

Bureau International des Poids et Mesures

Consultative Committee for Units (CCU)

13th Meeting (September 1998)

Note on the use of the English text

To make its work more widely accessible
the Comité International des Poids et Mesures
publishes an English version of these reports.
Readers should note that the official record
is always that of the French text.
This must be used when an authoritative reference
is required or when there is doubt
about the interpretation of the text.

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THE BIPM AND THE METRE CONVENTION

The Bureau International des Poids et Mesures (BIPM) was set up by the Metre Convention signed in Paris on 20 May 1875 by seventeen States during the final session of the diplomatic Conference of the Metre. This Convention was amended in 1921.

The BIPM has its headquarters near Paris, in the grounds (43 520 m²) of the Pavillon de Breteuil (Parc de Saint-Cloud) placed at its disposal by the French Government; its upkeep is financed jointly by the Member States of the Metre Convention.

The task of the BIPM is to ensure worldwide unification of physical measurements; its function is thus to:

- establish fundamental standards and scales for the measurement of the principal physical quantities and maintain the international prototypes;
- carry out comparisons of national and international standards;
- ensure the coordination of corresponding measurement techniques;
- carry out and coordinate measurements of the fundamental physical constants relevant to these activities.

The BIPM operates under the exclusive supervision of the Comité International des Poids et Mesures (CIPM) which itself comes under the authority of the Conférence Générale des Poids et Mesures (CGPM) and reports to it on the work accomplished by the BIPM.

Delegates from all Member States of the Metre Convention attend the General Conference which, at present, meets every four years. The function of these meetings is to:

- discuss and initiate the arrangements required to ensure the propagation and improvement of the International System of Units (SI), which is the modern form of the metric system;
- confirm the results of new fundamental metrological determinations and various scientific resolutions of international scope;
- take all major decisions concerning the finance, organization and development of the BIPM.

The CIPM has eighteen members each from a different State: at present, it meets every year. The officers of this committee present an annual report on the administrative and financial position of the BIPM to the Governments of the Member States of the Metre Convention. The principal task of the CIPM is

to ensure worldwide uniformity in units of measurement. It does this by direct action or by submitting proposals to the CGPM.

The activities of the BIPM, which in the beginning were limited to measurements of length and mass, and to metrological studies in relation to these quantities, have been extended to standards of measurement of electricity (1927), photometry and radiometry (1937), ionizing radiation (1960) and to time scales (1988). To this end the original laboratories, built in 1876-1878, were enlarged in 1929; new buildings were constructed in 1963-1964 for the ionizing radiation laboratories and in 1984 for the laser work. In 1988 a new building for a library and offices was opened.

Some forty-five physicists and technicians work in the BIPM laboratories. They mainly conduct metrological research, international comparisons of realizations of units and calibrations of standards. An annual report, published in the *Procès-Verbaux des Séances du Comité International des Poids et Mesures*, gives details of the work in progress.

Following the extension of the work entrusted to the BIPM in 1927, the CIPM has set up bodies, known as Consultative Committees, whose function is to provide it with information on matters that it refers to them for study and advice. These Consultative Committees, which may form temporary or permanent working groups to study special topics, are responsible for coordinating the international work carried out in their respective fields and for proposing recommendations to the CIPM concerning units.

The Consultative Committees have common regulations (*BIPM Proc.-Verb. Com. Int. Poids et Mesures*, 1963, **31**, 97). They meet at irregular intervals. The chairman of each Consultative Committee is designated by the CIPM and is normally a member of the CIPM. The members of the Consultative Committees are metrology laboratories and specialized institutes, agreed by the CIPM, which send delegates of their choice. In addition, there are individual members appointed by the CIPM, and a representative of the BIPM (Criteria for membership of Consultative Committees, *BIPM Proc.-Verb. Com. Int. Poids et Mesures*, 1996, **64**, 124). At present, there are ten such committees:

