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| **World Meteorological Organization****Commission for Instruments and Methods of Observation** **Second Session of the Expert Team on Operational Metrology (ET-OpMet)**Tokyo, Japan, 27-30 November 2017 | **CIMO/ET-OpMet-2/Doc. 5.3(3)**  |
| Submitted by:Damien Prescod13.11.2017 |

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# TITLE

 **Status & Plan for Inter-laboratory Comparisons**

 **WMO RA III & IV**

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| **Summary and purpose of document**This document provides information on the status & plans for Inter-Laboratory Comparisons (ILC) between CIMH & neighboring labs in WMO RA III & IV as well as Accreditation bodies concerned with similar calibrations. It identifies the challenges encountered with regional ILCs, illustrates the ongoing tests on alternatives to mercury sensing and future plans for collective regional replacement of mercury bulb recording dependency. |

**Action proposed**

The Meeting is invited to review this document and to agree on the actions needed to advance the progress of ILCs & Mercury Sensing alternatives.

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 **Appendix:** Sample Data from Intellisense Under-Test

**Status & Plan for Inter-laboratory Comparisons in WMO RA III & IV**

***Status of CIMH Lab***

1. The Caribbean Institute for Meteorology & Hydrology CIMH is presently having the laboratory procedures reviewed by the Barbados National Standards Institute BNSI. The initiative is aimed at advancing the status of the lab from an “Unaccredited” to an “Accredited” one.

 On September 16th a seminar was conducted at the CIMH under the tutelage of Mr Hayden Rhynd, the focus of the course was to advance the status of the CIMH’s lab towards the ISO/IEC 17025 standard. It is thought that with the assistance of the BNSI the lab can achieve this accreditation in the very near future. Along with the laboratory procedures and methods of operation, it has been indentified that attention to the administrative obligations of managing an accredited laboratory are required. These obligations are inclusive but not limited to tasks such as Internal Audits, Archiving of Calibration Documents & Periodically Scheduled External Procedural Reviews.

A guidance document has been provided to the CIMH endeavours to jettison the lab status from non-accredited towards Accredited. The document outlines a four tiered structured process whereby any lab seeking ISO/IEC 17025 accreditation is given step by step assistance in self-evaluation of the status of the lab journey towards accreditation. The CIMH has completed Tier 2 (Personnel Excellence & Equipment) of the guide document since it mainly deals with the actual processes in the day-to-day operation of the lab, Tier 1 (Organizational Readiness) is concerned with administrative & management processes outside of the realm of the lab work and testing. Tier 3 (Quality System Documentation & Realization) shall be reached after completing objectives in Tier 1/2 and finally Tier 4 (Verification & Implementation) the level where the auditing agency issues ISO certification.

 Plans have been drafted for further actions in the first quarter of the 2018 calendar year; additional seminars shall be scheduled as objectives on the guidance document are addressed.

***Laboratory Inter-Comparisons & Mercury Recording Alternatives***

1. Within Region IV CIMH has not performed any external inter-comparisons to date, there has also not been any cross comparison with region III relating to laboratory processes. What has been done however is internal cross comparisons for alternate technologies to mercury sensing. There were plans to perform cross comparisons with other meteorological agencies in the region. However given the events of the 2017 Hurricane season where Maria and Irma caused catastrophic damage to many islands, plans for such inter-agency action was suspended. The CIMH has assisted territories such as Grand Cayman, Grenada, Dominica and

The St Vincent & the Grenadines with exploration into the new accurate & safer technologies for mercury sensing.

At the CIMH a cross comparison test was conducted during the months of January – March 2017 utilizing students (Bahamas, St Vincent, Barbados) who were undertaking a course for Meteorological Observers. They were exposed to the Intellisense device from Fairmount Systems in the UK. The test was aimed at familiarizing the students to alternate technologies and to get the experience with devices such as the Intellisense that may replace their usual mercury bulb recordings in the near future.

The Instruments staff of the CIMH lab also conducted a second cross comparison test, this testing period was conducted for two main reasons.

1. To provide more accurate data recordings, since there were many gaps in the students data sets during their tests.
2. To aid in scientifically sound arguments “for” or “against” the use of the technology under test.

What was recognized via our tests is the sharp accuracy of the unit especially in the dry bulb data set, as can be seen in the graphs below. There was hardly any drastic variation of data points when the mercury bulb was compared to the Intellisense device’s dry Pt 100 probe.

Graph 1: **Intellisense Dry Probe Data vs Mercury Dry Bulb Data**

 Analysis of the wet bulb versus the Intellisense wet (wick soaked) probe provided some varying results “initially”. There was a concern raised over the behaviour of the Intellisense probe when data collected was compared to the

mercury bulb recordings. As can be seen in Graph 2 the initial data points are outside of tolerance for temperature. This lead us to ask why….. “ Why is the wet probe behaving so dissimilarly from the dry probe?”. What we identified was an error in the sheathing of the wet probe with the wick, whereby too much of the probe was being immersed in the distilled water container, what was required was for the wick to facilitate the capillary action of water towards the head of the probe. It was after this adjustment was made that we saw more accurate wet bulb data being recorded.

