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Analysis phase of systematic approach to training (SAT) for nuclear plant personnel

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FOREWORD

The IAEA and many Member States have recognized the benefits of a systematic approach when training nuclear plant personnel. The Systematic Approach to Training (SAT), fully described in the IAEA publications, is recommended as the best practice for attaining and maintaining the competence and qualification of NPP personnel. Typically, SAT is organized into distinct phases of Analysis, Design, Development, Implementation, and Evaluation, and relies on Feedback as a process for continuous improvement. While some Member States have adopted comprehensive procedures and methods to implement their chosen approach to training, others have used less rigorous "graded approaches" that limit formality and resources yet adhere to an overall systematic approach. This is particularly true for the Analysis phase of SAT, which can be very resource intensive.

The intention of this publication is to provide Member States with examples of the Analysis phase to form the foundation of SAT-based training programmes. Although methods of analysis vary, the results of the analyses included here provide information to assist readers to design, develop, implement, and evaluate training for the jobs, tasks and responsibilities under consideration.

This publication was initially drafted by the IAEA Secretariat working with a team of consultants. Data was later gathered from Member States and reviewed by the consultants with further contributions received from an Advisory Group meeting. The results are presented here to reflect actual practices used to perform analysis for nuclear training programmes.

This TECDOC will prove useful for, and is addressed to, nuclear power operating organizations facing the challenge of developing training programmes for their own personnel. This publication is available in two formats — as a conventional printed publication in English, edited into a common style from the contributions of Member States, and also as a compact disc (CD) containing Member States' original contributions which, in some cases, contain additional material in their national language.

Appreciation is expressed to all Member States and individuals who contributed data on the Analysis phase of SAT, especially to R.J. Bruno, J.-C. Hazet, A.Yu. Kazennov and J.A. Yoder, all of whom also assisted in reviewing the data. Particular thanks are due to C.R. Chapman and A.Yu. Kazennov for reviewing the report. The IAEA officer responsible for this publication was A. Kossilov of the Division of Nuclear Power.

EDITORIAL NOTE

CONTENTS

1. INTRODUCTION

1.1. PURPOSE OF THE PUBLICATION

The purpose of this publication is to offer examples of and methods used in the Analysis phase of the Systematic Approach to Training (SAT) for nuclear plant personnel. There is no intention to judge or imply that one method is preferable to another. This publication is available in English, in a conventionally printed format, and also includes a compact disk (CD). The CD contains some additional data contributed by Member States in the national language of the contributor. It is intended that this publication will provide useful information for anyone who has chosen to use SAT for the training of their nuclear plant personnel.

1.2. SYSTEMATIC APPROACH TO TRAINING

A SAT is presented in great detail in several IAEA publications. For the purpose of this publication, readers should refer to Refs [1] and [2]. SAT typically is described in terms of five phases: Analysis, Design, Development, Implementation, and Evaluation; practice demonstrates that all phases are necessary and critical to the success of this approach. It is assumed that readers are familiar with SAT and the use of terms and concepts presented in this IAEA publication.

1.3. SCOPE OF THE PUBLICATION

The international nuclear training community has accumulated a wealth of experience on SAT, including the Analysis phase. The IAEA Member States have been able to exchange and debate this experience and develop various methods of undertaking the Analysis. By means of this publication the Member States are able to share this experience with others by offering examples of methods of Job Analysis that are currently in use.

This publication emphasizes the importance of the Analysis phase of SAT; it describes various methods of Job Analysis in common use and, in the Appendices, gives examples that have been provided by IAEA Member States. References are given to other publications relating to the Analysis phase.

1.4. THE ANALYSIS PHASE OF SAT

The Analysis phase comprises the identification of job-specific knowledge, skills and attitudes required to competently perform a particular job. Indeed, most new training programmes begin with Analysis and proceed with the other phases; mature programmes commonly use Analysis as part of the revision control process to maintain and improve existing programmes and materials. As a starting point for new programmes, and as a significant part of maintaining existing programmes, it is clear that Analysis is a critical activity that can be time consuming but, nevertheless, must be performed accurately and without unnecessary expenditure of resources.

The purpose of the Analysis phase is to determine training needs and identify job-specific training requirements. Data generated in the Analysis phase is essential and is an important input in developing explicit training objectives and any associated training materials. Analysis properly completed will provide a reliable basis for job or performance oriented training, for quality training, and for qualified and licensed personnel. Moreover, experience has shown that utilities can derive significant additional benefits from carefully considered Analysis, such as upgrades to plant procedures and job descriptions, modifications to plant systems, establishment of clear expectations for personnel performance, and improvement of personnel selection, recruitment and evaluation systems.

The ultimate goal of a SAT project is reliable and effective training implementation, not merely Analysis. An optimization should be achieved. Training programmes derived from insufficient analysis may miss their target, and ultimately omit the correct scope or depth. Alternatively, attempts to derive training programmes from analysis efforts, that strive for perfection to analyze jobs, activities, tasks or competency, have quickly found that the resources to accomplish such an effort are beyond the scope of most organizations. The administration of nuclear training programmes reflects the reality of both ends of this spectrum, as shown in the examples provided in the Appendices.

1.5. INFORMATION TECHNOLOGY

During the Analysis phase of SAT a considerable amount of data is typically generated. It has been found useful at some plants to purchase or develop software programs to establish a database to aid the recording of analysis information and to provide a link to the training data developed in other phases of SAT. While this is a consideration in beginning the Analysis phase, it should not preclude the initiation of the effort. Experience with the Analysis phase methods selected and adapted for plant specific use will help to identify the particular needs and database design requirements. In addition, other Member States can be contacted for information about the specific software programs that are used and their potential usefulness. Having a database also facilitates the routine maintenance and updating of the analysis information that are necessary as a result of future plant design changes, procedure changes or other changes that may occur in the duties and responsibilities of different job positions within the plant organization.

2. DESCRIPTION OF METHODS

2.1. SELECTION OF AN APPROPRIATE METHOD FOR ANALYSIS

The Analysis phase of SAT provides the core information essential to establish training programmes that are job-related and performance-based. There are several different methods of analysis, each having merit when applied appropriately. The two most common methods of analysis are referred to as Job and Task Analysis (JTA) and Job Competency Analysis (JCA). Correctly applied analysis is cost-effective in the long term because it ensures that training resources are used effectively to identify only those tasks or activities and related competencies that need to be formally included in a training programme. The Analysis phase consists of Job Analysis and either Task Analysis or Competency Analysis.

In order to present a broad picture of the analysis methods employed, the following explanations for the readers may be useful. Based on the national or corporate practices, the performers of the Analysis phase are using the notions “competency” and “competencies” in different meanings. For example, in some Analysis phase applications one can find the treatment of:

- competency as a group of related knowledge, skills and attitudes needed to perform a particular job;
- competency as the areas of personal capability that enable the individuals to perform successfully in their jobs by completing task effectively;

- competency as the ability to perform the activities within an occupation or function to the established standards;
- competencies as a competency in plural in broad meaning;
- competencies as the groups of related knowledge, skills and attitudes needed to perform a job in an effective manner to an established standard;
- competencies as the abilities to perform the activities or generally stated tasks to the established standards.

In order to as much as possible present the practices of various countries, utilities and organizations, the above mentioned notions "competency" and "competencies" are used in rather broad meanings in this TECDOC providing the opportunities for the readers to recognize a specific meaning from the context.

Job analysis is a systematic technique used to obtain a valid Task List or competency list for a specific job (e.g. a maintenance mechanic). A job can be divided into functional units called Duty Areas. A Duty Area is a distinct major activity involved in performing the job (e.g. a Duty Area for a maintenance mechanic could be maintaining pumps and fans). Duty areas are convenient in organizing tasks or competencies when conducting a Job Analysis. A task is a measurable, well-defined unit of work, with an identifiable beginning and end (e.g. tasks for the pump Duty Area could be: install pump, repair pump, service pump, inspect pump).

The Job Analysis process involves:

- developing a list of tasks or activities (and competencies for the latter);
- validating the list;
- selecting tasks or competencies for further analysis.

A Task or Competency Analysis is then performed to examine each task or competency, to identify the associated knowledge, skills, and attitudes (KSAs). These KSAs are then used in the Design phase of SAT to develop cognitive, psychomotor, and affective training objectives. The cognitive, psychomotor, and affective training objectives respectively identify what a trainee needs to know (knowledge), needs to be able to perform (skill), and needs to value (attitude). Many tasks require all three types of training objectives. One reason why different methods of analysis have been developed is because each lends itself, in varying degrees of difficulty, to the transition to these three types of training objectives.

An important consideration in conducting a Task or Competency Analysis is the entry level in the education and experience of personnel. The depth of analysis necessary will change depending on the requirements established for prior education and experience. For example, detailed analysis of tasks or competencies for some underlying academic knowledge in areas such as mathematics, physics, thermodynamics, etc. may not be necessary if personnel already possess this knowledge acquired during prior education. Similarly, analysis for some maintenance personnel craft skills may not be necessary if personnel are required, by the plant, to have specific craft skills prior to employment. In the future, changes in the entry level education may be significantly affected by a decrease in graduates from nuclear engineering or science related programmes. This may have a significant impact and result in the need for additional training for new employees. The ageing workforce at many plants may also place a higher priority on initial training, as these experienced people reach retirement age.

Analysis should develop sufficient information to be able, in the Design phase of SAT, to define measurable, performance-based training objectives. All methods of analysis have advantages and disadvantages, so each situation must be considered to determine the best method to use. However, while selection of an appropriate Analysis phase method is important, other factors will influence the success of the Analysis phase and subsequent training programme development — regardless of the method chosen and used; examples of the influencing factors are the experience and ability of the training staff, the availability and quality of job incumbents or experts, commonly referred to as subject matter experts (SMEs), the current quality of the training programme, availability and quality of design documentation (e.g. procedures, design descriptions), and the complete support and involvement of plant management.

References [1] and [2] contain a discussion of experience gained and lessons learned from the implementation of SAT Analysis. The Appendices to this TECDOC provide examples of data regarding resources that have been needed to undertake a wide range of SAT Analyses.

2.2. SELECTING AN ANALYSIS METHOD

Factors to consider when selecting an analysis method include the following:

- Type of job being analyzed (e.g. maintenance mechanic, department manager, operating supervisor, control room operator, etc.).
- Availability of task or competency lists for a similar job position from another plant.
- Availability of adequate job descriptions for the job position being analyzed.
- Availability of operating and maintenance procedures and instructions.
- Availability of safety analysis reports, operational experience data, system design descriptions, equipment operating and maintenance manuals, and other technical manuals and documents.
- Quality and availability of existing Qualification Documents and training materials.
- Availability of information technology to handle the data collected.
- Availability and quality of input from subject matter experts. SMEs need to be senior, experienced job incumbents or experts for the job for which training is to be developed. (This factor is generally the most important.)

2.3. FUNDAMENTAL ELEMENTS OF ANALYSIS

The following elements of the Analysis phase are fundamental requirements.

- Procedures that define the analysis process are available.
- Key facility personnel (management, SMEs; i.e. job incumbents and training staff) are trained in the process, are involved in the analysis process until it is complete, and concur with the results.
- Job Analysis is conducted to determine the tasks or activities required for job performance. Tasks are identified, documented, and prioritized according to organizational goals.
- Task or competency statements are written.
- Tasks are selected for training.
- Task or Competency Analysis is conducted (as necessary) to determine the knowledge, skills, and attitudes that are necessary for the job.
- The analysis process and results are documented and maintained current.

2.4. METHODS OF ANALYSIS

2.4.1. Job and Task Analysis method (JTA)

Job and Task Analysis (JTA) traditionally involves a combination of research, job incumbent interviews and surveys. Job Analysis typically involves the following eight steps:

(1) review available job information;

(2) select and train job analysts;

(3) develop a preliminary Task List;

(4) validate the preliminary Task List;

(5) prepare a survey or interview questionnaire;

(6) select the survey sample and conduct the survey or interviews;

(7) analyze the results of the survey or interviews;

(8) validate the tasks.

The task statements are then further analyzed to identify the job-related knowledge, skills, and attitudes. The method can be very time and resource intensive; it should be used only when sources of information such as accurate procedures, Task Lists and SMEs are unavailable, or if the job is very complex and critical to plant performance, or if other methods are considered inadequate to produce the necessary results.

The traditional JTA method can be used for any job at a plant. This method of JTA is best used for operating, maintenance, and technician jobs. In general, this method results in a good identification of necessary job skills, lower level cognitive knowledge objectives, and a very good linkage to performance-based training objectives.

References [3]–[7] contain detailed information on the traditional approach to Job and Task Analysis. Although this approach might not be used, it is beneficial if training personnel understand this more detailed method; it will help them to understand and correctly implement more simplified methods.

2.4.2. Job Competency Analysis method (JCA)

The traditional Job Competency Analysis method involves essentially the same basic steps as Job and Task Analysis. The major difference is that job activities, or more generally stated tasks, are identified. Job competency statements are then determined and analyzed to identify the related knowledge, skills, and attitudes that support the competency. The knowledge, skills, and attitudes are then generally grouped together and sequenced.

The JCA method can be used for any job position at a plant. By using traditional methods of surveys and interviewing, the amount of time needed to complete the procedure is similar to traditional JTA methods. The JCA method is best used for management and supervisory positions and for engineering support personnel. In general, the method results in good identification of higher level cognitive tasks, the abilities required to perform these tasks, and related knowledge. It also is a good method for identification of attitudes.

References [1], [8], [9] contain more specific information on the Job Competency Analysis method.

2.4.3. Table-top analysis methods

The JTA and JCA traditional methods described above can be very resource intensive. In response to this concern, “table-top” methods have been developed. Table-top analysis is a process, the success of which depends upon a small team of SMEs and a facilitator to reach consensus on job needs. Table-top methods can be very effective in quickly determining, at reasonable costs, the tasks or activities that must be performed by persons employed in a particular job. Table-top analysis methods operate on the following three premises:

- Expert workers are better able to describe and define their job than anyone else.
- Any job can be effectively described in terms of the tasks or activities that successful personnel perform in that job.
- All tasks or activities have direct implications for the knowledge, skills and attitudes that personnel must have in order to perform the tasks safely and correctly.

Table-top methods typically involve the following steps:

- Orient the team of SME's and training staff.
- Review the job.
- Identify Duty Areas — see Section 2.1.
- Identify tasks or competencies.
- Select the tasks or competencies for training — see Section 2.5.
- Perform Task or Competency Analysis, as necessary, in order to be able to develop measurable and performance-based training objectives.

Table-top methods can be used to analyze any job. The analysis typically results in identifying between eight and twelve Duty Areas or functions and from fifty to two-hundred task or competency statements that outline what a successful job incumbent must be able to do.

References [9]–[13] contain detailed information on table-top JTA and JCA methods and information on the desired qualifications of team members and the facilitator assigned to conduct either method.

Table-top Job and Task Analysis

The table-top Job and Task Analysis method involves the steps described above. This method can be enhanced by using combinations of verification, document, and templating analysis methods, described in Section 2.4.5. The development of the training objectives that support the identified tasks is best accomplished concurrently with the analysis of the tasks. In many cases, once team members have gained experience, the training objectives can be developed directly without the need to perform a detailed Task or Competency Analysis. However, it is important for the personnel who perform table-top JTA to be familiar with the traditional approaches to JTA and to be guided by an experienced facilitator.

Table-top Job Competency Analysis

The table-top Job Competency Analysis method also involves the same steps as described in Section 2.4.3 and a combination of methods described in Section 2.4.5. In addition to the use of JCA for the analysis of job tasks and activities, the method is also useful for the development or revision of job content guidelines. These guidelines typically identify, in training objective format, the academic knowledge associated with a job position. Some guidelines also contain the affective objectives that specify the attitudes and values associated with the non-technical and human factors aspects of competent job performance. Adapting these content guidelines can significantly reduce the amount of time and effort needed to design and develop content of the training programme for a particular job.

References [15]–[23] are examples of content guidelines that have been developed for typical jobs at a nuclear power plant.

2.4.4. Combination of Job and Task Analysis and Job Competency Analysis

In practice a combination of JTA and JCA can be used. The JTA method is used to identify all tasks and is good for identifying the lower level tasks, related knowledge and skills and associated training objectives. The JCA method is then useful to identify higher level cognitive tasks, related knowledge and associated affective objectives such as attitudes and values. The JCA method is also good for identifying "non-technical" competencies related to teamwork, communications, and also management, leadership and other "soft skills".

2.4.5. Techniques used to support JTA and JCA

The following techniques are generally used to support JTA and JCA. Their use can reduce the time and cost to conduct the analysis by utilizing existing materials and pre-designed formats such as templates.

Verification analysis

This technique allows training programme materials to be determined, based on work already undertaken at other plants on the same or similar tasks or topics. This process can save significant effort and cost. Communication with, or visits to, other plants will enable plants to take advantage of existing experience and materials. Analyses been already performed in nuclear industry and nuclear power, that can be adapted to nuclear plant jobs, are available for many Reactor Operator, reactor supervisor, maintenance, and technician positions. Using these lists requires the help of SMEs and a trained facilitator. These experts use the lists to decide which tasks are relevant and to identify the tasks that require modification to reflect plant-specific job requirements. Other sources of information and industry guidelines that may identify job-related training requirements include guides to good practices, technical standards, and vocational programmes.

The verification technique includes the following steps:

- Gather relevant existing training materials and task information from local and external sources.
- Compare this information to the plant-specific needs.

– Modify the information as needed.
– Verify (SMEs do this) the accuracy of the information.

References [10], [12] contain additional information on this technique.

Document analysis

This technique is especially valuable when accurate procedures and other job-related documents are available. Document analysis is a simplified technique for determining required knowledge and skills directly from operating procedures, administrative procedures, and other job-related documents. An SME and a trainer review each section and step of the procedure or document to determine training programme content.

Document analysis includes the following steps:

– Review the procedure or document and list the knowledge, skills and attitudes required by a job incumbent.
– Verify the accuracy of the results.

References [10], [12] contain additional information on this technique.

Templating

Training content can be determined by the careful review and analysis of a template (a list of plant systems, theory topics, or a list of generic training objectives). The templating technique uses a simplified process for determining content or developing training objectives associated with the operation or maintenance of a specific plant system. This technique produces generic and system-specific training objectives for use in the development of the training programme.

Some plants have approached the design of training based on the systems an individual operates or maintains. A template containing generic training objectives is reviewed by SMEs for applicability. This approach directly generates system-specific terminal and enabling training objectives. It is important that the template be carefully reviewed to determine the applicability of each item to the system. If this review is not accomplished, the technique may over-specify the training needs.

The templating technique includes the following steps:

– Develop or modify an existing template to meet plant needs.
– Use a trainer and a subject matter expert(s) to select applicable objectives and/or complete portions of the template for a given system, component, or process.

References [6], [10], [13], [28] contain examples of templates that can be used.

Functional and topic analysis

When a job requiring a broad spectrum of tasks (e.g. management or engineering) is being analyzed, a technique called functional analysis can be used. Rather than conducting a

Job Analysis to identify specific tasks, major functions of the position are identified. After the competencies necessary to perform the major functions are identified, those competencies can be analyzed to determine specific training objectives for training.

Topic analysis is a variation of this technique and can be used to identify general theoretical knowledge needed for various jobs. Functional analysis and topic analysis are both conducted using JCA. The techniques can be used to develop training programme content or to modify existing training programme content guidelines for management and supervisory personnel, training instructors, safety inspectors, engineering support personnel, and other plant positions.

Reference [3] contains additional information on functional analysis. References [24]–[27] are examples of content guidelines and training material developed using functional analysis techniques. Reference [28] contains examples of existing academic and theoretical content guidelines that were developed using topic analysis techniques.

2.5. TECHNIQUES USED TO SELECT TASKS OR COMPETENCIES FOR TRAINING

After the task or competency list is developed, it is necessary to determine which tasks or competencies require formal training and which are not so important and, therefore, do not warrant formal training. This decision has a significant impact on training resources. If the criteria for determining which tasks or competencies require formal training are too broad, a great deal of resources may be needed to design, develop, implement, evaluate and maintain training. Conversely, if the selection criteria are too restrictive, training deficiencies may occur and result in costly personnel errors. The key to an effective balance is to ensure that qualified personnel are involved in the decisions, and that criteria appropriate to plant safety and reliability are used. The qualified personnel are those who know the job, the tasks or competencies, and the associated hazards and complexity of performance.

There are several techniques for selecting tasks or competencies for training. The traditional technique for selecting tasks involves determining the difficulty, importance (e.g. impact on safety and reliability), and frequency of each task performance or competency use, and applying the results to a decision tree that rates each of these factors. Criteria, such as number of persons performing tasks or activities or the delay tolerance (the amount of time that may elapse before operator action is needed) in performing the tasks or activities, are sometimes also considered. Other techniques, such as SME discussion and consensus, can produce acceptable results for selecting tasks or competencies. However, the results of any technique used are not absolute and should be challenged, evaluated, and refined as necessary. In all cases, the results should accurately reflect job requirements and should have the agreement of competent job incumbents and management.

Regardless of the selection technique used, tasks or competencies are then typically classified into training categories. The first category is for those tasks or competencies that do not require formal training (e.g. classroom, laboratory, simulator, structured on-job training). Even though these tasks or competencies do not require formal training, acquisition of the knowledge, skills and attitudes associated with the tasks or competencies is still necessary. These knowledge, skills and attitudes are normally addressed by job-entry requirements, or are readily learned through experience as part of working in the job at the plant. Some plants also include these tasks or competencies in their on-job qualification standards or checklists to ensure they are learned while undertaking the job. The second category is for those tasks or competencies for which initial formal training is required. The third category is for those tasks or competencies that require both initial training and also need to be included in the continuing training programme (e.g. periodic retraining programme).

Sometimes an additional category of tasks or competencies is also used. These are tasks or competencies that require training, but will not be taught until that specific knowledge and skill is needed. For example, tasks or competencies specifically associated with maintenance of a complex pump could best be taught just prior to scheduled maintenance.

References [3], [7], [10], [12] contain information on methods and techniques used to select tasks or competencies for training.

2.6. LINKAGE TO THE DESIGN PHASE

The purpose of the Analysis phase is particularly to produce sufficient data to allow measurable training objectives to be derived from this data and developed in the Design phase of SAT. When using a table-top method to conduct the analysis it is beneficial to use the same personnel to develop and write the training objectives while the analysis of tasks or competencies (or groups of tasks and competencies) is being performed. By combining these steps, better assurance is provided that the training objectives adequately reflect the analysis data. Combining the steps also ensures that there is a direct and logical linkage between the tasks or competencies, the training objectives, and job performance. With experience, the KSAs or content outlines can be converted to, or written directly as, training objectives. In addition, the use of templating methods facilitates the transition from tasks or competencies directly to training objectives without the need to generate separate lists of KSAs.

To enable plant SMEs and training staff to gain experience with all phases of SAT, it has also been found beneficial to select a Duty Area or related group of tasks and complete the Design, Development, Implementation, and Evaluation phases of SAT. This not only provides plant SMEs and training staff with a better understanding of the entire SAT process, but also validates the SAT procedures and produces training materials that can be used to begin the training of personnel. More importantly, it provides plant management the opportunity to evaluate the results of adopting SAT. By producing positive results sooner it can also serve to gain, and maintain, the necessary plant management support and continued allocation of resources.

References [28] and [29] contain guidelines and information useful for the development and writing of cognitive, psychomotor, and affective training objectives.

2.7. OPTIMIZING THE RESOURCES

In some situations, the resources and level of effort required to conduct the analysis methods, discussed in Sections 2.4.1 and 2.4.2, would be more cost-effective if applied in situations where plants are standardized and the job tasks are very similar from plant to plant. In such cases, conducting a detailed analysis once for a job such as a Reactor Operator, and using the results for all plants may be cost-effective. Even where plants are not standardized, there are some jobs that are basically the same at any plant. For example, the radiation protection technician Job and many maintenance jobs have many common tasks, even though the plants may be different. In such cases, conducting a detailed analysis once for use by all plants may also be cost-effective. Common training material could also be developed in the Design and Development phases of SAT to further improve cost-effectiveness.

The following good practices in optimizing and saving resources needed for Analysis phase may be also recommended:

- Co-operation between plants in sharing analysis data. Free of charge exchange by analysis data even among commercial plants and private power generating companies may be benefitial for all parties involved.
- Use of common or standardized SAT models within national nuclear power industry or plant family. A number of standardized SAT models may be employed for various job classifications.
- Establishment of the information banks accumulating Analysis and other SAT phases data from various sources.
- Establishment/assignment of the committees or organizations for co-ordination of nuclear training activities, SAT implementation in particular.
- Development or adopting of national or industry-wide SAT procedures and guidelines. It may provide a basis for analysis data effective exchange, for quality assurance and quality control of analysis activities and products.
- Regular accumulation and publishing of national or industry good practices.
- Development or purchasing and use of specialized integrated software packages to support SAT implementation, the analysis activities in particular.

3. SELECTED EXAMPLES OF ANALYSIS

3.1. DATA GATHERING

Data was gathered for the different methods of analysis, providing examples of each method. These examples have been provided by nuclear facilities from Member States in response to a questionnaire, illustrated in Section 3.1.1, from the IAEA. This questionnaire was developed by a team of experts in consultants meetings at the IAEA. It should be noted that the terminology used in the examples may vary from organization to organization, and from that used in this descriptive text, according to national or local practices.

3.1.1. IAEA questionnaire sent to Member States

Information Requested for SAT Analysis Examples
(Items 1 through 12 should be provided on the attached table)

1. **Job position**. The job title of the position analyzed and a brief (one line) description of the job. (If you wish to provide information for more that one job position, please use separate tables).

2. **Country.** The country from which the example comes.

3. **Utility/NPP**. The name of the utility and/or NPP from which the example comes (If it is not desired that this information be included in the IAEA document, leave this item blank.)

4. **Type of NPP** e.g. : PWR, BWR, WWER, RBMK, PHWR, AGR.

5. **Type of analysis.** Select from one of the following:
   - Job and Task Analysis (JTA)
   - job competencies analysis (JCA)
   - combined JTA/JCA
   - other (provide a brief description)

   Also provide a brief (one or two sentences) indication of why this type of analysis was chosen.

6. **Total duration.** How long did it take to complete the analysis?

7. **Resources needed.** How many people (including Contractors) were involved in the process and how much time did they devote? (e.g. 2 Chemistry Technicians (total of 15 person-days), 1 Operation Department Manager (total of 2 person-days)).

8. **Special tools.** List any special tools that were used for this type of analysis (e.g. databases, templates, special analysis software).

9. **Procedures/references.** List the procedures that were used to implement the analysis and references used as the basis for the analysis process/procedures.

10. **Identification of attitudes.** It is generally recognized that it is more difficult to identify attitudes than skills and knowledge. If your analysis provided a particular way to identify attitudes please indicate briefly the content of this approach or provide references.

11. **Strengths.** Briefly identify the strengths of this analysis process.

12. **Weaknesses/difficulties encountered.** What weaknesses did you find in this analysis process? What difficulties did you encounter?

Additional information

In addition to completing the table on the following page, please provide a description of all aspects of your SAT Analysis phase. This description should include examples of the tasks, competencies, knowledge, skills and attitudes as well as associated learning objectives for some aspects of the job (e.g. for the Duty Areas). Preferably this information should not exceed 10 pages. In general this information should be in English. However, it is not necessary to translate Task Lists, or other computer printouts.

SAT Analysis Table

(This table was sent to Member States with the Questionnaire shown in Section 3.1.1)

1 — Job position	
2 — Country	
3 — Utility/NPP	
4 — Type of NPP	
5 — Type of analysis	
6 — Total duration	
7 — Resources needed	
8 — Special tools	
9 — Procedures/references	
10 — Identification of attitudes	
11 — Strengths	
12 — Weaknesses/difficulties encountered	

3.2. OVERVIEW OF ANALYSIS DATA

Some examples in the Appendices are from facilities with considerable experience in these methods, and others are from those just starting an SAT process. The examples are related to different jobs so that the user of this publication can have a broad overview of the methods used. This information is presented in SAT Analysis Tables. Appendices A, B, C, D contain selected examples from twelve facilities in eight Member States covering all methods described in Section 2 of this TECDOC. Examples were selected for Appendices A to D based on the completeness of the material submitted. Appendix E contains additional SAT Analysis Tables as an overview of the analysis from fifteen facilities from eleven Member States. Where an example in the Appendices has further supporting details in the CD version, this is indicated.

3.3. SELECTED EXAMPLES

Each example is described using the same format. The SAT Analysis Tables contain the following information:

- The job definition.
- The country.

– The utility providing the example.
– The type of plant.
– The type of analysis method used and why it was chosen.
– The resources, including how many people were needed for this analysis, their job position, the number of meetings, the total person-days needed.
– If another method is used in conjunction with the main method.
– The tools used to support the method.
– The types of procedures used.
– How the attitudes were identified.
– The strengths and weaknesses of the method.

3.4. SUMMARY OF NATIONAL PRACTICES

3.4.1. Bulgaria

SAT has been introduced within the framework of PHARE-funded and bilateral (US DOE) projects. The uses of JCA and of combined JTA and JCA are preferred. The available analysis data from similar plants and from Contractor data has been widely used. The lists of tasks and competencies found were sent to the NPP for expert evaluation. The job descriptions of the Kozloduy NPP personnel are detailed and "SAT ready", so there has been no need to compile special detached forms to describe a job position. The report of the NPP operational event analysis has been widely used during the Analysis phase.

3.4.2. Canada

In Canada, a combination of the table-top Job Task Analysis method (maintenance groups), the Job and Task Analysis and Verification Analysis method (licensed operational positions) and the template analysis method (non-licensed operational positions) have been used to generate tasks lists and identify the knowledge, skills and abilities for each. Difficulty was experienced in starting the JTA process and it has since been found beneficial to seek advice from individuals with experience in the JTA process.

3.4.3. France

JCA has been chosen by EDF to describe the different job positions within the NPPs. This method has been developed based on the French educational system methods. This approach allows to overcome the tendency by utility staff to eliminate elements of knowledge which are not directly linked to one task. Indeed, it has been shown that comprehension of the physical process behind manipulation enhances performance.

The JCA is typically undertaken by a group of experts using a table-top technique under the supervision of the Corporate Resources department (MCP) of EDF's Nuclear Generation department at a national level. These experts are subject matter experts from the MCP, experienced job incumbents, Training Specialists and job position supervisors. To ensure a consistent approach in the process, the experts involved in the Analysis phase are also involved in the design of the training programmes including the training objectives.

Due to the standardized EDF NPPs, each job position analysis applies to all plants for each type of NPP; this improves the cost-effectiveness of the analysis.

3.4.4. Hungary

A combined JTA-JCA methodology was developed and applied at the first stage for eight operational and eight maintenance job positions. The work was completed for 11 of them between 1996 and 1998. At the beginning of 1998 the Regulator made a requirement to extend the SAT application for each licensed job position (altogether 25). On the basis of the previous work experience and data generated, the Analysis, Design and part of the Development phases were completed for all positions within a year. It is expected to finish all the development work before the end of 1999.

The Analysis, Design and the Development phases of SAT are strongly supported by data management.

3.4.5. Russian Federation

In recent years SAT has been accepted as a basis for training development by a significant part of the national nuclear power industry. With a growing recognition of the importance of adequate training for safe and efficient operation, this has resulted in numerous projects for implementing SAT. Extensive analysis data were produced for various job positions at different Russian nuclear sites using a wide variety of analysis methods. Practically all analysis methods and techniques described in this TECDOC have been employed in various projects to establish, develop, and upgrade NPP personnel Training Systems. Comparing with other methods, a table-top method has been used most often and has been proved to be an effective tool both to ensure training programme quality and to meet the immediate training needs of the sites.

Establishing a set of national standards and guidelines for training at nuclear facilities provides the opportunity for a suitable level of personnel proficiency. Accumulated analysis experience is used as a basis to develop industry-wide guidelines and quality criteria for the SAT Analysis process. Extensive information exchange and co-operation activities, such as training staff meetings, workshops, and site-to-site contacts within the development of training programmes, involvement and support of the utility management, all this stimulates progress in the area of SAT Analysis effective conducting.

3.4.6. Slovakia

The formal process of applying SAT (including the Analysis phase) to the training of NPP personnel started in Slovakia in 1995 when the IAEA Technical Co-operation Project on Upgrading of NPP Personnel Training Programme was implemented. During the process of SAT application for selected job positions, JCA was adopted from the French method of JCA as this was introduced during the workshops held during the scope of the project. The results gathered within the Analysis phase can be easily used after verification also at Slovakia NPPs (NPP Bohunice V-1 and NPP Mochovce).

In addition to JCA, JTA was adopted for Slovak purposes within the framework of the International nuclear safety Programme granted by the US Government in 1997-1998. The JTA was used for an instructor job position.

3.4.7. Ukraine

Implementation of SAT began with an assistance from international organizations. Use of JTA started through developing the training programmes for NPP licensed personnel. This assured attaining and maintaining the competence and qualification of these personnel. The patterns, which had been prepared in Word Perfect template, were used to link results of the Analysis phase with training programmes.

Nowadays, as well as JTA, the Combined JTA/JCA method is used particularly for personnel who are identified as being most involved with safety, and also for other job positions. Results from one site are widely used at other sites. Data Base Software is used to facilitate both Analysis and Design activities.

