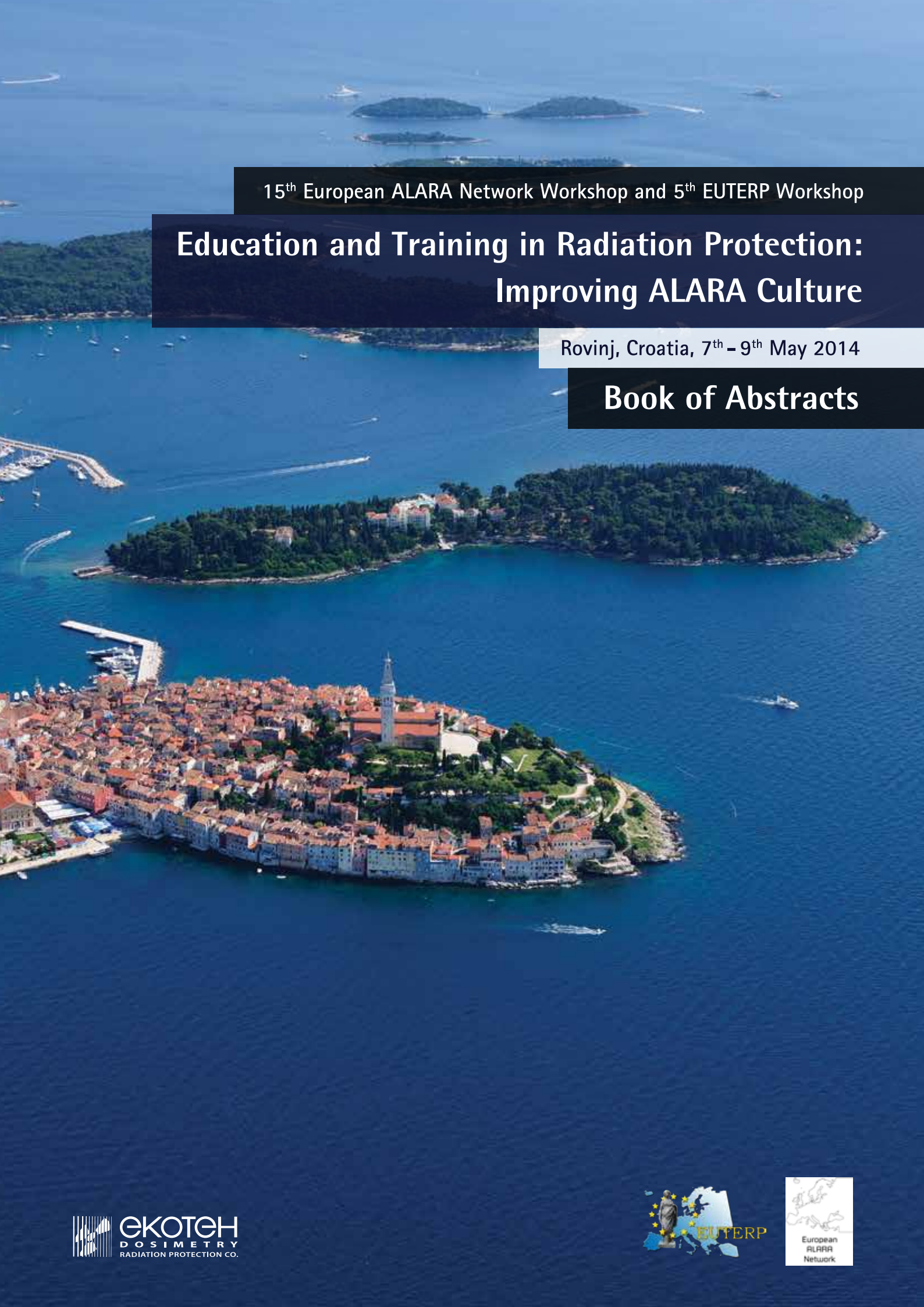

15th European ALARA Network Workshop and 5th EUTERP Workshop

Education and Training in Radiation Protection: Improving ALARA Culture

Rovinj, Croatia, 7th - 9th May 2014

Book of Abstracts

EKOTEH DOSIMETRY RADIATION PROTECTION CO.

EUTERP

European ALARA Network

Education and Training in Radiation Protection: Improving ALARA Culture

BOOK OF ABSTRACTS

7 – 9 May 2014, Rovinj, Croatia

HOSTED BY

EKOTEH DOSIMETRY RADIATION PROTECTION CO.

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SCIENTIFIC PROGRAMME

WEDNESDAY 7TH MAY 2014

INTRODUCTION

Chairpersons ***R. Paynter (EUTERP), F. Vermeersch (SCK•CEN)***

09:00 - 09:15 **Welcome introduction**
S. Medaković, Director of Croatia's State Office for Radiological and Nuclear Safety (SORNS)

09:15 – 09:30 **EAN presentation**
F. Vermeersch (SCK•CEN - EAN)

09:30 – 09:45 **EUTERP presentation**
R. Paynter (EUTERP)

Session 1. SETTING THE SCENE

Chairpersons ***R. Paynter (EUTERP), F. Vermeersch (SCK•CEN)***

09:45 – 10:15 **Education and training in radiation protection in the European Basic Safety Standards - its relation with ALARA**
G. Simeonov (EC – DG ENERGY)

10:15 – 10:45 **Finding, conclusions & recommendations on E&T in RP in Europe. Focus on RPE, RPO & workers**
T. Vermeulen (HERCA)

10:45 – 11:15 *Coffee-break, Posters*

11:15 – 11:30 **ENETRAP III**
M. Coeck (SCK•CEN)

11:30 – 11:45 **IRPA Guiding Principles for Establishing a RP Culture**
B. Le Guen (EDF), C. Schieber (CEPN)

11:45 – 12:00 **Recent developments within the European Framework of RP Education and Training**
A. Schmitt-Hannig (BfS)

12:00 – 12:15 **Discussion**

12:30– 14:00 *Lunch Break*

Session 2. BUILDING ALARA INTO RADIATION PROTECTION TRAINING PROGRAMMES

14:00 – 14:15 **Optimisation of radiation protection (ALARA): a practical guidebook**
C. Schieber (CEPN)

14:15 – 14:30 **Reflections on ALARA in RP training**
F. Vermeersch (SCK•CEN)

14:30 – 14:45 **Elaboration of training scheme on radiation protection of patients**
C. Rousse (ASN)

14:45 – 15:00 **Drawing up radiation protection plans**
S.-G. Jahn (ENSI)

15:00 – 15:15 **Discussion**

15:15 – 15:45 *Coffee-break, Posters*

WORKING GROUP SESSION (four WGs in parallel)

15:45 – 17:45

WG1. How to assess the effectiveness of training?
Facilitator: J. Stewart (PHE)

WG2. Tools to improve the effectiveness of training
Facilitator: F. Vermeersch (SCK•CEN)

WG3. What is achieved by recognition schemes?
Facilitator: R. Paynter (EUTERP)

WG4. Incorporating ALARA culture in training requirements - How to improve risk awareness and the radiation protection and ALARA understanding for different stakeholders and for different exposure situations?
Facilitator: D. Faj (MEFOS)

WELCOME COCKTAIL

THURSDAY 8TH MAY 2014

Session 3. MEASURING THE EFFECTIVENESS OF TRAINING, THE ROLE OF QUALIFICATION AND RECOGNITION SCHEMES

Chairperson	***A. Schmitt-Hannig (BfS)***
08:30 – 09:00	**Assessing the effectiveness of training - what are we Looking for?** J. Stewart (PHE)
09:00 – 09:15	**Testing the effectiveness of training - a practical solution** E. Grindod (PHE)
09:15 – 09:30	**Teaching RP principles - possibilities for more effective approach** M. Koželj (Jožef Stefan Institute)
09:30 – 09:45	**Discussion**
09:45– 10:15	**Poster Session (Presentation from Authors)**
10:15– 10:45	*Coffee break, Posters*

