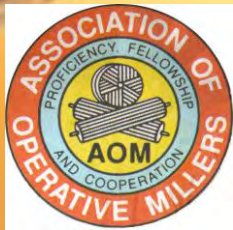


International Association of Operative Millers

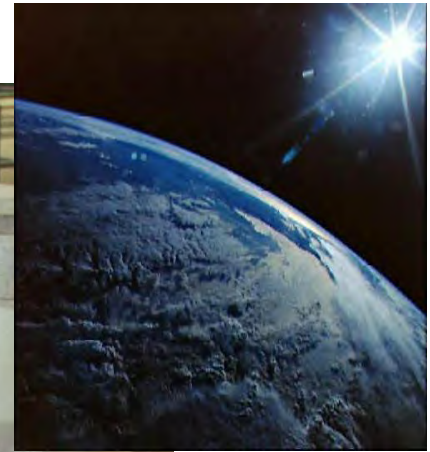
Arusha, Tanzania

David Mueller
Fumigation Update
Sulfuryl fluoride, methyl bromide,
phosphine



IAOM – Fumigation Update

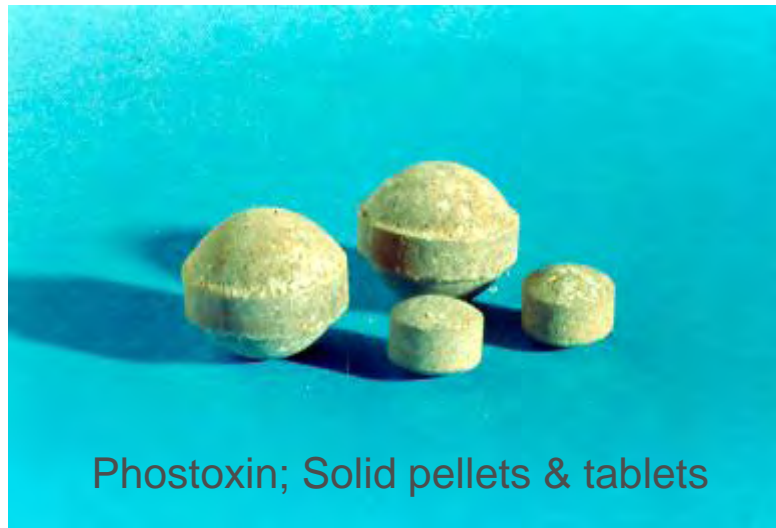
Methyl Bromide Phase Out....



IAOM – Fumigation Update

Phosphine

Cylinderized phosphine and solid phosphine formulations.



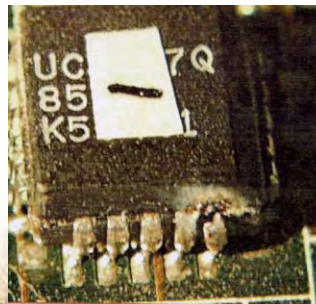
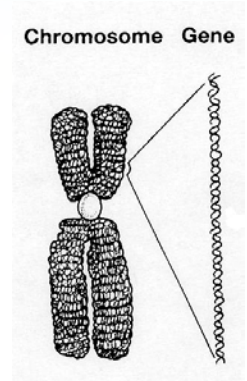
Phostoxin; Solid pellets & tablets



ECO₂FUME; Australian invention to control phosphine release

Phosphine Update

- Used to fumigate commodities worldwide
- Insect resistance found in Asia, India, Africa, Australia
- Least expensive fumigant
- Label changes
- Corrosive to copper at high concentrations



Phosphine Recirculation...

