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ISSN - 0250 - 5010

ANNALEN
VAN
DE BELGISCHE VERENIGING
VOOR
STRALINGSBESCHERMING

VOL. 39, N° 3, 2014

4e trim. 2014

Present and future challenges in radiation protection by the young generation

Driemaandelijkse periodiek
1050 Brussel 5

Périodique trimestriel
1050 Bruxelles 5

ANNALES
DE
L'ASSOCIATION BELGE
DE
RADIOPROTECTION

Ce numéro contient des textes d'exposés présentés lors de la réunion organisée par l'Association belge de Radioprotection (BVSABR)

Dit nummer bevat teksten van uiteenzettingen ter gelegenheid van de vergadering van de Belgische Vereniging voor Stralingsbescherming (BVSABR)

Present and future challenges in radiation protection by the young generation

Brussels, 19-09-2014

SOMMAIRE **INHOUD**

Annales de l'Association belge de Radioprotection, Vol.39, n° 3, 2014
Annalen van de Belgische Vereniging voor Stralingsbescherming, Vol.39, nr 3, 2014

LARGE EDDY SIMULATION OF RADIOACTIVE POLLUTANT DISPERSION OVER AN OPEN FIELD FOR TIME-DEPENDENT DOSE ASSESSMENT

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Introduction

The estimation of the dose to the general public after the accidental release of radioactive gases is an essential part of the nuclear emergency planning. This is in particular important in order to be able to take effective countermeasures. At the near-range, Computational Fluid Dynamics (CFD) can form an alternative for the Gaussian-based models which are known to have a limited accuracy close to the source and in situations with complex air flow [1, 2]. Further, applying Large Eddy Simulation (LES) turbulence modeling also includes the transient behavior of the wind field in the simulation. Simulating the pollutant dispersion in the atmospheric boundary layer with LES and coupling this with a beta and gamma dose rate model results, therefore, not only in an increased accuracy but also quantifies the dynamic behavior of the dose rate. Such an assessment can be particularly useful when studying the optimization of measurement strategies, and when estimating measurement uncertainties related to atmospheric effects. In this work, we simulate the dispersion of ^{133}Xe over an open field and monitor the dose rate at ground level. We illustrate that the instantaneous beta dose rate is nearly zero except for large peaks which appear at irregular time intervals. The gamma dose rate fluctuates with a limited spread around a non-zero mean, regardless the energy of the gammas emitted.

Model

We use an Eulerian approach to simulate the pollutant dispersion from a stack release over an open field under neutral atmospheric stratification. The evolution of the concentration c is formulated as a transient three-dimensional convection-diffusion problem where the sub-grid scale (SGS) pollutant flux is modeled based on an eddy-diffusivity approach:

$$\frac{\partial c}{\partial t} + \nabla \cdot (\boldsymbol{u}c) = \nabla \cdot \frac{\nu_{sgs}}{Sc_{sgs}} \nabla c - \lambda c + S \tag{1}$$

where c is the pollutant concentration, $\boldsymbol{u}$ is the wind field, Sc_{sgs} is the SGS Schmidt number which is set equal to 0.4 [3], ν_{sgs} is the SGS eddy viscosity, λ is the radioactive decay constant, and S is the pollutant source. The instantaneous profiles for velocity and eddy viscosity are produced by a large eddy simulation of the atmospheric boundary layer to impose a realistic representation of the wind field. The SGS eddy viscosity is evaluated using a Lagrangian scale-dependent dynamic model [4].

From the concentration, beta and gamma dose rates are computed at every instant using the local concentration and the point-kernel method with buildup factors, respectively [5,6]:

$$\dot{d}_{\beta,x_0} = K_\beta \, \bar{E}_\beta \lambda c(x_0) \tag{2a}$$

$$\dot{d}_{\gamma,x_0} = \frac{K_\gamma E_\gamma \mu_{en}}{\rho} \iiint_V \frac{B}{4\pi r^2} e^{-\mu r} \lambda c(x', y', z') \, dx' dy' dz' \tag{2b}$$

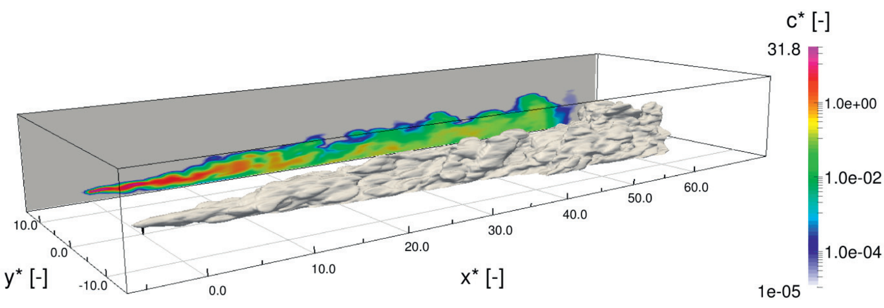

Fig 1. Isosurface of $c^* = 10^{-5}$ $(= cUL^2/R)$, released from 75 m altitude.