Session 4 TOOLS AND METHODS

Chairperson	***M. Schouwenburg***
10:45 – 11:05	**The use of 3D computer simulation tools in specific job training, risk communication and safety** F. Vermeersch (SCK•CEN)
11:05 – 11:25	**"Serious Game" (3D video games) for training workers at nuclear facilities** A. Pin (CEA)
11:125 – 11:45	**How to integrate the "Humans factors" dimensions within a reviewing project of the HP training for outside workers?** I. Fucks (EDF)
11:45 – 12:00	**Discussion**
12:30– 14:00	*Lunch Break*

WORKING GROUP SESSION (four WGs in parallel)

14:00 – 15:30	**WG1. How to assess the effectiveness of training?** Facilitator: J. Stewart (PHE)
	WG2. Tools to improve the effectiveness of training Facilitator: F. Vermeersch (SCK•CEN)
	WG3. What is achieved by recognition schemes? Facilitator: R. Paynter (EUTERP)
	WG4. Incorporating ALARA culture in training requirements - How to improve risk awareness and the radiation protection and ALARA understanding for different stakeholders and for different exposure situations? Facilitator: D. Faj (MEFOS)
15:30 – 16:00	*Coffee-break, Posters*

Session 5. NATIONAL APPROACHES

Chairperson	***Ivana Kralik (SORNS)***
16:00 – 16:15	**Education and Training system in Croatia (Case study)** *D. Posedel (Ekoteh)*
16:15 – 16:30	**Greek Atomic Energy Commission initiatives with respect to education and training of outside workers** *M. Kalathaki (GAEC)*
16:30 – 16:45	**Providing qualifications as the key to professional Radiation Protection Culture - RP education and training in Germany in the light of the new EURATOM BSS** *J. Vogel (German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety)*
16:45 – 17:00	**The challenge of implementing Radiation Protection Experts and Officers in Belgium** *P. Froment (AV Controlatom)*
17:00 – 17:15	**Discussion**

18:30 DEPARTURE TO ST ANDREW ISLAND FOR GALA DINNER

FRIDAY 9TH MAY 2014

Session 6. WORKING GROUP SYNTHESIS

Chairpersons	***M. Coeck (SCK•CEN), P. Croüail (CEPN)***
09:00 – 09:30	**WG1**
09:30 – 10:00	**WG2**
10:00 – 10:30	**WG3**
10:30 – 11:00	**WG4**
11:00 – 11:30	*Coffee-break, Posters*

CLOSING SESSION

11:30 – 12:00	**Workshop Conclusions** P. Croüail (EAN), R. Paynter (EUTERP), P. Shaw (EAN)

13:00-20:00 EXCURSION TO BRIJUNI ISLANDS

QUESTIONS FOR WORKING GROUPS

ALL WORKING GROUPS:

- What constitutes bad training?
- What would constitute “optimum” training?

WG1. How to assess the effectiveness of training?

Facilitator: J. Stewart

- What do we mean by “effective training”?
- What is the most effective means of assessing the knowledge gained (examinations, tests, etc.)?
- What else (i.e. other than knowledge gained) should we try to measure?
- What other means are available for measuring the effectiveness of training, for example after persons have returned to work?

WG2. Tools to improve the effectiveness of training

Facilitator: F. Vermeersch

- How do we assess that training is required (or needs refreshing)?
- What is the range of training (and learning) tools available? Which tools work best, and under which circumstances?
- What is the best use of methods such as remote learning or e-learning?
- How do we ensure that training continues to deliver improvements and value?

WG3. What is achieved by recognition schemes?

Facilitator: R. Paynter

- Does formal recognition of training and trainers improve optimisation of protection?
- What criteria should be considered for the mutual recognition of national qualifications
- Would that criteria change according to the field of activity?
- Does mutual recognition of qualification favour the mobility of workers?

WG4. Incorporating ALARA culture in training requirements - How to improve risk awareness and the radiation protection and ALARA understanding for different stakeholders and for different exposure situations?

Facilitator: D. Faj

- What is the best way to explain concepts such as stochastic effects and individual and collective risks?
- How can we focus on changing behaviours and attitudes (rather than just providing information)?
- How can we integrate radiation protection/ALARA into a wider Health and Safety training programme?
- How should training be modified for different stakeholders and different exposure situations?

ABSTRACTS

THE ENETRAP III PROJECT

Michèle Coeck

SCK•CEN Academy, Boeretang 200, BE-2400 Mol, Belgium

For a vast amount of applications in the medical, industrial, research and other sectors, a good understanding of radiation protection (RP) is fundamental in order to protect workers, the public and the environment from the potential risks of ionising radiation. Within this perspective, building and maintaining an advanced level of competence in RP, assuring sufficient well-trained personnel and organising an adequate knowledge management, is crucial. Effective education and training (E&T) is a critical element in these matters, helping to prevent the decline in expertise and to meet future demands. ENETRAP III adds new and innovative topics to existing E&T approaches in RP. It will further develop the European reference training scheme with additional specialized modules for Radiation Protection Experts working in medical, geological disposal and NPP. It will implement the ECVET principles and will establish targeted assistance from regulators that will play a crucial role in the endorsement of the proposed courses and learning objectives. ENETRAP III will also introduce a train-the-trainer strategy. All organised pilot sessions will be open to young and more experienced students and professionals. In this way, ENETRAP III aims to contribute to increasing the attractiveness of nuclear careers and to lifelong learning activities. A web-based platform containing all relevant information about E&T in RP will facilitate an efficient knowledge transfer and capacity building in Europe and beyond. ENETRAP III will also propose guidance for implementing E&T for Radiation Protection Experts and Officers, hereby providing extremely important assistance to all Member States who are expected to transpose the Euratom BSS requirements into their national legislations. Moreover, ENETRAP III will demonstrate the practical feasibility of earlier developed concepts for mutual recognition and thus provide leading examples in Europe demonstrating effective borderless mobility.

RECENT DEVELOPMENTS WITHIN THE EUROPEAN FRAMEWORK OF RADIATION PROTECTION EDUCATION AND TRAINING

Annemarie Schmitt-Hannig

BfS

The European Commission (DG Energy) has launched a number of projects in radiation protection with different objectives. A substantial part of their results will contribute to support the implementation of the Euratom BSS requirements on E&T in radiation protection by the EU Member States within the next years. Specific guidance with regard to RPE and RPO still needs to be developed in line with the recommendations of HERCA.

At the same time, the European Commission (DG Research and Innovation), is moving from the FP7 to the Horizon 2020 framework programme, Euratom nuclear fission research being part of it including radiation protection research as well as E&T activities.

In a wider context, these projects and networks will form an integral part of the EU strategy, Europe 2020, which requires more effective investments in education, research and innovation. The SET-Plan (European Strategic Energy Technology Plan) "Education and Training Roadmap" puts forward key education and training activities to assist the development of the necessary cooperation frameworks among academia, research institutes and other partners.

The strategy includes support for lifelong learning and borderless mobility, in particular, to ensure multilateral exchanges. Obstacles preventing the mobility of qualified experts should be removed (e.g. national regulations regarding specific job qualifications, linguistic barriers, or different technological cultures.

As part of this strategy, the development of master courses is proposed which should be open to CPD programmes in line with the European Qualification Framework (EQF) developed by the European Commission' (DG Education and Culture), bridging ECTS (European Credit Transfer and accumulation System) and ECVET (European Credit system for Vocational Education and Training) in the near future.

It is of vital importance that the E&T strategies of the European research and technology platforms, such as MELODI, SNETP and IGDTP are properly integrated into this framework and are cooperating to improve radiation protection in practice and help disseminate ALARA culture.

