Chapter 18
The International Basic Safety Standards and Their Application in Medical Imaging

John Le Heron and Cari Borrás

Abstract In 2011, several international organizations, led by the International Atomic Energy Agency, completed the latest revision of the document commonly known as the Basic Safety Standards (BSS), and during the course of 2012 its formal approval by each of the cosponsoring organizations was completed. The BSS is used worldwide as the basis for radiation protection legislation and regulations. As in the previous versions, this updated BSS sets out the radiation protection requirements for workers, members of the public and patients. Particular attention is given to the use of radiation in medical applications, the potential benefits of which are increasing, especially with the developments of new imaging technologies and wider use of image-guided interventions. The provision of radiological procedures involve a multidisciplinary team led by a physician who often is not the licensee of an authorized facility, thus the responsibilities in medical exposures are shared by several individuals. The BSS establishes the education, training and competence requirements and lists the functions of the radiological medical practitioners, referring medical practitioners, medical radiation technologists and medical physicists. Procedure justification is to be shared between the referrer and the medical radiological practitioner, who is also responsible for optimization of protection, aided by the medical radiation technologist who chooses the appropriate patient techniques, and by the medical physicist, who calibrates sources, assesses image quality and patient dose, and is responsible for the physical aspects of the quality assurance programme, including equipment acceptance testing and commissioning. They all participate in preventing, detecting and assessing unintended

J. Le Heron (✉)
Radiation Protection of Patients Unit, Division of Radiation, Transport and Waste Safety, International Atomic Energy Agency, A-1400, Vienna, Austria
e-mail: J.Le.Heron@iaea.org

C. Borrás
Radiological Physics and Health Services Consultant, 1501 44th St. NW, Washington, DC 20007, USA
e-mail: cariborras@starpower.net

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and accidental medical exposures. The practical implementation of these BSS requirements should ensure the radiation protection and improve the quality of practice in a radiological facility.

Keywords Human imaging for non-medical purposes • Justification • Medical exposure • Occupational exposure • Optimization • Public exposure • Radiation protection • Safety standards • Unintended and accidental medical exposures

1 Introduction

The use of radiation in medicine continues to grow throughout the world, bringing immense benefit to patients and to society. The growth is due to several factors. At one level there are simply more machines, increasing the ease of access to radiological procedures, especially in the developing world. Secondly there continue to be developments in technology and techniques that have changed how radiological procedures are performed and what they can achieve – for example, digital technologies are replacing analogue systems, MDCT is replacing SDCT, image-guided interventional procedures are utilised in many areas of medicine replacing surgical or other procedures, and virtual procedures are becoming a reality. Due to the increasing capabilities of radiological procedures, the role of imaging in particular is changing – on the one hand, radiology is becoming the first "port of call" in determining what is wrong with the symptomatic patient and, on the other, it is increasingly taking on a role in the early detection of disease, often in asymptomatic individuals.

The potential benefits arising from radiation in medicine are increasing. But radiation can also cause harm, with deterministic, carcinogenic and hereditary effects. The responsible use of radiation requires a regulatory framework that gives a formal structure to ways of ensuring that the benefits can be utilised and, at the same time, keeping the harm to an acceptable level. Regulatory requirements for radiation protection should be essentially the same throughout the world and this naturally leads to the role of international safety standards in providing a consistent approach to ensuring radiation protection.

The development of safety standards is a statutory function of the International Atomic Energy Agency (IAEA). In particular, the IAEA statute (Article III.A.6) expressly authorizes the Agency "to establish standards of safety for protection of health" and "to provide for the application of these Standards". The IAEA published the first set of basic safety standards in June 1962 as Safety Series No. 9 [4], following the guidance of their Board of Governors in 1960 that "The Agency's basic safety standards ... will be based, to the extent possible, on the recommendations of the International Commission on Radiological Protection (ICRP)". A revised version was published in 1967 and a third revision in 1982. This edition, titled the 1982 Edition of Safety Series No. 9 [5], was jointly sponsored by the IAEA, the International Labour Organisation (ILO), the Nuclear