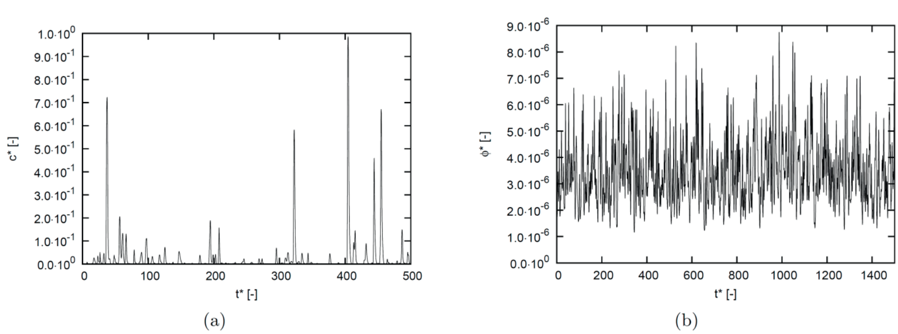

Fig 2. Observed concentration c^* $(= cUL^2/R)$ (a), and gamma fluence rate ϕ^* $(= \phi L^2/R)$ (b), as function of time t^* $(= tU/L)$ at 750 m due to the emission of ^{133}Xe from 75 m altitude.

where, $r^2 = (x_0 - x')^2 + (y_0 - y')^2 + (z_0 - z')^2$ K_β and K_γ are conversion factors, $\bar{E}_\beta$ is the average beta energy per disintegration, E_γ is the gamma energy released per disintegration, μ_{en} is the linear attenuation coefficient in air and B is the dose build-up factor. Depending on K_β, the beta dose rate can be interpreted as skin or inhalation dose rate [[5]].

The model is applied to the dispersion of ^{133}Xe. This radionuclide disintegrates by beta minus decay into a stable daughter, accompanied by the emission of gamma radiation. The geometry of the case simulated is very simple, i.e. an open field without any obstructions from buildings or vegetation. The pollutant is released from 75 m altitude (= L). Further, instead of reporting the beta and gamma dose rates, we bound ourselves to a discussion of the local concentration and the gamma fluence rate, respectively, to eliminate the effect of the receptor characteristics on the result.

Results

A typical result of the dispersion simulation is shown in Fig. 1 as an instantaneous, three-dimensional isosurface of the dimensionless concentration $c^* = 10^{-5}$ $(= cUL^2/R)$. The turbulent nature of the boundary layer clearly results in a non-uniform plume with a spread increasing with the distance from the point of release. The resulting local concentration and gamma fluence rate observed at a distance of 750 m from the source are shown in Fig. 2 as a function of the non-dimensional time t^* $(= tU/L)$ for the emission of ^{133}Xe.

It is observed that even under constant pollutant emission rate, strongly fluctuating dose rates in time are registered. However, a clear difference between beta and gamma radiation is apparent. The concentration (Fig. 2a), and consequently the skin or inhalation dose rate, is nearly zero except for large peaks which appear at irregular time intervals. These peaks raise the dose rate almost instantaneously several orders of magnitudes. The gamma fluence rate on the contrary (Fig. 2b), fluctuates around a clear non-zero mean with maximum deviation of a factor of two from the mean. Depending on the distance from the source and the pollutant release height, this difference can raise up to a factor of four.

Because of the significantly different behavior of the local concentration and the local gamma fluence rate, these results suggest that both are very hard to link. This means that, in case of a pollutant release, neither the skin dose rate nor the inhalation dose rate can be estimated accurately from local gamma dose rate measurements. However, the model presented provides the means required to estimate an upper boundary to the skin dose or inhalation dose received.

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Annales de l'Association belge de Radioprotection, Vol. 39, n° 3, 2014
Annalen van de Belgische Vereniging voor Stralingsbescherming, Vol. 39, nr. 3, 2014

PRESENT AND FUTURE CHALLENGES IN RADIATION PROTECTION BY THE YOUNG GENERATION - PERSPECTIVE FROM ELECTRABEL

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Abstract
This paper presents the results of a survey of 10 persons working in the field of radiation protection inside the Electrabel (GDF-Suez) Organisation. The survey addresses the 3 questions Q1 "How you came into contact with radiation protection ?", Q2 "what are you doing & why you like it?", Q3 "what are the future challenges for the young generation ?". The paper attempts to identify the main and common messages expressed by the interviewed persons.