OPTIMISATION OF RADIATION PROTECTION (ALARA): A PRACTICAL GUIDEBOOK

Sotirios Economides[1], Cristina Nuccetelli[2], Serena Risica[2], Caroline Schieber[3], Annemarie Schmitt-Hannig[4], Fernand Vermeersch[5]

[1] GAEC, Greece, [2] ISS, Italy, [3] CEPN, France, [4] BfS, Germany, [5] SCK•CEN, Belgium

In 2009, the European ALARA Network created a specific working group on ALARA Culture. The objective of the working group is to maintain and further develop the high level of radiation protection by promoting the ALARA culture in all fields of application, implementing the ALARA principle into practice, and analysing feedback from implementing ALARA in various sectors.

As part of the ALARA culture dissemination, the working group is drafting a practical guidebook on optimisation of radiation protection (ALARA), to be used by radiation protection professionals or other stakeholders involved in ALARA processes : competent authorities, manufacturers, licensees, radiation protection professionals, professional associations, exposed workers, public, patients, ...

After an introduction on the basic concepts of radiation protection and their origins, the book presents the ALARA process, the main actors and their responsibilities and elements supporting the approach. It then gives many examples of ALARA in practice for workers and public in various exposure situations, for patient protection as well as for emergency and post accident situations.

The objective is to have the book ready by the end of 2014. I will then be made available for free download on the EAN website: http://www.eu-alara.net

REFLECTIONS ON ALARA IN RP TRAINING

F. Vermeersch

SCK•CEN

In this presentation some reflections will be given on how ALARA and radiation protection fit in a wider management of risk and the contribution of ALARA in radiation protection training.

The presentation is investigating the specific training needs of the different stakeholders (competent authorities, licensees and managers, RP professionals, manufacturers and designers, exposed workers and the public) with respect to risk awareness, radiation protection, ALARA and ALARA culture.

These reflections will be an input for further discussion in the working group 4 on incorporating ALARA culture in training requirements in order to improve risk awareness and the radiation protection and ALARA understanding for different stakeholders and for different exposure situations.

ELABORATION OF TRAINING SCHEME ON RADIATION PROTECTION OF PATIENTS

Carole Rousse[1], Jean-Luc Godet[1], Caroline Schieber[2], Maria Annik Boursault[3]

[1] Autorité de sûreté nucléaire, Paris, France, [2] CEPN, Fontenay-aux-Roses, France, [3] Consultante en ingénierie de formation, Paris, France

Context

According to the article L. 1333-11 of the French public health code (PHC), since the 20th of July 2009, the practitioners and the individuals involved in the practical aspects of medical radiological procedures as well as the individuals who perform the quality assurance program of equipments (according to article R. 1333-67 of the PHC) must have followed a theoretical and practical training, every 10 years, on radiation protection of patients.

The order of the 18th May 2004, issued according to article R. 1333-74 of the PHC, defines for each professional the program of the training. Organisms which deliver training just have to follow the program defined by the order.

Assessment of the training

Assessment of the training was done by ASN in 2010-2011 with the help of CEPN and an expert in training. Assessment of the initial education of the professionals is in progress.

This assessment points out some positive results:

- the program of the training on radiation protection of patient which is mandatory by the order is followed,
- the rate of professional who were trained is satisfactory except for specific medical staff.

On the other side, heterogeneity has been noticed concerning:

- the duration of the training
- the number of people trained in a same session,
- the quality of the pedagogic methods and the supports of the training,
- the methods for the assessment of the trainees.

The assessment reveals that the objectives of the training are not clearly defined in the order and that this may partly explain the heterogeneity of training.

Elaboration of a strategy of training on radiation protection of patients

ASN has set up a working group with professionals (physicians, physicists, radiographers, radiopharmacists) to elaborate the scheme of the training so that it takes a more operational character and promotes a culture of the radioprotection of the patient. A training engineering process was carried out with the help of experts in training.

Four different groups have been involved in the process, radiographers, cardiologists, dental surgeons and a multidisciplinary group for radiotherapy (physicians, physicists, radiographers).

Thus the purpose of the training was defined and developed through five general objectives which are common for all the medical professionals or the domains identified. Currently, two approaches have arisen for the elaboration of the training scheme corresponding to these objectives: one by medical profession (radiographers in radiology, radiologists, interventional radiology physicians, dental surgeon), the other one by domain (radiotherapy, nuclear medicine). In that latter case the training involves all the professionals. A detailed scheme was developed for radiographers in radiology and for cardiologists describing the operational objectives, the pedagogic methods and the duration needed for the training.

Perspectives

ASN has developed with professional organizations a strategy for the training on radiation protection of patient. The purpose of the training and the general objectives have been defined. The common objectives have now to be developed for each profession and domain taking into account the initial education and specific needs according to a graded approach based on risk. This approach concerns also the periodicity of retraining and the modalities of assessment of the trainees.

Professional guides will define the recommended educational methods and the modalities of assessment of the trainees.

The ASN decision will make mandatory the frame for the training, the purpose, the general and pedagogical objectives as well as the minimal requirements in terms of skill of the trainers and elaboration of the professional guides.

DRAWING UP RADIATION PROTECTION PLANS

S. G. Jahn

Swiss Federal Nuclear Safety Inspectorate

For education and training of ALARA in RP, exercises on drawing up a radiation protection plan are relevant component of the RP courses in Switzerland. Especially for RPE (Strahlenschutzsach-verständige) and RPO (Strahlenschutztechniker und –Fachkräfte) the necessary aspects of a RP plan, including the optimization of protection measures, are trained by working in groups on a given simple example for radiological relevant assignments. The results of the working groups have to be presented and discussed. In the course more exemplary RP plans are demonstrated to go into the aspect of ALARA in greater detail. Additional in some courses the final examination comprises the drawing up of a RP plan.

In the report one example of an exercise (preparing a RP plan for a given task with an open radioactive source) will be explained and discussed in detail showing how to teach aspects regarding ALARA culture.

ASSESSING THE EFFECTIVENESS OF TRAINING – WHAT ARE WE LOOKING FOR?

Joanne E. Stewart

Head, CRCE Leeds, Public Health England

The intent when delivering radiation protection training – whether from the perspective of a single training event or from a national training programme – is that the training delivered is *effective* , ie that it results in the desired and/or required outcome. It is becoming common-place now to define and describe training activities in terms of intended outcomes, which a positive development, but there has perhaps been little progress in closing the loop and actually reviewing whether or not the training process has been effective. Arguably, this is not a particularly straightforward task -what are the appropriate indicators for effective training ? do these vary depending on sector or application? is it best to focus on the effectiveness of individual events or is it more appropriate to consider the matter on a national basis? does the understanding of "effectiveness" vary amongst those bodies or individuals who are undertaking the assessment?

This presentation will explore the issues raised above with the aim of initiating discussion on how best to assess effectiveness. Some suggestions for appropriate performance indicators for effective training will be put forward along with suggestions as to how – and by whom – they could be used.

TESTING THE EFFECTIVENESS OF TRAINING – A PRACTICAL SOLUTION

E. L. Grindrod and J. E. Stewart

Centre for Radiation, Chemical and Environmental Hazards, Public Health England, Leeds, United Kingdom

A traditional approach to 'testing training effectiveness' is to set a written paper at the end of the training event. A good paper might including multiple choice questions (a quick way to test knowledge) and short answer questions (to test application). The results of this type of assessment tell the trainer how well students can recall information, how well they understand radiation protection principles, and whether the student can apply them on paper. This testing method is straightforward to administer and the results are quantitative, allowing for 'grading' and 'ranking' of performance. However, under classroom examination conditions, it can be difficult for a student to demonstrate that he or she would take an appropriate course of action in the heat of the moment - when it might matter most.