3.4.8. United Kingdom

Job Competency Analysis (JCA) by the table-top technique has been widely used in the United Kingdom since the 1980s when its nuclear power industry adopted the SAT with its five accepted phases. Instructors within the UK's nuclear power industry training function have always been recruited from NPPs (and hence are SMEs), subsequently trained in all phases of SAT, some later specialising in educational theories and assessment/evaluation techniques.

From the 1960s the UK central nuclear training centre was supported and advised by a committee which included NPP managers. With NPP top management endorsement from the outset of the UK nuclear power programme, there was no difficulty in implementing SAT and conducting analysis of NPP jobs and responsibilities, including human factor skills.

Having seen the resources used to undertake JTA in some parts of the world for use by training instructors not all of whom had NPP backgrounds, the UK nuclear industry, with all its instructors coming from NPPs, decided that its optimum choice for analysis was JCA with the immediate design and development of training programmes for all NPP jobs.

3.4.9. United States of America

Job and Task Analysis (JTA) is the predominant method used in the USA at commercial nuclear power plants and the nuclear facilities operated by the US Department of Energy (DOE). The traditional JTA method was adopted from the Instructional System Design method originally developed by the US military. In the early 1980s the Institute of Nuclear Power Operations (INPO) conducted industry-wide generic JTAs for operations, maintenance, and technical support positions for pressurized water reactors and for boiling water reactors. These JTAs were then used by the nuclear power plants to develop plant specific analyses. In addition, industry wide training programme content guidelines for each job position were also developed. Because of the diversity of DOE nuclear facilities, each facility conducted facility specific JTAs — except for the radiation protection technician job, for which a DOE-wide table-top analysis was conducted. The DOE also developed generic training programme content guidelines and fundamentals training manuals for use by all facilities for training in subjects such as nuclear physics, chemistry, materials science and thermodynamics.

Table-top methods are now usually used to improve the cost-effectiveness of the Analysis phase. The effort today is directed towards maintenance of the JTA data. Continuous improvements are being made in areas such as management and supervisory training, teamwork, and diagnostics skills. In addition, INPO conducts professional training and development seminars for nuclear power plant managers, operations and maintenance managers, shift managers, Reactor Operators, and other nuclear plant personnel.

4. CONCLUSIONS

Based on the data gathered from the Member States and the discussions of the Advisory Group Meeting the following conclusions were reached:

– The SAT is now accepted by the nuclear industry world-wide, and extensive analysis data and experience are available. Utilizing this experience, when carefully selecting and implementing a method of analysis, can optimize the use of available resources.

– The ownership of plant management, availability of subject matter experts (SMEs) and knowledgeable facilitators are key factors for the initial and continuing success of SAT in general, and Analysis in particular. It is essential that all members of the analysis team have an understanding of the SAT process prior to beginning analysis.

– The results of the Analysis phase, such as task and competencies, should be clearly linked to training objectives. To validate and improve analysis results, analysis data should be maintained to incorporate design and procedure changes, lessons learned from operating experience and feedback from training. An appropriate software database is an effective tool to maintain the analysis data.

– To improve the quality of training programmes to meet training needs, the Analysis phase of SAT must be properly implemented. Existing training programmes should be reviewed, recognizing they may contain task, competency and KSA data which can be used.

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Note: The US Department of Energy listed publications are available on the Internet at http://cted.inel.gov/cted/eh31

Appendices A–E

EXAMPLES OF SAT ANALYSES

Appendix A

SELECTED EXAMPLES OF JOB AND TASK ANALYSIS METHOD (JTA) — EXAMPLES OF JOB ANALYSIS

A.1. Job Analysis for PWR Health Physics Technician (USA)

1 — Job position	Health Physics Technician
2 — Country	United States of America
3 — Utility/NPP	Duquesne Light Company/Beaver Valley Power Station
4 — Type of NPP	PWR
5 — Type of analysis	Job Analysis
6 — Total duration	Duration: — Initial — unknown — Biennial validation — two weeks
7 — Resources needed	Biennial validation: — Training Specialist — 6 person days — Health Physics Technician — 2 person days — Health Physics Supervisor — 1 person day — Health Physics Instructor — 3 person days — Clerical support — 1 person day
8 — Special tools	Dataease database
9 — Procedures/references	Nuclear Power Division Training Administrative Manual Procedure (attached)
10 — Identification of attitudes	None
11 — Strengths	None
12 — Weaknesses/difficulties encountered	None

Additional information

The following materials are attached to explain the Job Analysis employed:

– The Chapter "Job Analysis" of training Administrative Manual used to guide the performance or update of a Job Analysis;
– A part of actual Task Matrix (the whole Task Matrix contains 324 tasks, and may be found on CD supplementing the publication).

Duquesne Light Company
Nuclear Power Division
Training Administrative Manual

APPROVAL SHEET

Volume: 3	**Chapter No.:** Procedure 1-1	**Revision No.:** 7

Chapter Title:	Job Analysis
Pages Issued:	1–7, Figures 1-1.1 — 1-1.5
Effective Pages:	1, 3, 7

Description of Changes: Revised to ensure that a job incumbent reviews the Task List. Deleted reference to INPO Task I.D. Numbering convention. Deleted General Manager, Nuclear Support Unit approval signature line in procedure.

Approval Signatures:

Signature	
N/A Quality Assurance	(Volume 1 only)
General Manager, Nuclear Support	
N/A General Manager, Nuclear Operations	(If Applicable)
N/A General Manager, Maintenance Programs	(If Applicable)
N/A Manager, Health Physics	(If Applicable)

NOTE: Appropriate Vice President and Department Manager signatures added if applicable.

Effective Date: ______________________________

1.0. PURPOSE

To guide the performance or update of a Job Analysis.

2.0. SCOPE

This procedure applies to any initial Job Analysis or Job Analysis revision performed by the Nuclear Power Division Training Department for the following job positions:

- Chemistry Technician
- Instrumentation & Control Technician
- Radiation Technician
- Electrician
- Mechanic
- Nuclear Control Operator
- Nuclear Operator
- Senior Reactor Operator
- Nuclear Shift Supervisor
- Shift Technical Advisor
- Maintenance Supervisor

3.0. DEFINITIONS

DIFFICULTY, IMPORTANCE AND FREQUENCY (DIF) — Task attributes used to help determine the need to provide training for personnel performing that task.

JOB ANALYSIS — The systematic review of the duties of a particular job position to determine the tasks to be covered in a training program for that job position.

JOB ANALYSIS RESULTS REPORT — A report written by the Training Specialist, which identifies and summarizes the results of the Job Analysis.

STATUS — Each task is assigned a status of Train, Retrain or No Training depending on its DIF ratings. The status provides a guideline for how the task should be treated with respect to training.

SUBJECT MATTER EXPERT (SME) — A job incumbent qualified and experienced in performing a particular job.

TASK MATRIX — A list of the tasks for a particular job position and the training (lesson plans, OJTs, procedures, JPMs, etc.) associated with each task.

4.0. RESPONSIBILITIES

4.1. The Training Systems Supervisor is responsible for initiating Job Analysis reviews with an Action Item and reviewing the initial results.

4.2. The Training Specialist or Instructor is responsible for coordinating and completing the Job Analysis review with SMEs and applicable personnel.

4.3. The Training Director is responsible for reviewing the Job Analysis Results Report and initiating necessary changes.

4.4. The General Manager, Nuclear Support Unit is responsible for review and approval of the Job Analysis Results Report and for obtaining applicable station department manager review and approval.

5.0. REFERENCES

NPDTAM, Volume 1, Chapter 4
Task List Modification Form (Figure 1-1.1) attached
INPO 83-009, Task Analyis Procedure
INPO 85-006, Principles of Training System Development
ACAD 91-015, The Objectives and Criteria for Accreditation of Training in the Nuclear Power Industry

6.0. INSTRUCTIONS

6.1. Training Specialist/Instructor

6.1.1. Obtain the current Task List for the job position to be reviewed. It can be printed from the JTA database.

6.1.2. Conduct a review of the current Task List with the applicable SMEs.

If the Task List is found to be adequate, proceed to 6.1.3.

If the Task List is found to be inadequate (>50% change) and needs revised, report the findings to the Training Systems Supervisor and the applicable Section Training Director and revise Task List based on:

6.1.2.1. Applicable plant procedures and/or plant operating manuals.

6.1.2.2. Plant work requests and appropriate related documentation.

6.1.2.3. Omit use of Task List Modification Form and proceed to 6.1.4.

6.1.3. Review the Task List with SMEs and mark all additions, deletions and changes on a Task List Modification Form (see Figure 1-1.1) as follows:

NOTE: All changes may be marked on a matrix printout as a substitute for Figure 1-1.1.

6.1.3.1. Enter the job position being reviewed in the space provided.

6.1.3.2. Enter the date.

6.1.3.3. If the task is to be deleted, enter a "D" in the first column, the Task I.D. Number of the task to be deleted in the second column and the reason for deletion in the column labeled "Action".

6.1.3.4. If a task is to be added, enter an "A" in the first column, a unique ten digit Task I.D. Number in the second column and the title of the task in column labeled "Action".

6.1.3.5. If a task title is to be changed, enter a "C" in the first column, the Task I.D. Number in the second column and a description of the change in the column marked "Action".

6.1.3.6. When the entire list has been reviewed, number the pages in the space provided.

6.1.3.7. Ensure that all changes on the Task List Modification Form are identified on the Task Survey Form (Figure 1-1.2) before proceeding.

6.1.4. Mark the ratings for Difficulty, Importance And Frequency for added and changed tasks on a Task Survey Form as follows:

6.1.4.1. If the Task List is being reviewed by more than one SME, use a consensus number for each rating. If the SMEs are conducting the review separately, give each of them their own Task Survey and average the results.

6.1.4.2. Use a survey criteria scale similar to Figure 1-1.3.

6.1.4.3. Retain the Task Survey Form and the survey criteria scale for history.

6.1.4.4. DIF numbers may, optionally, be included on the Task List Modification Form under "Action".

6.1.5. Determine the "status" of each task.

6.1.5.1. Apply a Task Selection Chart (Figure 1-1.4) to the task ratings to determine the “status" of each task. For computerized Task List, the “status” is automatically calculated.

NOTE: The cut-offs and each corresponding status can be adjusted by the applicable Training Director. The status provides guidance on how the task should be covered in training as follows:

— “No Training” — The task need not have formal training
— “Train” — The task should be covered in initial training
— “Retrain” — The task should be covered in continuing training as well as initial training

6.1.5.2. Retain the Task Selection Chart for history.

6.1.6. Obtain task list approval

6.1.6.1. Obtain written approval of the revised Task List from training and station management (Figure 1-1.5) if it was reviewed originally as inadequate.

6.1.7. Update the Task Matrix

6.1.7.1. Make additions and deletions per SME recommendations.

6.1.7.2. Review the training program (lesson plans, OJTs, JPMs, simulator scenarios, etc.) with an instructor to update existing cross-references and/or to determine cross-references for new tasks.

6.1.8. Assemble the Job Analysis Results Report.

6.1.8.1. Identify the following:

- who reviewed the Task List
- when the Task List was reviewed
- number of tasks added and reasons for addition
- number of tasks deleted and reasons for deletion
- number of tasks changed
- number of “added” tasks which require no training (according to DIF numbers)
- list of “added” tasks which require additional training (according to DIF numbers)

6.1.8.2. Develop recommended status based on Task Selection Chart and judgment of subject matter experts. Factors that should be considered include:

- availability of detailed guidance on task performance (i.e. procedures)
- similar tasks already included in training
- task performance assignments (i.e. performed by all job incumbents, or reserved for specialists).

6.1.8.3. Include the following reference documents:

- The Task List reviewed
- The Task Survey Forms of survey scale
- The final Task Matrix
- Task Selection Chart
- The Task List Modification Forms.

6.1.9. Sign the Task Matrix approval page (Figure 1-1.5) and submit the completed Job Analysis Results Report to the Training Systems Supervisor for review.

6.1.10. Following review and approval by training and station management, submit the signed Job Analysis Results Report to the appropriate clerk for filing.

6.2. Training Systems Supervisor review process

6.2.1. Review the Job Analysis Results Report.

6.2.2. Have changes made as necessary.

6.2.3. Submit the Job Analysis Results Report to the appropriate Training Director with a cover memo identifying the review period.

6.2.4. Have clarification and corrective actions incorporated into the report, based on review by the appropriate Training Director and General Manager, Nuclear Support Unit.

6.3. Section Training Director

6.3.1. Review Job Analysis Results Report.

6.3.2. Initiate changes to address identified problems.

6.3.3. Initiate a Task Analysis for new tasks that are not presently supported by training.

6.3.4. If necessary, forward the Job Analysis Results Report and identified changes to the Training Systems Supervisor for modifications.

6.3.5. Sign the Task Matrix approval sheet and report cover sheet.

6.3.6. Forward the signed Job Analysis report to the General Manager, Nuclear Support Unit.

6.4. General Manager, Nuclear Support Unit

6.4.1. Review the Job Analysis Results Report.

6.4.2. If necessary, discuss modifications with appropriate Training Director and Training Systems Supervisor.

6.4.3. Forward the report to the applicable station Department Manager for review and approval.

Developed/Revised by

Reviewed by: Training Director/Training Systems Supervisor Date

Job position ______________________
Date __________________

Page ____ of ____

TASK LIST MODIFICATION FORM

D — Delete
A — Add
C — Change

	Task #	Action

	NAME	JOB	DATE
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			

SAMPLE

I&C TECHNICIAN (MCR) TASK SURVEY

SYSTEM: SENSORS/TRANSDUCERS (901)
ACTIVITY: MAINTENANCE AND SURVEILLANCE (02)
JOB POSITION: I&C TECHNICIAN (MCR) (10)

I.D. NUMBER	TASK TITLE	DIFF.	IMP.	FREQ.
9010010209	CHECK/REPLACE THERMOCOUPLE			
9010020209	CHECK/REPLACE RESISTANCE TEMPERATURE DETECTOR			
9010030209	CHECK/REPLACE BELLOWS ASSEMBLY			
9010040209	FILL SEALED BELLOWS ASSEMBLY			
9010050209	CHECK/REPLACE FLOAT SENSOR			
9010060209	CHECK/REPLACE BOURDON TUBE SENSOR			
9010070209	CHECK/REPLACE DIAPHRAGM SENSOR			
9010080209	CHECK/REPLACE FLOW SENSOR			
9010090209	CHECK/REPLACE ACOUSTIC SENSOR			
9010110209	CHECK/REPLACE TURBIDITY CELL			
9010120209	CHECK/REPLACE PH CELL			
9010130209	CHECK/REPLACE OXYGEN CELL			
9010140209	CHECK/REPLACE HYDROGEN CELL			
9010150209	CALIBRATE CARBON DIOXIDE MONITOR			
9010160209	REPAIR PHOTO SILICA ANALYZER (LIGHT DETECTOR)			
9010170209	CHECK/REPLACE VIBRATION SENSOR			
9010180209	BACKFILL SENSING LINES (REFERENCE LEGS)			
9010190209	REPAIR/CALIBRATE MAGNETIC FLOW MEASURING DEVICE			
9010200209	REPLACE GAS FILLED TEMPERATURE SENSOR			
9010210209	CHECK/REPLACE RADIATION SENSOR			
9010220209	CHECK REPLACE CONDUCTIVITY CELL			

SAMPLE

SURVEY CRITERIA SCALES

DIFFICULTY

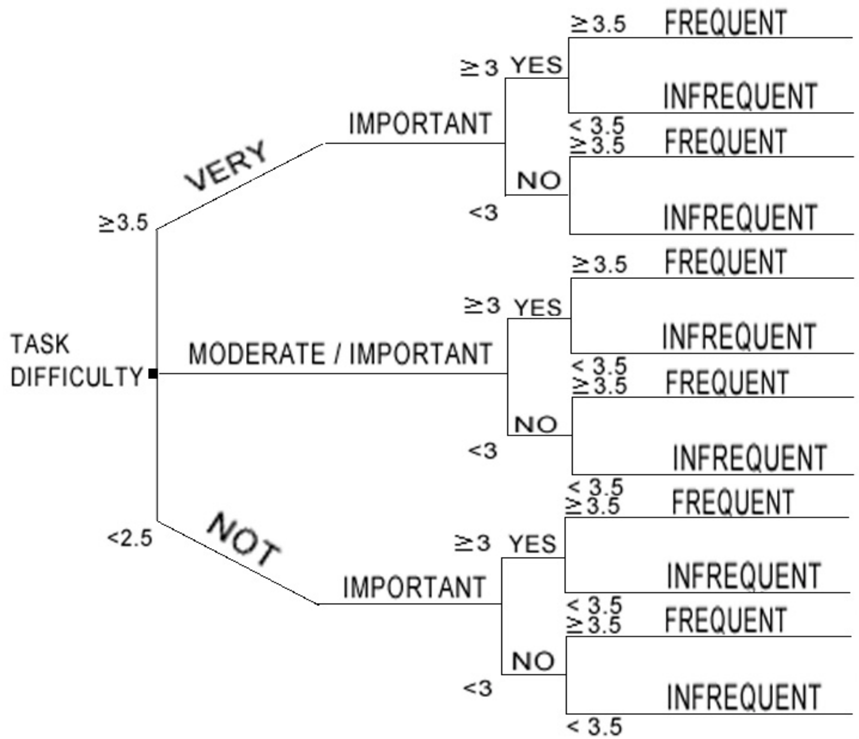
Min.	1 -	**VERY EASY** (SUCCESSFUL TASK PERFORMANCE REQUIRES LOW MENTAL ACTIVITY AND LOW MOTOR COORDINATION)
	2 -	**EASY** (SUCCESSFUL TASK PERFORMANCE REQUIRES LOW MENTAL ACTIVITY AND HIGH MOTOR COORDINATION)
	3 -	**AVERAGE** (SUCCESSFUL TASK PERFORMANCE REQUIRES MEDIUM MENTAL ACTIVITY, IRRESPECTIVE TO THE DEGREE OF MOTOR COORDINATION NEEDED)
	4 -	**DIFFICULT** (SUCCESSFUL TASK PERFORMANCE REQUIRES HIGH MENTAL ACTIVITY AND LOW MOTOR COORDINATION)
Max.	5 -	**EXTREMELY DIFFICULT** (SUCCESSFUL TASK PERFORMANCE REQUIRES HIGH MENTAL ACTIVITY AND HIGH MOTOR COORDINATION)

IMPORTANCE

Min.	1 -	**NEGLIGIBLE** (IMPROPER TASK PERFORMANCE MAKES ALMOST NO DIFFERENCE IN PLANT OPERATION)
	2 -	**UNDESIRABLE** (IMPROPER TASK PERFORMANCE MAY RESULT IN EXCEEDING ADMINISTRATIVE REQUIREMENTS, MINOR CONSEQUENCES TO PLANT OPERATION, OR MAY REQUIRE SOME CORRECTIVE ACTION)
	3 -	**SIGNIFICANT** (IMPROPER TASK PERFORMANCE MAY RESULT IN EXCEEDING FEDERAL REQUIREMENTS, EQUIPMENT OR SYSTEM DAMAGE, REDUCED PLANT AVAILABILITY, OR IT MAY REQUIRE CONSIDERABLE CORRECTIVE ACTIONS)
	4 -	**SEVERE** (IMPROPER TASK PERFORMANCE MAY RESULT IN EXTENDED LOSS OF POWER GENERATION, OR CONSEQUENCES REQUIRING EXTENSIVE CORRECTIVE ACTION)
Max.	5 -	**EXTREMELY SEVERE** (IMPROPER TASK PERFORMANCE MAY BE ENORMOUSLY TIME CONSUMING OR COSTLY TO CORRECT)

FREQUENCY

Min.	1 -	LESS THAN ONCE PER YEAR
	2 -	ANNUALLY/SEMI-ANNUALLY (5–12 MONTHS)
	3 -	MONTHLY/QUARTERLY (3 WEEKS–4 MONTHS)
	4 -	WEEKLY/BI-WEEKLY (1–2 WEEKS)
Max.	5 -	DAILY (OR MORE FREQUENT THAN ONCE PER WEEK)



STATUS	D-I-F
TRAIN	≥3.5, >3, ≥3.5
RETRAIN	≥3.5, >3, <3.5
NO TRAINING	≥3.5, <3, ≥3.5
TRAIN	≥3.5, <3, <3.5
TRAIN	<3.5, ≥2.5, ≥3, ≥3.5
RETRAIN	<3.5, ≥2.5, ≥3, <3.5
NO TRAINING	<3.5, ≥2.5, <3, ≥3.5
TRAIN	<3.5, ≥2.5, <3, <3.5
NO TRAINING	<2.5, >3, ≥3.5
TRAIN	<2.5, ≥3, <3.5
NO TRAINING	<2.5, <3, ≥3.5
NO TRAINING	<2.5, <3, <3.5

Job Analysis

Task List/Task Matrix

Approval Sheet

Job position: ____

Training Specialist __________________________ ____/___/___

Training Systems Supervisor __________________________ ____/___/___

Comments: ____
____
____
____

Section Training Director _________________________ ___/___/____

Comments: ____
____
____
____

General Manager, Nuclear Support Unit ____________________ _______/____/____

Comments: ____
____
____
____

Station Manager Review And Acceptance ______________________ ___/___/____
______________________ ___/___/____
______________________ ___/___/____
______________________ ___/___/____

Comments: ____
____
____
____

Attachment

A part of actual Task Matrix for Radiation Technician (task examples are presented in the table below, see Task I.D. Number)

RADIATION TECHNICIAN TASK MATRIX DATE 07/08/98

SYSTEM: GENERAL RADIATION TECHNICIAN (GRT) PAGES 1–11

JOB POSITION: RADIATION TECHNICIAN

		Task I.D. Number	Lesson Plan numbers	Related Procedures	OJT/TPE if required	D-I-F Calculated Status	Retraining Frequency (Months)
Count samples with computer based multi-channel analyzer	GRT	001	RTTP-D1	RIP 5.17, 5.18	1	4/2/5 Train	
Operate portable underwater gamma survey equipment	GRT	015	RTTP-D3 RTTP-D11	RIP 3.21 & 3.22 RP 8.8	3, 11	2/2/3 Train	42
Prepare decontamination solutions and agents for personnel use	GRT	035	RTTP-D11	RP 2.3	11	2/2/1 Retrain	42
Perform air tritium surveys	GRT	045	RTTP-D8	RP 7.3	8	1/2/3 No Training	
Zero pocket dosimeters	GRT DOS	109	RTTP-D4	RP 4.3	4	2/2/2 Retrain	
Perform and document radiation monitor valve alignment verifications	GRT IPI	118	RTTP-D14 and D15	RIP 2.32, 2.33, 2.34	14, 15	2/3/5 Train	
Set-up portable Area Radiation Monitors	GRT PI	138	RTTP-D14	RIP 2.4, 2.5 & 5.2	14	3/2/3 Train	
Train personnel on the proper use of MSA Ultravue Negative Pressure Air Purifying Respirators	GRT RES P	157	RC-2	HPM-CH2 RP 10.4		2/2/2 Retrain	42
Determine the location of radioactive hot spots	GRT RWP	168	RTTP-D9	RP 8.5	9	2/2/4 Train	
Dispose of post-accident samples	GRT SHIP	182	MCD-6	REOP 2.1		2/3/1 Retrain	

JOB POSITION: RADIATION TECHNICIAN

		Task I.D. Number	Lesson Plan numbers	Related Procedures	OJT/TPE if required	D-I-F Calculated Status	Retraining Frequency (Months)
Complete Unit 1 prerequisites for radiation monitor calibration	IPI	001	RTTP-D14	RIP 1.11, RIP 2.29	14	3/3/4 Train	42
Calibrate portable area monitors in the RMS	IPI	002	RTTP-D14	RIP 2.4 & 2.5	14	3/2/3 Retrain	42
Calibrate Unit 1 installed area monitors	IPI	003	RTTP-D14	RIP 2.3, RIP 1.2	14	3/3/3 Train	42
Calibrate Unit 1 gaseous/liquid/post accident radiation monitors	IPI	004	RTTP-D14	RIP 2.8, 2.9 & 2.14	14	4/3/4 Train	42
Calibrate SPING channels	IPI	005	RTTP-D14	RIP 2.10	14	4/3/2 Retrain	42
Calibrate N-16 monitors	IPI	006	RTTP-D14	RIP 2.30	14	4/3/1 Retrain	42
Perform a SPING pressure correction calculation	IPI	007	RTTP-D14	RIP 2.31	14	1/2/5 No Training	42
Complete Unit 2 prerequisites for radiation monitor calibration	IPI	008	RTTP-D15	RIP 1.11 RIP 2.24	15	3/3/4 Train	42
Calibrate Unit 2 installed area monitors	IPI	009	RTTP-D15	RIP 2.19	15	3/3/3 Train	42
Calibrate Unit 2 gaseous/liquid/post accident radiation monitors	IPI	010	RTTP-D15	RIP 2.21 & 2.23	15	4/3/4 Train	42
Set-up and operate the Canberra Series Plus MCA	IPI	011	IPI-11	RIP 2.25	15 IPI-11	4/3/2 Retrain	42
Perform a RM-11 Magtape archive	IPI	012		ROAP 2.202		4/1/3 No Training	42

RADIATION TECHNICIAN TASK MATRIX DATE 07/08/98

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JOB POSITION: RADIATION TECHNICIAN

		Task I.D. Number	Lesson Plan numbers	Related Procedures	OJT/TPE if required	D-I-F Calculated Status	Retraining Frequency (Months)
Perform Chi-square and generate counter control charts	PI	001	RTTP-D1	RIP 5.8	1	2/2/3 Train	
Perform and determine high voltage plateous	PI	002	RTTP-D1	RIP 5.11	1	2/2/2 Train	42
Calibrate a telector	PI	006	RTTP-D3	RIP 3.5	3	3/2/3 Retrain	42
Perform an efficiency check on the PCM-1B	PI	023	RTTP-D4	RIP 4.22	4	3/3/1 Retrain	42
Operate the Precision Electrometer Model 500	PI	024	RTTP-D16	RIP 1.7	16	3/3/2 Retrain	42
Perform the weekly efficiency check on the PM-6	PI	027	RTTP-D4	RIP 4.7	4	2/2/4 Train	42
Perform the weekly operational check on the PCM-2	PI	029	ROPCT 96.2.3	RIP 4.23		3/3/4 Train	42
Available for assignment	PI	030				/ / No Training	

JOB POSITION: RADIATION TECHNICIAN

		Task I.D. Number	Lesson Plan numbers	Related Procedures	OJT/TPE if required	D-I-F Calculated Status	Retraining Frequency (Months)
Leak test respirators	RESP	001	RTTP-D12	RP 10.11	12	2/2/3 Retrain	42
Inspect and repair powered air-purifying respirators	RESP	002	RTTP-D12	RP 10.12	12	2/2/3 Retrain	42
Perform breathing air quality analysis	RESP	003	RTTP-12	RP 10.9	12	2/2/2 Retrain	42
Inspect, test and repair a BioPak 240P respirator	RESP	006	RESP-5	RP 10.24	RESP-5	/ / Train	24
Clean and sanitize respirators	RESP	008	RPM-17	RP 10.1	None	/ / Train	42
Perform an emergency SCBA weekly surveillance	RESP	009	RESP-1	RP 10.22	RESP-1	/ / Train	42
Start, operate and shut-down the Bauer portable air compressor	RESP	013	RESP-3	RP 10.25	RESP-3	/ / Train	42
Change oil in Bauer portable air compressor	RESP	014	RESP-3	RP 10.25	RESP-3	/ / Train	42
Perform a functional test of an open circuit SCBA	RESP	015	RESP-4	RP 10.13	RESP-4	/ / Train	42
Vent oil pump in Bauer portable air compressor	RESP	016	RESP-3	RP 10.25	RESP-3	/ / Train	42
Change Securus purifier cartridges in Bauer portable air compressor	RESP	017	RESP-3	RP 10.25	RESP-3	/ / Train	42

JOB POSITION: RADIATION TECHNICIAN

		Task I.D. Number	Lesson Plan numbers	Related Procedures	OJT/TPE if required	D-I-F Calculated Status	Retraining Frequency (Months)
Post and label radioactive hot space	RWP	001	RWP-2	RP 7.2 & App 11	RWP-2	1/3/3 No Training	42
Direct the installation and removal of temporary shielding	RWP	002	RWP-2	RP 8.6	RWP-2	3/3/2 Retraining	42
Evaluate the effectiveness of temporary shielding	RWP	003	RWP-2	RP 8.6	RWP-2	2/2/2 Retraining	42
Conduct job specific ALARA review briefing	RWP	004	RWP-2	RP 8.5	RWP-2	3/2/3 Train	42
Maintain RWP associated records (work package survey etc)	RWP	005	RWP-1	RP 8.1	RWP-1	3/2/5 Train	42
Generate a radiation work permit utilizing the HIS-20	RWP	006	RWP-1	RP 8.1 & 8.13	RWP-1	4/3/5 Train	42
Terminate an RWP utilizing the HIS-20	RWP	007	RWP-1	RP 8.1 & 8.13	RWP-1	4/2/4 Train	42
Develop a job specific ALARA review	RWP	008	RWP-2	RP 8.5	RWP-2	4/2/3 Train	42
Retrieve and maintain RWP associated data utilizing the corporate computer	RWP	009	RWP-1	RP 8.10	RWP-1	3/2/5 Train	42
Conduct ALARA ongoing job evaluation	RWP	010	RWP-2	RP 8.5	RWP-2	3/2/5 Train	42
Conduct exposure versus job progress EVALUATION	RWP	011	RWP-2	RP 8.5	RWP-2	2/2/2 Retrain	42
Develop a respiratory protection ALARA evaluation	RWP	012	RWP-2	RP 8.11	RWP-2	3/2/3 Train	42

JOB POSITION: RADIATION TECHNICIAN

		Task I.D. Number	Lesson Plan numbers	Related Procedures	OJT/TPE if required	D-I-F Calculated Status	Retraining Frequency (Months)
Fill a liquid nitrogen dewar	SHIP	001	RTTP-D2	RIP 5.18	2	2/2/3 Train	
Maintain radioactive source accountability records	SHIP	002	RTTP-D16	RP 1.1	16	3/3/3 Train	
Determine the shipping category of radioactive material	SHIP	003	RWS-01 RWS-02	RP 3.23, 3.24, 3.27, 3.28, 3.43		4/3/5 Train	36
Document packaged material survey data in the radioactive material shipping record	SHIP	004	RWS-01 RWS-02	RP 3.6		3/3/5 Train	36
Placard the transport vehicle	SHIP	005	RWS-01 RWS-02	RP 3.9, 3.11, 3.12, 3.22		1/3/4 No Training	36
Complete, review and maintain the RMSR and supporting documentation in compliance with applicable requirements	SHIP	006	RWS-01 RWS-02	RP 3.6, 3.32		4/3/5 Train	36
Inspect a radioactive material shipment for compliance with DOT and NRC regulations	SHIP	007	RWS-01 RWS-02	RP 3.3, 3.9, 3.11, 3.12, 3.21, 3.29		3/3/4 Train	36
Examine shipping records accompanying material received to ensure compliance with federal requirements	SHIP	008	RWS-01 RWS-02	RP 3.3		3/2/4 Train	36
Determine the radioactive waste classification for disposal	SHIP	009	RWS-01 RWS-02	RP 3.32		4/3/3 Train	36
Determine DOT marking and labeling requirements	SHIP	010	RWS-01 RWS-02	RP 3.11, 12, 13, 22, 23, 24, 27, 28, 38, 39		3/3/5 Train	36

A.2. Job Analysis for RBMK-1000 main control room Senior Reactor Operator (Russian Federation)

1 — Job position	Senior Reactor Operator (Leading Engineer for Reactor Control — according to Russian Federation's job classification). Operates nuclear reactor and all reactor safety systems from main control room.
2 — Country	Russian Federation
3 — Utility/NPP	Concern "ROSENERGOATOM", Kursk NPP
4 — Type of NPP	RBMK-1000
5 — Type of analysis	Job and Task Analysis. Also other analysis methods and techniques were employed, table-top analysis, document analysis, templating. It should be taken into consideration that due to critical needs been identified the development and implementation of SAT-based training programmes were focused mostly on continuing training. These analysis methods and techniques were chosen by the following reasons: — Methods and procedures advised by the contractors (Exitech Corp./USA and ENIKO MIFI/Russian Federation). — Initial set of well-specified SAT procedures provided by the Contractors. — Extremely safety-related job position. — Job position tasks sufficiently defined in plant procedures. — Comparatively small number of tasks. — Representative numbers of both psychomotor and cognitive tasks. — Relatively small number of supervisory and management competencies needed for the job. — Urgent need to firstly develop and upgrade the continuing training (vs. initial training). Continuing training needs were mostly task oriented. — Urgent need in an input to the development of full-scope simulator scenarios (full-scope simulator was being delivered at that time).
6 — Total duration	It took about 8 months from the time the analysis started until the first part of training was conducted. Approximate duration of Analysis phase activities is indicated below. It should be mentioned, that customized, optimized and cost-effective SAT model was in use to develop and implement SAT-based continuing training programmes. Job Analysis was fully performed. Task analysis was done on package basis achieving the goal to implement SAT-based continuing training and to receive a feedback including necessary revisions to SAT model and procedures employed as soon as possible. Training objectives were derived directly from the tasks and task elements within the Analysis phase omitting knowledge and skills identification. Concluding Task List contained 68 tasks. — Overall training of project team on SAT methodology — 5 weeks, including one week for Analysis phase training. — Task List development, validation, and approving by plant — 1 month. — analysis of one task, including the development of training objectives (with conditions, objective statement, and standards) — from 2 to 10 days (depending upon the task and procedure adequacy).

