International Forest Quarantine Research Group IFQRG-12
Sept 8-12, 2014 Rome, Italy
Meeting Report

1.1	**Welcome address –** Eric Allen (IFQRG Chair) welcomed the group to Rome and gave a brief outline and the background history of International Forestry Quarantine Research Group (IFQRG).
2	**Opening of the meeting**
3	**Local information (IFQRG-12-03)**
4	**Meeting logistics and arrangements**
5	**Introductions (IFQRG-12-06)** IFQRG attendees gave their introductions (a full list of attendees is appended to this report).
6	**Review and adoption of agenda (IFQRG-12-05)** Chris Howard kindly offered to serve as rapporteur
6.1	**List of documents (IFQRG-12-04)**
7	**Report of the 2013 IFQRG-11 meeting (IFQRG-12-07) – Eric Allen** Eric Allen reviewed the highlights of the IFQRG-11 report. Short discussion regarding the acceptance of the science behind the Cardiff Protocol at the IFQRG-11 meeting
7.1	**Review of actions items from IFQRG 11** 1 Continue to monitor research results on bacterial pathogens as forest pests (Evans) 2 Continue quantification of integration measures for risk reduction in wood products (Allen, Ormsby, Evans, Dentelbeck) 3 Submit IFQRG comments on wood standard through the IPPC Online Comment System (Allen) 4 Comments on treatment Criteria will be passed on the TPFQ for their consideration (Allen) 5 Subgroup to develop and publish peer-reviewed paper linking pest-related variables used in the MPL equation (final stage of Cardiff Protocol) to reliability statistics (0.95, 0.97, 0.99) to establish recommended test numbers for pest groups (Ormsby, Evans, Uzunovic, Liebhold, Brockerhoff) 6 Subgroup to develop text outlining possible improvements in non-compliance reporting (McDaniel, Aliaga, Britton, Wlodarczyk, Janowiak)
8	**Update of other bodies**
8.1	**Update on IPPC standards – IPPC Secretariat** The IPPC secretariat (Brent Larson) reviewed the draft ISPMs and draft specifications posted for member consultation. Handcraft Standard Wood Standard – Out for country consultation Criteria for ISPM-15 – will likely be under review under member consultation All draft ISPMs and associated background documents can be found on the IPPC website at: https://www.ippc.int/core-activities/standards-setting/member-consultation-draft-ispms

8.2	**CPM – IPPC Secretariat** Brent Larson Possible development on electronic certification of Phytosanitary certificates ISPM 26 on fruit flies
8.2.1	**Adopted standards – IPPC Secretariat** No forestry-related standards were adopted at CPM-9
8.3	**TPPT – IPPC Secretariat** Mike Ormsby Several treatments under review - dielectric heating and sulfuryl fluoride fumigation. Process is moving forward with comments under review DH – Needed to be accepted in ISPM15 before broader acceptance into ISPM28 Two requirements are in ISPM 15 that are not in ISPM28 1) Wood size 2) Time for temperature SF – Effective on insects but not pinewood nematode at higher temperatures Possible two treatment schedules for ISPM28 and ISPM15 1) Just insects 2) Insects and pinewood nematode Short discussion on pinewood nematode and its vector. **TPFQ - IPPC Secretariat** Julie Aliaga and Eric Allen Standard out for country consultation on international movement of seeds. Annex for tree seeds under development by TPFQ. Primary concern is spread of fungi. Mike Ormsby TPFQ is providing SC with a report investigating effectiveness of penetration of MB on high moisture content wood. Brent Larson IPPC SC subcommittee Had a meeting to discuss what other standards are needed by NPPOs. Discussion on the development of a standard on forest surveillance and monitoring methods. **Action Item (March 2015)** – Put together an outline for development by IFQRG and submission review prior to TPFQ document (Mike Ormsby, Steve Pawson, Ian Gear, Shiroma Sathyapala)
8.4	**FAO Forest Protection and Health Program – Shiroma Sathyapala** Gave a broad overview of the program. The program depends on developing partnerships with local entities in a country that raise issues (mainly developing countries). FAO is providing the framework and guidance while local officials supply the leg work and specific expertise. Program looks for gaps where important issues are not being addressed. Project locations for pests include: Lebanon, KPR, Iran, Albania, China Project locations for diseases: Turkey, Iran, Lebanon Through the program many documents have been produced, including a Guide to Implementation of Phytosanitary Standards in Forestry. E-Learning courses for individuals are also available. Guide may need updating – expertise required. Possible reprinting based on availability of funds.

