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Current thoughts on evaluation criteria for phytosanitary treatments and update on RF and phosphine work

Uzunovic A., Hoover, Kelli, Mack Ron and Allen Eric

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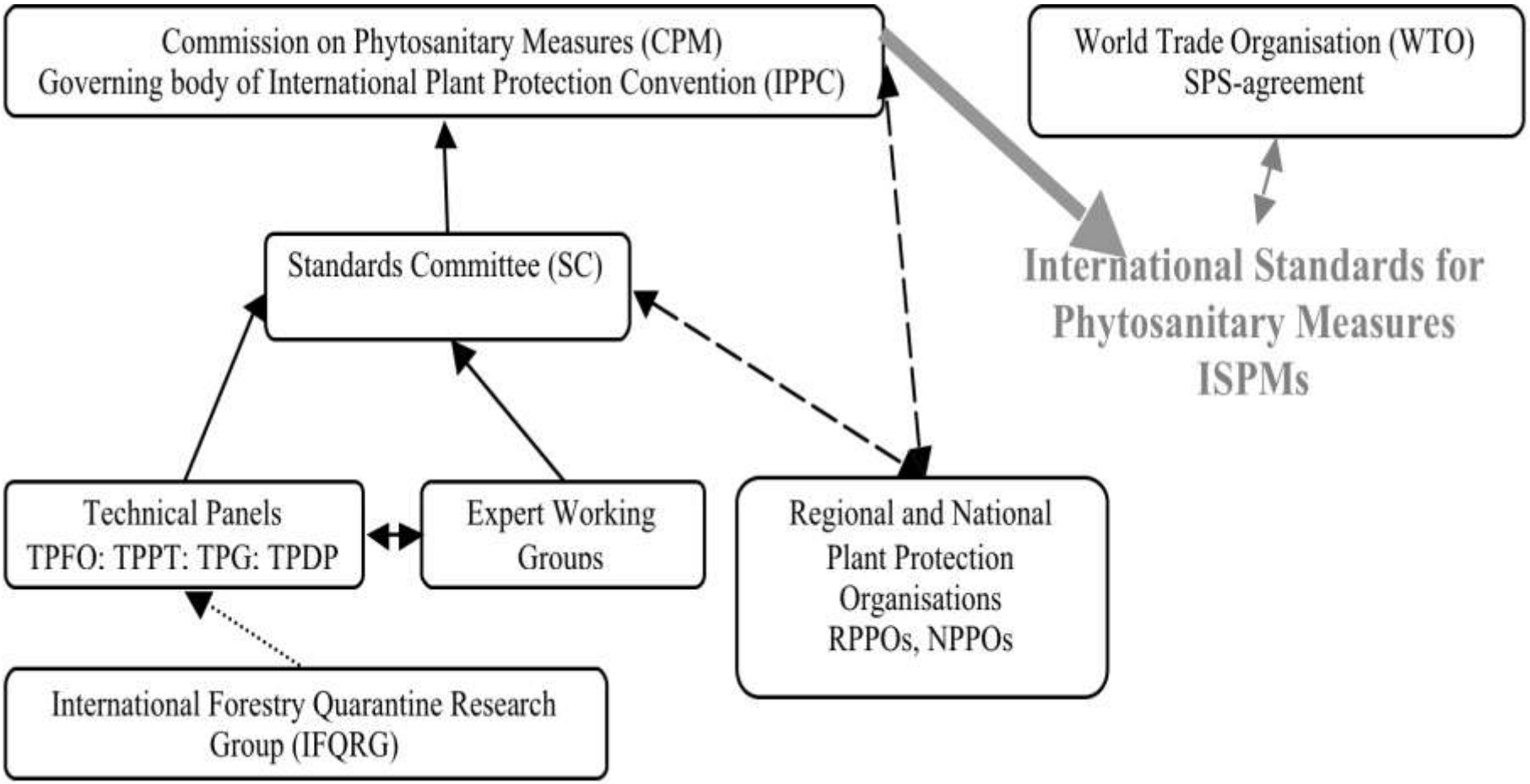
IPPC, WTO, ISPMs, IFQRG