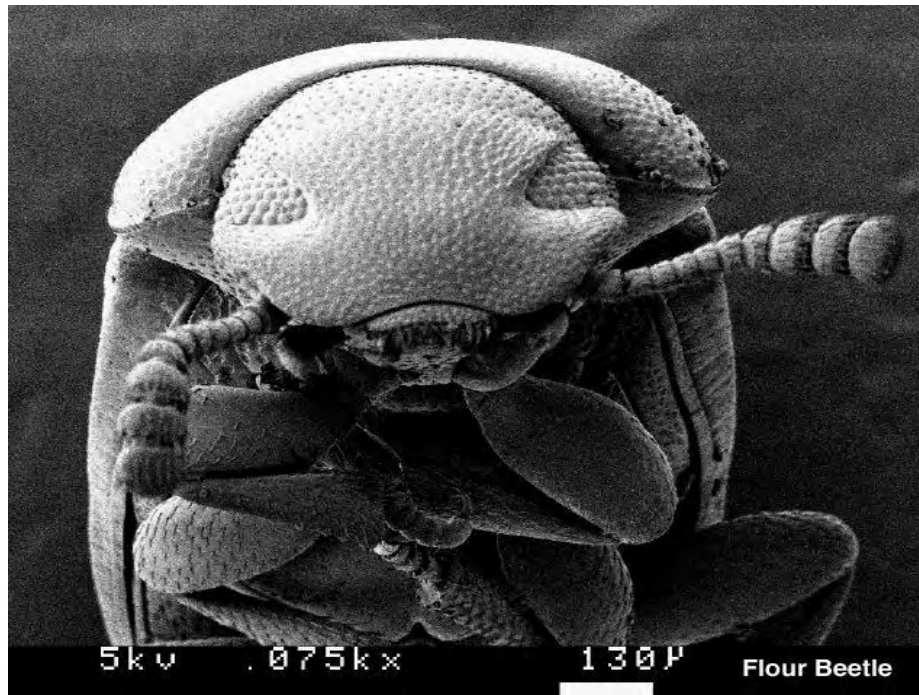
A better way to fumigate grain

- Phosphine is placed on top of the grain and the gas is recirculated upward for to offer even distribution in the bins.
- J-System



IAOM – Fumigation Update

Miller's Target Pest: *Tribolium spp.*



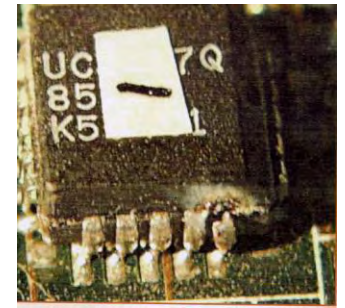
Phosphine and Heat...



*Increased temperature
stresses insects*



Heat – 35 - 40° C
Phosphine – 50 -75 PPM
24 - 30 hours



Warning:
Manage
corrosion

IAOM – Fumigation Update

Methyl Bromide Alternative Projects
Under the Montreal Protocol
(GTZ, UNDP, UNIDO, UNEP, The World Bank)



- Mauritius
- Zimbabwe
- Cote I'vories
- Vietnam
- Philippines
- Thailand
- Jamaica
- Turkey
- Georgia
- *St. Kitts*



