radiologists for the relief of suffering. Many of us hope, too, that the name of Stockholm will be for ever associated with two outstanding achievements—the promulgation of the first international recommendations for the well-being and protection of the X-ray and radium worker, and secondly, the adoption of an international unit of X-ray intensity.

Ladies and gentlemen, the city of Stockholm has paid us a great compliment in its active support of the Congress and its generous hospitality to-night. May I attempt to voice our gratitude and to assure the city that its profound beauty and the gracious kindliness of its Royal House and its citizens have for ever enchained our hearts with links of esteem, admiration and deep affection.

Later in the evening nearly 2,000 attended the ball, which was held in the magnificent Blue Hall adjoining, the scene being one of almost mediæval splendour.

On Thursday, July 26, the official banquet was held in the Winter Garden of the Grand Hotel Royal, at which some 800 members and their friends were present. The Choral Society of the University of Stockholm sang Swedish folk songs, and dancing again went on until the small hours.

Throughout the week numerous entertainments, excursions, etc., were arranged for the visiting ladies. No one who was present is likely to forget the Stockholm Congress for many years.

INTERNATIONAL RECOMMENDATIONS FOR X-RAY AND RADIUM PROTECTION

At the meeting of the Radio-Physics Section of the International Congress of Radiology at Stockholm on Thursday, July 26, the proposals of the British X-ray and Radium Protection Committee were discussed.

Dr. G. W. C. KAYE, in moving the adoption of the proposals, said:—

As the result of its seven years' experience in England and a close scrutiny of the protective recommendations in other countries, the British X-ray and Radium Protection Committee ventures to submit for international adoption a series of recommendations designed to assist in the well-being of the radiological worker and to unify protective measures in all countries. These proposals, which have been circulated to all members, are not to be regarded as regulations or as having any legal significance or authority. Such a question, it is considered, is best left to each individual country to deal with.

The proposals are to be regarded as an attempt at representing, according to present notions, ideal conditions which will, for example, be helpful in designing new X-ray departments or modifying existing ones. It may well be that in some cases and in some countries it may not be possible to follow the recommendations rigidly. Some latitude is no doubt possible and for that reason we have confined ourselves to major recommendations and left it to each country to elaborate detail.

It is anticipated that, as time goes on, experience will indicate more clearly than we know now in what directions relaxation of the recommendations may be expedient and desirable, and it is therefore suggested that the recommendations, if they are adopted, should come up for review at each subsequent International Congress.

Dr. Kaye said that, as the result of discussion, a few minor amendments should be made to the proposals as printed and circulated. These he read out, and then formally proposed the adoption of the proposals so amended.

Dr. L. S. TAYLOR (U.S.A.) formally seconded the motion, which was supported by members from Germany, Holland, Sweden, Italy, Belgium and other countries, and subsequently carried unanimously.

Dr. KAYE then proposed the following motions:—

(1) The Radio-Physics Section has unanimously approved, with certain minor emendations, the proposals of the British X-ray and Radium Protection Committee and forwards them to the meeting of the General Assembly for endorsement and promulgation.

(2) The Radio-Physics Section recommends that the opportunity should be given at the Third International Congress for the discussion of any revision of these proposals which experience may suggest in the interim.

These proposals were carried unanimously. They were later approved by the Executive Committee of the Congress, who submitted them for approval to the general assembly of members on Friday, July 27. The Executive Committee also suggested that an International Protection Committee should be formed to consist, in the first instance, of the following members:—Dr. L. S. Taylor (U.S.A.), Dr. G. Grossmann (Germany), Dr. I. Solomon (France), Dr. R. Siévert (Sweden), Dr. Ceresole (Italy), with Dr. G. W. C. Kaye and Dr. S. Melville (England) as hon. secretaries. This committee would make itself responsible for exchanging views and presenting suggestions to the next Congress. All three proposals were unanimously approved by the general assembly.

The approved recommendations are as follows:—

INTERNATIONAL RECOMMENDATIONS FOR X-RAY AND RADIUM PROTECTION

The following recommendations were adopted at the Second International Congress of Radiology in Stockholm in July, 1928.

1. The dangers of over exposure to X rays and radium can be avoided by the provision of adequate protection and suitable working conditions. It is the duty of those in charge of X-ray and radium departments to ensure such conditions for their personnel. The known effects to be guarded against are:

(*a*) Injuries to the superficial tissues;

(*b*) Derangements of internal organs and changes in the blood.