Radiation protection organization and interviewed personnel
Electrabel (GDF-Suez) currently operates 7 reactors distributed on 2 sites in Belgium : Doel and Tihange. Each site is staffed with more than

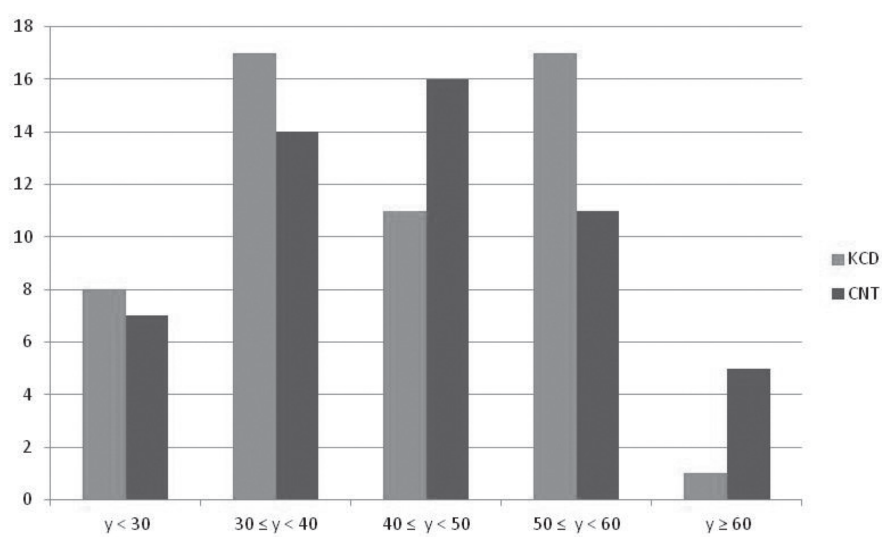

Fig 1. Age distribution for the Electrabel RP staff of Doel (KCD) and Tihange (CNT) on July 2014

800 persons working in different departments. Per site, the Radiation Protection (RP) service is staffed with ~ 60 persons, amongst which 3 people managers, ~ 10 supervisors and ~ 50 RP technicians. Figure 1 shows the age distribution at both sites ; one observes that less than 10 persons per site belong to the category "< 30 y".

There is also a Corporate Nuclear Safety Department located at Brussels, staffed with ~ 25 persons, amongst which ~ 5 persons working in the field of radiation protection.

The author proceeded in July 2014 to the volunteer interviews of RP staff of Doel, Tihange and Corporate department, in order to collect a view about the targeted "young generation". There was no age restriction for the interviewees but it was attempted to check whether the perception differs with age. The Table 1 below provides some information w.r.t. the 9 interviewed persons + author. The fact that the interviewees were volunteer might affect the results of the survey.

	Doel	Corporate	Tihange
Managers	(F, 29 y)	(F, 30 y), (M, 42y)	(F, 34y)
Supervisors		*	(M, 55y), (M, 54y), (M, 31y)
Technicians	(M, 27y), (M, 26y)	*	(M, 28y)

Table 1. Interviewed personnel (M = Male / F = Female)

Outcome from Q1 "How did you come into contact with radiation protection?"

The majority of answers tend to show that working in radiation protection is a motivated choice, driven by the technical / scientific interest. RP workers are generally interested by questions like :

- *"what is radiation protection ?"*
- *"what is a radiologically controlled area (RCA) ?"*
- *"How is working a radiation measurement device ?"*

More generally, it is also observed that working in a nuclear power plant is a deliberate choice, motivated by different reasons, as for example :

- Wish to do a job that is different as compared to the others
- Motivation for working in a large plant producing electricity

The interested persons were generally in contact with the company before appointing for a job in RP : working as contractor for Electrabel, friends or family members working for the company, internal career reorientation, ... This seems to indicate that one has to be faced to the RP world to get motivated for such a job (no mention of RP job appointment after having read a newspaper of a vacature announcement on a web site).
The initial background of the interviewed persons is of course scientific :
- Managers : engineers (chemistry, electro-mechanics, physics)
- Technicians : technical degree (chemistry, electro-mechanics).

Outcome from Q2 "What are you doing & why do you like it?"
With respect to the daily job, one has to distinguish between 3 categories of personnel :
- Sites RP people managers & supervisors : their job consists in the work coordination, coaching, supervision, update and upgrade of procedures, ...
- Sites RP technicians : they are working on the field and perform a wide range of tasks : radiation maps, RP measurements, check of transport containers, calibration of devices, support to workers leaving the RCA, control of practices in RCA, tracking of the contamination, ... There are roughly 2 kinds of tasks : (i) radiological measurements and (ii) control of the respect of RP rules in RCA (e.g. use of the protective clothing).
- Corporate RP experts : those are in charge of the RP "*governance*" inside the company. The term "governance" covers several activities, amongst which the independent control (e.g. annual independent reporting about the RP performance of our sites, independent review of RP practices and comparison with the state of the art practices) and the strategy (e.g. development of internal policies and requirements for the whole fleet).

The interviewed RP staff is motivated by his job for the following 3 main reasons :
  - Scientific basis of RP
  - Contact with various workers is at the core of the job (coaching, advise)
  - Diversity of the RP activities

Outcome from Q3 "Challenges for the young generation ?"
In order to help the interviewed persons to identity the future challenges for the young generation, the author first asked what, according to them, is

working good and bad in RP, for their own company but also at a broader scale.