1. The Consultative Committee for Electricity and Magnetism (CCEM), new name given in 1997 to the Consultative Committee for Electricity (CCE) set up in 1927;
2. The Consultative Committee for Photometry and Radiometry (CCPR), new name given in 1971 to the Consultative Committee for Photometry (CCP) set up in 1933 (between 1930 and 1933 the CCE dealt with matters concerning Photometry);
3. The Consultative Committee for Thermometry (CCT), set up in 1937;
4. The Consultative Committee for Length (CCL), new name given in 1997 to the Consultative Committee for the Definition of the Metre (CCDM), set up in 1952;

5. The Consultative Committee for Time and Frequency (CCTF), new name given in 1997 to the Consultative Committee for the Definition of the Second (CCDS) set up in 1956;
6. The Consultative Committee for Ionizing Radiation (CCRI), new name given in 1997 to the Consultative Committee for Standards of Ionizing Radiation (CCEMRI) set up in 1958 (in 1969 this committee established four sections: Section I (X- and γ -rays, electrons), Section II (Measurement of radionuclides), Section III (Neutron measurements), Section IV (α -energy standards); in 1975 this last section was dissolved and Section II was made responsible for its field of activity);
7. The Consultative Committee for Units (CCU), set up in 1964 (this committee replaced the "Commission for the System of Units" set up by the CIPM in 1954);
8. The Consultative Committee for Mass and Related Quantities (CCM), set up in 1980;
9. The Consultative Committee for Amount of Substance (CCQM), set up in 1993;
10. The Consultative Committee for Acoustics, Ultrasound and Vibration (CCAUV), set up in 1998.

The proceedings of the General Conference, the CIPM and the Consultative Committees are published by the BIPM in the following series:

- Comptes Rendus des Séances de la Conférence Générale des Poids et Mesures;
- Procès-Verbaux des Séances du Comité International des Poids et Mesures;
- Reports of Meetings of Consultative Committees.

The BIPM also publishes monographs on special metrological subjects and, under the title *Le Système International d'Unités (SI)*, a brochure, periodically updated, in which are collected all the decisions and recommendations concerning units.

The collection of the *Travaux et Mémoires du Bureau International des Poids et Mesures* (22 volumes published between 1881 and 1966) and the *Recueil de Travaux du Bureau International des Poids et Mesures* (11 volumes published between 1966 and 1988) ceased by a decision of the CIPM.

The scientific work of the BIPM is published in the open scientific literature and an annual list of publications appears in the *Procès-Verbaux* of the CIPM.

Since 1965 *Metrologia*, an international journal published under the auspices of the CIPM, has printed articles dealing with scientific metrology, improvements in methods of measurement, work on standards and units, as well as reports concerning the activities, decisions and recommendations of the various bodies created under the Metre Convention.

MEMBER STATES OF THE METRE CONVENTION

Argentina	Japan
Australia	Korea (Dem. People's Rep. of)
Austria	Korea (Rep. of)
Belgium	Mexico
Brazil	Netherlands
Bulgaria	New Zealand
Cameroon	Norway
Canada	Pakistan
Chile	Poland
China	Portugal
Czech Republic	Romania
Denmark	Russian Federation
Dominican Republic	Singapore
Egypt	Slovakia
Finland	South Africa
France	Spain
Germany	Sweden
Hungary	Switzerland
India	Thailand
Indonesia	Turkey
Iran (Islamic Rep. of)	United Kingdom
Ireland	United States
Israel	Uruguay
Italy	Venezuela

LIST OF MEMBERS OF THE CONSULTATIVE COMMITTEE FOR UNITS

on 8 September 1998

President

I.M. Mills, International Union of Pure and Applied Chemistry [IUPAC],
Commission STU.

Executive secretary

P.W. Martin, Bureau International des Poids et Mesures [BIPM], Sèvres.

Members

Committee of the Russian Federation for Standardization, Metrology and
Certification [GOST], Moscow.

International Astronomical Union [IAU].

International Commission on Illumination [CIE].

International Commission on Radiation Units and Measurements [ICRU].

International Electrotechnical Commission [IEC], Technical Committee 25.

International Organization for Standardization [ISO],
Technical Committee 12.

International Union of Pure and Applied Chemistry [IUPAC],
Commission STU.

International Union of Pure and Applied Physics [IUPAP],
Commission SUN-AMCO.

National Institute of Metrology [NIM], Beijing.

National Institute of Standards and Technology [NIST], Gaithersburg.

