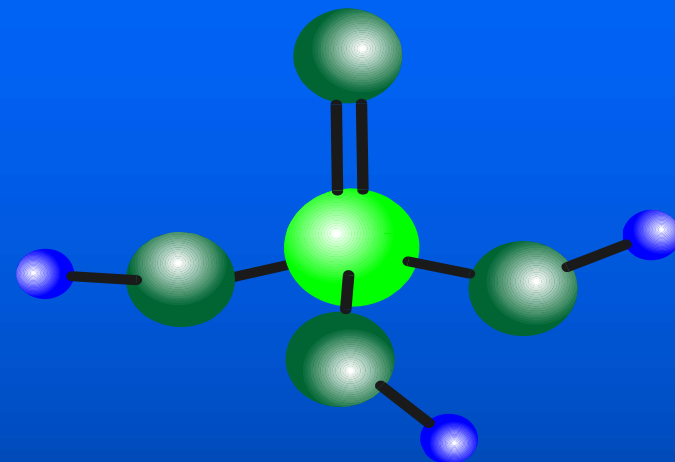
Methyl Bromide Disadvantages

- Ozone depletion
- Odorless, colorless gas
- Needs recirculation fans
- Aerates slowly at times
- Residue buildup possible with multiple fumigations
- Can cause burning upon contact with the skin in the liquid form
- Pupal stages are tolerant to MB than other stages
- At high temp., MB generates hydrobromic acid
- Penetration low compared to other fumigants (sorption)
- Under close scrutiny – Phase out
- Diminishing Supply - Montreal Protocol
- MB re-registration



Phosphine

- PH_3
- Boiling point = -87°C
- Molecular weight = 34.04
- Specific gravity = 1.2, air = 1
- Vapor pressure = 34.2 atm, 20°C
- Explosion point = 1.79% volume, or 17,900 ppm



Phosphine Packaging

- Tablets
 - 500 ea/flask, 14 flasks/case
- Pellets
 - 1660 ea/flask, 21 flasks/case
- Prepac Tablets
 - 33 tablets/prepac, 48 prepacs/pail
- Prepac Rope
 - 1056 Tablets/Rope



Phosphine pellets & tablets



- Pellets 0.6 grams of aluminum phosphide
 - releases 0.2 grams phosphine
- Tablets 3.0 grams of aluminum phosphide
 - releases 1.0 grams phosphine
- Prepacs 100 grams of aluminum phosphide
 - releases 33.0 grams of phosphine

Phosphine



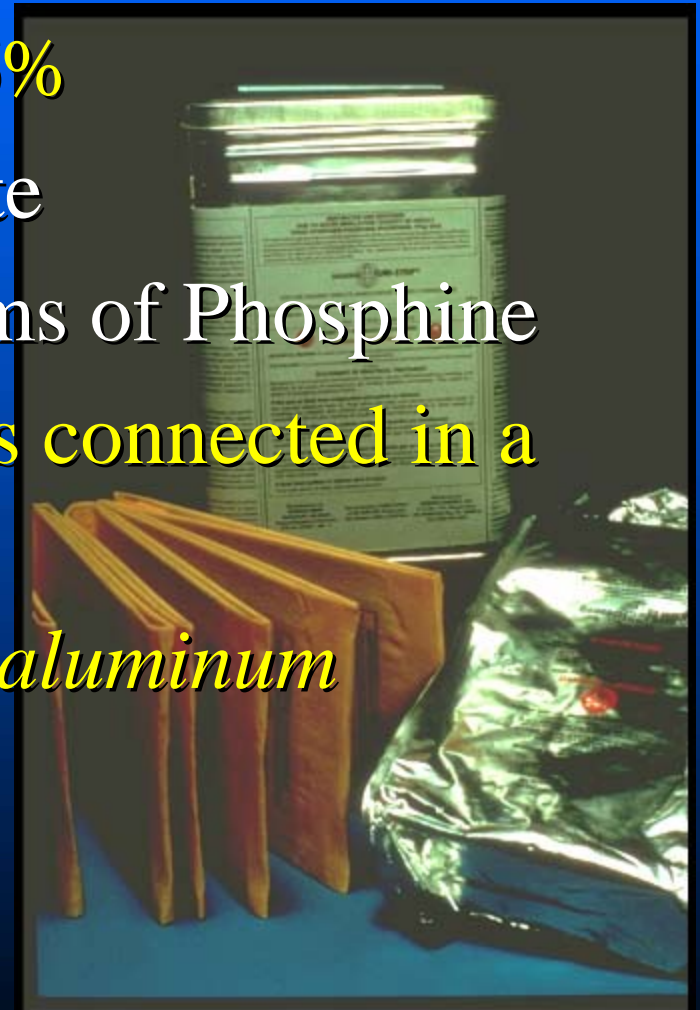
Phostoxin® Pre-Pacs

- 33 tablets in a moisture permeable material
- Spent residue is left contained
- Dust must not contact processed foods