The challenges may be grouped into 3 categories : the changing (national) context impacting the Electrabel activities, the challenges related to the continuous improvement principle to which Electrabel adheres and challenges outside Electrabel (see Table 2).

Changing context impacting the Electrabel
• Engagement, training and knowledge transfer of young RP technicians • Dismantling of NPP's (incl. clearance of waste), new projects (LTO)
Continuous improvement
• Harmonization of the regulations for transport of radioactive material at the European scale • Keep RP practicable (>< regulations ?) • Harmonization of the RP practices • Broader view on RP for technicians (or enlarged RP culture) • How to increase the performance when you are already good ? • RP responsibility of the non RP specialists
Challenges outside Electrabel
• Better communicate about radioactivity and RP • Make the RP public perception more objective

Table 2. Future challenges perceived by and for the young generation

In the 1st category, the dismantling of the nuclear power plants is pointed out as a challenging issue for RP. Perspective of dismantling NPP's has a twofold effect : this is perceived as a poor perspective for engaging into a nuclear career, whereas the needs for RP will be effectively enhanced during the decommissioning period. Both RP technicians and RP people managers also point out the absence of RP school for technicians, such that this training is currently assured by the company but which represents a significant investment. Furthermore RP people managers mention the difficulty to recruit those RP technicians and fear a worsening situation following the "phase out" law, especially at Doel.

The 2nd category of gathers challenges in the category “continuous improvement”. Those are generally based on the statement that the company improved a lot in the field of RP during the last 10 years and that presently ranks amongst the best performers in the world. Therefore the questioning “*how to increase the performance when you are already good ?*”. This category highlights the need for harmonized RP practices between NPP’s and a better matching between the practices and the regulations. Two additional challenges identified in this category are the enhancement of the RP responsibility of non RP specialists (who consider too often that RP is of the sole responsibility of the RP staff) and the enlarged RP culture for RP technicians, as developed below.
The 3rd category is oriented towards to public and the way to communicate about radioactivity and RP to the general public. As an illustrating example, several RP technicians motivated by their work face some difficulty to communicate about their job and to be understood by their neighbourhood.

Personal analysis
Interviewing the RP personnel, it was quite obvious that experience helps the persons to identify the main issues and challenges in RP. Nevertheless no significant difference between the age categories was identified. But it was striking to observe the difference between the RP technicians on the one hand and the RP managers and experts on the other hand :

- The RP technicians are daily working in RCA. They know very well their unit / site but have few knowledge about the practices of the other site (KCD vs CNT) or about the foreign practices. They know how to do a measurement and / or what is the good behaviour in RCA. However they have few knowledge about the why and the underlying scientific background of RP.
- The RP managers / experts are less present in RCA (time management). They have adequate knowledge of the Electrabel practices and foreign practices as well (participation to conferences, peer review in foreign plants, etc.). They are not daily user of RP measurement devices but they know the “why” and have sufficient knowledge of the scientific background of RP.

Even though this matter of fact corresponds to industrial constraints, there is some interest from some interviewed RP technicians to get a broader view on foreign RP practices and the underlying scientific background (let's quote that such a request may also help the RP technicians in a better communication with the surrounding public).

A more personal perception is that the RP discipline is currently practised by 3 different categories of people (Figure 2) :

- The scientists, working in the national research centers, the universities and active in scientific committees like the ICRP ;
- The regulators, working for the national safety authorities, but also supra-national organisations, like IAEA, HERCA, etc ;
- The operators, who may exchange practices and experience through dedicate operators committees, like WANO, INPO, etc.

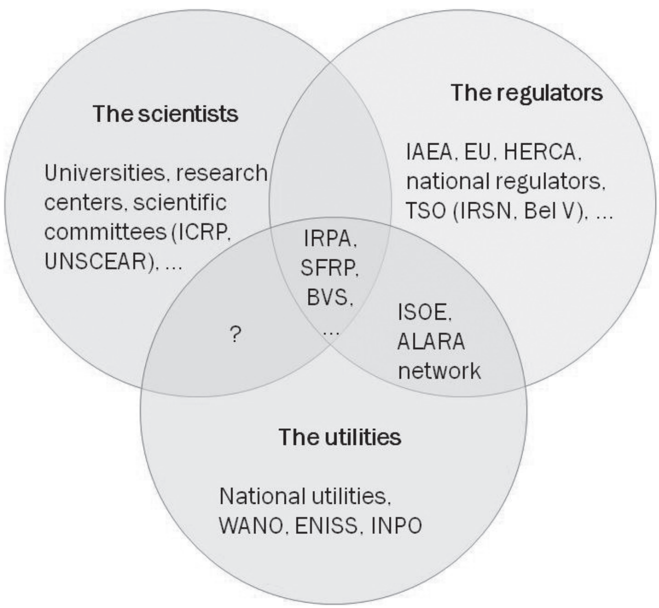

Fig 2. Schematic representation of the 3 RP "communities"

Regulations are inspired from a scientific background, as it should be, but sometimes suffer from a lack of consideration of the operational practices (e.g. strong focus on the studies from the regulators, whereas a more pragmatic approach may be preferred from the utilities). Enhancement of the interfaces between the 3 RP "worlds" is perhaps an area for improvement, for the better matching between scientific basis, regulations and operational practices. At this level, the RP national (e.g. ABR-BVS, SFRP) and international (IRPA) associations may play a crucial role.

