European Medical ALARA Network

Final Report WORKSHOP WP6

WP leader
Swedish Radiation Safety Authority

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Final report

Workshop WP6

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Attention of	Georgi Simeonov, European Commission, Directorate-General for Energy

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Workshop organisation

The first EMAN Workshop, held 7-9 June 2012 in Vienna, was organised by the EMAN Consortium with local support from the staff at the ESR office in Vienna. The workshop attracted 70 participants from various professional and stakeholder groups. In addition to the seven EMAN Consortium members, several international organisations and associations were present, such as the European Coordination Committee of the Radiological, Electromedical and Healthcare IT Industry (COCIR), the Association of the Heads of the European Radiological Protection Competent Authorities (HERCA), the International Commission on Radiological Protection (ICRP), the International Atomic Energy Agency (IAEA), the European Society of Paediatric Radiology (ESPR), the European Association of Nuclear Medicine (EANM), the European Society for Radiotherapy and Oncology (ESTRO) and the European Society of Gastrointestinal Endoscopy (ESGE).

The workshop programme was developed by the EMAN consortium and was divided into six plenary sessions and three working group sessions. The plenary sessions were divided into these themes: Stakeholder Involvement – present activities on optimisation, what can be improved and how it can be done; good examples of activities on optimization; and the future EMAN network. The programme is included in Appendix 1.

The working group sessions were divided into three parallel groups dealing with computed tomography (CT) , interventional radiology and X-ray outside X-ray departments. In each group, current important issues concerning optimization were discussed such as: “What are the problems in the optimization of medical exposures?” “What are the solutions to these problems?” “How do we make the solutions happen and what communication activities are needed?”

The workshop was summarized including a session presenting the conclusions from the working groups and a session discussing the future of the EMAN network.

Conclusions from the workshop

A summary of the conclusions from plenary sessions

Plenary Session 1: Stakeholder Involvement – present activities on optimisation
In this session, presentations were given by representatives from four stakeholders: the European Coordination Committee of the Radiological, Electromedical and Healthcare IT Industry (COCIR), the Association of the Heads of the European Radiological Protection Competent Authorities (HERCA), the International Commission on Radiological Protection (ICRP) and the International Atomic Energy Agency (IAEA). The representatives explained their interest and activities with regard to ALARA and Radiation Protection.

COCIR reported on the CT manufacturers’ voluntary self-commitment and impact on CT dose optimisation, which includes topics such as accurate image quality assessment, development of dose reduction technologies, improved patient centric dose management through IHE-REM profile and extensive product training on existing and new dose reduction techniques.

HERCA, which currently represents 49 radiation protection authorities from 31 European countries, was established to respond to the need for a common understanding, mutual approach and whenever possible harmonization between authorities. Its Terms of Reference state that HERCA aims at having an impact on the practice of radiological protection within the States of HERCA members and involving the European Commission and other relevant stakeholders in its activities. HERCA has established a Working Group on Medical Applications dealing with different topics of joint interest including: justification (including exposure of asymptomatic individuals) and inspection competence of authorities and commitment of CT manufacturers. The work has resulted in the voluntary self-commitment of CT manufacturers and strengthening of capabilities of authorities to improve optimization on national and European levels. HERCA will continue its co-operation with stakeholders such as manufacturers and professional societies, as well as European projects including EMAN to emphasize the importance of implementing justification and optimization of radiation protection in practice.

ICRP reported on the work in Committee 3: Protection in Medicine, which develops recommendations and guidance on optimization in imaging and on the protection of patients, staff and the public against radiation exposure. ICRP has published a number of documents focusing on optimization in imaging of interventional radiology, CT, digital radiology, paediatrics, cardiology, etc.

