CYLINDERIZED PHOSPHINE FUMIGANTS – A METHYL BROMIDE ALTERNATIVE

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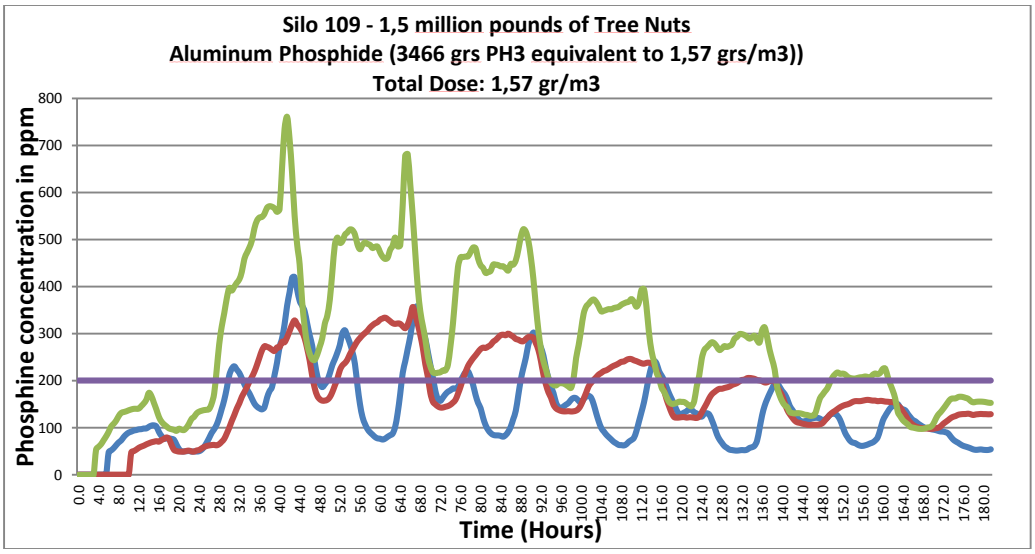
Cylinderized phosphine fumigants were first registered in the United States in the year 2000 followed by the California registration in 2001. The registration happened to coincide with the phaseout of methyl bromide which gave the industry an opportunity to find ways to successfully use these fumigants as a means to replace many of the accepted and time-tested methyl bromide applications. Metal phosphide fumigants have been used for decades, but cylinderized phosphine required intense stewardship and field testing to determine how it can be used in many of the different scenarios and fumigation enclosures where methyl bromide or metal phosphide fumigants had been used.

$ECO_2FUME^{®}$, which is 2% phosphine and 98% carbon dioxide created challenges when we first ran fumigation trials in the walnut industry in 2001. Because of the carbon dioxide in the formulation when released into the fumigation enclosure, the vapor pressure created by the expansion of liquid carbon dioxide to the gaseous form created issues with gas retention. This required structural improvements to the fumigation structures, but once completed, $ECO_2FUME^{®}$ has been used extensively in the nut processing industry as well as many other commodity groups for over 13 years.

