INSTITUTE OF PROTECTION AND NUCLEAR SAFETY

ASSESSMENT OF JOB TRAINING PROGRAMMES

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authors:
H.Faber
E. Desmares

B.P.6 - 92265 FONTENAY-AUX-ROSES CEDEX FRANCE
Télex : SURIN 270049 F - Tél. standard : 46.54.70.80

Tél. : (1) 46 54 80 71
Fax : (1) 46 54 88 40

1 - INTRODUCTION

The skills of the workers responsible for operating and maintaining nuclear installations constitute an important factor in controlling operational safety. Therefore, it is essential for the operator to develop the skills required. As a result, assessing the training system is an important part of assessing safety.

The IPSN has developed a method for assessing the efficiency of the operator's training system. As the operator is responsible for skills assessment, it was the training process developed by the operator which formed the subject of this assessment.

In this document we describe the model which was used as a basis for assessing the training process. This process covers all the conventional aspects such as training courses, classes etc. as well as all other means of acquiring and imparting skills such as on-the-job training, shadow training, informal talks etc. The information results from the implementation of this assessment method

In general, the IPSN sees skills development as a dynamic process which cannot ever be considered complete. This approach requires the results to be verified regularly in relation to the fixed objectives. If necessary needed this verification should be followed by an adjustment of the objectives. One of the aims of the IPSN skills assessments is to ensure that the system of acquiring skills set up by the operators takes this aspect into account and adapts to the innovations and changes in the socio-technical system.

2 - ASSESSMENT FRAMEWORK

It must be borne in mind that in France the nuclear operator is responsible for the training and the qualification of personnel. The French safety authority does not participate in the workers training procedure. That is to say, it does not impart skills to the workers, instead it evaluates the training procedure itself. The IPSN has a mission of technical assistance to the safety authority and carries out assessments in this area on its behalf.

The employee training procedure may be assessed in various situations:

- installation under commissioning,
- integration of computerised (sub)systems into the existing installations,
- setting up new operating or maintenance procedures,
- etc.

The aim of this assessment is to verify that the methods and means set up by the operator are sufficient to ensure that the relevant people permanently possess the skills to control the functions relating to their areas of responsibility. This principle also means that for each function, both **objectives in term of skills required** for carrying out safety-related tasks and the **means to acquire these skills** will be set.

3 - OPERATIONAL DEFINITION

The skills acquired by the workers in charge of running and maintaining a nuclear installation must enable them to make the decisions that fall to them to guarantee the safety of the installation at all times. If the word skills is a wide-ranging term, it is however, necessary to define it precisely. M. de Montmollin offers the following definition: *"skills are the organised set of knowledge, know-how, representation, and reason that each person makes use of to accomplish a specific task"*. (Ref.1). This shows that skills do not have a specific definition, even though each person reflects them in their professional practice.

4 - METHODOLOGY USED FOR ASSESSMENT

4.1 - Assessment Model

The IPSN has developed a model to monitor and analyse the operator's training activities. The aim of the assessment is to give an opinion on the operator's training process in relation to the safety demands of operating. The first stage in this assessment is to make the operator establish his approach. The second stage is to analyse the efficiency of the system set up by the operator.

The function of this model is not to make recommendations to the operator. It is solely designed for assessing. Specifically, it concerns an analysis of the options chosen and/or the actions undertaken or not by the operator, in relation to each of the stages covered in the model.

4.2 - Basis for the model

The model which has been developed is based on several considerations:

- On the one hand, the IPSN considers that the process for developing and implementing training systems must follow an iterative cycle.
- On the other, the IPSN believes that this cycle must cover both the overall training policies (corporate or macro level) as well as the individual projects (operational depatments or rmicro level).

The training cycle can be represented by a double loop (Figure 1) which represents the two levels, both macro and micro, and is characterised by the following four phases:

❶ Definition of a target situation[1]
❷ Specification of a programme which will allow the target situation to be reached
❸ Implementation of the programme
❹ Experience feedback

The progression of the training cycle made up of these four phases must enable the target situation to be reached. The actions in each of the four phases must be suitably defined. At the end of the cycle, experience feedback enables the means used for training to be evaluated, the target situation to be adjusted, or a new one defined. That is the beginning of a new cycle. In an industrial operating situation, successive cycles follow at a set frequency.