PHE's Centre for Radiation, Chemical and Environmental Hazards has been using a combination of traditional written paper, practical assessment and group discussion, to test knowledge, application and the competences of emergency responders

at the end of a training event. This has provided a number of advantages over a written test alone, but introduces a range of challenges too.

This paper discusses the format of the assessment, its advantages and disadvantages, and looks at areas for possible future development.

TEACHING RADIATION PROTECTION PRINCIPLES – POSSIBILITIES FOR MORE EFFECTIVE APPROACH

Matjaž Koželj and Vesna Slapar

Jožef Stefan Institute, Ljubljana, Slovenia

Explanation of radiation protection principles is considered to be one of the most important subjects in radiation protection courses. It should justify entire radiation protection system and establish the confidence in radiation protection measures and recommendations as we lecture it. Unfortunately, “official” definitions are very concise and aimed to the use of radiation sources in various practices and it seems that the explanation should rely on examples and cases from radiation protection. While this approach could be successful for people with some previous experience in radiation protection, it is not clear for the beginners. Even more, it creates the impression, that the logic behind the radiation protection principles is something “invented” by a group of experts for a special and exclusive use in connection with radiation sources.

Of course, this is not true. We can find different areas of our life where the same or similar logic as that behind radiation protection principles is used and applied. Justification, optimisation and use of some limits are present in many activities and aspects of human existence, although these principles are not explicitly revealed and communicated to the public. Even more, their use is “normal” and logic behind acceptable without special consideration. Traffic, medicine, free-time activities are just some of the areas where the implementations of the similar (same) principles as in area of radiation protection could be identified and could be used to explain the principles, and the logic behind.

It is our wish to illustrate and discuss the possibilities and advantages of teaching the radiation protection principles through analogies with “normal life” and “common” examples. According to our experience, this approach is more attractive, more effective and enhances understanding of basic radiation protection principles, especially for the beginners.

THE USE OF 3D COMPUTER SIMULATIONS TOOLS IN SPECIFIC JOB TRAINING, RISK COMMUNICATION AND SAFETY

Vermeersch Fernand and Nijs Robby

SCK•CEN, Mol, Belgium

An appropriate general training of the work force in radiation protection forms the bases of a good attitude towards the radiation risks on the work floor. However some problems or tasks can be very specific and demand more detailed information of the work site and the radiation risks involved.

This presentation shows how 3D simulation tools, virtual reality technology and internet technology can be used to support specific training and communication in the radiation protection field. A part of the training on the work floor can now be replaced by training using computer simulation techniques thus avoiding exposure during training. The current visualization capabilities allow a good representation of the radiation risks by 3D dose and dose rate maps. Different work scenarios can be evaluated and scored on their dose account and by doing so support decisions in the ALARA approach.

Research on this subject and a working tool are presented in this field. An overview of the available tools will be presented.

A SERIOUS 3D GAME FOR EDUCATION AND TRAINING IN RADIATION PROTECTION

Alain Pin

Technical Officer, CEA/INSTN

The National Institute for Nuclear Science and Technology (INSTN /Teaching Unit of Cherbourg-Octeville) and OREKA (Company specialized in engineering 3D software) have developed an innovative teaching tool named O.S.I.R.I.S. (Tool for Simulation of work under ionising radiation).
The tool is built on a virtual 3D environment in which users operate in a totally free way in the first-person (the user is immersed in the scene as if the press camera was positioned at eye level).
The action is located in a pressurised water reactor in the environment of a steam generator building during a steam generator tube control.
The users are students or professionals who want to learn how to protect the workers against radiation (for example Competent Persons in Radiation Protection in France). In real time, they can move in different scenes that depend on the state of the equipment. They can use different instruments like radiation survey meters or probes to control smears (loose contamination).

Through the use of this serious game, users must: - establish a predictive dose evaluation (several maps depending on the state of the equipment must be made by the users: dose rate measures, radioactive contamination control).

- Think about signs of radiological risks to put in place at the workstation (markup, barricade tape to control access, ...) and on the collective or portable control instruments necessary (atmospheric contamination monitor, gamma dose rate area monitor,...)
- implement the principles of radiation protection (Principle of justifications, principle of optimisation - ALARA principle, As Low As Reasonably Achievable- and principle of limitation). In particular, learners think about the different ways to reduce the dose received (exposure time, shield, distance, and activity) to achieve an optimized assessment of dose.
- supervise the collective dose performed (daily) and react in case of alarm on the dosimeters, or if the collective dose performed increase (to analyse the dose alarm event, to investigate the origin of the alarm dose, to take safety measures,...).
- perform the dose result of the operation, analyse the gap between the predictive collective dose and the collective dose achieved, and decide about the lessons to provide feedback.

HOW TO INTEGRATE THE "HUMANS FACTORS" DIMENSIONS WITHIN A REVIEWING PROJECT OF THE HP TRAINING FOR OUTSIDE WORKERS?

Isabelle Fucks[1], Alexandre Riedel[2], Gérard Cordier[2], Alain Quiot[2], Damien Gouzy[3]

[1] EDF R&D, [2] EDF, [3] SIFOP

CONTEXT

EDF is involved within a reviewing project of the safety, health and physic training for his outside workers.

This project results from an internal feedback and learning process which point out the competences of the workers as a source of progress. This project is also motivated by a period characterized by a very important shutdowns campaign, with decennial maintenance operations, linked to the future of the nuclear field, and a large incoming of new outside workers. Regulatory evolutions motivated it also.

It began in 2012 and the first new training will be operational in September 2014. The involvement of the different stakeholders, interesting by the training of the outside workers, was planned as soon as the project began. Representatives of the outside firms and training centers were involved within the different steps of the project: strategic analyze, needs expression, design, and so on. Task groups were organized and coordinated during among two years by a project team to hold the deadline.

Beside this "risk governance" aspect of the project, the human factors dimensions were also expected to integrate it and to bring a new way of thinking and designing a training program.

PURPOSE

The purpose of this contribution is to illustrate the contribution of Human factors competences to the design of relevant and effective HP training. The contribution will aim to answer the following questions:

1. What does it mean to take into account human factors dimensions within a reviewing training formation?
2. How to integrate the human factors dimensions in the design of a HP training program?
3. How to appreciate the efficiency of the training program?

With the experience feedback, the taking into account of human factors within a training program introduced three major challenges for the EDF organization:

- Is it a « best way » to train to the respect of the HP rules?
- Is it possible to adapt and transform the technical and formal vocabulary to aim a better understanding of the rules? (Does "irradiation" make more sense than exposition? Does contamination make more sense than internal exposition?)
- Is it possible to train or to alert the workers to the risk management without observing that risks and events occur during operations?

Training is an important component of an Alara Culture because the training space and time are the right place and time to introduce to workers a first vision about radiological risks, HP values, HP expectations. Nevertheless training is only a component of an Alara Culture, the development of HP behaviors depend on a global approach, an ongoing and endless process, within which the management is a key success.

EDUCATION AND TRAINING SYSTEM IN CROATIA (CASE STUDY)

D. Posedel[1], I. Kralik[2], D. Faj[3]. S. Jurković[4]

[1] EKOTEH Dosimetry Co., [2] State Office for Radiological and Nuclear Safety, [3] Faculty of Medicine, Osijek, [4] Clinical Hospital Center Rijeka

From the early beginning of our independence, education of both radiation protection professionals and exposed workers has been recognized as a key element for improvements in radiation safety culture. Aim of training in radiological equipment operational principles, basics of radiological physics, nature of radiological risk and principles of radiation protection is improvement of protection of patients, decrease of public exposure and minimization of risk for exposed workers.

From early training courses organized by the Croatian Institute for Radiation Protection, a predecessor of today's State Office for Radiological and Nuclear Safety, the radiation protection education system suffered many changes with the years, to become a multi educational organization system involving medical educational institutions and radiation protection experts. From general education program at the beginning, specific educational programs were developed according to specific end-user practices, with more detailed approach to individuals and their specific radiation protection aspects.

