

## The European ALARA Network, activities and outputs

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### Abstract

*The principle of optimisation is the cornerstone of practical radiation protection and states that exposures to ionising radiation must be kept as low as reasonably achievable (ALARA) taking into account several factors as well as socio-economic ones. In the absence of specific guidance, the need for a dedicated platform to discuss, gather and disseminate information on the practical implementation of ALARA within the radiation protection community was identified.*

*The European ALARA Network (EAN), created in 1996, and, now on the eve of its 25<sup>th</sup> anniversary, is a platform that promotes the implementation of the ALARA principle for occupational, public and patient exposure in all exposure situations. In its more than 24 successful years of operation the network has proven to be a sustainable and valuable organization contributing to the promotion and the practical implementation of ALARA through the exchange of practical experience in the different domains among European countries.*

*In this paper an overview is given of the networks' history, and the results of its activities and outputs made available to stakeholders over the years. This includes the outcomes of workshops, the publication of biannual newsletters, results of surveys and the creation of subnetworks and thematic working groups.*

*We also give an insight to our planned activities for the coming years based on the recently developed and approved strategic agenda (2021-2026).*

### 1. Introduction

The three principles of justification, optimisation and limitation of exposure to ionising radiation form the basis of the system for radiation protection in practice. It is clear that the principle of optimisation forms the core of practical radiation protection. This principle is stated in ICRP 103 (2007) [1] as *"the likelihood of incurring exposures, the number of people exposed, as well as the magnitude of their individual doses should be kept as low as reasonably achievable taking into account economic and societal factors"*. Its importance is underlined by further broadening the concept to include stakeholder involvement in the decision process and optimising below appropriate dose constraints and reference levels for all planned, emergency and existing exposure situations.

The objective of implementing ALARA is to reach an 'acceptable' level of risk, below the dose limit, the latter being the upper bound of the 'tolerable' level of risk. ALARA is an obligation of means, and not an obligation of results, in the sense that the result of the ALARA approach depends on processes, procedures, and judgments and is not a per se given value of exposure. It involves the application of reasonableness taking into account the prevailing circumstances, transparency on the decision making process and the optimal use of resources. This means that the acceptable level of exposure will depend on the exposure situation as well as technical, societal and economic considerations [2,3].

The practical ALARA procedure, first promoted in “ALARA from Theory towards Practice”, published by EC in 1991 [4], describes five successive steps to achieve optimisation. The first step is the evaluation of the exposure situation, to identify the need for action. The second step identifies the possible protective options to keep exposures ALARA and evaluate their effectiveness. The third step is the selection of the best option under the prevailing circumstances. This is a complex step where the decision maker needs to take into account individual equity, stakeholder involvement, technical and economical boundary conditions, safety and safety culture. The selected exposure reducing option then needs to be implemented using an effective radiation protection programme in the fourth step. The fifth step, a regular review of the exposure situation examines whether there is a need to review the protective options based on their effectiveness and the prevailing circumstances. It is a step towards reviewing the protection again and, if necessary, restarting the procedure at step one. The five steps can be seen as a process of continuous improvement in the level of protection and forms part of a dynamic risk management system taking all hazards into consideration.

It is clear that some guidance needs to be given in applying the principle and the steps in practice. Optimisation is a frame of mind, always questioning whether the best has been done in the prevailing circumstances. It requires a forward-looking iterative process aimed at preventing exposures before they occur. It is dynamic, taking into account feedback experience as well as technical and socio-economic developments. It requires both qualitative and quantitative judgments and an optimal use of resources.

A platform such as the EAN enables the stakeholders in the radiation protection community to exchange their experience and benefit from international feedback in the field. It aims to promote the implementation of the ALARA principle for the optimisation of occupational, public and patient exposures in all exposure situations and to provide a focus and a mechanism for the exchange and dissemination of information from practical ALARA experiences. The network identifies topical issues of common interest through networking and examines them in workshops or working groups to further improve the practical implementation of ALARA.

In its 24 years of activity the network has gathered information on ALARA in the domains of industry and research, non-destructive testing, medical, decommissioning, existing exposure situation and emergency situations. The gathered information is made available through the workshops, website, newsletters and the results from surveys and working groups.

