MONITORING THE EFFECTIVENESS OF THE TRAINING PROGRAM IN RADIATION PROTECTION, SAFETY, SECURITY AND ENVIRONMENT AT THE BELGIAN NUCLEAR RESEARCH CENTRE SCK•CEN

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ABSTRACT

The Belgian Nuclear Research Centre SCK•CEN is one of the largest research centres in Belgium with more than 60 years of experience in nuclear science and technology. Continuous Professional Development activities are offered to SCK•CEN employees with the objective to maintain and increase the competences of the employee in order to optimize the output and wellbeing on the workfloor.
Given the nature of the SCK•CEN activities, a compulsory training program in radiation protection, safety, security and environment is organized for all employees. The training program consists of a mixture of On the Job Training, face-to-face training and e-learning. The content of the training program is adapted to the type of activities of the employee. Lecturers of the SCK•CEN Academy develop the training material and teach the face-to-face training sessions.
In order to evaluate this training program, information is gathered on two levels. On the one side the reaction of the participants to the training is monitored through their feedback shortly after the training course. On the other side the degree to which the participants have acquired new knowledge is measured.

1. Introduction

SCK•CEN performs research on themes that are important for the society of both today and tomorrow and delivers services to industry, healthcare, government and other third parties. Through the SCK•CEN Academy for Nuclear Science and Technology education and training activities are provided at national and international level, covering all topics that are part of the R&D portfolio of SCK•CEN. For all employees and PhD students a program for continuous professional development (CPD) is foreseen. This is centrally organized by a unit called the "SCK•CEN Learning Centre". The Learning Centre is responsible for the development and implementation of the policy on CPD actions, as well as the management and practical organization of the associated training activities.

The SCK•CEN Learning Centre works on all aspects of corporate training activities: from collecting and analyzing training needs, determining the offer of training activities, contacts and negotiations with suppliers, towards registrations and practical organization of events, until the monitoring of attendance, analysis of the feedback and verifying the efficiency and effectiveness of the training activities.
Safety is a key priority at SCK•CEN, next to values like responsibility, excellence, innovation, integrity and sustainability. All training activities of the Learning Centre are organized in four categories:

- Safety, security, environment, health, quality
- Scientific and technical competences
- Personal and management competences
- Your professional environment

Each of them pay attention to topics that reflect the main activities of SCK•CEN and cover all needs of the SCK•CEN personnel in order to maintain and extend their competences. Specifically towards safety, security and environment, a dedicated introduction session was introduced and CPD activities are organized on a regular basis. The aim is to increase safety on the work floor and embed our employees in the company safety culture.
This article focuses on the learning pathway in the framework of radiation protection, safety, security and environment for new employees at SCK•CEN.

2. Training program in radiation protection, safety, security and environment

2.1 Target public

All persons requiring access to the technical domain for work purposes (excluding visitors) follow an on-line information session on general safety procedures, complemented by specific modules relevant to the work the person will be carrying out at the technical domain. This is also mandatory for new (temporary) employees or external persons spending at least six months at SCK•CEN. In addition to the information session, the personal supervision plan describes other training courses and information sessions to be followed within a certain time frame. These are tailored to the tasks and responsibilities and the specific risks the person is exposed to during his/her job. Typical industrial hazards associated with the working environment at SCK•CEN are, among others: fire, mechanical, heavy loads, chemical, electrical, mining,… Due to its nuclear activities, radiation hazards are also part of the working
environment at SCK•CEN.

The staff at SCK•CEN consists of researchers, engineers, technical staff and administrative staff. About half of the personnel holds an academic degree, but a large part of the personnel does not have a specific nuclear background. This has implications on the type and level of training courses that are organized. A distinction can be made between personnel that is professionally exposed to ionizing radiation due to their daily activities (access to controlled areas), and members of the personnel that are not exposed professionally. The professionally exposed personnel is treated as a special target group in the E&T strategy of SCK•CEN.