7 — Resources needed	The following personnel were involved: — One Leading SME — training centre instructor (draft Task List development and Task Analysis conducting) — part-time since performing regular duties as an instructor. — Three consultants from Exitech Corp./USA and ENIKO MIFI/Russian Federation (project activities' co-ordination, OJT, facilitating, coaching, verification, QC) — part-time. — Four SMEs — 2 MCR Senior Reactor Operators (SROs), Plant Shift Supervisor, Plant Deputy Chief Engineer responsible for nuclear safety (table-top Job Analysis, participation in Task Analysis, verification of analysis data) — on temporary basis. — Plant shift personnel — SROs, Unit Shift Supervisors, Plant Shift Supervisors (verification and validation of analysis data, Task Lists, task ratings). — Plant managers — within plant Training Review Committees activities (verification and approving). — Training centre technical support personnel (document production and turnover). Approximate expenditure of the resources was as follows (excluding resources spent for initial training on SAT basics): — Job Analysis: • Leading SME — 3 person-weeks for initial draft Task List development • External consultants — totally approximately 6 person-weeks (for the whole Analysis phase including both Job and Task Analysis) • Other SMEs — approximately 2 person-weeks • Plant shift personnel — totally 4 person-days • Plant managers — totally 2 person-days • Technical support personnel — totally 3 person-days — Task analysis: in average 1-2 person-weeks per task (including Task Analysis, development of terminal and enabling training objectives and test items)
8 — Special tools	— Paper forms and computer templates — MS Office software — Specialized software (SATEX) developed and provided by the Contractors (ENIKO MIFI and Exitech Corp.)
9 — Procedures/references	*Procedures:* — Set of 27 SAT procedures (administrative and implementation) delivered by Exitech Corp./USA and ENIKO MIFI/Russian Federation within the project. This set of SAT procedures was adapted together by the plant and the Contractors and finally adopted by the plant. Two procedures from this list, namely "Job Analysis" and "Task Analysis" were extensively used during the analysis process. *References:* — Industry regulations, plant job descriptions, plant Technical Specification, FSAR, plant procedures and other plant technical documentation. — Examples of Task Lists (from US NPPs). — Quality assurance programme developed for this SAT implementation project. — The IAEA documents.

10 — Identification of attitudes	Identification of attitudes was not formally addressed to within described analysis activities. However, the attitudes were considered and addressed to during Design and Development phases, and also within the development and implementation of other continuing training modules/sessions dealing with safety culture, operating experience, event study, regulations in nuclear field, emergency preparedness, teamwork, supervisory and management training. Also the attitudes are addressed to in training modules within General Employee Training And Industrial Safety Training.
11 — Strengths	— Accurate and precise identification of Duty Areas and tasks — Application of the criteria to verify and validate Job Analysis and Task Analysis data — Accurate development of explicit training objectives and tests (including conditions, objective statements, and standards) — Less resources comparing with traditional JTA due to optimized Analysis and Design phases — Comparatively clear Analysis procedures — Good specification of training materials to be developed — Increased job performance orientation of training conducting and objectivity of training evaluation — Direct involvement of plant managers and other plant personnel in Job Analysis, identification of training needs, review of training-related problems, development and implementation of training-related and other management solutions — Identification of plant procedures/documentation deficiencies and development of the recommendations initiated to upgrade job descriptions, regulations, and plant operating procedures. Chronologically it was the first successful project which included JTA for a RBMK Senior Reactor Operator. The results of analysis are consistent with the results obtained at other NPPs with RBMK in the Russian Federation and Ukraine.
12 — Weaknesses/difficulties encountered	Problems and difficulties which were met while using the employed analysis methods were as follows: — Necessity in increasing of NPP training centre staff and involvement of high-qualified SMEs (for first-run analysis conducting). — Necessity in extensive training of the instructors and SMEs on SAT methodology and SAT procedures. — Problems arisen when some of initially trained SMEs and instructors left the project team been assigned for the other jobs. — Resource-extensive nature of SAT implementation for wide range of plant job classifications (graded approach or alternative SAT is needed for various job positions). — Need in adaptation of initial version of SAT model to such job classifications as maintenance personnel, supervisory and management personnel. For example, in order to fix this problem an optimized approach to maintenance personnel training was elaborated and being implemented.

Additional information

1. GENERAL

The analysis of main control room Senior Reactor Operator job was conducted within the project implemented to develop and upgrade the Kursk NPP overall training system through an introduction of SAT. This comprehensive project included Systematic Training Needs Analysis, establishment of project QAP based on SAT standards, training of plant managers and project team in SAT principles and methodology, development and implementation of SAT procedures, development and implementation of SAT-based continuing training programmes for operations and maintenance personnel, development and implementation of instructor initial and continuing training programmes, development and stage-by-stage implementation of supervisory and management training, reorganization of Kursk NPP training department, upgrade of training centre infrastructure, development and implementation of modern computer-based training tools and support computer systems.

A wide range of jobs were analyzed within this project, e.g. all MCR personnel, several department Shift Supervisor jobs, dosimetry personnel on duty, several maintenance personnel jobs, supervisory and management personnel, training centre instructors.

The examples of analysis methods employed are provided in the table below:

Job position/training programme	Analysis methods and techniques used
MCR Senior Reactor Operator	JTA, table-top analysis, document analysis, templating
MCR Unit Operator	Combined JTA/JCA, table-top analysis, document analysis, templating
MCR Senior Turbine Operator	Combined JTA/JCA, table-top analysis, document analysis, templating
Unit Shift Supervisor	Combined JTA/JCA, table-top analysis, document analysis, functional analysis, templating
Plant Shift Supervisor	Combined JTA/JCA, table-top analysis, document analysis, functional analysis, templating
Reactor Department Shift Supervisor	Combined JTA/JCA, table-top analysis, document analysis, templating
Turbine Department Shift Supervisor	Combined JTA/JCA, table-top analysis, document analysis, templating
Electrical Department Shift Supervisor	Combined JTA/JCA, table-top analysis, document analysis, templating
Senior Maintenance Foreman (Reactor Equipment)	Combined JTA/JCA, table-top analysis, document analysis, templating
Maintenance Fitter (pump equipment)	JTA, table-top analysis, document analysis, templating
Supervisory and management training programmes	JCA, table-top analysis, functional analysis, topical analysis
Instructors	Combined JTA/JCA, verification analysis, functional analysis, topical analysis

The implementation of SAT was initiated by the Kursk NPP top managers in 1995–1997 through the involvement of external contractors, ENIKO MIFI/Russian Federation and Exitech Corporation/USA. These companies, within the comprehensive project mentioned above, performed the transfer of training know-how, coaching and facilitating of Kursk NPP project team. This project established a solid basis for further implementation of customized SAT at Kursk NPP, and generated also such important results as the enhancement of personnel training reliability and effectiveness, reinforcement of plant managers training programme ownership, and development of the whole plant training system.

2. ANALYSIS DATA

It should be mentioned that the analysis activities within the first-run SAT project of 1995-1997 started with several job positions from operations, maintenance, supervisory and instructor job classifications in order to pilot various analysis methods and techniques most appropriate for the jobs of different nature, criticality to safety and complexity. At the same time, these jobs selected had covered urgent outstanding needs of Kursk NPP in the development and upgrade of personnel continuing training programmes.

The Task List for Main control Room Senior Reactor Operator is provided in Attachment 1. The examples of Task Analysis data and training objectives in Russian language are available on compact disk supplementing the publication.

Attachment 1

Task List

Main Control Room Senior Reactor Operator
Kursk NPP, Stage 2

Date: 23.11.95 Edition No. 1

Approved by:

V.M. Ryakhin (Kursk NPP, Chief Ingineer)	signature	date
P.T. Nikolaev (Kursk NPP, Deputy Chief Ingineer of Stage 1)	signature	date
M.I. Vyskrebenets (Kursk NPP, Deputy Chief Ingineer of Stage 2)	signature	date
V.S. Plitsevoy (Kursk NPP, Deputy Chief Ingineer of Stage 3)	signature	date
S.A. Kushkovoy (Kursk NPP, Reactor Plant 1 Manager)	signature	date
V.B. Goncharov (Kursk NPP, Reactor Plant 2 Manager)	signature	date
A.A. Shashkin (Kursk NPP, Reactor Plant 3 Manager)	подпись	date

Project manager:

V.P. Galberg (Kursk NPP Deputy Chief Engineer)	signature	date

Project coordinators:

A.V. Uvakin (Kursk NPP)	signature	date
A.Yu. Kazennov (ENIKO MIFI)	signature	date
W. Giese (EXITECH)	signature	date

Experts:

Yu.N. Anikin (Kursk NPP)	signature	date
S.E. Novikov (Kursk NPP)	signature	date
I.M. Krivenko (Kursk NPP)	signature	date

Originators:

V.G. Ivankin (Kursk NPP)	signature	date
N.V. Tikhonov (ENIKO MIFI)	signature	date

MCR Senior Reactor Operator Duty Areas List

1. Normal operation.
   - 1.1 Maintenance and adjustment activities.
   - 1.2 Work on Nuclear Safety Department programmes.
   - 1.3 Refuelling.
   - 1.4 Start-up preparation.
   - 1.5 Start-up.
   - 1.6 Designed stable power operation.
   - 1.7 Scheduled power output decrease.
2. Beyond operational limits activities. Failures not caused violation of plant safe operation conditions.
3. Beyond safety limits activities (emergency situations).
4. Accidents.
5. Routine activities.
6. Response to alarm actuation.

Note: In the column "Procedure adequacy" of the table "SRO Task List" the adequacy of procedures is given based on preliminary evaluation. At the stage of job Analysis this information is needed only for task rating and selection (i.e. for identification of one of the following categories in the column "Category" ("Rating"):
N – No training required; T – initial Training required; C – initial and Continuing training required. At the stage of Task Analysis more accurate information on procedure adequacy will be obtained, and it will be directed to the corresponding Kursk NPP subdivisions for consideration of a necessity in procedure or other document revision and completion.

Legend: Proced. Adequ. – Procedure Adequacy, F – Frequency, I – Importance, D - Difficulty, L – Low, A – Average, H – High, Categ. (Rat.) – Category (Rating), JPM - Job Performance Measure, MC – Manager Training Criticality, MA - Manager Approval.

Main Control Room Senior Reactor Operator - Stage 2

Task No.	Task Statement	Reference (procedure)	Proced. audeq.	F	I	D	Categ (Rat.)	JPM	MC	MA
Duty area № 01:	**Normal operation**									
2SRO11001	Ensure the reactor safe and reliable shut down and transition to subcriticality.	900-PTO 1042-RC-2	X X	L	H	A	**T**			
2SRO11002	Control the temperature mode of shut down and cooled down reactor.	900-PTO 957-RC-2	X X	L	A	A	**T**	X		
2SRO11003	Evaluate the correctness of the selected cooling mode of the shut down reactor.	900-PTO	X	L	A	A	**C**			
2SRO11004	Correct power setpoints.	510-TAI	X	L	H	A	**C**	X		
2SRO11005	Review all the changes in the reactor and its systems implemented during the maintenance.	900-PTO 1042-RC-2	X X	L	H	A	**C**			
2SRO12001	Check the status of reactor equipment and its systems before nuclear hazardous work.	900-PTO 689-RC-2 1042-RC-2 Eng.solution	X X X X	L	H	A	**T**			
2SRO12002	Evaluate whether bypassing protections, interlocks, alarms and CPS elements is allowable.	900-PTO 510-TAI-2	X X	A	H	H	**T**			
2SRO12003	Perform actions in the case of CPS rod and servomotor replacement on power.	1042-RC-2 510-TAI-2	X X	L	H	A	**C**	X		
2SRO12004	Perform actions in the case of pulse-type flow sensor of CPS distributing header replacement on power.	689-RC-2 917-RC-2	X X	L	H	A	**C**	X		
2SRO12005	Evaluate whether a work on the programme meets nuclear safety requirements prior to its beginning.	900-PTO 1042-RC-2 689-RC-2	X X X	A	H	H	**T**			
2SRO12006	Control the conducting of nuclear hazardous work in the reactor.	900-PTO 1042-RC-2 689-RC-2 957-RC-2 Eng.solution	X X X X X	L	H	A	**C**			

Task No.	Task Statement	Reference (procedure)	Proced. audeq.	F	I	D	Categ (Rat.)	JPM	MC	MA
Duty area № 01:	**Normal operation**									
2SRO13001	Perform actions in the case of fuel channels refuelling including refuelling special cases.	900-PTO 2974-TAI 2551-OYBIN 957-RC-2 1042-RC-2	X X X X X	H	H	A	**C**	X		
2SRO13002	Perform actions in case of radial power detector connection and disconnection on power.	2974-TAI	X	A	A	A	**T**			
2SRO14001	Check the mnemonic fuel channels indicator board compliance with core fuel load.	900-PTO	X	H	H	A	**T**			
2SRO14002	Check the operability of Reactor SKALA Process Monitoring System equipment prior to reactor start-up.	900-PTO 1359-TAI 1042-RC-2	X X X	L	A	A	**T**	X		
2SRO14003	Analyse the availability of reactor channel water flowrate monitoring and control system.	900-PTO 1042-RC-2 1007-OYBIN	X X X	L	H	A	**T**	X		
2SRO14004	Check CPS availability for reactor start-up.	900-PTO 510-TAI 976-TAI-2 1042-RC-2	X X X X	L	H	H	**T**	X		
2SRO14005	Check protections and interlocks are put into operation.	900-PTO 976-TAI 1042-RC-2	X X X	L	H	A	**T**			
2SRO15001	Make the reactor critical.	900-PTO 779-OYBIN 1042-RC	X X X	L	H	H	**C**	X		
2SRO15002	Increas the reactor power from critical up to the minimum control level.	900-PTO 779-OYBIN 1042-RC-2	X X X	L	H	H	**C**	X		
2SRO15003	Analyse the compliance of core fuel actual load with core fuel load map using leak detection system.	900-PTO 1007-OYBIN 1042-RC-2 Load Map	X X X X	L	H	A	**T**			

Task No.	Task Statement	Reference (procedure)	Proced. audeq.	F	I	D	Categ (Rat.)	JPM	MC	MA
Duty area № 01:	**Normal operation**									
2SRO15004	Increase reactor power from minimum control level up to the rated power.	900-PTO 957-RC-2 1042-RC-2	X X X	L	H	H	**C**	X		
2SRO16001	Compare the new data of reactor physics calculations with the reactor installation actual parameters.	900-PTO 1359-TAI	X X	A	H	A	**T**			
2SRO16002	Flatten core axial and radial power flux distributions after power increase.	900-PTO 957-RC-2 1042-RC-2	X	A	H	H	**C**	X		
2SRO16003	Flatten graphite stack temperature distribution.	900-PTO 957-RC-2 1042-RC-2	X	H	H	A	**C**	X		
2SRO16004	Perform automatic controllers transition.	900-PTO 998-TAI 932-TAI	X X X	H	H	A	**C**	X		
2SRO16005	Control power distribution at the change of core thermohydraulic parameters.	900-PTO 957-RC-2	X X	L	H	A	**C**	X		
2SRO17001	Decrease reactor power to given level by means of power setpoint unit.	900-PTO 957-RC-2	X X	A	A	A	**C**	X		

Task No.	Task Statement	Reference (procedure)	Proced. audeq.	F	I	D	Categ (Rat.)	JPM	MC	MA
Duty area № 02: Beyond operational limits activities. Failures not caused violation of plant safe operation conditions										
2SRO20001	Stabilise power distribution after reactor power decrease undertaken by Power Fast Decrease Key.	900-PTO 957-RC-2 1042-RC-2	X	L	H	A	**C**	X		
2SRO20002	Evaluate whether reactor temporary operation is allowed in case of equipment failures or parameters deviations.	900-PTO 957-RC-2 1042-RC-2	X	A	H	A	**T**			
2SRO20003	Determine the cause of fast radial fluxtilt.	900-PTO 510-TAI 957-RC-2	X	L	H	H	**C**			
2SRO20004	Determine the cause of slow radial fluxtilt.	900-PTO 510-TAI 957-RC	X	H	H	A	**T**			
2SRO20005	Determine the cause of fast axial fluxtilt.	900-PTO 510-TAI 957-RC-2	X	L	H	H	**C**			
2SRO20006	Determine the cause of slow axial fluxtilt.	900-PTO 510-TAI 957-RC-2	X	H	H	A	**T**			
2SRO20007	Perform actions in case of spontaneous CPS rod moving (manual control, shortened absorber rod, or fast-acting protection system).	900-PTO 510-TAI 957-RC-2 1042-RC-2	X X X X	L	H	H	**C**	X		
2SRO20008	Correct radial flux fluxtilt.	900-PTO 510-TAI 957-RC-2	X	H	H	A	**C**	X		
2SRO20009	Correct core axial fluxtilt.	900-PTO 510-TAI 957-RC-2	X	H	H	A	**C**	X		
2SRO20010	Correct the decrease of fuel channel critical power margin coefficient.	900-PTO 510-TAI 957-RC-2	X	A	H	A	**C**	X		

Task No.	Task Statement	Reference (procedure)	Proced. audeq.	F	I	D	Categ (Rat.)	JPM	MC	MA
Duty area № 02: Beyond operational limits activities. Failures not caused violation of plant safe operation conditions										
2SRO20011	Perform actions in case of graphite temperature raise.	900-PTO 510-TAI 957-RC-2	X	A	H	A	**C**	X		
2SRO20012	Perform actions while identifying leaking fuel assembly.	900-PTO 1007-OYBIN 957-RC-2	X	L	H	A	**C**	X		
2SRO20013	Perform actions in case of reactivity spikes.	900-PTO 957-RC-2	X	L	H	A	**C**	X		
2SRO20014	Perform actions in case of fuel channel's integrity monitoring signals.	900-PTO 936-TAI 1042-RC-2	X	L	H	A	**C**	X		
2SRO20015	Perform actions in case of CPS rod jamming.	900-PTO 1042-RC-2	X X	L	H	A	**C**	X		
2SRO20016	Perform actions in case of CPS failures not caused violation of safe operation conditions.	900-PTO 510-TAI 1022-RC-2	X X X	L	H	A	**C**			

Task No.	Task Statement	Reference (procedure)	Proced. audeq.	F	I	D	Categ (Rat.)	JPM	MC	MA
Duty area № 03:	**Beyond safety limits activities (emergency situations)**									
2SRO30001	Perform actions in case of events requiring decrease of reactor power.	900-PTO 957-RC-2 1042-RC-2	X X X	A	H	A	**T**	X		
2SRO30002	Perform actions in case of events requiring reactor shut down.	900-PTO 957-RC-2 1042-RC-2	X X X	L	H	A	**C**	X		
2SRO30003	Perform actions to correct violation of safety limits on fuel channel power.	900-PTO 510-TAI 957-RC-2 1042-RC-2	X X X X	L	H	A	**C**	X		
2SRO30004	Perform actions in case of CPS failures caused violation of safety limits or plant safe operation conditions.	900-PTO 510-TAI 957-RC-2	X X X	L	H	H	**C**	X		
2SRO30005	Perform actions in case of spontaneous reactor power increase beyond the safety limits.	900-PTO 510-TAI 957-RC-2 833-OYBIN	X X X X	L	H	A	**C**	X		
2SRO30006	Perform actions at reactor shut down by AZ – 5 (reactor scram) or fast-acting protection system.	900-PTO 957-RC-2	X X	L	H	A	**T**	X		
2SRO30007	Control the reactor at AZ – 1, AZ – 2 (at power decrease by 60% or 50%).	900-PTO 957-RC-2	X X	L	H	A	**C**	X		
2SRO30008	Perform actions in case of CPS rods control failure.	900-PTO 510-TAI	X X	L	H	A	**C**			

Task No.	Task Statement	Reference (procedure)	Proced. audeq.	F	I	D	Categ (Rat.)	JPM	MC	MA
Duty area № 04:	**Accidents**									
2SRO40001	Perform actions in case of a fuel channel rupture, reactor channels water supply lines rupture, distributing group header or steam-water rupture.	900-PTO 833-OYBIN 1007-OYBIN 936-TAI 1022-RC-2	X X X X X	L	H	H	**C**	X		
2SRO40002	Perform actions in case of CPS coolant loop dewatering.	900-PTO 833-OYBIN 917-RC-2 1022-RC-2	X X X X	L	H	H	**C**	X		
2SRO40003	Perform actions in case of accidents during fuel channels refuelling.	900-PTO 2551-OYBIN 1022-RC-2 1042-RC-2	X X X X	L	H	H	**C**	X		

Task No.	Task Statement	Reference (procedure)	Proced. audeq.	F	I	D	Categ (Rat.)	JPM	MC	MA
Duty area № 05:	**Routine activities**									
2SRO50001	Perform shift turnover.	1022-RC-2 1612-PTO	X X	H	A	A	**T**	X		
2SRO50002	Check controls' operability.	900-PTO 510-TAI 957-RC-2 1493-PTO	X X X X	A	H	A	**T**	X		
2SRO50003	Check the compliance of CPS rods position with MCR control rod position indicator and with rods position printout.	900-PTO 1022-RC-2	X X	H	H	L	**T**	X		
2SRO50004	Check the compliance of local pairs of set-points with the reactor fuel loading.	900-PTO Fuel Map	X X	H	H	L	**T**	X		
2SRO50005	Evaluate the operability of equipment and systems significant for plant safe operation using plant safe operation criteria.	900-PTO 1022-RC-2	X X	H	H	A	**T**			
2SRO50006	Control reactor parameters for which normal operation limits are set.	900-PTO 1022-RC-2	X X	H	A	A	**T**			
2SRO50007	Analyse "SKALA" printouts.	900-PTO 1359-TAI	X X	H	H	A	**T**			

Task No.	Task Statement	Reference (procedure)	Proced. audeq.	F	I	D	Categ (Rat.)	JPM	MC	MA
Duty area № 06:	**Response to alarm actuation**									
2SRO60001	Perform actions at reactor space pressure increase alarm.	900-PTO 936-TAI	X X	L	H	A	**C**	X		
2SRO60002	Perform actions at pressure increase alarm in the rooms of reactor channels water supply lines, reinforced leaktight compartment, drum-separator rooms.	900-PTO 833-OYBIN	X X	L	H	A	**C**	X		
2SRO60003	Perform actions at fuel channel flow decrease alarm.	900-PTO 1007-OYBIN 1042-RC	X X X	A	H	A	**C**	X		
2SRO60004	Perform actions at fuel channel flow increase alarm.	900-PTO 1007-OYBIN 1042-RC	X X X	A	H	A	**C**	X		
2SRO60005	Perform actions at alarm signal of flow decrease in CPS distribution header.	900-PTO 917-RC-2	X X	A	H	A	**C**	X		
2SRO60006	Perform actions at alarm signal of flow increase in CPS distribution header.	900-PTO 917-RC-2	X X	A	H	A	**C**	X		

Appendix B

SELECTED EXAMPLES OF JOB COMPETENCY ANALYSIS METHOD (JCA)

B.1. JCA for PWR Industrial Safety and Radiation Protection Technician (France)

1 — Job position	Industrial Safety And Radiation Protection Technician Consulting, assistance, checking, verifying, monitoring industrial safety and radiation protection activities
2 — Country	France
3 — Utility/NPP	All EDF NPPs
4 — Type of NPP	PWR
5 — Type of analysis	Job Competency Analysis (JCA)
6 — Total duration	4 times 2-day meetings in a nine month period. Plus 2 steering committees at the beginning and the end of the analysis.
7 — Resources needed	4 plant section heads, 2 Safety And Radiation Protection (SRP) Engineers, 2 dedicated SRP Trainers, 4 SRP technicians, 2 corporate SRP Experts, 3 Human Resources Experts. All these persons were involved in all meetings.
8 — Special tools	No special tools excepts typing software.
9 — Procedures/references	Procedures used were the procedures that are in use in EDF for all Job Competency Analysis such as "*Quality of Training Programmes*", June 1995.
10 — Identification of attitudes	The attitudes as well as skills and knowledge were identified on a discussion basis inside the working groups, considering different experiences of the group, and the work being done by the SRP technicians at the power plants.
11 — Strengths	Direct relation with the job itself (through involving job incumbents). Gives later a comparison with the existing competencies. Not time consuming.
12 — Weaknesses/difficulties encountered	

Additional information

1. GENERAL PROCESS

In France, EDF has chosen the Job Competency Analysis or JCA approach to define knowledge, skills and attitudes to develop the necessary competencies to hold a given job. This approach based on determining the competencies to be demonstrated in specific job conditions, allows us to overcome the tendency for utility staff to eliminate elements of knowledge which are not directly connected to one task. Indeed, it has been shown that comprehension of the physical process behind the manipulation enhances performance. the "why" is as important as the "how".

All NPP jobs in EDF are progressively analyzed using JCA. This results in specific documents called "référentiel métier" (translated into Job Reference Frames) which list, for each job, the inter-relationships between job activities, the conditions of performance, the competencies involved, the expected results and knowledge, skills and attitudes to be acquired.

This first phase of the SAT process could be triggered by three different sources of needs:

- technical problems repetitively encountered during operations,
- strategic projects launched at the company (quality awareness programme, safety culture, etc.) or the plant level (new computer, etc.),
- job/trade evolution due to new technologies, new organization, etc.

Job reference frames allow human resources managers and section heads to compare the competencies needed for a given job with the competencies already demonstrated by the personnel in charge of the job. They can then identify the competencies to be produced and decide if training is one or the only solution for that. They could study other possibilities such as a new organization, a recruitment programme or subcontracting.

When training is chosen as the most efficient way to produce the needed competencies, the latter become the overall training objectives. The associated KSAs will then form the raw material for building training objectives. These Job Reference Frames are thus the source of generic KSAs. training engineering staff will add in collaboration with plant managers and section heads other plant specific KSAs.

From there, the Design phase of the SAT process takes over.

2. APPLICATION TO INDUSTRIAL SAFETY AND RADIATION PROTECTION (SRP)

Two special project groups were set up. The "production" group comprised four plant SRP section heads, two SRP engineers, two dedicated SRP trainers, four SRP technicians, two corporate SRP experts, three human resources experts. As experts in Risk Analysis, auditing activities, or management were called upon to shed light on specific topics. This group reported to a steering committee composed of one plant manager, one deputy plant manager, one operation section head, one maintenance section head and one corporate SRP expert.

The first group met 4 times during two consecutive days over the nine months between September 94 and July 95. The steering committee met twice, once in February 94 and a second time at the end of the project last week of June 95.

2.1. Review of SRP mission

It is in the framework defined by all French legal texts and industry guidelines that the mission of SRP professionals is determined. The pivotal principle is that risk prevention is based on self-protection: safety cannot be dissociated from all work activities. “Safety is business of all, safety is implemented by each of us”. The responsibility of the supervisors is to ensure that conditions of application are filled with that implementation is effective.

The mission of SRP professionals is then to co-ordinate and facilitate all actions of risk prevention in domains like industrial safety, radiation protection and fire protection. As expert he advises and assists plant sections and subcontractors working on the plant equipment. He is also in charge of checking and verification activities as well as promoting risk prevention through participation in specific training and communication.

2.2. SRP Job Reference Frame

Table 1 represents a copy of the actual document. Activities have been regrouped into domains with a global definition for each for them. Competencies are also regrouped around large ones common for all domains such as getting information, investigating and analyzing, treating to make proposals, checking and verifying, reporting.

Competencies and performance levels have to be read horizontally, line to line whereas conditions of realization and associated knowledge have to read vertically as they refer to the whole domain.

This Job Reference Frame is the source from which another project group composed of SRP professionals and trainers has designed and developed training programmes.

This publication represents the common reference from for all SRP job in EDF NPPs. The generic competencies have to be completed by those associated with plant specific requirements. Also, even if this reference publication is first aimed toward training and the other phases of the SAT process, it could be used as a valuable information resource for other activities such as management, communication or auditing.

Text cont. on page 69.

TABLE 1. PROFESSIONAL ACTIVITIES AND COMPETENCIES REFERENCE FRAME

CONSULTING ACTIVITIES	**Definition :** The **consulting** activities take place off line, upstream from the action to be carried out. Thanks to documents and methodologies, the risks prevention professionals participate in preparing the action and helping in the decision making, especially in the selction of protective equipment and measurements to be taken in regard to safety rules.

Conditions of achievement (information, equipment, obligations)	***Abilities*** **/Competencies**	**Performance requirements (expected results, indicators)**	**Related KSAs (general & theoretical Knowledge Skills & Attitudes**
From : - a request from a team supervisor, a section head or a contractor, - the industrial Safety and Health Physics Section, its possibilities and availabilities, - the safety, security, quality rules and regulations,	*Being informed :* - gathering facts and data, expectations, the request items, - update on environment, the context, the conditions and the chronological accounts of the problem raised, - identifying and selecting technical relevant information	- New wording of request and problem raised (items described, put into relation,...), - similar situations checked in various experience feedbacks, - updating on required regulations and documents.	In fields of **industrial safety, health physics, fire prevention, environment protection:** - state-of-the-art practices, - equipment technology, - company doctrine and manufacturer's specifications, - risks prevention.
- the use of equipment and its availability, - the constraints due to the customer/the situation (place, schedule, budget, environment,...), - simulations.	*Analysing :* - identifying and characterizing the problem, - assessing its extent and its degree of emergency, - clarifying and relating all the data gathered (context, chronological accounts).	- Physical measurements carried out if necessary, - comparison with the existing texts and information sources, - diagnosis established and confirmed.	**Laws and regulations :** - law nr.91.1414 of 31.12.91 on prevention of risks, - laws nr.75.306 of 28.04.75 and nr.88.662 on health physics in Basic Nuclear Facilities (1988), - law nr.92.158 (1992) on works carried out by other companies,
	Dealing with : - making proposal for the solution(s) best adapted to context according to technical and socio-economic criteria, - identifying and taking into account the logistic support required for action, - expressing various scenarios and identifying the feasibility conditions	- Explanatory scenarios proposed, - action decisions considered in their achievement and implication.	- quality decree of 10.08.84, - basic rules applying to labor law (working hours, business trips,...), - texts and doctrines concerning fire (RCCI : Design and Construction Rules related to Fire of PWR Nuclear Islands). **Knowing the company :** - organization, circuits, operations (EDF/other companies, plant/site technical support group, nuclear power plant/corporate resources departments,...), - procedures, quality plan,... - safety rules, - authorization requirements.
	Checking : - checking the validity and the adaptation of the scenarios to the problem(s) raised : from the customer viewpoint from the generating facts	- Proposals and figures checked as compared to standards and/or experience feedback, - solution withheld modelized, - request satisfied	**Methodology and "general tools" :** - written and oral expression, - office automation (word processing, spreadsheet), - problems analysing and solving, - basic calculations, paying attention/listening/readjustment,...
	Reporting : - formalizing one's proposals - generating an experience feedback	- Documents established with clarity and accuracy (reports, objectives book, good practices file,...), - traceability of the consulting activities guaranteed.	

ASSISTANCE ACTIVITIES

Definition :

The **assistance** activities are distinguished by the following :
- real time development (during and on the site work, including the prevention "act" if necessary),
- following a request for advice or, more on an ad hoc basis,
- helping in the action ("giving a hand" rather than "doing for someone".

The assistance may also be defined as a technical support to workers.

Conditions of achievement (information, equipment, obligations)	***Abilities*/Competencies**	**Performance requirements (expected results, indicators)**	**Related KSAs (general & theoretical Knowledge Skills & Attitudes**
From : - a request from a team leader, a section head or a contractor, - the industrial Safety and Health Physics Section, its possibilities and availabilities, - the safety, security, quality rules and regulations,	*Being informed :* - gathering facts and data, expectations, the request items, - updating on environment, the context, the conditions and the chronological accounts of the problem raised, - identifying and selecting technical relevant information	- Relevant information gathered (problem, chronological accounts,...),	In fields of **industrial safety, health physics, fire prevention, environment protection:** - state-of-the-art practices, - equipment technology, - company doctrine and manufacturer's specifications, - risks prevention.
- the work permit - possible work and reference procedures, - the use of equipment and its availability,	*Analysing :* - identifying and characterizing the problem, - assessing its extent and its degree of emergency, - identifying its feasibility.	- Problems raised in one's field of skills, - Intervention features indentified, - required blockings defined, - key points established.	**Laws and regulations :** - law nr.91.1414 of 31.12.91 on prevention of risks, - laws nr.75.306 of 28.04.75 and nr.88.662 on health physics in Basic Nuclear Facilities (1988), - law nr.92.158 (1992) on works carried out by other companies,
- the constraints due to the customer/situation (place, schedule, budget, environment,...),	*Dealing with :* - carrying out specific measurements and implementing special equipment, - completing with the participant the analysis of risks liable to be encountered on site, - participating in implementations.	- Intervention limits defined, - measurements sheets well-informed, - deviations dealt with, - prevention plan well-informed.	- quality decree of 10.08.84, - basic rules applying to labor law (working hours, business trips,...), - texts and doctrines concerning fire (RCCI : Design and Construction Rules related to Fire of PWR Nuclear Islands). **Knowing the company :** - organization, circuits, operations (EDF/other companies, plant/site technical support group, nuclear power plant/corporate resources departments,...), - procedures, quality plan,... - safety rules, - authorization requirements.
	Checking : - checking if the intervention is correctly carried out and its relevance with regard to the problem raised.	- Self-protection rules observed, - blockings and key-points respected, continuation of action feasible under the best conditions, - risks abolished.	**Methodology and "general tools" :** - written and oral expression, - office automation (word processing, spreadsheet), - basic calculations, paying attention/listening/readjustment,...
	Reporting : - formalizing the updates and results of one's intervention, - generating experience feedback	- Documents established with clarity and accuracy	

CHECKING ACTIVITIES

Definition :

Set of operations carried out by the structures of the Industrial Safety and Health Physics Section according to a systematic method enabling to check the achievement and the quality of its own activities.