- Zimbabwe Grain Depot

IAOM – Fumigation Update

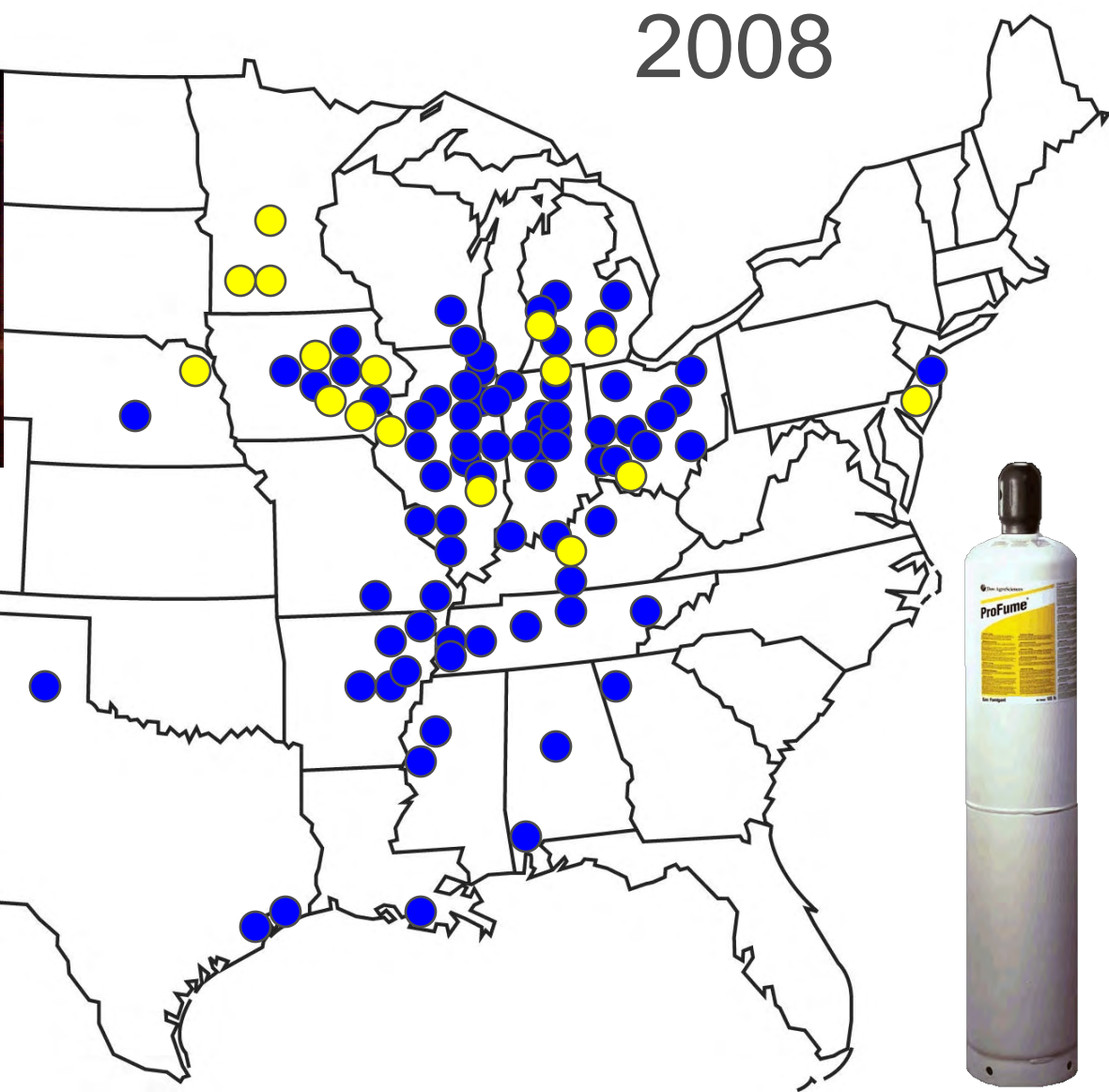
New Sulfuryl Fluoride for flour mills and food factories

USA, German, Chinese SF producers



Mills and warehouses fumigated with sulfuryl fluoride

2008



Mauritius Flour Mill

December 31- January 2, 2008



**Mauritius
Flour Mill**
ProFume* plus
IPM Program



Hands-on Stewardship Training



The FumiGuide™ computer software program helps manage the fumigation. Hardy Henry fumigation crew of Port Lewis and Dow's Suresh P. reviewing fumigant gas readings.

Advantages to Sulfuryl Fluoride

- Not an ozone depleting substance
- Better penetrating gas than MB
- Stewardship program offers a safer fumigation
- Gas cost is similar to MB
- Effective against all stages of insects or rodents



IAOM – Fumigation Update

Purdue University Insect Mortality Study: 99.2% mortality of all stages of *Tribolium*



Table 1. Preliminary evaluation of mortality (%) of RFB life stages under SF or MB fumigation in four different flour mill facilities.

| Facility | Egg | | Larvae | Pupae | Adult |
|----------|----------|-----------|--------|-------|-------|
| | Type I * | Type II * | | | |
| SF 1 | 40.61 | 100 | 100 | 100 | 100 |
| SF 2 | 90.67 | 99.33 | 100 | 100 | 100 |
| SF 3 | NA | 89.47 | 100 | 98.67 | 100 |
| SF 4 | 93.84 | 98.61 | 100 | 100 | 100 |
| SF 5 | 73.81 | 86.46 | 100 | 100 | 100 |
| MB 1 | 68.24 | 70.58 | 100 | 100 | 100 |
| MB 2 | NA | 100 | 100 | 99.6 | 100 |
| MB 4 | 97.62 | NA | 95.1 | 93.63 | 95.1 |

Table 2. Preliminary evaluation of mortality (%) of IMM life stages under SF or MB fumigation in four different flour mill facilities.