Committee 3 is currently working on:

- Justification issues in medical exposures as well as in diagnostic imaging of asymptomatic individuals
- Radiation protection in cone-beam CT (medical and dental)
- Occupational protection issues in interventional procedures
- Extending the use of diagnostic reference levels for interventional radiology, digital radiology and new technologies

The IAEA reported on its work to maintain a website that is known worldwide – http://rpop.iaea.org – containing valuable information for health professionals in various medical specialities as well as information for patients and the public. Additional resources from the IAEA include publications, international standards and training material, and posters.

The last presentation of this session was about how networking can be used as a tool for improving ALARA. It pointed out that the development of standards (IAEA, EC), the stakeholders' commitment and technological evolution (new communication means) have in particular led to the building of networks over the last 15 years for a better implementation of ALARA 'in practice' through exchange of information and experience on good practices, including all relevant stakeholders. Some networks are devoted to all sectors (European ALARA Network, EAN), others to specific sectors such as ISOE, EMAN or EAN NORM.

Examples of products from successful networks include: international surveys, topical workshops resulting in stakeholder recommendations, newsletters and websites, working groups and sub-networks. The secret to success of these networks is that they identify problems, provide solutions, develop products of great interest to all relevant stakeholders and that they are guided by enthusiasm and professionalism of individuals engaging in these networks.

The speaker also gave recommendations on the role that the EMAN network could have such as:

- EMAN could have a coordinating role for all stakeholders' activities and efforts for dose reduction.
- EMAN could provide a European platform for Education & Training and dissemination of materials.
- There is a need to improve the mechanism to ensure that end users are educated on dose reduction measures and associated clinical practices. EMAN could initiate/lead European harmonization of certification requirements for end users.
- Several important stakeholders should be involved in the future EMAN network. These are: HERCA, COCIR, IAEA, ICRP as well as European professional societies of different medical specialities.

Plenary Session 2: What can be improved and how can it be done – good examples

In this session, presentations were given by representatives from four European societies: the European Society of Paediatric Radiology (ESPR), the European Association of Nuclear Medicine (EANM), the European Society for Radiotherapy and Oncology (ESTRO) and the European Society of Gastrointestinal Endoscopy (ESGE). The representatives explained how their respective organisation deals with ALARA and radiation protection.

ESPR has become very interested in optimization in paediatric radiology, which is important since children face a higher level of risk from ionising radiation because they are more sensitive and have a longer lifespan. For instance, there is a need for optimization of examination protocols for children. ESPR has for this reason set up a task force for this issue. Three phantoms were built, which will be circulated in Europe to be used with different types of machine in a multi-centre study with the aim of providing optimized paediatric protocols. ESPR recommended that manufacturers should focus more on optimization of protocols for children. ESPR also emphasized the importance of justified referrals. For instance, avoid repeating investigation which has already been done, choosing other modalities without ionising radiation, and using referral guidelines in order to avoid unnecessary scans.

EANM reported on its initiatives in optimisation and radiation protection:

- the EANM Physics and Dosimetry Committees are actively involved in relevant radiation protection aspects
- EANM produces guidelines and brochures incl. guidance for technologists
- EANM is involved in optimization projects (such as ORAMED) and disseminates results
- EANM is involved in the development of a dosage card, indicating the activity to be administered per patient weight

It was pointed out that the ALARA principle in nuclear medicine is important for worker doses, public exposures and patients (reference activities), especially due to the increasing use of multimodality systems (such as PET-CT and SPECT-CT). It was pointed out that organisations such as EANM, HERCA and EMAN have an important role in terms of supporting optimisation of these systems.

ESTRO focussed its presentation on its education and training activities. ESTRO organises courses (from basic to advanced) as well as workshops, large scientific meetings, etc. It has established core

curricula for these courses, which cover the important areas of radiobiology, basic radiation physics and physics of teletherapy beams.

Since the aim of radiotherapy is sterilization of tumours with minimal damage to surrounding normal tissues, doses outside the tumour area must be minimized. Radiation protection aspects are especially important for paediatric patients. Radiation protection aspects also include room design (protection of workers), optimisation with regard to secondary cancers, quality assurance (QA), reporting of near misses, etc.