Today, State Office for Radiological and Nuclear Safety as the regulating authority represents a basis for our radiation protection educational system, giving authorization requirements through legislation, and authorizing educational institutions for those specific training programs. Training courses are organized and customized for specific practices, performed by trained lecturers experienced in radiation protection. On average, 1000 participants are trained every year.

Further improvements of educational systems are considered constantly, from harmonization of lectures between institutions to implementation of completely new, digital age based system, allowing participants to receive some lectures from their home, and chose appropriate time for training taking into account their professional responsibilities.

GREEK ATOMIC ENERGY COMMISSION INITIATIVES WITH RESPECT TO EDUCATION AND TRAINING OF OUTSIDE WORKERS

M. Kalathaki, K. L. Karfopoulos, E. Carinou and S. Economides

Greek Atomic Energy Commission

The involvement of outside workers in activities carried out in controlled areas has been under consideration by many international scientific and professional organizations. The Directive 90/641/EURATOM "on the operational protection of outside workers" was issued in order to deal with aspects related to the outside workers e.g. the monitoring of their doses, their education and training, the localization of any possible overexposure. Furthermore, it was transposed in the national legislation as a Ministerial Order and a radiation passbook was designed following the content of the directive.

Under this legal framework, Greek Atomic Energy Commission (GAEC), as the national competent authority performs on-site inspections at the installations of the outside undertakings in order to verify compliance with the related requirements. A lack of appropriate training on radiation protection and unawareness among the involved parties (undertakings, workers, operators) about their role, their responsibilities and their collaboration on certain issues, were some of the findings of the inspections.

Moreover, GAEC, in order to increase awareness among outside workers on radiation protection and to support the development of ALARA/Safety culture among them, organized special training courses on radiation protection in two different cities, Athens (2) and Thessaloniki (1). 70 outside workers, out of the 240 registered in the National Dose Registry, attended these courses. The 8 hour duration courses covered theoretical aspects (physics and biological effects of ionizing radiation, dose monitoring programme, the legislative framework for the outside workers) and practical aspects of radiation protection in medical applications.

Both the design and the provision of the training courses were performed in accordance with the adopted quality management system of GAEC, based on the ISO 29990:2010 for the design and provision of non-formal education. The initiative taken by GAEC, covered 30% of the registered outside workers in the country so far; however it is considered successful and contributes significantly in the enhancement of the national radiation protection system. Initiatives like this are going to be continued in the near future, while more actions (i.e. distance learning courses, dissemination of informative material, continuous communication with related professional bodies, etc) will also be taken.

PROVIDING QUALIFICATIONS AS THE KEY TO PROFESSIONAL RADIATION PROTECTION CULTURE
RP Education and Training in Germany in the light of the new EURATOM BSS

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For a successful implementation of radiation safety and ALARA culture in an undertaking, the responsibility of protection-aware experts and the availability of qualified staff are of predominant importance.

In this respect, the current German legislative framework is based on conferring responsibility in radiation protection to individual persons: The primary responsibility rests with the *Radiation Protection Executive* (Strahlenschutzverantwortlicher, SSV) that undertakings have to personally designate to be accountable for the undertaking's legal obligations. Depending on the legal form, the SSV must be the owner or director or a member of the executive board and this requirement places radiation protection in the direct duty of the undertaking's management.

To ensure operational protection and access to professional expertise, the SSV has to designate one (or more) *Radiation Protection Supervisors* (Strahlenschutzbeauftragter, SSB). As a prerequisite for approval of the designation, the SSB must have the *requisite expertise in radiation protection* and professional integrity and be granted sufficient competences within the undertaking to perform his tasks and duties. The SSB is, within his competence, personally accountable for the implementation of the radiation protection tasks and obligations.

The requisite expertise in radiation protection is granted by a competent body, if education, professional experience, and the successful completion of courses in radiation protection are examined to provide an appropriate level of qualification. Details of the requirements vary widely depending on the practice and are laid down in several regulatory guidelines published by the federal government. Prime advantage of the German approach is that both professional RP expertise and personal responsibility are available within the undertaking's organizational structure. In order to be feasible for all undertakings this means that the required qualification is limited for low-risk practices, following a graded approach.

In the recently adopted EURATOM Basic Safety Standards directive, to be implemented by EU Member States within four years from entry into force, the new functions of *Radiation Protection Expert* (RPE) and *Radiation Protection Officer* (RPO) have been introduced to the Community acquis. The RPE's main characteristic (following the *Qualified Expert* of the previous directive) is recognition of competence – comprising adequate knowledge, training, and experience – by the competent authority. The RPO holding technical competence and necessary means within the undertaking is a complementary concept optional for implementation by Member States. It is explicitly foreseen that the tasks of RPE and RPO may be assigned to the same person.

The legally binding provisions laid out in the BSS are both sufficiently prescriptive to ensure a minimum level of available competences and sufficiently general to accommodate different national approaches that have proven a sound approach to RP qualifications. It is expected that the concept of RPE will take the form of an independent comprehensively qualified consultant in some EU Member States while being seen as an operationally responsible implementer trained for specific practices in others. Due to the increased scope of the framework, the variations in national implementations are likely to be larger than currently, challenging initiatives establishing technical guidelines (as within ENETRAP, HERCA, ...) to implement flexibility to allow for this diversity.

The German concept of SSB, on a general level, joins the requirements for both RPE and RPO by comprising both a qualification approved by the competent authority and tasks and capacity within the undertaking. It is estimated that the existing German framework can be developed to implement the provisions of the new BSS in a transition rather than a disruption. Challenges for the national E&T framework in this respect are the integration of practices with natural radiation source (former *work activities*) and the continued need to ensure and improve quality of training when introducing new types of practice and technological developments. The federal government will evaluate and assess options in dialogue with stakeholders in the course of transposition and propose updated legislation as the result.

The new EURATOM BSS provide an adequate framework to develop and broaden the national approaches to radiation protection education and training. The associated opportunity to modernize concepts and qualifications will profit from international exchange and collaboration and facilitate improved professional protection culture.

THE CHALLENGE OF IMPLEMENTING RADIATION PROTECTION EXPERTS AND OFFICERS IN BELGIUM

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In Belgium, every nuclear or radiological installation must have a health physics service for the organization and the supervision of the measures taken in radiation protection. The head of the health physics service must be an expert in health physics, which is the implementation of the qualified expert such as described in the European Basic Safety Standard (Directive 96/29/Euratom). For every controlled area, a person is designated to ensure that local safety procedures are followed, and to ensure the good functioning of the means of protection. This person is to be seen as the assistant of the head of the health physics service.

The new European Basic Safety Standard introduced the radiation protection expert (RPE) and radiation protection officer (RPO). These professional profiles in radiation protection need to be transposed into the legal framework of every EU Member State, such as Belgium. In order to anticipate this future implementation, the Belgian Association for Radiological Protection (BVS-ABR) established in 2013 a working group to reflect on the implementation of the RPE and RPO. This working group consists of members of the BVS-ABR from different sectors such as: nuclear power industry, healthcare sector, universities and colleges, radiation protection control organisms, regulatory body, and an observer from the (Belgian) Federal Agency for Nuclear Control.

Different reference documents were used for drafting guidelines on the implementation of the RPE and RPO in Belgium. The new European Basic Safety standard with its' official translations was used to define each radiation protection profile, and to determine the tasks and responsibilities of the RPE and RPO. The Belgian legislation on radiation protection (Royal Decree of 20 July 2001 laying down the general regulations on the protection of the public, the workers and the environment against the hazards of ionising radiation) and the existing guidelines of the Federal Agency for Nuclear Control were mainly used to further develop the certification process.

