FUMIGATION AS A QUARANTINE TREATMENT FOR SOLID WOOD PACKING (SWP).

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Solid wood Packing (SWP) and dunnage from sources in China is the probable cause of the outbreak of *Anoplophora glabripennis* (Coleoptera: Cerambycidae) the Asian longhorned beetle (ALB) in two major metropolitan areas of the U.S. More recently another exotic forest pest, the emerald ash borer (EAB) *Agrilus planipennis* (Coleoptera: Buprestidae), has become locally established in the US. During 1996-1998, prior to the implementation of the interim rule requiring fumigation of SWP from China, there were 462 interceptions in numerous taxa at US ports of entry. Development of alternatives to methyl bromide (MB) and Schedule T404-b-1-1 are needed, due to the limitation or possible demise of MB as a fumigant. Sulfuryl fluoride (SF) (Profume®, Vikane®, Dow AgroSciences) is a possible candidate to replace MB, as is ethanedinitrile (C2N2, cyanogen) With these fumigants, data specific to ALB and other wood-boring insects is incomplete, but being improved upon by cooperative research between the USDA, the PRC, and CSIRO, among others.

Cooperative work with the Animal and Plant Quarantine Institute, Beijing PRC, since 2000, has resulted in data to support a reduced schedule for MB. The current Schedule T404-b-1-1 uses the same dose at 15.6ºC as at 4.4ºC, which is intuitively too high. Data from our cooperative work supports lower, effective doses at the intermediate temperatures of 10.0 and 15.6C.

With new doses, or species, being investigated it is imperative that actual container tests be conducted to demonstrate that CxT values estimated from field research actually generate sufficient CxT values under conditions odf commercial commerce that will be effective in eradicating pest species. Also, it is important to demonstrate the not only are CxT products sufficient, but also that specified fumigations are being conducted professionally and effectively. Another aspect is safety. Aeration must adequate to safeguard the health and safety of fumigators, shippers, PPQ Officers, Customs Officers, and ultimately the consignees.

We are currently conducting a cooperative fumigation project with the PRC, in which commercial SWP container fumigations are being monitored. Data collected includes load factor, fan use, doses applied, periodic gas concentrations

and distribution, CxT values obtained and ppm residual gas after aeration and after arrival at a US port of entry (Long Beach, CA).

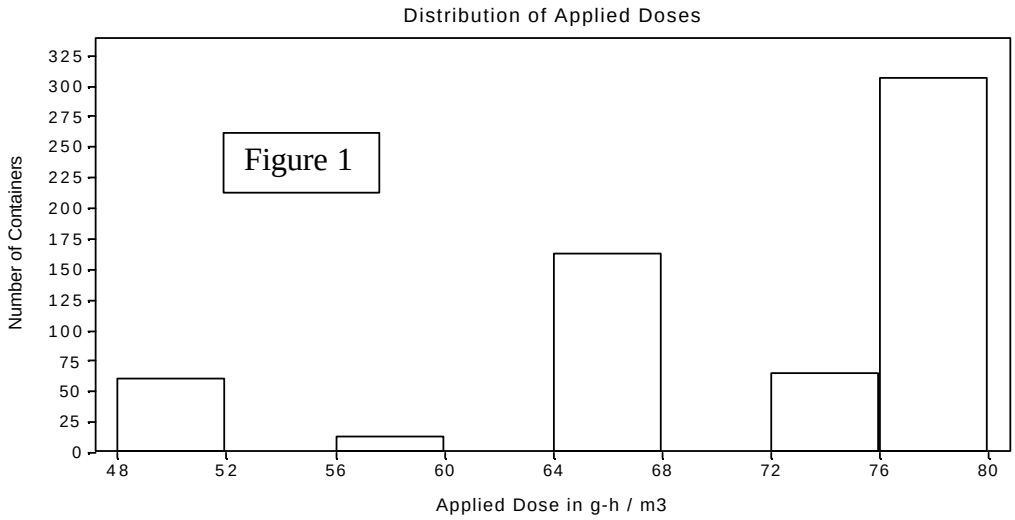
To date, a total of 609 container fumigations with five doses at four temperatures, have been monitored at the port of Shanghai, China (Fig.1). Of these, 134 have been located, held, and sampled for MB atmospheric residue using Drager® colorimetric tubes. We have found that, at this location, there were extremely large differences in MB concentrations within a container (Fig. 2) due to lack of circulation fans and overloading. The differences persisted, and did not equilibrate even after 24 hours (Fig. 3).

