TRAINING SCHEMES ON NUCLEAR SAFETY CULTURE FOR MANAGERS: THE TRASNUSAFE PROJECT

M.GIOT
Louvain School of Engineering, Université catholique de Louvain (UCL)
Place du Levant 2, Box L5.04.01, BE-1348 Louvain-la-Neuve, Belgium

B. CARLÉ, M.COECK, G.MESKENS
Belgian Nuclear Research Centre (SCK•CEN)
Boeretang 200, BE-2400 Mol, Belgium

P.CROÜAIL
Centre d'étude sur l'Evaluation de la Protection dans le domaine Nucléaire (CEPN)
28 rue de la Redoute, FR-92260 Fontenay-aux-Roses, France

ABSTRACT

TRASNUSAFE, a Project supported by the European Commission (FP7 - 249674), aims at designing, developing and validating two training schemes on nuclear safety culture for professionals operating at a high level of managerial responsibilities in nuclear installations. One of the training schemes is related to the nuclear industry, while the other is related to the other installations making use of ionizing radiation based technology, mainly the medical sector. Both training schemes will have a common basis reflecting the challenging approach to risk management, followed by sector-specific specialised modules. The final product will consist in a package of five training modules for managers of both industrial and medical sectors, ready for use after validation through pilot sessions.

The first section of the paper deals with a general presentation of the Project running since end 2010, including its objectives, structure and methodology. As presented in section 2, the Project started with an analysis of the needs made by means of a questionnaire and a set of five regional workshops. Section 3 reports on the conclusions of two reflection groups organised within the "European ALARA Network" (EAN) and the "European Training and Education in Radiation Protection Foundation" (EUTERP) networks. While the first aimed to clarify the links between the ALARA principle currently used in the radiation protection community and the safety culture of the nuclear industry, the second focussed on the different meanings of 'justification' of the radiological risk in societal and occupational context respectively, and on the implications of these findings for nuclear safety culture.

1. Introduction: objectives, structure and methodology of the Project

Safety culture has developed after the Chernobyl accident when it became clear that although the plant had trained operators using clear procedures backed up by safety management systems, deficiencies in the attitudes to safety in the organisation had let to a nuclear disaster. Since 1986, the use of the terms 'Safety Culture' and the application of the concept have spread not only over the nuclear industry, but also to other sectors including Process Industries, Rail, Aviation, Air Traffic Management, Medical and Food. For example, the definition adopted in 2006 by the European Society for Quality in Health Care (ESQHC), cited in [1] is : "*An integrated pattern of individual and organisational behaviour, based upon shared beliefs and values that continuously seeks to minimize patient harm, which may result from the processes of care delivery"..*