World needs uninhibited trade with significantly reduced risk of pest introduction

Relevant ISPMs, Commodities, Treatments

- ISPM No 28 – Phytosanitary treatments for regulated pests
- ISPM No 15 – Regulation of wood packaging
  - HT 56/30 adopted based on work on pine wood nematodes and its vectors; Fumigation with MeBr
  - In 2010 draft appendix: Evaluation criteria for new treatments, released for country consultation; Includes a list of target test pests and the required level of efficacy.
  - The list of pest to be tested was extensive and probit 9 efficacy requested. IFQRG reviewed the SC comments and worked on alternative approach

Probit 9: Hystory, Criticism

- Arbitrarily set by the USDA as satisfactory mortality for quarantine pests, based on work with fruit flies (probit 9 “efficacy”- to kill 99.9968% individuals in a population of 100,000 (one needs to kill 93,613 individuals)
- Controversy:
  - Large diversity of wood pests, scarce availability of key quarantine pests (50 dollars to rear one ALB, $4.7 million to rear and treat 93,613 beetles)
  - Results obtained through modeling give overestimated values
  - Lack of separate units in some pest (fungi),
  - Pseudoreplication (is testing population made of genetically diverse individuals

Current

- Alternative treatments for wood packaging are needed (MeBr use phasing out)
- Probit 9 requirement and extensive list of pest including a quarantinable pests (ALB, EAB) is serious impediment and prevents new treatment development and adoption
- IFQRG discussed treatment efficacy for several years and offered alternative approach in Sept 2011.
  - Haack et al 2011. Seeking alternatives to probit 9 when developing treatments for wood packaging materials under ISPM No. 15 EPPO bulletin 41:39-45
  - Schortemeyer et al 2011. Appropriateness of Probit-9 in the Development of Quarantine Treatments for Timber and Timber Commodities J. Econ. Entomology, 104(3):717-731.) .

An alternative 3-Step Approach

- Step 1:Pre-screening process to select tolerant pest and approximate lethal dose
- Step 2: Validate lethal dose on the most tolerant pest
- Step 3: Simulate operational conditions

Step 1 - Prescreening

- Target pests of quarantine importance, found in wood
- Test one available species from 7 representative pest groups:
  - a reference-easy-to-rear insect (e.g. from *Sitophilus, Oryzaephillus, Trogoderma* or *Ambrosia* beetle genera),
  - Pine wood nematode,
  - Decay fungus from *Heterobasidion* genus,
  - Scolytinae (bark beetles)
  - Bostrychidae (horned powder post beetles)
  - Buprestidae (metallic wood boring beetles)
  - Cerambycide (large wood borers).

Other pests from the original list were dropped, after justifications were discussed especially in relation to how relevant they are for wood products and if they are deemed to have significantly reduced risk of pathway via wood packaging materials (e.g. Anobiidae, Lepidoptera: (Cossoid-Sessoid-Tortricoid assemblages, Siricidae, Fusarium circinatum, tree killing Phytophthora spp., deep penetrating blue stain fungi, canker fungi/chestnut blight, root rot fungi)

Step 1

- Under controlled lab conditions, test different physical conditions
- Use small sample size (5-10 experimental units each that can contain one or more target pests)
- Use smallest wood samples as test units to ensure uniform dose delivery

Step 2 – Validation of Lethal Dose

- Replicated experiments (with no survivors) at the estimated lethal dose using the most tolerant pests determined during step 1.
- Minimum sample size of 60 experimental units, which achieves 0.95 statistical reliability at the 95% confidence level.
- If possible test one or two doses above or below the estimated lethal dose

Step 3: Simulate Operational Conditions

- Using the most tolerant pests under simulated operational conditions using wood samples similar in size to wood packaging material and infested to levels that reflect field conditions.
- Replication minimum 60 test units (achieves 0.95 statistical reliability at the 95% confidence level)
- If there are survivors test doses above (10%, 20%) until no survivors (100% mortality)
- At this stage the efficacy level of the treatment is to be reported based on the estimated total pest load in the treated material