In its presentation, ESGE recognised a lack in the knowledge on the part of endoscopists on doses received during endoscopic procedures, in particular ERCP. This is why ESGE developed a guideline on radiation protection in digestive endoscopy, which can be downloaded from its website. Important issues for radiation protection include:

- availability of enough medical physicists (shortage in some countries)
- need for a broad safety culture in hospitals
- need for good protocols for e.g. CT procedures coming from manufacturers
- need to optimize the machine settings by medical physicists (should be given sufficient time for doing so)

The recommendations from the above European societies for the future EMAN network were:

- EMAN should include radiation protection issues in paediatric radiology
- EMAN should include radiation protection issues in nuclear medicine
- EMAN should include radiation protection issues in radiotherapy

Plenary Session 3: Good examples of activities on optimization

In this session, presentations were given on good examples for interaction, communication, teamwork, education and training, tools with regard to ALARA and radiation protection as well as new modalities for managing radiation exposures.

Good examples of activities were presented in various fields, all showing the need for a multi-disciplinary approach for a good optimisation of radiation protection. The examples were:

- Clinical audits
- Interaction between hospital and manufacturers
- Interaction between radiographer, radiologists and medical physicist
- Tools needed to improve optimisation of digital imaging
- E-learning
- Current trends in Interventional Cardiology

Clinical audit

This example from Finland shows that, when it is well organised and coordinated at national level, the clinical audit is an efficient tool for a continuous improvement of radiation protection in the medical field.

The objective of clinical audits is to examine radiological practices, procedures and results against agreed standards for good medical radiological procedures. In Finland, an independent audit organisation has been created, which consists of a national advisory committee for coordination, giving advice and assessing the implementation for clinical audits. The organisation has made recommendations and issued guidelines for performing a 'good' audit. They also recommended specific multi-disciplinary teams for external audits.

The benefits of audits are also to improve the communication between the various professionals and to speed the development of appropriate quality systems.

Standards for good practices are a cornerstone of clinical audits. The latest recommendations have to be integrated in the audit guide. In this way, clinical audits are also a good way of disseminating information on the latest good practices.

Good coordination, guidance and follow-up of audits are essential to promote and verify nationwide benefit of the audits

Interaction between hospital and manufacturers

It is widely recognised that progress cannot be made without manufacturers, as optimisation requires a multi-disciplinary team approach. Various ways of working with them were presented:

One way is to use the guidelines for optimisation published by the manufacturers on their own websites since these guidelines are often valuable. Manufacturers should be encouraged to publish such documents, even in scientific journals.

Another way is to benefit from the training offered by the manufacturers. It is a good opportunity to re-learn techniques, review problems and optimise techniques away from the selling environment.

Finally, it is also possible to create specific teams with a manufacturer's engineer and applications specialist as well as a hospital's physicist and senior radiographer to work on special issues. The results of this work can then be forwarded to other departments and other hospitals.

Interaction between radiographer, radiologists and medical physicist

This presentation stressed the important role of radiographers as actors who are in between the medical doctors (who want good image quality) and the medical physicist (who want to reduce the doses). They are those who can understand both specialists and who are in charge of setting the parameters for the machines. Real teamwork between the radiologists, medical physicists and radiographers has to be organised so that the radiographers will know the clinical work, the X-ray technology and update their knowledge. Regular meetings should thus be organised between these three specialities. Radiographers can be given brief and simple instructions on how to best use the machines and fix the parameters according to the specific exams in order to find the right balance between image quality and doses.

The contribution of the medical physicists in optimizing the imaging chain: the true challenge

Specific technical questions related to the optimisation of patient protection in digital imaging were presented. It appears that evaluation and calculation tools are still needed and should be harmonized to provide better answers and improvement of protection.