Energy Agency of the Organisation for Economic Co-operation and Development (OECD/NEA), and the World Health Organization (WHO). The revision of these Standards started in 1991 with the incorporation in the process of the Food and Agriculture Organization of the United Nations (FAO), which had just published jointly with WHO the Codex Alimentarius, and the Pan American Health Organization (PAHO), which had had a radiological health programme since 1960 with strong emphasis on patient protection [3]. The new Standards, with the title International Basic Safety Standards for the Protection against Ionizing Radiation and for the Safety of Radiation Sources (known as the BSS) was published in 1996 [2], following the approval or endorsement of the governing bodies of all the cosponsoring organizations, a consensus of 192 countries. Since then, the BSS, promoted by the cosponsoring organizations, has been used as the basis for radiation protection legislation/regulations worldwide.

A review of the 1996 BSS, carried out in 2006 by the then cosponsoring organizations, concluded that, while there was no single major reason for a revision, a number of factors – including the then imminent publication of the new ICRP recommendations – justified preparing a new edition. The revision process started in 2007, with the incorporation of the European Commission and the United Nations Environment Program as potential cosponsors, and culminated in IAEA Board approval in 2011 for publication of an interim edition of the new document [6], pending final publication as a jointly sponsored standard when also approved by the co-sponsoring organizations. During the course of 2012, all the cosponsoring organizations completed their respective approval processes, clearing the way for the final publication in 2013. In the remainder of this chapter, the term BSS refers to the 2011 publication [6].

The BSS, in keeping with all the IAEA Safety Standards, uses as its starting point the scientific data of United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) and the recommendations of the ICRP, but it also draws upon extensive research and development work by national and international scientific and engineering organizations on the health effects of radiation and on techniques for the safe design and operation of sources.

The BSS has no particular mandatory status, but is available for countries to adopt/adapt if they wish. However, if a country wishes to receive technical assistance from the IAEA or from a co-sponsor of the BSS, then compliance with the BSS becomes a condition of that assistance. This has given the BSS a very important status in the developing world as the "bible" of radiation protection.

2 BSS Structure

Table 18.1 presents the structure of the BSS. Within this structure, the BSS consists of a series of requirements – statements that specify what must be done and by whom. They are grouped into requirements applicable for all exposure situations with additional separate requirements for planned exposure situations (situations of

Table 18.1 Structure of the International Basic Safety Standards – section and subsection headings

1. Introduction
Background
Scope
Structure
2. General Requirements for Protection and Safety
Definitions
Interpretation
Resolution of conflicts
Entry into force
Application of the principles of radiation protection
Responsibilities of the government
Responsibilities of the regulatory body
Responsibilities for protection and safety
Management requirements
3. Planned Exposure Situations
Scope
Generic requirements
Occupational exposure
Public exposure
Medical exposure
4. Emergency Exposure Situations
Scope
Generic requirements
Public exposure
Exposure of emergency workers
Transition from an emergency exposure situation to an existing exposure situation
5. Existing Exposure Situations
Scope
Generic requirements
Public exposure
Occupational exposure
Schedule I: Exemption and clearance
Schedule II: Categories for sealed sources used in common practices
Schedule III: Dose limits for planned exposure situations
Schedule IV: Criteria for use in emergency preparedness and response
References
Annex: Generic criteria for protective actions and other response actions in emergency exposure situations to reduce the risk of stochastic effects
Definitions

exposure that arise from activities that typically require authorization), emergency exposure situations (situations of exposure that arise from accidents or events and require prompt action in order to avoid or reduce adverse consequences) and existing exposure situations (situations of exposure that already exist when decisions on the need for control need to be taken). For each of the three types of exposure situation, the requirements are further grouped into requirements for

occupational exposure, public exposure and (for planned exposure situations) medical exposure. They apply to all situations involving radiation exposure that are amenable to control, and this clearly includes all uses of radiation in medicine, and hence in radiology.