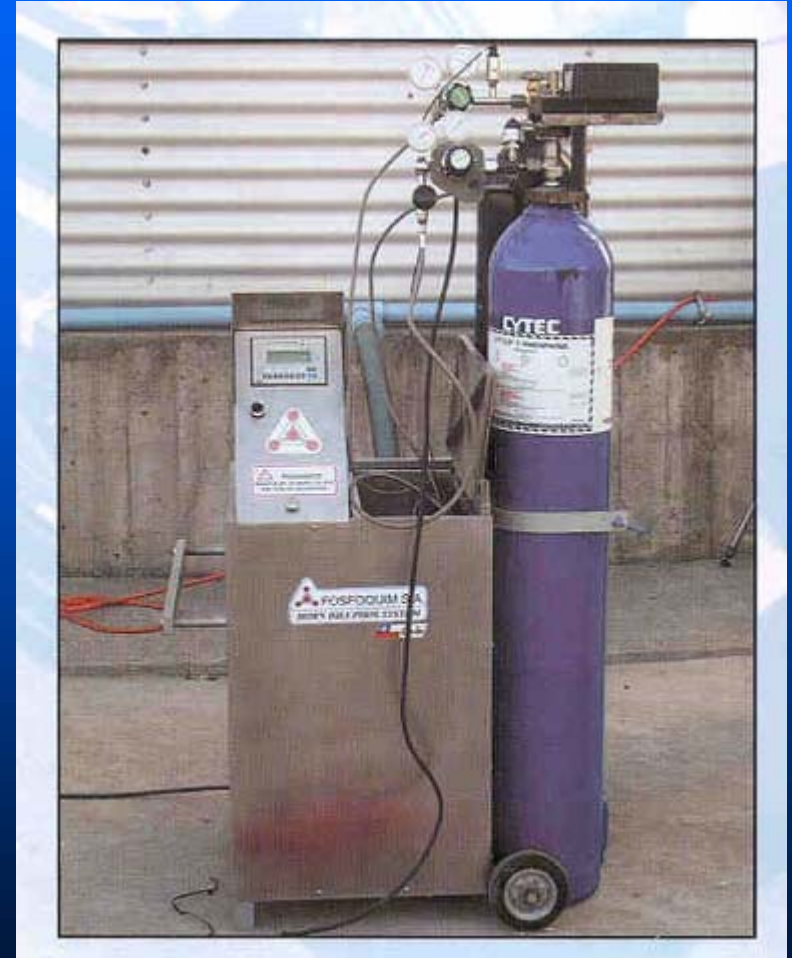
Fumi-cels & Fumi-strips

- Magnesium Phosphide 56%
- No Ammonium Carbamate
- Fumi-cel liberates 33 grams of Phosphine
- Fumi-strip is 20 Fumi-cels connected in a long strip
- *Much more reactive than aluminum phosphide*



Cylinderized PH₃

- EcoFume
 - PH₃ + CO₂
 - Value - Controlled dosing
- VAPORPH3OS (99.3% PH₃)
- Delivery System
 - Diluphos delivery system
 - Mix gas with air, special training required
 - Fosfoquim Phosphine Monitor – IR, continuous reading



Phosphine Disadvantages

- Minimum exposure period of 24 hrs.
- Signs of some resistance
- Highly flammable if not used properly
- Corrosive to certain metals



Sulfuryl Fluoride

- Inorganic, colorless, odorless
- Nonflammable, noncorrosive
- Essentially non reactive
- As Vikane® gas fumigant, primarily used for structural fumigation
- Control of drywood termites and other WDO and rodents
- As ProFume® gas fumigant, used in commodity and food handling establishments

Key Benefits of ProFume

- Broad-spectrum, effective and reliable control of all pest life stages
- Non-Corrosive to equipment or electronics
- Non-Flammable
- Low reactivity (no odor potential or off flavors)
- Excellent penetration & rapid aeration
- Does not deplete ozone -sustainable chemistry
- Flexibility to optimize current schedules and downtime