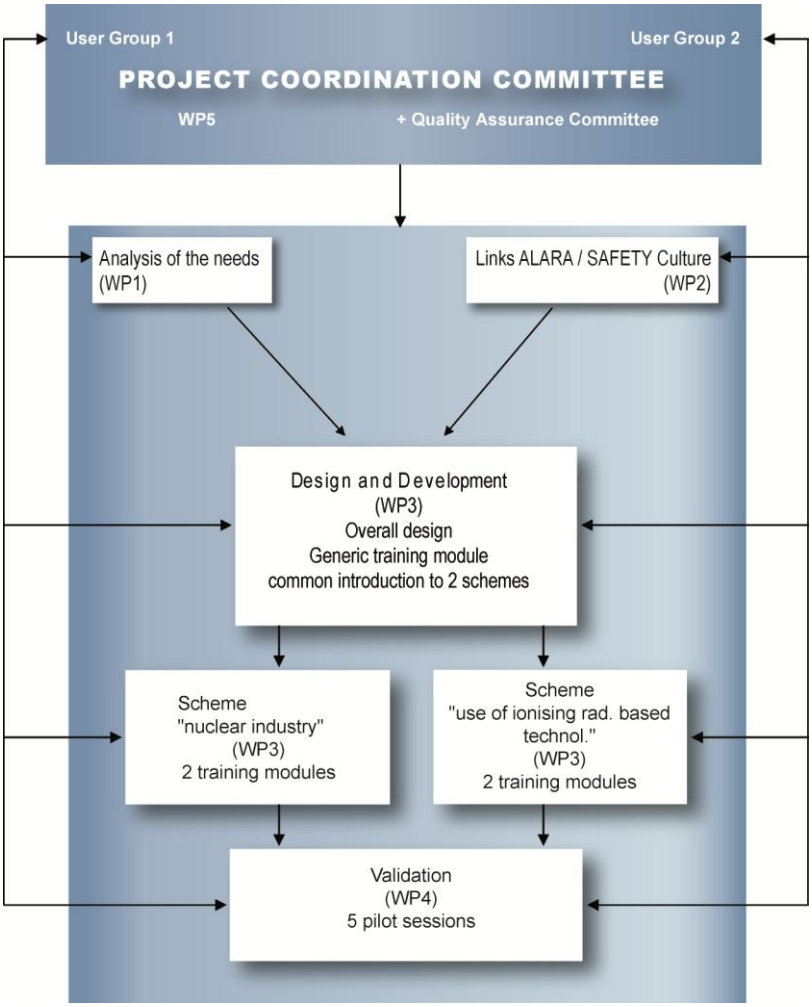

Fig 1. Structure of the TRASNUSAFE project

Reviewing the definitions proposed in the abundant literature since 1986 as done for example in [2] is out of the scope of this paper. Here, we refer to the concept of Nuclear Safety Culture (NSC) proposed by the International Nuclear Safety Advisory Group of the IAEA. In INSAG-4 [3] safety culture is defined as: "*that assembly of characteristics and attitudes in organizations and individuals which establishes that, as an overriding priority, nuclear plant safety issues receive the attention warranted by their significance*."
INSAG-11 [4] identified three phases in the development and strengthening of Safety Culture in an organization:
"(1) Safety is compliance driven and is based mainly on rules and regulations. At this stage, safety is seen as a technical issue, whereby compliance with externally imposed rules and regulations is considered adequate for safety.
(2) Good safety performance becomes an organizational goal and is dealt with primarily in terms of safety targets or goals.
(3) Safety is seen as a continuing process of improvement to which everyone can contribute".
It is clear that a culture of safety (and also of security) that governs the attitudes and behaviour of individuals needs to be integrated in the management system, and that

leadership is central to safety culture. Three IAEA publications of safety standards provide useful guidance [5], [6], [7].

TRASNUSAFE, a Project supported by the European Commission (FP7 - 249674), aims at designing, developing and validating two training schemes on nuclear safety culture for professionals operating at a high level of managerial responsibilities in nuclear installations. One of the training schemes is related to the nuclear industry, while the other is related to the other installations making use of ionizing radiation based technology, mainly the medical sector. Both training schemes will have a common basis reflecting the challenging approach to risk management, followed by sector-specific specialised modules.

The project is running since end 2010 for a period of four years. It is structured in five parts, denoted “WP” in Fig 1. It started with an analysis of the needs (WP 1) described in section 2 below, and with the work of two reflection groups focused on the links between nuclear safety culture and radiological risks (WP 2), subject of section 3. These two parts form the main subject of this paper. Based on them, the design and development of a generic training module, common to the two training schemes, and the definition of the contents of four specialised modules (WP 3) will be performed. After completion of the preparation of the five training modules, a pilot session will be organised (WP 4) to test each of them on a representative sample of trainees, and to develop any necessary corrections. The two training schemes will then be considered as validated and ready for current use. It is foreseen that all requirements of the European Credit system for Vocational Education and Training (ECVET) will be implemented in the training schemes, among others the explicit definition of learning outcomes of the training modules and the organisation of assessments leading to some sort of training passport or certificate. Note that the Project, supervised by a Coordination Committee (WP 5), is performed under Quality Assurance and benefits from the inputs of the members of two user groups. TRASNUSAFE is performed by 15 organisations from 9 different countries, 3 international associations, and a large set of important potential users. It is a joint effort of universities, research centres, regulators and industrial companies to set up a European package of five training modules on nuclear safety culture for managers of both industrial and medical sectors.

2. The analysis of the needs

The Project started with an analysis of the needs based on a questionnaire and a set of five regional workshops. This analysis was aimed at obtaining qualitative information on the characteristics of the potential trainees, their scientific background, their professional environment, their responsibilities and their expectations. It was also aimed at getting some quantitative information on the provisional fluxes of managers in charge of safety that can be expected for general or specific trainings on nuclear safety culture.

In the period June 2011 – September 2011, over 450 persons were invited by email to fill an online questionnaire. The persons consisted in selected geographically spread coordinators, aiming for a balanced group of respondents knowledgeable about existing safety culture training and training needs. The questionnaire provided 120 replies spread over 25 countries, evenly divided between nuclear industry (53.5%) and other users of radioactive materials (46.5%). It was noted that less than 25% of the respondents report on the existence of a specific safety training course in their organisation either as an internal training or with an external national training provider. For 22%, safety training is part of a university or a professional training curriculum, and about 24% take this training at an international level, mostly with IAEA. Most training programmes have an exam (70%), but only 48% provide an official diploma, certificate or accreditation. When summing up the number of people trained in the different programmes, one sees over 100 persons a year attending them.