Conditions of achievement (information, equipment, obligations)	*Abilities* /Competencies	Performance requirements (expected results, indicators)	Related KSAs (general & theoretical Knowledge Skills & Attitudes
From : - check lists, procedures, - safety, security, quality rules and regulations, - risk analysis carried out, - compilation of local requirements and instructions,	*Being informed :* - knowing the nature of the activity to be checked, - knowing the activity-related instructions, - identifying the check key points.	- Documents used (check lists and procedure) corresponding to the activity to be checked, - accurately established check points concerning the activities to be carried out.	In fields of **industrial safety, health physics, fire prevention, environment protection:** - state-of-the-art practices, - equipment technology, - company doctrine and manufacturer's specifications, - risks prevention. **Laws and regulations :**
- general knowledge regarding the activity, - relationship with the person in charge of the activity, - site knowledge,	*Analysing :* - establishing the check scenarios.	- Relevance and validity of scenario suggested, - Prior examination of various points to be checked,	- law nr.91.1414 (1991) on the prevention of risks, - laws nr.75.306 (1975) and nr.88.662 (1988) on health physics in Basic Nuclear Facilities, - law nr.92.158 (1992) on works carried out by other companies, - quality decree of 10.08.84,
- knowledge of the site's security organization, - taking part in meeting dealing with work requests, unit shutdown and scheduling.	*Dealing with :* - checking if the rules and regulations are applied, - checking the quality of the syntheses, - verifying that the individual's attitude and behavior are in compliance.	- Selection of check points met, - correct site housekeeping, - assessment and compliance of authorizations, permits, isolation documents...	- basic rules applying to labor law (working hours, business trips,...), - texts and doctrines concerning fire (RCC-I : Design and Construction Rules related to Fire of PWR Nuclear Islands).
	Checking : - verifying that all the keypoints have been checked, - carrying out experience feedback.	- Check list verified.	**Knowing the company :** - organization, circuits, operations (EDF/other companies, plant/site technical support group, nuclear power plant/corporate resources departments,...), - procedures, quality plan,... - safety rules, - authorization tasks.
	Reporting : - sounding the alarm if necessary, - setting up a checking follow-up file.	- Report filled out (tidily, clearly), - alarm given if necessary.	**Methodology and "general tools" :** - written and oral expression, - office automation (word processing, spreadsheet), - basic calculations, - paying attention/listening/readjustment,... - audit methodology

VERIFICATION ACTIVITIES

Definition :
All operations enabling to check the system's actual and permanent operation set up by the department to obtain and guaranteee the protection of people and prevent fires.

Conditions of achievement (information, equipment, obligations)	*Abilities* /Competencies	Performance requirements (expected results, indicators)	Related KSAs (general & theoretical Knowledge Skills & Attitudes
From : - Access to information*, - the regulations, - the safety rules, - the regulations and procedures compendium,	*Being informed :* - ...of the scheduling of activities, - ...of the schedules, procedures and safety system implemented.	- Meeting attendance, - quantitative and qualitative documents checking, - knowledge of the procedures.	In the fields of **industrial safety, health physics, fire prevention, environment protection:** - state-of-the-art practices, - equipment technology, - company doctrine and manufacturer's specifications, - risk prevention. **Laws and regulations :**
- all organization procedures, - the doctrine, - reporting to line management, - near accident situations, - work request meetings,	*Analysing :* - finalizing a strategy, - selecting the instructions and procedures to be tested, - detecting the possible incoherences, - relying on experience feedbacks.	- Overall wiew of the system, - set relevant instructions, - control key points according to selected activities.	- law nr.91.1414 (1991) on the prevention of risks, - laws nr.75.306 (1975) and nr.88.662 (1988) on health physics in Basic Nuclear Facilities, - law nr.92.158 (1992) on works carried out by other companies, - quality decree of 10.08.84,
- unit shutdown meetings, - work scheduling meetings.	*Dealing with :* - verifying if the instructions and various documents have been correctly carried out as per the doctrine, - making sure the risks inherent in all the activities have been considered, - organizing the general exercises.	- Checking compliance with the selection of instructions, - correct site housekeeping, - informed prevention plans.	- basic rules applying to labor law (working hours, business trips,...), - texts and doctrines concerning fire (RCC-I : Design and Construction Rules related to Fire of PWR Nuclear Islands).
* (scheduling the activities, software data base, evolution of inconveniences,...).	*Checking :* - making sure all the instructions have been correctly inspected, - carrying out an experience feedback.	- List, description of the established instructions inspection, - Inspection of exhaustiveness of the carried out risks analysis.	**Knowing the company :** - organization, circuits, operations (EDF/other companies, plant/site technical support group, nuclear power plant/corporate resources departments,...), - procedures, quality plan,... - safety rules, - authorization tasks.
	Reporting : - establishing a compliance to system report.	- Document produced (written, oral, software).	**Methodology and "general tools" :** - written and oral expression, - office automation (word processing, spreadsheet), - problems analysing and solving, - basic calculations, - paying attention/listening/readjustment,... - chairing groups/regulation,... **Ergonomics**

RADIATION AND SAFETY MONITORING ACTIVITIES	**Definition :** All operations enabling the structure of the Industrial Safety and Health Physics section to check that the contractor's personnel apply the arrangements appropriate to risks prevention in their activities.

Conditions of achievement (information, equipment, obligations)	***Abilities* /Competencies**	**Performance requirements (expected results, indicators)**	**Related KSAs (general & theoretical Knowledge Skills & Attitudes**
From : - Knowledge of the individual access booklets (Health Physics authorization and validation), - knowledge testing, - software applications, - CEFRI certification, - operational dosimetry, - risks analysis,	*Being informed :* - Consulting the basic data, - knowing the points to be checked, - knowing the doctrine related to these points, - finding out the nature of the activity, - knowing all local instructions.	- Main doctrine points overcome, - instructions sent to those concerned.	In fields of **industrial safety, health physics, fire prevention, environment protection:** - state-of-the-art practices, - equipment technology, - company doctrine and manufacturer's specifications, - risk prevention. **Laws and regulations :**
- existence of prevention plan, - knowledge of minor accidents.	*Analysing :* - assessing individuals' profile (dosimetry, tests).	- Scales applied to tests, - relevant progress axes suggested.	- law nr.91.1414 (1991) on the prevention of risks, - laws nr.75.306 (1975) and nr.88.662 (1988) on health physics in Basic Nuclear Facilities, - law nr.92.158 (1992) on works carried out by other companies, - quality decree of 10.08.84,
	Dealing with : - making sure the instructions are known (fire permit, solvent,...) - handing out, explaining the local instructions, - calling, if necessary, the physician and/or the person in charge of the contractor's personnel.	- Strictness of inspections (statistically meaningful results), - quality of relationship, - inspection of documents.	- basic rules applying to labor law (working hours, business trips,...), - texts and doctrines concerning fire (RCC-I : Design and Construction Rules related to Fire of PWR Nuclear Islands). **Knowing the company :**
	Checking : - Referring to, in case of availability, the check list of these operations, - carrying out an experience feedback.	- Synthesis of the operation, - Verification of minimum knowledge required.	- Organization, circuits, operations (EDF/other companies, plant/site technical support group, nuclear power plant/corporate resources departments,...), - procedures, quality plan,... - safety rules, - authorization requirements
	Reporting : - drawing up a statistical document, - writing out a general activity report, - informing the quality/purchase section.	- Clear and easy-to-read documents, - ability to make the most of technical documents	- test : doctrine and DSRE questions file. **Methodology and "general tools" :** - written and oral expression, - office automation (word processing, spreadsheet), - problems analysing and solving, - basic calculations, - paying attention/readjustment, - group chairing /regulation,... - DOSINAT/DOSIMO investigation thresholds, - DOSINAT, SYGMA, A22, MRH softwares.

WORK GROUP STEERING AND COMMUNICATION ACTIVITIES (for site personnel and contractor's personnel if any)	**Definition :** Voluntaristic process aiming at organizing the risks prevention promotion with the support of in line management (due to the behavior dimension).		
Conditions of achievement (information, equipment, obligations)	***Abilities*** **/Competencies**	**Performance requirements (expected results, indicators)**	**Related KSAs (general & theoretical Knowledge Skills & Attitudes**
From : - Upon request of the structures, and the management of the nuclear plants, of the sections, of the CHSCT, - upon request of the internal and external magazines (Vigilance, Vie Electrique,...),	*Being informed :* - Taking part in meetings, committees (ALARA, fire, communication,...), - organizing exchanges between companies and sites, - going through the specialized publications and documents.	- Relevant information selected, - quality of exchanges, - documents used as compared to the situations to be dealt with (for example : iodine, xenon,...).	- Expertise in one's field, - written and oral documents, - group organization and leading techniques.
- upon request of the corporate departments (DSRE, SPS, Corporate Resources Departments,...), - during unit shutdowns, in preparation,	*Analysing :* - ...the documents received, -...the accidents, the near accident, the experience feedback, the statistics.	- Information adapted and checked prior to circulation, - risks identified taken into account.	
- on the industrial Safety and Health Physics Section's structure initiative, relying on specialized resources and means (CRAM, INRS,...).	*Dealing with :* - setting up working groups, - organizing conferences, - writing articles, reports, - taking part in meetings (safety update), - taking part and contributing to start up meetings, - achieving prevention campaigns.	- Creativity of suggestions, - interest shown by participants, - information carriers adapted to the audiences : panels, videos, documents, papers,..., - security campaigns (tournaments, open days, contests, exhibitions).	
	Checking : - Observing safety actions taken over from and assumed by other Sections, - verifying that the policy is assumed by management contracts and indicators, - carrying out surveys and inquiries.	- Initiatives taken by other Sections on the theme of security, - modifications of organization (appointment of safety correspondents for instance), - messages taken into consideration for different fields,	
	Reporting : - achieving action follow-up and assuring appropriate reporting, - organizing meetings.	- Industrial Safety and Health Physics structure considered as welcoming and open to exchanges, - behavior evolution.	
		- Synthetic communications document with a reference, - followed up distribution of the documents established, - direct contact on site.	

TRAINING ACTIVITIES	Definition : All activities implemented by the risks prevention professionals (either in an organized or a co-organized session) to enable the personnel to attain the level of knowledge ans know-how in the various risks prevention fields (health physics, fire, traditional safety) and to develop the related skills.

Conditions of achievement (information, equipment, obligations)	*Abilities* /Competencies	Performance requirements (expected results, indicators)	Related KSAs (general & theoretical Knowledge Skills & Attitudes
From : - according to laws and regulations (fair labor standards act, doctrine, standard training plan, local professional training programme, policies,...), - local initiatives and section managers, - co-operation with site external sections and training sections, - fields of special concern (dangerous products, ALARA process, experience feedback,...).	*Being informed :* - Studying the site policies and measurements specific to the fields of concern, - improving one's knowledge in one's field of expertise.	- Training specifications and training file used in the training section, - items related to one's intervention field identified, - anticipation and preparation of the audience's and the structures' expectations,	The interventions are carried out in a confirmed field of skills (industrial safety, health physics, fire,...). Compulsory prerequisites : pedagogical training (2452 : transfer of knowledge, pedagogical initial training,...). Interventions carried out within Pers.888 (Health and Safety at Work Committee, CMP,...). Voluntary service and good relationship qualities welcome.
	Analysing : - identifying training objectives, - designing and developing adated actions.	- needs definition re-written and specified.	
	Dealing with : - scheduling the participants to the training sessions, - organizing specific training sessions, - motivating the staff and the strucures, - compilling one's own organization guide and one's own documents,	- Audience's expectations and needs identified, - training aims formalized, - fields of knowledge specified.	
	- chairing (or co-chairing) training actions or sequences.	- Training specifications and pedagogical files achieved, - prerequisites respected, - aims, contents, action modes adapted to situation and audiences, - quality of training delivery.	
	Checking : - assessing and synthesithing the trainees' acquired knowledge, - validation of actions, - participating in the syntheses (concerns line management).	- Relevance of the analyses, - taking into account the notes and suggestions made in the syntheses, - individual assessment files used.	
	Reporting : - taking part in experience feedback, - achieving quantitative evaluations, - comparing the achievements and the aims to the management contract, - checking the integration of the training actions in individual training plans.	- Attendance and participation to the training sessions (rate), - Section heads experience feedback used and taken into consideration, - results of training actions forwarded (syntheses, assessments).	

ENGINEERING ACTIVITIES IN THE FIELD OF RISKS PREVENTION (industrial safety, health physics, fire)	Definition :
	All the methodological steps linked, carried out off line, based on experience feedback analysis and multidisciplinarity. They are applied to the designing of action systems and prevention devices to effectively reach the goal set (preventing risks, limiting accidents). They aim at helping decision making thanks to reflexion and anticipation, as well as an off-line event analysis. They include the definition of the aims, the follow-up and the implementations and their associated indicators. Engineering is a suggestive force as well as an aid in decision making. Risks prevention engineering includes analyses of risks and of prevention needs, the prevention project design, the implementation co-ordination and control, as well as the assessment of the prevention's effects (according to AFNOR, training lists)

Conditions of achievement (information, equipment, obligations)	*Abilities* /Competencies	Performance requirements (expected results, indicators)	Related KSAs (general & theoretical Knowledge Skills & Attitudes
From : - Request and orders coming from internal sections (or from those of other Nuclear Power Plants), the Corporate Resource Departments, or other companies, - processes based on experience feedback*, - preparation and site engineering structures	*Being informed :* - regular check at all information sources (chronological accounts, experience feedback, SAPHIR,...), - taking part in symposiums and work sessions within the company (Corporate Resources Departments), as well as outside the company	- Mastering the specialized information in one's field, - standing and efficient listening capacity, - relevance of selected information, - identification of multidisciplinary aspects of problem to be solved.	- Expertises in the fields of conventional safety, health physics, fire (knowledge, experience, technicality, regulations,...), - techniques related to project management, - mastering the use od data banks (computerized maintenance management system,
- contributions and requests from various local or national committees (ALARA, fire prevention, industrial safety,...) - modification files (Design Department for Thermal and Nuclear Projects),	(INRS, DRIRE, OPRI, the fire brigade, subcontractors, French Atomic Energy Commission,...).	- Decision taker identified and request clarified, - coherence between research and the problem raised, - accuracy in the information selection and analysis, - timeliness in the choice of information.	SAPHIR, ISOE,...), - techniques of analysis and problems solving, - written and oral expression (new wording, synthesis, clarity,...),
- a large autonomy and a position within the organization enabling freedom of operation and independence in getting information and performing analyses, - regulations, **"The experience feedback consists in drawing lessons from the progress of an*	*Analysing :* - considering the aims of the PSE and PSU, - integrating the laws and regulations, - integrating experience feedback,	- Quality of the works (form and content), - feasibility items identified (costs/timeliness), - taking into account additional expertises, - anticipation and innovation, - suggestion within the context from the concerned actors' viewpoint (preparation, intervention, control,...).	- steering of groups, management of meetings - experience feedback/good practices (safety, ALARA process), - knowledge of the installation operation and of the site general organization.

B.2. JCA for WWER-1000 main control room and maintenance personnel (Russian Federation)

Example 1

1 — Job position	MCR Reactor Operator
2 – Country	Russian Federation
3 – Utility/NPP	Novovoronezh NPP, unit 5
4 – Type of NPP	WWER-1000
5 – Type of analysis	Some kind of Job Competency Analysis. Type of analysis was chosen by TACIS project
6 – Total duration	10 weeks
7 – Resources needed	One Training Consultant (total of 15 person-days). Two instructors (total of 80 person-days). Three MCR Reactor Operators (total of 9 person-days). One MCR Turbine Operator (total of 2 person-days). One Unit Shift Supervisor (total of 2 person-days)
8 – Special tools	Templates Database Special tables Questionnaires
9 – Procedures/references	Novovoronezh Training Centre (NVTC) manuals. EDF manuals.
10 – Identification of attitudes	No special comments
11 – Strengths	Team approach to identify correct competency. Cost-effective analysis, completed in short time. Not so much paper materials, no difficulties to maintain.
12 – Weakness/difficulties encountered	Not so detailed analysis (JCA) resulted in more subjectivity and influenced the development of correct and specific enabling training objectives at the next phase (DESIGN). There were some difficulties to validate the list of competencies due to the translation and interpretation problems.

Example 2

1 — Job position	Engine Mechanics Maintenance Foreman
2 – Country	Russian Federation
3 – Utility/NPP	Novovoronezh NPP, unit 5
4 – Type of NPP	WWER-1000
5 – Type of analysis	Some kind of Job Competency Analysis. Type of analysis was chosen by TACIS project.
6 – Total duration	8 weeks
7 – Resources needed	One Training Consultant (total of 15 person-days). Two instructors (total of 80 person-days). Two maintenance foremen (total of 10 person-days). One Maintenance Department Deputy Manager (total of 3 person-days).
8 – Special tools	Templates Database Special tables Questionnaires
9 – Procedures/references	NVTC manuals, EDF manuals.
10 – Identification of attitudes	No special comments
11 – Strengths	Team approach to identify correct competency. Cost-effective analysis, completed in short time. Not so much paper materials, no difficulties to maintain. Method allowed to find that job positions analyzed had narrow competencies
12 – Weakness/difficulties encountered	There were some difficulties to validate the list of competencies due to the translation and interpretation problems.

Additional information

Due to the objective reasons there were different schemes for SAT-based analysis which were used for implementation at Novovoronezh Training Center (i.e. JCA and JTA). No one particular method was chosen as a basic one due to many reasons including lack of financial resources. Finally NVTC customized SAT process for its own needs. The description of this customized approach is presented below.

Brief description of JCA model used

JCA model

(a) General approach

This approach was implemented within the framework of TACIS Project 4.1 in the co-operation with Electricite de France (France) during 1993-96. This approach is implemented in nuclear training centres in France. Within project conducting this approach was customized for Novovoronezh NPP (unit 5). Fourteen job positions were analyzed – from reactor field operator job positions up to Unit Shift Supervisor.

(b) Stages of the process

- identification of the problem
- identification of training needs
- defining methods of information collection
- collection of information
- identification of Duty Areas for each position
- gathering additional information
- development of general competency lists
- validation of competency lists
- selection of competencies for training (all competencies were included in the training)
- Competency Analysis
- validation of KSA lists.

(c) Examples of competencies, KSAs and training objectives

See Attachment 1 "Example of MCR Task-Competencies Matrix".

Description of customized SAT process

(a) General view

This kind of SAT was chosen and approved in 1997. In general this approach is based on JCA methodology. Detailed description of this process is included in the following NVTC administrative procedures:

- Requirements for nuclear training process at Novovoronezh TC.
- Systematic approach to training. General rules of implementation.

General scheme of customized SAT process employed at NVTC is presented in Attachment 2.

(b) Description of the ANALYSIS phase Steps

Description of the Analysis phase steps is provided in Table A, Attachment 2.

Conclusion

Novovoronezh TC used different methods for SAT Analysis. Now NVTC has results of analysis for 4 job positions using JTA, 20 job positions using JCA, and 6 job positions using customized SAT.

Experience has shown there is no need to carry out a very detailed analysis for some job positions (i.e. maintenance, surveillance and testing, managers, etc.). Hence it would be more efficient (if there are enough resources) to carry out a Task Analysis in depth for job positions of personnel who are directly facing and/or influencing nuclear safety.

NVTC is responsible for NPP personnel initial training not only for Novovoronezh NPP, but for various Russian NPPs. A status of SAT implementation as well as a method for identification of job position's specific KSAs differ from one NPP site to another. From this point of view, NVTC should continue an activity to hold all data of JTA/JCA of NVTC Customers in order to maintain the training programs.

SAT-based method customized and implemented in NVTC is efficient only if the amount of trainees for the alike programs is quite large.

Attachment 1. Example of MCR Reactor Operator Task-Competencies Matrix

Field of activity (see Table 1) and field of knowledge(see Table 2) shown are for operator job position (Novovoronezh NPP, Unit 5)

TABLE 1. FIELD OF ACTIVITY: NORMAL PLANT OPERATION
POSITION: REACTOR OPERATOR

DEFINITION: Monitoring and control of unit operation and equipment.
Contribution to control of external hazards.

	TASKS	IMPLEMENTATION CONDITIONS	COMPETENCY	EXPECTED RESULTS
1	Checking on the systems and equipment state.	Location: - MCR; - Emergency shut-down panel. Equipment: - desks, panels; displays; - communication tools. Background: - during shift turnover; - periodically; - in case of annunciator appearance; - in case of parameter deviation; - constantly general control.	To percept information, analyse it, make conclusion: - to determine the required scope of checking; - to select means and ways of checking; - to use facilities to value checking; - to correlate parameters with specifies values.	Determination of accordance of equipment and systems state with requirements of the design and construction code and operating procedures.
	Putting the reactor Installation into critical state (minimum-controlled power level).	Location: - MCR. Equipment: - Neutron Flux Monitoring System, control and scram System; - Make-up-Blow-Down System; - Decontaminated Condensate System; - control means; - monitoring means; - operational log-book; - task log-book; - communication means. Background: - Reactor Installation start-up; - process specifications requirements for putting the RI into critical state; - nuclear safety requirements; - interaction with turbine and chemical Departments staff; — presence of core physicist.	- To define the conditions required for bringing the reactor to critical state; - to define moment of putting into critical state; - to understand the potential danger of the violation of the construction and design rules; - to interact with SS; - to appreciate safety measures completeness.	Reaching critical conditions within the control range with nuclear safety being provided.

TABLE 1. (cont.) FIELD OF ACTIVITY: INCIDENTAL, ACCIDENTAL OPERATION
POSITION: REACTOR OPERATOR

DEFINITION: Monitoring and control of unit operation and equipment during incident/accident.
According to procedures to implement the urgent actions in case of incident/accident symptoms/parameters

TASKS	IMPLEMENTATION CONDITIONS	COMPETENCY	EXPECTED RESULTS
1. Detection and analysis of the incident.	Place: - MCR. Means: - panels; - switchboards; - displays; - technical specifications; - emergency procedures; - telephone; - loudspeaker. Background: - a lot of information related to malfunction; - a lot of disturbing factors; - unexpected things; - limited time schedule; - team work.	- to adapt himself to unusual situation; - to correlate incident with the previous actions of the shift personnel; - to select safety related information; - to establish the cause/effect of the event; - to choose information required for causes detection.	Identification of the incident.

TABLE 1. (cont.) **FIELD OF ACTIVITY: NORMAL PLANT OPERATION**
POSITION: REACTOR OPERATOR

DEFINITION: Monitoring and control of unit operation and equipment.
Contribution to control of external hazards.

TASKS	IMPLEMENTATION CONDITIONS	COMPETENCY	EXPECTED RESULTS
1. Checking on the systems and equipment state.	Location: - MCR; - Emergency shut-down panel. Means: - desks, panels; - displays; - communication. Background: - during shift turnover; - periodically; - in case of annunciator appearance; - in case of parameter deviation; - constantly general control.	To percept information, analyze it, make conclusion: - to determine the required scope of checking; - to select means and ways of checking; - to use facilities to value checking; - to correlate parameters with specifies values.	Determination of accordance of equipment and systems state with requirements of the design and construction code and operating procedures.

TABLE 1. (cont.) FIELD OF ACTIVITY: COMMUNICATION
POSITION: REACTOR OPERATOR

DEFINITION: To carry out effective and efficient communication during all stages of NPP operation

TASKS	**IMPLEMENTATION CONDITIONS**	**COMPETENCY**	**EXPECTED RESULTS**
1. Shift turnover: - reading the operational documents and evaluation of the information; - acquisition of verbal information on the state of the unit from reactor Department SS, Reactor Operator and Turbine Operator; - transfer of information on the state of the unit; - receiving report from the fieldworker; - Department SS, unit SS reports on the state of equipment and the shift turnover possibility; - interaction with emergency handling shift personnel.	<u>Place:</u> - MCR. <u>Means:</u> - operational log-book; - orders log-books, task log-book; - parameters register; - print out; - telephone; - loudspeaker. <u>Background:</u> - pre-shift medical examination; - increased number of personnel in the MCR; - noisy conditions; - limited time schedule; - stable conditions; - by the order of the Department SS, unit SS; - violation of normal operation conditions or in case of emergency.	- To determine additional information required to define the state of the unit; - to focus attention on the specific features of the equipment and unit state; - to adapt himself to the operator receiving (transmitting) information; - to acquire and evaluate information under conditions of malfunctions and incident handling.	To maintain continuing monitoring of the unit. Completeness and relevance of the transferred and accepted information.

TABLE 1. (cont.) FIELD OF ACTIVITY: TRAINING
POSITION: REACTOR OPERATOR

DEFINITION: To carry out with individual training programme , to transfer and upgrade skills

TASKS	IMPLEMENTATION CONDITIONS	COMPETENCY	EXPECTED RESULTS
1. Transfer knowledge capacities and skills: - explanations and comments on the operator's own actions; - demonstration of the skills by the operator; - answering the questions of ST, OJT; - giving recommendations to ST, OJT.	Place: - MCR; - Emergency shutdown panel; - in situation. Means: - panels; - switchboards; - displays; - training programmes; - procedures and operational documents; - related equipment. Background - normal operation conditions; - shadow training (ST); - on-the-job training (OJT); - in case of deviation of normal conditions.	- to consider the initial level of the applicant; - to select the optimum way of skills and knowledge transfer; - to guide the applicant during the OJT.	Carrying out the Shadow and On-the-job training programs.

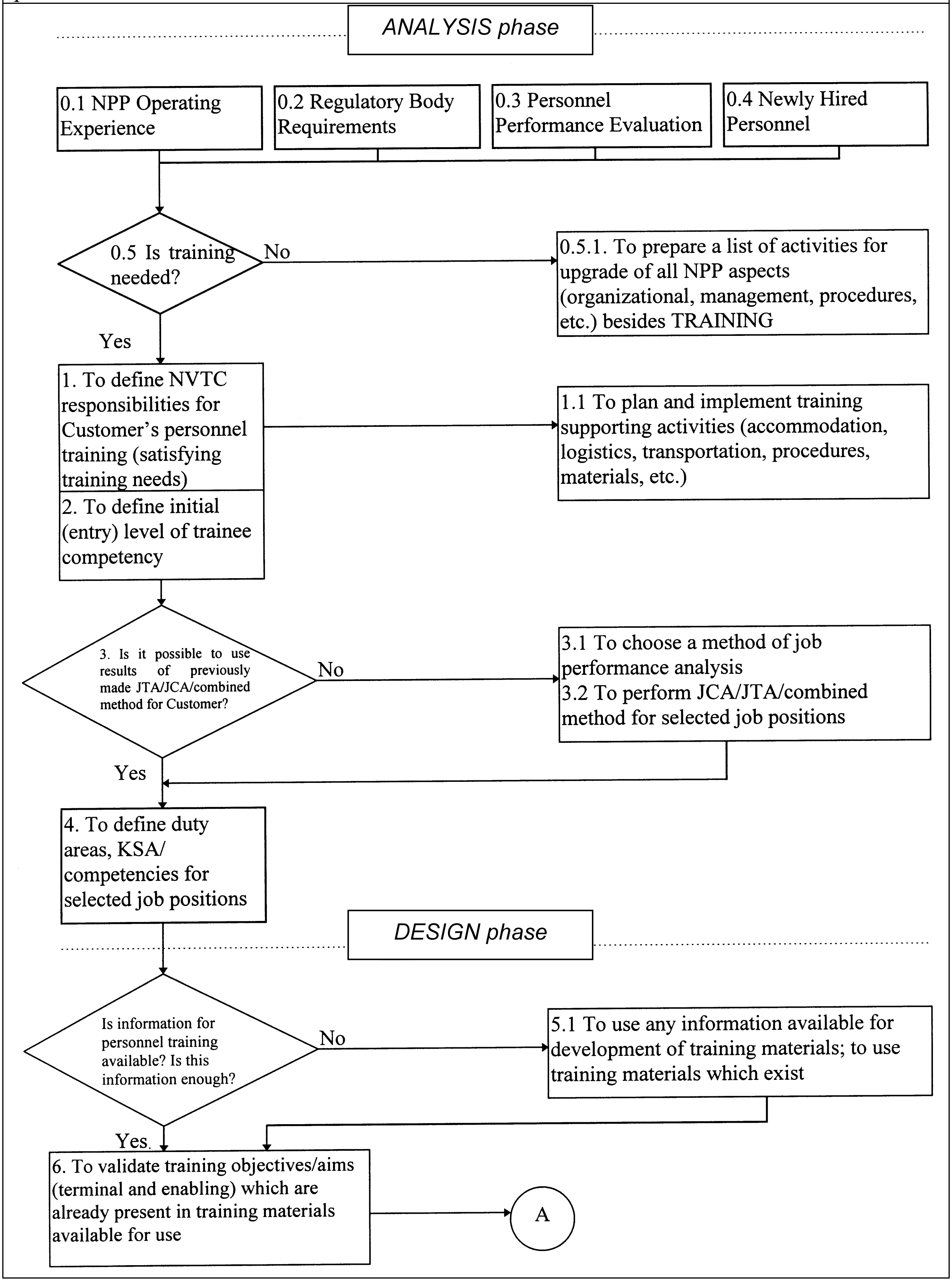
TABLE 2. FIELD OF KNOWLEDGE JOB POSITION — REACTOR OPERATOR (WWER-1000)

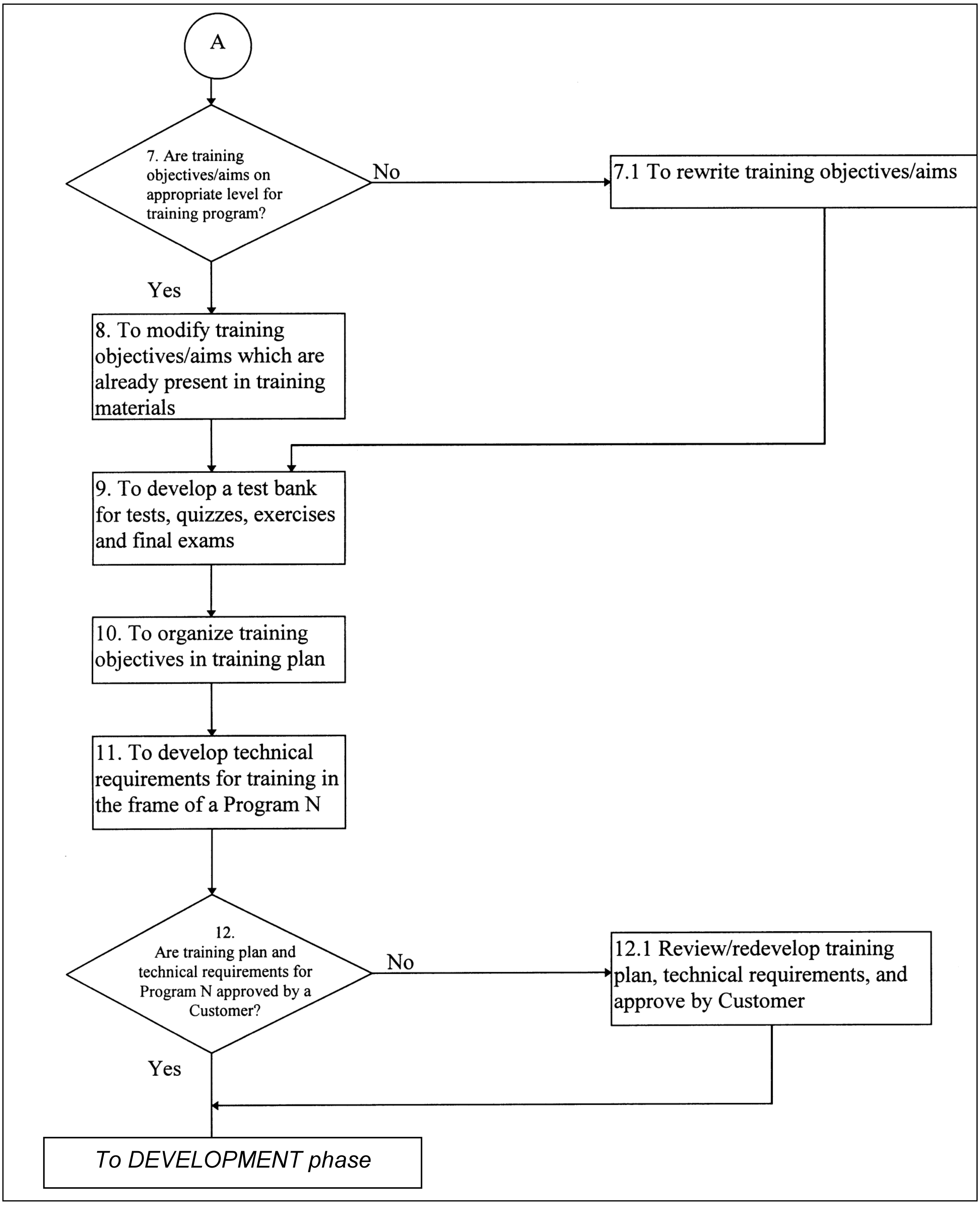
Job activity 4. Operation modes

N N	KNOWLEDGE	LEVEL of KNOWLEDGE	SOURCES	GENERAL AIMS OF TRAINING (to be able to)
1	2	3	4	5
1.	Process diagrams and lay-out of primary circuit equipment	3	Training in NPP TD OJT	To acquire the knowledge of primary circuit and reactor operation
2.	Primary circuit operation	3	- " -	
3.	Primary circuit auxiliary systems	3	- " -	
4.	Make-up — blow-down, special water treatment (Plant 1, Plant 2), controlled leakages	3	--“--	
5.	SG blow-down, special water treatment (Plant 5)	2	Chief designer's documents	
6.	Contaminated water treatment, special water treatment (Plant 3)	2	Training in NPP TD OJT	
7.	Fuel pool water cooling down and treatment, special water treatment (Plant 4)	2	- " -	
8.	Liquid radioactive waste storage	2	Training in NPP TD	
	…			
16	Fuel-handling equipment	2	Training in NPP TD OJT of the Reactor Dep. SS	To control refueling machine and fuel-handling equipment operation, to control refueling programme execution
	…			
27	Safety systems Passive, active safety systems HP safety injection system Emergency core cooling system Spray system Emergency feedwater HP compressed air Service water of secured consumers Emergency gas blow-off Control safety systems Instructions on safety systems operation …	3 3 3 3 3 2 - " - - " - - " - - " -	Training in NPP TD OJT - " - - " - - " - - " - - " - - " - - " - - " - - " - - " -	To acquire the knowledge of safety systems operation, to detect malfunctions which could cause non-serviceability of safety systems

