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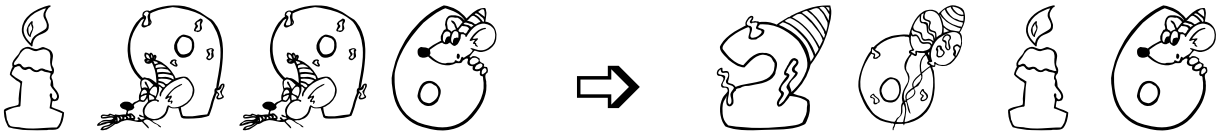

20 years of EAN Congratulations!

One of the fundamental principles in radiation protection is the optimisation of protection. Implementation of the optimisation of protection into practice is supported by the ALARA principle, requiring that radiation exposures be kept "*As Low As Reasonably Achievable*" when using ionising radiation.

Practical implementation and further development of the ALARA principle has been achieved by the successful cooperation of a number of experts with different professional backgrounds representing a large number of European organisations. These pioneers established the **European ALARA Network** 20 years ago with the support of the European Commission, and then, since 2005 as an independent association. In the last few years, a number of younger experts joined, enthusiastically supporting the activities of the network itself and contributing to its further development by exchanging experience and increasing networking activities.

The range of EAN activities, such as regular ALARA workshops, newsletters, sub-networks, European surveys, lessons-learned from incidents, etc., has been gradually extended over the last 20 years from optimisation of occupational radiation protection in industry and research, to occupational radiation protection in medicine and in NORM industries, and further on to the optimisation of radiation protection of patients and the general public. The focus of EAN is now very much on ALARA across all three ICRP exposure situations: planned, existing and emergency.

EAN has always placed a high priority on sharing experience and the practical implementation of ALARA in all sectors where ionising radiation is applied. You are interested in optimisation of radiation protection? We cordially invite you to join EAN activities. None of us is as smart as all of us!

Annemarie Schmitt-Hannig

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Significant Radiological Events in France during 2014 in Industrial Radiography

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Introduction

The French Institute for Radiological Protection and Nuclear Safety (IRSN) is the national public expert in nuclear and radiological risks. IRSN acts as support for the authorities competent in nuclear safety and radiation protection for civil and defense activities. As part of its main activities, IRSN is in charge of the surveillance of workers' and population's exposure to ionizing radiation. This surveillance is particularly based on the recording and monitoring of individual and collective doses, but also on the collection and analysis of events or incidents related to radiation protection. The objective of this analysis is to identify root causes (human error or equipment failure) and to propose improvements to prevent such events occurring and causing the radiation exposure of workers or the public.

Among all radiological events recorded by IRSN in 2014, 17 of them concern radiation protection in industrial radiography. These occurred during operations in dedicated shielded enclosures or during site radiography work. The types of devices used for these operations are "Gam", supplied by the French company Cegelec (about 90 % of the 600 gammagraphy apparatus used in France are "Gam80" or "Gam120"). All of these devices contained sealed gamma ray sources of Iridium 192, with activities ranging from 0.4 TBq to 2.62 TBq.

The majority of these events occurred in industrial facilities (11 events). The other events occurred during maintenance or control activities in nuclear power plants (6 events).
In accordance with national procedures of notification of significant radiation protection events, each event was rated using the International Nuclear Events Scale (INES): 13 events at level 0 (without safety significance), 2 at level 1 (anomaly) and 2 at level 2 (incident), meaning there are some significant dosimetric consequences to the operators or the public. For one of these cases the regulatory annual effective dose limit (20 mSv) had been exceeded for one operator, whereas in the second event one quarter of the annual effective dose limit was exceeded in a single exposure.
The events rated at levels 0 and 1 did not lead to uncontrolled exposures of workers or public. However, taking into account the activity of the radioactive sources used, they could have led to significant exposures. IRSN analysis identified two main causes of incident: the loss of control of radioactive sources and the non- compliance with the regulatory operational provisions, mainly due to presence of unauthorized people in the controlled area during site radiography work.

Loss of control of sources

The loss of control of sources corresponds to 3 different situations, all of which involve the source being no longer under the operator's control and unable to be returned to the shielded position (most of the devices used in France are projection type exposure devices, with a movable source assembly projected out of the device along a guide tube, by the use of a wind-out drive cable). Such a situation requires a specific and properly prepared response to recover the source. The three situations of loss of control of sources are:

- The source becomes stuck in the device, the guide tube or the collimator,
- The source becomes disconnected from its drive cable,
- The source is out of the equipment.

For all these situations, the current procedure in France prohibits the the operators from intervening; instead, they are required to inform the radiation protection officer and the authorities immediately, extend the boundary of the controlled area if necessary, and prevent access
to this area, in order to protect workers and public. The recovery plans have to be properly prepared, with an estimation of the risks and the associated doses, and they shall be agreed in advance by the French Nuclear Safety Authority (ASN).
Concerning the events recorded in France in 2014, IRSN identified two types of incident leading to the loss of control of

the source. The first one was due to the source becoming stuck. This situation might be caused by the presence of an object (dirt, sand, rust...) in the guide tube or in the container, by the deformation of the guide tube due to a fallen object, by a crank failure... The second type of event is due to the rupture of the source container shutter.

Sources becoming stuck

In 2014, IRSN was notified of 3 events due to the source becoming stuck in the guide tube (2 events), and in the container, outsidet the shielded position (1 event). This type of situation was analysed by IRSN in 2013 during an exhaustive survey, in order to define all the corresponding scenarios (39 distinct scenarios analysed), and was conducted by a working group initiated by ASN with the active participation of the radiography companies and the equipment manufacturer. The objective was to develop technical solutions for recovering a source in case of a loss of control and to identify constraints associated with the deployment of each solution.
The first event was rated at level 2 of INES scale, due to the intervention by the operators which led to significant overexposure consequences. The operators realized that the source was stuck in the guide tube before reaching its irradiation position and it couldn't return to the shielded position. The operators tried to push back the source by hand in the container and one of them received an effective dose of about 22 mSv. ASN inspectors concluded that their reaction was particularly guided by fear of incurring sanctions if the incident was revealed. That's why they have tried to return the source to its exposure device themselves.

The second event was caused by the presence of an object in the container so that the source could not return to its shielded position. This event had no overexposure consequences on the operators. However, it was classified at level 1 on the INES scale because an operator attempted to manually turn the shutter control to the off position while the source was in an unshielded position.
The third event concerned a source totally stuck in the guide tube during the return to the container. This event took place in a shielded enclosure, so the access restrictions avoided any exposure.

Rupture of the shutter

In normal operation, the source returns to the container at the end of irradiation. The depleted uranium shutter is then automatically turned to the off position, maintaining the source in the shielded position.
The rupture of the shutter when the source is in an unshielded position was considered as a rare event before 2014 (1 event declared in 1984 and 1 event in 2013). However, in 2014, it was the cause of 6 incidents, raising some new questions. After studying the events, it appears they were due to the lack of maintenance of the shutters of Gam 80/120 used in France. According to the manufacturer, the recent ruptures would be caused by embrittlement resulting from chemical processes.
This problem can't be visually detected, as the shutter is inside the container. However the problem should be detected during the return of the source to the container by different signals (indicators on the device, typical sound associated with the shutter closure...). The dose rate is also higher than usual because the protection provided by the depleted uranium is reduced. The detection of the problem can be delayed if one of these security checks is not carried out by the operators. This was the case for one event in 2014: after disconnecting the guide tube and locking the container, one of the operators realized that the alarm of his dosimeter was triggered. The second operator then made dose rate measurements which showed an unusually high value in front of the device, indicating that the source was not in the shielded position.
Nevertheless, none of these events had overexposure consequences on operators. In order to prevent such event, the shutter will be replaced periodically during the manufacturer maintenance.

Non-compliance with regulatory operational provisions

IRSN identified 8 events in 2014 related to the non-compliance with the regulatory operational provisions, mainly the mark-up crossing of the controlled area during site radiography work.