The role of Dose Reference Levels (DRLs) was also discussed. It appears that they are helpful for a global optimization approach. However, there is a need to complement their use by the development of optimization strategies for the day-to-day practice. Again, there is a need for European cooperation for sharing tools and/or sharing findings from studies.

The role of EMAN has been highlighted, as it could be a forum for bringing all the tools together and creating a bridge between science and hospitals as well as between EFOMP and other societies.

E-learning

E-learning on radiation protection for all professionals entitled to work in the field of medical exposures has been developed in Italy to meet the requirements of the European Directive. In 2005, a first level of education and training, to be followed at the workplace and at home, was developed. Up to now, more than 12,000 people have studied at this level. A second level has been set up since 2011 to address new clinical techniques. Each course is composed of various modules based on different types of teaching materials (multimedia lessons, documents, e-book). More than 5,000 people have already used this module. E-learning appears to be an efficient tool for reaching many professionals and delivering up-to-date theoretical training in all subjects of medical radiation protection, from basic physics, health effects of ionising radiation to specific techniques for evaluating and reducing doses.

Current trends in interventional cardiology

New techniques in interventional cardiology were presented, some of them allowing a reduction in staff dose by decreasing the fluoroscopy time, or even by not having the staff in the same room as the patient.

The recommendations for the future EMAN network were:

- EMAN could collect good examples of optimisation activities and evaluate and disseminate results.
- EMAN could bring all tools together to create a bridge between science and hospitals as well as between EFOMP and other societies.

A summary of major conclusions from the working groups

WG on CT procedures

WG 1 discussed issues related to CT procedures in three working group sessions. The WG activities had been prepared by WG 1: specific issues were introduced, answers were requested from the participants through a voting system and a discussion followed in order to clarify the position.

The discussion can be summarised as follows:

- On the part of CT, dose reduction tools are widely available. However, the knowledge on how to use these tools is sometimes lacking. In order to disseminate the knowledge on their use, a core team of a medical physicist, radiologist and radiographer needs to be established.
- Dedicated sets of standard protocols for different quality levels need to be provided by the manufacturers. For instance, the professional societies need to unify protocol definitions for the abdomen. There is also a need for incentives for using lower dose protocols. It was

suggested that low-dose protocols should be provided by manufacturers. EMAN could also act as a platform for exchange of low-dose protocols.

- There is a need for dose efficiency parameters that are easy to use, fair, objective and open for all scanners. In order to achieve this, dose recording and database format should become mandatory, based on standard protocol names, including size information (height, weight) to allow for local dose monitoring (DRL updates). Conversion of DLP to effective dose for all patient sizes must be standardised, for instance by the scientific societies.
- It was suggested that new scanners should issue warnings in specific unwanted exposure situations. It was emphasized that application training has to cover limitations (and advantages) of scanners.
- It was concluded that optimisation is multidisciplinary, for which there is a need for a core team – consisting of radiographer, radiologist and medical physicist. They should be given specific training and clear responsibilities.
- It was pointed out that since technology changes rapidly; multi-stakeholder efforts for training and education by manufacturers and core teams are required to provide up-to-date skills.
- It was pointed out that no single website covers radiation protection in medicine adequately. Therefore, web-based knowledge needs to be disseminated. It was proposed that a Wikipedia approach with fast peer review and continuous updates might be successful. This could be hosted either by EMAN or ESR. This should provide a web-based knowledge repository and forum for sharing best practices.
- It was discussed that EMAN might contribute to congresses and courses and it might publish its documents. EMAN sustainability as a multidisciplinary platform requires strong leadership and funding and minimal administration. EMAN could be integrated as a subgroup into EAN or ESR.

WG on Interventional Radiology

WG 2 discussed issues with regard to Interventional radiology in three working group sessions. The discussions concentrated on patient dose, staff dose, equipment, audits and training, and on future EMAN activities.