Graph 2: **Intellisense Wet Probe Data vs Mercury Wet Bulb Data**

1. **Challenges with Inter Laboratory Comparisons (ILC)**

 At present the main challenge CIMH is encountering with ILCs is from a personnel and resource perspective, in addition to the aforementioned issues more comprehensive knowledge is required to enable the lab to make contacts within similar agencies in nearby regions. Currently there is very limited knowledge of the laboratories in the Region IV or Region III performing the same calibrations CIMH is involved in. There is knowledge of laboratories in Costa Rica and Argentina however, it is expected that contact can be made with both or either of these laboratories and communications commenced on the way forward with ILCs. It is not expected that the language barrier should prevent efficient & effective communications as CIMH employs bilingual personnel capable of interpretation of Spanish.

 In relation to the challenges with equipment resources it would be difficult to cross compare methods of calibrations in some instances without losing the ability to perform the services required of the laboratory, unless the cross comparison is done outside of the active calibration service period (May-September regionally). For example if an ILC was done on Pressure using the PTB 330 from Vaisala and an urgent request was sent to CIMH for a calibration from a share holder, with our main PTB 330 at another lab under ILC we would lose the ability to perform that service thereby affecting the reliability of our expertise to clients. The obvious solution to such would be to purchase an additional PTB 330 but funding is limited and usually depends on “regional support” or “sustainability” projects.

 Personnel resources challenges are also hindering slightly the beneficial impact of ILCs from the perspective that given the responsibilities of the technicians managing the laboratory activities and conducting calibrations, there are many other duties being performed. The activities of the lab at present allow for dual roles to be conducted but as the lab is advanced toward an accredited ISO 17025 status it will become more difficult to conduct multi-tasking with the Instrument section. It is imagined that a dedicated role maybe required to effectively and efficiently manage and perform lab duties.

1. **Future Plans for Inter Laboratory Comparisons (ILC)**

Within Region IV (Argentina) and in Region III (Costa Rica) have been identified as possible ILC options. It is hoped that new relationships can be fostered via this meeting and subsequently via online interaction, thus providing methods of mutually beneficial inter-agency lab work. Outside of those two identified, the CIMH has made attempts via various workshops to bridge the work relationship gaps between our laboratory and the Meteorological laboratories in the region specifically in Cuba where wind calibrations are conducted.

 **Appendix**

***Sample Data from Intellisense Under-Test***

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| **Intellisense** |
| Dry Bulb / °C | Wet Bulb / °C |  R.H. % |
| 9:00 Obs | 3:00 Obs | 9:00 Obs | 3:00 Obs | 9:00 Obs | 3:00 Obs |
| 29.17 | 29.48 | 27.99 | 29.8 | 91 | 52 |
| 28.63 | 28.4 | 28.57 | 28.4 | 99 | 100 |
| 28.25 | 30.59 | 28.04 | 30.2 | 98 | 97 |
| 29.2 | 30.65 | 29.23 | 30.23 | 99 | 98 |
| 27.4 | 29.84 | 27.86 | 29.4 |   |   |
| 27.82 | 30.29 | 27.5 | 30.16 | 97 | 98 |
| 26.16 | 26.86 | 26.52 | 26.7 |   |   |
| 28.83 |   | 28.35 |   | 96 |   |
| 29.7 | 29.7 | 29.6 | 28.9 |   |   |
| 28.94 | 29.18 | 28.61 | 29.52 | 97 | 96 |
| 28.69 |   | 28.32 |   | 97 |   |
| 27.96 | 29.25 | 27.63 | 29.4 | 97 |   |
| 28.62 |   | 28.31 |   | 97 |   |
| 28.65 |   | 28.26 |   | 96 |   |
| 28.23 | 29.21 | 28.2 | 29.5 | 99 | 98 |
| 29.08 |   | 29.03 |   | 99 |   |
| 29.78 | 29.79 | 29.45 | 29.78 | 97 | 99 |
| 29.86 | 29.49 | 29.81 | 30.09 | 99 |   |
| 29.23 | 27.27 | 28.85 | 28.34 | 96 |   |
| 27.86 |   | 27.79 |   | 99 |   |
| 28.82 | 29.1 | 28.61 | 29.73 | 98 |   |
| 27.73 | 29.3 | 27.16 | 29.9 | 95 |   |
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***Sample Data from Mercury Bulb Thermometer***

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| Mercury |
| Dry Bulb / °C | Wet Bulb / °C |
| 9:00 Obs | 3:00 Obs | 9:00 Obs | 3:00 Obs |
| 29 | 29.5 | 24.8 | 28.4 |
| 28.5 | 28.5 | 25.2 | 25.5 |
| 28.4 | 30.5 | 25.5 | 25.3 |
| 29.3 | 30.5 | 24.8 | 25.4 |
| 27.4 | 29.4 | 24.9 | 24.9 |
| 25.1 | 30.1 | 25.1 | 25.8 |
| 26.4 | 26.1 | 25.5 | 25.3 |
| 28.9 |   | 28.9 |   |
| 26.4 | 28.9 | 25.5 | 28.9 |
| 29.2 | 29.4 | 24.9 | 26.4 |
| 28.87 |   | 25.6 |   |
| 28.1 | 29.4 | 25.3 | 24.8 |
| 28.7 |   | 24.6 |   |
| 28.7 |   | 24.5 |   |
| 28.6 | 29.4 | 25.3 | 24.5 |
| 29.5 | 29.7 | 25.5 | 25.4 |
| 29.9 | 30.1 | 25.5 | 25.7 |
| 30.1 | 29.7 | 26 | 25.8 |
| 29.4 | 27.5 | 25.8 | 24.6 |
| 28 |   | 26 |   |
| 28.1 | 29.3 | 25.2 | 25.5 |
| 27.1 | 29.5 | 24.8 | 24.5 |

*\*Empty Cell represent missing data*