As a result, the BVS-ABR working group elaborated a guidance document on the implementation of the RPE and RPO, treating topics such as: tasks and responsibilities, independence and delegation, externalisation, diversification towards applications and installations, education and training, certification and CPD (continual professional development). This document will be transferred to the Federal Agency for Nuclear Control to prepare the legal implementation of the RPE and RPO in Belgium.

This presentation will discuss the key points in the guidance document on the implementation of the RPE and RPO in Belgium, as well as the existing difficulties and challenges for the future. While the RPE profile already exists in Belgium in such a way that experts in Health Physics are performing the majority of the tasks described in the European Basic Safety Standard, the profile of the RPO is currently not formalised and needs to be developed in the daily management of radiation protection in the installations.

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Michèle Coeck
SCK•CEN

RADIATION PROTECTION TRAINING FOR EMERGENCY SERVICES IN AUSTRIA

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Seibersdorf Laboratories, Germany

Radiation protection is an interdisciplinary field attracting several emergency organizations in the same way. To ensure a smooth communication and cooperation it is necessary to perform at least parts of the training at the same level.

This is the reason why the radiation protection training award (Strahlenschutz-Leistungsabzeichen) was established half a century ago and became a nationwide success because it is a training at a high international level approved everywhere. And the trend of a close collaboration concerning the radiation protection training still continues!

HISTORY

To act professionally as a first responder it is necessary to possess a certain basic knowledge of practical and theoretical know-how in the field of radiation protection and the possibility of a good communication between the participating emergency services.

On the one hand there is a large variety of radiation protection trainings for emergency services in Austria as well as internationally coexisting in a refreshing way, on the other hand there has been the overarching trend to a general radiation protection training for all emergency services in Austria since several decades (starting 1963) which has been encouraged from the Seibersdorf Laboratories. It is worth mentioning that at that time no legal documents concerning radiation protection existed. The Austrian Radiation Protection Law was passed in 1969. In 2003 a multistage radiation protection training system could be established officially with the ÖNORM standard S 5207 (Radiation protection training for intervention personnel).

In 2007 the training content of the mentioned ÖNORM standard was transferred completely into the radiation protection intervention regulation and so it got a legal relevance.

TRAININGS

The “Basic training” for intervention personnel takes place in different emergency services and provides the basic knowledge theoretically and practically for successfully collaborating on a radiation protection operation.

The “advanced training I”, the successful completion of the radiation detection training, imparts the knowledge for leading a radiation detection team and working independently in the radiation area. It is closed with the examination of the radiation protection training award in bronze, taking place at the Seibersdorf Laboratories.

Degree holder of the “advanced training II” possess special knowledge of the middle radiation protection management. They are able to assess the situation in the event of a disaster concerning radioactive material and instructing their team in an efficient way. This training qualifies for getting the radiation protection training award in silver.

Special trainings require the completion of the “advanced training” and contain a further specialisation. They cover the field of the emergency services as well as the conjunction to technical applications like monitoring, disaster management, nuclear crime, disposal of radioactive materials and several other topics.

Owner of the radiation protection training award in gold possess a very broad knowledge on the field of radiation protection. They are able to organise and develop the field of radiation protection in their organizations.

CONCLUSION

In retrospect establishing this training system has been a great success because since 1963 there have been more than 30.000 members of emergency services completing the training until the training award in bronze. The next step will be the conjunction of this training system with international standards to have better cross-border cooperation as well as a better integration of promising information technologies like geoinformation systems and data processing systems.

DIRECT DIGITAL IMAGING; CAN WE REALLY REVEAL THE REASONS BEHIND THE IMAGE REJECTION

Sarah Hagi

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Since the 80's and reject analysis is considered a useful tool used for quality control, to evaluate radiographs as it leads to the retake of images again. In addition it helps improve the quality of service in imaging departments, increase the cost effectiveness. Direct Digital Radiography DR is the new imaging technique and a replacement to computed radiography CR in imaging. DR suppliers claim it reduces the necessity of unneeded repeats of imaging which results in a reduced radiation exposure of patients. Old CR systems have shown reject rates of 5% on the other hand DR has shown a reject rate of 12% on a couple of system in Norway. In 2011 our hospital installed 6 DR machines, our current study aims to determine the reject rate of DR systems in hospital, benchmark it with other institutes, explore the main causes of rejection and introduce a plan for improvement.

Material and methods: reject analysis data were collected over a period of 12 month from Jun 2012 till May 2013. 27 technicians would rotate over the year to work on every machine; the rejected analysis is automatically registered in the system which is a Kodak installed software built in the machine. Rejection reasons could not be deleted, and no imaging is allowed for the same patient without reporting the reason for rejection. All possible reasons for rejection are predefined by the machine.

Results: 89797 images were acquired in which 13371 were rejected, giving a rejection rate of 14.98%. Positioning errors accounted for 30.92% of the rejected images. Followed by artifact 28.46% and motion 17.1%. As for body parts; pelvis, abdomen spine and knee recorded reject rates higher than the average with no correlation between the number of scans and reject rates. 25% of the rejected images were ordered towne view.

Conclusion: the study has shown that there is a high number of unnesscesry repeated imaging for patients. In addition reject analysis proven to be an indicator for quality in imaging, reject reasons that have high percentage of occurrence should be given more focus while scanning the patients.

COMPUTED TOMOGRAPHY REFERRAL PRACTICE – EXPERIENCE AT A LARGE ACADEMIC HOSPITAL

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Objectives: To evaluate the current computed tomography (CT) referral practice with emphasis on correct clinical data and examination choice. Our second aim was to investigate turnaround times on all brain CT scans included in the study.

Methods: A retrospective analysis of all CT examinations in the radiology information system database was carried out at King Abdulaziz University Hospital, Jeddah Saudi Arabia. This study was conducted six months after hospital wide implementation of the iRefer criteria, the Royal college of Radiologists imaging referral guidelines. The review included all adult and pediatric patients who had attended the emergency department, out-patients, or were inpatients and had a CT request during the period from July to September 2012. Clinical data and indication for all subjects were evaluated and analyzed.

Results: 2322 records were investigated, of which 1695(73%) were adults and 627(27%) were pediatric patients. The majority of requests were for brain (36.9%). Of those, 46% were requested by the Emergency department, (86%) adult and (14%) pediatric patients. The total number of examinations performed with inadequate clinical information was 111; among those were 17(15%) pediatric patient requests. Report turnaround time was 1 day with a range of 0 to 38 days.

Conclusion: There is a need to increase collaboration between clinicians and radiologists to follow appropriateness guidelines, attain dose reduction strategies, and avoid CT overuse. Changing the current referral practice will take time; however there are several forms of educational tools that could be used in raising clinicians' awareness on radiation dose from radiological investigations.

COOPERATION IN EDUCATION AND TRAINING IN NUCLEAR CHEMISTRY (CINCH-II)

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In order to mitigate the effects of the decline of number of staff qualified in nuclear chemistry, the CINCH-II project aiming at the Co-ordination of education In Nuclear CHemistry is supported within FP7 Euratom from July 2013 to May 2016. The CINCH-II project is built around the three pillars Education, Vocational Education and Training (VET) and Distance Learning. These main pillars are supported by two cross-cutting activities – Vision, Sustainability and Nuclear Awareness that includes also dissemination, and Management.

In this poster the activities of the Institute of radioecology and radiation protection (IRS) of the Leibniz University in Hannover, Germany, are presented. IRS contributes to this project mainly by developing E-learning components and by providing a remote access to controlled exercises, based on the RoboLab concept. Additionally contributions to develop a Training Passport in Nuclear Chemistry and to support networking by dissemination of knowledge at German university and non-university institutions teaching radiochemistry are planned.