I. *Working Hours, etc.*

2. The following working hours, etc., are recommended for whole-time X-ray and radium workers:

(*a*) Not more than seven working hours a day.

(*b*) Not more than five working days a week. The off-days to be spent as much as possible out of doors.

(*c*) Not less than one month's holiday a year.

(*d*) Whole-time workers in hospital X-ray and radium departments should not be called upon for other hospital service.

II. *General X-ray Recommendations*

3. X-ray departments should not be situated below ground floor level.

4. All rooms, including dark rooms, should be provided with windows

affording good natural lighting and ready facilities for admitting sunshine and fresh air whenever possible.

5. All rooms should be provided with adequate exhaust ventilation capable of renewing the air of the room not less than ten times an hour. Air inlets and outlets should be arranged to afford cross-wise ventilation of the room.

6. All rooms should preferably be decorated in light colours.

7. X-ray rooms should be large enough to permit a convenient lay-out of the equipment. A minimum floor area of 250 sq. ft. (25 sq. metres) is recommended for X-ray rooms and 100 sq. ft. (10 sq. metres) for dark rooms. Ceilings should be not less than 11 ft. (3·5 metres) high.

8. A working temperature of about 18°C. (65°F.) is desirable in X-ray rooms.

9. Wherever practicable the X-ray generating apparatus should be placed in a separate room from the X-ray tube.

III. *X-ray Protective Recommendations*

10. An X-ray operator should on no account expose himself unnecessarily to a direct beam of X rays.

11. An operator should place himself as remote as practicable from the X-ray tube. It should not be possible for a well rested eye of normal acuity to detect in the dark appreciable fluorescence of a screen placed in the permanent position of the operator.

12. The X-ray tube should be surrounded as completely as possible with protective material of adequate lead equivalent.

13. The following lead equivalents are recommended as adequate:

X rays generated by peak voltages.	Minimum equivalent thickness of lead.
Not exceeding 75 KV.	1 mm.
,, ,, 100 ,,	1·5 ,,
,, ,, 125 ,,	2 ,,
,, ,, 150 ,,	2·5 ,,
,, ,, 175 ,,	3 ,,
,, ,, 200 ,,	4 ,,
,, ,, 225 ,,	5 ,,

14. In the case of diagnostic work, the operator should be afforded protection from scattered rays by a screen of a minimum lead equivalent of 1 mm.

15. In the case of X-ray treatment the operator is best stationed completely outside the X-ray room behind a protective wall of a minimum lead equivalent of 2 mm. This figure should be correspondingly increased if the protective value of the X-ray tube enclosure falls short of the values given in paragraph 13. In such event the remaining walls, floor and ceiling may also

be required to provide supplementary protection for adjacent occupants to an extent depending on the circumstances.

16. Screening examinations should be conducted as rapidly as possible with minimum intensities and apertures.

17. The lead glass of fluorescent screens should have the protective values recommended in paragraph 13.

18. In the case of screening stands the fluorescent screen should, if necessary, be provided with a protective "surround" so that adequate protection against direct radiation is afforded for all positions of the screen and diaphragm.

19. Screening stands and couches should provide adequate arrangements for protecting the operator against scattered radiation from the patient.

20. Inspection windows in screens and walls should have protective lead values equivalent to that of the surrounding screen or wall.

21. Efficient safeguards should be adopted to avoid the omission of a metal filter in X-ray treatment.

22. Protective gloves, which should be suitably lined with fabric or other material, should have a protective value not less than $\frac{1}{2}$ mm. lead throughout both back and front (including fingers and wrist). Protective aprons should have a minimum lead value of $\frac{1}{2}$ mm.

IV. *Electrical Precautions in X-ray Rooms*

23. The floor-covering of the X-ray room should be of insulating material such as wood, rubber or linoleum.

24. Overhead conductors should be not less than 9 ft. (3 metres) from the floor. They should consist of stout metal tubing or other coronaless type of conductor. The associated connecting leads should be of coronaless wire kept taut by suitable rheophores.

25. Wherever possible earthed guards should be provided to shield the more adjacent parts of the high-tension system. Unless there are reasons to the contrary the metal parts of the apparatus and room should be efficiently earthed.

26. The use of quick acting double-pole circuit breakers is recommended. Over-powered fuses should not be used. If more than one apparatus is operated from a common generator, suitable overhead multi-way switches should be provided.