N N	KNOWLEDGE	LEVEL of KNOWLEDGE	SOURCES	GENERAL AIMS OF TRAINING (to be able to)
1	2	3	4	5
	Secondary circuit :			
31	Turbine Department process schemes	2	Institute, Training in NPP TD OJT	To acquire the knowledge of turbine and secondary circuit equipment operation, to distinguish and evaluate operation conditions of various equipment of secondary circuit
32	Turbine and generator operation : - Turbine control and protection system - Turbine and generator lubrication system	2	Institute, Training in NPP TD OJT	
	Main condensate and feedwater	2	- " -	
	…			
43	Operating switch-overs	3	Training at the TC, OJT of the Reactor Dep. SS, Electrical Dep. SS, unit SS	
44	Cable lines layouts within the unit	2	Training at the TC, OJT of the Reactor Dep. SS, Electrical Dep. SS, unit SS, operating instructions, circuit	
	…			
59	Normal operation conditions	3	Training at the TC OJT	To determine, to analyze unit state parameters, to determine unit state according to process regulations
	Unit preparation for start-up after refueling	- " -	- " -	
	Unit start-up	- " -	- " -	
	Operation at power	- " -	- " -	
	Reactor shutdown	- " -	- " -	
	Scheduled cooling down and depressurization of the reactor coolant system	- " -	- " -	
	Refueling	- " -	- " -	
	Test programmes	- " -		

Attachment 2. Description of customized SAT used by NVTC (ANALYSIS and DESIGN phases

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7. Are training objectives/aims on appropriate level for training program?
No
7.1 To rewrite training objectives/aims
Yes
8. To modify training objectives/aims which are already present in training materials
9. To develop a test bank for tests, quizzes, exercises and final exams
10. To organize training objectives in training plan
11. To develop technical requirements for training in the frame of a Program N
12. Are training plan and technical requirements for Program N approved by a Customer?
No
12.1 Review/redevelop training plan, technical requirements, and approve by Customer
Yes
To DEVELOPMENT phase

TABLE A. DESCRIPTION OF PHASES' SEQUENCE WITHIN TRAINING PROGRAM DEVELOPMENT (PHASES ANALYSIS AND DESIGN)

No	*Step/phase*	*Criteria of activity/main works*
		ANALYSIS
0	0.1. Operating experience data 0.2. Regulator requirements 0.3. Results of work of the Customer personnel 0.4. The need in new personnel training	The analysis of needs shall be carried out in order to identify what constituents will be taken into consideration in the needs list development: • *operating experience data includes the list of equipment modifications, procedure changes, etc.* • *the Regulator requirements and standards lead to the necessity to include new topics into the programmes* • *results of personnel work as well as the relevant strong and weak points of the personnel work shall be accounted for* • *the company needs in personnel new training because of changing of the work places, new equipment and etc.*
	0.5. Is training really needed?	If training is really needed, shift to step 1.
1.	Identification of NV TC responsibilities as to the Customer personnel training (training needs analysis)	Issue of the list of jobs and/or programs basing on which it is necessary to carry out the analysis of applicability of the training materials developed earlier. *(Phases "0" and "1" shall be carried out in accordance with the NV TC document "Procedure of the staff training needs analysis and planning of its realization"*
	1.1 Planning and completion of the training support activities (reception, accommodation, transportation, consumables, logistics, technical documents, approval of documents etc.)	In case the necessity of training is definitely confirmed the strategy of realization is developed including the whole process of support (logistics of the staff training).
2	Definition/updating of the initial requirements to be met by personnel	In case new jobs are introduced or the new equipment is used the initial requirements to personnel shall be updated.
3	Can the results of the earlier completed Job Analysis be used for similar jobs?	It is verified how much the new job or profession differs from the one analyzed earlier. If the results obtained earlier can be used (for example, lists of tasks and competencies), shift to step 4. If they cannot be used, shift to step 3.1.
	3.1 Choose the method of Job Analysis and Task Analysis	Depending on the planned budget for development as well as the type of the job, initial data the method of the Job Analysis shall be chosen • expert method (table-top type) • detailed analysis with the identification of tasks and then skills and knowledge • competency level analysis • alternative method of analysis

No	*Step/phase*	*Criteria of activity/main works*
	3.2 Perform activity analysis and Task Analysis for the appropriate jobs.	In accordance with the method selected identify (shall be performed in accordance with NV TC document "Procedure of analysis of the staff professional activities"): • lists of job types • lists of the professional tasks performed • competencies and/or skills and knowledge within the scope of the analyzed job •
4	Identification of fields of knowledge for the appropriate jobs	If it is the first analysis, then it is expedient to compare the knowledge fields of professions/jobs in order to identify similar knowledge fields.
DESIGN		
5	Is the information applicable for the staff training available?	In accordance with the knowledge fields identified it shall be verified if there is enough information (process, standard, administrative, etc.) directly related to the analyzed job with reference to the knowledge fields identified. If the above information is available, shift to step 6. If the above information cannot be directly presented, shift to step 5.1.
	5.1 Make use of any documents available, other sources, existing training materials	The information and training materials close to the job analyzed shall be chosen and analyzed. As a result there shall be issued a list used for development of documents, including the training materials.
6	Check the existing statements on the objectives from the training materials available	All the selected training materials shall be checked at the level of the training objectives (identified and accepted earlier) which are included in them (the level of training objectives stated in such training materials shall not be above or below the level of the analyzed profession/job).
7	Are identified objectives at the level of the appropriate jobs?	If the objectives taken from the training materials developed earlier are at the relevant level, shift to step 8. If not, shift to step 7.1
	7.1 Develop new training objectives	As a rule, there are a lot of reasons why new training objectives shall be developed. Use the action verb glossary. The best way to develop training objectives is to fill in the training objective statement templates.
8	Modify existing training objective statements	Modification of the training objectives is effected in accordance with the established requirements, for example, through templates filling in. Note: Training objectives shall be developed for the identified competencies, knowledge, skills in such a way that there is always a differentiation between the general and specific objectives, terminal and enabling ones, etc.
9	Develop a bank of questions for the intermediate and final exams.	Choose an assessment method and questions for the purpose of control and measurement of the trainees' progress in each task selected for training. (For example, assessment method may include test questions, exams, on-the-job documents or control simulator exercises). A common bank of questions shall be prepared basing on the principle "For each training plan there shall be developed at least one evaluation question".

No	*Step/phase*	*Criteria of activity/main works*
10	Training objectives shall be presented as a training plan (as a part of program N)	Choose and develop the most acceptable and effective strategy of conducting and organization of training for the given scope. Define the sequence of acquirement of required knowledge, skills. Training objectives; training topics and lessons are grouped into the training units (for example, modules) in order to provide the maximum transmission of training when shifting from one topic to the other.
11	Develop the terms of reference (as a part of training Program N) for conducting of training according to the program	Responsibilities of training organization for training conducting shall be defined. Following bilateral responsibilities of training Contractor and Customer are to be established and then approved by the Customer: • training objectives; • training methods • use of the training technical aids • pre-training test requirements • methods of training evaluation • training plan (i.e. sequence of topics) • number of trainees in the group, etc.
12	Are the training plan and terms of reference of program N approved by the Customer?	Developed terms of reference, including training plan shall be approved by the Customer at Joint Commission on training process enhancement.
	12.1 Review/update training plan, terms of reference as per program N with reference to the proposals	Update with approval of the Customer.
Inputs for DEVELOPMENT phase		

B.3. JCA for WWER-440 Electrical Maintenance Worker (Slovakia)

1 — Job position	Electrical Maintenance Worker (Reactor Operator, Turbine Operator, radiation protection foreman, chemistry foreman, pump maintainer — worker, reactor maintainer — worker)
2 — Country	Slovakia
3 — Utility/NPP	VÚJE Trnava a.s. NPP Bohunice
4 — Type of NPP	WWER 440 /V213
5 — Type of analysis	JCA The analysis was discussed with French experts during the expert mission in the framework of the IAEA TC Project – SLR/0/003 Upgrading of NPP Personnel Training Programmes
6 — Total duration	4 weeks (almost the same for all job positions)
7 — Resources needed	One Electrical Maintenance Worker – 8 days One electrical maintenance foreman – 8 days One facilitator of the JCA – 20 days One training centre instructor – 20 days
8 — Special tools	No special tools were used
9 — Procedures/references	NPP Personnel Training Centre Procedure: *Guideline for SAT Analysis and Design of a Training Programme*
10 — Identification of attitudes	Required attitudes are identified, together with skills, by experts while working in groups
11 — Strengths	A relatively short period of time is needed; the analyses is done by a group consisting of subject matter experts (SMEs) and experts in SAT; therefore there is no need to train SMEs on SAT (just a brief acquaintance).
12 — Weaknesses/difficulties encountered	It is necessary to have one person responsible for the Analysis, Design and Development phases and also for feedback from Implementation and Evaluation phase of the SAT to assure proper training.

Additional information

The Job Competency Analysis was used to determine skills/attitudes and knowledge within the framework of the IAEA Technical Co-operation Project: “Upgrading of NPP Personnel Training Programmes” (1995–1997) which was oriented towards an implementation of SAT for selected job positions.

It has to be said that JCA, as it is used, is very closely connected with the Design phase of SAT and is usually conducted by the same group of people as that which undertakes the analysis.

The group for conducting the analyses and design comprises:

- two subject matter experts (experienced job incumbents) (wherever possible);
- supervisor of job incumbent;
- analyst;
- method facilitator.

The JCA is undertaken in several steps, as shown in Fig. 1.

Example of JCA for an Electrical Maintainer at NPP Bohunice, Slovakia

1. The list of job related activities was created.

The list for the Electrical Maintainer contains 64 job related activities. Eight of these are listed below:

- adherence to the fire and personnel safety regulations
- reading documents (technical procedure, blue prints, etc.)
- measuring and verifying parameters
- determining equipment for specific maintenance work
- setting and calibration of the equipment
- usage of radiation protection aids
- sampling the media (oil, hydrogen, battery acid, etc.)
- performing maintenance work on:
    - switch yards and busses
    - transformers
    - electrical drivers and generators
    - hoist equipment
    - electrical penetrations

2. The activities were classified into 3 groups:

- preparing the maintenance activity
- undertaking the maintenance activity
- communication

3. The activities in the groups were classified into subgroups A, B and C:

    A. Preparing the maintenance activity

        I. preparation of the maintenance materials

        II. preparation of the working area

        III. safety rules

B. Undertaking the maintenance activity

I. reconstructing the equipment parts

II. disassembling and assembling

III. tools and equipment used for maintenance activity

IV. measurement and in-site inspections

V. separating materials and decontamination

C. Communication

I. undertaking oral and written communication

II. filling out documents connected with maintenance activities

4. Identification of competencies

General and specific competencies, together with conditions of achievement, expected results (performance requirements) were identified for each subgroup of activities. This is achieved using tables. An example is shown in Table 1.

5. At the next step knowledge, skills and attitudes were determined for each specific competency. An example is shown in Table 2.

Conclusions

In addition to the Electrical Maintainer, SAT by JCA was also undertaken for the following job positions:

- Reactor Operator
- Turbine Operator
- radiation protection foreman
- chemistry foreman
- reactor maintainer
- pump maintainer

Some experience was also obtained with JTA. Within the framework of the US AID Program – "International Nuclear Safety Program", a training programme for an instructor was designed and developed using SAT with JTA.

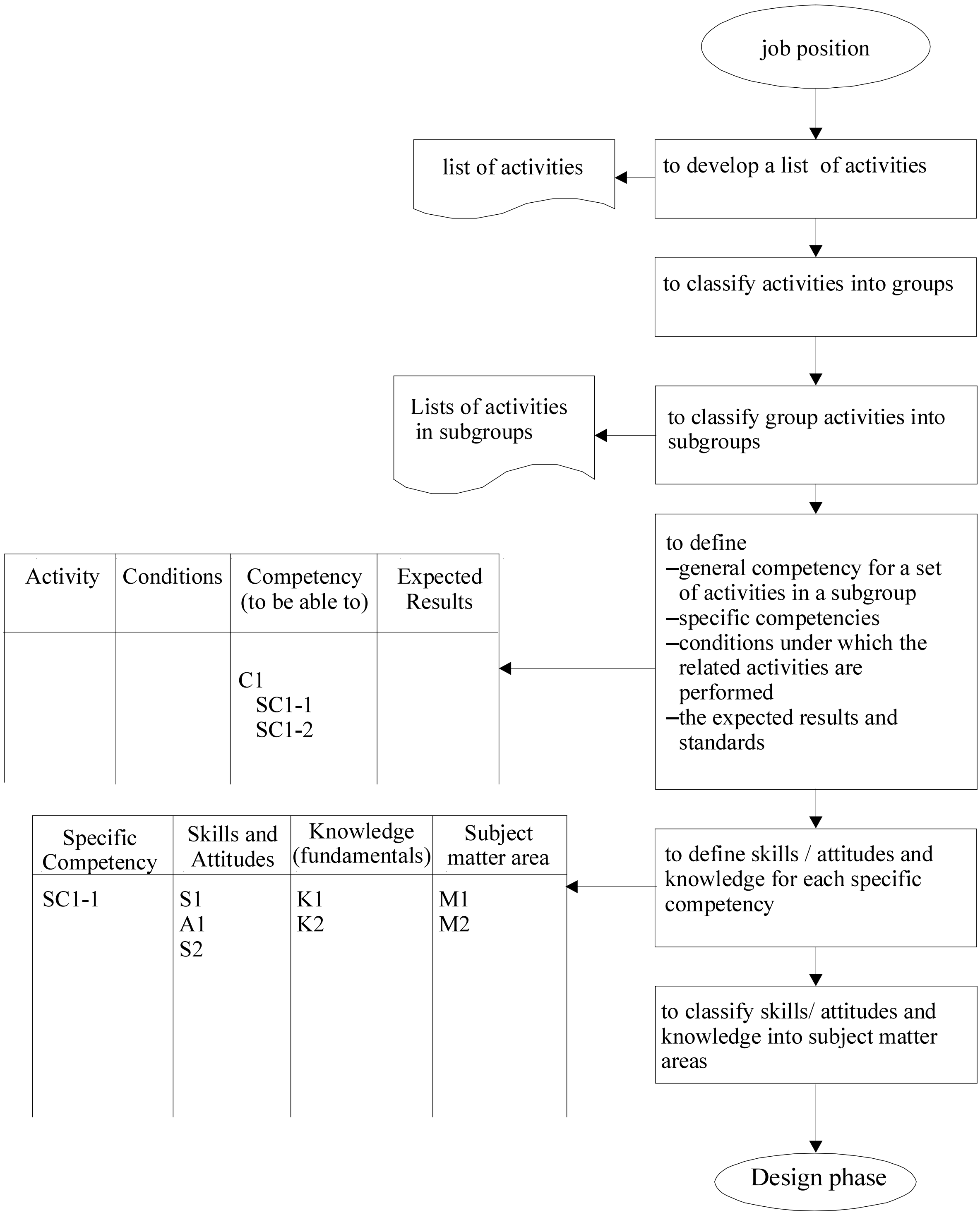


FIG. 1. Job Competency Analysis.

TABLE 1. IDENTIFICATION OF COMPETENCIES

Job position: Electrical Maintainer

A. Preparation of the maintenance activity

Activities	Conditions of achievement	To be able (competency)	Expected results
• Choice of the tools and equipment • setting and calibration of equipment • maintenance of tools and equipment • selection and collection of materials from stores • inspection of materials • material transportation • cleaning of tools and equipment	Tools and materials: • general electrical tools • specific tools in accordance with a technological procedure • specific equipment or tools • cleansing and lubrication agents • transportation means Information: • working order (specification of equipment and work required) • technological procedure • required documentation • site and building plans • material orders for stores Technical support • technologist	A.I. to prepare materials, tools and equipment required for specific maintenance work	All necessary materials, tools and equipment is prepared in precise and timely manner
		A.I.1.to prepare materials required for specific maintenance work	All materials required for maintenance work are properly collected
		A.I.2.to prepare tools and special equipment required for specific maintenance work	Specific aids required for maintenance work are manufactured and all necessary tools and equipment are prepared

TABLE 2. DETERMINATION OF KSAS

Job position: Electrical Maintainer

Competency: AI. 1: to prepare materials, tools and equipment required for specific maintenance work

Specific competency	Skills/attitudes	Knowledge	Subject matter area
A.I.1. to prepare materials required for specific maintenance work	a) selection of proper material b) selection of proper spare parts and components	a) types of materials and their properties b) protective and connection elements c) current load d) cleansing agents e) machinery parts f) blue prints	Materials for NPP Technical drawing
A.I.1. to prepare tools and special equipment required for specific maintenance work	a) usage of general electrical tools b) usage of specific electrical tools c) measuring of parameters d) usage of machinery equipment (bores, etc.)	a) measurement equipment	Measurement equipment

Appendix C

SELECTED EXAMPLES OF TABLE-TOP ANALYSIS

C.1. Table-top JTA for BWR maintenance technicians (USA)

1 — Job position	1. Instrument And Control Technician 2. Electrical Maintenance 3. Mechanical Maintenance 4. Radiological Protection Technician 5. Chemistry Technician 6. Instructor
2 — Country	United States of America
3 — Utility/NPP	Pennsylvania Power and Light Company, Inc. Susquehanna Steam Electric Station (SES)
4 — Type of NPP	General Electric — Boiling Water Reactor (BWR)
5 — Type of analysis	1. The original Job and Task Analyses (JTA) were conducted by interviews and questionnaires administered with job incumbents and supervisors. 2. Job Analysis verifications are conducted using a DACUM (***D***eveloping ***A*** ***C***urricul***UM***) format, a table-top analysis with cross-sectional representation of five to eight experienced line workers and supervisors, facilitated by training personnel. Information on the DACUM process is copyrighted by Ohio State University. (Norton, Robert E. "*DACUM Handbook*", The National Center for Research in Vocational Educational. Ohio State University, 1985.) 3. New tasks are analyzed by interviews between training instructors and task subject matter experts.
6 — Total duration	1. The original Job and Task Analyses conducted in 1983 took several calendar weeks and several person-weeks for each training program. 2. Job Analysis verification requires one day to conduct and approximately six to eight person-days. 3. Task analyses for new tasks take approx. one person-hour per task.
7 — Resources needed	1. Job Analysis verifications (conducted in DACUM or table-top discussion format) are generally conducted in one day, requiring six to eight person-days per training program. 2. Task analyses for new tasks take approximately one person-hour per task, with input from one instructor and one or two SMEs.
8 — Special tools	Susquehanna SES generally uses the DACUM process to verify job analyses. The DACUM process was originated by the National Center for Research in Vocational Education at Ohio State University, and requires training and qualification of facilitators before its use.

9 — Procedures/references	Susquehanna Training Center Procedure, STCP-QA-112, Job/Task Analysis Program (see below), provides guidance on the conduct and maintenance of job analyses for Susquehanna Steam Electric Station.
10 — Identification of attitudes	Susquehanna SES has not identified attitudes in job analyses.
11 — Strengths	The DACUM process is very good for job analyses. DACUM allows expeditious reviews of Task Lists to ensure currency and accuracy of job analyses. This process involves job experts, incumbents, training personnel, and a facilitator.
12 — Weaknesses/ difficulties encountered	The initial JTA was extremely time consuming, to the point of being cost prohibitive to repeat similar evaluations. JTA is not effective for analyzing jobs or tasks for planned/future jobs. Job analyses derived from the DACUM process do require reviews. The original report generated by a first DACUM for a particular work group is generally a significant step improvement over previous Task Lists, but the list is refined to a more stable state when a second or third DACUM panel verifies the currency and accuracy of the Job Analysis.

Susquehanna Steam Electric Station (SSES) has conducted job analyses for all accredited training programs and several non-accredited training programs. The current job analyses were derived primarily from DACUMs and table-top analyses. SSES maintains five job analyses for technical training programs, six for operations training programs, approximately 24 for specific engineering support Personnel groups, and one for the instructor training program. Basic statistics and examples of five technical training programs and the instructor training program are shown in the following tables.

SAMPLE JOB ANALYSIS INFORMATION

TABLE 1

Work group	Total number of tasks for work group	Number of Duty Areas within Job Analysis	Average number of tasks per Duty Area	Number of people in work group
Instrument and Control Technician	138	14	9.9	48

Sample Duty Area for this work group: Perform special tests **Sample tasks within this Duty Area**
Perform Diesel Generator Governor Tests test
Perform Main Steam Line Radiation Monitor tests
Perform Area Radiation Monitor tests
Perform HPCI/RCIC Governor tests

Sample objectives for task: Perform Diesel Generator Governor Tests
Define droop control mode and isochronous control mode with respect to control of the diesel generator.
Using a schematic diagram, describe the operation of the Standard Load Sensor.
Using a system diagram, analyze the response of the governor in the isochronous and droop control modes.
Troubleshoot a fault in the Woodward 2301 governor in the laboratory.

TABLE 2

work group	Total number of Tasks for work group	Number of duty Areas within Job Analysis	Average number of Tasks per Duty Area	Number of people in work group
Electrical Maintenance	88	21	4.2	75

Sample Duty Area for this work group: Circuit breakers, fuses, and disconnect switches **Sample tasks within this Duty Area**
Perform preventative maintenance on Moulded Case Circuit Breakers
Perform preventative maintenance on Air Circuit Breakers, 600 V or less
Perform maintenance on Air Circuit Breakers larger than 600 V
Test/replace fuses

Sample objectives for task: Perform preventative maintenance on Moulded Case Circuit Breakers
Describe what adjustments can be made to a moulded case circuit breaker.
Perform calculations of the test current used to test motor overload relays.
Perform an insulation resistance test on a moulded case circuit breaker.
Evaluate the test data of a moulded case circuit breaker and a motor overload relay based on the time current curves.

TABLE 3

Work group	Total number of tasks for work group	Number of Duty Areas within Job Analysis	Average number of tasks per Duty Area	Number of people in work group
Mechanical Maintenance	136	20	6.8	110

Sample Duty Area for this work group: Valves **Sample tasks within this Duty Area**
Inspect/test/repair Safety/Relief and Vacuum Breaker Valves
Inspect/repair motor-operated valve operators
Inspect and repair hydraulic operated valve operators
Inspect/repair air-operated valve operators
Inspect/repair valves
Perform corrective maintenance on Main Steam Isolation valves and actuators
Perform corrective maintenance on Explosive Squib Valves
Remove And install MSRVs

Sample objectives for task: Inspect/test/repair Safety/Relief and Vacuum Breaker Valves
Describe precautions to observe when working with valves with motor operators.
Identify diaphragm actuators and describe their operating principles.
Recognize the difference between safety valves, relief valves, and safety relief valves.
Perform disassembly, lapping, inspection, re-assembly, and test on one relief valve and one safety valve.

TABLE 4

Work group	Total number of tasks for work group	Number of Duty Areas within Job Analysis	Average number of tasks per Duty Area	Number of people in work group
Radiological protection	168	13	12.9	40

Sample Duty Area for this work group: Surveys **Sample tasks within this Duty Area**
Perform (obtain, count, document and evaluate) surveys for the presence of contamination
Perform an Airborne Activity Survey (including iodine samples, noble gas, tritium)
Perform Radiation Surveys
Prepare Area Contamination Report and Personnel Contamination Report forms
Perform radiological support during industrial radiography
Respond to start up/scram events
Perform Underwater Surveys
Perform air sampling of potential release points

Sample objectives for task: Perform (obtain, count, document and evaluate) surveys for the presence of contamination
Identify types of surveys performed at SSES and state the purpose of each.
Identify sampling techniques and equipment for the following types of radiological contaminants: particulate, iodine, noble gas, and tritium.
Describe various environmental and radiological conditions that might affect survey instrument response.
Convert meter indications of contamination detection equipment to contamination reporting levels in standard units.

TABLE 5

Work group	Total number of tasks for work group	Number of Duty Areas within Job Analysis	Average number of tasks per Duty Area	Number of people in work group
Chemistry Technician	135	10	13.5	15

Sample Duty Area for this work group: Radiochemistry analysis **Sample tasks within this Duty Area**
Perform isotopic analysis
Perform analysis of ventilation release samples
Perform gross gamma analysis
Perform tritium analysis
Perform gross beta analysis
Calculate the dose equivalent I-131 activity of reactor water
Perform solid radwaste analysis
Complete surveillance requiring vendor analysis results

Sample objectives for task: Perform isotopic analysis
List and explain the reasons for the Compton continuum, the Compton edge, and the Compton valley.
Relate the location of single and double escape peaks that may appear in gamma spectra to the pair production and annihilation processes.
State the reason for sum peaks appearing in gamma spectra.
Explain the term channel coefficient.
Determine the isotopic activity of a sample counted with a gamma spectrometry system.

TABLE 6

Work group	Total number of tasks for work group	Number of Duty Areas within Job Analysis	Average number of tasks per Duty Area	Number of people in work group
Nuclear Training Instructor	115	11	10.7	28

Sample Duty Area for this work group: Designing training **Sample tasks within this Duty Area**
Determine objectives
Determine the training setting (OJT, classroom, lab, sim)
Determine method of delivery
Establish training prerequisites
Review existing training material for applicability to task
Identify material remaining to be developed
Determine course length
Develop a table of specifications/sampling plan
Identify training resource needs, availability and limitations

Sample objectives for task: Determine objectives
Identify and define the three types of learning objectives: affective, cognitive, and psychomotor.
Define the three parts of an objective: condition, action, and standard.
Create learning objectives that identify the expected student outcomes from performance-based training.

SAMPLE TASK ANALYSES

Task analysis is performed by instructors and work group subject matter experts. Documented analyses are reviewed and approved by work group and training supervision. Two examples are shown. One is from Electrical Maintenance, and the second is from Instrument and Controls.

EXAMPLE 1

Work group: Electrical Maintenance
Duty area: Conduits, cables, and lighting
Task statement: Prepare/make fibre optic terminations
Is training required for this task? Yes: fibre optics
Is retraining required for this task? No **If "no", why not**? Simple to perform task, task covered by work plan or manufacturer information **If "yes", at what frequency should retraining be given**? N/A **If "yes", what setting for retraining**? N/A
Conditions: Repair/replacement of existing connectors or new equipment installation
Standards: Meet acceptance criteria identified for post-maintenance testing
References: Vendor technical information manuals
Special tools/equipment: 1. Siecor FBC-001 Optical Fiber Cleaver 2. Siecor Fiber Stripping Tool Instructions (Miller Tool) 3. Siecor Buffer Stripping Tool Instructions
List of task elements/steps or the procedure which delineates this task: 1. Troubleshoot fibre optic cable problems 2. Repair or install fibre optic cable 3. Identify fibre optic cable and connectors needed for specific job 4. Prepare cables 5. Make connections 6. Check for continuity

Task knowledge, skills, and attitudes: 1. Main parts of a fibre optic cable 2. Applications of simplex, duplex, and multifibre cable 3. Causes of attenuation in fibre optic transmissions 4. Install a fibber optic connector on the end of fibre optic cable in accordance with the specifications set forth in the Siecor Unicam SC/ST — Compatible/FC Connector Assembly Instructions. 5. Install an ST style connector according to the specifications set forth in the FIS Termination Procedures for FIS ST style Fibre Optic connectors 6. Polish an optical fibre connection to an "ideal" finish in accordance with the FIS termination procedures for FIS ST style fibre optic connectors 7. Fit an ST connector to the cable and cleave the fibre in accordance with the Terminator ST Style connector field termination procedures 8. Test a fibre optic cable for continuity 9. Troubleshoot fibre optic cables/connections

EXAMPLE 2

Work group: Instrument and Controls

Duty area: Perform special tests

Task Statement: Perform ex-core monitor tests

Is training required for this task? Yes: gamma-metrics neutron flux instrumentation and soldering gamma neutron flux system cable

Is retraining required for this task? No
If "no", why not? Vendor support and/or technical direction provided
If "yes", at what frequency should retraining be given? N/A
If "yes", what setting for retraining? N/A

Conditions: During 18 month surveillance or when indicated power from these instruments is not indicative of actual plant power

Standards: The instrument must be reworked/calibrated to within final tolerance of SI procedures listed below.

References:
IOM # 654
IOM # 655
SI-178-330/SI-278-330
SI-178-331/SI-278-331

Special tools/equipment: Multimeter, frequency counter, oscilloscope, voltage source, extender board (#158B7070P001)

List of task elements/steps or the procedure which delineates this task:
Major steps of task as prescribed in procedure SI-178-330:
1. Document results of the "as found" loop check
2. Adjust the amplifier
3. Adjust the signal processor
4. Calibrate indicators
5. Calibrate isolators
6. Document results of the final loop check

Task knowledge, skills, and attitudes:
1. Working in a transient high radiation area requires knowledge/training in radiation protection
2. Safety consciousness while working on scaffolding
3. Knowledge of associated technical specifications of the plant and potential plant impact while working on this system
4. Qualified to work independently
5. Troubleshooting ability as directed by technical manual/IOM

C.2. Table-top JTA for Stationary Operating Engineer (USA)

1 — Job position	Stationary Operating Engineer, Building 779 This job consists of the continuous operation of the various equipment to supply heat, power, water, ventilation, refrigeration, dehumidification, and sewage treatment for the plant needs.
2 — Country	USA
3 — Utility/NPP	US Department of Energy (DOE) — Rocky Flats Site
4 — Type of NPP	Nuclear Process Facility
5 — Type of analysis	Table-top Job and Task Analysis (JTA)
6 — Total duration	80 hours
7 — Resources needed	4 Stationary Operating Engineers — 18 hours each 1 Duty Area Foreman/Supervisor — 18 hours 1 Analyst — 80 hours
8 — Special tools	Templates
9 — Procedures/references	— DOE Order 5480.20A, *Personnel Selection, Qualification, and Training Requirements for DOE Nuclear Facilities* — DOE Training Program Handbook 1078-94, *A Systematic Approach to Training* — DOE Training Program Handbook 1074-95, *Alternative Systematic Approaches to Training* — DOE/ID-10435, *Table-Top Job Analysis Seminar Facilitator Guide*, DOE Training Coordination and Accreditation Program — Rocky Flats Environmental Technology Site Training User's Manual — Safe Sites of Colorado Training Program Plan
10 — Identification of attitudes	Skills and abilities were identified. Values and attitudes are taught in a Conduct of Operations course.
11 — Strengths	The table-top Job Analysis method is a more efficient, cost-effective method for developing a Task List than traditional Job Analysis methods. Identification of a valid list of tasks, skills, knowledge, and safety hazards of the SOE job position which serves as the basis for determining the training program content. This ensures that the SOEs learn exactly what is needed to perform their jobs safely and competently without spending too much or too little time in training or not having their performance of tasks evaluated before working in the field. Basing a training program on a valid Task List leads to more productive, safe, and competent performance.
12 — Weaknesses/difficulties encountered	Obtaining uninterrupted time. The SOEs were required to perform their jobs during the analysis.

Additional information

1.0 SUMMARY

The job duties for the Stationary Operating Engineer for Building 779 require qualification as defined in DOE Order 5480.20A. The duties involved in this job are divided into 26 tasks. The tasks in this report were defined from the information gathered in the round table meetings held to analyze the job duties of the Stationary Operating Engineer for Building 779. The scope of the round table was defined by the analyst and participants and incorporated 26 tasks along with the use of the following listed references:

1. DOE Order 5480.20A.
2. Utilities operating procedures for Utilities Building 779.
3. System operating requirements/process for systems currently without procedures.

2.0 DISCUSSION

2.1 Introduction

Attendance at the round table included sufficient number of participants for a complete identification of tasks needing training for Stationary Operating Engineers for Building 779.

2.2 Duty area information

A verification of the job classification and task titles for Building 779 SOEs was conducted with the participants. The job classification and task titles identified in Attachment 1 were agreed upon by all participants.

2.3 Stationary Operating Engineers

A rough draft of tasks performed was developed from the input of the SMEs. Each task was examined to determine a recommended training level (*no train, train, retrain*), based upon the relative importance, difficulty and frequency of task performance. Because of the nature of the material and process, relative importance and difficulty as defined in 3-MAN-002-01, Kaiser-Hill Training and Qualification Program, Section 3, Training Analysis, all of the tasks were termed “vital task” because if performed inadequately, the task could result in a toxic or radioactive release, extensive equipment damage, or serious personal injury. Two SOEs are assigned to Building 779 for each shift.