TRAINING COURSE FOR RADIATION PROTECTION SUPERVISORS/OPERATORS OF RADIOACTIVE FACILITIES

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he rise in ionizing radiation applications within the field of diagnostics and industry, with the corresponding increase in both number and doses received by workers and patients, requires suitable resources for education and training in radiological protection.

At Spanish legal law is reflected the importance of this training through legal documents as “Royal Decree 783/2001 of 6 July, amending the Regulation on protection against ionizing radiations” and “Royal Decree 1836/1999, of 3 December, approving the Regulation on Nuclear and Radioactive Facilities is approved. These laws establish the need for workers to get a specific training before starting activities with ionizing radiation.

The time requested for this training in classroom training is a real handicap for professional people and for the center where they belong to. But this inconvenient can be solved with the use of the Information and Communication Technologies (IT). The IT makes possible to carry out training through internet in an effective, easy and amusing way: “e-learning”.

The blended learning courses mixes the interaction of the classroom training with the advantages related to the training tools of the e-learning methodologies: time flexibility, the geographical independence of the student or the higher profit of the course. Its application at the Radiation Protection training is essential for the success of it, reducing the required time of classroom training as well as it is a way to improve the compatibility between professional and personal life of the students.

In the last two year (2012 and 2013) ACPRO’s Training Division has conducted 5 editions of blended courses focused on operators and supervisors. The course is in an Internet-accessible Virtual Campus, which allows access to multimedia contents, on line conference, videos, communication between students and instructors and the follow-up of students´ performance. Final assessment and practical lessons are done in a radiation facility and if the students successfully pass the course they obtain the competence as a supervisor / operator of radioactive facilities, being recognized by the Nuclear Safety Council.

The results obtained in the mentioned blended learning courses provides the justification of its suitability and they allow us to identify the areas to be improved.

THE EFFECTIVENESS AND EFFICIENCY OF RADIATION PROTECTION EDUCATION AND TRAINING IN LITHUANIA

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The education of radiation protection in Lithuania is covered by the specialized study programs, which provides several Universities in Lithuania. Most of these programs are dedicated for the medical physics, medicine, odontology, public health students. Also it is necessary to notice, that radiation protection course is included in the study programs intended for the environmental engineering, environmental protection, energy physics and other related study programs students. Although the radiation protection course is included in the mentioned study programs, but that does not ensure the qualified radiation protection specialists training. RPC is interested in qualified radiation protection specialists training, and in collaboration with the International Atomic Energy Agency (IAEA), time to time the young specialists nominating to the international Postgraduate Educational Course on Radiation Protection and the Safety of Radiation Sources. Also the qualification of the specialists time to time is improving at the various regional or inter-regional IAEA workshops, training courses, expert meetings etc.

Radiation Protection Centre (RPC) is a regulatory authority that plays very important role not only in Radiation Protection Supervision and Control, but also in regulation of Radiation Protection Training (RPT) system in Lithuania. The Law on Radiation Protection is one of the main legal documents in Lithuania, regulating the requirements for persons, who have to be trained in radiation protection. Regarding to the mentioned Law, on 22 November 2011 there was adopted an Order of the Minister of Health (Order No. 1001 On the Approval of Compulsory Radiation Protection Training and Instruction Procedure). On this Order there are determined the requirements for: persons, who have to be trained in radiation protection; for persons, who want to become lecturers; for training programmes and for the institutions, which want to provide the radiation protection training. According to this Order, the persons, working with ionizing radiation sources, also the persons, who might deal with the ionizing radiation sources on their work and the persons, responsible for radiation protection at their working facilities, have to be trained by initial training programmes before they start a work and have to be retrained every five years by the refresher training programmes to renew their knowledge.

GAMMA RADIOGRAPHY: PREPARATION FOR DAMAGE-FIGHTING IN TRAINING AND PRAXIS

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For industrial radiographic testing gamma devices containing sealed radioactive sources with an activity of several TBq are used. Due to the potential risk working with high-activity radioactive sources many requirements on their safety and security are made. One of them is the training on incidents due to equipment faults or human failure.

In Germany the Radiation Protection Ordinance requires approved radiation protection courses, including e.g. biology, radiation injuries and incident management (in theory and praxis). The practical part of the incident management includes source recovery due to equipment faults. This is according to ALARA only possible under lab conditions, meaning source holder dummies. The human factor in incident management (panic reactions) cannot be trained in a one week radiation protection course. Here we recommend continuous training on radiation protection officers and radiographers under work conditions, by the employer. Which is also a requirement of the German Radiation Protection Ordinance. Furthermore the employer has to provide adequate equipment for the source recovery. Of course this will also mean lab conditions but it enables the training of algorithms

(comparably first aid trainings).

Owing to unfortunate circumstances a severe incident (INES 3) happened 2013 in Germany, while handling a defect on a gamma source device. An intense and regularly training on incident management could one thing to avoid primarily radiation injuries of the radiographers and general public. To support the companies, special courses should be offered by the RP-Training Centers, e.g. DGZfP.

MULTISTEP OPTIMIZATION APPROACH IN MEDICAL RADIOLOGY: A PATIENT IMPERATIVE

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In view of progressively increasing amount of medical radiological procedures as well as relatively high patient doses received in computer tomography and nuclear medicine, a whole optimisation of medical radiology management shall include not only all existing aspects of optimization - having been actualized in the new Euratom Basic Safety Standard proposa - considering patient doses as the optimization targets, but also aware participation of patients as essential stakeholders in the overall process of efficient implementation of ALARA priciples in medical radiology..

Real and imaginary health risks steming from medical radiology applications forces us to develop novel forms of education, decision making and social communication approaches with the final aim to gain patient confidence to radiological diagnostic and therapeuthic procedures, on the one hand, and and maximal possible profit from such procedure.

There is proposed an interdisciplinary approach to societal optimization of the tripartite educator-medical personnel-patient interaction. As methodological keystones we choose the principles which could manage with the knowledge and information qualities: self-organization concept, 2) the principle of the requisite variety (for successful development of a given system (human being(s)) in external environment its internal variety should exceed the variety of its environment). A primary source of growth of human internal variety - information and its organized form – knowledge. All available forms of stakeholder involvement, their education and mutual interactions can be classified as mechanisms of societal optimization, increasing the internal variety.

There is revealed: public education, social learning and the use of mass media and internet are efficient self-organization mechanisms, thereby forming a knowledge-creating community. Such a created knowledge could facilitate promotion of adequate risk perception. It is concluded: self-organized social learning could promote adequate perception of risk and prevent, by diminishing uncertainties and unknown factors, social amplification of an imagined risk, as well as to increase the trust level.

It is emphasized the essential role of the patient's risk awareness and his general radiation protection knowledge in decision making on accomplishment of the recommended radiological procedure. In line of advanced international (EU, IAEA, WHO) projects on radiological personnel education, as the most efficient routes of education of public - or potential patents - are considered the following ones: 1) basic knowledge on radiation applications and protection to be received in secondary school, 2) life-long public educating – via printed and electronic (internet) publications and lectures issued by teaching institutions, regulatory authorities and professional bodies; 3) direct goal-oriented knowledge acquisition from the involved medical personnel about particular radiation risk/benefit issues of the certain radiological procedure.

NO CANCER PATIENT SHOULD BE ALONE: KING ABDULAZIZ UNIVERSITY HOSPITAL SUPPORTS THYROID CANCER PATIENTS

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The most common endocrine malignancy is thyroid cancer (TC). In many medical and researches centers have noted an increasing frequency of cases of thyroid cancer. According to Cancer Research UK, Saudi cancer registry centre and other bodies around the world stated that 70% of thyroid cancer patients are women. The most common way of treatment is using a radioactive isotope (131I). Iodine emits Beta and Gamma Radiation with 198 hours half-life. That raises a question “what women with TC should do in particular in Saudi Arabia where patient awareness is limited?” The medical physics unit in King Abdulaziz University Hospital (KAUH) established a counseling session to patients who are expected to undergo treatment with radioactive iodine. The journey was divided into three phases which are patient preparation before treatment, during the treatment and after release. Each part of the trip was written in both Arabic and English languishes to ensure the well understanding. The counseling covered small sample of male and female patients as a pilot test. There was a significant impact on the patient dose rate as well as isolation time. However, further investigations were done with a large sample of patients to avoid any statistical error. All results were as we expected.