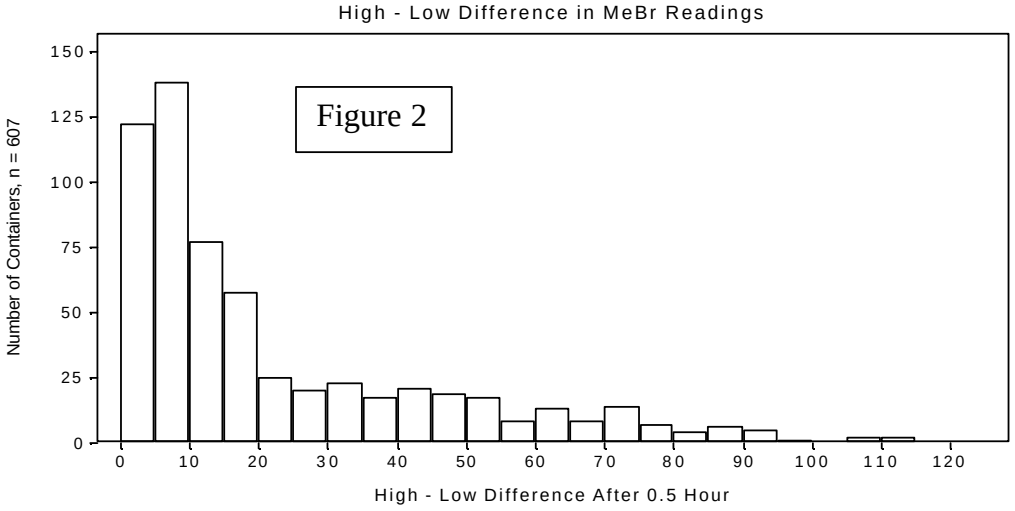
The uneven distribution of MB resulted in CxT products of great variability (Fig. 4). However, when the CxT products obtained at high, compared with low concentration sample points was considered, the variability of CxT products was even greater. Under these conditions, the lowest reading in a container should be used to represent the overall CxT product achieved in a given container.

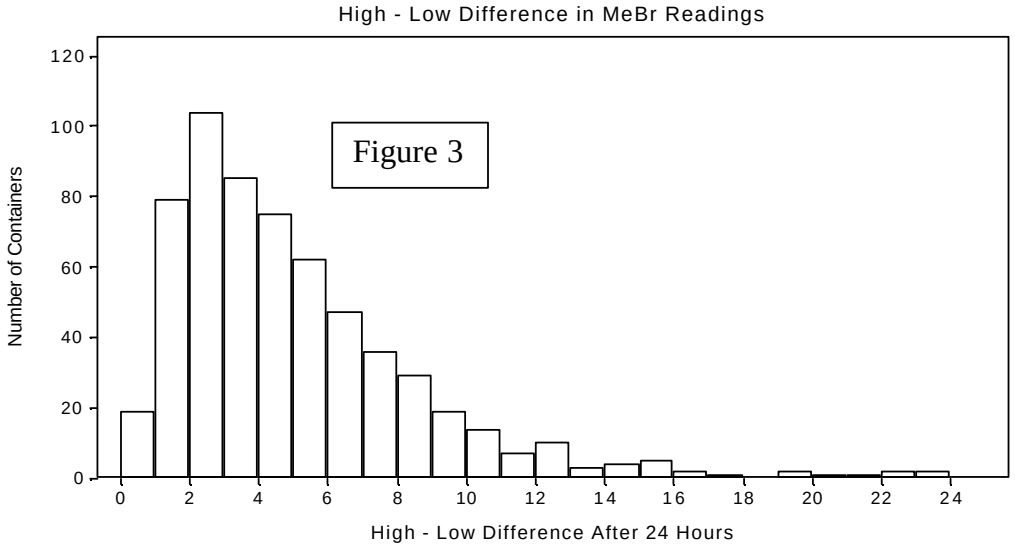
Lack of circulation may have contributed to poor degassing, even after 24 hrs of passive aeration. Fan aeration was marginal, due to inadequate fan size. Further, many fumigation sites lack power for fans. Figure 5 shows the MB residues one hour after re-sealing a container after typical aeration, with high levels re-accumulating. The result was that, after arrival in the US, 8 of 134 containers had MB residues >5 ppm, with the highest >50 ppm.

