Report of the meeting of the CCM Working Group on Low Pressures on April 25, 2005, at the NPL-UK in Teddington

Report written by Dr. Karl Jousten, PTB Berlin, Interim Chair WGLP

The participants agreed to the following agenda:

1. Welcome and membership of CCM working group of low pressures (WG LP). List of interested observers. WG LP web page.
2. Brief reports on Euromet.M.P-K1.a/b and SIM-EUROMET.M.P-BK3.
3. Presentation of preliminary results of CCM.P-K3.
4. Short report on progress of APMP.M.P-K4. General question on occasion of planned comparison NMIJ-MSLNZ within APMP: Bilateral comparison as RMO KC or CCM KC?
5. Planning of future CCM KCs.
6. Developments in improved low pressure transfer standards.
7. CCM WG on CMCs.
8. Various: Redefinition of the kg; Activities in ISO TC 112; Activities within SIM in LP field; Data of stability of transfer standards and link of the Euromet comparisons; Other.

The following report will refer to this numbering of the agenda.

1. The chair of CCM, Dr. Tanaka welcomed the attendees and introduced Dr. Jousten as interim chair of the CCM working group for low pressures (WGLP). Both he and Dr. Jousten expressed their thanks to the previous chairman, Dr. Archie Miiller, for his work as chairman as well as his very successful pioneering work for one of the first key comparisons within the CCM, the CCM.M.P-K4.
   The following members of the WG LP were confirmed: INMS-NRC (Canada), INRIM (Italy), KRISS (Korea), LNE (France), MSL-NZ (New Zealand), NIST (USA), NMIA (Australia), NMIJ (Japan), NPL (UK), NPL-I (India), PTB (Germany), SMU (Slowakia). The following new members (CCM members or observers) were adopted: CEM (Spain), CENAM (Mexiko), UME (Turkey). The latter was communicated to the interim chair during the 4th CCM conference by Dr. Kocas, UME, and was accepted by the WG LP. As observer the INMETRO (Brasil) was adopted.

Dr. Jousten announced that the BIPM provided a web page for the WG LP. The report of this meeting will be available on this site. Access to this web site will be given by an email to follow in the beginning of May.

2. Dr. Jousten gave a short summary report of the Euromet.M.P-K1.b and SIM-EUROMET.M.P-BK3, both carried out with the same protocol and the same transfer standards, in the range of $3 \cdot 10^{-4}$ Pa to 0.9 Pa. The two comparisons are already published in the Tech. Suppl. of Metrologia. Like these comparisons the Euromet.M.P-K1.a had been presented at the 4th CCM conference the week before.

3. Dr. Abbott from NIST reported on the progress of the CCM.P-K3 carried out between 1998 and 2002. Due to staff changes at NIST the evaluation of the data was significantly delayed until January 2005, when Dr. Abbott was assigned for this project. The pilot lab has organized the data since then and after finding out some inconsistencies in them, asked some participants to review their data. A preliminary data analysis for Draft A has been made and anonymised data were presented. Five transfer standards were circulated: 2 spinning rotor gauges (SRG), 2 Bayard-Alpert gauges (BAG) with glass envelopes, one with a stainless steel envelope (Stabil Ion Gauge SIG). The outcome of the comparison suffered from the breaking of the two BAG with glass envelopes. It was agreed by the WG LP to use just the data obtained with the 2 SRG and the SIG, as long as the available data from the BAG with glass envelope are consistent with the data obtained with the 2 SRG and the SIG and do not provide any additional information. The transport stability and the scatter of data after normalization suggest that a successful evaluation will be possible. The evaluation shall be carried out as suggested in a previous draft by Jousten, which resulted from experiences of a preceding comparison published in JVST A 15 (1997). Dr. Abbott indicated that after the data have been revised by the asked laboratories, he will forward to each participant their relative data to be confirmed. Draft A shall be finished in July.

4. Dr. Jousten informed the group about an email received by Dr. Mohan who is responsible in the pilot lab (NPL-I) for the APMP.M.P-K4 (10^{-3} Pa to 1 Pa). Apparently progress of this comparison is on hold because NPL-I cannot provide all transfer standards needed and is looking for help from another participant. No representative from APMP could add new information on this matter. In the context of another planned comparison within APMP, Dr. Jousten informed

about the two possible classification of comparisons following directly a CCM-KC with a proposed linkage to it: Either it is classified as RMO KC or CCM KC. In the first case the proposed pilot lab has to make the announcement to the responsible RMO TC chair who will forward it to the CCM secretary, who again will inform the CCM WG chair and KCDB manager. In the second case (CCM-KC) the proposed pilot lab makes the announcement to the CCM WG chair, who will forward it to the CCM secretary (then CCM chair) and the KCDB manager. Comparisons organised within a RMO shall normally be organised as such, comparisons between CCM members and agreed upon by the CCM WG LP shall be organised as CCM-KC.