In a medical facility in which radiation generators or radioactive sources are used (called here a radiology facility for simplicity), consideration needs to be given to the patient, the personnel involved in performing the radiological procedures and to members of the public that may be around. In addition, there may be carers and comforters of patients undergoing procedures, and persons who may be undergoing a radiological procedure as part of a biomedical research project. This chapter discusses the requirements of the BSS, in particular those for medical exposure resulting from medical imaging procedures, and how such requirements when applied practically in a radiology facility should ensure the twin goals of quality radiology and radiation protection. Clearly this chapter cannot purport to be a comprehensive or exhaustive summary of the BSS, and the reader must refer to the actual BSS for full details.

3 Medical Exposure

The BSS defines medical exposure as exposure incurred by patients for the purposes of medical or dental diagnosis or treatment; by carers and comforters; and by volunteers subject to exposure as part of a programme of biomedical research.

3.1 Responsibilities

Because radiological procedures involve a multidisciplinary team led by a physician who often is not the registrant or licensee of an authorized facility, responsibilities in medical exposures are shared by several individuals. At the higher level, there are requirements for the government, the regulatory body (for radiation protection) and, in the case of medical exposures, the health authority and professional bodies. At the individual level, in a radiology facility there are three key roles that are crucial to radiation protection for medical exposures – those of the radiological medical practitioner, the medical radiation technologist and the medical physicist. The radiological medical practitioner is the generic term that the BSS uses to refer to a health professional with specialist education and training in medical uses of radiation, who is competent to perform independently or to oversee procedures involving medical exposure in a given specialty. Clearly the radiologist is a radiological medical practitioner, but many other specialists may also take on that role, including cardiologists, orthopaedic surgeons, dentists, to name just a few. Medical radiation technologist is the generic term used to cover the variety of terms that are used

throughout the world such as the radiographer and the radiologic technologist, again to name just a few. The term medical physicist (medical physics is now classified by the ILO as a profession in the International Standard Classification of Occupations-08 [7]) is used in the BSS, replacing the expressions in the 1996 version of "expert" in "radiotherapy physics", "radiodiagnostic physics" and/or "nuclear medicine physics". In the BSS, a medical physicist is a health professional with specialist education and training in the concepts and techniques of applying physics in medicine, and competent to practise independently in one or more of the subfields (specialties) of medical physics, (e.g. diagnostic radiology, radiation therapy, nuclear medicine). Other individual responsibilities in medical exposures are assigned to the registrant or licensee; the manufacturers, suppliers of sources, equipment, or software; the workers; the referring medical practitioners; and the ethics committees.

Because the key persons acting in these roles have a significant impact on radiation protection, it is very important to ensure that only appropriate persons are permitted to act in these roles – it cannot be left to good luck. It therefore falls on the radiation protection regulatory body to ensure that the conditions of the authorization for a radiology facility establish that any individual seeking to act as a radiological medical practitioner, a medical radiation technologist or a medical physicist is specialized in the appropriate area, and meets the respective education, training and competence requirements in radiation protection. Typically a specialization would be recognized through a national system of registration, accreditation or certification, and appropriate area refers to diagnostic radiology and image guided interventional procedures in the first instance, but in many cases would be narrower, such as cardiology or urology, to give examples. Clearly the health authority and professional bodies are involved in this recognition process.

The general medical and health care of the patient is, of course, the responsibility of the individual physician treating the patient; however, when the patient presents in the radiology facility, the radiological medical practitioner has the particular responsibility for the overall radiation protection of the patient. This means the responsibility for the justification of the given radiological procedure for the patient in conjunction with the referring medical practitioner, and responsibility for ensuring the optimization of protection in the performance of the examination.

The role of the medical radiation technologist is crucial as his/her skill and care in the choice of techniques and parameters determines to a large extent the practical realization of the optimization of a given patient's exposure in many modalities.