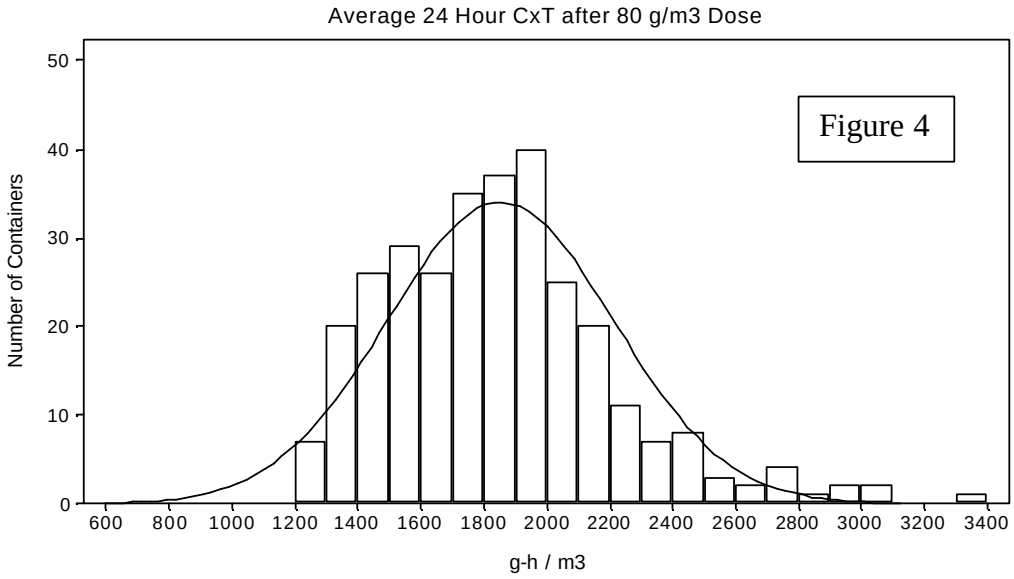
It is possible, that with improved fumigation techniques, lower doses of fumigant could be investigated. If gas distribution were reliably even and efficient, more uniform CxT products could be obtained with less fumigant. Further, risks of failure due to dead spots in the containers would be minimized.