National Physical Laboratory [NPL], Teddington.

National Research Laboratory of Metrology [NRLM], Tsukuba.

Organisation Internationale de Métrologie Légale [OIML].

Physikalisch-Technische Bundesanstalt [PTB], Braunschweig and Berlin.

L. Villena, Madrid.

The Director of the Bureau International des Poids et Mesures [BIPM],
Sèvres.

Consultative Committee for Units

Report of the 13th Meeting
(8-9 September 1998)

to the Comité International des Poids et Mesures

Agenda

- 1 Opening of the meeting; designation of a rapporteur.
- 2 Review of developments since the 12th meeting of the CCU.
- 3 Introduction of the neper as a special name for the SI unit one.
- 4 Possible introduction of a symbol for the unit one.
- 5 Possible extension of the range of SI prefixes.
- 6 Changing the prefixes k, h and da to K, H and D.
- 7 Standardization and improved SI base unit definitions for the new millenium.
- 8 Request for the “katal” as a coherent derived SI unit.
- 9 Progress towards a new definition of the kilogram.
- 10 Other business.

1 OPENING OF THE MEETING; DESIGNATION OF A RAPPORTEUR

The Consultative Committee for Units (CCU) held its 13th meeting at the Bureau International des Poids et Mesures, at Sèvres: four sessions were held on 8 and 9 September 1998.

The following were present: A. Allisy (ICRU), N. Capitaine (IAU), R. Dybkaer (IFCC), J.C. Gallop (NPL), V. Kose (PTB), I.M. Mills (President), B.W. Petley (IUPAP/SUN-AMCO), T.J. Quinn (Director of the BIPM), T. Sakurai (NRLM), B.N. Taylor (NIST), A.J. Thor (ISO/TC12).

Also present: P. Giacomo (Director Emeritus of the BIPM), P.W. Martin (BIPM).

Apologies for absence were received from Mr L. Villena and IEC/TC25*.

Prof. Mills reported the sad news of the death of Prof. Max McGlashan and asked that the committee members stand in silence for a few moments to remember a respected colleague who had made great contributions to the work of the CCU and to the wider field of standards and metrology.

It was agreed that Dr Gallop should act as rapporteur for this committee meeting.

2 REVIEW OF DEVELOPMENTS SINCE THE 12TH MEETING OF THE CCU

Dr Quinn reported that the main development since the previous meeting of the CCU in April 1996 had been the successful publication of the 7th edition of the SI brochure. Prof. Mills extended the special thanks of the CCU to Dr Quinn and Dr Blackburn for their efforts and for the great attention to detail applied to the production of the brochure. Dr Quinn replied that this had been a team effort involving many individuals at the BIPM and elsewhere.

* We regret to report on the death of Dr C.E. Kuyatt, representative of the IEC/TC 25, soon after the CCU meeting, on 12 September 1998.

3 INTRODUCTION OF THE NEPER AS A SPECIAL NAME FOR THE SI UNIT ONE

Prof. Mills summarized the present position concerning the neper and the bel, units used especially for expressing the values of logarithmic quantities such as logarithmic decrement or for field and power levels. Both neper and bel appear in the 7th edition of the SI brochure in Table 6 as non-SI units approved for use with the SI. The previously agreed intention of the CCU was that the CGPM would be asked to approve inclusion of the neper as a derived SI unit in view of its coherence (in contrast to the bel) with the SI base units and other SI derived units. Three papers were presented to the meeting which challenged this view.

Dr Petley suggested there were strong commonalities between the neper, bel, radian, steradian, bit and byte. He urged a prudent approach while we await any user response to the changes introduced in the 7th edition of the brochure.

Dr Taylor pointed out that the neper is the coherent unit for logarithmic quantities only if the various logarithmic quantities are defined in a certain way. Under other assumptions the bel would become the coherent derived SI unit for logarithmic quantities. He mentioned that the question of coherence of a system of units is an issue for ISO TC/12, which decided twenty-five years ago to adopt the neper as the coherent unit. In contrast industrial use favours the bel.

