A PROPOSAL TO I R P A FOR A SOLUTION OF THE PROBLEM OF THE S I - UNITS IN RADIATION PROTECTION AND RADIOLOGY

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1. INTRODUCTION

In order to be ready for the centennial of the International Metric Convention the decisions about the introduction of the SI units have been hurriedly pushed through by a small group of metrologists without sufficient consultation and participation of practicians and industry.

This is especially true and grave for the radiological units (Ci,R,rad,rem) where neither IRPA nor medical societies or their members had a fair chance to make comprehensive studies, proposals or statements in due time. Fortunately most countries which now try to introduce the recommendations into national legislations have been forced to recognize and reconsider the problems of the radiological units.

IRPA and its Associate Societies are urged to take advantage of this new situation and to act immediately in order to work out reasonable and practicable proposals.

2. THE PRESENT SITUATION

The bodies responsible for the SI units have very lately tried to correct at least a few of the worst drawbacks of the original puristic proposal by admitting the special names Gray for the unit of absorbed dose and Becquerel for the unit of activity. Countries which have tried to adopt the SI system have either given the "old" radiological units a special status allowing their future use side by side with the new SI units or have been forced by the arguments from health physicists, radiologists and industry to introduce a moratorium or provisional transition period of five to ten years in waiting for further international development. Even in the most recent publications of national or international bodies and in technical or scientific publications either the old units are still used exclusively or at worst side by side with the new ones; nobody dares to use the new units alone.

3. A SHORT REVIEW OF PROBLEMS AND ARGUMENTS

For practical application there is no obvious or recognizable need for other than the old radiological units.

One may not argue in the same way as for the change from non-metric anglosaxon units to the metric system. Contrarily to that case the SI units in radiation protection cannot bring simplification of calculations or improved international standardization because we already have this with the old units. All we have to expect are practical complications, errors, confusion and additional calculations. There will be no simplification of calculation by using SI units because already the old units are decimal ones while the non-decimal time units for half life or duration of measurements or exposures will remain. Changed conversion factors and the loss of a familiarity of long years with the orders of magnitude will bring further complications.

The orders of magnitude of practicable units should provide simple figures for the mostly used values. This is even recognized in the SI system, e.g. by admitting the bar = 10^5 Pa. Only in radiation protection we would be forced to use extremely unhandy orders of magnitude. The average citizen is able to understand prefixes between milli- and kilo-, technicians between micro- and Mega-, anything outside this range is even difficult for scientists, and everybody will have to look up such new ones as atto-, Peta- or Exa-.

Even in the SI system practical and proven "old" units have been preserved in various fields, such as kWh, eV, atomic mass unit, sea mile, knot, carat, tex, liter, are, minute, hours, decibel etc. Many of these units need much more troublesome descriptions by SI units than Ci, R, rad or rem. Thus there is no real argument against using old and new radiological units side by side, and the prejudice has been set for other applications and units. Why should radiation protection and radiology be discriminated compared with navigation or jewellery ?

An additional reason not to hurry with a decision about units is the fact that there are yet unsolved problems of radiological quantities such as a replacement of exposure or a more generally applicable similar quantity, or questions about dose equivalent and index quantities. These should be settled before the units can be dealt with in a coordinated way.

A large part of the efforts for better training and information of workers and of the public and for giving them at least an idea of the orders of magnitude of radiation exposures would be seriously impaired or even annihilated by switching to completely unfamiliar units and magnitudes. We will face serious accusations of falsification or cheating if we express environmental releases in Giga-Bq instead of mCi per year or reduce the dose values by a factor of 100 through the use of the Gy. That this may have uncontrollable political, psychological and economical effects in today's unstable situation regarding nuclear power and waste disposal should be quite clear even to scientists in the ivory tower.

Thus the whole question is no longer a purely scientific problem but has important practical and even political consequences. We must not forget that in radiation applications and protection today more than 90% of the work is done not by scientists but by technicians and workers with only limited radiation protection training.

Discussions at the Washington and Amsterdam IRPA congresses, at a NEA/ICRP seminar, in the Fachverband für Strahlenschutz and, as an excellent example, the "Andersen fairy tale" by J.W.Poston in the October 76 issue of "Health Physics" showed clearly the large opposition of the practical health physicists against a change (there is an even larger "silent majority"). In Switzerland the Federal Commission for Radiation Protection stated very clearly and categorically that the old radiological units should be kept together with the new SI units.

Can we really risk a radical change for the only sake of aesthetics and physical purism ?

Did any of the bodies recommending the SI units ever do a risk-benefit-cost analysis ?