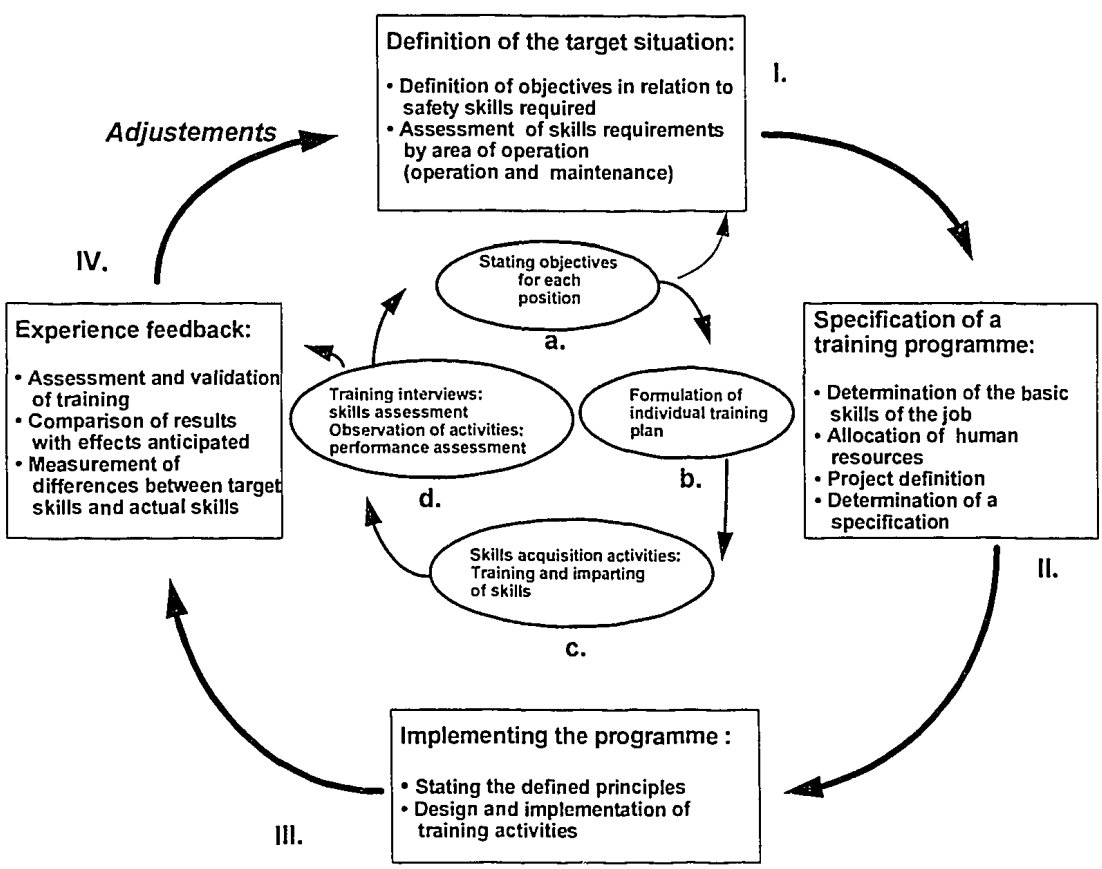

Figure 1 - The double loop shows the two levels, micro and macro, of the training process.

[1] In the IPSN's approach, the "target situation" is defined as the set of skills which must be brought together to ensure safe operation of nuclear installations.

4.3 - Application Procedure

- Analysis of documents

In order to assess the operator's contribution to each phase of the training cycle, the IPSN analyses reference documents supplied by the operator. These documents must describe all the measures taken to develop the skills of the workers responsible for the operation and maintenance of the nuclear installation.

- Interviews

This assessment consists of visits to the plant, to the personnel training centres and to the vendors' facilities. The aim of these visits is to meet with the personnel concerned, with their operational management which has a particular responsibility in the area of skills development of their collaborators and with the operational support in the field of training. In general, this support is supplied by engineers responsible for training in each department, the functional departments at plant and corporate levels and in training centres. In this way the IPSN aims to be aware of any discrepancies that may occur between the target situation defined in the training specification and the "on-the-job" reality (the real activity of operators and technicians).

5 - APPLICATION OF THE ASSESSMENT MODEL

The loop in Figure 2 shows the macro level of the progression of the four phases of the skills development cycle that the IPSN uses to analyse the procedure implemented by the operator.