	Forest surveillance standard would be incredibly helpful for this project to provide universal approach. Ron Mack suggested that a list of systemic treatments for tree and palm species would be useful for global emergency response use. Ron will follow-up with Shiroma.
8.5	**Phytosanitary Capacity Development – Sonya Hammons** Explained of the role of Capacity Development Committee (CDC). Works on issues where the Secretariat is involved. Gave a tour of the website and overview of materials and resources that are available, including reference documents and a roster of experts, and a list of ongoing projects of the Secretariat. There is an open commenting period for the documents so they are under a constant review process. A general discussion ensued where Capacity Development could become engaged with IFQRG and issues of importance to IFQRG. IFQRG members expressed concern over information communicated in the dielectric heat treatment publication. They were encouraged to submit recommended revisions through the CDC comment procedure. IFQRG members were encouraged to submit CVs to the CDC register of experts.
9	**Highlights of other meetings**
9.1	**APPPC - NAPPO ISPM 15 Workshop, Beijing** Brent Larson gave an introduction on the meeting (a joint effort between APPPC and NAPPO). The main focus was to facilitate communication between Asian countries and the rest of the world on issues regarding ISPM15. The meeting provided an opportunity to give Asian countries guidance on best practices regarding ISPM15. IFQRG was asked to explore 3 issues: 1) Examples of contaminating pests which may be found associated with wood packaging materials; 2) Infestation of wood packaging following treatment 3) How to properly use temperature measurement sensors There was discussion that IFQRG recommendations could be documented through the explanatory document. A report from the meeting was produced and should be consulted to determine if any recommendations should be made by NPPOs to the IPPC.
10	**Current phytosanitary issues**

10.1	**Regional Plant Protection Organisations (APPPC, COSAVE, EPPO, NAPPO etc)** **EPPO Forestry Panel– Andrei Orlinski** • Revised the Commodity Standard for conifers and sent for ultimate adoption. • Deleted the pests of *Buxus* from the EPPO alert lists because it is difficult to stop the spread on the international level, but it should be monitored on a local level. • Made several other additions and subtraction to the EPPO alert list. • Discussion of how EPPO can make a concerted effort to concentrate on urban trees and decide if they should have a separate workgroup for them. • Studied "non-manufactured wood commodities" (NMWC) – described what types of commodities would be included (ex. Wood chips), specific aspects and challenges that exist for each type. Began to explore how this might be developed into an EPPO standard. Some general discussion ensued around determining "standardized" terminology for the items listed under NMWC. Consider ISPM5. **Action Item (30 September):** A small working group was formed to advise EPPO on the potential NMWC standard (Adnan Uzunovic, Brian Zak, Filipa Pico); will produce an advisory document from IFQRG to EPPO. **APPPC – Mike Ormsby** Developed a regional standard on fumigation and participated in the ISPM15 workshop with NAPPO. This might be beneficial to provide the regional RSPM to NAPPO and FAO. **NAPPO – Eric Allen** • Ian McDonnell, NAPPO director, retired. There is a search for a new director. • Organization of NAPPO changed from panels to expert working groups • Wood Handicraft Standard was adopted in Feb 2014. • Science and Tech document released on EAB and biological control. • Science and Tech document on HT was finalized and is waiting for adoption by NAPPO exec. • Forestry Panel activities o ISPM 15 workshop, Beijing China o Follow up on comments made to the Science and Technology document on heat treatment o Develop specifications on systems approach to to manage pest risks associated with the movement of wood o Develop Science and Tech doc on Lymantriidae o Revise RSPM 33 (2009) *Guidelines for regulating the movement of ships and cargo from areas* o *infested with the Asian gypsy moth* o Work with EPPO on standard and risks associated with wood chips and wood residues
10.2	**EU projects: COST (REPHRAME, PERMIT)** **COST – Global Warning** Rene Eschen (Switzerland) was unable to attend but reported a new new COST Action, "Global Warning" The aim is to bring together scientists and regulators to explore a number of things for the future establishment of a network of sentinel nurseries to identify pests and their potential impact in the region of origin of live plants.