- **Patient dose:** It was concluded that DRLs are required for all interventional procedures and different standard patient sizes, including children, and that there is a need for international recommendations for the implementation of DRLs. It was suggested that dose reporting and archiving should be mandatory and that regulatory authorities should register the doses to establish national DRLs, especially in countries where there is a lack of medical physicists in radiology departments. It was also discussed whether other dose indicators such as interventional reference point or peak skin dose can be used. It was proposed that a harmonised and unique dose unit should be defined by the scientific societies and adopted by the manufacturers. It was suggested that for cases where a patient has received a high dose, a trigger level needs to be defined where actions are taken. For instance, the interventionist has to inform the patient and the dermatologist for follow-up.

- **Staff dose:** The suggestion was made to develop European guidelines which should, for each specific procedure, define the number and position of dosimeters and give the algorithm for estimating effective dose in interventional radiology/cardiology. It was pointed out that eye lens doses and the logistics for collecting the total dose of workers with different workplaces require special attention. It was emphasized that active dosimeters deserve more use since they add educative effect. The use of protective equipment was discussed and it was concluded that aprons must provide a minimum lead equivalency of 0.5 mm (in front)/0.25 mm (at back), collars, of 0.35 mm, and glasses of 0.5 mm (including side panels). Protective gloves are not recommended; instead, fingers should be kept out of the X-ray beam and finger dosimeters are suggested. If screens or ceiling-suspended shields are used, the above-mentioned values can be reduced. It was pointed out that suspended floor-based and table-based shields need to be positioned correctly, which may be problematic with biplane systems. It was suggested that best practice needs to be disseminated by the professional societies.

- **Equipment:** It was concluded that during the purchasing process, the specification of new equipment and performance should involve physicians and physicists. Quality control of the equipment should be mandatory and follow standard European protocols that include calibration. There is a need for optimised protocols for interventional procedures and it was suggested that they should be defined by manufacturers and professionals in cooperation. Experience shows that cooperation between manufacturers and users regarding optimisation must be improved.

- **Audits and training:** It was pointed out that quality audits to fulfil EU Directive 97/43 Euratom need to be implemented in all member countries. It was suggested that all healthcare professionals using interventional fluoroscopy need to undergo appropriate education and training in radiation protection. Levels of education and training need to be adapted to the specific intervention and its radiation risk. It was concluded that professional societies have an important role in terms of arranging education and training courses.

- **Future of EMAN:** It was concluded that a multidisciplinary approach creates better mutual understanding and a common language among stakeholders, resulting in improved optimisation. It was suggested that:

    - EMAN may act as a consensus voice of experts for the EC.
    - EMAN may serve as a discussion forum between medical physicists, radiographers, radiologists, other medical professionals, the industry and regulatory authorities.
    - EMAN may provide contacts to European and national experts for radiation protection questions.
    - EMAN should produce guidelines and synthesize guidelines with new research (but not duplicate existing guidelines). It should provide updated lists of literature on radiation protection.
    - EMAN working groups should prepare documents that may be discussed and approved at meetings.

WG on X-ray procedures outside the radiology department

WG 3 discussed issues with regard to X-ray procedures outside the radiology department in three working group sessions. The following special practices were identified in the discussion in this order of relevance: vascular surgery, gastroenterology, urology, orthopaedics, neurosurgery, anaesthesiology, general surgery, gynaecology, neonatology (bedside X-rays) and dentistry (above all, cone beam CT). The following topics were discussed:

- **Data collection on frequency of procedures and related patient and staff doses.** It was pointed out that dose monitoring for special practices, as required by the Directive, is not common and should be realised through the European scientific societies and at the national level.

- **DRLs for frequent and for high-dose procedures.** In the view of the lack of frequency and dose data, a pragmatic approach was suggested to preliminarily perform a limited collection of data as a first step. The EC should promote this and the professional societies need to be involved.

- **EC guidelines for optimisation of special practices.** It was suggested that the EC should consider guidelines for special practices and that EMAN can contribute to this work.