Problem with boundary of the controlled area

Use of a gamma radiography device requires defining a controlled area, to which access is forbidden to unauthorized persons. Barriers and notices must be used to define the controlled area (barriers, barrier tapes, notices and warning signals) and supervision must be provided to ensure that no one enters this area. The access, especially to change radiographic films, must also be done with specific precautions such as a checking the dose rate with a radiation survey meter. During 2014, among the events notified to IRSN, 6 of them corresponded to problems with boundary of the controlled area. Most of them (4 events) occurred in nuclear power plants. None of these events had led to overexposure consequences.
For 3 of these events, control of the security perimeter before and during exposures identified the problem (no barrier tape) as soon as possible and also avoided any unauthorized entrance. However, for one of the events, the problem has been identified only after several exposures. This could have led to higher risk of unauthorized entrance and consequently to a significant radiation exposure.
On only one occasion was it reported that an unauthorized

worker entered the controlled area because there was no visible demarcation. Indeed, the barrier tape was down and the worker realized he was in the controlled area after having put it back on. The source was not in the exposed position and this event had no exposure consequences.

Non-compliance with the entry rules in a controlled area

Two events were declared in 2014, indicating non-compliance with the entry rules in a controlled area. One of them concerned the entry of a non-authorized operator, who followed the operators when changing the radiographic film. As the source was in the shielded position, there were no exposure consequences.
The second event occurred when removing the radiographic film. Believing the source was in the shielded position, the operator approached the guide tube. He didn't use his survey meter, and he didn't stop after hearing the alarm of his personal monitor. The exposure lasted about 1 minute and the associated dose recorded by his dosimeter was around 5 mSv. This incident was rated at level 2 of INES scale. Although this type of event remains uncommon, it had already happened in 2009 in similar conditions and with the same exposure consequences. The operator in charge of the change of the radiographic films also approached the guide tube. He believed that the exposure was finished and entered the controlled area without waiting for an access authorization of his colleague.

Conclusion

In conclusion of this study, the loss of control of sources and the non-compliance with regulatory operational provisions are the main reasons of the events notified to IRSN in 2014. Except in 1 case, these events had no significant overexposure consequences however, the radiation exposures could have been much higher, in particular during the handling of equipment in the cases of blockage of the source and the unauthorized entrance in the controlled area during an irradiation. The training of operators, the renewal of the skills, the preparation of activities and improved awareness of workers circulating around the controlled area are the main improvements recommended to keep the risk of exposure ALARA as required by the regulations. ❑

References

ASN guide related to the declaration procedure and coding system for criteria concerning significant events related to safety, radiation protection or the environment, applicable to nuclear installations and the transport of radioactive materials.

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The γ-PROX® Concept

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The γ-PROX CONCEPT: a solution to optimize radiation protection in industrial settings

Regulations for using a portable gamma projector for industrial radiography require the delineation of a controlled work area using boundary. In France, regulations require that the average dose rate for the duration of an operation must remain below 0.0025 mSv/h at the boundary.
The controlled area, is only accessible to qualified personnel whose presence is essential, can in practice be very large. To reduce the size of this area, the Institut de Soudure Industrie has developed an innovative concept to work with an authorized gamma projector on French territory. This device called "γ-Prox" increases operators' protection by reducing radiation dose rates while also decreasing working area limits. Two patents have been filed, one on the positioning system and the other on the collimating system.

In terms of a practical example, radiographic testing performed with a 0,93 TBq Ir source (25 Curies), with a 2 hours cumulative exposure time and 6 hours operation time imposes a

40 metres radius working area (value obtained with using a 1/250th depleted uranium collimator, 1/100th effective attenuation measured on the side of it). In comparison, for the same activity and operating conditions but using a Se source with the γ-Prox system, the distance would be 8 metres.
The system is mainly composed of:

- a specific device for positioning and fixing onto the object to be examined,
- a collimation system (without depleted uranium) optimized in terms of efficacy / mass of the collimator and adapted to a given geometry and the shooting conditions,
- a shield to limit emerging radiation rates.

This system was used for the first time in French Guyana (Figures 1 and 2) during the inspection of circular pipeline welds. Most of the pipeline ran alongside a road at distance of 10 meters, with the impossibility of closing this road during the radiography work.

Figures 1 and 2. – The γ-Prox (contact version) in control situation on a 10'' pipe yard in French Guyana.

The γ-Prox system allows both the reduction of radiation risks for the operators and to persons in the public domain and has many advantages:

- Implementation simplicity without using sophisticated measuring equipment,
- Significant reduction of average dose equivalent rates,
- Improving quality by improving the repeatability,
- Adapted to the radiography projector authorized on French territory without changing any accessories.

The focusing characteristics of the γ-Prox system combined with a Se gamma source reduce significantly the dose equivalent rates. In this case, the dose rate values obtained reduced the working area perimeter by a factor of between 5 to 10, while still ensuring that the average dose at the boundary remained below 0,0025 mSv/h.

Conclusion

With increasingly demanding radioprotection regulations on activities using iridium-192, using low-energy radiation sources such as selenium-75 with the use of special devices like γ-Proximplemented by specially trained staff is an alternative to consider. ❑

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The Role of EFNDT in Radiation Protection

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What is EFNDT?

The European Federation for Non-Destructive Testing was founded in Copenhagen in May 1998. The overall mission of the European Federation for Non-Destructive testing (EFNDT) is to bring together the resources of the national NDT societies and organisations involved in NDT and related topics in Europe to create a more effective and more valuable voice for industry, the professions, the users and the wider community.

Membership

Full Membership of EFNDT is open to legally incorporated NDT Societies in the countries which fall in the geographical area of Europe defined by the UN. Associate Membership is open to other non-profit legally incorporated organisations interested in NDT worldwide. Currently there are 32 Full Members and 7 Associate Members.
NDT societies whether measured by membership (number of individuals, number of certificate holders or number of corporate members) or financial turnover vary hugely in size. As member of the EFNDT any society enjoys equal rights and has the opportunity to initiate work items.

Board of Directors

The Board of Directors (BoD) is an administration body with a duty to manage the Federation. It consists of 10 persons, including the President, Vice-President, alle elected for three years by the full members of EFNDT.
In 2015 representatives of Hungary (President), United Kingdom (Vice-Presisdent), Austria, Croatia, Germany, Spain, France, Belgium (Treasurer), Russia and Serbia were elected by the General Assembly. Herewith the BoD very well reflects the interests of the different national NDT member societies of EFNDT.

Objectives

Promotion of the science and practice of Non-Destructive Testing (NDT) and the improvement of quality and reliability of NDT is the prime concern of any EFNDT activity. In this sense, the Federation acts as a spokesperson for NDT in Europe and as a member of the International Committee for Non-Destructive Testing (ICNDT) also on a global level. Beside the organisation of conferences and seminars, EFNDT's focus is clearly set on the harmonisation and mutual recognition of qualification and certification of NDT personnel.
EFNDT Forums and Working Groups provide platforms for discussion and exchange and formally represent common concerns of the member societies to European institutions.
1.3 EFNDT and Radiation Protection:
Working Group 2 is the committee to deal with radiation protection in Industrial Radiography.
It is important to know that the involvement of European NDT societies in radiation protection is non-uniform. Whilst some larger societies, like the German and the British one are active in this field, most of the others are not. The reason is simply the different responsibility of the NDT societies due to different national regulations.

Qualification and Certification of NDT Personnel

It was already mentioned that qualification and certification of NDT personnel is a main objective of the EFNDT. Experts from EFNDT's Working Groups were heavily involved in the revision and harmonisation that produced the first worldwide standard for qualification and certification of NDT personnel. This standard, ISO 9712 published in 2012 defines the minimum requirements and are binding for Certifying Bodies all over the world.

NDT Qualification and Radiation Protection

ISO 9712 does not provide any requirements for radiation protection qualification. It just says: „Where not otherwise addressed by national regulations, there shall be an additional examination on radiation safety for the radiographic test method."

This lack of specification in the standard is very understandable because radiation protection qualification is subject to particular national instructions and ordinances. Hence, the national NDT societies are mostly not involved in radiation protection qualification and consequently they are mostly not involved in the national radiation safety policy.
This has, of course, also consequences for EFNDT Working Group 2 – Radiation Protection.