	PERMIT – no report It is recommended to IFQRG members to consult each group's website to stay informed on relevant activities. **Action Item:** Europeans involved in the above groups are requested to communicate a summary for inclusion into IFQRG12 report.
11	**Standards development**
11.1	**Handicrafts standard specification – Mike Ormsby** A general background on the creation of an ISPM was given, including the scope and tasks of the standard, and risks of the pathway. The expert working group is meeting next week (September 15-19) for the development of the standard.
11.1.1	**Handicraft Science Questions – Eric Allen** **Issues:** Moisture reduction is not a universal solution because there are pests that thrive in low moisture content (MC) wood, as well as fungi that are dormant in dry conditions and then become active if rewetted. Surface treatments (paint, lacquer) may protect the surface of the item but does not guarantee prevention of proliferation of already present pest. Size of the item is variable and not helpful in determining a consistently effective preventative measure. Another challenge is classifying the handicrafts because they are so variable in nature. Overriding issue is differentiating between what is a pathway and what is a true risk for a new infestation.
11.2	**ISPM 15 – Eric Allen**
11.2.1	**Science Question 1** 1) Examples of contaminating pests which may be found associated with wood packaging materials; Distinct definitions and examples of what is a contaminating pest were given. This is required for port inspectors to distinguish between contaminating pests and infestation pests. From the databases consulted, the majority of pests could be considered contaminating pests rather than infestation pests. A good first step is to produce a list of cosmopolitan contaminant pests that will be obvious to inspectors so they will not consider them ISPM15 noncompliant (ex. Spiders, ants)
11.2.2	**Science Question 2** 2) Infestation of wood packaging following treatment Three main organisms: fungi, nematodes, pests of dry wood (beetles and dry wood termites)

	Indeterminate how big of problem post treatment infestation is. Analysis of ISPM15 interception databases or new data collection is needed to understand the breadth of the problem. ISPM15 eliminated most of re-infestation risk through the bark threshold in the 2009 revision of the standard. ISPM15 has not been designed to eliminate all risk, but to minimize it. Consequently, post-treatment infestation is outside the scope of ISPM15. It was determined that a change in the philosophy of ISPM15 would be required to assess all post-treatment infestation. It was concluded that effective implementation of the standard should take precedence over the issue of post-treatment infestation. **Action Item (March 31, 2015):** Produce a support document that lists the contaminant and post-treatment infestation pests for inspectors that might be outside the scope of ISPM15 (Eric Allen, Mike Ormsby, Ron Mack, Ecki Brokerhoff, Steve Pawson, Lee Humble)
11.2.3	**Science Question3** 3) How to properly use temperature measurement sensors There are several documents that explain how to properly monitor temperature • ISPM15 text • Explanatory Document Supplemental educational training materials have been produced by some groups (ex. Embar in Portugal). Increased dissemination of the information in the Exploratory Document and educational materials is warranted. In practice, a facility can also treat to a higher temperature to assure that the necessary treatment temperature has been achieved. **Action Item (January 1, 2015):** Develop a simplified training document from the two existing Portuguese documents to be submitted to the CDC. This will be a joint effort between Embar and FEFPEB. (Filipa Pico and Paulo Verdasca)
11.3	**Review of 'Cardiff Protocol'** **Adnan Uzunovic – Background and History** Reviewed the challenges to developing appropriate efficacy data. Also provided background as to why IFQRG has been working on efficacy policy. Discussed how Probit 9 was the original efficacy requirement, but after country consultation it was determined that Probit 9 is too stringent, so another approach was necessary. The problem with Probit 9 is that it requires a large population to meet the required efficacy, and this is not possible with many of the pests that are associated with WPM. Instead, IFQRG had proposed a series of steps to achieve a desired efficacy in its first submission (IFQRG9 2011, Canberra, AU): Step1 – Screening process to determine most tolerant pest and life stage among pest groups to be a representative (7 of them) Step2 – Replicate the time/dose combination determined in Step1 on the most tolerant pest/life stage to confirm proper treatment dose. Step3 – Confirmatory Study under Simulated Operational Conditions Discussion ensued concerning statistical terminology (reliability and confidence) relating to experimentation. This is controversial because there needs to be a clear message in order for acceptance. The Cardiff Protocol was developed to reduce the experimental burden of the

Confirmatory Study. This would be achieved by taking advantage of the biological characteristics of pest groups and trade patterns.

TPFQ 2013 meeting in Brazil modified the first draft of the annex to ISPM15 on the criteria for the adoption of treatments for WPM and included a step to consider the physical parameters that would affect treatment efficacy.

Mike Ormsby – On the Cardiff Protocol

The Cardiff Protocol aims to utilize a comprehensive approach to assure that a treatment is effective (with desirable certainty) while also being realistic and feasible. It does this by taking into account all the biological characteristics that are required for a pest to successfully populate a new area.