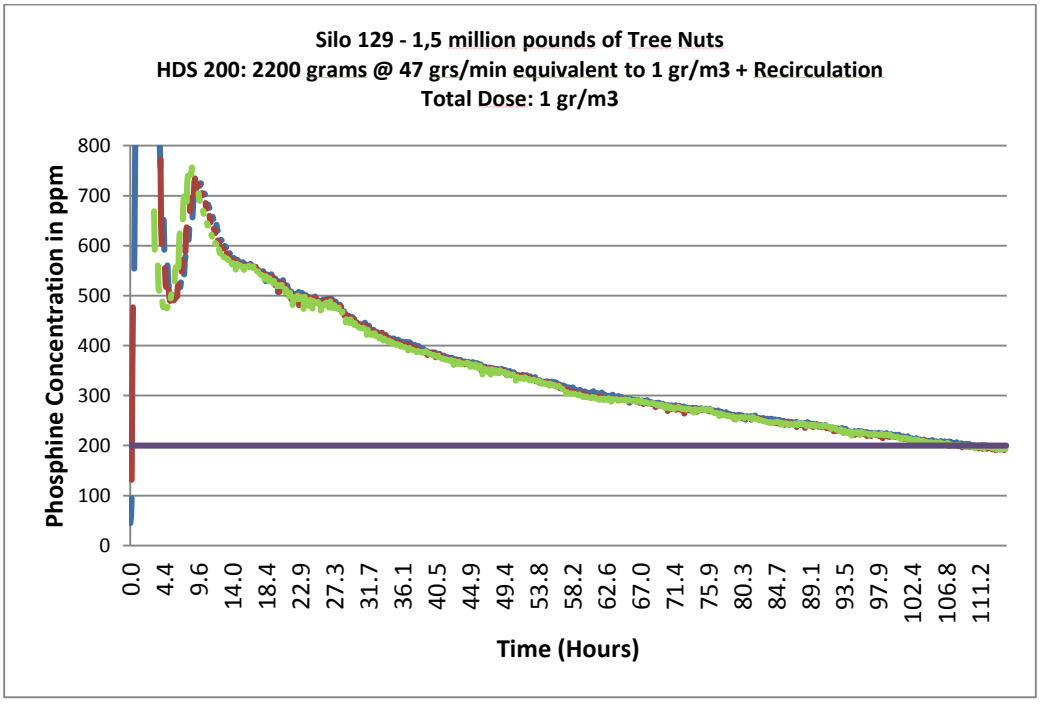
$VAPORPH_3OS^{®}$, 99.3% phosphine, requires specialized equipment manufactured by Fosfoquim, Chile, S.A., to apply phosphine at concentrations that are safe and effective for commodity applications. This equipment is available in four different configurations depending upon the volume of $VAPORPH_3OS^{®}$ required. We have found that the use of $VAPORPH_3OS^{®}$ can be a very cost-effective method of application, where specific dose requirements can be easily maintained over the exposure period. Through extensive field testing, we have found that phosphine applied using $VAPORPH_3OS^{®}$ through the HDS® (Fosfoquim) equipment can provide superior applications compared to metal phosphide fumigants when proper application techniques are used. Recent studies at a large tree nut processor in California have confirmed this by running several trials in metal silo structures using metal phosphides and $VAPORPH_3OS^{®}$ with or without recirculation:

The graph below shows phosphine concentrations using metal phosphide fumigants without recirculation, which was the tree nut processor's current method of application:



The results of the application show that phosphine concentrations were erratic throughout the silo giving less than optimum stored product insect control, which was evident from facility insect populations monitored later in the fall season which led to a processing plant fumigation.

The results from the VAPORPH$_3$OS® applications using the HDS® equipment plus recirculation resulted in the following concentrations:



The total amount of phosphine required for metal phosphide fumigations was reduced by over 50% when using VAPORPH$_3$OS®, and the concentration profile shows consistent phosphine concentrations throughout the silo. The use of VAPORPH$_3$OS® also allows the applicator to easily reintroduce additional fumigant if needed as compared to finding methods to

reintroduce additional metal phosphide fumigants. It has recently been decided by this facility to use VAPORPH$_3$OS® exclusively due to the success of these fumigation trials.

A considerable amount of research is being done by Dr. Spenser Walse and his group at USDA-ARS, Parlier, CA where we will soon be able to use VAPORPH$_3$OS® for application on fresh fruits under cooler temperatures. Cytec Industries (registrant of ECO$_2$FUME® and VAPORPH$_3$OS®) recently received approval of a label amendment which will allow users to apply doses up to 3625 ppm (maximum of 2500 ppm for fresh commodities at temperatures of 28°F – 43°F). The fresh commodity market is currently using "QPS" methyl bromide which may potentially convert to VAPORPH$_3$OS® in the near future.