2.2 Description of the training program

2.2.1 Training program for new employees

The compulsory training program for all new employees with a contract of 6 months or more consists of four parts, which are described below:

1. On-line information sessions to obtain access to the technical domain
2. On-the-job training for professionally exposed personnel
3. Introduction session
4. Dedicated training courses on radiation protection, safety, security and environment

On-line information sessions to obtain access to the technical domain
SCK•CEN organizes on-line information sessions on safety that are compulsory to every member of the personnel and persons who regularly enter the technical domain. The purpose of these information sessions is to familiarize the target audience with the general safety procedures at SCK•CEN, and to promote safety culture in the daily work of each individual. The content of these information sessions consists of a specific combination of modules depending on the work to be carried out. Ten separate modules are available: emergency situations, environment, security, radiation protection, fire hazards, personal protection means, dangerous goods, signalization, electricity and working at heights.

A combination of learning methods is offered in these information sessions. The information is distributed through e-learning modules that are available on the public SCK•CEN website. Complementary to that, the information is also available by means of a brochure. In order to assess whether the individual has grasped all information, an obligatory test is performed at the main entrance of SCK•CEN prior to access being granted. The test consists of a number of multiple-choice questions about the safety modules. In order to get access to the technical domain, the individual has to obtain a minimal score of 70%. In order to refresh the knowledge, skills and attitudes related to the safety topics mentioned above, the on-line information sessions and the test with randomized questions have to be repeated on a yearly basis by every member of the personnel of SCK•CEN and the external workers.

On-the-job training for professionally exposed personnel
There is an inevitable delay between the first day of being exposed to ionizing radiation and the associated risks, and attending a training course in radiation protection. Therefore, newcomers who are classified as professionally exposed personnel have to report themselves to the radiation protection officer responsible for the controlled area where they will work in the first work week. This radiation protection officer provides a guided tour in the installation and associated controlled area(s), focusing on the principles of good conduct in a controlled area. This involves actions to prevent contamination and irradiation, use of PPMs, use of personal dosimeters, measurements and decontamination, management of radioactive waste and transport, local contact persons, and specific emergency alarms and procedures. The personal contact with the local radiation protection officer facilitates getting acquainted with the local safety culture. Individual access to the controlled area is coupled to the successful completion of this on-the-job training.

Introduction session
New employees are invited to an introduction session covering different aspects about their new working environment. During a two-hour information session, the employees receive a general introduction to the mission, research tracks, technical installations and safety management of SCK•CEN. In a second part the supporting services at SCK•CEN are introduced from a practical point of view. This introduction session needs to be attended during the first months of employment. Attendance is registered by the Learning Centre and reported to the management.

Dedicated training courses on radiation protection, safety, security and environment
In addition to the entrance procedure and the introduction session, and within the first six months of employment, the new employees attend a face-to-face training course on radiation protection, safety, security and environment. As mentioned before, a distinction is made between personnel that is professionally exposed to ionizing radiation due to their daily activities, and members of the personnel that are not exposed professionally.
For the latter a training module of 3 hours is provided covering radiation protection and safety culture at SCK•CEN. This module aims at providing a low-level insight into ionizing radiation and its applications, the general framework of radiation protection and the safety culture at SCK•CEN. An 8 hour training module on radiation protection is offered to the professionally exposed persons, providing basic knowledge, skills and attitudes on ionizing radiation and its applications, detection and dosimetry, biological effects of ionizing radiation, and regulation on radiation protection and safety. This course module includes a 1,5 hour practical session on how to work with ionizing radiation.
Training modules on industrial safety, nuclear security and environment, each 1,5 hours, are generic for all new employees.

2.2.2. Refresher training

As mentioned before, each employee at SCK•CEN is obliged to take the randomized safety test each year. The content of the test is linked to the safety animations available online.

Next to this test, each employee will be asked to renew their knowledge, skills and attitudes on radiation protection, safety, security and environment by following a face-to-face refresher course on these aspects. The radiation protection module of this training course is reduced to 1 to 1,5 hour and covers a summary of radiation protection fundamentals, safety, safety culture and risk management. The other training modules on industrial safety, nuclear security and environment are identical to the initial ones.

2.3 Learning Management System

In order to register and monitor all CPD activities of the personnel, the SCK•CEN Learning Centre has developed a customized database. This tool allows the management of the practical organization of the training sessions, the registration of participants and the use of various reporting services. To increase awareness of the importance of training courses and its impact on safety, each member of staff has access to a personal webpage, showing the training courses they have attended in the past, including the validity of relevant certificates or qualifications. In close collaboration with the Internal Service for Prevention and Protection at Work (ISPPW), the Learning Centre coordinates the organization of training courses related to the risks in the working environment. Many of these courses have to be followed in the framework of qualifications, meaning that certificates have to be acquired before certain tasks can be executed. The certificates, including the respective deadlines, are also managed by the Learning Centre.