Basis:
Level of efficacy = Agg. Volume x Infestation level / MPL (max pest limit)

Issues:

- Potential issue is the "temporal parameter", which considers the life cycle of the packaging and its relationship to being a viable host for the pest.
- Vector and organism relationships
- Lack of fundamental science needed hinders the use of MPL for most pests
- Approach does not work well for fungi or bacteria.

Possible Solutions:

- Consider alternative grouping based on biological characteristics (infestation level) rather than taxonomic group
- Simplify the Protocol and ignore MPL
- Go for a simple number, e.g. a target efficacy level of 99%

Two ways to achieve 95% level of confidence at a particular level of efficacy:

- Direct testing – the problem is test sizes may be much greater than what is feasible
- Extrapolation analysis – the problem is that if associated curve fit is poor, the estimated dose will be much higher than what is practical or needed.

Expertise and knowledge is required to ensure that the estimations derived by the Cardiff Protocol are accurate.

Need several pieces of information:

- Aggregation levels of wood
- Infestation rates of pest groups in sawn wood

A number of issues were raised and discussed:

- There is a need for pragmatic solutions for treatment development that are economically viable and delivered in a timely fashion
- There is value in clear communication regarding the treatment development process (e.g. sampling, statistical terminology and considerations, etc.). Mike Ormsby indicated that TPPT is working on this document and will share it prior to IFQRG13.

Action Item (Jan 30, 2015)- Develop a letter of request of the global pallet industry regarding pallet volumes and distribute to key contacts. Aggregate data to develop a volume number (Brad Gething, Mike Ormsby)
Action Item (Jan 30, 2015)- Deconstruct literature data to determine infestation rates on key target pest groups (Eric Allen, Ron Mack and collaborators)

	<u>Action Item (February TPFQ meeting)</u>- Write a reference document ("Modified Cardiff Protocol") that will provide appropriate numbers of test experimental units for treatment testing for each group. Circulate to the IFQRG group for comment. (Eric Allen)
12	**Research reports –** PDF versions of the research report PowerPoint presentations will be posted on the IFQRG word area.
12.1	**Pest Epidemiology**
12.1.1	**EAB in Russia and Europe– Yuri Baranchikov** EAB damage is widespread across Russia. Assumed that infestation started about 1990. Distribution maps based on surveys of dead and declining trees rather than trap data. Indicated that pathway is not firewood movement. Spread is through natural flight or hitchhikers on transportation vehicles. Climate projections show that environment is suitable for EAB spread across Europe and rest of far Eastern and Western Russia Potential for parasitoid (*Spathius* spp.) endemic to eastern Asia may be effective at reducing *A. planipennis* populations to prevent spread. Experimental releases have been deployed in the US. Questions were raised about non-target effects.
12.1.2	**Results of Pine Wilt Disease Surveys in Russia – Oleg Kulinich** Russia surveyed for the presence of pinewood nematode in Far East. The research showed that PWN is not present but *B. mucronatus* is commonly found across Russia. Pine wilt disease symptoms are only observed in certain areas. It is believed that the bacteria (*Pseudomonas fluorescens*) associated with *B. mucronatus* may be responsible for inducing pine wilt disease in Russia. The extraordinarily warm summer in 2010 is believed to have contributed to the expression of the pine wilt disease.
12.1.3	**Recent Detections of Pests in WPM in Australia – Chris Howard** May/June 2014 – Asian longhorned beetle, brown mulberry longhorn beetle, and Japanese sawyer beetle, were detected in a large consignment from China. This detection was made "post-border" after inspection, making it particularly concerning. Interception led to a review of Australian policies regarding WPM imports. A preliminary review of interception data revealed that pests that can infest post-treatment are intercepted far more often than pests of living trees. Ensuing discussion led to the conclusion that post-treatment infestation is not applicable to ISPM15 (see 11.2.2) and that NPPOs need to understand this and need to implement systems that consider post-treatment infestation.
12.2	**Pest Detection Techniques**
12.2.1	No presentations
12.3	**Phytosanitary policy and regulations**