THE TRAINING CENTER ON RADIATION PROTECTION IN INSTITUTE OF RADIATION PROTECTION AND DOSIMETRY, BRAZIL

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CNEN, Brazil

In Brazil the use of radiation in different fields is distributed as Medicine 35 %, Industry 41%, Research 20%, Services 2% and Commerce 2 %. There are more than 8.5 thousand sources in use, 2 nuclear power plants and 4 research nuclear reactors. The Institute of Radiation Protection and Dosimetry-IRD, created on 1972 in Rio de Janeiro, is a unit of National Nuclear Energy Commission-CNEN. Its main purpose is to act as a National Reference Center in radiation protection, dosimetry and metrology on the applications of ionizing radiation in medicine, industry, power plants and other fields of human activity, in order to protect the worker, the patient and general public. Since 2001, a post-graduation program on Radiation Protection was implemented, unique in the country, aiming to provide academic and practical training to perform a safe work by professionals. This is an interdisciplinary course, Master and PhD degrees, which addresses the following areas: Radiation Biophysics, Medical Physics, Metrology and Radioecology. In 2010, in association with IAEA an extension course in Radiation Protection and Safety of Radioactive Sources was also implemented with the aim of training RP qualified experts. In addition, short-term training courses in specific areas such as nuclear medicine, radiotherapy, radiology, radiological emergency, industry, norm, radionuclide metrology, among others, are offered for over 20 years. Until 2012, 117 master thesis were concluded. The main area is Medical Physics with about 40%, followed by Radiation Biophysics 25%, Radioecology 21% and Metrology 14%. As RP qualified experts, 24 students per year obtain the title; for short terms courses, more than a thousand professionals have been trained. The demand is growing fast mainly due country's economic development, access to new technologies in medical field, growth of oil exploration and nuclear power plants. One can predict that over 2000 professionals will be trained in the next 5 years.

LEVEL OF EDUCATION AND TRAINING IN RADIATION PROTECTION IN THE CURRICULUM OF HEALTH PROFFESIONALS IN NORWAY

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Introduction: Today, medical exposure is widely used outside radiological departments, and new technology allows for more advanced diagnostic and interventional procedures. During 2008 and 2009 the Norwegian Radiation Protection Authority (NRPA) carried out inspections at 52% of all Hospital Trusts (HT) in Norway. The inspections revealed lack of skills in radiation protection at 91% of the inspected HTs. Insufficient knowledge in radiation protection were mostly associated to medical exposure outside radiological departments. The purpose of this survey was to get an overview of the amount and level of education and training in radiation protection (RP) in the curriculum of health professionals who is involved with medical exposures. In Norway all educational institutions have to implement the European Qualifications Framework for lifelong learning, based on learning outcomes defined in Knowledge, Skills and Competence (KSC).

Materials and Methods: Information about education and training in RP was collected from 47 educational institutions for 13 different health professionals. A questionnaire were developed to collect information about the provided theoretical topics within RP, practical training, number of educational hours, defined learning outcomes and information about any exams to evaluate the obtained KSC in RP. We also collected information from professional societies and 15 HTs about the expectations to health professional's knowledge about RP. The results were analyzed and compared with the recommended radiological protection training requirements given by ICRP publication 113.

Results: For the physicians we found that all groups except the nuclear medicine specialists have less training hours and KSC about RP in their curriculum than recommended by ICRP. Only nuclear medicine specialist of the physicians has learning outcomes and exam in RP in their education. For dental care most of the groups has more RP in their curriculum than recommended by ICRP. All educational institutions for surgical nurse have less education and training in RP than recommended. Most of the training topics in the education of radiographers have the same level and knowledge as ICRP recommend. Further, some results show a significant variation in skill, level and training hours between educational institutions. The result also shows that employers of HT expect that medical staff have more RP in their education.

Conclusion: It was found a substantial lack of learning outcomes in RP in the curriculum for surgical nurse and physicians except for nuclear medicine specialists. For some medical professionals it was significant variations between educational institutions. A challenge for the future work is to implement learning outcomes in RP in the curriculum for all medical professionals involved with medical exposures.

SYNERGETIC APPROACH TO ALARA CULTURE

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Despite the fact nuclear regulatory bodies are largely independent from promotion and application of nuclear energy, its every day work involves other stakeholder services who are related to nuclear energy field. In order to assure harmonised approach to regulatory processes, and high level of safety at licensee's sites, it is of paramount interest to have common understanding of ALARA approach among stakeholders. A tool that provides basis for such understanding is education and training, and a mean to verify that tool is standardisation of education and training programmes. Apart from regulators, licensees and service providers in the nuclear field, it is important to keep in mind that public is probably most important stakeholder that must have timely and "correct" information available when decision on the regulated activities needs to be taken. Irrespectively of the exposure situation, either it involves exposure of patients or workers, construction of the source storage pit in the industry, or exposure to contaminated commodities or sources of natural origin for example, decision on response to exposure situation have potentially long term effects on credibility of the radiation protection and safety system overall. Robust system for protection and safety should be based only on clear dissemination of responsibilities and understanding of the stakeholder's roles in applying ALARA principle. In today's fast changing world, where technology is rapidly improving in all fields of application of nuclear energy, it is more than ever important to have robust protection and safety system in place that is based on a current information. To achieve that, it is necessary to establish close and continuous cooperation between all stakeholders, based on common understanding of ALARA principle.

EDUCATION AND TRAINING IN RADIATION PROTECTION AND ALARA BY SCK•CEN'S ACADEMY FOR NUCLEAR SCIENCE AND TECHNOLOGY

Michèle Coeck

SCK•CEN

Preserving and extending nuclear knowledge on fundamental and peaceful applications of ionising radiation to serve society, is one of the key elements in SCK•CEN's research policy. Thanks to its thorough experience in the field of nuclear science and technology, its innovative research and the availability of large nuclear installations, SCK•CEN is an important partner for education and training in Belgium as well as at international level.

With the intention to better coordinate and strengthen the education and training activities fostered by SCK•CEN during the past years, our research centre launches in 2012 the Academy for Nuclear Science and Technology. Within the Academy, 60 years of expertise and experience gained from our different research projects is collected. In order to maintain and extend a competent workforce in nuclear industry, medical, research, and governmental organisation, and to transfer this nuclear knowledge to the next generations, the Academy acts in the following four domains:

1. Guidance for young researchers
   SCK•CEN opens its laboratories and its experts are available to supervise Bachelor, Master and PhD students. In addition, initiatives are taken towards high school pupils (guided thematic visits) and teachers (update on nuclear topics and provision of certain illustrations).
2. Organisation of academic courses and customized training for professionals
   The SCK•CEN Academy collaborates with several Belgian and foreign universities and contributes to academic learning. Furthermore, we foresee customized and modular training for professionals, in all nuclear topics we do research on, such as radiation protection and ALARA.
3. Policy support regarding education and training in nuclear domains
   The Academy strives towards better harmonisation of education, training practices and skills recognition on a national and international level, which becomes crucial in a world of dynamic markets and increasing workers' mobility.
4. Research on transdisciplinary aspects of education and training
   Understanding the benefits and risks of radioactivity requires technical insight and training, but also an understanding of the context and a sense for the social and philosophical aspects of the situation. The research of the SCK•CEN Academy concentrates on how to integrate this transdisciplinary approach in education and training programmes.

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