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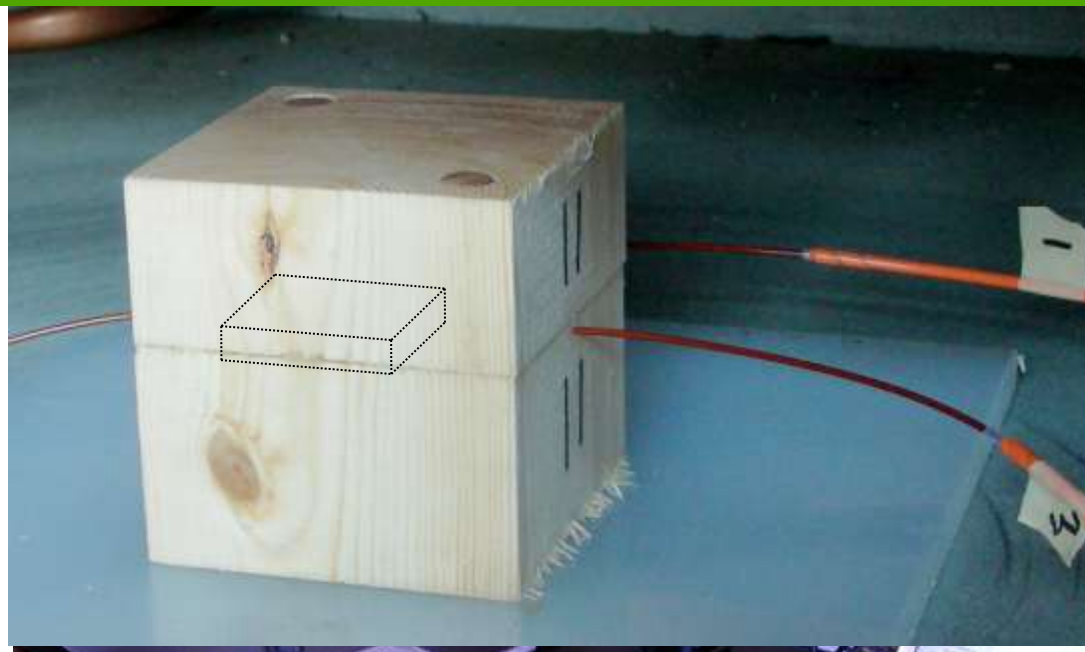
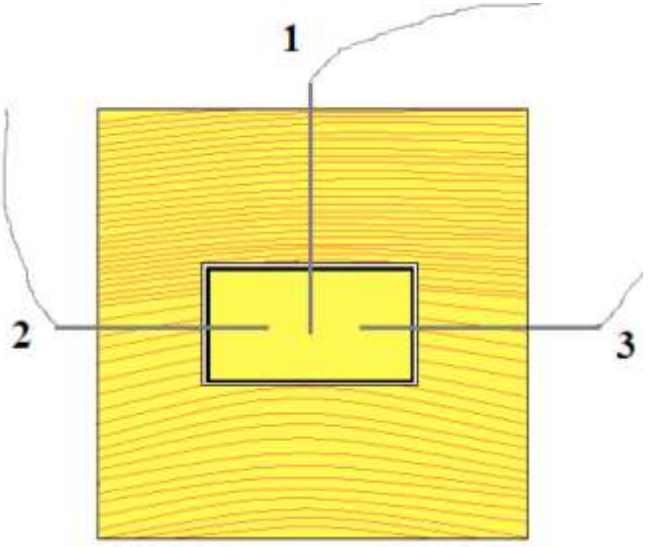
Lethal temperature for PWN in infested wood using Radio Frequency Energy