2.4 Lecturers

For customized training courses aiming at improving competences of SCK•CEN personnel working with radioactive materials or managing nuclear activities, the Learning Centre collaborates with the SCK•CEN Academy for Nuclear Science and Technology [1]. Founded in 2012, the Academy coordinates and strengthens all education and training activities of SCK•CEN, collecting more than 60 years of expertise and experience gained from different research projects. Among the SCK•CEN Academy lecturers, about 150 SCK•CEN staff members in total, are physicists, biologists, medical doctors, engineers, technicians and social scientists who all bring insights and ideas from their specific background into the course programs.

2.5 Evaluation of the training program

In order to determine the efficiency and effectiveness of training courses, an evaluation is performed using the Kirkpatrick training evaluation model [2]. This evaluation model contains four levels of evaluation and can be used to evaluate any kind of training. The first level, reaction, evaluates the degree to which participants find the training favorable, engaging and relevant to their jobs. Level 2, learning, measures the changes in knowledge, skills and attitudes with respect to the training objectives. The third level, behavior, evaluates the degree to which participants apply what they learned during training to their jobs. The fourth level, results, evaluates the degree to which the targeted outcomes occur as a result of the training. The training program in radiation protection, safety, security and environment is evaluated according to level 1, level 2 and to a small extent level 3 of the Kirkpatrick model.

Shortly after the end of each training course that is organized by the Learning Centre, participants receive a link to an online feedback form. This survey mainly assesses the reaction of the participants to the training and contains some questions that are related to level 2 (learning) and 3 (behavior). Participants are asked to evaluate, amongst other things, the content, trainer, course material and organization. Specifically for the radiation protection course for professionally exposed personnel (8 hours), a pre-post test was designed to assess the learning of the participants. At the start of the course, the participants receive a multiple-choice test (pre-test) with 12 questions that reflect the learning objectives. At the end of the course, the participants get a similar multiple-choice test, containing some questions

that are repeated from the pre-test and some additional questions. The learning gain is determined through a comparison of the scores on the pre-test to the scores on the post-test, with special attention for the repeated questions.

2.6 Online learning

With the objective to increase the flexibility for the participants and to increase the effectiveness of the training, a significant amount of online learning will be introduced in the training program. The online course will consist of a combination of instructor-led videos, interactive content, multiple-choice questions and small exercises. The learning management system will be used to offer the online courses and to analyze the training course. Information will be stored on the progress of the participants, the score on the tests and the time it took to finish the course. In order to maximize the impact on the skills and attitudes of the participants, a face-to-face closing session will be organized for all participants that have completed the online course. The degree of effectiveness of the face-to-face training will be compared with the effectiveness of the e-learning training, by applying the same methodology as is applied currently.

3. Conclusion

The new learning pathway for new SCK•CEN employees, with course modules on radiation protection, industrial safety, security and environment, was launched in September 2015. Feedback related to efficiency and effectivity was requested to all participants. Overall, the training courses were perceived positively by the participants, mentioning good applicability to the daily work environment and clear and up-to-date information. Learning was quantified in the difference between the score on the pre-test to the score on the post-test.

The organization and follow-up of CPD in general and specifically on radiation and industrial safety, customized to the needs of every member of the personnel at a large nuclear research centre like SCK•CEN remains challenging. Being a national research centre in Belgium, the sessions have to be offered in three different languages with a limited pool of lecturers. Furthermore, the heterogeneity of the workforce of SCK•CEN requires the content of training courses to be adapted to a mixed audience. The training course content was setup to begin with the basic fundamentals of radiation and industrial safety. Specialized training courses can be followed optionally or mandatory according to the local or regulatory requirements, or depending on the job description and associated competences needed.

4. References

[1] http://academy.sckcen.be/
[2] Kirkpatrick. D.L. (1959). Techniques for Evaluating Training Programs. Journal of the American Society of Training Directors, 13, 3–26.