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KCDB REPORT TO THE 8th JCRB MEETING

In the past year, the work related to the BIPM key comparison database, KCDB (http://www.bipm.org/kcdb), has been very active with frequent push of new information onto the Web. This includes the publication of new sets of CMCs freshly approved by the JCRB, the updating of information on key and supplementary comparisons, and the display of comparison results interpreted in terms of equivalence. We report here the evolution in content and design of the KCDB, giving some indication of the types of users who visit the KCDB website, as well as mentioning what steps we have taken to publicize the KCDB.

1. Update of the BIPM key comparison database (KCDB) since the 7th JCRB meeting

Appendix C

The 7th JCRB meeting was held on 8 and 9 October 2001 at the BIPM. Most of the Calibration and Measurement Capabilities (CMCs) approved at this meeting and in the time elapsed between the 7th and the 8th JCRB meetings (electronic approval via the interactive JCRB website http://www.bipm.org/JCRB) are now published via the KCDB. All of the newly published CMCs are relevant to metrology areas already present in the database at the time of the 7th JCRB meeting.

The present situation may be described as follows:

- *Photometry and Radiometry*:

Round 1 CMCs (those corresponding to "key comparison quantities or quantities very closely linked to key comparison quantities") declared by APMP, EUROMET, SADCMET and SIM were published via the KCDB on 10 October 2001 (APMP and EUROMET), 28 November 2001 (SADCMET) and 30 January 2002 (SIM). The corresponding CMCs declared via COOMET were sent for approval to the president of the JCRB on 22 February 2002.

- *Electricity and Magnetism*:

The publication of CMCs covering the full list of services in Electricity and Magnetism, carried out from January 2001 to April 2001, was completed with those from CCOMET on 24 October 2001.

- *Length*:

A first set of CMCs, covering a strict list of "key quantities" had been published in December 2000 (APMP, EUROMET and SIM) and in February 2001 (SADCMET). This was completed on 30 October 2001 by the publication of a second set declared by EUROMET and covering a much wider list of services.

- *Acoustics, Ultrasound and Vibration*:

CMCs declared by Malaysia and by SIM were respectively added on 4 October 2001 (date of the MRA signature by Malaysia) and 9 November 2001 to those from APMP, EUROMET and SADCMET already published in April 2001.

- *Chemistry*:

CMCs from APMP, COOMET, EUROMET and SIM covering the category of "gases" had been published on 15 June 2001, and completed on 11 January 2002 by those from Finland (once the Finnish provider NMI had been designated as a participant in the MRA).
CMCs from APMP, COOMET, EUROMET and SIM covering the categories of "pH" and "Electrolytic conductivity" were published on 22 February 2002.
CMCs from APMP, COOMET and EUROMET covering all other chemical categories should be published before the 8th JCRB meeting. Those from SIM, received at the BIPM on 20 February 2002, should be ready for publication by 14 March 2002.

By the time of the 8th JCRB meeting, the Appendix C database will contain about 12000 CMCs.

Appendix B

On 25 February 2002, 394 key and supplementary comparisons were recorded in the Appendix B database:

- About 27% of these had been carried out before the MRA was signed. They provide "Provisional equivalence" and are useful for supporting CMC declarations. It is highly probable that most of the "old" comparisons serving this purpose are now effectively entered into the database.
- About 55 % of the recorded comparisons are current or planned key comparisons carried out under the auspices of the Consultative Committees or the BIPM.
- The complement (18%) is composed of RMO key and supplementary comparisons.

The last two numbers are evidence that not all RMO key comparisons, even those directly corresponding to Consultative Committee key comparisons, are yet declared: one observes that the shortfall depends upon the RMO and/or the metrology area.

On 25 February 2002, Appendix B was displaying results for some 36 comparisons under the form of:

- individual laboratory measurements;
- equivalence statements (for key comparisons only);
- degrees of equivalence (for key comparisons only); and
- various graphs.

Though the "yellow part" of the matrix of equivalence (including the degrees of equivalence by pairs of laboratories) is generally felt as difficult to build and to read, the database displays it for all but one of the key comparisons "approved for equivalence", specifically because of the correlation terms in the uncertainty which may exist between pairs of laboratories (see CCEM-K3). In the single case where this information is not displayed the user has access to formulas allowing the computation of pair-wise degrees of equivalence.

Since November 2001, on average the results of one key comparison has been published each week. For those results published since the beginning of January 2002, a reference to the

Metrologia Technical Supplement (available on line) will be systematically given as soon as the .pdf version of the comparison final report is delivered to the BIPM.

On 25 February 2002, the Appendix B database did not yet include any results of RMO key comparisons linked to the corresponding CC key comparison. Two such examples are under way (EUROMET.EM-K4 and APMP.PR-K3.b) but are not yet ready. We have, however, already one example of results of a bilateral comparison, subsequent to a full-scale key comparison (CCQM-K9).

2. Present and future development of the BIPM key comparison database

Appendix C

CMCs published via the present Appendix C do not cover all metrology areas. We know, however, that CMCs relevant to Mass and Related Quantities and to Thermometry should fit the general model already in use for most of CMCs in Physics.
In this regard, note that the Appendix C Prototype has already successfully tested the entry of CMCs in Mass and Related Quantities declared by APMP and submitted to the JCRB for electronic approval by 15 March 2002.

The more recent and future developments concerning Appendix C are described below:

- *General Chemistry*

When on 15 June 2001 we opened the Appendix C Chemistry database with gas mixture data, we were fully aware that our system was provisional and could not handle correctly General Chemistry information. In addition, the CCQM at its 7th meeting requested that a filter on the Chemical category be implemented. We amended the complete system devoted to Chemistry in February 2002.

