PHOSPHINE FOR DISINFESTATION OF PINE LOGS AND SAWN TIMBER FROM NEW ZEALAND

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Introduction

The New Zealand economy relies on methyl bromide (MB) for quarantine treatment of export pine logs and sawn timber. A strong impetus for change in quarantine treatments is being provided by growing opposition to continued MB use. MB use is restricted internationally under the Montreal Protocol and lobbyists are campaigning on environmental and public health grounds for its complete phase-out. At the same time MB for QPS (quarantine pre-shipment) use is increasing as export of logs and sawn timber grows. In 2006 forest exports accounted for 68% of New Zealand's total MB use (178 tonnes).

STIMBR

Efforts to find viable alternatives to MB and advance fumigant stewardship in New Zealand have stepped up in the last two years and have led to the formation of STIMBR, Stakeholders in Methyl Bromide Reduction. In July 2008 STIMBR adopted its constitution as a first step to becoming an incorporated society. The initiative to form STIMBR came from the forestry export sector but has been embraced by industry (fumigant importers, fumigators, exporters, importers), government and research organisations. STIMBR has obtained agreement for introduction of a levy on MB imports and a business plan has been adopted. The business plan has three priority areas:

- Alternative fumigants with a focus on phosphine
- MB recapture/destruction
- Fumigant monitoring at ports

Phosphine as an alternative to MB

The export protocol for New Zealand's log trade to China stipulates disinfestation treatment using 'in-transit' phosphine treatment with 200 ppm phosphine for 10 days for control of quarantine pests such as black pine bark beetle (*Hylastes ater*) and burnt pine longhorn beetle (*Arhopalus tristis*). This treatment is used for 'in-hold' logs, is cost-effective and a viable alternative to MB. Zheng et al. (2004) showed that 200 ppm phosphine for 10 days was effective for control of *Arhopalus* eggs and adults and *Hylastes* larvae and adults. This is achieved using an initial treatment of 2 g phosphine/m^3 followed by a top-up treatment of 1.5 g phosphine/m^3. Subsequent research and commercial experience suggests that the minimum phosphine treatment duration may be shorter than the 10 days required at present. The goal of research has been to better define the minimum phosphine treatment for logs and for sawn timber. This will not only assist with making phosphine easier to apply for the Chinese market (the in-transit top-up is expensive) but also, in the long term, phosphine could replace MB use for New Zealand logs destined for other markets such as India. In addition, phosphine has potential to replace

MB for treatment of 'hitchhiker' insects on sawn timber exports. This presentation updates an earlier paper presented here (Glassey et al. 2005).

Phosphine depletion
Phosphine levels decline rapidly during treatment of logs. The presence of bark speeds the decline. Oxygen levels also decline and carbon dioxide levels rise during treatment.

Phosphine penetration of logs
Although key pests are bark-borne, preliminary data suggests phosphine can penetrate over 100 mm into logs with high moisture content.

Phosphine efficacy
Trials in 2006 showed complete mortality of *Arhopalus* adults, high mortality of *Arhopalus* eggs (range 93–95%) and variable mortality of *Hylastes* larvae (range 67–100%) after a treatment of 3 g phosphine/m^3 for 3 days on infested logs. The results did suggest a shorter treatment duration than 10 days was possible. In the following year, trials showed complete mortality of *Arhopalus* adults and *Hylastes* larvae after 3- 4 g phosphine/m^3 for 3- 5 days at 15°C. In 2008 two trials were carried out, one aimed at control of 'hitchhiker' *Arhopalus* adults in sawn timber stacks and the other aimed at obtaining a better understanding of the response of *Arhopalus* eggs and *Hylastes* larvae (found in logs) to phosphine fumigation. The first trial, at a commercial scale, showed that 1.5 g phosphine/m^3 for 16 hours at 21°C gave 100% mortality of *Arhopalus* adults. The second study, in the lab at 15°C, exposed *Arhopalus* eggs and *Hylastes* larvae to 11 phosphine treatments ranging in duration from 3 to 7 days. A mean concentration of 540 ppm phosphine for 7 days gave complete control of *Arhopalus* eggs and *Hylastes* larvae. Much higher concentrations were required for control of *Arhopalus* eggs and *Hylastes* larvae after 3 and 5 days (3200 and 1800 ppm respectively). Results and conclusions from the studies will be presented at the conference.

Summary – advantages of phosphine:
- Cost-effective
- Is currently being used 'in-hold' as a viable alternative to MB
- Research shows it is effective against target pests.

Current issues:
- Phosphine sorption by logs requires fumigant 'top-up'
- Need more research into minimum treatment durations.

Glassey K, Hosking G, Goss M 2005. Annual International Research Conference on Methyl Bromide Alternatives and Emissions Reductions held October 31- November 3, 2005,San Diego, California. (mbao.org/2005/05Proceedings/063GlasseyK%20MBAO%20alternativespaperNZ.pdf)

Zhang Z, van Epenhuijsen CW, Brash DW, Hosking GP 2004. Phosphine as a fumigant to control *Hylastes ater* and *Arhopalus ferus* pests of export logs. New Zealand Plant Protection 57:257–259.