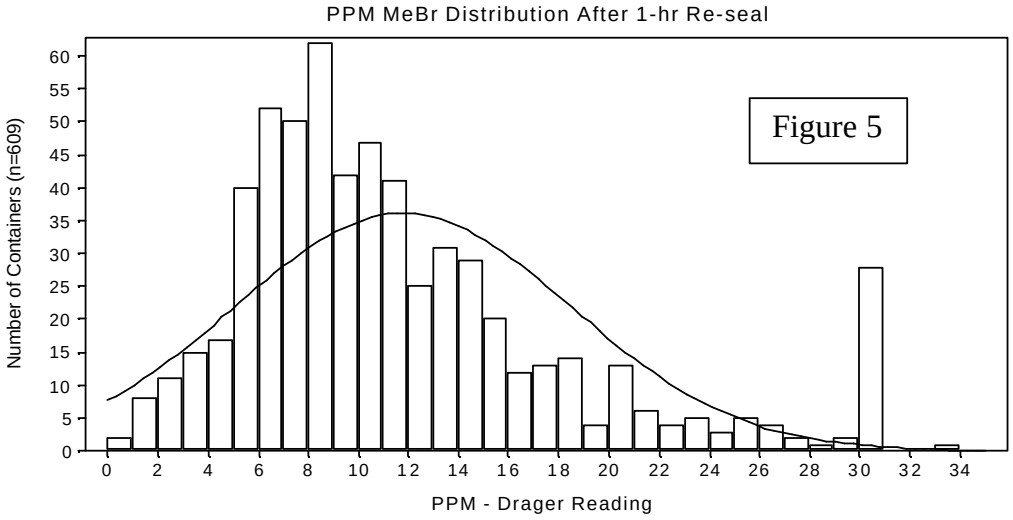
We are also conducting SWP trial fumigations of SWP with sulfuryl fluoride (SF, Profume®, Dow AgroSciences). SF was not effective vs. ALB at lower temperatures (4.4 and 10.0C), except at very high doses. Also, we may be able to lower estimated doses required for effective control at 15.6 and 21.1C, since semi-moribund larvae (those exhibiting only mandibular movement or slight body contractions) did not recover, even after placing them individually on artificial diet. These larvae were previously considered as alive, thus increasing estimates of survivorship. Control larvae, or those judged as alive (with good body turgidity or vigorous body movement) fully survived on the artificial diet. Future tests with SF at warmer temperatures will consider that lower SWP load factors (not commodity load) in containers, compared with small chamber tests, could result in higher CxT products. This could also justify lower applied doses, since excessive wood, is very sorptive of SF.


Distribution of Applied Doses
Figure 1
Number of Containers
0
25
50
75
100
125
150
175
200
225
250
275
300
325
48
52
56
60
64
68
72
76
80
Applied Dose in g-h / m3

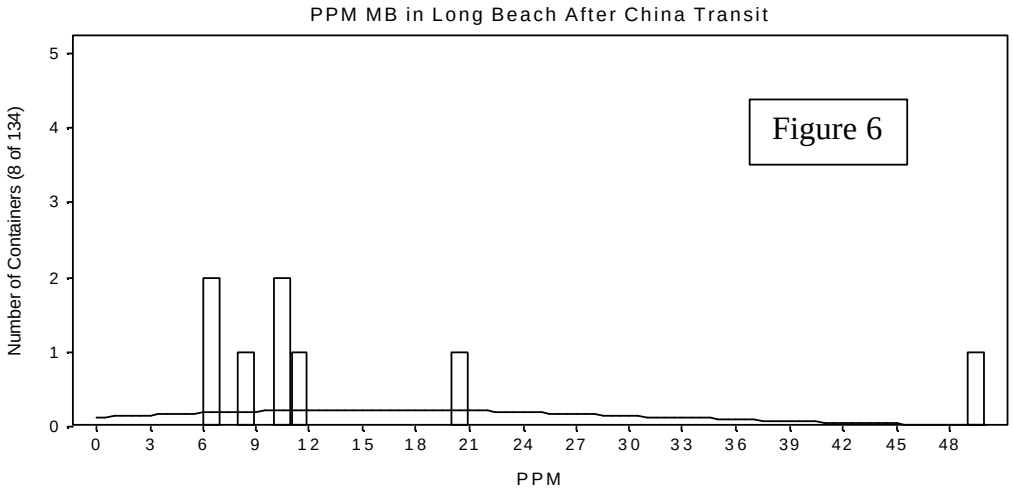

High - Low Difference in MeBr Readings
Figure 2
Number of Containers, n = 607
0
25
50
75
100
125
150
0
10
20
30
40
50
60
70
80
90
100
110
120
High - Low Difference After 0.5 Hour


High - Low Difference in MeBr Readings
Figure 3
Number of Containers
0
20
40
60
80
100
120
0
2
4
6
8
10
12
14
16
18
20
22
24
High - Low Difference After 24 Hours





PPM MeBr 1-hr After Re-seal Following an 8-24 hr Aeration.



PPM Recorded by Drager Tube in Long Beach Following China Transit