| Facility | Egg | | Larvae | Pupae | Adult |
|----------|----------|-----------|--------|-------|-------|
| | Type I * | Type II * | | | |
| SF 1 | 100 | 100 | 100 | 100 | 100 |
| SF 2 | 99.67 | 100 | 100 | 100 | 100 |
| SF 3 | NA | 80.46 | 100 | 100 | 100 |
| SF 4 | 90.65 | 91.67 | 100 | 100 | 100 |
| SF 5 | 98.89 | 87.21 | 100 | 100 | 100 |
| MB 1 | 88.67 | 95.4 | 100 | 100 | 100 |
| MB 2 | NA | 100 | 100 | 100 | 100 |
| MB 4 | 98.61 | NA | 100 | 100 | 100 |

*** Mortality Definitions**

- Type I : Unhatched eggs even if they died before adult stage.
- Type II : A hatched egg that couldn't successfully make it to the adult stage.
This included unhatched eggs and eggs that hatched but fail to reach adulthood.

IAOM – Fumigation Update

Good Penetration of Shifters and Wood

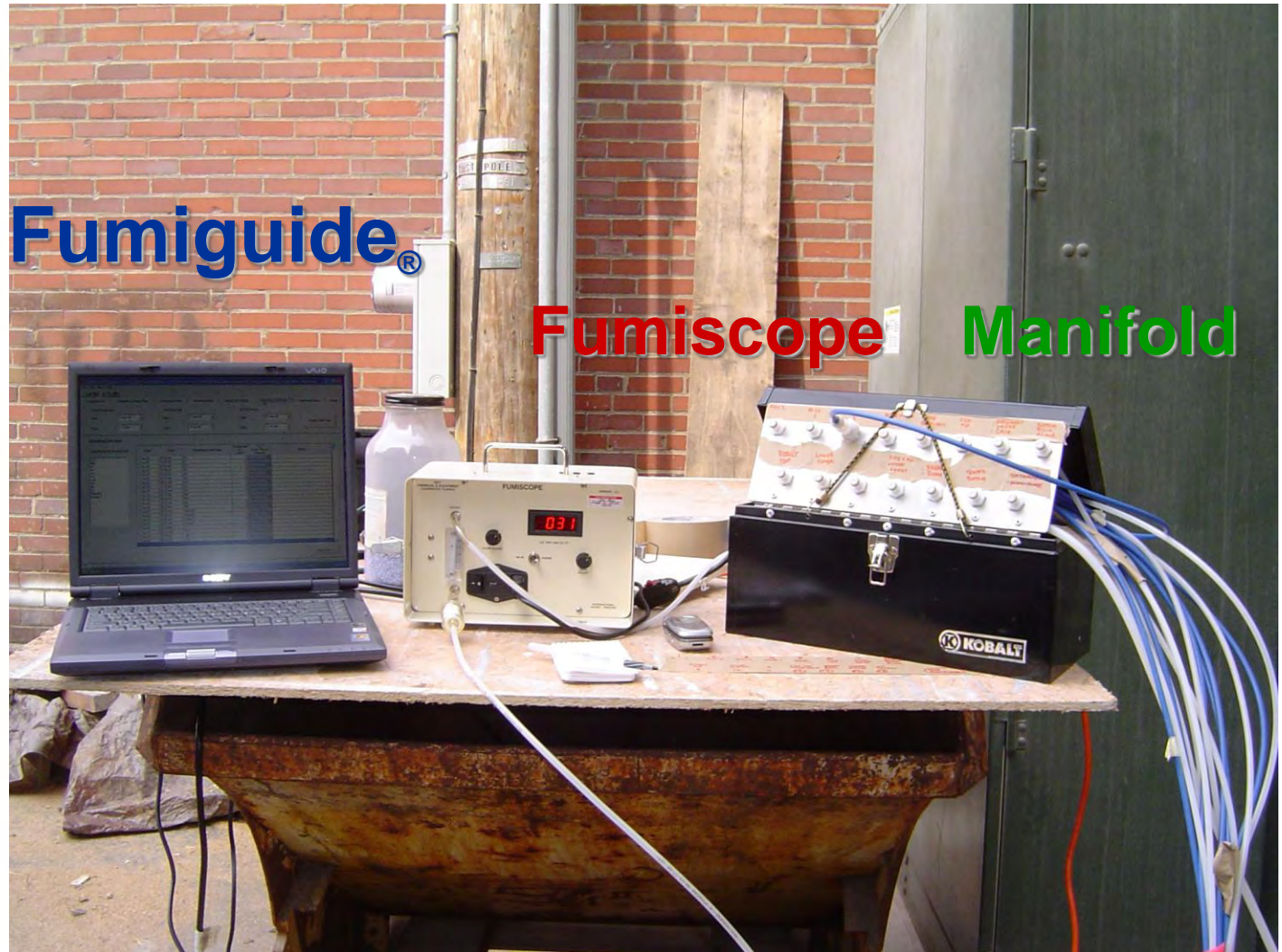


Disadvantages of Sulfuryl Fluoride

- Not registered in all countries
- North America, Europe, Asia, Africa
- Special monitoring equipment needed (US\$10,000.)
- Technical skills needed to perform Precision Fumigation.