Dr Thor stated that the wider use of the bel and decibel merely reflected the historical fact that before electronic calculators logarithmic tables were widely used for calculations and base ten logarithms were much easier to use than natural logarithms. The situation now was quite different and either base may be equally easily used. The entire system of quantities (especially the system of equations) is much simpler, however, when a natural logarithmic base is used. For complex quantities the only useful logarithm is the natural logarithm. The CCU should not consider retreating on the position it adopted at the previous meeting. The only issue should be the speed with which we press for the introduction of the neper as an SI unit.

In summary, Prof. Mills stated that the neper is the coherent unit in view of the prior inclusion of the radian. In expressions concerning exponential variation of a quantity with respect to time the harmonic situation (with an imaginary exponent) involves the angular frequency ω , with unit $\text{rad} \cdot \text{s}^{-1}$. When the exponent is real (and negative) a decrement or decay is obtained and then the unit multiplying time is the attenuation coefficient or decrement, which is measured in $\text{Np} \cdot \text{s}^{-1}$. Thus the neper is coherent with the radian and with the SI.

Dr Quinn proposed that a small working group consisting of Drs Petley, Taylor and Thor draft a proposal to submit to the CIPM suggesting that the neper should be included in the class of SI derived units and that the whole committee would consider this draft later in the meeting. After further discussion of the draft proposal on the second day of the meeting, it was agreed that the draft recommendation concerning the adoption of the special name neper be submitted to the CIPM as Recommendation U 2 (1998).

4 POSSIBLE INTRODUCTION OF A SYMBOL FOR THE UNIT ONE

Prof. Mills pointed out that at present there is wide use of a number of abbreviations expressing numerical values such as “ppm” and “ppb”. The problem here is that many of these are language dependent. In addition, confusion can often arise over the values of quantities due to different definitions of, for example, the term billion, or the differences between parts per thousand and parts per trillion (both expressed sometimes as “ppt”). The natural solution would be to encourage the use of the prefixes approved for use with SI units, but these must always be attached to a unit. To express purely numerical values a name and symbol for the derived unit “one” are required. Prof. Allisy raised the objection that the 7th edition of the SI brochure already contains separate definitions of the unit one (in Table 3 the derived units radian and steradian; in Table 6 the neper and the bel, non-SI units but accepted for use with the SI) and this meeting was proposing now to introduce yet another. There was general agreement, however, that a special symbol for the unit one be introduced with the express purpose of using this in conjunction with prefixes.

Dr Quinn proposed that a discussion paper prepared by the CCU be forwarded for the consideration of the CIPM suggesting that a special symbol for the unit one should be included in future editions of the SI brochure in Table 3. Dr Dybkaer, Prof. Dr Kose and Prof. Mills agreed to formulate a proposal to be brought before the whole committee. Following further discussion it was agreed that the proposed change to the SI is significant and should therefore be taken in two stages. A proposal with a view to changing the document should first be submitted to the CIPM, to be referred later to the CGPM. It was agreed that the draft recommendation on the special name for the SI dimensionless derived unit one, the U or the uno, for use with SI prefixes, be submitted to the CIPM as Recommendation U 3 (1998).

5 POSSIBLE EXTENSION OF THE RANGE OF SI PREFIXES

Two papers were submitted to the CCU, one from a working group of Drs Petley (chairman), Mills and Taylor, and another from the American Association of Physics Teachers (AAPT). There was general agreement that the AAPT proposal was more logical and because of its simplified rules for generating extended prefixes, more readily committed to memory by users. Unlike the CCU working group proposal, however, it proposes the use of multiple prefixes, specifically prohibited by the current SI brochure. Also it would require the deletion of the currently (but only recently) agreed prefixes for 10^{-24} and 10^{24} , so that the single prefix at the lower and upper ends of the range would finish with zepto and zetta, respectively, z being the last letter in both French and English alphabets.

Prof. Dr Kose, and Drs Gallop and Sakurai agreed that there was no immediate demand from users for the extended range although Dr Dybkaer pointed out that conversion from molar concentrations to atomic or molecular concentrations already involved factors of the order of 10^{24} .

It was agreed that nothing further should be done at present except to bring the attention of the CIPM to the proposal from the AAPT.