The medical physicist provides specialist expertise with respect to radiation protection of the patient. The medical physicist has responsibilities in the implementation of the optimization of radiation protection in medical exposures, including source calibration, image quality and patient dose assessment, and physical aspects of the quality assurance programme, including medical radiological equipment acceptance and commissioning. In radiotherapy, these functions are to be conducted "by or under the supervision of a medical physicist". For diagnostic radiological procedures and image-guided interventional procedures, they are to be performed "by or under the oversight of or with the documented advice of a medical physicist, whose degree of involvement is determined by the complexity of the radiological procedures and the associated radiation risks".

The medical physicist is also likely to have responsibilities in providing radiation protection training for medical and health personnel. In addition, he/she may also perform the role of the radiation protection officer (RPO), whose responsibilities are primarily in occupational and public radiation protection.

For a radiology facility, the radiation protection responsibilities described above for the radiological medical practitioner, the medical radiation technologist and the medical physicist will be assigned through an authorization (or other regulatory means) issued by the radiation protection Regulatory Body in that country or state.

The rights of the patient are being increasingly recognized in medical care, and this is extending to radiological procedures. The BSS requires that the licensee for the radiology facility ensures that the patient be informed, as appropriate, of both the potential benefit of the radiological procedure and the radiation risks.

3.2 Justification

The requirements in the BSS embrace the three ICRP principles of radiation protection – justification of the practice, optimization of the protection and dose limitation. Only the first two apply to medical exposure, i.e. dose limitation does not apply to medical exposure.

The concept of justification as it applies to medical exposure is reasonably well established, with the current 3-level approach having been introduced with the ICRP Publication 73 [8] and more recently reiterated in ICRP Publications 103 and 105 [9, 10]. However the transfer into day-to-day practice has proven more difficult, especially with respect to "level 3" justification for an individual patient undergoing a given radiological procedure. The evidence for the ineffective application of the principle has been gaining greater publicity in recent years, with many media reports appearing on inappropriate, unnecessary or unjustified radiological procedures. The process of revising the BSS provided an opportunity to improve requirements in this area.

Responsibility for both the generic justification (level 2) of a radiological procedure and the justification of radiological procedures performed as part of a health screening programme for asymptomatic populations falls on a country's health authority, in consultation with appropriate professional bodies. Ethics committees take on the responsibility for justification of medical exposures that occur as part of a programme of biomedical research.

In the BSS, justification for an individual patient (level 3) is a joint responsibility, performed by consultation between the radiological medical practitioner and the referring medical practitioner. The BSS also states what needs to be taken into account when performing the justification: appropriateness of the request; use of relevant national or international guidelines; urgency of the procedure; characteristics of the

exposure; characteristics of the individual patient; and last but not least, relevant information from previous radiological procedures. In some countries professional bodies have produced guidance on imaging procedures, including when they should be performed, when they should not be performed, advantages, limitations and radiation risk. Such so-called referral guidelines or appropriateness criteria [1, 12] are a useful bridge between the radiological medical practitioner and the referring medical practitioner in their joint responsibility.

A particular issue addressed in the BSS is that of justification of radiological procedures performed on asymptomatic individuals, intended for the early detection of disease but not as part of an approved health-screening programme. The situation might arise through "entrepreneurial" medicine, often with self-presenting patients, or it may be a "grey area" of medicine where the procedure has not yet become widely accepted medical practice. The BSS places joint responsibility on the referring medical practitioner and the radiological medical practitioner, but also puts the onus on relevant professional bodies or the Health Authority to develop guidelines. Further, the individual must be informed in advance of the expected benefits, risks and limitations of the procedure.

3.3 Optimization

Optimization of protection and safety is the second principle of radiation protection, and it comes into action once the justification has taken place. Protection and safety must be optimized for each and every medical exposure. What this means is described briefly below. As noted above, the radiological medical practitioner has prime responsibility for optimization, but the medical radiation technologist and the medical physicist also have very important roles to play.