EFNDT Working Group 2 – Radiation Protection

EFNDT WG2 "Radiation Protection" is identical with ICNDT's WG5. The Working Group provides a platform for discussion of radiation protection matters with a specific focus on "Industrial Radiography". Furthermore, WG 2 provides formal representation of the common concerns of the Working Group members to European and International institutions. The Working Group acts as an observer and advisor for the particular NDT needs of occupational radiation protection.
Though, the available resources of Working Group 2 are very limited members of Working Group 2 have contributed to the IAEA "ISEMIR" Working Group, attended diverse Technical Meetings organized by IAEA and EC and contributed e.g.; to the 4th European regional IRPA Congress in 2014.
WG 2 revises regulations for the safe transport of radioactive material. This is one important focus on the agenda of this working group. It includes safety aspects of packages and reduction of laborious operation costs connected with transportation regulation.

Conclusion

EFNDT only plays a minor role in international radiation protection because EFNDT's members are mostly national NDT societies without any influence on radiation protection qualification and the national radiation protection policy.
Nevertheless, EFNDT WG2 provides formal representation of the common concerns of the Working Group members to European and International institutions. The Working Group acts as an observer and advisor for the particular NDT needs of occupational radiation protection. ❑

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ENETRAP III – European Guidance on the Implementation of the Requirements of the Euratom BSS with respect to RPE and RPO – Implications for Industrial Radiography?

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Introduction

The Euratom BSS Directive lays down specific requirements for the Radiation Protection Expert (RPE) and for the Radiation Protection Officer (RPO) which have to be transposed by each Member State into national legislation and implemented in practice. Experience has shown that, even though the specific requirements in a European Directive may be quite clear, there can be widely varying approaches to the interpretation of those requirements and implementation in practice.

It is expected that the availability of clear and substantive guidance on how the new requirements for RPE and RPO would be best implemented in Member States would be of value, not only in facilitating the implementation of the requirements across Europe, but in helping to ensure a consistent approach.

This guidance document has been developed within the framework of ENETRAP III WP7 "Guidance to support the implementation of

E&T requirements for RPE and RPO as defined in the Euratom BSS". The objective of WP7 activities is to facilitate the implementation of the new requirements for RPE and RPO in Member States and to help ensuring a consistent approach throughout the European Union.

Radiation Protection Expert (RPE)

The Euratom BSS defines the Radiation Protection Expert as:
"radiation protection expert" means an individual or, if provided for in the national legislation, a group of individuals having the knowledge, training and experience needed to give radiation protection advice in order to ensure the effective protection of individuals, and whose competence in this respect is recognised by the competent authority;

Further information of the extent of knowledge expected of the RPE is given in Article 82 which specifies the range of topics on which the RPE is expected to provide advice:

Article 82
Radiation protection expert

1. Member State shall ensure that the radiation protection expert gives competent advice to the undertaking on matters relating to compliance with applicable legal requirements, in respect of occupational and public exposure.
2. The advice of the radiation protection expert shall cover, where relevant, but not be limited to, the following:
(a) optimisation and establishment of appropriate dose constraints;
(b) plans for new installations and the acceptance into service of new or modified radiation sources in relation to any engineering controls, design features, safety features and warning devices relevant to radiation protection;
(c) categorisation of controlled and supervised areas;
(d) classification of workers;
(e) workplace and individual monitoring programmes and related personal dosimetry;
(f) appropriate radiation monitoring instrumentation;
(g) quality assurance;
(h) environmental monitoring programme;
(i) arrangements for radioactive waste management;
(j) arrangements for prevention of accidents and incidents;
(k) preparedness and response in emergency exposure situations;
(l) training and retraining programmes for exposed workers;
(m) investigation and analysis of accidents and incidents and appropriate remedial actions;
(n) employment conditions for pregnant and breastfeeding workers;
(o) preparation of appropriate documentation such as prior risk assessments and written procedures;

The RPE is expected to provide high-level specialist advice on radiation protection to undertakings using sources of radiation. This advice will provide an important input to both the setting up of radiation protection arrangements in the undertaking and the ongoing operation of those arrangements. As such, the RPE will need to have a very good understanding of radiation protection principles and how they are applied and implemented in the workplace. The RPE will also need to have a comprehensive understanding of the relevant national legislation and be able to advise on the actions to take to ensure compliance.

Table 1. – Basic Requirements for Core Competence

An individual may be deemed as having the core competence necessary to act in the capacity of a Radiation Protection Expert, and be formally recognized as such by the national competent authority if he/she is able to satisfy the following criteria:
(i) An education to:
- *Bachelor degree level either specifically in radiation protection, or in a physical/engineering/mathematical discipline*

OR
- *An academic equivalent*

(ii) Knowledge and understanding of fundamental principles of radiation protection
(iii) Knowledge of operational radiation protection methods
(iv) The ability to develop and provide appropriate advice with those topics on which the RPE is expected to provide advice.
(v) A minimum of 3 years' experience working in radiation protection environment

The RPE definition requires the competence of the RPE to give radiation protection advice to be recognised by the competent authority. In this context, competence is the ability to provide good and effective advice to ensure the effective protection of individuals. National recognition schemes will need to assess competence of individuals by looking at the components that lead to competence i.e. the required level of knowledge (obtained through education and training), operational experience and communication skills. Training and development schemes for RPEs will need to cover the knowledge and skills required to be able to provide effective advice. The document provides required skills and specific competences for a number of topics where the RPE is expected to give advice.

A graded approach is appropriate when it comes to the required breadth and depth of operational experience before an individual becomes eligible for RPE recognition. The expected

minimum duration is 3 years, which should provide sufficient operational experience to fully develop the necessary competence to provide advice in respect of the majority of routine applications. However, in order to be considered a suitably competent RPE for more complex or involved applications for example, within the nuclear industry, a longer development period (in the appropriate environment) may be required.

RPE advice will be required in a wide range of situations, from the use of level gauges in an industrial plant to complex exposure issues associated with nuclear power stations. The required specialist knowledge and operational experience of an RPE will vary considerably depending on those sectors where the RPE provides advice. This is the issue of suitability; an RPE will be suitable to provide advice for a specific sector if he has the required competence for that sector. This will not necessarily mean that this RPE will also be a suitable for a different sector.
Member States will need to take account of suitability in their own regulatory processes. Some countries may wish to operate a core competence scheme where the core competence of RPEs is recognised, and requiring the employer to take responsibility for ensuring that the RPE appointed is suitable for the radiation application. Other Member States may decide to incorporate suitability into the recognition process by operating a recognition system that recognises RPEs for specific radiation practices. Either approach will satisfy the BSS requirement.

Before an individual may take on the role, or status, of an RPE he must have his capacity to act in that role formally recognised by the competent authority. This recognition is a process and the Euratom BSS requires that Member States ensure that arrangements are in place for the operation of this process.

Arrangements for RPE recognition on the national level can be considered to be made up of two components:

- The establishment of a Recognition scheme or framework
- Routine operation of the scheme

The document describes the two components in detail.

The acceptance, or mutual recognition, of professional qualifications between Member States in the EU is important to facilitate the movement of professionals between countries by having the qualification or endorsement to practice that profession in one country accepted or recognized in another country so that that same profession can be practiced there. This concept is clearly applicable to RPE status.

The process of mutual recognition should, as far as practicable, be pragmatic and straightforward; for this to be the case there must be a good degree of commonality with respect to the key elements of, and criteria applied to, the various national schemes which should be the case if the general guidance provided in this document is applied. The document provides criteria and aspects to be addressed in accepting RPE status in other Member States proposes mechanisms for mutual recognition.

Radiation Protection Officer (RPO)

The RPO role is primarily concerned with the oversight and supervision of the radiation protection arrangements in the workplace. The duties will be very specific to the undertaking where the RPO works and are likely to involve close liaison with the workers, supervisors and managers.