12.3.1	**Global industry view on ISPM15 – Fons Ceelart** It was communicated that pallet associations from across the world are making a concerted effort to communicate common global issues. These issues include: • Lack of harmonization of marking schemes • Variable enforcement of policies • Need for alternative treatment methods • Need for practical HT field compliance test The industry requested feedback on the lack of harmonization regarding marking, and the industry was informed that the proper audience is the industry's NPPO.
12.3.2	**Economic effect of implementation of ISPM15 in Africa – Luca Tasciotti** Studies focusing on economic effects of ISPM15 on developing economies have been very limited. Overall economic analyses have shown that the economic burden is fairly large, and tends to equal the increased value of the export, so there is a trade-off. Study will include Cameroon, Botswana, Mozambique, and Kenya and will investigate the effect of implementation of ISPM15 in these countries. The information gathered from the study will help other developing countries to make educated decisions regarding ISPM15 implementation. A request was made to IFQRG regarding sources of information for African countries that would aid in performing the study.
12.4	**Wood Treatments**
12.4.1	**Comparative Study of Radio Frequency (RF) & Microwave (MW) Heating – John Janowiak** Presented a background on current ISPM15 treatments and the proposed dielectric heating (DH) standard. Several aspects of the DH proposal were questioned including the depth of penetration of the technologies and the requirement of reaching the treatment temperature within 30 minutes. Experimental design: matched white oak samples ranging from 9 cm^2 to 24 cm^2 were heated by MW and RF (equivalent power of 3.4kw). Temperature measurements were taken at different depths for each specimen from the core to the surface. Treatment times were held for 2 minutes after 60 ºC was achieved to ensure compliance with ISPM15 treatment schedule. Results showed that from 9 – 14 cm dimensions, RF and MW were relatively similar in heating rates, but above 14 cm RF heated much faster than MW. Moreover, above 14 cm MW could not achieve 60 ºC in the required 30 minutes. RF tended to show much better heating consistency in comparison to MW. Theoretical depth of penetration for dielectric energy was explored. This is where 63% of the electromagnetic energy is absorbed. The equation for depth of penetration shows that it is inversely proportional to frequency. So depth of penetration is greater for RF than MW (as frequency is much higher for MW than RF). The research group is looking to use the theoretical physics to develop treatment schedules. Higher power trials were run with RF. Increased heating times were observed, but not to the level of increased power. To get an approximate 70% increase in heating rate required tripling the amount of power applied. Current study is investigating commercial size treatments using RF of 60 to 120 cm thicknesses of white oak, red oak, and ash.

12.4.2	**Determining Treatment Cost of Pallets Under Dielectric Heating Criteria – Kelli Hoover** Study was performed on white oak, which represents the worst case scenario for North America. The oven used in this study was not optimized, so the comparisons made are specific to this study and most likely not representative of potential industrial scale settings. Capital costs were not included in the cost models because they are unknown at this time. Two different power settings were explored, and both estimates resulted in a treatment cost of $0.25/per pallet. Higher power required more energy, but allowed for more efficient treatment. Regarding industry HT data collected: the industry was not very cooperative in sharing their costs for HT. In addition, they often were not sure of their true costs for HT. HT costs are highly dependent on the cost of energy and fuel. Current research shows that smaller companies would benefit from DH more that larger companies because they pay more for energy. Request was made to IFQRG members to communicate industrial HT costs for other countries.
12.4.3	**Control and traceability of ISPM15 heat treatment – Gabriel Robert** French Food, Agriculture, and Forestry Dept. is interested in tracking heat treatment due to fraud in the system. There are several characteristics of wood that can be considered: • Moisture Content • Sugar content • Extractive content • VOC concentration In 2005 a European partnership explored the feasibility of several methods to track HT wood. • "Electronic Nose" – effective, but very expensive equipment • Bio Chemi Luminescence – effective, less expensive but requires well-trained operator • Near Infrared Spectroscopy – not as effective because of moisture variation. There is other ongoing research investing the feasibility and improve the technology.
12.4.4	**EAB pupal chamber depth in ash logs from Michigan, USA – Ron Mack** Due to some uncertainty regarding the maximum depth of pupal chambers in ash infested by EAB, a dedicated study was performed to make an absolute determination. The literature revealed that there was no consistent reference for measuring depth (including or excluding bark thickness). The current study used the maximum pupal chamber distance from the cambium, regardless if the chamber was found in the sapwood or bark. Over 13,000 stem cross sections were analysed. Key findings: • More than 50% of pupal chambers were formed in bark • There were 28 examples of sapwood chambers exceeding 1 cm depth in ≥ 12" diameter material • Maximum pupal chamber depth in sapwood was 18 mm