Conclusion

Through a survey of 10 voluntary persons working for Electrabel in the radiation protection domain, the author summarizes the main observations :

- Working in radiation protection is a motivated choice and the RP staff of Electrabel is made of people having typical backgrounds (chemistry, electro-mechanical)
- There are 3 main motivating factors for working in RP : work diversity, scientific background and social dimension
- The main challenges perceived by and for the young generation are :

o The dismantling of the nuclear power plants
o Recruitment, training and knowledge transfer to the young generation
o Enhanced exchange between the various RP practitioners
o Enhanced public education about radioactivity and radiation protection.

Acknowledgement
The author wants to acknowledge his RP colleagues having agreed to be interviewed.

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Annales de l'Association belge de Radioprotection, Vol. 39, n° 3, 2014
Annalen van de Belgische Vereniging voor Stralingsbescherming, Vol. 39, nr 3, 2014

PERSONAL VIEW ON THE PRESENT AND FUTURE CHALLENGES IN RADIATION PROTECTION BY THE YOUNG GENERATION

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Abstract

This paper is a personal reflection of the author, working as a recognized expert in health physics and prevention advisor at a university, on why the young generation should choose to develop a career in radiation protection.

1. Introduction

Being one of the various young professionals working within the area of radiation protection, and this already for some years, I am in favour of the interesting nature of radiation protection as a field of activity at present. But does and will radiation protection still offer enough challenges to attract fresh blood to continue the work that has already been done? And what exactly are these challenges? This article is a personal reflection on these questions. It is written based upon the personal experience as a recognized expert in health physics and prevention advisor at a university.

2. Reasons for choosing a job in radiation protection

There are many reasons that are in favour of choosing a career in radiation protection. Some examples are highlighted below.

Radiation protection, there is something for everyone there

Radiation protection offers a variety in fields of activity as well as organizations in which one could work. The three main disciplines within radiation protection are: health physics, medical radiation physics and occupational medicine. All three of them require a specific scientific education, training and matching continuous development. The corresponding functions are characterized by the (possibly) exposed target groups on which they focus on the one hand, and their own particular job responsibilities on the other hand. In practice this does result in various job possibilities in a broad range of organizations, such as licensees (e.g. universities, hospitals, nuclear power plants, …), recognized bodies, occupational medicine services and the government.

A job in health physics is a versatile job

Working within the field of health physics, and thereby executing the broad range of tasks listed in article 23 of the Royal Decree of 20 July 2001[1], definitely requires a highly scientific interest. To be able to perform an expert risk assessment and to determine the corresponding adequate preventive measures, a thorough knowledge of the activities and processes involving the use of ionizing radiation is essential. However, one should not solely focus upon the risks imposed by the use of ionizing radiation. Activities are usually characterized by a whole set of risks, arising from inherent features of materials and equipment used, among others. Accordingly, these risks and their (possible) interaction with the risk that follows on the use of ionizing radiation, should also be included in the risk assessment. Besides this, organization specific factors such as the prevailing HSE (Health, Safety & Environment) culture highly influence the practical radiation protection system within an organization. As a consequence the same type of activities in two different organizations does not automatically lead to an identical set of corresponding preventive measures.

The focus of practical radiation protection nowadays lies upon the development and enhancement of ALARA culture. As a consequence, aspects such as communication, stake holder involvement and education and training gain more and more interest in practical radiation protection. In other words, next to technical skills, soft skills prove to be indispensable for professionals in health physics (and in radiation protection in general) to support a successful establishment and embedding of a radiation protection culture within an organization.

1 Royal Decree of 20 July 2001 laying down the General Regulation for the protection of the public, workers and the environment against the hazards of ionizing radiation;

Science doesn't stand still

Science, and therefore also the knowledge of ionizing radiation and radiation protection, is evolving continuously. Clearly, this rise of information can and will affect international recommendations and legislation with respect to these subjects. A rather recent example is the recommendation of the Internal Commission on Radiological Protection to reduce the dose limit for the lens of the eye for occupational exposure from 150 mSv to 20mSv in a year, and its integration in Council Directive 2013/59/EURATOM of 5 December 2013[2]. In addition to the influence on legislation, the increased knowledge of ionizing radiation and radiation protection shall also lead to the optimization of existing devices and techniques involving the use of ionizing radiation, as well as to the development of new ones.