The new BSS gives the following definition for the Radiation Protection Officer:

"radiation protection officer" means an individual who is technically competent in radiation protection matters relevant for a given type of practice to supervise or perform the implementation of the radiation protection arrangements;

Further information on the duties of the RPO is given in Article 84:

Article 84
Radiation protection officer
1. Member States shall decide in which practices the designation of a radiation protection officer is necessary to supervise or to perform radiation protection tasks within an undertaking. Member States shall require undertakings to provide the radiation protection officers with the means necessary for them to carry out their tasks. The radiation protection officer shall report directly to the undertaking. Member States may require employers of outside workers to designate a radiation protection officer as necessary to supervise or perform relevant radiation protection tasks as they relate to the protection of their workers.
2. Depending on the nature of the practice, the tasks of the radiation protection officer in assisting the undertaking, may include the following:
(a) ensuring that work with radiation is carried out in accordance with the requirements of any specified procedures or local rules;
(b) supervise implementation of the programme for workplace monitoring;
(c) maintaining adequate records of all radiation sources;
(d) carrying out periodic assessments of the condition of the relevant safety and warning systems;
(e) supervise implementation of the personal monitoring programme;
(f) supervise implementation of the health surveillance programme;
(g) providing new workers with an appropriate introduction to local rules and procedures;
(h) giving advice and comments on work plans;
(i) establishing work plans;

(j) providing reports to the local management;
(k) participating in the arrangements for prevention, preparedness and response for emergency exposure situations;
(l) information and training of exposed workers;
(m) liaising with the radiation protection expert.
3. The task of the radiation protection officer may be carried out by a radiation protection unit established within an undertaking or by a radiation protection expert.

The RPO needs to have an understanding of radiation protection principles and arrangements that are relevant to the practice he is involved with. It follows that, to be competent in the role, the RPO will need to have a practical understanding of the principles of radiation protection, the relevant regulatory requirements and operational arrangements.

In addition to having the knowledge and understanding described above, an RPO will need to be effective in the roles of supervision, communication and local management. Since radiation protection is part of the general Health and Safety structure, the RPO should have a direct communication channel with the Health and Safety managers within the undertaking. This will ensure that an independent channel is in place for the reporting of radiation safety issues to the appropriate managers and will facilitate the implementation of corrective measures. To carry out the required functions the RPO will need to command respect, be in a position of authority or have local management responsibility for the work being undertaken. The suitability of a particular person for undertaking the role of RPO is the responsibility of the employer, who will need to consider the person's technical competence, communication and managerial skills and line management position in relation to the work being supervised.

Employees appointed to act as RPO will need to have an adequate level of understanding of concepts related to radiation protection and should also be acquainted with the safe and secure use of radiation sources as relevant to the application. The level of training required will be very dependent on the complexity of the radiation application the RPO is responsible for, and the associated duties and radiation protection tasks. There will, however, be a core level of training that is necessary for all RPOs regardless of the practice or sector in which they work. These are derived from the duties of the RPO stated in the BSS and are specified in Tables 2 and 3 below.

Table 2. – Core learning outcomes for the RPO: Radiation protection principles

Knowledge (facts, principles, theories, practices)	Skills (cognitive & practical)	Competence
K1. Understand basic atomic structure. K2. Be aware of the laws of radioactive decay K3. Understand radiation quantities and units K4. Be aware of the mechanisms for the production of x-rays K5. Understand the fundamentals of radiation detection K6. Have a basic understanding of the biological effects of radiation K7. Understand the differences between deterministic and stochastic effects K8. Understand the general principles of radiation protection K9. Understand the application of the inverse square law. K10. Understand the shielding properties of different materials (e.g. paper, aluminium, steel, lead) K11. Understand the concepts of justification and optimisation.	S1. Explain the relative risks of different types of radiation and the shielding requirements for each. S2. Correctly interpret dose, dose rate and surface contamination data. S3. Calculate dose rates at varying distances from a source. S4. Select appropriate shielding material for a range of sources.	C1. The application of the principles of radiation protection to workplace situations.

Knowledge	Skills	Competence
K12. Understand the regulatory requirements for local rules and procedures.	S5. Be able to draw up appropriate local rules and safety procedures for a range of applications.	C2. Draw up and issue suitable local rules for a practice and supervise their implementation.
K13. Understand the regulatory requirements for workplace monitoring. K14. Be aware of the different types of monitoring equipment that are available for the measurements of dose rate and surface contamination monitoring, and the advantages and limitations of each type of monitor.	S6. Be able to carry out measurements using dose rate and contamination monitors. S7. Be able to interpret the monitoring results for comparison with the relevant criteria.	C3. Carry out a programme of workplace monitoring: - The selection and use suitable radiation monitors - Interpretation of results - Associated record keeping
K15. Understand the regulatory requirements for source accountancy.		C4. Maintain suitable records of the sources of radiation at the practice.
K16. Know the required safety and warning systems for the radiation equipment in use at the premises and understand the testing criteria and safety standards for these systems.		C5. Carry out periodic assessments of safety and warning systems.
K17. Understand the regulatory requirements for health surveillance and personal monitoring. K18. Be aware of the different types of personal dosimeter available and their suitability for different types of radiation. K19. Understand the national requirements for the maintenance of dose records.	S8. Select the appropriate dosimeter for different types of radiation.	C6. Oversee the maintenance of a health surveillance programme. Select suitable personal dosimeters for the radiation practice. Provide suitable dosimeters to the persons working with radiation and keep appropriate dosimetry records. Review dose records and initiate remedial action.
K20. Understand the emergency response arrangements in place at the practice and the RPO's role in these arrangements. K21. Understand the regulatory requirements for emergency response arrangements including any requirement for the periodic rehearsing of these arrangements. K22. Be aware of general design and safety principles for a range of common practices.	S9. Be able to draw up emergency response arrangements for a range of common applications S10. Draw up shielding and safety & warning system requirements for common practices.	C7. Draw up emergency response plans for the practice in collaboration with the RPE. Implement the emergency response plans. C8. Liaise with the RPE in the specification of safety systems and procedures for new installations.

The role of the RPO will in many cases not be the primary function of the person who holds the RPO post. The RPO may be an engineer, a scientist, a medical doctor, a health and safety specialist or an operational manager, and the amount of time that he devotes to the RPO role will be dependent on the nature and complexity of the radiation application. The educational requirements associated with the person's primary role will in most cases be sufficient for the function of RPO. For many radiation applications it is sufficient if the person carrying out the role of the RPO has a secondary level of education. In some facilities with complex radiation protection arrangements and the potential for significant dose e.g. nuclear reactors, radiochemistry laboratories using a range of radionuclides, a tertiary educational level may be appropriate.

The RPO may need to have further practice-specific training and experience before he is considered suitable for a specific practice. For example, an RPO may be considered to be competent and suitable for a straightforward practice, such as industrial gauges, if he has a good understanding of the core requirements of the RPO role, together with experience of applying this knowledge in the field. However, such a person will not be a suitable RPO for industrial radiography without first receiving additional training and experience on the radiation protection issues associated with this area of work. It follows that RPO training will fall into two categories: core training, common to all practices, and supplementary training related to practice-specific radiation protection elements.

The formal training of RPO should involve covering the core syllabus and, as appropriate, any supplementary content pertinent to the practice in question. The content may be

covered separately (ie in modular form, core + specific 1 + specific 2 etc) or combined into a single course.
Classroom based training is unlikely to cover all the practical radiation protection and safety aspects and skills associated with specific work tasks; hence additional experience in the workplace and on the job training can be very effective in the overall training programme for RPO. In this form of training the participant works in the normal place of work either under the direct supervision of, or with indirect input from, an experienced mentor.
Work experience relevant for working as an effective RPO in a specific practice may range between weeks and years, depending on the complexity of the practice, the level of radiation risk involved and the specifics of the working environment. For example:

- A potential RPO in a small facility where only XRF (x-ray fluorescence) and XRD (x-ray diffraction) equipment would only need a few weeks work experience (assuming he was suitably qualified for his "normal" tasks) in order to exercise the RPO role. In this situation the radiation risks are low, the work routine and regulatory compliance straightforward to ensure.
- A potential RPO for industrial radiography employing both x- and gamma techniques would require substantial operational experience before taking on the role. The radiation risk is high, the work (probably) very dynamic in nature and regulatory compliance may be complex.