The first step in the optimization process is to ensure that any medical radiological equipment or any software that could influence the delivery of medical exposure is used only if it conforms to established national or international standards.

The performance of a given radiological procedure typically involves many decisions over technique and technical parameters, most of which will have some impact on the image quality and the patient dose. Achieving the right balance is aim of optimization. The BSS requires that, for diagnostic radiological procedures and image guided interventional procedures, the radiological medical practitioner, in cooperation with the medical radiation technologist and the medical physicist, must ensure that the following are used:

- Appropriate medical radiological equipment and software; and
- Appropriate techniques and parameters to deliver a patient exposure that is the minimum necessary to fulfil the clinical purpose of the procedure, taking into account of the:
  - Relevant norms of acceptable image quality; and
  - Relevant diagnostic reference levels.

In addition to this general requirement applicable to all exposures in radiology, there is a further requirement for special consideration in the following situations in radiology:

- Paediatric patients subject to medical exposure;
- Individuals subject to medical exposure as part of a health screening programme;
- Volunteers subject to medical exposure as part of a programme of biomedical research;
- Relatively high doses to the patient, such as CT and image guided interventional procedures;
- Exposure of the embryo or foetus, in particular for radiological procedures in which the abdomen or pelvis of the pregnant woman is exposed to the useful radiation beam or could otherwise receive a significant dose;
- Exposure of a breast-fed infant as a result of a female patient undergoing a radiological procedure with radiopharmaceuticals.

A prerequisite for being able to perform any radiological procedure successfully is that the equipment about to be used is going to function correctly, and its radiation output is reproducible and predictable. For these reasons, the BSS has requirements for all X-ray systems to be calibrated and their performance to be monitored through a programme of quality assurance. Responsibility for calibration falls on the radiology medical physicist, and calibrations must be in terms of appropriate quantities using nationally or internationally accepted protocols. They must take place with new equipment at commissioning prior to clinical use, after any maintenance that could affect the dosimetry and at intervals approved by the Regulatory Body. A team approach is needed for the quality assurance programme, with the active participation of medical physicists, medical radiation technologists and radiological medical practitioners, and taking into account principles established by WHO, PAHO and relevant professional bodies. Regular and independent audits must be a feature of the quality assurance programme with audit frequencies in accordance with the complexity of the radiological procedures being performed at the radiology facility and the associated risks.

Every radiology facility must know what levels of radiation dose they are typically using when performing common radiological procedures that result in acceptable image quality, and this is another requirement of the BSS. Responsibility for performing the measurements falls on the medical physicist, using calibrated dosimeters and following nationally or internationally accepted protocols. But in addition, the results of the patient dose assessments must be compared with the nationally or regionally established diagnostic reference levels (DRLs). If the comparison shows that the typical dose for a given radiological procedure exceeds the relevant DRL, or if the typical dose falls substantially below the relevant DRL and the exposures do not provide useful diagnostic information, then a review must be conducted to determine whether the optimization of protection and safety for patients is adequate or whether corrective action is required.

The establishment of DRLs is the responsibility of government, as a result of consultation between the health authority, professional bodies and the regulatory

body. The use of DRLs as briefly outlined above is a very important aspect of optimization of radiation protection. Their use is in effect a "litmus test", identifying situations where the optimization might be outside what would be considered acceptable practice – identifying outliers. The setting of a value for a DRL for a given procedure necessarily is based on assessment of current practice in achieving a particular clinical goal. The DRL value is then applied prospectively. However, review of DRLs must take place periodically, especially as new techniques and technologies are introduced into practice. The prospective application of the then new DRL values starts a new cycle, and in this way, over time, the use of DRLs will influence current practice in the direction of quality radiology coupled with appropriate patient radiation protection.