12.4.5	**Integrated phytosanitary pest management as an acceptable phytosanitary measure for wood exports – Steve Pawson** The volume of wood exports from New Zealand , particularly raw logs, is increasing, however there is a strong need for alternative phytosanitary treatments to MeBr. New Zealand is perusing multiple alternative treatments for logs, including alternative chemicals and heat. In addition they are exploring an integrated approach that assesses the risk of pest infestation and the need for phytosanitary treatments during periods of low pest prevalence, e.g., in winter. The proposed integrated approach explores both temporal and spatial methods. This involves an understanding of where pests are located and understanding when they are active during the year. With this data the probability of infestation of a log in can be estimated and then used as part of a risk analysis to determine if pre-export phytosanitary treatment are required. An extensive national trapping network has been established to determine the abundance of pests and experimentation is underway to estimate dispersal of pest species. Future steps are planned to parameterize the different components of Bayesian Network to model pest abundance and infestation risk in the landscape..
12.4.6	**Integrated measures to prevent movement of *Agrilus planipennis* in sawn wood – Eric Allen** When exploring certain wood processing measures that reduce infestation rates of pests, it is critically important to understand where the pest is located in tree stems. For the case of EAB, the larvae are located at the cambium and pupae are located at varying depths of the sapwood and bark. The adults then emerge from the pupal chambers. Typical processing of the tree stem into WPM involves debarking and then sawing into various lumber and timber dimensions and reduced to pallet components. Finally, the lumber is heat-treated. During the process, the outer edges of the wood see higher temperatures at a longer duration than the standard schedule of 56 ºC for 30 minutes. When these processing steps are quantified into estimations of risk reduction, 99.9999% of EAB pupae would be killed. When yearly Canadian wood exports were considered and the risk reduction applied, it was estimated that approximately 52 pupae would have survived. This number can be used in the evaluation of the overall risk of movement to another country. Further information is required to support general acceptance of systems approaches on many more organisms.
12.4.7	**Alternative method for determination of ISPM15 compliance – Gabriel Robert** In 2013, France explored an alternative method to monitor the ISPM15 heat treatment protocol. In 2005 they chose to have only air temperature recordings to monitor heat treatment and today they would like to change from wood temperature that is lower? shorter than air temperature. The results showed that it can't be ensured that the entire load is treated properly using only 2 wood temperature probes at 56 °C for 30 minutes due to the heterogeneity of heating in the heat chamber and the heterogeneity of wood moisture content and density. Final temperatures and hold times should also be increased above the prescribed 56ºC for 30 minutes to ensure proper treatment monitored by wood temperature probes.

12.4.8	**SF and Phosphine against fungi and PWN – Adnan Uzunovic** Collaboration with USDA APHIS and FP Innovations to investigate the effectiveness of sulfuryl fluoride and phosphine against fungal pathogens and pinewood nematode. Fungi were grown on grain rather than wood to ensure growth and provided a good experimental unit for testing. A micro GC was used to measure fumigant concentration over time, so several dosages could be evaluated. Results: • Phosphine was effective at killing PWN at 1000 ppm for 14 days of exposure, but not at 10 days of exposure • Phosphine was ineffective against most fungi at both exposure times • SF had a mixed result at 24 hrs and 15 and 20 ºC of exposure at all concentrations • SF was effective at 72 hrs and 15 and 20 ºC of exposure at concentrations above 160 g/cm^3 • SF was not effective against most fungi at 24 hrs and 15 and 20 ºC, somewhat more effective at 48 hours, and even more effective at 72 hours of exposure (at increased fumigate concentration)
13	**Review and adoption of IFQRG-12 report**
13.1	**Research opportunities** • Looking at the sub-lethal effects of treatments on organisms • Vector relations • Quantification of integrated measures • Development of dielectric complex parameters for optimization of DH treatment • Use of biological control agents against forest quarantine pests • **<u>Generation of a strategy document that clearly communicates, in a comprehensive manner, opportunities for cooperative funding for quarantine research (Possible CPM presentation)</u>** • Exploration of other experimental parameters (catalysts, synergists) that improve the effectiveness of fumigation
13.1.1	**Industry science questions** • Realization of a commercial scale RF treatment unit for industrial prototyping • Review of state of the art on alternatives to MB fumigation
13.2	**Work program for 2014-15** **See action items**
13.3	**Date and location for IFQRG-13** 2015 Potential location: Manchester, UK (Date TBD) 2016 Potential location: New Zealand (Date TBD)
14	**Close of meeting**

Participant List

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