The document provides details on the assessment and maintenance of competence as well as on recognition and appointment.
Further guidance, including guidance in the area of industrial radiography, can be found in reports developed within the framework of the ENETRP II project and available at the ENETRAP II homepage: http://enetrap2.sckcen.be/en/Documents. ❑

References

[1]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, on the 5th December 2013
[2] ENETRAP II report WD2.1, Report on requirements and methodology for recognition of RPE's.
http://enetrap2.sckcen.be/en/Documents.
[3] ENETRAP II report WD4.2,: Reference Standards for RPE Training,
http://enetrap2.sckcen.be/en/Documents
[4] COUNCIL DIRECTIVE 2005/36/EC of 7 September 2005 on the recognition of professional qualifications.
[5] Recommendation of the European Parliament and of the Council of 23 April 2008 on the Establishment of the European Qualifications Framework for lifelong learning (EQF), (2008/C 111/01).
[6] ENETRAP II reports WD3.1 - Requirements for RPO competencies and WD3.2 - Report on European reference standards for RPO training,
http://enetrap2.sckcen.be/en/Documents

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Radiation Protection of a Novel Radiotherapy System for the Treatment of Age-Related Macular Degeneration

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Abstract

This article will give an overview of this novel system and describe the planning, installation and commissioning process of the first unit of its kind in the UK. It will present the challenges inherent to assuring adequate radiation protection for this novel unit and review the 'worst case scenario' model of conservative protection models (ALARA), by considering economic and clinical factors and the requirement to 'Make best use of public funds'.
Environmental and occupational measurements taken in Sheffield will be presented, which demonstrate regulatory compliance.

Description of Oraya system

Wet form of the Age related Macular Degeneration (Wet AMD) can cause significant sight loss in an elderly patient group, leading to reduced independence and increased social care costs. An effort was made to deliver this treatment previously using Linear Accelerators using fields of 1.5cm x 3cm [1], but delivered only modest benefits [2] or resultant radiation retinopathy [3]. Prior to the introduction of the Oraya IRay, the only NICE approved alternative treatment was two monthly intra-ocular injections of Lucentis [4].

The Oraya IRay provides a cheaper, radiotherapeutic (but non-oncologic) treatment of this disease. Three stereotactic beams deliver 16 Gy of 'Low' energy X-rays (Low being relative to megavoltage oncologic radiotherapy) at 100 kVp and 18 mA, using highly collimated (4 mm diameter) beam sequentially to the macula. The primary target of the therapy is deterministic injury to the proliferating bloodvessels which cause this disease, thereby controlling or stopping leakage in the retina. Another mechanism of action is the retardation of fibrotic scarring, which has been shown to be a secondary cause of vision loss for patients on monotherapy anti-VEGF treatment [5]. The focused volume of dosage at the macula is the reason that there have been no cases of radiation retinopathy when compared to older treatment methods [6]. The treatment is given once and used in combination with anti-VEGF injections. Patients treated with the IRay device sit at the machine with their chin on a chin rest (Image 1). There is no operator control of the dose, which is preset and not adjustable [7]. In effect there is only one 'treatment plan' for which patients are selected who are suitable for the treatment. Treatment time for all three beams is about 4 minutes.

Radiation Protection Prior Risk Assessment

Although 16 Gy is a radiotherapy dose, the effective dose delivered is only 0.3 mSv due to the high collimation and low volume of tissue irradiated. This system then presents a challenge for radiation protection, as the dose sits with a Radiotherapy Radiation Protection Adviser (RPA), the energy with Diagnostic RPA and the unit itself in an Ophthalmology department, which may not be familiar with X-ray Protection Requirements. Identifying who is going to be responsible for the risk assessment is the first hurdle.

1. 'Worst Case' approach to prior risk assessment

Having decided who is responsible for addressing the protection requirements, the next question to arise is workload. It is common for protection assessments to determine the 'worst case' protection scenario and estimate protection requirements on that basis. In general this is practicable and complies with ALARA because the logarithmic nature of attenuation means that even over-protection by an order of magnitude may still fall well within the protection provided

by standard building materials. This provides assurance for compliance with regulatory requirements.

With the Oraya system patient through-put has a practical maximum of approximately 4 patients per hour for 8 hours per working day, which equates to a maximum of 8000 treatments per year. This represents a standard 'worst case' assessment which an RPA might take as the basis estimating the protection requirements.

With the Oraya system the primary beam is attenuated by a 3.18mm Lead headrest which is interlocked behind the patient's head, so only secondary scatter protection need be considered. The 4mm diameter collimation results in 'low' levels of scatter (again relative to Radiotherapy). The peak scatter of 275 mSv per hour at 1m (at 120 and 240 degrees) is not 'Low' by diagnostic radiology standards! (Image 2, [7]) 'Beam on' time is approximately 4 minutes per treatment or 16 minutes per hour. This gives a scatter dose rate of 73.3 mSv per hour, 587mSv per day or 157mSv per working year at 1m. Applying a dose constraint of Time Averaged Dose Rate 2000 (TADR2000) of 0.3 mSv/yr (3/10 pf the public limit as recommended by ICRP 103 [8]) and arriving at a required attenuation of 1.91X10-3, which is equivalent to approximately 1.5 mm Pb for a barrier at 1m (i.e. at the Operator's protective screen, which is specified as 1.6mm Pb). This is not excessive in terms of standard diagnostic radiological protection. If the 0.3 mSv/yr dose constraint can be achieved without recourse to significant levels of additional radiation protection, then this is ALARA.

However, the Oraya system is unlikely to be installed in a radiology or radiotherapy department, but in an Ophthalmology clinic. Unlike a dedicated radiation facility, the building may be of a lighter structural design (particularly modern facilities) and the staff in the area may have little experience of ionising radiation, which can raise anxieties about the installation. Increasingly 'wet' building trades are being avoided within hospitals. Instead stud partition walls are preferable, utilising Lead ply and plasterboard or other cheaper, lower attenuation materials when necessary. Where bespoke protection is being retrofitted to an existing facility, the cost can rapidly escalate if the workload is overestimated. In such an environment the use of a 'worst case' approach might deliver staff assurance, but may incur significant unnecessary building costs. Are RPAs justified in using a 'worst case scenario' approach to prior risk assessment?

2. Prior risk assessment based upon clinical workload data

The justification for using a 'worst case' approach has generally been two-fold: Steadily increasing workloads over the lifetime of the equipment; and, the excessive cost of remedial works should the protection prescribed prove to be insufficient. We might also consider that the application of regulatory limits generally become more stringent as technological developments allow improvements in best practice delivery of ALARA doses. In general this decision rests upon the professional judgement of the RPA. In the majority of cases this approach is appropriate.

However, in the case of the Oraya system, it is necessary to consider the reality of patient numbers. In any one year in the United Kingdom there will be ~134,000 new patients for whom this treatment is applicable [9, 10, 11], equivalent to an average of 5,500 per health region or 900 per hospital Trust. Thus to use a worst case approach of 8000 patients would immediately apply ~9 times overestimate of the protection required.

If we estimate the protection required based upon clinical prevalence of Wet AMD using the figure of 900 patients per year (~ 1 session per week of 16 patients) the shielding required will depend upon several factors which must be considered:

- Scatter – a function of angle from the patient
- Distance to the nearest barrier
- Occupancy of adjacent areas

Image 3 indicates the level of lead shielding required for

1. 8000 patients per year at 1m; 100% occupancy
2. 900 patients per year at 1m; 100% occupancy
3. 900 patients per year at 2m; 100% occupancy
4. 900 patients per year at 2m; 50% occupancy

which clearly demonstrates the unnecessary levels of shielding required if the worst case scenario is adopted.

