MONITORING FOR PRECISION FUMIGANT APPLICATION IN FOOD-PROCESSING PLANTS

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Lethal dosages of sulfuryl fluoride (SF) are determined using the general multiplicative relationship of gas concentration and exposure time (D=CxT). At SF dosages used to control termites and wood-destroying beetles, the C:T relationship is nearly 1:1. Therefore, a decrease in gas concentration (C) can be offset by a proportional increase in exposure time (T) to achieve an equivalent dosage (D). Similarly, an increase in C can be offset by a proportional decrease T to achieve the equivalent D. For example, a 0.5-fold decrease in C is offset by a 2-fold increase in T, and a 2-fold increase in C is offset by a 0.5-fold decrease in T. Laboratory evaluations are currently underway to define the C:T relationship for stored-product insect pests.

The amount of fumigant to be introduced into the fumigated area to achieve the desired dosage (D) depends not only on the CxT relationship but also on the half-loss time (HLT) of the area to be fumigated. The HLT is the time in which half of the gas is lost from a fumigated area. HLT values vary from structure to structure, and even between areas within a structure, depending on the various construction designs. HLT values impact the amount of gas to be used. High HLT values, those in excess of 24 hours for 24-48 hour exposures, are desirable. HLT values of 8-15 hours are common for food-processing structures. Low HLT values, those below 10 hours, can significantly increase the amount of gas that will be necessary to achieve the desired dosage.

Monitoring gas concentrations at several positions within the fumigated area is critical to documenting actual dosages achieved throughout the fumigated area. Knowing the actual gas concentrations allows one to determine if and when gas equilibrium is achieved, calculate HLT values, re-introduce gas in specific areas in order to achieve the desired dosage within the time allotted, and determine when aeration procedures may be initiated.

Monitoring data from SF fumigation research trials will be used to demonstrate a common problem for all fumigants, that being significant variation in HLT and final CTs across different areas of structures. This is especially true in multi-floor buildings such as four mills, and in structures constructed of varying exterior wall materials. The benefits of thoughtful planning of fumigant introduction line, monitoring line, and circulation fan placement to achieve targeted dosages in all areas of the fumigated structure will be demonstrated. Only through monitoring of gas concentrations from multiple positions within the fumigated area can efficient use of fumigants be achieved while attaining the necessary dosages for the control of stored-product insect pests throughout fumigated structures.

Precision fumigation, using only the amount of fumigant needed, where it is needed, provides both short and long term benefits to fumigators. Short term, fumigant cost savings can be

realized while providing control that may not have been achievable in non-monitored fumigations. Long term, judicious use of fumigants demonstrates good stewardship, which is critical to the long term success of fumigators and continued registration of any pesticide.