Collaboration set at IFQRG: FPInnovations, Penn State University, USDA, PLC Inc

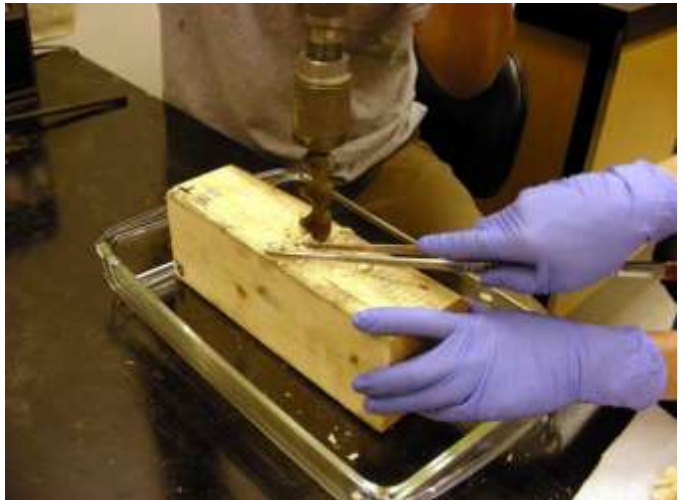
Microwave Heating - Step 1 and 2





Step 2-Material preparation

Microwave heating - Step 3



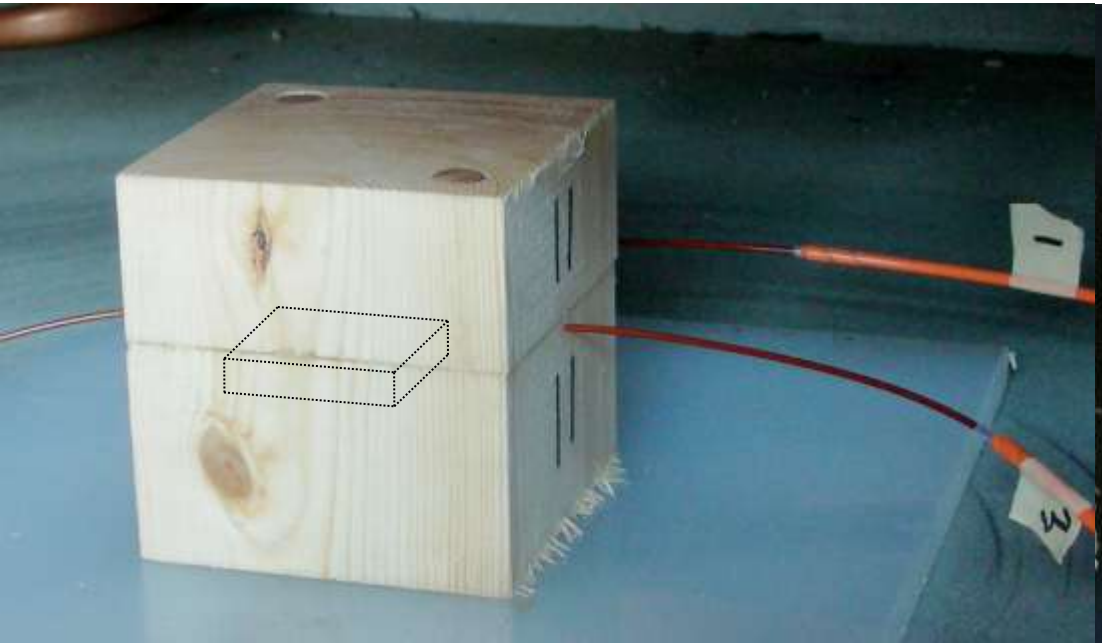
2009- submission made to IPPC to use MW as an alternative treatment for wood packaging (60° C for 1 minute through wood)

Hoover et al 2010. Lethal Temperature for Pinewood Nematode, Bursaphelenchus xylophilus, in Infested Wood Using Microwave Energy. Journal of Nematology. 42(2): 101-110

Radio Frequency Heating

MW-915-2450MHz; RF 13.56-27.12 MHz)