2.4 Task analysis

Using the information (duty list, entry knowledge, and skill/abilities), the participants examined each task that was selected for *train* or *retrain* to determine task-level information (conditions, references, safety hazards, and standards). In addition, specific knowledge and skills/abilities required for competent task performance were determined for each task. For the sake of requested document size, this publication includes Task Analysis data for only tasks 1 and 3 in Attachment 2.

3.0 CONCLUSION

The data obtained through the round-table provides the foundation of a quality training and qualification program. This training will be given to personnel qualifying for the position of Stationary Operating Engineer for Building 779.

4.0 PREREQUISITE TRAINING

— 019-235-02 General Employee Training
— 023-435-01 RCRA (CBT)
— 023-482-01 Radiation Worker Level II
— 019-395-07 Lockout/Tagout — H&SP-2.08
— 019-395-08 Lockout/Tagout — Application
— 019-750-01 Hazardous communications
— 038-597-01 Nuclear material safeguards
— 056-284-01 Respirator indoctrination
— 071-400-01 Hearing conservation
— 056-284-02 Respirator fit
— 012-273-01 Alarms, sounds and responses

4.1 Continuing training

Continuing training will be on-going for the Stationary Operating Engineers for Building 779. Within the two year period, the following topics will be covered in continuing training:

A. Theory and principles of facility operation:

  — Authorization basis
  — OSR/FSAR
  — Procedures (new and revised)

B. Lessons learned

C. Facility Instrumentation and Control:

  — Topics from list of reference material
  — Electrical Distribution Plant Power
  — Health Physics Vacuum System
  — HVAC systems

D. Fire suppression

— Electrical safety
— Criticality safety

E. Emergency and abnormal procedures:

  — Plant and building emergency plans
  — Spill response
  — Building drills

F. Other site facility building exchange of information:

- Steam Plant
- Water Plant
- Waste Water Treatment Plant

G. Conduct of Operations:

- Utility operating procedures
- Watch standing practices per SOE rounds procedure and Conduct of Operations Procedure (COOP)
- Plant/Instrument Air
- Refrigeration System
- Steam/Condensate System
- Zone I Ventilation System
- Emergency Power
- Tower Water System
- Process Cooling Water System

4.2 Proficiency

Stationary Operating Engineers that are out of the job function for more than six months will be required to re-take a comprehensive exam and on-the-job training to be re-qualified for operations. Operators will also be required to be briefed on any changes to all governing procedures.

5.0 LEARNING OBJECTIVES

All tasks were determined to require on-the-job training (OJT). The learning objectives are listed in the Qualification Document for Building 779 SOEs. For the sake of requested document size, this document includes only the portion of the Qualification Document for tasks 1 and 3 in Attachment 3.

ATTACHMENT 1: Job Analysis Results
General Task Information

Job classification:	Stationary Operating Engineer	
Duty area: 779		Revision: 00

Task List (Page 1 of 1)

No.	Task Statement	Difficulty 1-5	Importance 1-5	Frequency 1-5	Abnormal/Emerency Y- N
1	Verify proper operation of air compressor	5	2	4	Y
2	Blowdown air receivers	5	5	5	N
3	Lineup the electrical distribution system	3	1	2	Y
4	Operate the emergency generator during load test EBEN 1, 2, and 3	3	1	1	Y
5	Operate the main control room during an emergency load test	3	1	1	Y
6	Respond to loss of electrical power	2	1	1	Y
7	Shift the running fuel oil transfer pump to "standby" and standby pump to Run	5	5	5	N
8	Rotate ventilation fans for 779A	3	1	1	Y
9	Rotate ventilation fans for 779 BL-101 A/B	3	1	1	Y
10	Monitor ventilation fan 779 B-201	5	4	4	N
11	Rotate glovebox fans 782 (plenum 401)	3	1	1	Y
12	Rotate hood fans 782 (Plenum 402)	3	1	1	Y
13	Rotate building exhaust fans 782	3	1	1	Y
14	Rotate glovebox fans 729 (Plenum 408	3	1	1	Y
15	Rotate building exhaust fans 729	3	1	1	Y
16	Monitor supply fan 779. F-1	5	4	4	Y
17	Monitor supply Fan 782	5	4	4	N
18	Monitor supply fan filter (plenum 407)	5	2	2	N
19	Monitor supply fan HV-1 room 127, 779	5	5	5	N
20	Adjust negitive on a filter plenum	4	1	1	Y
21	Monitor cooling tower operations	4	4	4	N
22	Transfer lead position on Cooling fans DSC	4	4	3	N
23	Monitor steam operations	4	1	1	Y
24	Monitor chiller operations	4	4	3	N
25	Monitor Health Physics Vacuum System	4	1	1	Y
26	Monitor HVAC System	4	1	1	Y

For all tasks, enter the *average rating* from the round table participants in the appropriate box.
If the task involves an abnormal and/or emergency situation, indicate with **Y** (yes) in the appropriate box, if not, then indicate with **N** (no) in the appropriate box.

ATTACHMENT 1: Job Analysis Results (Cont.)
Job Analysis Worksheet

Job classification:	Stationary Operating Engineer	
Duty area:	779	Revision: 00

Task List (Page 1 of 1)

No.	Task Statement	normal	infrequent	emergency	train	no train	retrain	vital	perform	simulate	discuss	memory	Control Manipulation	job aid	Supervisor
1	Verify proper operation of air compressor	X			X		X	X	X					X	X
2	Blowndown air receivers	X			X		X	X	X					X	X
3	Lineup the electrical distribution system	X			X		X	X	X					X	X
4	Operate the emergency generator during	X			X		X	X	X					X	X
	load test EGEN 1, 2, and 3	X			X		X	X	X					X	X
5	Operate the main control room during an	X			X		X	X	X					X	X
	emergency generator load test				X		X	X	X					X	X
6	Respond to loss of electrical power			X	X		X	X	X					X	X
7	Shift the running fuel oil transfer pump to	X			X		X	X	X					X	X
	"standby" and the standby pump to run				X		X	X	X					X	X
8	Monitor ventilation Fan for 779 BL-101 A/B	X			X		X	X	X					X	X
9	Rotate ventilation for 779 BL-101 A/B	X			X		X	X	X					X	X
10	Monitor vention fan for 779 BL-201	X			X		X	X	X					X	X
11	Rotate glovebox fans 782 (plenum 782)	X			X		X	X	X					X	X
12	Rotate hood fans 782 (plenum 402)	X			X		X	X	X					X	X
13	Rotate building exhaust fans 782	X			X		X	X	X					X	X
14	Rotate glovebox fans 729 (plenum 409)	X			X		X	X	X					X	X
15	Rotate building exhaust fans 729	X			X		X	X	X					X	X
16	Monitor supply fan 779B, F-1	X			X		X	X	X					X	X
17	Monitor supply fan 782 (plenum 406)	X			X		X	X	X					X	X
18	Monitor supply fan filter (plenum 407)	X			X		X	X	X					X	X
19	Monitor supply fan HV-1 room 127, 779	X			X		X	X	X					X	X
20	Adjust negative on a filter plenum	X			X		X	X	X					X	X
21	Monitor cooling tower operations	X			X		X	X	X					X	X
22	Transfer lead position on Cooling fans DSC	X			X		X	X	X					X	X
23	Monitor steam operations	X			X		X	X	X					X	X
24	Montor chiller operations	X			X		X	X	X					X	X
25	Monitor Health Physics Vacuum System	X			X		X	X	X					X	X
26	Monitor HVAC System	X			X		X	X	X					X	X

Approval

Subject matter SOE

Subject matter SOE

Duty Area Foreman/Supervisor

Duty Area Foreman/Supervisor

Attachment 2 Task Analysis Results
Task Analysis Worksheets

Task number	**001**
Task statement	Verify proper operation of backup compressor for/in 729 and 779

Conditions

No flammable fumes present
LCO's satisfied
Pre-Evolution Briefing was performed
Emergency equipment available
Tower water system operational
Process cooling water system operational
Electric power to all three compressors is on
Electric power to dryers is on
Air pressure gauge reads between 80 psi — 100 psi

References

Final Safety Analysis Report (FSAR) Building 779
Compressed Air Systems Building 779 UOP (UTL-3)
Health and safety procedures manual
Material phase safety sheets (MSDS)

Safety hazards

Rotating equipment
Pinch points sharp objects
Heavy objects, back injury
Crushing
Thermal

Standards (in accordance with)

Compressed Air Systems Building 779 UOP (UTL-3)
Back-up compressor operational

Knowledge

Building orientation
Tools and equipment needed
Hazards involved
Response to equipment alarms
Response to LCO's
Personnel protective equipment needed
Documentation requirements
Knowledge of air compressors, receivers and dryers
Understanding of major valves associated with air compressors
Knowledge of pre-filters and after filters associated with Air Compressor Systems
Understanding use of Nitrogen System associated with Instrument Air System
Understanding principles of operation of the Compressed Air System
Knowledge of locations of all associated components of the air compressor system
Understands the purpose of the air compressor and associated equipment
Knows systems associated with each compressor
Know setpoints for air regulators
Know applicable compressor setpoints
Know electrical power supply for air compressors
Knows applicable procedures/orders/instructions for Compressed Air System
Location of all isolation valves
Knowledge of response to upset or emergency conditions

Skill/Ability

Ability to operate system
Ability to fill out associated documentation
Ability to respond to system/component casualties

Control Manipulations

Valves associated with Plant Air System
Switches associated with air compressors
Valves associated with Nitrogen System (backup to Instrument Air)

Task analysis worksheet

Task number 003
Task statement Lineup the Electrical Distribution System

Conditions

Operation on the plan of the day
Personnel protective equipment worn, if applicable
Pre-evolution briefing was performed
Diesel operational
Stationary Operating Engineers
Normal and alternate power supplies to buildings
Bldg. 779 Electrical Distribution System in normal configuration

References

4-X73-UOP-779-010, Electrical Operations (if approved for use)
4-X74-ERP-779-009, Emergency Response Procedures (if approved for use)
Building 779, UTL-1 Procedures

Safety hazards

Electrical hazards
Pinch points
Sharp objects
Thermal

Standards (in accordance with)

4-X73-UOP-779-010, Electrical Operations (if approved for use)
4-X74-ERP-779-009, Emergency Response Procedures (if approved for use)
Electrical Distribution System properly lined-up

Knowledge

Building orientation
Hazards involved with the electrical systems
Response to equipment alarms
Response to LCO's
Knowledge of the electrical distribution throughout the building
Knowledge of the components the electrical systems throughout the building
Knowledge of breakers and switches with facility
Knowledge of power supplies with the UPS system
Understanding of equipment Emergency Generator
Understanding of alarms and setpoints associated with Emergency Generators
Understanding of breakers and electrical panels
Knowledge of proper alignment of breakers
Knowledge of response to upset conditions associated with the Electrical Distribution System
Understanding of notification requirements associated with loss or line-up of the Electrical Distribution System

Skill/ability

Use of eye wash and safety shower
Ability to monitor control room operations
Ability to fill-out proper paper work
Ability to properly log entries
Ability to correctly align breakers
Use of emergency equipment

Control manipulations

Breaker switches

Attachment 3 Qualification Document for Building 779 SOEs

QUALIFICATION STANDARD

Employee name____**Employee no.**____________________

Knowledge requirements

Task No.	Title
001	Compressed Air System

STANDARD

Without the aid of references (except as noted), demonstrate in an oral interview by satisfactorily answering the questions listed below in the requirements section.

REQUIREMENTS

Initial Box

☐ 001.01 State the purpose of the Compressed Air System.

☐ 001.02 Describe the major components of the Compressed Air System for 729 and 779.

☐ 001.03 State the setpoints and operating parameters for the Compressed Air System.

☐ 001.04 Given a one-line diagram of the Compressed Air System, locate the major system components.

☐ 001.05 Identify the power sources for the compressors and air dryers.

☐ 001.06 Identify the OSRs associated with the Compressed Air System.

☐ 001.07 Describe the controls and indications available for operation of the Compressed Air System including:
- Utilities control room
- Local controls and indications

☐ 001.08 Identify the major valves in the Compressed Air System.

☐ 001.09 State the reasons for the Compressed Air Backup Systems, including normal and emergency operations.

☐ 001.10 Describe the operation of the air dryers in Building 779.

☐ ________________________________
Signature

COMMENTS

QUALIFICATION STANDARD

Employee name____**Employee no.**_____________________

Theoretical Knowledge Verification

Task No.	**Title**
003.	Electrical Distribution System

STANDARD

Without the aid of references (except as noted), demonstrate in an oral interview by satisfactorily answering the questions listed below in the requirements section.

REQUIREMENTS

Initial Box

☐ 003.01 State the purpose of the Electrical Distribution System.

☐ 003.02 State the purpose of the Electrical Distribution System's major components.

☐ 003.03 Define how electrical components are labeled.

☐ 003.04 Given a building/site layout diagram, locate the following Electrical Distribution System's major components:

- Main transformers
- Main switchgears
- Tie breakers
- Key switches
- Motor control centres
- Automatic transfer switches
- Emergency diesel generators
- Criticality Alarm for the PA,779, 729 and 705
- LS/DW IA 779 and 729
- C-Battery

☐ 003.05 Describe the principles of operation of the Electrical Distribution System, including a normal loss of power and UPS load switching.

☐ 003.06 Given a one-line diagram of the Electrical Distribution System, trace the electrical flow paths for 782, 779 and 729.

☐ 003.07 Given a one-line diagram of the Electrical Distribution System, identify selected loads.

☐ 003.08 State the normal reason(s) for loss of electrical power.

☐ 003.09 Describe the indications of an electrical breaker trip.

☐ 003.10 Identify the precautions associated with proper electrical breaker operation.

☐ 003.11 Define electrical load sequencing for 782.

☐ 003.12 Describe the effect an excessive building electrical load will have on the emergency diesel generators.

☐ 003.13 Describe the effect a continued electrical power outage will have on the UPS batteries, Criticality alarm, and LS/DW.

☐ 003.14 State the reason for load testing.

☐ 003.15 State the reason for performing a line-up of the Electrical Distribution System following a load test for 782,729 and 779.

☐ 003.16 Using applicable procedures and drawings, identify the normal breaker status of selected electrical equipment in the Building 779 complex.

☐ 003.17 State the alarm conditions for the Electrical Distribution System in 782 and 779.

☐ 003.18 State the parameters for the following operational safety requirements (OSRs):

- UPS availability
- Normal and alternate power availability
- Emergency generator system availability
- Fuel supply

☐ ______________________________

Signature

COMMENTS

C.3. Table-top JTA for WWER-1000 Unit Shift Supervisor (Russian Federation)

1 — Job position	Unit Shift Supervisor (USS)
2 — Country	Russian Federation
3 — Utility/NPP	Balakovo NPP
4 — Type of NPP	WWER-1000
5 — Type of analysis	JTA including table-top method
6 — Total duration	Approximately 24 days; however, training programmes for subordinate positions had not been developed, so the Analysis phase included identifying the tasks for which mastery should have been attained before an operator became a candidate for USS. In addition, the work was performed through an interpreter which added time to the process due to reduced efficiency.
7 — Resources needed	SAT expert — 1 Trainer — 1 SME (incumbents) — 2 to 4 Reactor Department Supervisor — 1
8 — Special tools	No tools were used in the Analysis phase, however, templates were used during development of learning objectives.
9 — Procedures/references	— ACAD 91-012, *Guidelines for Training and Qualification of Licensed Operators* — ACAD 92-004, *Guidelines for the Conduct of Training and Qualification Activities* — INPO 88-003, *Guideline for Teamwork and Diagnostic Skill Development* — DOE Training Program Handbook 1078-94, *A Systematic Approach to Training* — DOE Training Program Handbook 1074-95, *Alternative Systematic Approaches to Training* — DOE/ID-10435, *Table-Top Job Analysis Seminar Facilitator Guide, DOE Training Co-ordination and Accreditation Program* — Guidelines on SAT implementation at Balakovo NPP — Job and Task Analysis Procedure at Balakovo NPP
10 — Identification of attitudes	Direct transfer from the US nuclear industry of selected attitude-related aspects of job performance, including safety consciousness and teamwork.
11 — Strengths	Combining a procedure-based Task Analysis, validation of Task Lists from other facilities, and using the table-top analysis methodology improved the efficiency of the analysis process over traditional methods involving interviews and surveys.
12 — Weaknesses/difficulties encountered	USS is a senior position in a career progression comprising several subordinate job positions. Ideally, training programmes for the subordinate positions would have been completed first.

Additional information

Comments on Job and Task Analysis of the Unit Shift Supervisor job position

Before initiating the analysis of the Unit Shift Supervisor (USS) job position, a survey of subordinate job positions was performed to identify the knowledge, skills, and abilities expected of an entry-level Shift Supervisor candidate. Surveys were performed of the Reactor Bay Shift Supervisor, the Turbine Bay Shift Supervisor, the control room Reactor Operator, and the control room Turbine Operator. Because programmes of instruction had already been developed for reactor building and turbine building operators, additional analysis was not necessary to identify the knowledge, skills, and abilities associated with those positions on which a Shift Supervisor candidate would have already received training.

The survey of the control room Reactor Operator and Turbine Operator positions was based on the results of the JTA at Khmelnitsky NPP and previously conducted JTA for these job positions at Balakovo. A table-top review of the Task Lists for each position was performed. Each task statement was assessed for applicability to Balakovo NPP, then, for each applicable task, a determination was made regarding the pertinence of the task to Shift Supervisor training. If it was determined that task performance should have been mastered as a control room operator incumbent, then the task was deselected for Shift Supervisor training. If the task would not normally have been mastered as a control room operator, then the task was added to the Task List for Shift Supervisors.

The survey of the Reactor Bay and Turbine Bay Shift Supervisor positions was performed by first identifying the job responsibilities, then evaluating each to identify the related skills, knowledge, and abilities that an incumbent should have mastered.

With the entry-level USS candidate knowledge, skills, and abilities identified, a Job and Task Analysis of the job position was performed. The Job Analysis was based on the USS Task List developed as part of the Balakovo NPP simulator project. Each task statement was reviewed by subject matter experts, edited as necessary, then placed on the draft Task List. Using the tabletop analysis methodology, the draft Task List was validated and additional tasks were added to produce a validated Task List.

The 300 tasks on the validated Task List were re-organized into a task-to-training matrix, train/no train decisions were made, and then the tasks were analyzed to identify task elements, knowledge, and skills.

Selected tasks with elements, knowledge, skills, and learning objectives are given below:

Task Statement 1:

Supervise operator’s response to self needs steam supply line break.

Elements:

1. Identify self needs steam line break.
2. Direct TO to isolate section of self needs steam line between SN fast reducing valves and RQ31S02.

3. Direct TO to switch on-site steam line to section of self needs steam line between RQ31S01 and RQ31S02.
4. Direct TO to shutdown turbine and/or control turbine trip.
5. Direct TO to check MFP trip.
6. Direct RO to verify reactor download by power cutback system.
7. Direct TO to isolate condensate flow to deaerator.
8. Direct RO to verify reactor download by power limit controller.
9. Direct TO to control trip of the auxiliary feedwater pumps AFP-1, 2.
10. Direct RO to manually trip the reactor.
11. Direct TO to specify location of break.
12. Direct TO to maintain stable working main steam line pressure.
13. Direct TO to verify steam supply to ejectors and seals from ROY14/6.
14. Direct RO to control RCP trip due to SG low level.
15. Control feeding of SG by emergency feedwater pumps EFP when SG level falls below 150 sm.

Skills and knowledge:

1.1 Know symptoms of self needs steam line break.
1.2 Know location of indicators and annunciators upon those it is possible to identify self needs steam line break.
1.3 Be able to identify self needs steam line break.
2 Know how to isolate section of self needs steam line between SN fast reducing valves and RQ31S02.
3 Know EOP steps for this situation.
4 Know that MFP should be tripped due to low deaerator (i.e. suction) pressure.
5 Know that should be the reactor power limit controller work due to main feedwater pump (MFP) trip or turbine trip.
6 Know that should be the reactor power cutback work due to main feedwater pump (MFP) trip or turbine trip.
7 Know that during this transient it is necessary to isolate condensate flow to deaerator in order to stabilize steam parameters.
8 Know that auxiliary feedwater pumps AFP-1, 2 should be tripped due to low deaerator (i.e. suction) pressure.
9 Know the requirements of main unit working procedure for loss of feedwater to SG.
10 Know how to specify location of break.
11 Know operators response to reactor trip.
12 Know that steam must be supplied to ejectors and sealings from ROY14/6 if there is self needs steam line break between SN fast reducing valves and RQ31S02.
13 Know that should be RCP trip due to SG lower level.
14 Know that feeding of SG will start from emergency feedwater pumps EFP when SG level falls below 150 sm.

Learning objectives:

Terminal objective:

Direct operator response during self-needs steam supply line break in accordance with EOP.

Enabling objective:

1. Describe symptoms of self-needs steam line break.
2. Show in control room indicators and annunciators upon those it is possible to identify self-needs steam line break.
3. Be able to identify self needs steam line break.
4. Describe how to isolate section of self-needs steam line with break.
5. Describe a main unit parameters trends and status of unit equipment during self-needs steam line break.
6. From memory, list EOP steps for transient with self needs steam line break.
7. Explain requirement of Tech Specifications to trip reactor for transient with self needs steam line break.
8. Explain how to specify location of break.
9. From memory, list EOP steps for reactor trip.
10. Enumerate sources of steam for ejectors and sealings.
11. Explain how interlocks and blocks work during deep reduction of SG level.

Task statement 2:

Supervise personnel actions during turbine roll and bringing it to 1500 revolutions per minute.

Task elements:

1. Check for permission from station and turbine Department management to start up turbine.
2. Check turbine start-up checklist requirements are complete for turbine drain valves.
3. Direct TO to heat up main stop and control valves.
4. Direct TO to heat up moisture separators.
5. Check turbine readiness for start-up.
6. Check that unit status and conditions allow turbine start-up.
7. Direct TO to open main stop valves.
8. Direct TO to roll turbine and bring it to 1500 revolutions per minute.
9. Verify proper operation of turbine EHC according to temperature status of turbine.
10. Direct TO to check temperature and mechanical status of turbine.

Skills and knowledge

1. Know permissions that are necessary for turbine start-up.
2. Know turbine start-up check list requirements for turbine drain valves.

3.1 Know turbine start-up procedure.

3.2 Know how to heat up main stop and control valves.

4.1 Know turbine start-up procedure.

4.2 Know how to heat up moisture separators.

5.1 Know unit status and conditions that allows to start up turbine.

5.2 Be able to identify that unit status and conditions allow turbine start-up.

6. Know how to identify turbine readiness for start-up.
7. Know turbine start-up procedure.

8.1 Know turbine start-up procedure.

8.2 Know how turbine roll to 1500 revolutions per minute is conducted.

9. Know procedure for turbine start-up from different temperature and mechanical status.
10. Know turbine start-up procedure.

Learning objectives

Terminal objective:

Describe operator actions during turbine roll and increase to 1500 revolutions per minute according to procedure.

Enabling objective:

1. List management permissions that are necessary for turbine start-up.
2. Describe the start-up check list requirements for turbine drain valves position.
3. List main turbine operational and turbine start-up procedures steps.
4. Explain how to heat up main stop and control valves.
5. Explain how to heat up moisture separators.
6. Describe unit status and conditions that allow turbine start-up.
7. Determine that unit status and conditions allow turbine start-up.
8. Describe how to identify turbine readiness for start-up.
9. Describe turbine start-up from different temperature and mechanical status.
10. Explain what is necessary to control during turbine start-up.

Task Statement 3:

Supervise personnel actions in response to trip of 2 RCPs.

Elements:

1. Detect the trip of two RCPs.
2. Order Reactor Operator to monitor reactor power decrease as a result of emergency unloading system response.
3. Order Reactor Operator to monitor reactor power decrease as a result of power restrictor response.
4. Order Turbine Operator to monitor turbine load decrease by operation of electrohydraulic controller in mode "RD-1" with floating pressure set-point.
5. Order Turbine Operator to check if steam is supplied to auxiliary steam collector through dumping valve.
6. Order Turbine Operator to check if steam is supplied to feedwater pumps through auxiliary steam collector.
7. Order Turbine Operator to monitor feedwater controller for steam generator with tripped RCPs.
8. Order Reactor Operator to monitor transition of reactor power controller to "N" mode after power restrictor response is finished.
9. Order Reactor Operator, I&C bay SS, electrical bay SS to identify the cause of RCP trip.
10. Order Reactor Operator to startup auxiliary circulating pump for tripped RCPs.
11. Order Reactor Operator to adjust nuclear instrumentation system set-points according to number of running RCPs.
12. Order Reactor Operator to put control rod positions in compliance with Tech. Spec. requirements.

Knowledge and skills

1.1 Know the indicators of trip of 2 RCPs.

1.2 Know the location of instruments and annunciators to identify trip of 2 RCPs.

1.3 Be able to identify trip of 2 RCPs.

2. Know that emergency unloading system shall decrease reactor power in the case of trip of 2 RCPs.
3. Know that power restrictor shall decrease reactor power in the case of RCP trip.
4. Know that electrohydraulic controller shall transit to RD-1 mode with floating pressure set-point when emergency unloading system is actuated.
5. Know that steam to auxiliary steam collector shall be supplied through dumping valve in the case of RCP trip.
6. Know that steam to feedwater pumps shall be supplied from auxiliary steam collector in the case of RCP trip.

7. Know the logics of feedwater controller in the case of RCP trip.
8. Know the logics of reactor power controller in the case of emergency unloading system actuation.
9. Know interlocks and protections actuated by RCP trip.
10. Know the procedure steps for the transient described in emergency mitigation procedure.

11.1 Know the procedure steps for the transient described in emergency mitigation procedure.

11.2 Know the nuclear instrumentation system set-points for different number of running RCPs.

12.1 Know the procedure steps for the transient described in emergency mitigation procedure.

12.2 Know Tech. Spec. requirements for control rod positions.

12.3 Know the procedure to withdraw control rod bank used by emergency unloading system.

Learning objectives

Terminal objective:

Direct personnel actions in response to trip of 2 RCPs at 100% power according to emergency mitigation procedure.

Enabling objective:

1. Describe basic parameters trends in the case of trip of 2 RCPs.
2. Describe the symptoms of trip of 2 RCPs.
3. Show the instruments and annunciators to identify RCP trip.
4. Demonstrate the ability to identify trip of 2 RCPs.
5. Describe automatics responses to trip of 2 RCPs.
6. List protections and interlocks actuated by RCP trip.
7. Describe operation of controllers in the case of trip of 2 RCPs.
8. From memory, list the emergency mitigation procedure steps for trip of 2 RCPs.
9. List nuclear instrumentation set-points for different number of running RCPs.
10. State Tech. Spec. requirements for control rod positions.
11. Describe the procedure to withdraw control rod bank used by emergency unloading system.

C.4. Table-top JTA for WWER-1000 Reactor Operator/Senior Reactor Operator (Russian Federation)

1 — Job position	Reactor Operator/Senior Reactor Operator (RO/SRO)
2 — Country	Russian Federation
3 — Utility/NPP	Balakovo NPP
4 — Type of NPP	WWER-1000
5 — Type of analysis	JTA including table-top method
6 — Total duration	Approximately 14 days; however, because the focus of the programme was on teaching the SAT process to personnel who had not worked with it before, it is difficult to separate the time spent on pure analysis from the time spent on the Analysis phase of the programme. In addition, the work was performed through an interpreter which added time to the process due to reduced efficiency.
7 — Resources needed	SAT expert – 1 Trainer – 1 SMEs (incumbents) – 2 to 4 Reactor Department Supervisor
8 — Special tools	No tools were used in the Analysis phase, however, templates were used during development of learning objectives.
9 — Procedures/references	— ACAD 90-016, *Guidelines for Training and Qualification of Nonlicensed Operators* — ACAD 92-004, *Guidelines for the Conduct of Training and Qualification Activities* — DOE Training Program Handbook 1078-94, *A Systematic Approach to Training* — DOE Training Program Handbook 1074-95, *Alternative Systematic Approaches to Training* — DOE/ID-10435, *Table-Top Job Analysis Seminar Facilitator Guide, DOE Training Coordination and Accreditation Program* — Guidelines on SAT implementation at Balakovo NPP — Job and Task Analysis procedure at Balakovo NPP
10 — Identification of attitudes	Direct transfer from the US nuclear industry of selected attitude-related aspects of job performance, including safety consciousness.
11 — Strengths	Combining a procedure-based Task Analysis, validation of Task Lists from other facilities, and using the table-top analysis methodology improved the efficiency of the analysis process over traditional methods involving interviews and surveys.
12 — Weaknesses/difficulties encountered	Basic resources were limited. Data was recorded by hand rather than on a computer and sufficient paper for copying was not always available. The TTA team was adequate, but additional support from job incumbents and reactor Department management would have improved the process outputs.

Additional information

Comments on JTA of Reactor Operator/Senior Reactor Operator job position

The Reactor Operator (RO) and Senior Reactor Operator (SRO) are members of the Reactor Operations Department shift crew who work as field operators in the reactor building. Both RO and SRO report to the Operating Engineer, the Reactor Department Superintendent, or the Deputy Superintendent. The difference between the two positions is based only on experience. Because the duties and responsibilities are identical, the job position is referred to as RO/SRO.

The RO/SRO makes periodic rounds of the reactor building to verify proper operation of mechanical equipment. He operates mechanical equipment as directed by the control room Reactor Operator, including pumps, valves, heat exchangers, strainers, and filters. He reads and interprets thermal hydraulic measuring devices for temperature, flow, pressure, differential pressure, and liquid level. The RO/SRO prepares equipment for maintenance, observes maintenance activities in progress to ensure that industrial safety requirements are met, and maintains cleanliness of reactor building equipment and assigned Reactor Department areas. During emergencies, the RO/SRO verifies proper operation of automatic system functions and performs required operations manually in the event that automatic systems do not function as designed. In the event of fire in the reactor building, the RO/SRO fights the fire until the station fire department arrives at the scene.

RO/SRO incumbents must pass an annual examination on radiological protection and industry safety, operational procedures, fire safety, and rules for construction and safe operation of NPP equipment. They also must pass an annual examination for work in the radiological restricted zone and a biennial examination on nuclear safety.

Analysis

A comprehensive analysis identified all RO/SRO training needs and a complete programme design was performed to identify units of instruction, sequence, setting, and training duration. Measures were incorporated to improve the efficiency of the Analysis and Design phases. Generic Task Lists from the US nuclear industry were used to stimulate the initial analysis efforts and the table-top analysis (TTA) methodology was implemented to save time over the traditional analysis methodology involving survey instruments and interviews of incumbents, supervisors, and managers. Using the table-top analysis methodology, each Reactor Division System was analyzed as a separate Duty Area with system level tasks organized by activity as follows:

Activities

— Startup
— Operation
— Maintenance
— Abnormal/emergency

After the SMEs described the tasks for a given system, the task descriptions were reworded as task statements, reviewed by the SMEs for agreement, assigned a taxonomy number, and then placed on the list of validated tasks. The tasks were re-organized by taxonomy number into a task-to-training matrix, and then the TTA team made a train/no train/overtrain decision for each task. Train/no train decisions and decisions on initial versus continuing training were based on subjective assessments of task difficulty, importance, and frequency. For each task requiring training, the TTA team made a preliminary determination of the evaluation setting and method, and then analyzed each task. Once the tasks had been analyzed, learning objectives were developed using a template approach. Tasks-to-training matrix and the list of cognitive learning objectives built by the templating for one system (TK — makeup water system) appear on the following pages.

Task-to-Training Matrix for Reactor Operator and Senior Reactor Operator Positions

Taxonomy number	Task Statement	Initial Training	Continuing Training
TK0001001RD03	Inspect system	+	
TK0001002RD03	Fill and vent system	+	
TK0001003RD03	Check operability of valves	+	
TK0001004RD03	Test and adjust charging pump oil system		+
TK0001005RD03	Test operability of standby charging pump	+	
TK0001006RD03	Align system for pump operation in recirculation line-up		+
TK0001007RD03	Check bearing oil level	+	
TK0001008RD03	Fill oil reservoir		
TK0001009RD03	Report to SS when charging pump is ready for start		
TK0002010RD03	Inspect system	+	
TK0002011RD03	Shift oil pumps as scheduled		+
TK0002012RD03	Verify standby charging pump aligned before scheduled shifts of charging pump	+	
TK0002013RD03	Verify proper charging pump operation after pump is started by the CR operator	+	
TK0002014RD03	Manually control steam supply to the deaerator		+
TK0002015RD03	Shift deaerator steam supply control to automatic when operational temperature is reached	+	
TK0002016RD03	Backflush charging pump filter when directed by the CR operator		+
TK0002017RD03	Adjust lube oil temperature	+	

Taxonomy number	Task Statement	Initial Training	Continuing Training
TK0002018RD03	Adjust lube oil pump relief valve		+
TK0003019RD03	Verify charging pump loop is isolated	+	
TK0003020RD03	Drain isolated pump loop	+	
TK0003021RD03	Install tags		
TK0003022RD03	Install valve locking devices		
TK0003023RD03	Drain system	+	
TK0003024RD03	Perform valve lineups		+
TK0003025RD03	Verify work package requirements are met	+	
TK0003026RD03	Report to the Operating Engineer		
TK0004027RD03	Manually operate valves if remote operation fails		
TK0004028RD03	On increasing charging pump suction temperature, vent suction heat exchanger		+
TK0004029RD03	On emergency trip of running charging pump investigate its conditions	+	
TK0004030RD03	On emergency trip of running charging pump support start of a standby charging pump		+
TK0004031RD03	On failure of charging pump controller manually control differential pressure between charging pump head and primary coolant system		+
TK0004032RD03	Inform the control room of abnormal conditions		
TK0004033RD03	In the event of oil fire perform the steps of fire fighting procedure		+
TK0004034RD03	Isolate oil leaks		+

BALAKOVO NPP
REACTOR OPERATOR AND SENIOR REACTOR OPERATOR
TK SYSTEM LEARNING OBJECTIVES

1.0 **TERMINAL OBJECTIVE:** Describe the purpose of the TK system.