3.4 Unintended and Accidental Medical Exposures

With all the above requirements in place in a radiology facility, the desired outcomes of quality radiology and patient radiation protection should be ensured. However, there is always the potential for things to go wrong or awry, and the BSS require that steps are taken to minimize the likelihood of unintended or accidental medical exposures arising from flaws in design and operational failures of medical radiological equipment, from failures of and errors in software, or as a result of human error.

The events of concern in radiology are:

- Any diagnostic radiological procedure or image guided interventional procedure in which the wrong individual or the wrong tissue of the patient has been subject to exposure;
- Any exposure for diagnostic purposes that is substantially greater than was intended;
- Any exposure arising from an image-guided interventional procedure that is substantially greater than was intended;
- Any inadvertent exposure of the embryo or foetus in the course of performing a radiological procedure; and
- Any failure of medical radiological equipment, software failure or system failure, or accident, error, mishap or other unusual occurrence with the potential for subjecting the patient to a medical exposure that is substantially different from what was intended.

Should any of these occur, then prompt investigation is required to determine the doses involved, and to identify and implement corrective actions needed to prevent a recurrence. Records of the investigation need to be kept, and the referring medical practitioner and the patient need to be informed.

3.5 Reviews and Records

The BSS requires periodical radiological reviews – an investigation and critical review of the current practical application of the radiation protection principles of justification and optimization for the radiological procedures that are performed in the medical radiation facility. Responsibility for the radiological review falls on the radiological medical practitioners in the radiology facility, in cooperation with the medical radiation technologists and the medical physicists.

The final requirements in the BSS for medical exposures relate to record keeping. There are requirements for records in three broad areas – personnel records, including delegations of radiation protection responsibilities and training of personnel in radiation protection; records of calibration, dosimetry and quality assurance, including results of the calibrations and periodic checks of the relevant physical and clinical parameters selected during treatment of patients, dosimetry of patients, local assessments and reviews made with regard to DRLs, and records associated with the quality assurance programme; and records of medical exposures – for diagnostic radiology and image guided interventional procedures, information necessary for the retrospective assessment of doses; exposure records for volunteers in biomedical research; and reports on investigations of unintended and accidental medical exposures.

4 Occupational Exposure

The BSS defines occupational exposure as exposure of workers in the course of their work. In a radiology facility, many persons will be subject to occupational exposure. However, the level of occupational exposure associated with radiology is highly variable and ranges from potentially negligible in the case of simple chest X-rays, to significant for complex interventional procedures. In most cases, the main determinant for occupational exposure is proximity of personnel to the patient when exposures are being made and the length of these procedures. Interventionists are a particular concern as they typically receive the highest occupational exposure in medicine.

Occupational radiation protection is achieved by application of the three ICRP principles of justification, optimization and dose limitation. Table 18.2 lists the dose limits for workers given in the BSS. Following the latest recommendation of the ICRP [11], the equivalent dose limit to the lens of the eye in a year is now 20 mSv – in the 1996 BSS it was 150 mSv. In practice, to afford radiation protection for medical personnel in radiology, it is the application of optimization and dose limitation that is arguably the most important. However, it should be recognized that the lack of rigorous application of the justification principle is resulting in the performance of significant numbers of unnecessary imaging examinations, and these add to occupational exposure.

Table 18.2 Dose limits[a] for occupational exposure, from the BSS [6]

Workers > 18 year of ages	Apprentices and students[b], 16–18 years of age
An effective dose of 20 mSv per year averaged over 5 consecutive years (100 mSv in 5 years), and of 50 mSv in any single year	An effective dose of 6 mSv in a year
An equivalent dose to the lens of the eye of 20 mSv per year averaged over 5 consecutive years (100 mSv in 5 years) and of 50 mSv in any single year	An equivalent dose to the lens of the eye of 20 mSv in a year
An equivalent dose to the extremities (hands and feet) or the skin[c] of 500 mSv in a year	An equivalent dose to the extremities (hands and feet) or the skin[c] of 150 mSv in a year