As a result of the evolution of science, radiation protection in daily practice doesn't stand still either. However, the extent of the effect on daily practice largely depends upon the nature and frequency of the organization's activities. *Example: The effect of the use of a new type of apparatus in a medical imaging department of a hospital will be much larger than the outcome of a similar situation within an average academic research laboratory. The difference in magnitude is due to the fact that, in most cases, techniques that make use of ionizing radiation only make up a small part of all techniques used within an academic research lab. What of course also partly finds its origin in the temporary nature of research projects at universities in general.*

Radiation protection will never be complete

What might discourage certain people, looks appealing to others: radiation protection will never be finished off. It so happens that similar to the field that aims at the well-being of workers, radiation protection focusses on continuous improvement. The ALARA principle being the core of exposure optimization, and as a consequence being heart of radiation protection in practise.

2 COUNCIL DIRECTIVE 2013/59/EURATOM of 5 December 2013 laying down basic safety standards for protection against the dangers arising from exposure to ionising radiation, and repealing Directives 89/618/Euratom, 90/641/Euratom, 96/29/Euratom, 97/43/Euratom and 2003/122/Euratom.

3. Challenges for radiation protection professionals

In the field of radiation protection at our university there are no short-time big changes in the air, as we know them for instance in the medical sector (e.g. radiation therapy by means of alpha emitters). This paragraph therefore focusses upon two rather general challenges (i.e. irrespective of the nature of the organization's activities) for radiation protection professionals.

- The current public perception of radioactivity is rather negative. My personal experience does confirm this finding: researchers often mainly focus upon the risk following the use of ionizing radiation when they perform a prior risk assessment of their experiments. They overrate this specific risk compared to the other risks inherent to their experiments (e.g. chemical risks). Therefore *the creation of a more realistic (i.e. objective) general perception of radioactivity* still remains a challenging task for professionals in radiation protection. Besides, let us not forget the important role of general perception when drawing up legislation. It provides an answer on the question 'What is considered to be acceptable'. In addition, a more objective general perception of radioactivity might lead to a clearer (and thereby more attractive) image of radiation protection in general.

- For the organizations that did not yet *develop and maintain a close collaboration with the Internal Service for Prevention and Protection at Work (ISPPW)*, this definitely becomes a challenge for the near future. It is my personal conviction that integration of radiation protection within the well-being policies of an organization, is one of the conditions for a successful radiation protection system, as well as the embedding of it within the culture of an organisation.

4. Conclusion

Although this article only discusses a few of them, radiation protection does offer a whole set of challenging reasons for the young generation to opt for a career within this area. Radiation protection itself however, is also still facing a challenge, namely the persistent challenge to attract the necessary number of new and highly motivated (young) professionals.

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Annales de l'Association belge de Radioprotection, Vol. 39, n°3, 2014
Annalen van de Belgische Vereniging voor Stralingsbescherming Vol. 39, nr.3, 2014

CHALLENGES OF THE FANC REGARDING TO MEDICAL AND INDIVIDUAL DOSE MONITORING OF WORKERS

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Abstract

The main aspects of the remit of the "Medical and Individual Dose Monitoring" Unit of FANC's Health Protection Department are described in this paper which examines development and major progress made over recent years as well as considering current and future challenges.

Introduction

The main aim of the Health Protection Department in FANC's Health and Environment Division is to provide guaranteed radiation protection for patients, workers and the general public. In order to satisfy this aim efficiently and consistently, it is essential to have close collaboration with a number of external parties such as other national or international bodies/organisations, the academic world, the medical sector, research, professional or scientific organisations and, last but not least, the actors on site with approvals or licences issued by the Agency.

Over the course of the past decade, one of the major challenges faced by the Department has been to develop and expand on these external partnerships, not least by establishing a more open dialogue with actors in the field.

Medical and individual dose monitoring

The task of implementing radiation protection for workers by licensees and employers entails setting up both medical monitoring and individual dose monitoring amongst other things. The role of the “Medical and Individual Dose Monitoring” Unit is to guarantee that these monitoring assignments are carried out adequately and effectively.

The Agency and the Federal Public Service for Employment, Labour and Social Dialogue (FPS ELSD) share responsibility for radiation protection of workers, with the SPF being responsible in the global context of welfare in the workplace and FANC being responsible for protection against ionising radiation. It was thus necessary to meet around the table to expand on and organise this collaboration process. The signing of a collaboration agreement between the two parties in 2008 was an important stage in the process.

Medical monitoring [[1]]

The recognition of occupational physicians who carry out medical monitoring of workers exposed to ionizing radiation is a mean of ensuring the quality of this monitoring. In addition, maintaining a constructive dialogue with recognised occupational physicians is also essential to support them in their duties and contribute to the dynamics of this profession. A number of initiatives have been taken along these lines since 2007:

- Doctors were consulted in 2008 to clarify/draw up training and education-related criteria with a view to obtaining approval.
- An initial round table on the subject of medical and individual dose monitoring was arranged in May 2009 with a view to identifying the various problems in the field and collecting the views of recognised occupational physicians on the draft exposure register initiated by the Agency.
- On the basis of feedback from radiological incidents involving workers in 2013, it was possible to identify a number of improvement options for medical monitoring of exposed staff, such as:
  - o availability of recognised occupational physicians;
  - o collaboration with the health physics department;
  - o maintaining and building up practical knowledge and adequate responses by practitioners in incident situations.