27. Some suitable form of kilo voltmeter should be provided to afford a measure of the voltage operating the X-ray tube.

V. *Radium Protective Recommendations*

(A) *Radium Salts*

28. Protection for radium workers is required from the effects of:

(*a*) Beta rays upon the hands;

(*b*) Gamma rays upon the internal organs, vascular and reproductive systems.

29. In order to protect the hands from beta rays, reliance should be placed, in the first place, on distance. The radium should be manipulated with long-handled forceps, preferably made of wood, and should be carried from place to place in long-handled boxes, lined on all sides with about 1 cm. of lead. All manipulations should be carried out as rapidly as possible.

30. Radium, when not in use, should be stored in a safe as distant as possible from the personnel. It is recommended that radium tubes or applicators be inserted into separate lead blocks in the safe, giving a thickness of protective wall amounting to 5 cm. of lead per 100 milligrammes of radium element.

31. A separate room should be provided for the "make-up" of screened tubes and applicators, and this room should only be occupied during such work.

32. In order to protect the body from the penetrating gamma rays during handling of the radium, a screen of not less than one-inch thickness of lead should be used, and proximity to the radium should only occur during actual work and for as short a time as possible.

33. The measurement room should be a separate room and it should contain the radium only during its actual measurement.

34. Nurses and attendants should not remain in the same room as patients undergoing radium treatment.

35. All unskilled work or work which can be learnt in a short period of time should preferably be carried out by temporary workers, who should be engaged on such work for periods not exceeding six months. This applies especially to nurses and those engaged in "making-up" applicators.

36. Discretion should be exercised in transmitting radium salts by post. In the case of small quantities it is recommended that the container should be lined throughout with lead not less than 3 mm. thick. It is more satisfactory to transport large quantities by hand in a suitably designed carrying case.

(B) *Emanation*

37. In the manipulation of emanation, protection against the beta and gamma rays has likewise to be provided.

38. The handling of emanation should be carried out, as far as possible, during its relatively inactive state.

39. The escape of emanation should be very carefully guarded against, and the room in which it is prepared should be provided with an exhaust fan.

40. Where emanation is likely to come in direct contact with the fingers, thin rubber gloves should be worn to avoid contamination of the hands with active deposit. Otherwise, the protective measure recommended for radium salts should be carried out.

41. A separate pumping room should be provided with a connecting tube

from the special room in which the radium is stored in solution. The radium in solution should be heavily screened to protect people working in adjacent rooms. This is preferably done by placing the radium in solution in a lead-lined box, the thickness of lead recommended being according to the following table:

Quantity of radium element.	Thickness of lead.
0·5 gram.	6·0 inches (15 cm.)
1·0 ,,	6·6 ,, (16·5 ,,)
1·5 ,,	6·8 ,, (17 ,,)
2·0 ,,	7·2 ,, (18 ,,)

INTERNATIONAL X-RAY UNIT OF INTENSITY

At the general assembly of members on July 27, at the Second International Congress of Radiology at Stockholm, the following proposals from the International X-ray Unit Committee were formally adopted:—

1. That an International Unit of X radiation be adopted.

2. That this international unit be the quantity of X radiation which, when the secondary electrons are fully utilised and the wall effect of the chamber is avoided, produces in one cubic centimetre of atmospheric air at 0°C. and 76 cm. mercury pressure, such a degree of conductivity that one electrostatic unit of charge is measured at saturation current.

3. That the international unit of X radiation be called "the Röntgen," and that it be designated by the small letter "r."

4. That various standard methods be employed to establish the unit.

5. That for all comparative purposes it is advisable to employ ionisation chambers which have been calibrated in terms of a standard chamber for X radiation of the various qualities employed. It is also advisable to make the wall effects of these chambers as small as possible.

6. That the practical instrument used to measure X-ray output be called a dosage-meter.

7. That the constancy of the indications of the dosage-meter be tested by means of gamma radiation emitted from a definite quantity of radium element, the measurement being carried out always under the same conditions.

8. That any specification of dosage is incomplete without specifying the quality as well as the quantity of the radiation. The quality of X radiation used for practical purposes is very varied, and it would be impracticable to give a complete specification of it; but much information can be obtained from a knowledge of the degree of absorption of the radiation in standard materials, the peak voltage applied to the tube, together with the filter employed and the general character of the high-tension apparatus.