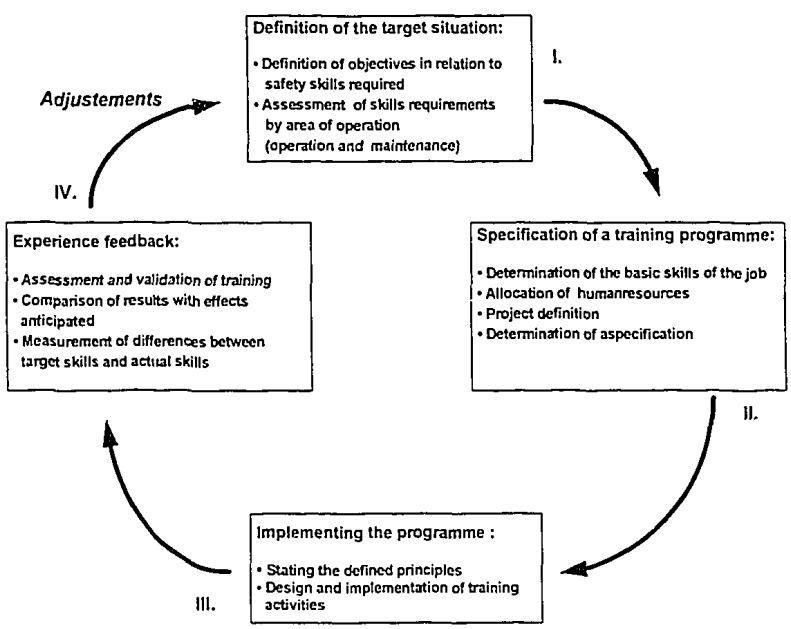

Figure 2 - the loop shows the macro level of the training process

5.1 - Definition of a target situation in relation to skills

Establishing the target situation constitutes a delicate phase in any training process. This is even more the case when this process regards the skills required for operational safety because to establish the target situation, all these skills must be identified in order to control all the situations which could occur with widely differing degrees of probability. The description of the skills required (sometimes called the "job referential of skills ") constitutes an important reference basis in the assessment context. The IPSN considers that it is not enough to establish a referential in advance, but that it must be validated by experience, and that taking experience feedback into account enables the target situation to be more precisely established by a process of successive iterations.

Currently, the IPSN draws upon the knowledge it has gained from its experience in the area of nuclear safety assessment to assess the sets of basic skills suggested by the operator. The opinion resulting from this assessment includes the measures taken by the operator to utilise experience feedback (see §5.4) for optimising the set of basic skills.

One of the aims of the IPSN at this stage is also to verify that the "target" skills that the operator has set itself are compatible with the established organisational framework. This obviously requires the functions as well as the activities which their operators must carry out to be established.

5.2 - Specification of a training programme which will allow the target situation to be reached

In the initial phase, the target situation was expressed in terms of skills required to practice and master a function. The following phase involves in particular, establishing the content of the training programme and its components. However, the training programme can only be approved if the functions are defined in a certain amount of detail. This is because the mastering of each aspect of the position corresponds to a required level of skill.

To establish the training programme, the skills required for each function are described in terms of the knowledge and ability which must be acquired and of the methods to be implemented to enable these knowledges and aptitudes to be achieved.

In this phase, assessment consists of identifying and analysing the means employed by the operator to set the specifications of its training programme. The training programme specifications arise from the establishing work carried out beforehand. They constitute some of the elements to be analysed.

One important aspect to take into consideration is the level of knowledge that the workers already possess. When this knowledge is part of the initial knowledge necessary for a certain function, it is stipulated in the "prerequisite" conditions of the position. These conditions constitute the job profile, the description of which helps to allocate human resources to the jobs (recruitment, career management).

In assessing this phase, the IPSN analyses the way in which the operator includes these elements in engaging the training programme.

5.3 - Implementing a training project

In this phase, the training programmes established in the preceding phase must be carried out according to the methods also stipulated there. Whether it consists of classroom training, practical training, for example on a simulator, or on-the-job shadow training, this phase is the most "visible" for the people involved, as for them it leads directly to the result, i.e. "skills acquisition".