- **Harmonisation of staff dose monitoring.** It was pointed out that EU Member States have different (and some have no) standards on how to monitor staff doses. In order to harmonise monitoring procedures, development of a European recommendation is needed. Active dosimeters are an effective tool for enhancing education in radiation protection. The importance of identifying high dose practices requiring hand and eye lens dose monitoring was emphasised. A dosimetry database is needed and should include an individual's specialisation and workload.

- **Mobile fluoroscopy equipment for complex and long procedures in surgical theatres:** It was pointed out that inadequate equipment and radiation shielding must be replaced according to international standards.

- **Education and training:** It was concluded that many practitioners have little or no radiation protection education. It was suggested that the recommendations from the MEDRAPET project can be used to address competence building in radiation protection and develop the necessary learning outcomes. EMAN can support this process by providing e-learning tools and course modules. Practical training is the duty of the employer, for example a teaching hospital and therefore the core team will have an important role here.

- **Clinical audit:** The lack of clinical audit for special practices was mentioned and it was suggested that EMAN can contribute in the development of such a programme.

- **Inspections:** It was concluded that in many countries, special practices are not inspected by the authorities. It was suggested that HERCA should promote inspections and that EMAN can contribute to guideline development.

- **Stakeholder involvement in EMAN**: It was pointed out that the involvement of stakeholders from special practices is probably the most critical and difficult task. It was suggested that the positive experience from involving gastroenterological endoscopists in Italy will serve as a model for approaching other stakeholders.

A summary of the conclusions drawn about the future network

Presentation of future work

The agreement of the scientific society partners (ESR, EFRS and EFOMP) and the other project partners (BfS, SSM and CEPN) to support future EMAN activities after the end of the contract has been announced. In particular, ESR has offered to actively take the lead of the network. In particular, ESR has offered to actively take the lead of the network; the ultimate goal – supported by the EMAN Steering Committee - will be to create an umbrella organisation covering all aspects of radiation protection in medicine. Since this larger project largely exceeds the dimensions of the current project supported by the EC, and since it will not be realized by the formal end of the EC project (October 31st, 2012), a letter of intent of the scientific (and regulation authorities) partners will guarantee the future of the current EMAN network dedicated to optimization. Major efforts will, however, be made to reach the goal of a comprehensive umbrella network covering all aspects of medical radiation protection and open to all partners willing to participate.

The main aim of the future network will be to contribute to the dissemination of radiation protection and safety in all areas of application of ionising radiation in medicine; in particular, to develop dedicated work packages aiming to identify and cooperate with the different stakeholders and the other networks, to develop communication strategies and to identify success factors for the network.

Panel discussion of consortium members
A. Anja (SSM), A.M. Schmitt-Hannig (BfS), P. Vock (ESR), M. Prokop (ESR), S. Christofides (EFOMP), G. Paulo (EFRS), C. Schieber (CEPN), F. Vanhavere (EURADOS) and M. Rehani (IAEA) as discussion facilitator
Representatives agreed that the rapid changing of radiological technology, with an evident "disconnection between what is possible and what is done" in the daily practice for the optimisation of radiation protection, requires the development of forms of cooperation between different stakeholders to increase the awareness of radiation and the implementation of good practices.

The patients deserve harmonised practices and the same good level of radiation protection across Europe and EMAN can be one of the mechanisms for reaching this aim by identifying problem areas, providing solutions and disseminating best practices. According to the working group discussions, a 'core team' is seen as the modality for developing and applying optimisation strategies at the hospital level, and EMAN can work to develop curricula and training material to support the education and training of national and local 'core teams'.

Because European ALARA networks have as their main priority the involvement of all stakeholders in their specific sector, it has been recommended to work on developing such a strategy for the medical sector as a priority. On the other hand, for a pragmatic approach and taking into account the foreseen limited resources available in the first stage of development of the network, it has been

suggested to identify two strong issues to work on and involve the public with an extensive communication strategy. At the same time, it has been recommended to immediately consider important practices performed outside radiology departments requiring optimisation, such as cardiology, nuclear medicine and radiotherapy.

