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SUBJECT: REVIEW OF AN IMPROVED VERSION OF A PHOSPHINE GAS GENERATOR

On December 3, 2007, Frank Schneider, Kevin Solari, and I traveled to Stanislaus County to meet with the County Agricultural Commissioner’s (CAC) staff and representatives of the company that was developing a phosphine-generating device to be offered for sale in the county. This device was touted as an improved version from the one that I reviewed in March of 2007. That particular unit had several safety concerns:

1. Use of duct tape to connect gas delivery hose.
2. How are spent residues handled?
3. Open pour loading method (tear open plastic packets, pour material into reaction vessel).
4. How is efficiency of scrubber insured or measured?
5. Dog-clamps to seal various vessels may be prone to over/under torque.
6. Use of plastic lines that could be dislodged.
7. Design as shown can be easily damaged or tampered with.
8. No provision for phosphine gas monitoring for the operator.
9. How is line purging confirmed?
10. What are the procedures during an emergency?
11. Is there an emergency shutdown procedure/switch?
12. How are the scrubber materials replaced?
13. What would liquid in the reaction vessel do during introduction of QuickPHlo-R?
15. Phosphine gas has a LEL of 1.87%. Are the fans intrinsically safe?

All of these concerns have been addressed in this production version of the device:

Use of duct tape to connect gas delivery hose:

The delivery hose (braided-steel covered) uses steel connectors to attach to the structure to be fumigated.
How are spent residues handled?
   Spent residue drops into a stainless-steel container. The container has handles that allow
the worker to remove the container and dispose of the spent residue according to local
regulations.

Open pour loading method (tear open plastic packets, pour material into reaction vessel):
   Though open-pour is still required, the nature of the packets and the granular aluminum
phosphide, along with the use of cotton gloves, should provide adequate protection of the
worker from dermal contact with the material.

How is efficiency of scrubber insured or measured?
   Use of a phosphine-monitoring device is required by the Applicators Manual. This can be
used as a check of scrubber function.

Dog-clamps to seal various vessels may be prone to over/under torque.
   For the most part, dog-clamps have been replaced by cam-locks or other such clamps that
are less prone to over-torque.

Use of plastic lines that could be dislodged.
   Either plastic lines have been replaced with stainless-steel lines or the plastic lines are
better shielded from accidental removal.

Design as shown can be easily damaged or tampered with.
   New design encloses much of the operational system, less prone to impact damage or
tampering.

No provision for phosphine gas monitoring for the operator.

How is line purging confirmed?
   A sampling port has been added to confirm purging, as necessary.

What are the procedures during an emergency?
   These are to be part of the label required Fumigation Management Plan.

Is there an emergency shutdown procedure/switch?
   Installed.
How are the scrubber materials replaced?
    Scrubber charcoal is now supposed to be in its own removable cartridge, which is
removable as a unit from the top of the scrubber cylinder. Material is to be replace yearly
or at indication of breakthrough.

What would liquid in the reaction vessel do during introduction of QuickPHlo-R?
    Part of initiation sequence in preparation of application is air-drying of the reaction
vessel, considerably reducing the change of water in the reaction vessel during loading of
granules.

Inadequate electrical design.
    Corrected.

Phosphine gas has a LEL of 1.87%. Are the fans intrinsically safe?
    Fan motor sealed from shaft and blades, only remote chance of explosive conditions.

The device, as presented at this meeting, appears to be adequately engineered to provide a low-
hazard procedure for the generation of phosphine gas for commodity fumigation. Though each
unit that may be brought to California has to be custom built for the particular chamber it will
service, if these future units are built to the standard of this production model, there should not
be any undue hazard for operators.

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