4. SOME ELEMENTS OF A RISK-BENEFIT-COST ANALYSIS

We are urged by ICRP to do an analysis of the necessity and of the risks, benefits and costs of any radiation exposure. If we want to remain credible, it is compulsory that we do the same thing if we want to introduce new quantities or units in radiation protection. Space does not allow to present a complete analysis, so only a few of the factors which would have to be analyzed in order to reach an acceptable decision shall be enumerated:

Risks:

- High probability of frequent and grave errors by many orders of magnitude in radiation protection, radiology and radiotherapy with real risks for life and health (this is a significant difference for radiological units compared with many other units).
- Political, psychological and economical risks due to public reactions with consequences for decisions on nuclear power and waste disposal. These risks are so serious in the present situation that no scientists may forget about these practical aspects in favour of purely scientific arguments.

Benefits, Needs:

- No real benefit for radiation protection or radiology has been shown.
- No real need for a change has ever been expressed by practicians.

Costs:

The proposed short transition times of five to ten years without sufficient time for testing and introduction of new units would provoke a huge amount of completely unnecessary costs such as:

- Scrapping and replacement or conversion of measuring instruments that still work satisfactorily and could remain in service many more years; additional costs for recalibration (even the standardizing laboratories would be flooded by calibration requests and might be unable to handle those in due time).
- High costs for industry for design and production of new instruments within a very short time, resulting in unnecessarily high investments for exaggerated production capacities which would be used only a short time, and consequently resulting in increased costs for the buyers without an additional benefit in terms of performance.
- Large expenditures in manyears and money for:
  - training and instruction,
  - recalculation of limits, working levels and similar complications,
  - amendment and replacement of laws, regulations, codes, standards, recommendations, textbooks, forms, manuals, handbooks etc., without the cheaper possibility to wait for other and sufficient reasons for a replacement or amendment,
  - costs of all errors and their consequences which will happen during many years due to the forced introduction of unfamiliar units and unhandy orders of magnitude.

Summing up the probable results of an analysis of the needs, risks, benefits and costs we find:

- no real or urgent needs
- no real benefits
- plenty of real risks and hazards
- many complications for practical application
- unnecessary and very high costs at a very unfavorable time when funds are short and urgently needed for much more important applications and when manpower and training in radiation protection and radiology are barely sufficient for the most urgent needs.

- We are buying a "pig in a poke" by adopting a system which has not been tested or evaluated at all in practice and which is obviously neither desired nor accepted by the practicians.

Can we really take this responsibility as health physicists, scientists and citizens ?

5. A PROPOSAL FOR A COMPROMISE AND FOR ACTIONS BY I R P A

In order to avoid an unfruitful polarization between supporters and opponents of the SI units, the only reasonable solution, at least for the decade to come, seems to be the coexistence of the old and new units. There is no need to hurry with a final solution as the practicians are still happy with the old units and the SI supporters may use the new ones if they dare.

What we need is sufficient time for a serious, objective and thorough study of the real needs, problems and possible solutions, including compromises. The yet open problems of certain radiological quantities must be solved before we can attempt a final solution for the units. We must improve cooperation and should use the available time for sampling the opinions of all concerned. Once suitable proposals have been found, sufficient time should be allotted for a thorough evaluation and practical testing and for assuring the acceptance by a majority.

These are the reasons for a motion by the Fachverband für Strahlenschutz to the General Assembly of IRPA. We believe that IRPA due to its structure and wide range of members is the predestinated body for coordinating the efforts towards a solution of this problem. We propose that :

1. IRPA takes action to reconsider and reevaluate the problem of the radiological units in connection with the SI system in order to work out an optimal and practicable solution without undue risks and costs;
2. IRPA sets up a working group or committee for the management of this problem;
3. This working group organizes an inquiry among the Associate Societies and their members with the aim to get representative opinions and proposals on all questions and problems submitted by the working group;
4. The working group evaluates the answers of the Societies and worksout a proposal for a representative statement by IRPA, proposes further actions by IRPA, submits the above proposals to the Associate Societies and to the Executive Council of IRPA in such time that a discussion can be held and decisions can be taken at the 5th International Congress of IRPA and at the corresponding General Assembly.

We do not urge you to decide now for or against the SI units. All we ask for is cooperation, time and support in order to find a satisfactory, reasonable and practicable solution for this and for similar future problems. We are seeking a solution which will not be introduced before it will be ready for general acceptance, which will last for a sufficient period, which we can support with good conscience and from which we will get a real benefit for radiation protection without unnecessary and undue risks, costs and complications.