In accordance with the system chosen for training, the assessment leads either to examine files, to carry out interviews with trained workers and their superiors or even to make observations in the training centres or at the work stations if it concerns shadow training.

5.4 - Experience feedback

One of the main objectives of a training course is accreditation. Throughout the training activities, assessments must verify if this objective will be met. This enables possible stumbling blocks to be detected and overcome.

Experience feedback has a double objective:

- to validate the suitability of a training programme for the people following it.
- to fine tune the fixed (quantitative and qualitative) objectives concerning training at the beginning of a cycle depending on the results obtained.

Depending on developments observed during the operating phase (new technology, new procedures and new organisations), the initial objectives must be adjusted in terms of skills required. It should be noted that the skills required may be reviewed in two ways, i.e. increased demands or diminished demands.

At this stage of assessment, the IPSN bases itself on the *indicators* used by the operator to judge the effectiveness of the training process and on the *data gathered* from experience feedback. A form of experience feedback implemented by the IPSN during assessment is the "course training review", where the participants in the courses give "on the spot" feedback on the training activity they participated in. These course reviews provide experience feedback on the training itself. However, this form of experience feedback has its limitations, as it does not deal with matters relating to putting this newly acquired knowledge into practice.

5.5 - Moving from the macro level to the micro level

Figure 3 shows the second loop, corresponding to the procedure set up on the individual level.

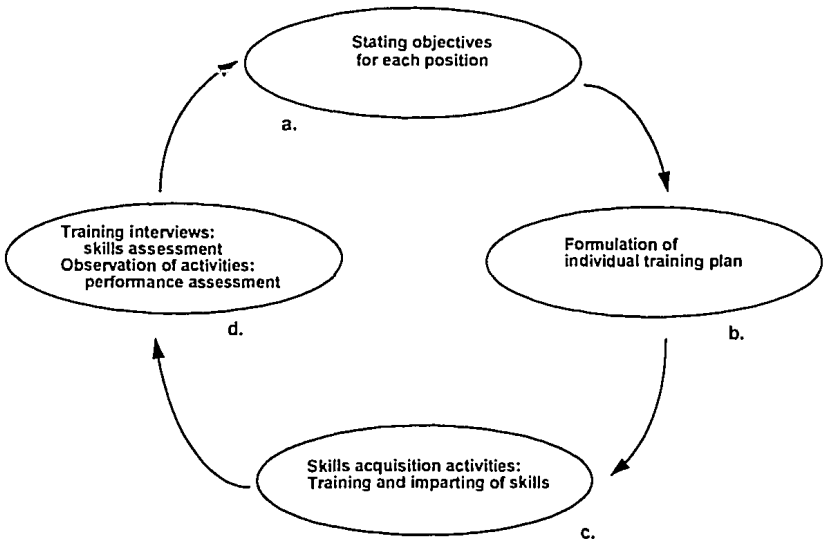

Figure 3: the loop shows the micro level of the training process

5.6 - Translation of the collective objectives to the individual level

On the macro level, the target situation objectives in terms of skills are established for a whole group of people. On the micro level, these objects must be transferred to an individual scale. The individual objectives must be stipulated in the context of the general objectives. As a result, they deal with whatever each individual needs in order to acquire the skills he is required to have in the field of safety.

These objectives must appear in each specific training plan associated with a post. It being given that an individual does not begin at zero with regard to skills, the objectives are fixed for him to overcome the discrepancies between the objectives set in the collective training plan and his actual skills.

An example of an individual objective is to have acquired by a certain date all the necessary skills to be able to receive the nuclear safety accreditation. However, when the individual objectives are being fixed, the potentiality of failure has to be taken into account.

5.7 - Formulation of an individual skills development programme

The objectives in terms of skills to be acquired by each individual, as well as possible shortfalls at the level of initial training (initial studies completed by professional experience or by continued training) must be dealt with by individual training

programmes. The progression of these programmes must bring the worker up to the skills level required by the function he has to carry on.

The IPSN assessment in this phase focuses on the method for developing individual training programmes.

In this assessment, the IPSN observes that the operator relies on the individual skills reviews to develop its programmes. The priority areas where individual skills have to be expanded are identified. These reviews take into account the discrepancies observed between the objectives of the specific training programme and the skills acquired by the worker. The IPSN judges it necessary for programmes developed in this way to take into account the particular limits on the amount of knowledge that each adult can assimilate.