- *Ionizing Radiation*

The specificity of CMCs in Ionizing Radiation is two-fold:

  - the two “blue” columns, “Source of traceability” of the CMC EXCEL files, normally available for RMO review only, should be available to the database user in the case of Ionizing Radiation; and
  - the Classification of services drawn up for Ionizing Radiation does not rely on a “pile-up” of items defining (as ordinarily done for CMCs in Physics) services, sub-services and individual fine services.

A new part of the Appendix C database is thus being designed for hosting CMCs in Ionizing Radiation. The associated search engine will propose independent choices in lists of “Quantities”, “Media” and “Source types” as well as a “free-entry search” for selecting radionuclides. Our schedule is to open the Appendix C database for Ionizing Radiation in April 2002, as soon as some CMCs in this field are approved by the JCRB.

- *Implementation of new facilities for CMC declaration*

Following a request from the Electricity and Magnetism community, two new possibilities are now offered for simplifying the presentation of CMC EXCEL files. These may also apply to other fields, for instance Photometry and Radiometry.

  - Uncertainty matrices.
    A huge number of CMC lines can be gathered into one or a few CMC lines in cases where the uncertainty is better described by a matrix rather than by a single range of

values (for instance, AC/DC voltage transfer uncertainty which takes the form of a matrix assigning one uncertainty value to one voltage and one frequency). The Web programming will provide a link to the full matrix.

- Closely related CMCs.
  Two CMCs that are closely related (for instance, the real component and the imaginary component of an AC resistance) will appear close by when returned by the Web, though they are still declared in two separate EXCEL lines.

In order to implement these two new features of the Appendix C database, the document dated "March 2001" entitled "Instructions for drawing up CMC files" has been completed. The full set of instructions is now dated "February 2002" and is available at: http://www.bipm.org/enus/2_Committees/JCRB.shtml.
The Appendix C Web programming will be amended in the summer of 2002 to take these new features into account and thus be ready for hosting new rounds of CMCs in Electricity and Magnetism or Photometry and Radiometry (scheduled for the end of 2002).

Appendix B

The Appendix B database and Web programming will be entirely rebuilt during the course of the year 2002 with two new ideas for development:

- The dimension of "time".
  This relies on a classification of comparisons according to the epoch of their full validity. The old information would not be cancelled and would remain available on request, but the first information appearing on the screen would concern the "present" comparisons.
- The notion of "family" or "group"
  This relies on a classification of comparisons according to their common features (same quantity, same measurand level, same methods, etc.). According to this scheme the corresponding RMO and CC key comparisons would appear close by on the screen.

We also intend to design a general model for results of comparisons, thus giving up the present publication of images. This could not be achieved before we had real examples of results of RMO key comparisons linked to corresponding CC comparisons.

3. Visits to the KCDB

During the 7th JCRB meeting, a question arose as to the types of users who visit the KCDB, especially those interested in Appendix C. This is in effect a crucial question if one considers the amount of work Appendix C demands from the NMIs and RMOs.

A survey on the frequentation of the KCDB was carried out over the year 2001. The following features were observed:

- The number of visits (one visit corresponds to one computer linking to the main KCDB URL address http://www.bipm.org/kcdb) has continuously increased from about 1200 visits in January 2001 to about 1600 in February 2002 (for sake of comparison: the BIPM website receives about 900 visits each day). Each visitor "hits" the KCDB site on average 10 times.
- Among these visitors, some return several times during the month. For instance, in October 2001, 1583 visits were received from 1240 different computers. It is highly likely that the regular visitors are people from NMIs.

- Although we record the IP number of each computer linking the KCDB site, it is very difficult to know who is visiting the site. About 70% of the visitors reach us via an Internet provider (AOL, for instance) or via a global search engine (Altavista, for instance). Such visitors do not leave any trace of their identity.
- Among the resolved IP numbers, we observe nearly equal fractions of visitors from:
  - NMIs;
  - research laboratories (Observatories, French CNRS, geology, radiology protection, semi-conductors, etc.);
  - education (Universities, Libraries, etc.);
  - commercial firms; and
  - industries (Air Liquide, Boeing, Caterpillar, Du Pont, Honeywell, IBM, JAL, Lockheed Martin, Motorola, Schneider, SAAB, etc.).

This study turned out to be disappointing mainly because so many visitors cannot be identified. One solution could be to ask each visitor to fill in a brief questionnaire indicating their affiliation and interest in the KCDB.

4. Publicizing the KCDB

The first action taken towards publicizing the KCDB was the production of a leaflet (three-fold A4 format) about the MRA and the KCDB. This was widely distributed at meetings, congresses, etc. The second edition of this leaflet has just been published.

Three additional actions were taken since the beginning of the year 2002:

- Presentation of a poster (authors: R. Wielgosz and C. Thomas) entitled, “International comparability of gas standards: the Mutual Recognition Arrangement, MRA, and the BIPM key comparison database, KCDB” at the ISO/TC 158, 2nd Gas Analysis Symposium and Exhibition 2002, in Maastricht, The Netherlands (30 January to 1 February 2002).
- Production of a paper (authors: P. Allisy-Roberts and C. Thomas) entitled, “The operation of the CIPM mutual recognition arrangement and its relevance to the SSDLs”, to be published in the next SSDL Newletters.
- Presentation of the KCDB on the NIST booth at Pittcon 2002 (18 to 21 March 2002) in New-Orleans (Louisiana). We are grateful to Dr H. Semerjian from the NIST for inviting us to share the NIST stand and thus have a first opportunity to present our database to the Chemical industry community.

We are seeking further involvements of this type.