Recently the EAN Working Group on ALARA Culture achieved the elaboration of a book on the ALARA principle “*Optimization of Radiological Protection - ALARA: A Practical Guidebook*” [5] based on the experience gathered, giving a clear and practical picture of what ALARA is and how to apply it, in line with the last recommendations and standards from international organizations. It includes more than 40 practical examples of application in the field under different exposure situations. The book is available to download free of charge on [www.eu-alara.net](http://www.eu-alara.net).

## **2. History and development of the EAN**

The network started in 1996 as one of the European Framework programs for Research and Development. A group of enthusiastic experts from different European countries formed the core of the network. The coordination of the network was and is performed by CEPN (France) and PHE (National Radiological Protection Board at the time, United Kingdom) and a group of experts from several European states.

The network became a self-supporting legal entity in 2005 as a non-profit organisation under French law with an administrative board looking at financial matters and a steering group that discusses and plans the activities of the network. The network is supported through financial and in-kind

contributions from different institutions, companies, regulatory authorities, etc. represented per country in the board and the steering group [6].

Currently there are 18 countries that are participating in the steering group with experts from different fields: radiation protection authorities, research institutes, industrial companies, hospitals, education and training, services etc. Participation to EAN activities is made on a voluntary basis and is open to all European organizations who approve the EAN Terms and Conditions and wish to support the network.

The focus of the network was first directed to the application of the ALARA principle in industry and research, later the scope was broadened to include the medical field and the NORM-industry. The current scope is broadened to include all exposure situations and in line with ICRP recommendations [1].

Every five years a strategic agenda is established taking into account the results of the past activities and the topical issues of common interest that were identified through workshops, networking and surveys. This forms the basis of the work program for the coming years. Section 4 will give an insight on the coming activities of the ALARA network.

### 3. EAN activities and outputs

As discussed in the introduction, the activities of the ALARA network involve the gathering and processing of international and national information from member countries on radiation protection and the application of the ALARA principle. This is done through the organisation of workshops, surveys and of course through networking with other organisations. The activities and results obtained through different interactions and activities are described below:

#### *Networking*

The network exchanges information with different organisations and projects to discuss subjects of common interest. An overview is given in the table below:

<b>Organisations or projects networking with EAN</b>	
AFAN	African ALARA network
ARAN	ALARA network in the ASIA Pacific region
EFOMP*	European Federation of Organisations for Medical Physics
EFNDT*	European Federation of Non-Destructive Testing
EFRS*	European Federation of Radiographer Societies
EMAN	European Medical ALARA Network
ESR	European Society of Radiology
EURADOS	European Radiation Dosimetry Group
EUTERP	European Network on Education and Training in Radiological Protection
IAEA	International Atomic Energy Agency
ICRP**	International Commission on Radiological Protection
IRPA	International Radiation Protection Association
ISEMIR	Information System on Occupational Exposure in Medicine, Industry and Research
ISOE	Information System on Occupational Exposure
NERIS	European Nuclear and radiological Emergency management and Rehabilitation strategies
ORAMED	Optimization of RADIation protection for MEDical staff
RECAN	ALARA Network in the Central and East Europe

\* Collaboration agreement signed with the EAN

**\*\* Organisations in formal relations with ICRP**

Besides exchanging information the EAN also provided technical support and assistance in the creation of new ALARA networks in central and East Europe (RECAN), Asia and the Pacific region (ARAN) and recently 2 African ALARA networks [7].

When a topic or sector needed further, deeper and specialised discussion the network supported the creation of new networks, subnetworks or working groups devoted to certain subject areas regarding ALARA.

<b>Sub-networks</b>	
EASN	European ALARA Sub-Network on Research Reactors (2002-2009)
EAN-NDT	European ALARA Network on <b>NDT</b> (Non-Destructive Testing) (2003)
ERPAN	European Radiation Protection Authorities Network (2005) (yearly meeting)
EAN <sub>NORM</sub>	European ALARA Network for Naturally Occurring Radioactive Material (2007) (merged in 2017 with EU NORM to create European NORM Association)
EMAN	European Medical ALARA Network (2009-2012)

As an example, the European Radiation Protection Authorities Network (ERPAN), was created as a result of the recommendations of the 8<sup>th</sup> EAN Workshop, and acts as an exchange platform between regulatory authorities on issues related to the operational level. Since its creation in 2005 it has held yearly meetings to exchange operational regulatory experience.