Clearly actual levels of protection are dependent upon the choice of an appropriately sized room, use of realistic workload figures and occupancy of adjacent areas. It is also evident that although this is a radiotherapy system, accommodating it within normal NHS facilities is not only practical, but well within standard radiation protection practice for most hospital environments.

Good practice also suggest that the control panel and protective screen are position so that the entrance door is in the shadow of the protective screen, providing an additional level of protection, should staff enter the room at an inappropriate time. Local practice is to lock the door during treatment. In case that room configuration does not allow the entrance door to be in the shadow of the protective scree, the IRay system has the door interlock option which can be installed and connected to the

door, such that if the door is opened x-ray delivery will stop.

Discussion of Methodology and Environmental Monitoring

It could be argued that using the TADR2000 when the exposure is being delivered during one session per week is perhaps not appropriate, as the exposure is being delivered over a significantly shorter period. Justification for this is based upon: The use of the 0.3 mSv dose constraint; the rotation of staff through Ophthalmology clinics; and the occupation of adjacent areas. Should there be an adjacent office, which is permanently occupied by the same individual(s), then protection of the adjoining wall may need to take local considerations into account. However, since the protection required has been calculated based upon the accumulated dose over a year and the dose constraint of 0.3 mSv/yr, the delivery (High dose rate over a series of short exposures or low dose rate over an extended period) does not change the shielding assessment.

Environmental monitoring is required after any installation, especially for a novel device. Monitors were placed inside the room around our installation and on the operator's side of the control panel screen. The first 3 months monitoring recorded no exposure, due mainly to a slow take up where only 25 patients were treated. A further 3 months monitoring period, during which 67 patients were treated, returned the results presented in the Table 1 below:

Table 1. – Results of the environmental monitoring.

Position (Inside treatment room)	Distance (m)	Recorded dose (mSv)	Extrapolated to 900 patients/yr (mSv)	Lead attenuation required for 0.3 mSv constraint	Lead Equivalent (mm)
Nearest Wall	1.46	1.0	13.4	0.022	0.64
Operator side of Control Panel	0.92	0.6	8.1	0.037	0.5
Door (Beyond Control screen 'shadow')	2.45	0.2	2.7	0.111	0.25

This demonstrates that the protection required using real world workloads and distances, even assuming 100% occupancy, is readily achievable with only modest levels of protection required.

The extrapolated dose behind the control panel raises a question. If 900 patients per year are treated this gives rise to a potential occupational dose of 8.1 mSv per year. However, this was measured directly behind the screen (as can be seen in Image 4). Seated, the operator is considerably further back, at approximately 1.7m from the patient. This gives an inverse square law corrected extrapolated annual occupational dose of 2.4 mSv. While significant, this would not require classification of workers, but does not appear ALARA. However, in practice, routine personnel monitoring has returned no measured occupational doses to date. This makes this reading somewhat suspect, as at this level, it would be reasonable to expect some dose to register on staff personnel monitoring badges. Further environmental monitors have been put in place and staff dosimetry will continue to be closely scrutinised until patient numbers peak and stabilise.

The primary reason for potentially high occupational doses rests entirely with the room chosen for the installation. Our room was at the limits of the minimum size into which the unit would fit. Fortunately walls of 20cm Concrete (and including two external walls) meant that external protection requirements were readily met. However, the operator's console is rather squeezed into the room. The most practical solution for ensuring occupational doses are controlled is to select a treatment room which is of a more suitable size.

Conclusion

The Oraya IRay offers a novel clinical treatment for a debilitating disease. It delivers a therapy dose of highly targeted radiation using collimated stereotactic beams. This presents a challenge to RPAs who may be unfamiliar with dealing with doses of this magnitude and/or energy. In practice standard diagnostic radiation protection techniques can be applied, with the proviso that use of 'worst case' workload figures may significantly over-estimate the level of shielding required and incur unnecessary cost as a result. Environmental monitoring confirmed estimates of shielding required. Environmental and personnel monitoring will require ongoing review to ensure that increasing workloads do not compromise protection provision. ❑

References

[1] External Beam Irradiation of Subfoveal Choroidal Neovacularisation Complicating Age-Related Macular Degeneration: One-Year Results of a Prospective, Double-Masked, Randomised Clinical Trial. Dennis M. Marcus, MD; Chris Sheils, MD; Maribeth H. Johnson, MS; Sandra N. McIntosh, PhD; Diance B. Leiback, BA; Albert Maguire, MD; Judith Alexander, BA, Chandler N. Samy, MD. Arch Ophthalmol. 2001;119:171-180.

[2] Radiotherapy for age-related macular degeneration. http://www.nice.org.uk Interventional Procedure Guidance document No: IPG0049, 2004.

[3] Proton Beam Irradiation for NeovascularAge-Related Macular Degeneration; Hadi J. Zambarakji, FRCOphth, MD, Anne Marie Lane, MPH, Eric Ezra, FRCOphth, MD, Danny Gauthier, MD 1 Michael Goitein, PhD, Judy A. Adams, CMD, RT(T)(R), John E. Munzenrider, MD, Joan W. Miller, MD, Evangelos S. Gragoudas, MD. American Academy of Ophthalmology 2006, 2012-2019.

[4] Ranibizumab and pegaptanib for the treatment of age-related macular degeneration. https://www.nice.org.uk/guidance/ta155 NICE technology appraisal guidance [TA155], August 2008

[5] Bloch, S. B., et al. (2013). Subfoveal fibrosis in eyes with neovascular age-related macular degeneration treated with intravitreal ranibizumab. Am J Ophthalmol, 156(1), 116-124 e111

[6] Iray Radiotherapy System, Model 5000 User Manual, 0400-0102 Rev 12, Oraya Therapeutics, Inc. 2012.

[7] REF X IRay® Radiotherapy System Radiation Scatter Assessment, Oraya Therapeutics. 2014.

[8] Annals of the ICRP Publication 103

[9] Office of National Statistics. Mid-2012 Population Estimates for Clinical Commissioning Groups (CCGs) in England

[10] 1.2% of population age >50. Owen et al, British Journal Ophthalmology; The estimated prevalence and incidence of late stage age related macular degeneration in the UK; Incidence was estimated from modelled age-specific prevalence. 10.1136/bjopthalmol-2011-301109

[11] 61% - 65% - Martin DF, et al., Ranibizumab and Bevicizumab for NVAMD, NEJM April 2011. VIEW 1 (BL) - 66% - Heier JS et al., Intravitreal Afibercept (VEGF Trap-Eye) in (wAMD), Ophthalmology 2012.09.006. VIEW 2 (BL) 59% - 62% - Heier JS. Birmingham Midlands Eye Centre (City Hospital NHS Trust) 60% + Survey of patients in clinic, diagnosed within the past year. Gilles MC - 88% - 94% - Gilles MC, et al., Prospective Audit of Exudative AMD: 12 month outcomes in treatment naive eyes, IOVS, July 2013.

Images

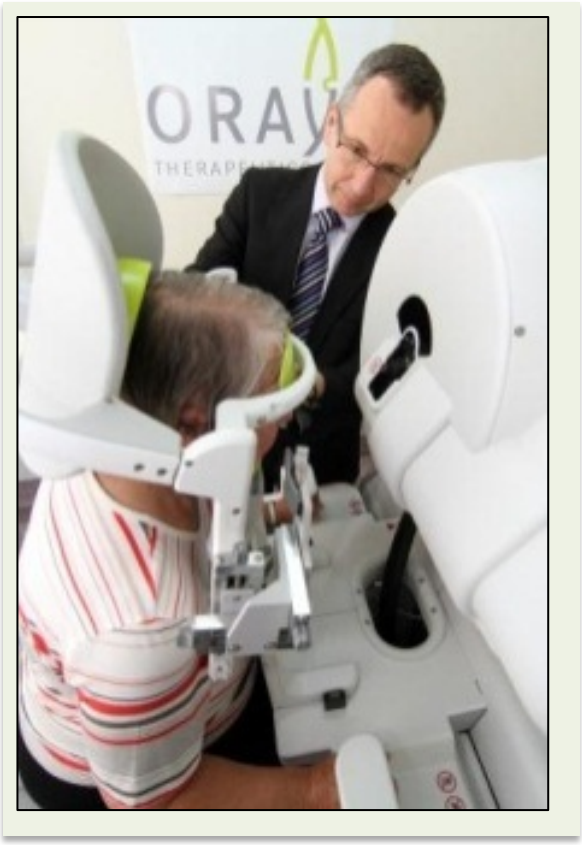

Image 1. – The Oraya system (taken from New therapy tackles leading cause of blindness 20 August 2014) http://www.sth.nhs.uk/news/news?action=view&newsID=631)