A Memorandum of Understanding (MoU) between EMAN and the professional societies, with the support of the EC, can be a mechanism for aiding the inclusion of stakeholders in the network.

Some suggested activities have been discussed for the development of a sustainable network. Among others, e-learning tools, clinical audits and European/national 'core team' education can form part of the first business plan.

It has been underlined that financial resources are not the only issues to consider, but recruitment of dedicated and enthusiastic people and the growing reputation of the network are essentials. A network with a great reputation will help to enlist enthusiastic and motivated people and will add value to the suggested creation of an 'EMAN stamp'.

Finally, EMAN should consider the responsibility it has in addressing optimisation issues in the medical field, because European advancements are usually viewed as a model in other parts of the world.

HERCA's view. R. Bly
HERCA has received valuable information from EMAN and foresees more cooperation in the future. In particular, HERCA wants information on the future activities that are planned in order to plan possible cooperation in order to avoid duplication. It also expects recommendations on the need for European guidance. It was reiterated that HERCA would like to see all relevant stakeholders participating in EMAN.

The EC view of the future of EMAN. G. Simeonov
The European Commission is looking for the involvement of other important stakeholders in EMAN, for example representing the fields of nuclear medicine and radiotherapy. It expects from the future network a demonstration of commitment and leadership for radiation protection in medicine.

The Commission is particularly interested in the development of programs for clinical audits, since this area is poorly implemented in many EU member states.

Finally, it has been assured that recommendations coming from the EMAN project and this workshop will be passed on to the competent EU offices.

Recommendations for the future activities of EMAN

During the workshop, recommendations for the future EMAN network were given by speakers during the plenary sessions. Recommendations for the future network were also disseminated during the working group sessions. The recommendations that were mentioned several times and discussed frequently were the following:

- The EMAN project has so far only been working with optimisation issues regarding X-rays. Therefore, the EMAN network should include radiation protection issues in other areas such as nuclear medicine and radiation therapy.

- Since children face greater risks from ionising radiation because they are more sensitive and have a longer lifespan, and since there is often a lack of standard examination protocols for children and because radiation protection aspects in radiotherapy are especially important for paediatric patients, the EMAN network should put effort into its involvement in paediatric radiation protection.
- The EMAN network should put effort into the involvement of other important stakeholders, not only those directly involved in the optimisation process, but also stakeholders working in special practices outside X-ray departments.
- The EMAN network should be involved in the development of clinical audits since this area is poorly implemented in many EU Member States.
- Medical radiation protection is a multidisciplinary area. For this reason, the EMAN network should promote the implementation of core teams consisting of radiologists, radiographers and medical physicists. The core teams for nuclear medicine and radiotherapy should include equivalent professionals.
- There are many good examples of optimisation activities, but they are sometimes hard for the end users to find. EMAN could evaluate and disseminate results and bring tools together in order to act as a bridge between science and hospitals as well as between societies.

Appendix 1:

EMAN Workshop Program

EUROPEAN WORKSHOP ON OPTIMISATION OF RADIATION PROTECTION IN MEDICINE

Billrothhaus, Vienna, Austria, 7-9 June 2012

Preliminary program

THURSDAY 07.06.2012

10.30 – 11.00 Registration

Session 1: Opening ceremony and introduction to the EMAN project

Chairpersons: Anja Almén, Anders Frank

11.00 – 12.30 Introduction
T. Cederlund and A. Almén (SSM)

EC – the importance of optimization in the medical sector
G. Simeonov (EC)

Optimization of radiation protection in CT procedures
E. Nekolla (BfS)

Optimization of radiation protection in interventional radiology procedures
H. Ducou Le Pointe (ESR)

Optimization of radiation protection for x-ray procedures outside the radiology department
R. Padovani (EFOMP)