Another way of progressing on the implementation of the ALARA principle in certain subject areas is through activities in working groups. They are created by requests from external organisations or on the initiatives of EAN members. These working groups gather information and prepare deliverables in the form of recommendations, overview or guiding documents on the subject at hand. The working group on radon prepared a statement on radon to be discussed in ICRP. The working group on ALARA culture prepared a generic paper on the subject that was presented at the IRPA 13 congress in Glasgow in 2012. As mentioned in the introduction the same working group also prepared an update of the book "ALARA from theory to practice", entitled "Optimisation of radiation protection (ALARA): a practical guidebook" that is now available on the EAN website.

*ALARA Workshops*

The EAN organises regular workshops in different subject areas regarding ALARA. The topics are chosen by the EAN steering group based on an evaluation of possible improvements of practical ALARA in these areas (topical issues). These workshops are attended by 60 to 120 experts from different countries and different professional backgrounds with experience in radiological protection. Papers are presented that set the scene of the subject area followed by papers with practical examples of the implementation of ALARA. Poster sessions allow brief communications on the topic at hand.

For each of the workshops a set of topics and questions in relation to the workshop subject area are prepared in order to facilitate discussions by the different working groups during the meeting. The results of the discussions are presented in the plenary session leading to recommendations that are then transmitted to the stakeholders. The conclusions and recommendations are also published in the ALARA newsletter, on the EAN website and in different national radiation protection journals.

<b>List of the European ALARA workshops</b>	
ALARA and decommissioning	Saclay, 1997
Good radiation practices in industry and research	Oxford, United Kingdom, 1998
Managing internal exposure	Munich, Germany, 1999

Management of occupational radiological and non-radiological risks: lessons to be learned	Antwerp, Belgium, 2000
Industrial radiography, improvements in radiation protection	Rome, Italy, 2001
Occupational exposure optimisation in the medical and radio-pharmaceutical sectors	Madrid, Spain, 2002
Decommissioning and site remediation	Arnhem, Netherlands, 2003
Occupational radiological protection control through inspection and self-assessment	Uppsala, Sweden, 2004
Occupational exposure to natural radiation	Augsburg, Germany, 2005
Experience and new developments in implementing ALARA in occupational, public and patient exposures	Prague, Czech Republic, 2006
ALARA in radioactive waste management	Athens, Greece, 2008
ALARA issues arising for safety and security of radiation sources and security screening devices	Vienna, Austria, 2009
ALARA and the medical sector	Oscarborg Fortress, Norway, 2011
ALARA in existing exposure situations	Dublin Castle, Ireland, 2012
Improving ALARA Culture through Education and Training	Rovinj, Croatia, 2014
ALARA in Industrial Radiography	Bern, Switzerland, 2016
ALARA in Emergency Exposure Situations	Lisbon, Portugal, 2017
ALARA for Decommissioning and Site Remediation	Marcoule, France, 2019
Innovative ALARA Tools	Athens, Greece, 2019

Already 19 workshops have been organised since the creation of the network in the successful format described above. It shall be highlighted that the co-organisation of workshop with partner organizations such as EFNDT (workshop 16), NERIS (workshop 17), ISOE (workshop 18) and European research platform (PODIUM, workshop 19) has shown good participation and valuable outcomes.

In 2021, the EAN established a working group to survey and assess the impacts of the conclusions and recommendations that have been formulated following each workshop. The next workshop (2022) will focus on the optimisation of exposures in the medical field (cf. 5).