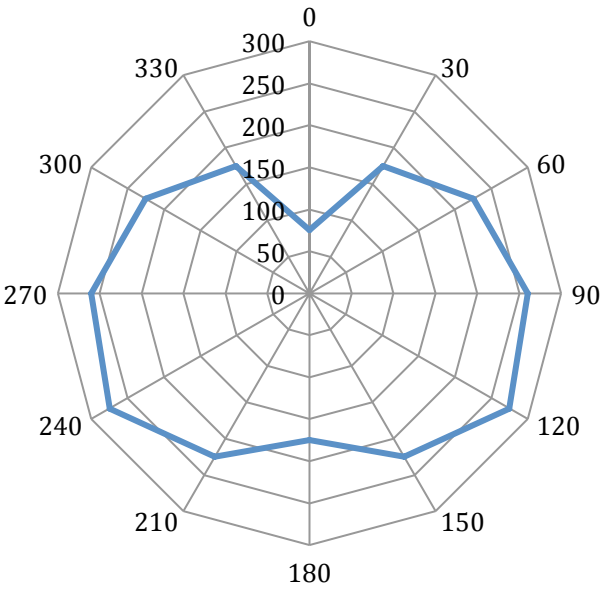

Image 2. – Dose rates at 1m (mSv/hr). This data was measured at a range of heights and the highest value taken. The patient is sat facing 0 degrees and the data is listed clockwise.

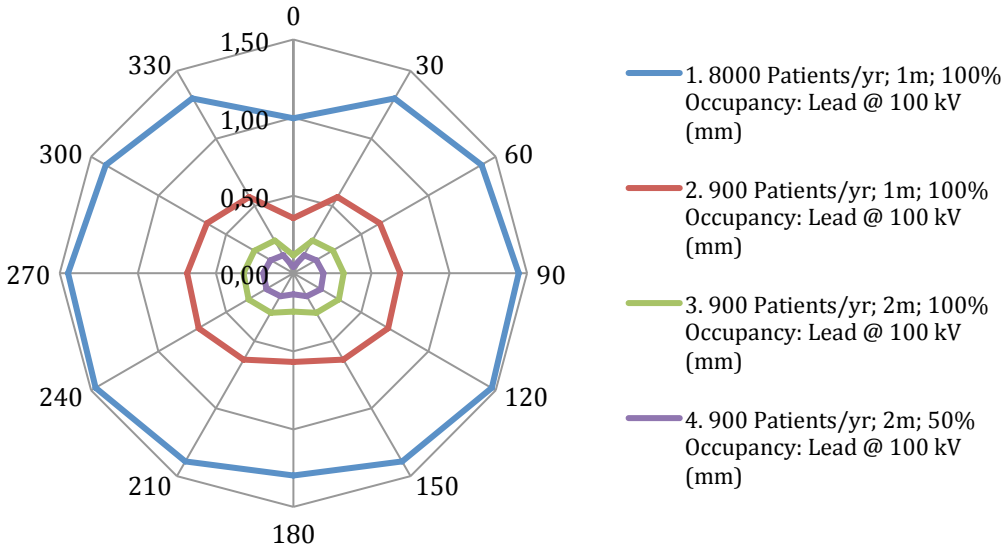

Image 3. – Shielding requirements

Image 4. – Environmental Monitoring

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On the Use of Thyroid Shielding in Dental Radiography. An Answer and a Survey

Preliminary notes

First of all, please note that the article on the use of thyrdoid shielding (EAN Newsletter issue 37, February 2016) **has been updated** by its author, Mr.J. Holroyd (PHE, United-Kingdom). The new version is online.

Secondly, the Swedish Radiation Authority (SSM) sent to the Editorial Board its own position on the practices described in the article and its recommendations regarding thyroid shielding. This letter is published below.

In order to gather a European picture of the different practices in this field, the Ediorital Board and J. Holroyd drafted a short survey to gather more information about the regulations and national guidance in your country/facility regarding

- collimation,
- thyroid shielding,
- paralleling technique
- and lead aprons

when it comes to oral, panoramic, cephalometric and dental CBCT radiographies. The survey is on-line:

https://sylvainandresz.typeform.com/to/wonS13

The survey is very short (expected completion time > 10 min) and we would urge our readers to take this short time to complete it. The results will be published and analysed in a future EAN Newsletter. Thank you in advance.

Access to the EAN survey on dental radiography practices:

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Thyroid shielding is mandatory for dentists working in Sweden, and has been so for a long time. The Swedish Radiation Safety Authority has a regulation for x-ray use in dental radiography with intra-oral receptors that states: ”When X-ray exposure is performed a protection of the patient's thyroid should be used, unless there are special reasons against this. The protection should have a radiation shielding ability equivalent to at least 0.25 mm lead.” (SSMFS 2008:5, 4§). Thyroid shielding is not mandatory for dental radiography with panoramic x-ray or CBCT, due to the risk that the shield covers structures that are essential to the diagnostics.

The evidence base for this regulation is partly given in the references to the article mentioned above (Sikorski and Taylor (1984). Another important evidence is given by Stenström et al, 1983, Radiation shielding in dental radiography: ”The protective effect in the thyroid region from different types of radiation shieldings at intraoral radiography has been studied…” ”No significant difference in the protective effect in the thyroid gland could be found between the different types of thyroid shieldings. There was a dose reduction by approximately a factor of 2 to the thyroid region down to 0,08 mGy per full survey using parallelling technique, and

below 0,001 mGy for single bitewing exposure."

Furthermore, in another article, Stenström et al states: "The doses in the central part of the parotid and thyroid glands were then 0,5 and 0,12 mGy , respectively, from a full survey with 20 intraoral films. With a leaded shield the thyroid dose was reduced to 0,05 mGy." Citation from Absorbed doses from intraoral radiography with special emphasis on collimator dimensions, part of Birgitta Stenströms dissertation Dose Contributions to the Swedish Population from Oral Radiography, 1986.

Thus, the use of thyroid shields generally means halving the dose to the thyroid. As it is a relatively simple measure with a negligible cost, and it is generally accepted by the patients, it is a good example of a practical application of the ALARA principle, As Low As Reasonably Achievable. This is, of course, assuming that the shield actually reduces the radiation to the thyroid. As seen above, the documentation supports that using thyroid shields lowers the dose to the thyroid. We have not found any documentation of the opposite.

The prevalence of thyroid cancer is growing, and in the perspective of an ageing population it should be of interest to all health professionals, as long as reasonable, to use all kinds of preventive measures. The American Thyroid Association recommends the use of thyroid shielding during dental x-ray examinations in its "Policy Statement on Minimizing Radiation Exposure from Medical, Dental Diagnostics" from 2012.
The use of thyroid shielding for intraoral radiography has no negative side effects, and if it is used as a routine on every patient, the effort is minimal.