6 CHANGING THE PREFIXES k, h AND da TO K, H AND D

Prof. Mills regarded this as a sensible proposal but one which should be introduced to run in parallel with the existing symbol definitions for a transition period of perhaps ten years. Dr Thor agreed and reported that the IEC has reached the final voting stage on the adoption of names and symbols for binary multiples and that here the symbols use upper case letters followed by lower case i, noting especially the symbol Ki for 2^{10} . This has obvious similarities with the proposed changes to the SI prefixes.

It was agreed that no changes be recommended for the present and that when a change is made it should be done as a whole, not prefix by prefix. If at a future time multiple prefixes were to be introduced to the SI, that would also be an appropriate time to change the prefixes k, h and da to K, H and D. This proposal should be combined with the AAPT proposal on the extension of the prefixes and brought to the attention of the CIPM in a single paper.

7 STANDARDIZATION AND IMPROVED SI BASE UNIT DEFINITIONS FOR THE NEW MILLENNIUM

Prof. Mills mentioned that there is a view suggesting that a standardized form for the definitions of the base units of the SI is desirable. Logic might dictate that since some units depend on the prior definition of others (especially the second) it might be possible to define the units in a more rational order. Dr Taylor presented a paper (CCU1998-1) which proposed standardized and improved definitions of the SI base units. Prof. Dr Kose agreed that a standardization was desirable but felt that this was not the moment to attempt such a thing. A more appropriate time would be when, for example, a new definition of the kilogram was required. Dr Petley suggested that since discussions with the other Consultative Committees would be required, wider circulation of Dr Taylor's and Dr Thor's papers would not be appropriate. There was general agreement that the ISO style of definition was not liked since it lacks grammatical sense. Although Dr Giacomo favoured the elimination of symbols of the base units from the definitions the committee generally opposed this view. It was agreed that a working group consisting of Prof. Dr Kose, Dr Quinn, Dr Taylor and Dr Thor should refine the draft document and then have it sent by mail to each of the Consultative Committees for comment, following which the group would then report back to the next CCU meeting. The document should at this stage consider only the definitions of the base units. The working group should aim to have a draft document ready to send to the next consultative committee meeting (the CCQM) in February 1999.

8 REQUEST FOR THE "KATAL" AS A COHERENT DERIVED SI UNIT

Dr Dybkaer presented, on behalf of the International Federation of Clinical Chemistry and Laboratory Medicine (IFCC), a paper requesting the adoption of a special name "katal" for the coherent derived SI unit the $\text{mol} \cdot \text{s}^{-1}$. He pointed out that catalytic activity may be expressed in terms of mass or number of molecules produced, or in terms of antigenic activity in biological and medical measurements. A widely used unit U is not a coherent SI derived unit. Medical technician users find the unit $\text{mol} \cdot \text{s}^{-1} \cdot \text{l}^{-1}$ inconvenient. Informal use of a special name katal for $\text{mol} \cdot \text{s}^{-1}$ has already been introduced. This will not drive out the use of the incoherent unit U until a special name can be incorporated into the SI. This special name could appear in the SI brochure in

Table 3 for the same reason that the becquerel, sievert and gray currently appear there, namely, for their importance in safeguarding human health.

Drs Petley and Taylor expressed the view that inclusion of the katal may open up a Pandora's box since many other special interest groups may wish to include their own special names for coherent units in view of their importance to human health. Dr Gallop remarked that the existence of the three radiological special names for over twenty years had not yet produced a similar proliferation.

Dr Quinn argued that any future proposals from the physics or engineering communities for special names should be ruled out but that, in view of the SI's relative neglect of the metrological needs of chemists and biologists, any recommendations coming from those communities should be carefully considered.

Prof. Mills asked if the name "katal" should be used for other quantities with the same dimension as catalytic activity (i.e. having the SI unit $\text{mol} \cdot \text{s}^{-1}$). Dr Dybkaer said that it would not be appropriate to use the name for flow, for example. Its use should be limited to the physical quantity catalytic activity.

It was agreed that the draft recommendation on the special name for the SI unit mole per second, the katal, for the expression of catalytic activity, be submitted to the CIPM as Recommendation U 1 (1998).