Enabling objectives

1.1 Describe the interconnection with the YA system.
1.2 Describe the interconnection with the YT system.
1.3 Describe the interconnection with the YD system.
1.4 Describe the interconnection with the TF system.
1.5 Describe the interconnection with the VF system.
1.6 Describe the interconnection with the TE system.
1.7 Describe the interconnection with the TN system.
1.8 Describe the interconnection with the TB30 system.
1.9 Describe the interconnection with the RQ system.
1.10 Describe the interconnection with the TY system.
1.11 Describe the interconnection with the TB20 system.
1.12 Describe the interconnection with the TS10 system.

2.0 **TERMINAL OBJECTIVE:** Describe the function of TK system components.

Enabling objectives

2.1 Describe the function of the charging pumps, booster pumps, and lube oil pumps.
2.2 Describe the function of the deaerator.
2.3 Describe the function of the regenerative heat exchanger.
2.4 Describe the function of the letdown heat exchanger.
2.5 Describe the function of the charging water heat exchanger.
2.6 Describe the function of the hydraulic heel and heat exchanger.
2.7 Describe the function of the pressure regulating valve.
2.8 Draw a simplified diagram of the TK system and label all major components.

3.0 **TERMINAL OBJECTIVE:** Describe TK system startup and operation.

Enabling objectives

3.1 Describe the fill and vent procedure.
3.2 Describe pump recirculation.
3.3 Describe the pump start process.
3.4 Describe adjustment of lube oil temperature.
3.5 Describe backflush of charging pump suction filters.
3.6 Describe transfer lube oil pumps and filters from operating to standby.
3.7 Describe how to adjust a lube oil pump relief valve.
3.8 Describe how to prepare for initiating steam flow to the deaerator.

4.0 **TERMINAL OBJECTIVE:** Describe TK system interlocks and blocks.

Enabling objectives

4.1 Describe trips associated with the charging pumps.
4.2 Describe the interlock associated with the letdown isolation valve.
4.3 Describe actuation of the standby heat exchanger.
4.4 Describe actuation of the standby charging pump.

5.0 **TERMINAL OBJECTIVE:** Describe abnormal and emergency operations.

Enabling objectives

5.1 Describe how to vent the heat exchangers.
5.2 Describe how to manually adjust the charging pump governor.

6.0 **TERMINAL OBJECTIVE:** Describe shutdown and preparation for maintenance.

Enabling objectives

6.1 Describe system alignments for maintenance.

C.5. Table-top JTA for Candu 600 Electrical Maintainer (Canada)

1 — Job position	Electrical Maintainer.
2 — Country	Canada
3 — Utility/NPP	New Brunswick Power, Point Lepreau Generating Station
4 — Type of NPP	Candu 600
5 — Type of analysis	Table-top Job Analysis Training needs assessment
6 — Total duration	5 workshops taking 2 days per workshop = 10 days
7 — Resources needed	Subject matter experts from the Electrical Department. Facilitators knowledgeable in the Job Analysis process. There were 5 workshops conducted requiring a total of 98 person days of effort for the Job Analysis.
8 — Special tools	We are currently producing our own database to handle the data from the analysis process
9 — Procedures/references	— Maintenance procedures from the separate work areas. — Point Lepreau Training Procedure – Guidelines for Training Needs Assessment — TP 60.11 — DOE document — Table-top Job Analysis DOE-HDBK-1076-94
10 — Identification of attitudes	This will occur during the Design phase of the process.
11 — Strengths	Use of subject matter experts from the selected work areas. Brainstorming through table-top analysis. Selecting a cross section of SMEs from the working level with variations in experience. Facilitators knowledgeable in the Job Analysis process. Educating the SMEs on the process of Job Analysis using specific examples.
12 — Weaknesses/difficulties encountered	It was difficult to establish a consistent level of task to prevent detailing of tasks at this point in the SAT process.

Table-top job Task Analysis workshops

Five, two day workshops were conducted for the EI&C work group in order to complete the Job Analysis for the position of Electrical Maintainer. The analysis team members identified crew ‘Duty Areas’ and ‘tasks’ for each “Duty Area” through review of maintenance procedures and brainstorming identified Duty Areas. These tasks identified were categorized into four groups, based on the following criteria:

"Black" criteria

- Task performed often enough that one does not forget how to do it.
- There is low difficulty when performing task.
- There is low probability of error when performing task.
- Improper task performance has low potential to impact public safety, worker safety, the environment or the reliable operation of the station.
- Training would not significantly increase the probability that the task/activity be executed without error (factors other than training may have a greater significance. e.g. Procedural discrepancy, environmental, fatigue).
- Task can be learned and competently performed with just mentoring, OJT, job experience, and/or a job assessment/procedure.

"Yellow" criteria

- Task is only performed typically during plant or equipment outages.
- Task typically performed less often than once every 13 weeks.
- Time would be available for training prior to need for task performance.
- If task is performed improperly, there are moderate to high consequences, and has potential to impact public safety, worker safety, the environment or the reliable operation of the station.
- If task does not meet this criteria, choose another box.

"Green" criteria

- Improper task performance may impair reliability of a system or process or may initiate an ER (moderate consequence of error), has potential to impact public safety, worker safety, the environment or the reliable operation of the station.
- Related task performance maintains proficiency on this task.
- One-time training is sufficient to learn competent task performance.

"Red" criteria

- Task requires frequent practice to maintain proficiency.
- Task is performed during non-routine or emergency conditions.
- Proper task performance is critical to safety (extreme consequences -- serious injury, death, or site emergency), and has potential to impact public safety, worker safety, the environment or the reliable operation of the station.
- Task performed seldom enough that one may forget how to perform task.

Black criteria	No training
Green criteria	Core training
Yellow criteria	Just in time training
Red criteria	Continuing training

At the time of the first workshop, the subject matter experts were instructed that the four criteria were four types of training, and what type of training was not revealed. For some of the tasks the group had difficulty reaching a consensus as to which criteria best matched. For later workshops, the type of training was revealed to reduce the difficulty, based on feedback received. The job position of the Electrical Maintainer was divided into 8 positions. There was a total of 89 separate Duty Areas divided among the 8 positions. In total there were 686 separate tasks identified. An example output of the analysis is shown below. Following is a short list of some of the tasks from one of the Duty Areas showing the type of training identified.

ELECTRICAL CREW	98-10-21		
DUTY AREA	**Task List**	**Training Type**	**COMMENT**
SWITCH GEAR (4.16 kV 13.8 kV)	Test relays	Core training	
	Perform housecleaning	No training	
	Perform maintenance on transformers & instrumentation	Core training	
	Perform maintenance on 4.16 kV breakers	Core training	
	Perform maintenance on 13.8 kV breakers	Core training	
	Perform cell maintenance	Core training	
	Troubleshooting miscellaneous faults	Core training	
	Use grounding device	Core training	
	Perform maintenance on vacuum contractors	Core training	

Following, is a training needs assessment which identifies the KSAs as well as a copy of the objectives, written checkout and job performance measure which can be tied back to the objectives.

Personnel Involved in a needs assessment

The **assessor** (typically a work group trainer) is the individual undertaking the training needs assessment.

The **verifier** (normally a trainer) verifies the assessor's identification of skills/knowledge under objective 3 and, under objective 6 to verify the training need. Once the six objectives have been addressed, the verifier should confirm that a formal training needs assessment has been completed.

The **SME** (subject matter expert) is an individual, qualified and experienced in performing a particular task, a set of tasks or highly knowledgeable in some specific subject area, who is to provide expert opinion to the assessor on the skills/knowledge which require training under objective 5 below.

The objectives of this assessment are to identify:

1. The reason for doing the assessment.
2. The tasks involved.
3. Skills and knowledge implied to perform the task based on criteria 1.
4. Generic skills and knowledge implied as prerequisites.
5. Identify the unique skills/knowledge (from objective 3) which are considered to require training, if they meet criteria 2 and or criteria 3.
6. Training needs as new or continuing.

C.6. JCA for PWR Station Chemist (United Kingdom)

1 — Job position	Station Chemist (term used for the Head of the NPP Chemistry Dept)
2 — Country	United Kingdom
3 — Utility/NPP	British Energy
4 — Type of NPP	PWR
5 — Type of analysis	JCA table-top analysis
6 — Total duration	12 months
7 — Resources needed	3 Station Chemists + 2 chemist instructors from training function
8 — Special tools	None
9 — Procedures/references	Internal procedures followed.
10 — Identification of attitudes	Attitudes identified from experience of three NPP Chemists
11 — Strengths	Results "owned" by those working at the NPP's. Analysis statements using defined performance verbs are easily converted, in the Design phase of SAT, into training objectives.
12 — Weaknesses/difficulties encountered	Careful planning needed to get the analysis group together regularly at a central location for regular meetings.

Additional information

1. Background

Job Competency Analysis, using a comprehensive table-top technique, was undertaken over a period of about a year in the mid-1980s for the post of Station Chemist for a typical gas-cooled nuclear power plant in the United Kingdom. In 1989 the results of this analysis were used as the basis for further JCA, again using a table-top technique, for a PWR Station Chemist (Head of a NPP Chemistry Department). In the United Kingdom in the 1980s there were two utilities — South of Scotland Electricity Board (SSEB) and Central Electricity Generating Board (CEGB) — that built, owned and operated the 14 UK commercial NPPs. It was, therefore, not difficult to bring together the Station Chemists from each UK NPP to attend an SAT Analysis meeting at the CEGB central training centre. All instructors/tutors (including three former chemistry department personnel) at the central training centre had been recruited from NPPs, and so were also subject matter experts (SMEs); these SMEs had been provided with instructional/teaching/assessment skills and some had additionally specialised in educational theory, including a detailed understanding, and a working experience, of the five phases of the SAT.

2. Technique — gathering data

The purpose of the SAT Analysis meeting in the mid-1980s was to initially identify "What the nuclear chemist needs to know" to competently undertake the relevant job and responsibilities at a nuclear power plant. The outcome was later extended beyond the knowledge or cognitive domain to include requirements of skills and attitudes in the psychomotor and affective domains, so identifying all knowledge, skills and attitudes (KSA) required. At the SAT Analysis meeting, the 14 Station Chemists were divided into three groups. One group concentrated on gas chemistry, another on water chemistry and the third on radiochemistry, lubricants and safe practices. Each group was joined by a training centre chemistry instructor (having been previously employed for several years in NPP chemistry departments) to catalyse discussion and take notes, the suggestions being thoroughly debated during brainstorming sessions. One Station Chemist from each group subsequently presented the ideas of his peers to the full meeting at which further suggestions were offered, thereby causing the NPP Chemists to gain "ownership" of the information provided.

3. Technique — refining data for gas-cooled NPPs

A small working-group was established, comprising two Station Chemists (SMEs) nominated by the full meeting referred to above, to represent NPP current chemistry, and the three training centre chemistry SMEs, to convert the suggestions into a suitable format. Over a period of a year (this period was necessary because the members of the group had many other responsibilities and activities to undertake) the suggestions from the three groups at the full meeting were combined by the working group into a series of draft SAT Analysis documents; these were sent on a regular basis to the 14 Chemists at their NPPs for further comments. The final draft was reviewed after 12 months at another SAT Analysis meeting of the Station Chemists and further refinements made, resulting in sixteen areas of knowledge, skills and attitudes being identified.

The statements of KSA required for a competent Station Chemist were all written in objective terms, using performance verbs defined specifically at the UK's CEGB central training centre for unique taxonomy levels in each of the cognitive, psychomotor and affective domains. This technique, particularly the use of defined performance verbs, enabled the Station Chemists and the staff at the training centre to agree, from the outset of the total training programme, exactly what topics, and to what depths, in terms of knowledge, skills and attitudes, were required by all NPP Chemists to undertake their jobs. This technique also enabled the prior competence of all chemistry trainees, and the success and effectiveness of their subsequent training, to be readily assessed against the defined criteria.

4. Technique — modification for a PWR Chemist

In recruiting persons for the first UK PWR, the CEGB recruited engineers and scientists from its existing experienced gas-cooled reactor NPP personnel. These designate appointees were sent out of the UK on structured training programmes to utilities having operational PWRs. From these engineers and scientists some were chosen to become PWR training centre instructors/tutors and given further training in instructional techniques and all phases of SAT. The PWR Chemist designate, following his additional PWR chemistry and SAT training, used the gas-cooled Chemists' KSA document in combination with his recently acquired additional PWR KSA to undertake a further table-top JCA. Chemists from the design and construction teams of the UK PWR also participated in this table-top analysis. The goal was to compile a training programme specifically for chemistry staff for the UK's first PWR. This JCA resulted in the gas-cooled sixteen areas being expanded to twenty-one areas, covering all aspects of PWR design and operation from a chemistry viewpoint. The resultant document, "the knowledge, skills and attitudes required by a PWR Station Chemist" was written, also using pre-defined objective verbs. From these statements PWR chemistry training programmes and training materials were subsequently designed and developed with relative ease for chemistry staff and for other PWR NPP personnel who required information on chemistry.

5. Operations, maintenance, nuclear engineering, radiological protection

The technique described above, or similar, has been used also for many other job positions at UK NPPs.

Appendix D

SELECTED EXAMPLES OF COMBINED JTA/JCA METHODS

D.1. Combined JTA/JCA for WWER-1000 Reactor Operator (Ukraine)

1 — Job position	Reactor Operator (RO)
2 — Country	Ukraine
3 — Utility/NPP	National Nuclear Energy Generating Company ENERGOATOM South-Ukraine NPP
4 — Type of NPP	Three units WWER-1000
5 — Type of analysis	Combined JTA/JCA This method was chosen taking into account several criteria such as availability of plant documentation and information, resources, time allocated, results from other projects, nature of the job positions analyzed, etc. Combined JTA/JCA was selected as a reasonable compromise between accuracy and labour consumption.
6 — Total duration	Analysis phase duration: 3.5 month Note: The duration of the phase were longer than planned. The phase was prolonged to address more specifically the critical tasks as it was recommended by the IAEA Experts.
7 — Resources	14 man-months Note: The experts have been performing the analysis in parallel with their usual every-day activities, and they were not able to allocate much time for the analysis. The duration of the Analysis phase would be much shorter if they worked full time for the analysis.
8 — Tools	Database software
9 — Procedures/references	— SUNPP Training System Conceptual Document (UKR/4/003/CON-01) — Overview of Systematic Approach to Training. Procedure (UKR/4/003/GEN-00) — Analysis Procedure (UKR/4/003/ANA-00) References used: — IAEA-TECDOC-525 — INPO TSD 1985 — DOE Handbook “*Training Program Handbook: Systematic Approach to Training*” — DOE Handbook “*Table-Top Job Analysis*”. — DOE Handbook “*Table-Top Training Program* Design” — DOE Handbook “*Alternative Systematic Approaches to Training*”

10 — Identification of attitudes	Our analysis did not provide any *particular* way to identify attitudes. However, when analyzing the Task Analysis Data we selected the competencies required. All the competencies related to human factors, are selected in order to improve, somehow, the attitudes of job incumbents. So we could mention here all the competencies associated with this subject (communication, leadership, human error, stress control, self-verification, etc.)
11 — Strengths	— Reasonable resources demands — Enough attention is paid to the critical tasks — The method is not difficult for SMEs to understand — Suitable for MCR personnel — Cost-benefit rate is good. The time needed to perform a Combined analysis is shorter than is needed for JTA. — The analysis made is much more thorough than the one made by JCA; the information concerning each job position is more comprehensive. — The results obtained through this method, taking into account the initial availability of plant documentation and information, are quite satisfactory.
12 — Weaknesses/difficulties encountered	The Weaknesses/difficulties listed below are related to both the Analysis and Design phases. — Current database management programme does not allow a convenient interface to be established which directly relates tasks to the training objectives and, especially, back from the objective to the task. — Having compiled all the competencies for a particular job position it is sometimes not easy to recall from which tasks these competencies came. This makes it difficult to write good performance-based objectives to address the competencies. — There is no convenient mechanism to ensure that the list of simulator sessions is comprehensive and covers all the competencies required. — A group of SMEs is required for each activity.

Additional information

The analysis described below has been performed within the IAEA Project UKR/4/003 “Training for Safe operation and management of NPPs”

The ultimate goal of the IAEA Project UKR/4/003 was to develop and to upgrade Ukrainian NPP personnel training system in order to enhance the NPP operational safety and improve NPP management, through the development of the SAT concept for SUNPP personnel training as well as a management system for SAT implementation at SUNPP.

The project was undertaken between 1995 and 1997. SAT methodology was applied to the following four job positions:

— Unit Shift Supervisor (USS)

— Reactor Operator (RO)

— Turbine Operator (TO)

— Senior Duty Electrical Technician (SDET)

Project participants

The project participants and responsibilities were as follows:

The IAEA was responsible for organization of activities within the scope of the IAEA actions (fellowships, experts missions, etc.), as well as to review and monitor whether the project goals are achieved. Additionally, IAEA was responsible for organizing Project Co-ordination Committee (PCC) meetings and the evaluation of implementation of Project Plan and Quality Programme.

The project activities were mainly performed by the experts of SUNPP and Tecnatom (Spain), the latter was the "Contractor" to the Agency for this project.

To perform the project activities a local project team was created at SUNPP. The project team was composed of training centre personnel and subject matter experts (SMEs) from the plant. SMEs were training centre instructors, job incumbents and their supervisors. The project team consisted of a Local Project Manager, an Assistant Local Project Manager, and four work groups supervised by the group leaders.

The IAEA experts evaluated the work performed within the project and provided their comments, recommendations and methodological support at various stages of the project.

The overall co-ordination and evaluation of the project activities were carried out by the PCC which was composed of the IAEA project Technical Officer, the Contractor Project Manager, the Head of NPP Personnel Training Department of ENERGOATOM (former GOSKOMATOM), the Head of SUNPP training centre and IAEA technical experts.

Selection of analysis type

The type of analysis selected for the project was combined JT&CA method. The selection was based on several criteria such as availability of plant documentation and information, resources, time available, results from other projects, job positions selected, etc.

The purpose of the analyses was to identify all competencies needed to perform a specific duties of the job position. These competencies were used then to develop training objectives at the Design phase of SAT.

Process used to achieve the transfer of methodology

For each of five SAT phases including analysis the following process was in use:

- Development and supply a phase specific procedure
- Conducting a training course on specific phase, covering:
  - Philosophy of the phase
  - Training on a SAT procedure including practical exercises, on-job training and trial application of the procedure using current plant information
- Work by local experts
- The Contractor experts reviewed materials developed and provided recommendations on necessary improvements

Software used

The database software was used to facilitate the Analysis And Design activities. The following data were inserted and handled by the database:

- Job positions
- Plant systems list
- Taxonomy code of competencies
- Task Lists (including the values of Difficulty, Frequency And Importance for each task)
- Competencies associated with the tasks and systems
- Training objectives

Activities performed at the Analysis phase

One of the main objectives of this phase was a transfer of know-how to the local experts, to enable them to perform by themselves in the future the analysis of any NPP job position. In order to achieve this objective, the analyses were performed for four job positions selected for the project, which were indicated above.

Analysis phase started at the beginning of July 1995 after corresponding training course had been conducted. The work performed by the local experts included:

- Adaptation of the systems list and taxonomy code of competencies to SUNPP needs and their insertion into the database.
- Development of comprehensive job descriptions to obtain all current information on the job positions.
- Job Analysis to produce a list of all tasks being performed within a job position, and insertion of the tasks into the database.
- Evaluation of tasks by Contractor. The tasks were evaluated by local team members, job incumbents and their supervisors. The results of evaluation were inserted into the database and statistically processed to obtain estimated values for Contractor.
- Selection of tasks for initial and continuing training. Selection was based on above mentioned ratings for Contractor. initially the selection of tasks for initial and continuing training was made automatically using the software (the ratings for Contractor were processed using decision-making tree). Additionally, Task Lists, task ratings and task selection results were reviewed by the SMEs.
- Task analysis, where the selected tasks were split into the elements in order to further determine the competencies required to perform each task.
- Identification of the competencies needed to perform all the tasks associated with a particular system. The relations “systems-competencies” were inserted into the database.

After the PCC meeting held in December 1996, it was agreed to perform a more detailed analysis for critical and safety-related tasks. That extended both Analysis and Design phases and delayed the start of Development phase. As was agreed, the relations “tasks-competencies” for the critical tasks were also inserted into the database

The outputs from the Analysis phase were as follows:

— Systems list and taxonomy code of competencies for SUNPP (UKR/4/003/TRD-GEN).

— Job descriptions (UKR/4/003/TRD-JOB-RO/TO/SS/SE).

— Task Lists (UKR/4/003/TRD-TSK-RO/TO/SS/SE) for all analyzed job positions. Each task comprises:
  - A general Task List
  - A list of tasks for initial training
  - A list of tasks for continuing training

— Task analysis data for those tasks selected for training (this data was irganized using special formats)

— Competencies list for each job position, including:
  - A list of competencies for initial training
  - A list of competencies for continuing training.

The PCC’s recommendations on the Analysis phase

The following general recommendations regarding the Analysis phase were made at the Final PCC meeting:

— Ensure a traceability across Analysis and Design phases data, i.e. a clear direct trace from tasks to training objectives and back to tasks.

— Improve taxonomy code for SUNPP and more precisely adapt the taxonomy code to the needs and specifics of SUNPP.

Attachment 1

Example of evaluated Task List for Reactor Operator associated with one system (System 101. Primary Systems)

Code	Task description	Frequency	Importance	Difficulty	Criterion	Activity
01-01-101-001	Fill the primary system	3.00	3.00	4.00	T	01
01-01-101-002	Perform primary system gas removal	2.00	3.00	4.00	T	01
01-01-101-003	Isolate high-pressure pipelines from low-pressure pipelines	2.00	4.33	4.33	T	01
01-01-101-004	Perform primary circuit hydraulic pressure test, P=35bar	2.00	4.00	4.00	T	01
01-01-101-006	Prepare primary system for heating up to the temperature of hydraulic pressure test	2.00	2.67	4.00	T	01
01-01-101-007	Test the operability of Reactor Coolant Pump motors without load	1.33	3.67	3.33	T	01
01-01-101-008	Add nitrogen to the pressurizer	1.50	3.00	3.50	-	
01-01-101-009	Test the hydro-accumulators	1.00	4.00	4.00	T	01
01-01-101-010	Start a Reactor Coolant Pump to remove gas from primary circuit	1.33	3.33	3.33	T	01
01-01-101-011	Perform primary system heating up to the temperature of hydraulic pressure test	2.00	3.33	4.00	T	01
01-01-101-012	Perform primary circuit hydraulic pressure test for tightness, P = 200bar	1.67	3.67	4.00	T	01
01-01-101-013	Perform primary circuit hydraulic pressure test for strength, P = 250bar	1.33	3.67	4.00	T	01
01-01-101-014	Prepare the primary circuit for elimination of leakage after hydraulic pressure test	1.67	3.00	3.67	T	01
01-01-101-016	Verify conditions required for primary system heating up to the nominal parameters	2.00	3.33	4.00	T	02
01-01-101-017	Perform primary system heating up to the nominal parameters	2.00	3.33	3.67	T	01
01-01-101-018	Replace nitrogen by steam in the pressurizer	2.00	3.50	3.50		
01-01-101-020	Verify conditions for approach to criticality	2.00	3.67	4.00	T	02
01-01-101-021	Withdraw control rods to working position	2.33	3.67	3.67	T	01

01-01-101-022	De-borate reactor coolant system to a critical condition	2.00	4.00	4.00	T	01
01-01-101-024	Increase reactor power up to 20-25% of nominal	2.00	3.00	4.33	T	01
01-01-101-025	Make the reactor critical (at minimal controlled power level)	2.00	4.67	4.33	T	01
01-01-101-026	Increase reactor power up to nominal	2.00	3.67	4.33	T	01
01-01-101-028	Turn off a primary loop (shutdown a Reactor Coolant Pump)	1.33	3.67	4.00	T	01
01-01-101-029	Turn on a primary loop (start a Reactor Coolant Pump)	1.33	3.67	4.33	T	01
01-01-101-030	Decrease reactor power to zero (minimal controlled power level)	2.00	3.67	4.33	T	01
01-01-101-032	Perform SG Relief Valve Test	1.00	4.33	4.00	T	01
01-01-101-033	Perform SG Main Steam Isolating Valve test	1.67	4.00	3.67	T	01
01-01-101-034	Perform Atmospheric Steam Dump Valve test	2.00	4.00	3.67	T	01
01-01-101-035	Perform primary system cooling down to 120 deg.C	2.00	3.00	3.67	T	01
01-01-101-036	Perform High Pressure Safety Injection System test	1.33	4.00	3.33	T	01
01-01-101-037	Perform Pressurizer Power Operated Relief Valve test	1.00	4.33	3.67	T	01
01-01-101-038	Perform primary system cooling down to 70 deg.C	2.00	3.33	3.33	T	01
01-01-101-039	Perform testing Of Low Pressure Emergency Core Cooling System (ECCS)	1.00	4.00	3.33	T	01
01-01-101-040	Drain primary system to the level of reactor vessel flange	1.33	2.67	3.33	T	01
01-01-101-041	Drain primary system to the level of reactor vessel "cold" nozzle axis	1.00	3.00	3.67	T	01

Attachment 2

List of training objectives for the training unit P-01-2-101 "Primary System" (classroom setting)

Code	Training objective
P-01-2-101-A-00-00	Describe system operation, principal equipment of the system, I&C and regulation associated with the system
P-01-2-101-A-00-01	List functions of the system
P-01-2-101-A-00-02	Explain design criteria for the systems
P-01-2-101-A-00-03	Describe simplified flowchart of the systems locating the principal equipment
P-01-2-101-A-00-04	Describe the system interconnections with the other systems it is related with
P-01-2-101-A-00-05	Describe the system main components identifying their functions, description and main design characteristics
P-01-2-101-A-00-07	Describe the functions and purpose of the transmitters, indicators and alarms associated to the system
P-01-2-101-A-00-08	Identify the remote control elements, analysing the control devices associated to their components and its logic
P-01-2-101-A-00-09	List interlocks and automatic signals of the system and their functions
P-01-2-101-A-00-10	Define the system alignment and its equipment status for each one of the plant operation modes
P-01-2-101-A-00-11	Explain experience of the system operation at SUNPP and other plants
P-01-2-101-A-00-12	Explain main requirements of technical specifications relating to the system

Note: Training objectives listed above correspond to only one training unit (Unit P-01-2-101), and do not cover all the competencies required to perform the tasks associated with the Systems 101. The rest of competencies are covered in other training units.

D.2. Combined JTA/JCA for WWER-440 Refuelling Machine Operator (Hungary)

1 — Job position	Refuelling Machine Operator
2 — Country	Hungary
3 — Utility/NPP	Paks NPP
4 — Type of NPP	WWER-440
5 — Type of analysis	Combined JTA/JCA
6 — Total duration	6 months (calendar time)
7 — Resources needed	1 co-ordinator (facilitator) (part - time SME) 4 analysers (job incumbents — SMEs) 1 reviser (line manager of the Refuelling Machine Operators) 1 consultant (HMP staff member — experienced SAT-developer)
8 — Special tools	"SAT administrator" database and SAT Analysis, design tool
9 — Procedures/references	— The IAEA Technical Reports Series No.-380 — HMP procedures for SAT process — Training code of Paks NPP
10 — Identification of attitudes	A general competency structure has been developed by plant, training and human factor experts. This general competency structure led the analysers to develop job specific competencies, and to identify the necessary attitudes.
11 — Strengths	— Strongly supported by procedures and software tools — The accumulated experience of previous SAT work — For a new analysis, the elements of job position analyses been previously conducted can be used via the database — Easy to maintain the analysis data
12 — Weaknesses/difficulties encountered	Still manpower and time consuming Fully involved professionals are necessary

Additional information

1. Background information

1.1. Hungarian Model Project

In the mid 90s a four-year IAEA project has been launched with the expectation to comprehensively develop NPP personnel training in Hungary called “Strengthening Training for Operational Safety at Paks NPP”. One of the main objectives of the project was to introduce SAT into the practice of training.

1.2. Scope of the project

The project initiated SAT-based training developments for 16 job positions. For 11 out of the 16 job positions, SAT developments have been finished. Two posts have ceased to exist due to plant organizational restructuring. In case of three posts, availability of subject matter experts was inadequate, by the end of the project, thus a progress in further conducting of Analysis phase could not be made.

1.3. Extension of the project work

At the end of 1997 the Hungarian Regulatory Body seeing the benefit of the work accomplished within the project, made the switch over to SAT-based training obligatory for all licensed job positions. This work had a very short time frame allowed for, the end of 1998. The Paks plant management allocated sufficient financial resources to accomplish the tasks and retained the project staff for the control thereof. The one-year period, for most of the positions, proved to be sufficient only for the completion of analysis and design and the start of the Development phase, even though the activities were co-ordinated by experienced SAT developers making maximum use of and leaning onto the outputs of their past work. With this extension, the switch onto SAT basis was accomplished for the following posts:

Job positions in hierarchy	Licensed	HMP original scope
Executive level ***Group leader level*** ***Operator, engineer level*** ***Unit shift leader level*** ***Plant shift leader level***		
primary circuit field operator		x
primary circuit senior field operator	x	
Reactor Operator	x	x
secondary circuit field operator		x
Turbine Operator	x	x
secondary circuit senior field operator	x	
senior electrician	x	x
chief electrician	x	
I&C Technician		x
I&C shift team leader	x	
common systems CR operator	x	
health physics Shift Supervisor	x	
Unit Shift Supervisor	x	
plant Shift Supervisor	x	
Refuelling Machine Operator	x	
component engineer	x	
control rod drive mechanic		x
leader of decontamination	x	
leader of electromechanical maintenance	x	
leader of protection and control systems	x	
leader of technological safety	x	
primary circuit valve maintenance team leader	x	x
reactor maintainer		x
reactor coolant system component maintenance team leader	x	
reactor fitting supervisor	x	
reactor maintenance Shift Supervisor	x	
RCP maintainer		x
rotating machine maintenance team leader	x	
safety valve maintainer		x
safety valve maintenance team leader	x	
QC senior system supervisor	x	

2. *An insight into the applied SAT approach*

The selection, or rather, the development of the SAT method to be applied was influenced by a number of factors. The experts accredited by the Agency brought methods and experiences of their respective countries. The acceptance of these methods without criticising resulted in the failure of the initial attempts. The wandering in the woods of solutions lasted for a year, then finally the team of developers, composed exclusively of plant experts, found the "trail". Tailor-making the method, and developing the tools and the appropriate procedures the "Paks-SAT" was being born.