5.8 - Implementing a training programme

This third phase consolidates the previous two phases. The skills acquisition programme must progress at a speed which leads to optimal integration of the subjects learned. This phase of apprenticeship and perfection is carried out according to the conditions established at the macro level.

For this phase of assessment, the IPSN takes into account the educational criteria used by the operator to choose the way of optimising the transfer of knowledge.

The IPSN observed in particular, that this phase can comprise training courses but also participation in certain "real" activities. This approach is frequently used in the commissioning phase of an installation, in particular establishing relations simply by a shadow training system between the installation's operations workers and site management organisation workers or even vendor personnel.

Shadow training requires the already qualified personnel to posses a certain teaching "skill" to carry out these activities. If this is the case, these educational situations help the transfer of skills required to master these activities.

In this respect it appears that the operator does not systematically ensure that the workers involved in tutoring in the shadow training system are well qualified technically.

5.9 - Assessment of skills acquired by workers

Above all, training must enable the workers to reach the level required to guarantee their functions, including safety of the installations in operation. The performance of the workers can be observed through the results obtained from their work. Their behaviour when faced with safety-related problems constitutes a permanent indicator for their superiors. This experience feedback must be carried out by the management directly responsible for it.

In this phase of assessment, the IPSN emphasises above all the relevance of the criteria used to assess the performance of workers in the area of safety and the treatment of discrepancies.

The observations made by the IPSN have enabled the means used by the operator to formalise the skills acquired and those to be acquired by the workers to be verified. "Performance review" interviews take place between the management and its staff. Through these interviews the operator is able to gauge the skills acquired by each worker at an individual level, depending on the training programmes in which he has participated, and the experience that carrying out his functions has given him. These interviews enable the individual training programmes to be adjusted, depending on the skills already acquired, being acquired or to be acquired, in order to contribute to the performance of the worker in his position.

5.10 - Adjustment of the collective and individual objectives of skills development

The two loops, corresponding to the macro and micro levels, can not exist independently of each other. Figure 1 shows the way the two loops interact. Interaction between the micro and macro levels occurs mainly at the establishment of the target situation phase and at the experience feedback phase.

The expression of the general objectives at the individual level constitutes a vital link for implementation of job training programs within the established policy. As regards the individual skills reviews, it is thanks to the overview of all these reviews that experience feedback can be supplied and the training adjusted. On the macro level, training management or human resources management uses this experience feedback to adjust the collective objectives and to establish its training policy for a new cycle.

The IPSN has verified the existence of an active link between the individual interviews and the experience feedback, that may have a bearing on the system as a whole. The observation made is that interaction between the two levels is not sufficiently explicit. In fact, the operator is not in a position to verify the balance between the aimed skills, the skills which are actually required and the skills acquired.

6 - RESULTS OF ASSESSMENT AND DISCUSSION

The model was used for the assessment of the training procedure designed for the operation and maintenance personnel in an installation under commissioning.

On the basis of experience acquired while using this model, it appeared that the assessment needed focus on a few key points of the cycle as it is shown. In particular, the objective assignment and experience feedback stages are those in which the resources used for assessment have to be substantial.

It could be sufficient to analyse these two stages to obtain an assessment of the operator's training system. However, in practice, it appears that the overall model we proposed constitutes a broader conceptualisation of the training process than that initially proposed by the operator. In the context of the assessment described above, this model becomes a common frame of reference accepted by the assessor and the operator which makes communication between the two parties, and therefore analysis, considerably easier.

Having established this context for communication, certain problems were quickly identified and discussed with the operator. For example, to deal with a discrepancy between the objectives set for certain training modules on a simulator and the procured assimilation, the IPSN suggested to the operator that assessment of understanding and practice of trained principles be carried out by the instructors.

CONCLUSION

The experience acquired by the IPSN through several assessments relative to nuclear installations, has served to highlight the importance and the difficulty associated with establishing objectives for a training system which will guarantee the permanent safety of the installation. Another difficulty is that which consists of adapting the objectives to the workers' training courses.

Training objectives must be adjusted in accordance with experience feedback. It is through a dynamic skills improvement procedure that we can improve safety.

REFERENCE

[1] *"L'intelligence de la tâche; éléments d'ergonomie cognitive". M. De Montmollin. Berne, Peter Lang, 1984.*