### *Surveys*

Since EAN became a well-established network in 2000, it was decided to use the network as a vehicle to support European Surveys on current topics in radiological protection. The surveys were and are performed through national contacts. The summaries of the surveys can be downloaded from the website. The following different topics have previously been surveyed:

- The implementation of the European Basic Safety Standards in Directives 96/29 and 97/43 in national regulations (2006),
- The management of radioactively contaminated soils (2006),
- Potential exposures in nuclear installations (2007),
- The Diagnostic Reference Levels (DRLs) in Europe (2007),
- Radon exposure management (2010)
- Aircrew exposures (2011 and renewed in 2018)
- Declaration systems of incidents (2011)
- Use of thyroid shielding in dental radiography (2016-2017)

### *ALARA newsletter*

The ALARA newsletter is published twice a year with contributions on good practices, lessons learned, workshop results and practical implementations of ALARA. Already 44 issues have been published. As an example, the 44<sup>th</sup> issue contains contributions on radiation protection and COVID, regulation about

radon at work, the view of Nuclear Energy Agency on reasonableness, the European radiation protection research roadmap and practical guidance on shielding in medical diagnostics. The Newsletter is distributed through the website, a mailing list and also through the contact persons and national radiation protection societies. According to several sources and tracking, the Newsletter reaches thousands of experts and institutions in Europe and also worldwide.

#### *EAN website*

The EAN website ([www.eu-alara.net](http://www.eu-alara.net)) is regularly updated and gives access to different information regarding the networks' activities such as the electronic versions of the newsletter, papers of the workshops, summarised conclusions and recommendations. Several hundred of individuals visit regularly the website.

#### **4. New challenges for EAN**

The range of EAN activities has been gradually extended over the last 24 years from optimisation of occupational radiation protection in industry and research, to occupational radiation protection in medicine and in the NORM area, and further on to the optimisation of patient exposures, and of the general public in all exposure situations.

In the medical sector, important improvements have been identified in recent years, however the number of exposed individuals and the magnitude of the doses received indicate that there is much more scope for ALARA, notably to keep pace with recent developments in the use of new imaging techniques and radiopharmaceuticals.

In nuclear industry and research a mixed situation is expected in the coming years. On the one hand the ageing of existing installations will lead to decommissioning and a large-scale retirement of nuclear workers – including radiation protection specialists (RPE, RPO). On the other hand, new nuclear installations (nuclear power plants, nuclear waste disposal, isotope production facilities, research reactors, new reactor designs, etc.) are under development or will be developed in the near future. Both need knowledge and skills from the radiation protection community to implement the ALARA principle in all life stages of a nuclear installation. This requires an ongoing focus on maintaining and expanding skills and competencies, through radiation protection and ALARA education and training.

More and more attention is now paid to the management of existing exposure situations (e.g. NORM) and applying the ALARA principle in the prevailing circumstances is still challenging as epitomized by recent SFRP-IRPA workshops ([9], [10]) to which EAN participated.

The process to implement the Euratom Directive 2013/59 in national legislation is now achieved: it will provide numerous examples of the practical implementation of ALARA. There is scope to work towards harmonization of practices in some areas and this will be achieved by promoting the sharing of experience.

These considerations have led EAN network to include the following key ALARA themes in our strategic agenda for 2021-2026. In the medical field attention will be given to interventional radiology, new imaging techniques and the production and safe use of new radiopharmaceuticals, with special attention to exposure situations involving alpha exposure.

In the nuclear industry, research and the medical field EAN network will focus on a further harmonization of practices in the implementation of the ALARA principle. This will support the ongoing focus of maintaining and further developing knowledge and skills in these fields.

The key ALARA themes will be developed through the organisation of workshops, discussions in working groups and networking with different organisations and projects to explore subjects of common interest.

## 5. Conclusion

The European ALARA Network has proven to be a successful platform to exchange and disseminate practical experience in the field of ALARA. This is emphasised by a presentation by UNSCEAR where EAN is described as being a part of one of the four pillars supporting the global organisation of radiation protection. The four pillars are identified as science, principles, standards and practice. The EAN is mentioned together with ISOE and EURADOS and IRPA as supporting the practical pillar of radiation protection.

The key factors for the success of the European ALARA Network are the informal way of operation and the enthusiasm of all the participants, supported by their respective organizations, and the willingness to share their experience with colleagues from other countries and to promote the ALARA principle from a practical point of view.

In the coming years the focus of the work of EAN will remain on sharing experience on the practical implementation of ALARA. The challenge is to extend the application of ALARA to all sectors and all exposure situations taking into account the continuous technological developments in ionising radiation applications and the increasing number of exposure situations. This involves investigating new exposure situations, re-examining existing ones but also sharing and disseminating good practices, experience and knowledge to help raise standards on implementing the ALARA principle in practice.

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