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FUMIGATION OF AN EMPTY SHIPHOLD USING THE HORN GENERATOR/ MAGTOXIN® GRANULES SYSTEM

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(report to be presented by Mark Mathews)

An empty shiphold aboard the freight vessel "Canadian Trader" was fumigated using the Horn Generator/Magtoxin® Granules System under an experimental use permit authorized by the Canadian government. The fumigation was conducted in Toronto Harbor in June 1999 aboard the freight vessel "Canadian Trader".

The Horn Generator/Magtoxin® Granules System is a device for the rapid production of phosphine atmospheres within structures requiring fumigation. The Generator is positioned outside the structure where it rapidly generates phosphine by reaction of the Granules, a high-assay magnesium phosphide product, with liquid water. This reaction is carried out inside the Generator under an atmosphere of carbon dioxide. The phosphine is then pumped from the Generator into the structure through a recirculation system. The Generator produces a non-hazardous aqueous slurry (pH=7) of magnesium carbonate which must be disposed of. The carbonate contains less than 0.001% unreacted phosphide.

Hold No. 6 having a volume of 245,815 cu.ft. was dosed at a rate of 40g PH_3 per 1000 cu.ft. This dosage corresponds to a theoretical concentration of 1000 ppm PH_3. Efficacy was determined by placing vials of test insects in various locations throughout the shiphold. All life stages of the red flour beetle, rice weevil and the lesser grain borer were used. Levels in the hold of about 1000 ppm were reached at approximately 4-5 hours after injection of phosphine was begun. Measurements were made at the bottom, middle and top of the hold over the 73 hour duration of the fumigation. Diurnal temperatures varied from about 6^{o}C to 32^{o}C. These low temperatures produced a partial vacuum within the hold at night during which time it was difficult to obtain accurate concentration readings.

Complete control of all life stages of the three test insects was achieved after 73 hours of fumigation. Control of red flour beetle and rice weevil was achieved with 48 hours of fumigation. However, a small percentage of the lesser grain borers survived the 48-hour treatment.

An industrial hygiene survey was conducted on the operator of the Generator during the periods when additions of granules were being made. A time-weighted average of less than 0.01 ppm PH_3 was estimated over this 15-minute period during which exposure was possible. This calculates to an 8-hour time-weighted total average of less then 0.003 ppm PH_3.

Some advantages of the Horn Generator/Magtoxin® Granules System are:

- Rapid production of high concentrations of phosphine
- Fewer man-hours required
- Ease of redosing or addback of phosphine
- Generation is not dependent on ambient temperature or humidity
- Application may be started and stopped at anytime

Other structures which may be fumigated with the Horn Generator/Magtoxin® Granules System include:

- large silos and tanks
- warehouses, tarpaulin covered commodities
- chambers and other similar structures

Applications for registration of the Magtoxin® Granules have been submitted to the United States and Canadian Governments. However, no estimate of when these registrations will be granted is presently available.