5. Two comparisons were suggested before the meeting: A. Successor (and replacement) for K9 (high vacuum, SRG). B. He leak rates into vacuum. No further suggestion was made at the meeting. The reasoning for A is that K9 is outdated (20 years ago), and for provisional equivalence only. However, K4 and K3 have replaced K9 in the sense that the methods used and standards compared were very much the same. Dr. Miiller added that in the nearer future SRG might be available that have a greatly extended range for comparison purposes, so that it would make sense to wait for the result. The reasoning for B is that no CMC entries exist for leak rates (flow rates for low values). This means that there is no equivalence within the MRA established and there is no general traceability of accredited labs to the CIPM MRA (also important for MRA ILAC). Considering the points above, the WG LP decided to carry out a comparison of He leak rates with glass permeation leaks as transfer standards. As participants were identified: IMGC, PTB, NIST, KRISS, CENAM, LNE, NPL (calibrations after or at 2007), NMIJ (after or at 2007), CMI. PTB volunteered as pilot lab. Further details of the calibration procedure as the range of temperatures, choosing the connectors and number of repeat measurements etc. shall be agreed upon by the participants. The time line shall be the following: The pilot lab will draft a protocol in 2005 and acquire the necessary transfer standards. These shall be checked for a about a year's time to establish their long term stability and suitability as transfer standards. At the earliest the circulation of the standards can be foreseen for the end of 2006.

6. The letter sent in 2003 by the WG LP to the management of the Forschungszentrum Jülich to encourage further work on SRG for its extension into UHV, had no positive effect. Dr. Miiller, however, said that Bernd Lindenau from Forschungszentrum Jülich has started to continue work on this subject and may get help from Dr. Fremerey who recently retired.

7. Dr. Jousten informed the WG LP about the new WG on CMC of the CCM that will have its inaugural meeting on April 27 in Sevres. This working group shall facilitate the inter-regional CMC review process. Dr. Tanaka added information about the purpose of the new WG. A discussion developed to which extent peer reviews shall be necessary or obligatory in the future, especially in the respect that the quality documentation is normally written in the local language and would have to be translated just for the purpose of the assessment. The cost factor of peer reviews was also mentioned.

8. The following statement on the subject of a possible redefinition of the kg was adopted: "The CCM working group on low pressures took note of the efforts to redefine the kilogram, especially as recently described by Mills et al. in Metrologia 42, 71-80 (2005). The WG LP is not aware of any significant consequence on the realisation of the pressure scale below 1 kPa, especially the uncertainty thereof, if redefined as described in the mentioned publication. The WG LP would like to bring into attention, however, that redefining the kg has serious consequences for mass metrology and its related very strong and important community. Therefore the WG LP recommends that this decision should only been made with the consent of this community. The WG LP also believes that any change of the definition of the kg should be made with caution as it may not be long-lasting. The public expects from the CIPM that any changes of the SI system are steady, long lasting and bring clear improvements for the SI units under change. If in the future the CCM may need help for a new definition of the kilogram or its practical dissemination from the WG LP in respect to outgassing measurements, gas adsorption, vacuum environment etc., the CCM WG LP is prepared to be of any possible help in his hands." Dr. Jousten reported on the activities of the ISO Technical Committee TC 112. Important for the WG LP is the new Technical Specification ISO TS 3567 that has the title "Calibration by direct comparison with a reference gauge: General set-up and procedure". This states e.g. in Section 6.6. that reference gauges have to be traceable to a primary or national standard with a calibration certificate according to ISO 17025. The WG LP adopted the following statement to express its interest in the MRA related work on vacuum calibrations of ISO: "The CCM WG LP welcomes the activity of ISO TC 112 to develop technical specifications and standards for the dissemination of the pressure scale in the vacuum regime by comparison with reference standards. These specifications and standards shall help to correctly disseminate the vacuum

pressure scale on a secondary level and underlines the significance of the MRA, both of the CIPM and ILAC. The CCM WG LP encourages further work of ISO TC 112 to develop technical specifications and standards for the evaluation of measurement uncertainties in this field and for procedures of the calibration of vacuum gauges."

Dr. Torres gave an overview of the activities of SIM in the LP field. During the last few years the cooperation and activities among the national laboratories from SIM in vacuum have increased significantly. Particularly training courses have been carried out. A pilot study for a comparison of the CENAM and INMETRO standards in the range $3 \cdot 10^{-3}$ Pa to 0.9 Pa was carried out. NIST and CENAM, however, are so far the only countries with primary standards for fine and high vacuum, but NRC, Canada, is establishing another one.

Dr. Legras gave a report of the equivalence of the vacuum standards at 1 Pa of all laboratories that were independent to each other and that took part in the three KCs CCM.M.P.K-4, EUROMET.M.P.K1a and b.

Dr. Akimichi informed the WG LP about a planned new APMP comparison in the range from 10^{-3} Pa to 1 Pa that shall be linked to CCM.M.P.K-9. Six NMI will participate. The protocol has been prepared. Transfer standards will be SRGs, for which a transport device as used in the EUROMET.M.P.K1b shall be acquired from PTB. Planned date of the start of the comparison is within 2005.

At the end of the meeting Dr. Tanaka suggested to the WG LP to nominate Dr. Jousten as regular chair of the WG LP on the occasion of the CCM meeting later this week. His suggestion was unanimously accepted, after which Dr. Jousten expressed his thanks to the WG LP for their trust in him and their support.