By way of a response, the Agency took a number of actions in consultation with the sector such as organising annual ongoing training afternoons to build up the range of ongoing training provision available to these practitioners.

Individual dose monitoring

Approval of services performing external dosimetry [2], as established in 2008, was also a major step forward since it guaranteed the technical quality of individual external dose monitoring for workers. In a similar vein, the criteria for approving services performing internal dosimetry departments are currently undergoing development.

Another imminent challenge is to develop practical modalities for individual dose monitoring in the regulation in close consultation with the stakeholders (health physics departments, dosimetry services, occupational physicians). These will particularly be concerned with application of double dosimetry, dosimetry of the lens following the reduction in the annual limit in accordance with the new European Directive on basic safety standards in radiation protection (the new BSS) [3] or subtracting background noise from the results of dosimeter readings.

Exposure register

Origin and objectives

In order to guarantee individual dose monitoring for all exposed workers in an efficient way, it is essential to have access to a modern and powerful exposure register. In addition it should also allow to monitor efficiently the critical sub-group of external workers.

The system which was set up in 2007, by FPS ELSD at the time, was not particularly functional and did not permit optimum monitoring of external workers. It was thus decided that a new system should be developed. For reasons of efficiency and consistency with the respective tasks of the two parties involved, it was deemed more logical and effective to transfer these powers to FANC.

Thanks to its statistical and reporting functionalities, the system should provide a powerful tool to help with the following objectives besides its usefulness in verifying compliance with dose limits:

- Identifying critical groups;

- Promoting dose optimisation within a particular sector/group;
- Establishing priorities in connection with awareness, training or inspection activities;
- Drawing up and publishing official reports.

By modernising the exposure register, the underlying intention was also to modernise the dose reporting process to the authorities, i.e., replacing the system of sending paper exposure tables by forwarding electronic files.

The idea was also to ensure that the system was open to stakeholders and used as a central communication tool, specifically between the licensee and external companies with a view to monitoring external workers. Henceforth, parties working in the field should be involved in this project right from the outset and during all key development stages.

Progress

A number of key stages were implemented as part of this project between 2007 and 2010, namely:

- Business and functional analysis of the system in consultation with external users,
- Development of an intermediate version for submission to the sector, to be tested by a group of future external users,
- Implementation of annual electronic dose transfers using a format defined by the Agency via the health physics and dosimetry services.

However, at the end of this initial development and trial period, it was decided to look to a different technological solution to develop the exposure register on the basis of technical and organisational reasons. This led to a standby period until June 2014.

However, during this standby period, two important stages were still implemented from a legal viewpoint: the paper reporting procedure to the FPS ELSD was officially replaced by electronic reporting to the Agency and the dosimetry law, which provided a legal framework for creation and use of an exposure register by the Agency, was published.

Current and future developments
Development will continue using a phased approach:

- The first stage entails developing a database with statistical/reporting options that are accessible internally by the end of 2014. These options will also be accessible externally on request by indirect means or by issuing periodic reports.
- The second stage entails implementing the data upload functionality via an e-portal and developing regulatory texts describing the content and practical modalities applicable to the system:
  - o The first upload exercise is scheduled for March 2015 (gradual increase in the transfer frequency with a view to reaching the monitoring cycle frequency by January 2018);
  - o It is assumed that the regulations will be published by January 2016.
- The following are scheduled in subsequent stages, the timing of which has yet to be defined;
  - o opening up the system and its functionalities to stakeholders;
  - o developing functionalities to ensure optimum monitoring of external workers;
  - o extending the register to include other types of radiological monitoring data like medical fitness or RP training followed by the workers.

Collaboration on an international scale
Within the current context of free exchange and mobility workers within European union, it is important to consider radiological monitoring of workers on a European scale.

We participated in a HERCA working group [4] in this connection, this group being concerned with the critical question of external workers in Europe and possible harmonisation between European Union countries in terms of radiological monitoring of this specific group. Concrete progress has been made by this working group, including a radiological passport model, description of compulsory radiological monitoring data for external workers in the new BSS and a guidance document on using and implementing radiological passports.

The group also investigated the transition to a European system for electronic exchange of radiological data. Based on the results of this investigation, the European Commission agreed to finance the project to develop such an exchange system in which the role of the working group would entail providing back-up information for the business and functional analysis.

European requirements

The mandatory transposition of the new BSS published in January 2014 into the Belgian regulation by January 2018 will pose a crucial and cross-disciplinary challenge for the Agency as a whole. Prior to this transposition, the intention is to arrange consultations with stakeholders on various regulatory topics.