Therefore, the ALARA-based advice for use of thyroid shields in intraoral radiography should be the following: Keep it simple; use the thyroid shield on all patients and for all types of exposures. ❑

Bibliography

Sikorski PA, Taylor KW. 1984. The effectiveness of the thyroid shield in dental radiology. Oral Surg 58. 225-36.
Kircos LT, Angin LL, Lorton L. 1987. Order of magnitude dose reduction in intraoral radiography. J Am Dent Assoc 114(3). 344-7.
Sinnott B, Ron E, Schneider AB. 2010. Exposing the thyroid to radiation: a review of its current extent, risks, and implications. Endocr Rev 31(5). 756-73.
NCRP. 2003. Radiation Protection in Dentistry. NCRP Report No. 145. National Council on Radiation Protection and Measurement. Bethesda, MD.
American Dental Association Council on Scientific Affairs. 2006. The Use of Dental Radiographs - Update and Recommendations. Journal of the American Dental Association 137. 1304-1312.
European Commission. 2004. European Guidelines on Radiation Protection: The Safe Use of Radiographs in Dental Practice, Office for Official Publications of the European Communities, Luxembourg, Netherlands.
Stenström B, Rehnmark-Larsson S, Julin P, Richter S. 1983. Radiation shielding in dental radiography. Swed Dent J 7. 85-91.
Stenström B. 1986. Dose distributions to the Swedish population from oral radiography. Swed Dent J. Supplement 40.
Strålsäkerhetsmyndighetens föreskrifter, SSMFS 2008:5, om tillstånd att inneha och använda viss röntgenutrustning för odontologisk röntgendiagnostik
IAEA: Thyroid Cancer Effects in Children, Staff Report, August 2005:
http://www.iaea.org/newscenter/features/chernobyl-15/thyroid.shtml

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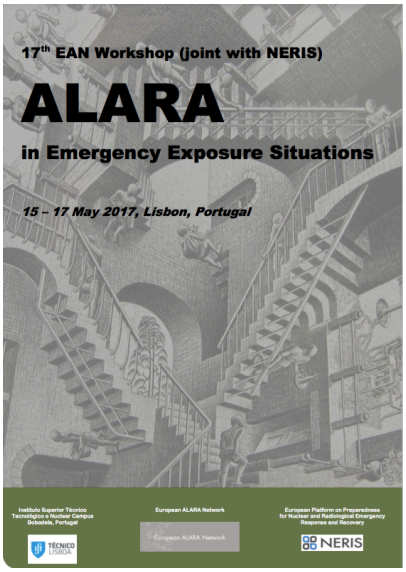
Next EAN Workshop

EAN 17th Workshop: ALARA in Emergency Exposure Situations
Organize in collaboration with NERIS
15-17 May 2017, Lisbon, Portugal



Emergency exposure situations can arise as a result of a nuclear accident, a malicious or terrorist act, or any other unexpected radiological event. It requires a quick response and sustainable countermeasures and remedial actions in order to avoid or reduce adverse short-term and long-term consequences. Radiation exposures can be received by the public, first responders, workers and volunteers engaged in the post-accident recovery.
The ICRP recommendations and European Basic Safety Standards – the bases for national regulations - re-emphasize the principle of optimisation (ALARA) as applying to emergency exposure situations. For the purpose of radiological protection, reference levels for emergency exposure situations should be set. More importantly, it is necessary to establish emergency plans based on an optimum protection strategy, resulting in more good than harm for the exposed people and the affected territories. In that perspective, lessons learnt from the Fukushima accident are of utmost importance.
The objectives of the workshop are:

- To show, in particular from the experience of Fukushima accident, the challenges posed by the optimisation of exposures in emergency and post-accident situations;
- To review the national arrangements for assessing, monitoring and mitigating the radiological consequences of an emergency, especially with regard to applying the ALARA principle to public and occupational exposures;
- To review the arrangements for managing emergency doses to workers
- To review the arrangements for providing ALARA-based training for the different types of stakeholders who would be engaged in the emergency response and long-term recovery actions.

The workshop will consist of presentations (oral and posters) intended to highlight the main issues, and a significant part of the program will be devoted to discussions within working groups. From these discussions, participants will be expected to produce recommendations on ALARA in emergency exposure situations, which are addressed to relevant local, national and international stakeholder.

In practice

Workshop will be held at IST campus, located at Bobadela, 13 km north of Lisbon.

Note that NERIS 3rd Workshop will be held from 17-19 May at the same location.

Registration link down below
Where you can find additionnal information, itinerary, registration fees etc.:

REGISTRATION LINK :

http://www.planetreg.com/EANworkshop17NERISworkshop3

EAN Logo contest

We are in the process of rejuvenating some elements of the Network and notably our logo.

If you have designer skills or are imaginative, send your proposed logo to the Editoral Board.

EAN members will select the logo and **the winner will receive an ALARA prize**. ❑

ALARA NEWS

NERIS Training Course on Late Phase Nuclear Accident Prepardness and Management

The Training Course on "Late Phase Nuclear Accident Preparedness and Management" is organised by the Nuclear Protection Evaluation Center (CEPN, France) and the Institute of Radiology (RIR, Belarus) in cooperation with the European platform NERIS on emergency and post-accident preparedness and response. The training course is co-funded by the European Joint Programme for the integration of radiation protection research CONCERT.
The course will take place from **June 19-23, 2017** at the Institute of Radiology (RIR) in Gomel, Belarus.

The main objective of the course is to provide principles and practical guidance for the key players involved in the preparedness and recovery of living conditions in contaminated areas in the aftermath of a nuclear/radiological accident. The course is based on international recommendations and on the material produced and developed in several European and international projects (ETHOS, SAGE, NERIS TP, etc.) as well as the first results obtained under PREPARE and SHAMISEN programs. The course is made of lectures, practical working sessions, technical visits and discussions. It strongly relies on the practical experience of Belarussian organisations in the management of the Chernobyl consequences as well as on the first lessons from the management of the consequences of the Fukushima accident.
If you want to know more, you will find the first announcement, preliminary programme and registration form following this link:

http://www.eu-neris.net/index.php/activities/training-courses/105-first-announcement-march-2016.html

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The reborn of the 'Young Club' of the French Society for Radiation Protection (SFRP)

After years of sleeping, the club of the Young Members of the French Society for Radiation Protection (abrevitated 'Young Club of the SFRP') has reborn. This is thanks to the efforts of the Administrative Board of the SFRP and a bunch of young radiation protection professionals.

A Bureau has been elected in April 2016 and now 20 young professionnals from various professional sectors (nuclear industry, medical, phamarceutics etc.) have joined the Young Club. They agreed to a 'Strategic Agenda' and initiated several actions.

- Involve the Young Members in the activities of the SFRP.
- Make the SFRP more visible on the Internet and social networks: https://www.facebook.com/SFRP
- Get in touch with students studiing in ionizing radiation and radiation protection and develop strong relationship with their schools and universities.

- Contribute to the planning of SFRP's events and organize a specific event toward radiation protection students and young professionals to exchange and discuss on subjects at stake.
- Create a network of young radiation protection professional at the national level and participate to the networks at international level.

Note that Mr. B-M. Hayadi (see the article on radiography incidents in France in this issue) is member of the Young Club. We hope the Club will continue to publish in the ALARA Newsletter! ❑

The members of the Young Club

FAQ ALARA

The IAEA proposed a list of frequently asked questions (FAQ) which intends to provide information to radiation protection specialists so they can answer quickly and correctly the most frequently asked questions. The EAN Newsletter proposes a selection of this FAQ in each issue.

How should the ALARA approach be implemented in the case of doses received to the extremities?

This question involves examining what is meant by the concept of optimization when dealing with doses received to the extremities.

In the case of stochastic effects, optimization can be implemented by focusing on the risk of cancer, which can only be estimated on the basis of the "whole body" effective dose. Doses received to the extremities therefore have to be aligned with the whole body doses. This is achieved by applying well-established calculation rules that take into account the radiosensitivity of each organ or tissue.

For example: Supposing that an individual receives a dose of 500 mSv to the extremities (dose limit to the extremities). Given the weighting factor (w_T) for the skin of 0.01, and the fact the hands account for only 5% of total skin surface (therefore, no dose is received by 95% of the skin), the 500 mSv delivered to the extremities represents a whole body effective dose of

$$[(500 \times 0.05) + (0 \times 0.95)] \times 0.01 = 0.25 \text{ mSv}.$$

Thus, even if a worker reaches the dose limit to the extremities every year for 5 years, the corresponding total effective dose will be 1.25 mSv, which is well below the 100 mSv in 5 years effective dose limit.

In reality, doses received to the hands are usually much lower than the 500 mSv per year dose limit, but the ALARA approach may still be applied. ❑

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