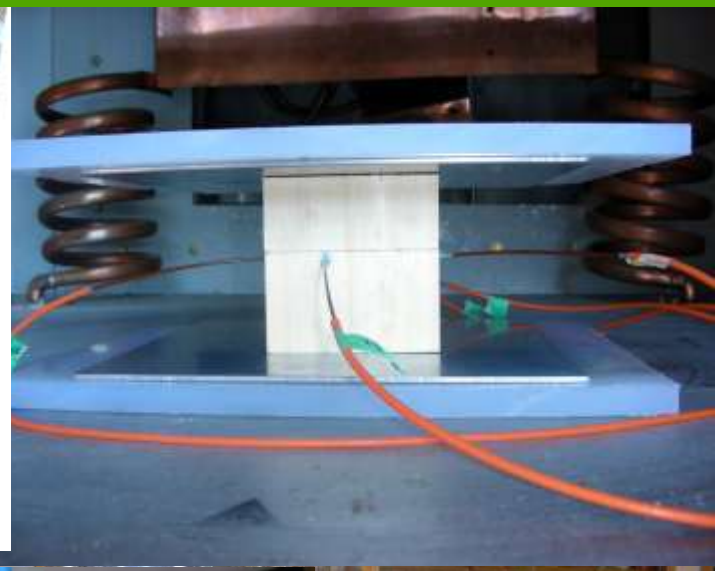
- Step 1-2 :10 wood blocks infested with PWN at 13 temps (40, 48, 50, 52, 54, 55, 56, 58, 60, 63, 67 and 70° C) to generate survival curve and determine temperature that produces 100% mortality
- Step 3: Verify lethal temperature with scaled up experiment (industrial operational condition) and meet probit nine efficacy requirement using “brute force” approach



RF Oven Arrives from USDA

Step 1 - treatment







Stage 3 - RF Treatment

Results for RF heating: Stage 1 and 2

- 56° C for 1 minute produced 100% mortality
- Thirty replicates treated at 54, 56 and 58 ° C (bracketing), no survivors at 56 and 58° C
- Nematode survival assessed 6 and 21 days after treatment

Results for RF heating: Stage 1 and 2

- On average 5,409 nematodes per small wood block
- Large amount of variability in temperature profiles observed
- After last probe reaches target and after 1 min hold there is difference of 10° C below target and 48° C above target.
- Although all probes reached target, IR images showed areas that sometimes may have 20° C below target (cold spots)
- Because of cold spots some nematode survival observed (13 at 54° C, 3 at 56° C and 2 at 58° C (out of blocks tested).

