SESSION 5: APPLICATION METHODOLOGY OF CA AND/OR FUMIGATION, INCLUDING THE USE OF CARBON DIOXIDE UNDER INCREASED PRESSURE

B.W. BRIDGEMAN
Grainco Limited, 619 Ruthven Street, Toowoomba, Queensland 4350, Australia

Rapporteur's Report

The application methodology session was well supported, with 12 papers presented. These epitomized the mood of the conference, emphasis being on alternatives to methyl bromide (MB). However, the papers varied considerably in content; they covered the following areas: controlled atmospheres (CA's) generated using nitrogen (N_2), CA's generated using carbon dioxide (CO_2), CO_2 under high pressure and phosphine (PH_3) (a, fumigation techniques; b, manufacture; c, disposal).

There were no papers covering MB, which appears to have a limited future. On-site production of N_2 for stored-product disinfestation was the subject of a paper presented by Cornel Adler. He outlined work undertaken to establish environmentally friendly, residue-free, worker-safe insect control methods. He indicated in his conclusion that, once the high capital cost of the equipment and the cost of supervision could be reduced or justified, membrane and PSA systems could develop into viable alternatives for fumigation in gastight bins, particularly in remote areas.

Chris Bell also reported on on-site generation of low-oxygen (O_2) atmospheres. He reported on the evaluation of the performance of a propane burner used to generate low-O_2 atmospheres in sealed bins. The system had some potential for future application, but a number of operational challenges remained to be addressed. Variations in bin sealing techniques, bin dimensions, effect of wind, effect of temperature and cost were discussed.

Jonathan Banks in his presentation discussed the accuracy of models used to describe the gas-distribution characteristics involved in purging grain bulks with N_2. He referred to the plug-flow and mixing processes observed under field conditions. Results obtained from the models came within 90% of the field data in which these phenomena actually occurred. He indicated that the models had been derived from data collected over 20 years.

A new product for short term fumigations was introduced by Lothar Benzing. He described a new metal phosphide product. This formulation in bags provides a 20-min delay before decomposition and generation of any PH_3. He reported that once decomposition commences, this product breaks down more rapidly than other existing ones. This development will, to some extent, address the safety concerns associated with use of metal phosphide preparations, and it will be a real bonus to those who carry out fumigations.

The need for fumigations to be active rather than static was highlighted by Bob Winks in his presentation. He contended that the many variables that may influence the success of a fumigation, such as wind and the chimney effect, could be minimised or eliminated by the use of active fumigation systems. SIROFLO® (the subject of an exhibit during a field trip) and SIROCIRC™ were discussed as examples of active systems that provide improved efficacy, better economy and, most importantly, far greater ability to comply with environmental standards. He reported that active fumigation has been widely adopted in Australia.

"Gaseous phosphine: a revitalised fumigant" was the subject of a paper presented by Bob Ryan, who described the BOC product PHOSFUME™. The potential for this product as a replacement for MB was discussed.

Disposal of metallic phosphide formulations by burial was the subject of Jan van Graver's presentation. He indicated that emissions of PH_3 from the burial site during the first 10 days after burial can exceed the TLV. Thereafter PH_3 emissions remained below 0.3 ppm. He suggested that burial of unused (unspent) formulations results in lower concentrations of PH_3 in the environment than might be expected from allowing the formulation to decompose in air.

The economic feasibility of PH_3 recirculation using "closed-loop fumigation" systems in sealed bins was presented by Ron Noyes. The improvements obtained using this method of fumigation were reported to have provided savings of approximately US$0.50 per t for a single fumigation.

The potential for using CO_2 under high pressure to control pests in cocoa beans and hazelnuts was outlined by Sabine Prozell. It was suggested that this technique could provide an alternative non-residual disinfestation process for these and similar commodities.

Christoph Reichmuth, using the same technique, reported on control of the tobacco beetle (*Lasioderma serricorne*). He indicated that the process tended to be temperature dependent, and further trials were required to refine the technique in this application.

The final paper in this session, also presented by Christoph Reichmuth, described the rate at which O_2 is replaced in bales of compressed tobacco disinfested with N_2 or CO_2. In the examples described, 6 h were required to obtain the target distribution.