Scientific/technology and standards watch

A constant and cross-disciplinary challenge faced by the Agency is to carry out its duties in line with current realities. This can only be done by being vigilant to the scientific, technological and standards evolution in the field.

References

[1] More information can be found on the FANC website in the professional profile "recognized physician": role of the recognized physician, legal references, criteria for training/education of occupational physicians candidates for recognition, continuous education events organised by FANC, … http://www.fanc.fgov.be

[2] FANC Decree of 1 July 2008 establishing the conditions and criteria for recognition of dosimetry departments for performing external dosimetry. For more information, see also in the professional profile "dosimetry" on the FANC website.

[3] Council Directive 2013/59/Euratom of 5 December 2013 laying down basic safety standards for protection against the dangers arising from exposure to ionising radiation, and repealing Directives 89/618/Euratom, 90/641/Euratom, 96/29/Euratom, 97/43/Euratom and 2003/122/Euratom. http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2014:013:0001:0073:EN:PDF

[4] HERCA is for "Heads of the European Radiological protection Competent Authorities". Information about the progress and achievements of the HERCA Working Group on European radiation passbook and outside worker can be found at the following link: http://www.herca.org/WGs.asp?WGnr=1

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Annales de l'Association belge de Radioprotection, vol.39, n°3, 2014
Annalen van de Belgische Vereniging voor Stralingsbescherming, vol.39, nr 3, 2014

A CAREER IN RADIATION PROTECTION

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Abstract

There are a lot of challenges that people working in the field of radiation protection have to overcome each day. But finding solutions to these problems together with meeting new people all the time and working in changing environments is what makes this job interesting and why people should choose to look for a career in this field.

Content

When people talk about radiation or radioactivity, the first thing that comes in mind is usually something that has to do with nuclear power. So mostly when explaining to people what sort of work I do, they are surprised that it isn't what they expected.

It's the same thing when you first start thinking about a career in radiation protection. It might seem that job opportunities are limited, when in fact there are a lot of different fields to choose from, medical physics (radiology, nuclear medicine, radiotherapy), health physics, NORM, etc. Furthermore has the amount of work been increasing rapidly over the last few years, so for me the search for an interesting job turned out not to be a problem.

When I graduated in medical physics (radiology) the first thing I had to do was getting accredited by the FANC. This process was confusing in the past because there were no clear guidelines on what was expected of you, especially during the one year internship. Luckily, on 07/11/12, guidelines [1] were published that made clear what themes the internship should focus on.

One of the tasks of a medical physics expert is optimizing the radiation dose given to patients. This means working closely with people from the radiology department. They usually have a good background in radiation protection and will have a good understanding of the importance of dose optimization.
Departments where the staff doesn't have as much experience (for example the Operation Room, dentists,…) getting people motivated to improve patient dose is not always as easy. Typically this is because it involves extra work to be done in their already busy schedule. A good medical physicist though, will have to make people understand the importance of dose optimization and radiation protection, something that is not always easy to do. Then again this combination of science and people skills is what makes my job interesting.

Besides my tasks as a medical physics expert I also work as a radiation expert for Belgian customs in the seaports of Antwerp and Zeebrugge. In these ports containers are screened for the presence of radioactivity. This is done by using radiation portals that are spread out all over the ports. A big part of the job involves helping customs when radioactive contaminated goods or radioactive sources are found in containerized cargo.

Working in a port can be challenging sometimes because finding a solution is anything but standard. Often it isn't possible to open containers, therefore taking the cargo out is not always an option. In these circumstances radionuclide and dose rates measurements have to be performed on the outside of the container. This makes that estimating the risk and working out solutions will never become repetitive or tedious.

Because people working in the port usually have no background in radiation protection, they tend to be very suspicious towards radiation and radioactivity. So taking care what to say and especially what not to say when explaining that the contents of a container are radioactive and describing the risks that are involved, is very important. Dock workers refusing further work or shippers refusing to move the container are not uncommon. Convincing them to go on nevertheless is my challenge.

In the case the radiation source cannot be removed, the container is either sent back to the country of origin or accepted by the recipient. In both cases this usually involves getting a transport licence or getting permission by the FANC.
A problem we occasionally encounter is the refusal of a foreign government to accept radioactively contaminated containers to enter their country. This can cause containers to be blocked for a long period of time and can result in very high storage costs. Fortunately for us, communication and cooperation with FANC on these matters are very good so at the end of the day even the most difficult case gets resolved.

Above all this, what makes a career in radiation protection interesting to me, is that you encounter new things every day. This makes my job anything but a boring desk job. Facing new challenges, meeting new people, working in different environments and with new equipment keeps me motivated to do my job. This is the main reason why I think other people should opt to work in the field of radiation protection or medical physics.

References

[1] 07/11/12 Vaststelling stage programma's medische stralingsfysica voor radiotherapie, radiologie en nucleaire geneeskunde

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