A list of topics was included in the questionnaire, and the question of their relative importance was submitted. They were: risk concept and risk culture; nuclear safety definition and history; radiation protection principles; radiation safety and radioactive sources; human factors; incident reporting and learning from non-conformities; ALARA[1] principle, implementation and tools; organisational culture; managers responsibilities (legal issues); the societal context of safety culture; case studies. All these topics were scored as important to very important. Some other topics were suggested by the participants, like: working environment psychology in nuclear installations; responsibility at all levels of organisation; types of exposures (planned, medical, non-medical, etc.); specific training on terrorist possible attacks using radioactive dirty bombs and similar; long term operation issues and decommissioning; applicability of standard managerial tools in nuclear industry; implementation of error reduction tools; non radiological/nuclear accidents, even in nuclear facilities; communication of relevant information - the right information to the right people at the right time; etc.

A wide variety of organizational forms was suggested, but a majority of the participants prefers classroom style sessions combined with homework and/or internet based training. On the duration of the training, there is absolutely no consensus. On the contrary, a large consensus was recorded on the need for an exam or test, and the need for a diploma or accreditation (over 80%). However, many suggestions were formulated on non-traditional exams and on-the-job follow-up. Also a European recognition is demanded (70%).

An estimate of the future participation was asked in detail, including per the professional background of the participants. When all the answers are summed with participants estimates per country, a 'market' of over 500 trainees / year is predicted for the generic module, while when answering for only the own organization, the figures add up to over 1000 course participants in the next 5 years (over 200 / year).

The regional workshops complement this information on the needs, and give more insight into the most relevant contents. Five regional workshops were organised in Brussels, Bucharest, Madrid, Manchester and Ljubljana. The need to develop the safety culture training specifically for high managerial level was recognised. This training is supplementary to the safety training given to the workforce in the nuclear industry or in other sectors working with radioactive sources. While the latter safety training is work related, tuned to concrete working conditions and often organized by (and in) the companies, the safety culture training for managers approaches safety as a risk management issue. As such this safety culture training for managers is largely sector independent. The training needs to address the 'management perspective' of safety culture: it will approach safety culture as a risk management challenge. The training will focus on the importance of a safety policy, ways to foster a good safety culture, management systems to manage the safety, tools to measure safety culture, consequences of inappropriate safety culture, etc. To be successful, the training should use concepts from management sciences and adopt the 'language' of senior managers. The importance of selecting experienced trainers is also outlined.

The generic module of TRASNUSAFE shall start from a universal approach to risk management: safety culture is a general challenge for organisations. However for organizations dealing with nuclear material and radioactive sources, the safety culture training also needs to include sector specific elements, such as an overview of the safety systems generally implemented in the sector, and an overview of the system of radiation protection, including attention for protection principles as optimization and justification, and techniques such as ALARA processes. This aspect is the subject of the next section.

3. Reflections around nuclear safety culture and radiological risk

[1] ALARA = As Low As Reasonably Achievable

Two reflection groups (RG) were organised within the “European ALARA Network” (EAN) and the “European Training and Education in Radiation Protection Foundation” (EUTERP) networks.

The EAN RG, mainly focused its discussions on the optimisation (ALARA) principle and how to improve the ALARA culture of ‘safety managers’. To address this issue, the RG examined the target audience who need to improve its competences (knowledge, skills and attitudes) regarding ALARA aspects. It was pointed out that the wording ‘safety manager’ is not always relevant to designate the potential trainees, especially in the medical and non-electro-nuclear industrial sectors. Therefore, the reflection group proposed to work with the following definitions of ‘safety’, ‘radiation protection’ and ‘radiation safety’:

- **(Nuclear) safety** covers actions taken to prevent (nuclear) accidents or radiological events, and mitigate their consequences. The word ‘nuclear’ safety is often connoted to nuclear industry even if the word applies to other areas (e.g. medical field, non-electro-nuclear industry).
- **Radiation protection**, sometimes known as **radiological protection**, includes scientific bases and management / organisational issues that allow to protecting people (public, patients and workers) and the environment from the harmful effects of ionizing radiation. The system of radiological protection is described in details in the ICRP recommendations (especially Publications n° 103); it is based on the implementation and respect of the justification, optimisation (ALARA) and limitation of exposures principles.
- **Radiation safety** is often considered as the protection of personnel against harmful effects of ionizing radiation by taking steps to ensure that people will not receive excessive doses of radiation and by monitoring all sources of radiation to which they may be exposed.