Results: Stage 2

- **Based on IR images the lethal temperature was 55.5-57.4 ° C**

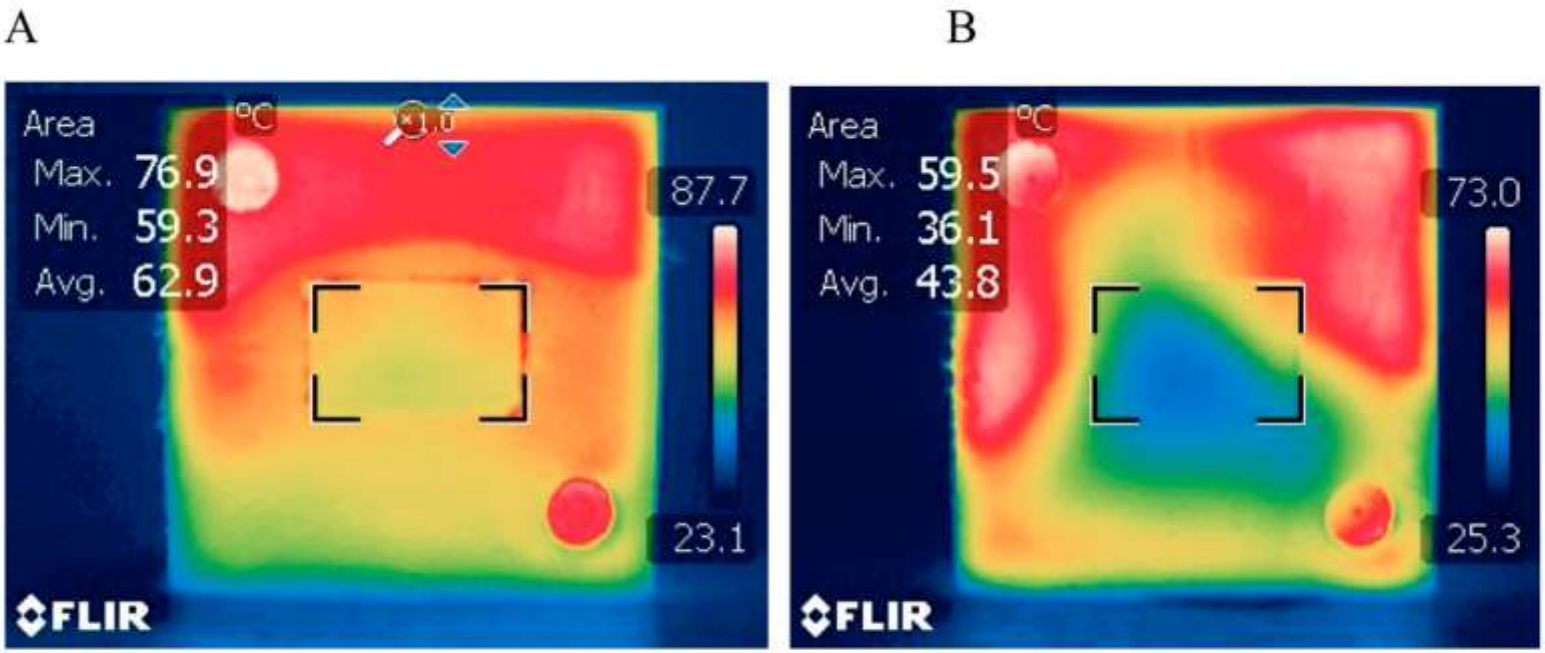
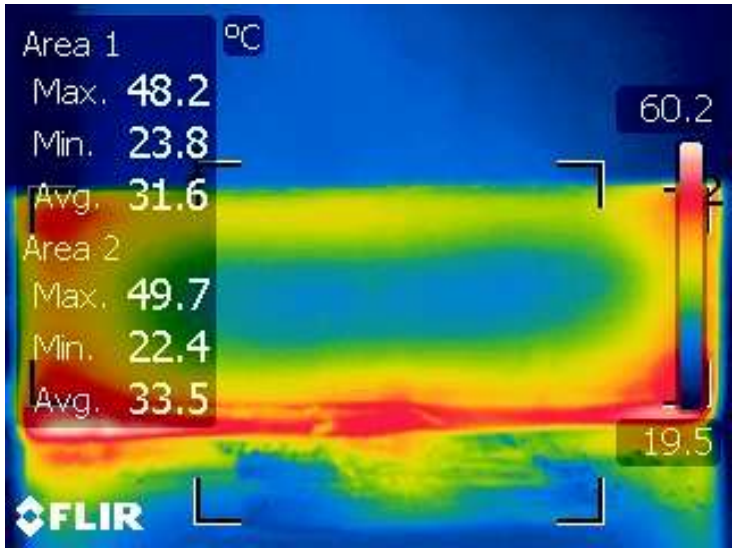
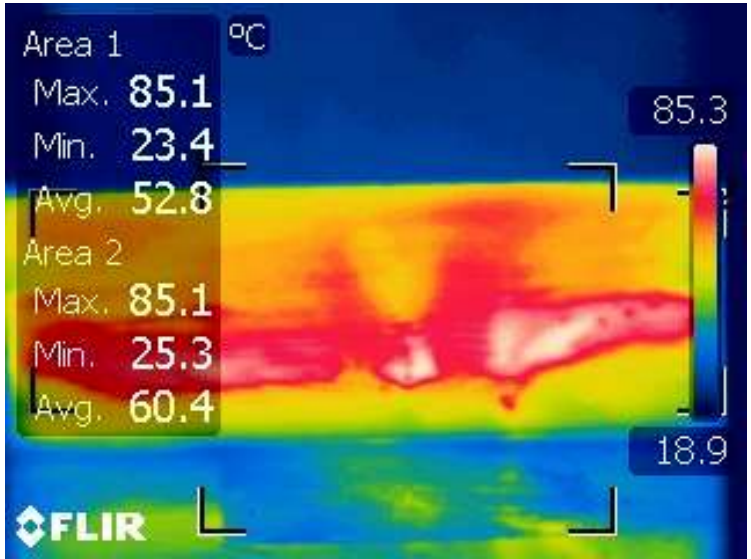


Figure 7: IR image of a well treated sample that had no nematode survival (A) and of a sample that had nematode survival due to a cold spot (B). Target temperature was 56°C.