9 PROGRESS TOWARDS A NEW DEFINITION OF THE KILOGRAM

Dr Taylor presented a paper to the committee (CCU1998-9) which summarized some issues concerning a possible future redefinition of the kilogram. In the paper he does not address the issue of a possible change of name such that SI prefixes could be used with the SI unit of mass in the same manner as with other SI base units. The paper considers only two possible routes to redefinition, one based on the watt balance in which the value of the Planck constant is fixed and the other based on a determination of the Avogadro constant and fixing its value. He showed how these two approaches are related. He pointed out that the watt balance provides a mechanism for easily monitoring the kilogram whereas repeated redetermination of the lattice spacing of Si does not provide quite as straightforward a means. For a definition of the unit of mass in the SI that fixes the value of the Avogadro constant, the

unified atomic mass unit also becomes fixed. Dr Taylor suggested that in future the appropriate mechanism for managing the redefinition should start with setting up a working group being composed of members from the relevant Consultative Committees (including the CCU, CCEM, CCQM and CCM). Dr Kose and Prof. Mills had the support of the committee when they proposed that this is not yet necessary, but that experimental progress with both possible routes to redefinition should be monitored closely.

10 OTHER BUSINESS

The International Commission on Illumination has asked if, in the definition of the lumen, it is necessary to include Ω_0 . Dr Quinn proposed that a reply be sent based on a response made by Dr Terrien in 1979 to the effect that Ω_0 is not required.

Prof. Allisy thanked the chairman on behalf of all the committee members for his patience and effectiveness in dealing with the agenda.

The next meeting of the committee will be arranged to occur most probably during 2000 or 2001 so as to mesh with the meeting cycles for other Consultative Committees.

J. Gallop, Rapporteur
September 1998,
revised January 1999

**Recommendations of the
Consultative Committee for Units
submitted to the Comité International
des Poids et Mesures**

1 RECOMMENDATION U 1 (1998):
Special name for the SI unit mole per second, the katal,
for the expression of catalytic activity*

The Consultative Committee for Units,

considering

- the importance for human health and safety of facilitating the use of SI units in the field of medicine and biochemistry,
- that a non-SI unit called “unit”, symbolized U, equal to $1 \mu\text{mol} \cdot \text{min}^{-1}$, which is not coherent with the SI, has been in widespread use in medicine and biochemistry since 1964 for expressing catalytic activity,
- that the absence of a special name for the SI coherent unit mole per second has led to the results of clinical measurements being given in various local units,
- that the use of SI units in medicine and clinical chemistry is strongly recommended by the international unions in these fields,
- that the International Federation of Clinical Chemistry and Laboratory Medicine (IFCC) has asked the Consultative Committee for Units to recommend the special name katal, symbol kat, for the SI unit mole per second,
- that while the proliferation of special names represents a danger to the SI, exemptions are made in matters related to human health and safety (15th CGPM, 1975, Resolutions 8 and 9, 16th CGPM, 1979, Resolution 5),

noting that the name katal, symbol kat, has been used for over thirty years for the SI unit mole per second to express catalytic activity,

recommends the adoption of the special name katal, symbol kat, for the SI unit mole per second in the fields of medicine and biochemistry for the expression of catalytic activity.

* After consulting the CCQM, the CIPM decided to propose a modified version of the recommendation to the 21st CGPM.

2 RECOMMENDATION U 2 (1998):

The neper and the bel*

The Consultative Committee for Units,

considering that

- the natural logarithm is used to define logarithmic decrement, field level and power level in the system of quantities on which the SI is based,
- quantities and quantity equations on which the SI is based become simplified when the natural logarithm is used,
- in particular for complex quantities the only useful logarithm is the natural logarithm,
- with the use of the natural logarithm, the radian and the neper become coupled, and thus the two units should be given the same status in the SI,
- the 20th CGPM (1995, Resolution 8) decided to interpret the then supplementary units in the SI, namely the radian and steradian, as dimensionless derived units and, consequently, to eliminate the class of supplementary units as a separate class in the SI,
- the CIPM, in the seventh edition of the SI brochure (1998) has accepted the name neper, symbol Np, as a special name and symbol for the coherent SI unit “one”, for expressing the values of logarithmic quantities when using natural logarithms, and also the name bel, symbol B, as a practical unit for expressing the values of such quantities when using logarithms to the base ten, and has emphasized the importance of stating the reference level,
- there is a need to complete the internal consistency of the SI by formally adopting a special name and symbol for the SI unit “one”, for expressing the values of logarithmic quantities in areas such as acoustics and electrotechnology,

recommends

- the adoption of the special name neper, symbol Np, for the SI dimensionless derived unit “one”, for expressing the values of logarithmic quantities such