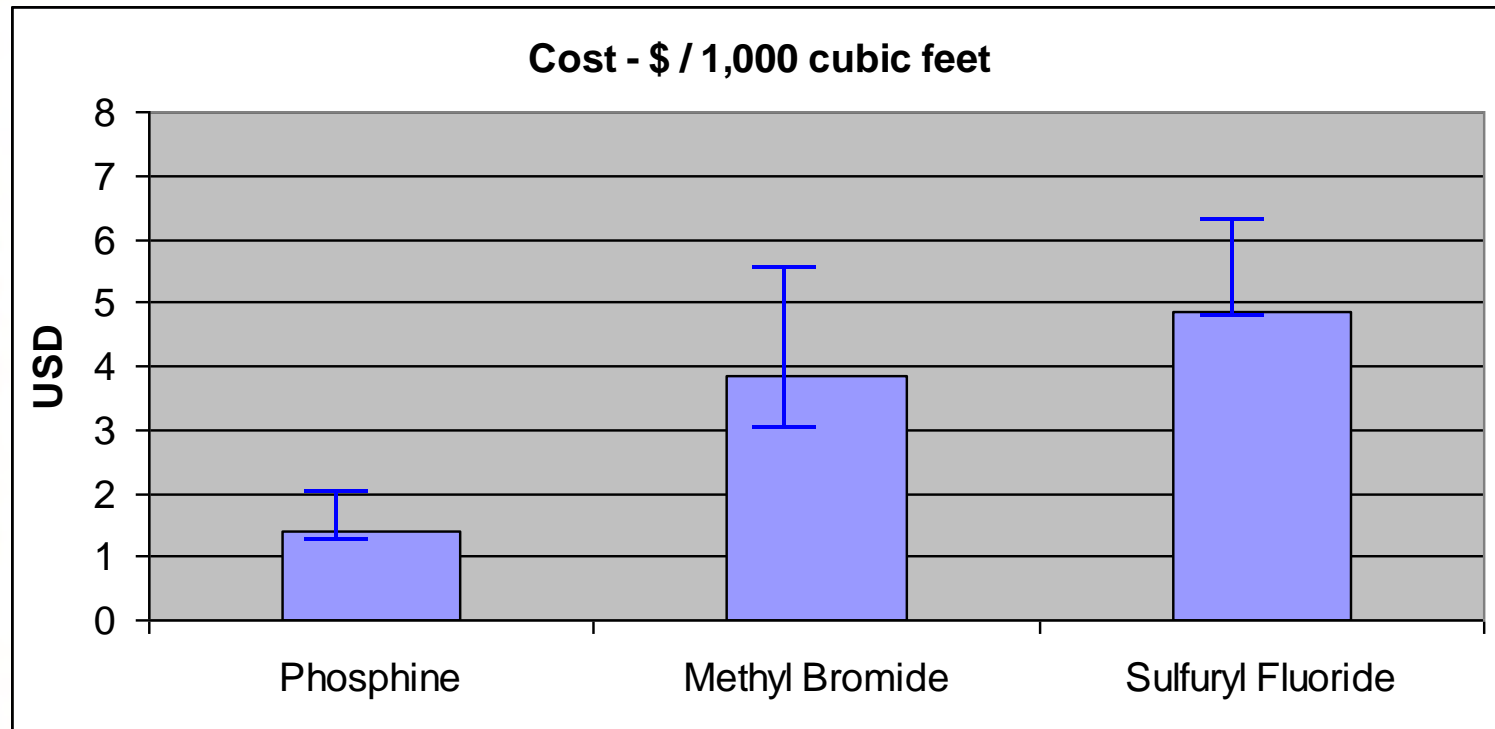


Monitoring gas levels of in a flour mill fumigation is important



IAOM – Fumigation Update

Fumigant Cost



* 1,000 sq. ft. = 33 cu. m

Conclusions

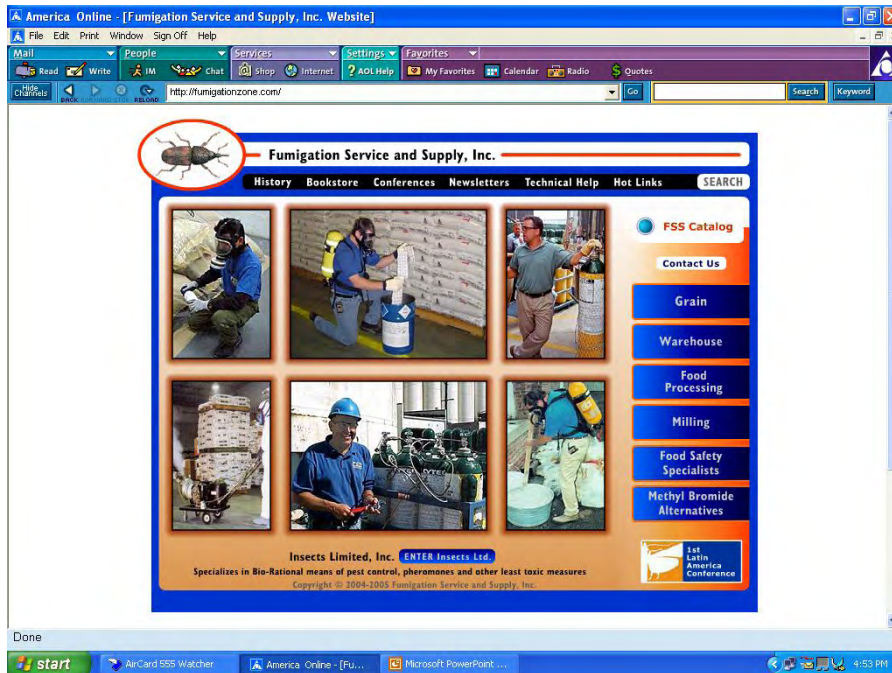
- Sulfuryl fluoride & Phosphine can be a viable and economic replacements for methyl bromide in flour mills and food factories if used properly.