12.30 – 14.00 Lunch break

Session 2: Plenary session 1 – Stakeholders involvement – Present activities on optimization

Chairperson: Graciano Paulo,
Rapporteur: Annemarie Schmitt-Hannig

14.00 – 15.20 The manufacturers impact on optimization – COCIR
N. Denjoy (COCIR)

The authorities impact on optimization – HERCA
R. Bly (HERCA)

ICRP – Recommendations on optimization in imaging and documents in progress
E. Vano (ICRP)

IAEA - the initiatives conducted in the international setting
M. Rehani (IAEA)

Networking as a tool for improving ALARA
C. Lefaure

15.20-15.30 Introduction to Working groups in parallel
A. Almén

15.30 – 16.00 Coffee break

Session 3: Working groups in parallel – Current important issues concerning optimization – problems and solution

16.00 – 17.30	CT procedures	Interventional radiology	X-ray outside x-ray department

18.00 Dinner

FRIDAY 08.06.2012

Session 4: Plenary session 2 – What can be improved and how can it be done – good examples

Chairperson: Stelios Christofides
Rapporteur: Filip Vanhavere

08.30 – 10.00 Optimization in pediatric radiology –future needs
C Owens (ESPR)

European Association of Nuclear Medicine (EANM) – Overview of initiatives in optimisation and radiation protection
M. Nowak Lonsdale (EANM)

ESTRO current and future activities
E Aird (ESTRO)

Radiation protection in digestive endoscopy – European Society of Digestive Endoscopy (ESGE) Guideline
K. Paraskeva

Optimisation in Vascular and Interventional Radiology – CIRSE
F. Fanelli (CIRSE)

10.00 – 10.30 Coffee break

Session 5: Working groups in parallel – Current important issues concerning optimization – making solutions happen and action plan

10.30 – 12.00	CT procedures	Interventional radiology	X-ray outside x-ray department

12.00 – 13.30 Lunch break

Session 6: Plenary session 3 – Good examples of activities

Chairperson: Peter Vock,
Rapporteur: Caroline Schieber

13.30 – 15.30 The impact of clinical audit on developing optimization and good practices.
H. Järvinen

Good example of interaction between hospital and manufacturer
S. Ebdon-Jackson

Good example of contact between radiographer and radiologists and MP
D. Pekarovic

Reaching persons outside the radiology department – education and training – e-learning
G. Tosi

The contribution of the medical physicist in optimizing the imaging chain: the true challenges
H. Bosmans

Current trends in Interventional Cardiology: New modalities to manage radiation exposure, contrast application and avoid contrast nephropathy.
H. D. Glogar

15.30 – 16.00 Coffee break

Session 7: Working groups in parallel – Future activities for EMAN including needed support activities e.g. communication activities

16.00 – 17.00	CT procedures	Interventional radiology	X-ray outside x-ray department

SATURDAY 09.06.2012

Session 8: Plenary session 4 – Conclusions from the working group

Chairperson: Filip Vanhavere
Rapporteur: Peter Vock

08.30 – 10.00 CT procedures
Interventional radiology
X-ray outside x-ray department

10.00 – 10.30 Coffee break

Session 9: Plenary session 5 – Discussion and presentation of the future work of EMAN

Chairperson: Anja Almén

Discussion Facilitator: Madan Rehani

10.30 – 10.40	Presentation of the future network *G. Frija, P. Vock*
10.40 – 11.15	Panel discussion of consortium members
11.15 – 11.40	Questions from the floor
11.40 – 11.50	HERCA's view *R. Bly*
11.50 – 12.00	The EC view of the future of EMAN *G. Simeonov*

Session 10: Plenary session 6 – Workshop conclusions

Chairpersons: Anja Almén, Torsten Cederlund

12.00 – 12.15	Conclusions *Annemarie Schmitt-Hannig*
12.15 – 12.30	Closing remarks