PHOSPHINE FUMIGATION MONITORING WITH A REMOTE WIFI SYSTEM

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The fumigant phosphine (PH_3) is being evaluated as a replacement for methyl bromide in quarantine and pre-shipment uses, log fumigations, and for chamber or container fumigation. With the current regulations for phosphine, continual monitoring during the fumigation is required, which could be labor-intensive and time-consuming due to access and employee availability, especially during nigh-time. A PH_3 monitoring system was developed that included robust phosphine sensors, a local wireless communications network (wifi), hot-spot cell phone communications, and cloud-based data collection software.

This remote sensing system was first evaluated during the fumigation of wheat stored in 4000-bushel, steel grain bins 22 feet in diameter. However, the system could potentially be used in any fumigation involving PH_3. For this test, airlines were distributed in the bin for sampling the gas concentrations in parallel with the remote sensors. Two, remote sensors were inserted into the grain at the top of each bin. One sensor was located in the center and one was located about 12" from the south wall. A series of four fumigation procedures were done and each procedure lasted over 6 days. For each fumigation, the remote sensors were collecting gas concentration measurements every two hours while the airlines were sampled 2-4 times per day.

Each fumigation resulted in significantly different concentration and time profiles. Although the profiles were dramatically different, the air samples and the remote sensors gave similar trends. However, with the increase data with the wifi system, sub-cycle appeared evident in the final concentrations. In addition, the concentration data was easily collected and available on viewing on a computer.

As an additional test for sensor repeatability, all four sensors were placed into a single 55 gallon barrel and a phosphine pellet was added. The sensors repeated to ~ 30 ppm of each other over the treatment range of 0 to 700 ppm. Future research efforts will look at phosphine monitoring in different containers (railcars, pallet stacks, barrels, small sheds, etc.).