The application of radiation protection principles is not developed at the same level in the nuclear and the non-nuclear sectors. Most of the time, in non-nuclear industries and in the medical sector, a greater attention is given to the ‘limitation of exposures’ principle, the justification and optimisation (i.e. ALARA) principles being less known and applied. As a result, ‘Radiation protection’ is improperly perceived and reduced in these sectors to the ‘prevention of radiological accidents’ and the ‘limitation of exposures’. In the nuclear sector, the ALARA principles are often better known thanks to initial and continuous training and dedicated organisation (e.g. ALARA committees).

The EAN RG also proposed the minimum content regarding ALARA issues that would be important to add in the generic and specific modules of the TRASNUSAFE training course. In addition to the theoretical aspects, some practical examples of ALARA implementation as well as lessons learned from past radiological incidents/accidents in different sectors (‘real case studies’), would be essential. In the generic module, the RG listed the basic elements of the radiological protection system that have to be known by safety managers, and how to knowingly exercise their responsibility for the optimisation of radiation protection in their day-to-day work:

- Introduction of the historic roles of the international organisations (UNSCEAR, ICRP, IAEA, NEA/OECD, EC, etc.) in the construction of the radiological protection system and the resulting national legal frameworks;
- Potential health effects of ionizing radiations;
- Foundation of the precautionary approach (e.g. linear no-threshold model);
- Definitions of the three radiological protection principles: Justification, Optimisation, Limitation of exposures.

In addition, due consideration should be given to the practical implementation of the optimisation principle at the management level.

The RG proposed a set of case studies that should be further developed, as training material. For the specific training modules, the case studies will be selected according to the domains of activity of the trainees.

The EUTERP RG mainly focused its discussions on the justification principle and the needs for a trans-disciplinary knowledge base for nuclear safety and radiological protection. The RG agreed that there is a need for safety managers, from both the medical and nuclear energy contexts, to improve their competence base with considerations on the broader societal aspects related to the justification of activities involving exposure to ionising radiation. In particular, there is a need for them to develop insight in:

- the functioning of the concept of risk and the meaning of risk justification in society;
- the interaction between science and policy;
- the meaning of 'ethics' in radiological risk governance and the relation of ethics with regulation;
- the meaning of 'participation' of civil society and the general public in R&D and decision-making.

The EUTERP RG agreed that E&T programmes for safety managers in the medical and nuclear energy fields should dwell on a common basis dealing with more theoretical reflections and comparative analyses related to the four above presented elements (risk in society, science/policy, ethics/regulation and participation).

Consequently, the EUTERP RG recommends that the TRASNUSAFE project should consider the inclusion of specialised course modules on these elements, in the foreseen training schemes.

4. Conclusions

The findings made and recommendations formulated by the analysis of the needs and reflections around nuclear safety culture and radiological risk provide a sound framework for the design and development of the TRASNUSAFE training courses. Details can be found in the corresponding deliverables accessible on the TRASNUSAFE web page of the ENEN Association:

http://www.enen-assoc.org/en/training/for-nuclear-community/efts-fp7/trasnusafe-fp7.html.

References

[1] Agra, Y. and Recio, C. "*Patient Safety Culture Report focusing on indicators*", European Union Network for Patient Safety (EUNetPaS), 2010, 54 p.

[2] UK Health and Safety Executive, "*Safety Culture: A Review of the Literature"*, HSL/2002/25, 2002.

[3] INSAG-15, "*Key Practical Issues in Strengthening Safety Culture"* , A report by the International Nuclear Safety Advisory Group, IAEA, 2002, 32 p.

[4] INSAG-24 "*The Interface Between Safety and Security at Nuclear Power Plants"* , A report by the International Nuclear Safety Group, IAEA, 2010, 39 p.

[5] IAEA Safety Standards *"Fundamental Safety Principles"*, Safety Fundamentals, No.SF-1, IAEA, 2006, 37 p.

[6] IAEA Safety Standards *"The Management System for Facilities and Activities"*, Safety Requirements, No.GS-R-3, IAEA, 2006, 43 p.

[7] IAEA Safety Standards *"Application of the Management System for Facilities and Activities"*, Safety Guide, No.GS-G-3.1, IAEA, 2006, 146 p.