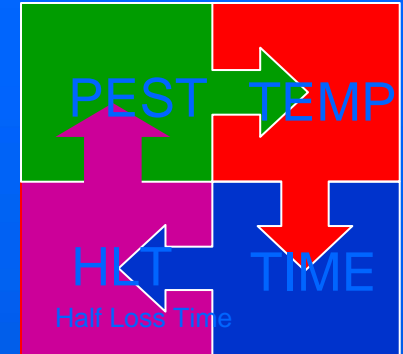


ProFume Use Pattern

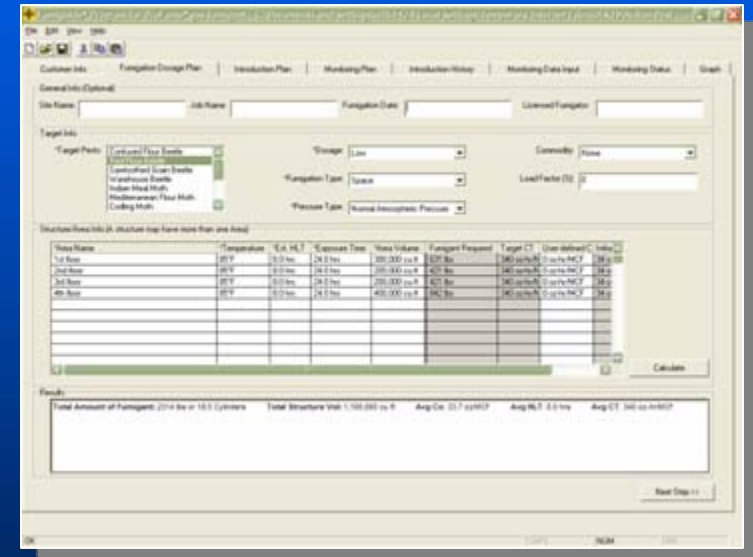
- Non-residential structures
- Stationary transportation vehicles (railcars, shipping containers, trucks, etc., excluding aircraft)
- Temporary and permanent fumigation chambers
- Storage structures
- Food handling establishments (e.g., pet food facilities, bakeries, food production facilities, mills, warehouses, etc.)



Precision Fumigation™: Fumiguide™ Program



- A MS-Windows based program
- Dosage calculation tool:
 - Based on pest species, desired level of control temperature, exposure time, volume and load factor, HLT
 - Gives gas introduction instructions
- Allows “what if” scenarios to help fumigators and customers
- Records fumigation data and produces reports and graphs
- Takes the guesswork out of fumigation



Fumigant Stewardship Programs

- ❑ Needed for long term viability of fumigants
- ❑ Emphasis on safety
- ❑ Varied from product to product. Generally provided by manufacturers or their representatives
- ❑ Fumigation Management Plans

Fumigation Management Plan

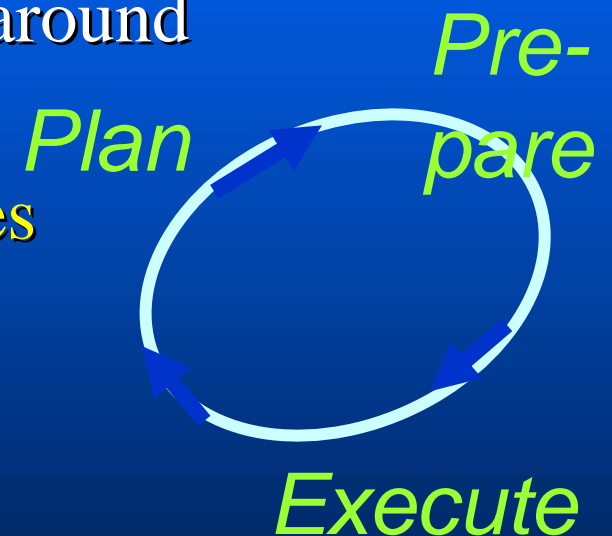
#1. **Plan with the end in mind** - sealing and introduction plan should be developed around aeration plan

#2. Use responsible stewardship at all times

#3. No two fumigation jobs are alike

#4. Fumigation must:

- Effectively control the pests
- Not cause undue risk to people or property
- Be practical within given time constraints



Questions