[a]The dose limits are for planned exposure situations

[b]Apprentices who are being trained for employment involving radiation and students who use sources in the course of their studies

[c]The equivalent dose limits for the skin apply to the average dose over 1 cm^2 of the most highly irradiated area of the skin. The dose to the skin also contributes to the effective dose, this contribution being the average dose to the entire skin multiplied by the tissue weighting factor for the skin

In the BSS, the employer and licensee have joint responsibility for the protection of workers against occupational exposure, and that includes ensuring that:

- Protection and safety is optimized and that dose limits for occupational exposure are not exceeded;
- A radiation protection programme is established and maintained, including classification of areas, establishment of local rules and procedures, and provision of personal protective equipment;
- Arrangements are in place for the assessment of occupational exposure through a personnel monitoring programme; and
- Adequate information, instruction and training on radiation protection and safety are provided.

Personnel also have responsibilities with respect to occupational radiation protection, including that they must follow the rules and procedures and they make proper use of the monitoring equipment and personal protective equipment provided.

The reader is referred to the BSS for full details on requirements for occupational radiation protection.

5 Public Exposure

Public exposure refers to exposure incurred by members of the public excluding any occupational exposure or medical exposure. In a radiology facility this means personnel whose duties do not involve the use of radiation and any visitors to the facility, including patients except when they are undergoing their own radiological procedure.

Table 18.3 Dose limits[a] for public exposure, from the BSS [6]

An effective dose of 1 mSv in a year[b]
An equivalent dose to the lens of the eye of 15 mSv in a year
An equivalent dose to the skin of 50 mSv in a year

[a]The dose limits are for planned exposure situations
[b]In special circumstances, a higher value of effective dose in a single year could apply, provided that the average effective dose over 5 consecutive years does not exceed 1 mSv per year

The BSS sets out requirements needed to ensure adequate protection for members of the public. For a radiology facility, this usually means ensuring appropriate shielding for areas where radiation is used and controlling access to areas where radiation is used. Responsibility for this lies with the licensee. Public dose limits are listed in Table 18.3.

6 Human Imaging Using Radiation for Non-Medical Purposes

Not all human imaging takes place for medical purposes. Global events and social considerations have led to an increasing worldwide usage of human imaging for various aspects of security screening. This typically takes place in public places, such as airports, border control, prisons and court houses. For these applications, specially designed inspection imaging devices are used. The BSS sets out radiation protection requirements for such activities.

There are however some other situations where again human imaging takes place for non-medical purposes, but the procedure is conducted by medical personnel, using medical clinical radiological equipment. Such situations are employment related, or for legal or health insurance purposes, performed without reference to clinical indications. In these cases, the optimization requirements of the medical exposure section of the BSS apply.

7 Impact of the BSS

The impact of the BSS in a given country will depend, in the first instance, on the degree to which the country's legislation and regulations adopt or incorporate the requirements of the BSS. This process depends on governments, and is influenced by politics, resources and priorities. The health authority and the professional bodies, particularly medical imaging (i.e. radiology), radiation technology and medical physics societies, all have important advisory and advocacy roles to play in this process.

But what is critical is not what the law says but the practical implementation of the BSS in radiology facilities. Awareness about the BSS and its role needs to be promoted. If and when required, education and training resources should be provided and infrastructure should be strengthened. In a given radiology facility, the health professionals not only need to assume their respective radiation protection responsibilities described above, but they also need to demonstrate to management that improving radiation safety culture yields additional dividends, i.e. better working conditions, better patient care and, as a consequence of greater patient satisfaction, potentially more financial revenues. The implementation of the BSS will be facilitated if it is seen as adding value to the process of providing radiology services, and not as yet another burden.

8 Conclusions

The BSS is an excellent example of successful collaboration among leading global stakeholders in radiation protection. It provides a set of requirements that form the basis for ensuring acceptable levels of radiation safety and protection for patients, personnel and members of the public, and at the same time leads to the practice of radiology being performed in a manner that results in quality patient care.

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