* The CIPM at its 87th meeting shortly after the meeting of the CCU transformed this recommendation into a draft Resolution to the 21st CGPM meeting in October 1999.

as logarithmic decrement, field level or power level when using natural logarithms, and

- the confirmation of the decision by the CIPM to accept for use with the International System the name bel, symbol B, and its commonly used sub-multiple the decibel, symbol dB, that may be considered as non-coherent units when logarithms to the base ten are used.

3 RECOMMENDATION U 3 (1998):

**Special name for the SI unit one, the U or the uno,
for use with SI prefixes***

The Consultative Committee for Units,

considering that

- the use of SI prefixes with SI units allows the use of units of the SI with a magnitude much greater or less than that of the SI units,
- while the use of SI prefixes compromises the coherence of the SI, it has undoubtedly added to its practical value and contributed to its widespread use,
- there is at present no convenient way of using the SI prefixes to express values for dimensionless quantities for which the unit has no special name,
- it can be unsatisfactory to use for this purpose powers of ten expressed in the form 10^n ,
- in consequence, expressions such as “per mille”, “ppm”, “ppb” and “ppt” which are often language dependent and in some cases ambiguous in their meaning have come into widespread use, and that this is to be deprecated,

recommends the adoption of the special name U or uno, symbol U, for the dimensionless derived unit one, for use in combination with the SI prefixes to express the values of dimensionless quantities which are much greater or less than one.

* The CCU preferred to leave it open as to the final choice of the name and invited the CIPM to make suggestions. The CIPM subsequently decided to take note of this recommendation but took no action for the time being other than to encourage wide examination of the proposal.

LIST OF ACRONYMS USED IN THE PRESENT VOLUME

1 Acronyms for laboratories, committees and conferences

AAPT	American Association of Physics Teachers, College Park MD (United States)
BIPM	Bureau International des Poids et Mesures
CCE*	Consultative Committee for Electricity, see CCEM
CCEM	(formerly the CCE) Consultative Committee for Electricity and Magnetism
CCM	Consultative Committee for Mass and Related Quantities
CCQM	Consultative Committee for Amount of Substance
CCU	Consultative Committee for Units
CGPM	Conférence Générale des Poids et Mesures
CIE	International Commission on Illumination
CIPM	Comité International des Poids et Mesures
GOST	The State Committee of the Russian Federation for Standardization, Metrology and Certification, Moscow (Russian Fed.)
IAU	International Astronomical Union
ICRU	International Commission on Radiation Units and Measurements
IEC/TC 25	International Electrotechnical Commission, Technical Committee 25: Quantities and units, and their letter symbols
IFCC	International Federation of Clinical Chemistry and Laboratory Medicine
ISO/TC 12	International Organization for Standardization, Technical Committee 12: Quantities, units, conversion factors
IUPAC	International Union of Pure and Applied Chemistry
IUPAP	International Union of Pure and Applied Physics
NIM	National Institute of Metrology, Beijing (China)
NIST	National Institute of Standards and Technology, Gaithersburg (United States)

* Organizations marked with an asterisk either no longer exist or operate under a different acronym.

NPL	National Physical Laboratory, Teddington (United Kingdom)
NRLM	National Research Laboratory of Metrology, Tsukuba (Japan)
OIML	Organisation Internationale de Métrologie Légale
PTB	Physikalisch-Technische Bundesanstalt, Braunschweig and Berlin (Germany)
STU	Commission on Physicochemical Symbols, Terminology and Units of IUPAC
SUN-AMCO	Commission for Symbols, Units, Nomenclature, Atomic Masses and Fundamental Constants of IUPAP

2 Acronyms for scientific terms

SI	International System of Units
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