Results- Stage 3

- No survival was found in any of the 15 treated blocks treatments at 60° C inside the encapsulating blocks
- Nematode survival observed in only one block treated at 58° C (here one probe after one minute hold showed 55.7° C)
- Reaching minimum required temperature throughout the profile of treated wood is very important





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Tests With Phosphine at FPInnovations

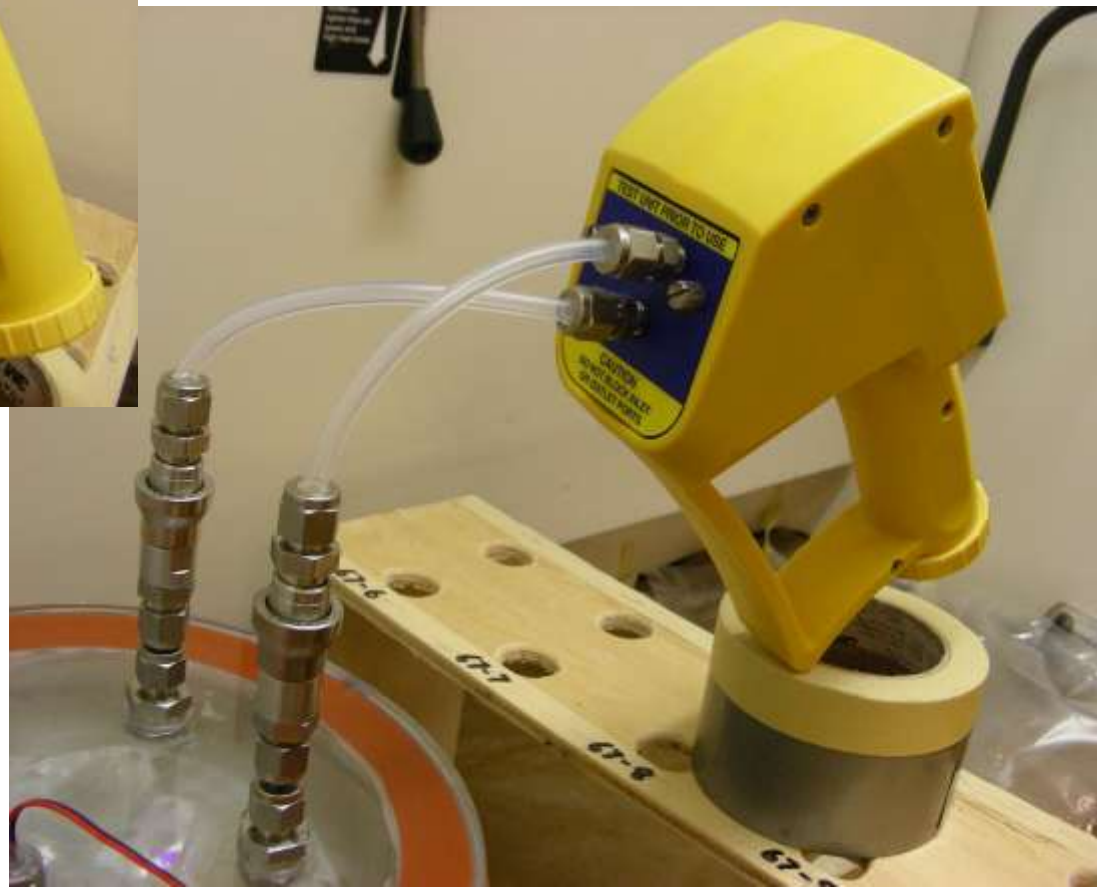
Adnan Uzunovic
Mycologist – Durability and Protection

Work in 2009/10
To Develop Small Scale Lab Set Up

- Container (10L glass Jars)
- Gas used (ECO_2FUME; 2% PH_3 in CO_2)
- Monitor and measure test gas concentration (Drager Pac7000; Kitagawa kit)
- Finalize test procedures and data analysis

Work in 20010/11- Small Scale Lab Set Up

Port-a-sense Gas Detector



- Adjusted for a loop measuring
- Reads 20-2000 ppm
- 5 minute average
- No loss in gas

Thank you !