- Phosphine resistance needs to be managed.
- Fumigants work better in warm temperature.
- Monitoring gas levels is essential.



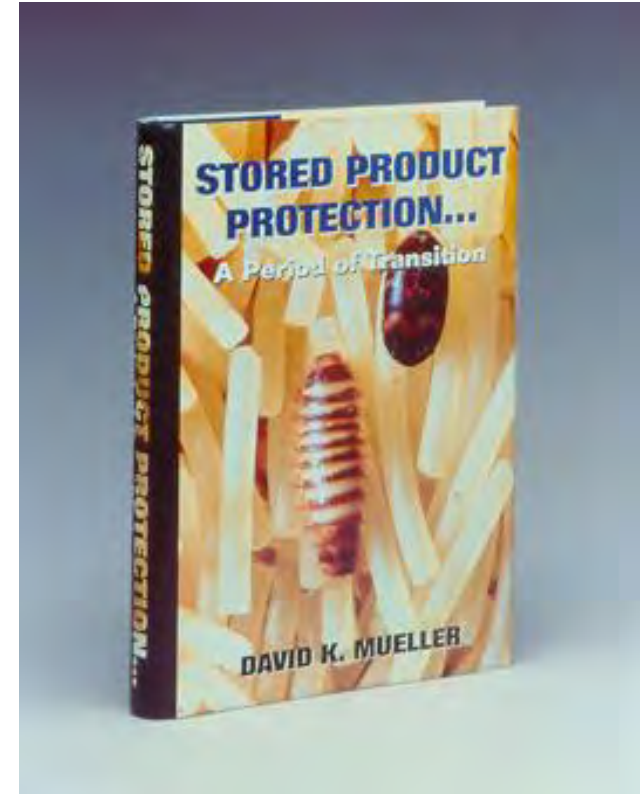


FSS

QUESTIONS?



www.fumigationzone.com



- 
- Ricardo Guimaraes, Global Business Leader
 - Dow AgroSciences LLP, USA
 - Stanley , Europe