2.1. Analysis phase description

The selection or development of the applicable analysis approach were affected by the following conditions:

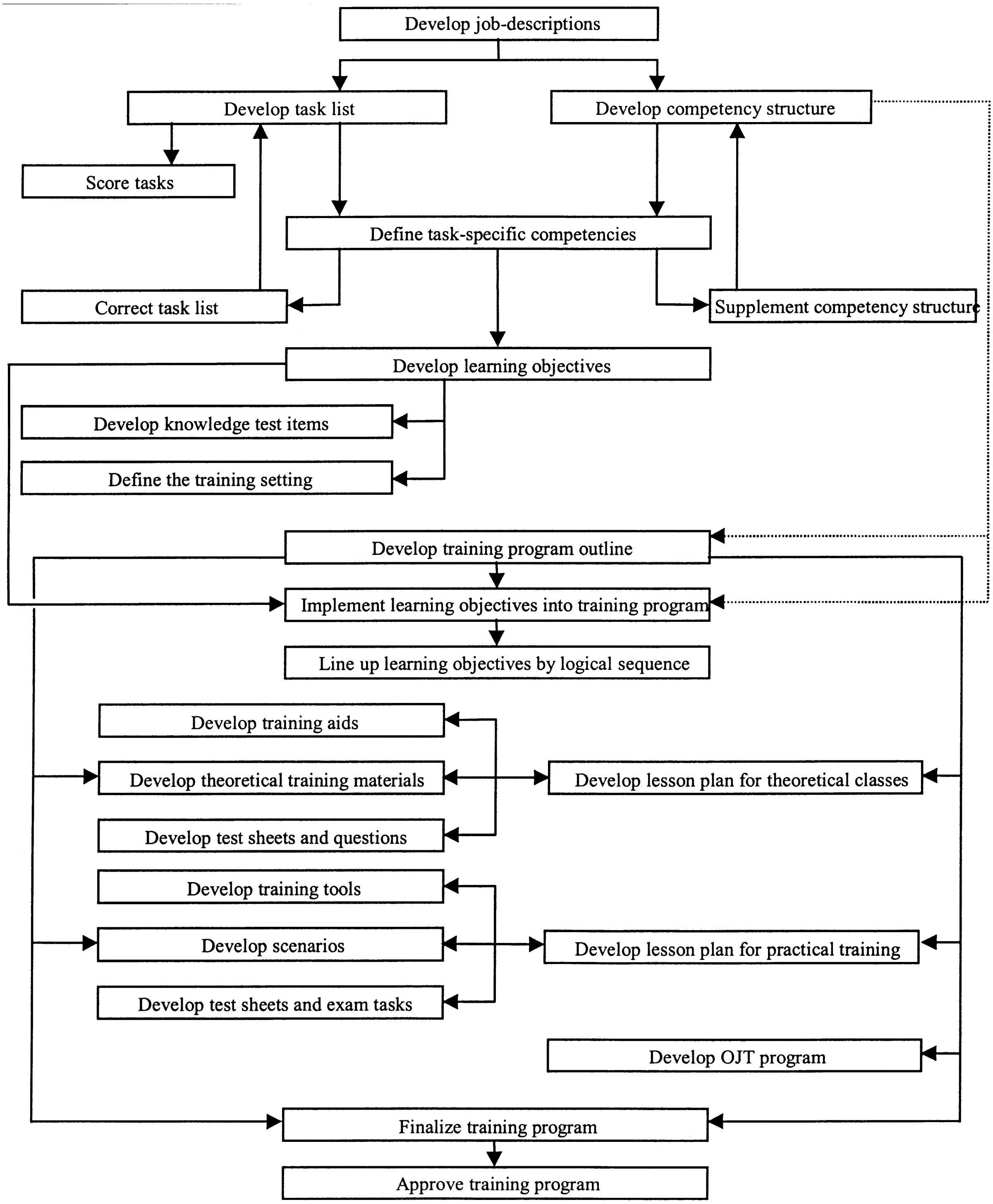
— Lack of nuclear industrial infrastructure
— Low quality of plant documentation
— Complex plant technology, numerous components, multiple control rooms
— Extensive number of posts in the organization scheme, multi-level
— Lack of up-to-date training materials

— Appropriate commitment from plant management
— Effective project management
— Availability of required financial resources
— Availability of experts carrying required plant specific and training related KSAs
— Availability of knowledge and skills required for software tool developments

Based on the above it was necessary, or the plant could afford to apply a method which was work intensive but compensating the missing or incomplete input data. Thence, the detailed listing and analysis of job-specific tasks could not be neglected. However, as many advantages of a competency approach were obvious, the project decided to make use of both by combining the two, developing its own analysis method.

This analysis process typically generates large amount of data the handling of which may only be effective with appropriate information technology background. We made attempts in this area as well by taking open market software products – all of them unsuccessful. The solution was a home-made database management software, which completely considers the characteristics of the data generated, circumvents internal data recordings, allows copying of data sets amongst positions, easy to maintain and acknowledges analyzers' working culture.

The following flowchart shows the relations between the steps of the applied Analysis, Design and Development phases:



Relations between Analysis, Design and Development phases.

2.2. Description of the individual analysis steps

Job description development	
Purpose:	Define the job position by the • the entry (educational) qualification requirement • the final qualification requirement description of the main tasks and responsibilities
Input:	Plant administrative documentation National, plant regulations and procedures for training and qualification
Output:	Clear, written comprehensive picture of the job position
Task List development	
Purpose:	Describe the whole range of tasks of the job position in a structured form
Input:	Plant operating, maintenance procedures Plant administrative procedures Personal experience of job incumbents
Output:	Detailed lists of tasks, structured by • Duty areas • Systems, equipment • Tasks, task elements, task element steps
Task scoring	
Purpose:	Classify (score) the tasks by • Frequency • Importance • Difficulty
Input:	Detailed Task List Classification criteria Personal experience of job incumbents
Output:	Filtered Task Lists
Competency structure development	
Purpose:	Describe all the required competencies, knowledge, skills and attitudes which are necessary for a certain job position, in a logical structure
Input:	Existing training plans Personal experience of • job incumbents • respective line managers • trainers • human factor experts
Output:	Structured, draft list of the competencies
Competency definition	
Purpose:	Select the relevant competencies for a task on the basis of the analysis of the task as for nature and performance conditions
Input:	Task List Competency structure Plant procedures Professional expertise and experience of job incumbents
Output:	Defined competencies for all tasks Revised competency structure

2.3. Examples

2.3.1. Task List details for the Refuelling Machine Operator

Job position: Refuelling Machine Operator

Duty areas:
Administrative
Fresh fuel handling
Spent fuel handling
Intermediate spent fuel store related
Refuelling machine related

Systems:
10-tons crane
20-100-tons crane
Fresh fuel cage
Fresh fuel store
Rotating table
Refuelling machine
etc. (altogether 66 items)

Task List details:

Refueling Machine Operator - Fresh fuel handling - Fresh fuel store

- ☒ **Fresh fuel store**
  - *Regulations*
    - 01;02PR41 plant procedures
    - Mechanical Division Reg. No22. Fresh fuel size control
    - Director General Reg. No35. Entry to fresh fuel store
- ☒ **Operations prior to fresh fuel arrival**
  - ☒ Checking stores from fresh fuel receipt aspects
    - ☒ Visual check, cleaning initiated if required
    - ☒ Ensure room for incoming fuel
    - ☒ Filling rotating table with transport cages of 30 if necessary
  - ☒ Checking availability and operability of hoists, rigging materials and other tools for fresh fuel receipt
- ☒ Checking of fresh fuel upon arrival
- ☒ Fresh fuel intake
- ☒ Handing over empty fresh fuel containers
- ☒ Preparing fresh fuel for loading into reactor
- ☒ Transport of cages full of fresh fuel to Pool 1
- ☒ Transport of fresh fuel on site
- ☒ Input of pellets into bundles and transport to Pool 1 (installation 1)
- ☒ Input of pellets into bundles and transport to Pool 1 (installation 2)
- ☒ Fresh fuel wash with alcohol
- ☒ Participation in load tests

2.3.2. Competency structure details for the Refuelling Machine Operator

- **<u>Refueling Machine Operator</u>**
- ☒ **Entry level**
- ☒ **Staff competencies**
  - ☒ **General safety knowledge**
  - ☒ **General plant knowledge**
  - ☒ **N-plant technical knowledge**
- ☒ **Job-specific competencies**
  - ☒ **General professional knowledge**
  - ☒ **Administrative tasks**
  - ☒ **Job-specific skills**
  - ☒ **Communication at work**
  - ☒ **Fresh fuel-specific**
    - ☒ Fresh fuel-specific
    - ☒ Systems
      - ☒ purpose
      - ☒ structure
      - ☒ operation
      - ☒ normal parameters
      - ☒ interlocks, protections
      - ☒ procedures, orders
    - ☒ Component
      - ☒ general
      - ☒ operational principles
      - ☒ construction
      - ☒ procedures
      - ☒ limitations
      - ☒ place and way of operation
    - ☒ Surveillance
    - ☒ Fuel assembly
    - ☒ Control assembly
    - ☒ Absorber part of control assembly
  - ☒ **Spent fuel-specific**
  - ☒ **V213M/K refueling machine operations**
  - ☒ **Spent fuel dry storage facility-specific**
  - ☒ **Emergency**
- ☒ **Human factors**
  - ☒ **Individual commitment featuring safety culture**
  - ☒ **Cognitive abilities and skills**
  - ☒ **Cooperation and communication aptitudes and skills**
  - ☒ **Managerial aptitudes and skills**
  - ☒ **Maintenance of fitness for work**
  - ☒ **Individual characteristics influencing development in skills**

2.3.3. Task-competency association details for the Refuelling Machine Operator

Refueling Machine Operator - Fresh fuel handling - Fresh fuel store

- ⊠ **Fresh fuel store**
  - *Regulations*
    - 01;02PR41 plant procedures
    - Mechanical Division Reg. No22. Fresh fuel size control
    - Director General Reg. No35. Entry to fresh fuel store
  - *Competencies*
    - Job-specific competency**Administrative tasks**Regulations, procedures**Technical regulations, procedures
    - Job-specific competency**Fresh fuel-specific**Components
    - Job-specific competency**Fresh fuel-specific**Systems knowledge
- ⊠ **Operations prior to fresh fuel arrival**
  - *Competencies*
    - Job-specific competency**Fresh fuel-specific**Surveillances**Component**Place, mode and frequency of surveillance
    - Job-specific competency**Fresh fuel-specific**Surveillances**Systems**Place of surveillance
    - Job-specific competency**Communication at work**Interface with superior or workmate
    - Job-specific competency**Communication at work**Interface with organizational units
    - Job-specific competency*\Job-specific skills**Rigging
    - Job-specific competency**job-specific skills**knowledge of and skills in use of hoists and rigging materials
  - ⊠ **Checking stores from fresh fuel receipt aspects**
    - ⊠ **Visual check, cleaning initiated if required**
    - ⊠ **Ensure room for incoming fuel**
    - ⊠ **Filling rotating table with transport cages of 30 if necessary**
  - ⊠ **Checking availability and operability of hoists, rigging materials and other tools for fresh fuel receipt**
- ⊠ **Checking of fresh fuel upon arrival**
- ⊠ **Fresh fuel intake**
- ⊠ **Handing over empty fresh fuel containers**
- ⊠ **Preparing fresh fuel for loading into reactor**
- ⊠ **Transport of cages full of fresh fuel to Pool 1**
- ⊠ **Transport of fresh fuel on site**
- ⊠ **Input of pellets into bundles and transport to Pool 1 (installation 1)**
- ⊠ **Input of pellets into bundles and transport to Pool 1 (installation 2)**
- ⊠ **Fresh fuel wash with alcohol**
- ⊠ **Participation in load tests**

2.3.4. Task-Competencies-Learning objectives details for the Refuelling Machine Operator

Refueling Machine Operator - Fresh fuel handling - Fresh fuel store

- ☒ **Fresh fuel store**
  - *Regulations*
    - 01;02PR41 plant procedures
    - Mechanical Division Reg. No22. Fresh fuel size control
    - Director General Reg. No35. Entry to fresh fuel store
  - *Competencies*
    - Job-specific competency**Administrative tasks**Regulations, procedures**Technical regulations, procedures
      - *Learning objectives*
        - The trainee shall be able to describe and perform actions in connection with fresh fuel stores according to relevant regulations and procedures
    - Job-specific competency**Fresh fuel-specific**Components
      - *Learning objectives*
        - The trainee shall be able to name and group tools used in fresh fuel stores per task
        - The trainee shall be able to describe roles, construction and operation of fresh fuel store equipment
    - Job-specific competency**Fresh fuel-specific**Systems knowledge
      - *Learning objectives*
        - The trainee shall be able to state differences of fresh fuel stores from constructional and operational aspects
        - The trainee shall be able to describe role and construction of the fresh fuel store and typical operations therein
- ☒ **Operations prior to fresh fuel arrival**
  - *Competencies*
    - Job-specific competency**Fresh fuel-specific**Surveillances**Component**Place, mode and frequency of surveillance
    - Job-specific competency**Fresh fuel-specific**Surveillances**Systems**Place of surveillance
      - *Learning objectives*
        - The trainee shall be able to describe conditions to receipt of fresh fuel
    - Job-specific competency**Communication at work**Interface with superior or workmate
    - Job-specific competency**Communication at work**Interface with organizational units
      - *Learning objectives*
        - The trainee shall be able to state mode and targets of contact when initiating task performance in fresh fuel store by other organizational units
    - Job-specific competency*\Job-specific skills**Rigging
    - Job-specific competency**job-specific skills**knowledge of and skills in use of hoists and rigging materials
      - *Learning objectives*
        - The trainee shall be able to describe and use hoists and rigging materials used in fresh fuel stores
  - ☒ **Checking stores from fresh fuel receipt aspects**
    - ☒ **Visual check, cleaning initiated if required**
    - ☒ **Ensure room for incoming fuel**
    - ☒ **Filling rotating table with transport cages of 30 if necessary**
  - ☒ **Checking availability and operability of hoists, rigging materials and other tools for fresh fuel receipt**

Appendix E

ADDITIONAL SAT ANALYSIS TABLES (IN ALPHABETICAL ORDER BY MEMBER STATES)

E.1. Verification JTA for WWER-440 Control Room Reactor Operator and other operations (Armenia)

1 — Job position	Control Room Reactor Operator Control Room Turbine Operator Chemical Department Shift Supervisor
2 — Country	Armenia
3 — Utility/NPP	ANPP
4 — Type of NPP	WWER-440
5 — Type of analysis	Verification Job and Task Analysis (JTA)
6 — Total duration	Approximately 6 weeks
7 — Resources needed	4 engineers, 3 of them constantly
8 — Special tools	Computers, databases, templates
9 — Procedures/references	Administrative and operational procedures
10 — Identification of attitudes	Primary Analysis phase
11 — Strengths	
12 — Weaknesses/difficulties encountered	Initial unavailability of subject matter experts

E.2. Table-top JTA for Candu 6000 Shift Manager/Control Room Shift Supervisor (Canada)

1 — Job position	Shift Manager/control room Shift Supervisor
2 — Country	Canada
3 — Utility/NPP	Ontario Hydro Nuclear (OHN) — Pickering A, Pickering B, Darlington, Bruce
4 — Type of NPP	Candu 600
5 — Type of analysis	Table-top Job & Task Analysis
6 — Total duration	6 months
7 — Resources needed	OHN subject matter expert — 1 person per site OHN Training Superintendent — 1 person EXITECH Corporation consultant — 1 person
8 — Special tools	EXITECH training analysis management tools — TEAMS
9 — Procedures/references	— EXITECH Corporation Job And Task Analysis procedure — OHN Job and Task Analysis procedures — INPO Shift Manager Program — INPO and IAEA training development procedures
10 — Identification of attitudes	Not considered
11 — Strengths	Subject matter expert job knowledge and job experience. Management commitment to complete the analysis and understand the importance of a JTA for the long-term success of the utility.
12 — Weaknesses/difficulties encountered	Arranging individual schedules to have representatives from multiple sites at the same location at the one time.

E.3. Table-top JTA for Candu 6000 Authorized Nuclear Operator (Canada)

1 — Job position	Authorized Nuclear Operator
2 — Country	Canada
3 — Utility/NPP	Ontario Hydro Nuclear (OHN) — Pickering A, Pickering B, Darlington, Bruce
4 — Type of NPP	Candu 600
5 — Type of analysis	Table-top Job and Task Analysis
6 — Total duration	6 months
7 — Resources needed	OHN Subject matter experts — 3 people per site OHN Training Superintendent — 1 person approximately 2 person-months EXITECH Corporation consultant — 1 person per site
8 — Special tools	EXITECH training analysis management tools — TEAMS
9 — Procedures/references	— EXITECH Corporation Job and Task Analysis procedure — OHN Job and Task Analysis procedures — NUREG 1122 PWR generic knowledge and abilities — INPO and IAEA training development procedures
10 — Identification of attitudes	Not considered.
11 — Strengths	Subject matter Expert job knowledge and job experience. Subject matter expert ability to quickly learn and apply the JTA process. Management commitment to complete the analysis and understand the importance of a JTA for the long-term success of the utility.
12 — Weaknesses/difficulties encountered	Arranging SME support for the duration of the project.

E.4. Table-top JTA for Candu 6000 Major Panel Operator (Canada)

1 — Job position	Major Panel Operator
2 — Country	Canada
3 — Utility/NPP	Ontario Hydro Nuclear (OHN) — Darlington, Bruce
4 — Type of NPP	Candu 600
5 — Type of analysis	Table-top Job and Task Analysis
6 — Total duration	6 months
7 — Resources needed	OHN subject matter experts — 2 people per site OHN Training Superintendent — 1 person approximately 1 person-month EXITECH Corporation consultant — 1 person
8 — Special tools	EXITECH training analysis management tools — TEAMS
9 — Procedures/references	— EXITECH Corporation Job and Task Analysis procedure — OHN Job and Task Analysis procedures — NUREG 1122 PWR Generic knowledge and abilities — INPO and IAEA Training development procedures
10 — Identification of attitudes	Not considered.
11 — Strengths	Subject matter expert job knowledge and job experience. Subject matter expert ability to quickly learn and apply the JTA process. Management commitment to complete the analysis and understand the importance of a JTA for the long-term success of the utility.
12 — Weaknesses/difficulties encountered	Arranging SME support for the duration of the project.

Darlington — ANO Job Analysis Data

Area	Task #	Task Statement	Procedure Name	Freq	Import	Diff	Rating
056	0205630510	Shutdown Condensate Makeup System	Condensate Makeup	1.00	2.00	2.00	T
056	0205630610	Startup Condensate Makeup System	Condensate Makeup	1.00	2.00	2.00	T
056	0205600110	Startup Condensate System	Main Condensate	1.00	2.00	3.00	T
056	0205600210	Shutdown Condensate System	Main Condensate	1.00	2.00	3.00	T
056	0205630110	Transfer low pressure feed heaters to single bank operation	Boiler Feed Water	1.00	2.00	3.00	T
056	0205630210	Confirm operation of heating steam to deaerator during poison prevent	Main Condensate	1.00	2.00	3.00	T
056	0205630310	Change duty of large deaerator level control valves	Main Condensate	1.00	2.00	3.00	T
056	0205630410	Respond to high/low condenser makeup tank levels	Condensate Makeup	1.00	2.00	3.00	T
056	0205630730	Respond to deaerator level dual program failure	Main Condensate	1.00	2.00	3.00	T
056	0205630830	Respond to high deaerator level	Main Condensate	1.00	2.00	3.00	T
056	0205630930	Respond to deaerator level program failure	Main Condensate	1.00	2.00	3.00	T
056	0205631210	Perform operator test procedures (dearator high level switch)	Operator Test Procedure	2.00	3.00	1.00	T

The following signatures indicate concurrence with the selection of tasks to be included in further training development. Duty Area: 056

Plant Department Manager: ____________________ System Matter Experts: ______________________

Training Manager or Designee: ________________ ______________________

Crew Review — Shift Supervisor: _______________

E.5. JTA for PWR Electrical Section Group Leader (China)

1 — Job position	Electrical Section /Maintenance Branch — Low Voltage Group Leader
2 — Country	China
3 — Utility/NPP	Guangdong Da Ya bay Nuclear Power Plant
4 — Type of NPP	PWR
5 — Type of analysis	Job and Task Analysis
6 — Total duration	8 weeks (1997.11~12)
7 — Resources needed	Performing group: — 3 instructors (total of 48 person-days) — 2 training engineers (total of 32 person-days) — 2 training experts (total of 32 person-days) Interviewers: — 1 Maintenance Branch Head (total of 1 hour) — 1 Electrical Section Head (total of 1 hour) — 5 Electrical Section Engineers (total of 5 hours) — 1 Blocking Manager (total of 1 hour) — 2 Health Physics Engineers (total of 2 hours) — 2 Maintenance Group Leaders (total of 2 hours)
8 — Special tools	None
9 — Procedures/references	"Nuclear Power Plant Personnel Training and its Evaluation — A Guide book"/ IAEA Technical Reports Series No.380
10 — Identification of attitudes	No comment
11 — Strengths	Defines the job tasks in more detail than the usual way. Completely covers all competence related jobs.
12 — Weaknesses/difficulties encountered	There are no clear standards to clarify the details of job tasks. The lack of experience to perform this analysis. Too much time is spent for the analysis process.

E.6. Table-top combined JTA/JCA for PHWR Control Engineer (India)

1 — Job position	Control Engineer Operates the NPP from the control room in accordance with approved procedures and principles.
2 — Country	India
3 — Utility/NPP	Nuclear Power Corporation of India
4 — Type of NPP	PHWR
5 — Type of analysis	JTA and JCA combined table-top
6 — Total duration	Three months
7 — Resources needed	Two operation experts Two training experts One SAT facilitator
8 — Special tools	Databases of tasks executed/anticipated. Root Cause Analysis.
9 — Procedures/references	— IAEA-TECDOC-525 — IAEA Technical Reports Series No. 380
10 — Identification of attitudes	— by Root Cause Analysis — by human factors training — follow ups
11 — Strengths	Economical Time-effective Implementable Combined approach for routine and non-routine tasks
12 — Weakness/difficulties encountered	Heavy reliance on SAT trainees Lack of consensus for want of structured approach for non-routine tasks standards

E.7. Table-top JTA for PHWR Maintainer (India)

1 — Job position	Maintainer Conducts preventive and breakdown maintenance as requested and in accordance with approved principles and procedures.
2 — Country	India
3 — Utility/NPP	Nuclear Power Corporation of India
4 — Type of NPP	PHWR
5 — Type of analysis	JTA, table-top
6 — Total duration	Two months
7 — Resources needed	Two Maintenance Engineers One Maintenance Supervisor One SAT facilitator
8 — Special tools	Databases of tasks expected/executed Root Causes Analysis
9 — Procedures/references	— IAEA TEC DOC-525 — IAEA Technical Reports Series No. 380
10 — Identification of attitudes	— by Root Causes Analysis — by human factor training.
11 — Strengths	Focuses on quality and procedures Time effective Implementable
12 — Weakness/difficulties encountered	Heavy documentation and Task Listing needed.

E.8. JCA for PHWR Maintenance Superintendent (India)

1 — Job position	Maintenance Superintendent Implements and controls maintenance activities in all disciplines to ensure high NPP performance indicators from maintenance angle.
2 — Country	India
3 — Utility/NPP	Nuclear Power Corporation of India
4 — Type of NPP	PHWR
5 — Type of analysis	JCA
6 — Total duration	One month
7 — Resources needed	One operation expert One safety expert One maintenance expert One SAT facilitator
8 — Special tools	Root Cause Analyses
9 — Procedures/ references	— IAEA-TECDOC-525 — IAEA Technical Reports Series No. 380
10 — Identification of attitudes	— by Root Causes Analysis — by human factor training
11 — Strengths	Cost effective Need based
12 — Weakness/difficulties encountered	Lack of consensus for standards to be attained

E.9. Combined JTA/JCA for PWR Main Control Room Operator Applicants (Republic of Korea)

1 — Job position	Main Control Room Operator Applicants *
2 — Country	Republic of Korea
3 — Utility/NPP	Korea Electric Power Corporation(KEPCO)/Kori Unit 3.4 and Yonggwang Unit 1.2
4 — Type of NPP	PWR (WH 950 MWe, 3 Loops)
5 — Type of analysis	Combined JTA/JCA (to identify the job competencies effectively)
6 — Total duration	1 month
7 — Resources needed	3 Simulator instructors (total of 30 person-days) 3 Shift supervisors (total of 3 person-days)
8 — Special tools	None used. It is planned to develop the Analysis phase software appropriate to the training organizations and systems, based on the experiences of model case application of SAT.
9 — Procedures/references	IAEA-TECDOC-525 Rev.1 and some US utilities' procedures for SAT Analysis. The Analysis phase procedure will be developed appropriate to the training organization and systems based on the experiences of model case application of SAT.
10 — Identification of attitudes	Reference was made to some INPO publications and IAEA-TECDOC-525 Rev.1 to select the attitudes to be needed for the job position.
11 — Strengths	Method used allowed to identify the job competencies effectively. SME group which consists of trainee's supervisors and instructors can identify the job competencies of their subordinates correctly and simply.
12 — Weaknesses/difficulties encountered	Structuring the competencies into a logical framework and organizing the training objective into training module or lesson unit.

* KEPCO Nuclear Power Education Center, KNPEC, which is the centralized nuclear power employee training centre in KEPCO, applied the SAT methodology to MCR operator applicant's course as a model case last year. The purpose of this model case application was to find out the problems in application to KEPCO training organization and systems which differ from the western electric utilities. Based upon the experiences of model case application of SAT, we are now developing the detailed SAT phase procedures. Above comments are our draft opinions and more detailed analysis procedures and results will be informed on later.

E.10. JTA for RBMK-1500 Main Control Room Reactor Operator (Lithuania)

1 — Job position	Main Control Room Reactor Operator
2 — Country	Lithuania
3 — Utility/NPP	Ignalina NPP
4 — Type of NPP	RBMK
5 — Type of analysis	Job and Task Analysis
6 — Total duration	7 months (on a part-time basis) Analysis was performed under the joint activity of Ignalina NPP, US DOE and IAEA.
7 — Resources needed	1300 person-hours
8 — Special tools	Similar JTA which served as an example was performed at the Chernobyl, Khmelnitski, and Balakovo NPPs for similar job positions.
9 — Procedures/references	Job and Task Analysis guidelines developed by the US Department of Energy under the auspices of the International safety Program
10 — Identification of attitudes	Not applicable
11 — Strengths	The use of JTA results in an identification of job-specific knowledge and skills which can then be used as the basis for designing a job-specific training programme. The analysis approach can often proceed directly from plant procedures. The JTA approach will identify performance standards for each task, thereby giving plant management effective means of communicating their performance expectations to plant personnel.
12 — Weaknesses/difficulties encountered	None

E.11. JCA for RBMK-1000 Reactor Operator (Russian Federation)

1 — Job position	Reactor Operator
2 — Country	Russian Federation
3 — Utility/NPP	Rosenergoatom Concern/ Smolensk Training Centre for Smolensk NPP
4 — Type of NPP	RBMK-1000
5 — Type of analysis	Job Competency Analysis was selected to study practically how to use the analysis methods and techniques. The experts from the UK and Spain provided consultation within the TACIS project.
6 — Total duration	5 weeks
7 — Resources	1 instructor (5 person-weeks) 3 NPP experts (6 person-weeks) 1 database technician (1 person-week) 2 managers responsible for training at NPP and training centre (2 person-weeks) Total: 14 person-weeks
8 — Special tools	Database mfoxplus, attachments specifically developed for data insertion and statistic processing
9 — Procedures/references	— Analysis phase procedures — Reactor Operator job instruction — Reactor Operator training programme — Smolensk NPP unit Technical Specifications — Instruction on system and equipment operation — Instruction on excursion and emergency situations — Technical case of Smolensk NPP unit 2 safety — Report on Smolensk NPP operation analysis — Taxonomic code (list of competencies)
10 — Identification of attitudes	Attitudes were identified by Smolensk NPP experts through round-table discussions with the application of job and operation instructions.
11 — Strengths	Relatively small manpower resources needed. Easy to develop training programme.
12 — Weakness/difficulties encountered	Highly qualified experts are required to implement the analysis. It was difficult to develop training objectives on the basis of competencies. As a result, training materials were identified mostly based on the experience of an instructor.

Additional information

NEEDS TO IMPLEMENT ANALYSIS

— Training programmes were developed 8 years ago.
— Training programmes were developed without application of SAT methodology.
— Some changes were introduced to instructions on equipment and unit operation.
— Evaluation of the training showed some deficiencies in training.

— Necessity to implement recommendations published in the IAEA final reports relating to RBMK safety Review (1994-phase 1, 1996- phase 2; six working groups dealt with operational issues and one working group dealt with human factor issues).
— Desire displayed by the international organizations to render assistance in applying SAT methodology.

ORGANIZATION OF WORK

— Setting-up the working group (including recruitment of the experts with the required level of qualification and knowledge).
— Conducting of a two-week seminar on SAT methodology and setting the task to implement Analysis phase by the experts of the working group.
— Provision of the working group with materials and technical support, conducting of computer classes which enabled to work with the required programmes.
— Development and keeping the schedule of the work.
— Execution, approval and archiving of the documents.

IMPLEMENTATION OF THE ANALYSIS PHASE

— Development of a full Task List for a job position.
— Smolensk NPP job incumbents for corresponding job positions were involved in the development of the full Task List.
— Smolensk Training Centre (TC) instructor supervised and co-ordinated the work. Foreign experts, working under the project of the technical assistance rendered to Smolensk TC, provided advice on the regular basis.
— Task Lists were developed as per job activity. The following activities were identified for the operations personnel:
  - preparation for the start-up
  - start-up and shut-down
  - normal mode of operation
  - emergency modes
  - severe accidents, including Beyond Design Basis Accidents
  - repair and maintenance

Five hundred (500) tasks were identified for Reactor Operator training programme. About 300 tasks were identified for Unit Shift Supervisor training programme. The experts considered this amount of tasks to be optimum, taking into account their experience and the fact that training for these job positions has been already conducted.

Evaluation of the tasks

Three experts evaluated the tasks separately and gave a mean mark to each task. Each task was evaluated by criteria of difficulty , importance and frequency on the scale from 1 to 5.

Selection of the tasks for analysis was done using the following criteria. The difficult tasks (3 points and more) and important tasks (3 points and more) and infrequent tasks (less than 2 points) were selected for further analysis. After processing the results, the Task List for a Reactor Operator included 180 tasks, and the Task List for a Unit Shift Supervisor included 140 tasks. The group of experts analyzed the tasks which were not selected for further analysis. They added not more than 10 tasks to each Task List (it was done upon the request of at least one expert participated in the review of task selection).

Job Competencies analysis for Reactor Operator job position

Job competencies analysis for Reactor Operator job position involved the allocation of competencies from previously developed competencies' list to each task. The allocation of competencies was done by Smolensk NPP experts. A taxonomic code was given to each competency. Repeatedly allocated competencies were automatically excluded. In this way the list of the competencies required to perform Reactor Operator tasks was compiled.

Job and Task Analysis for Unit Shift Supervisor job position

Job and Task Analysis for Unit Shift Supervisor job position was achieved by identifying steps of each task, and by defining required knowledge, skills and attitudes for each step, and finally developing training objectives for each knowledge or skill. On average, a task included 8 steps, each step included associated 1-2 knowledge and 1-2 skills.

CONCLUSIONS

Smolensk TC developed 8 initial training programmes and 8 continuing training programmes for Smolensk NPP operators. All programmes were developed with the application of SAT methodology. Seven programmes, produced before 1997, were developed by using Job Competency Analysis. Job and Task Analysis was used to develop a Unit Shift Supervisor training programme in 1997. The application of job competencies analysis saves manpower and time. But the saved manpower and time was wasted during the development of training materials as the tasks had not been analyzed in detail, and many issues had to be discussed during the Development phase once again. Job and Task Analysis was more time-consuming, but all the programmes developed through applying this analysis were more satisfactory for the instructors.

On the basis of the grouped training objectives, the training materials were developed in a better way. It is felt that Job and Task Analysis must be used to develop training programmes used in NPP training departments. Job Competency Analysis should be used to develop training programmes for the same specialities required at different NPPs for which the training is conducted at Rosenergoatom relevant centralized training facilities.

E.12. JTA/JCA for RBMK-1000 Turbine Department Shift Supervisor (Russian Federation)

1 — Job position	Turbine Department Shift Supervisor Being the leader of turbine Department shift personnel, he supervises the operation of two turbines and all systems related to turbine Department from his working place in turbine hall.
2 — Country	Russian Federation
3 — Utility/NPP	Concern “ROSENERGOATOM”, Kursk NPP
4 — Type of NPP	RBMK-1000
5 — Type of analysis	Combined Job and Task Analysis and Job Competency Analysis. Also table-top analysis, document analysis and templating methods and techniques were employed. The chosen type of analysis was considered the most effective and suitable for the job. Task statements are similar (“start up…”,”shut down…”) and they are applied to a large number of technological systems (turbine, evaporators, condensers, etc.).
6 — Total duration	It took about 8 months from the time the analysis started until the first part of the training was conducted. Job Analysis is done and tasks rated. The tasks selected for continuing training were analyzed on package basis.
7 — Resources needed	— 1 Turbine Department Shift Supervisor — total of 10 person-days. — 1 instructor (former Turbine Department Shift Supervisor) — total of 90 person-days. — 1 Head Of Turbine Department — total of 5 person-days. — 2 experts in SAT — total of 90 person-days.
8 — Special tools	Paper forms and computer templates were used for analysis data collection both as hard copy and in computer.
9 — Procedures/references	Set of 27 SAT procedures was developed and delivered by the Contractors (ENIKO MIFI/Russian Federation and Exitech Corp./USA). Two procedures from this list, namely “Job Analysis” and “Task Analysis” were extensively used during the analysis process.
10 — Identification of attitudes	Identification of attitudes was not formally addressed to within described analysis activities. However, the attitudes were considered and addressed to during Design and Development phases, and also within the development and implementation of other continuing training modules/sessions dealing with Safety Culture, Operating experience, Event Study, Regulations in nuclear Field, Emergency Preparedness, Teamwork, Supervisory and Management Training. Also the attitudes are addressed to in training modules within general Employee Training and Industrial safety training.
11 — Strengths	— Accurate and precise identification of Duty Areas and tasks — Application of the criteria to verify and validate analysis data — Accurate development of explicit training objectives and tests (including conditions, objective statements, and standards) — Less resources comparing with traditional JTA due to optimized Analysis and Design phases

	— Comparatively clear analysis procedures — Good specification of training materials to be developed — Increased job performance orientation of training conducting and objectivity of training evaluation — Direct involvement of plant managers and other plant personnel in Job Analysis, identification of training needs, review of training-related problems, development and implementation of training-related and other management solutions — Identification of plant procedures/documentation deficiencies and development of the recommendations initiated to upgrade job descriptions, regulations, and plant operating procedures. Chronologically it was the first successful project which included JTA/JCA for a RBMK Turbine Department Shift Supervisor.
12 — Weaknesses/difficulties encountered	Problems and difficulties which were met while using the employed analysis methods were as follows: — Necessity in extensive training of the instructors and SMEs on SAT methodology and SAT procedures. — Problems arisen when some of initially trained SMEs and instructors left the project team been assigned for the other jobs. — A big number of Duty Areas and tasks (more than 300) for this job position. Duty areas mostly correspond to a big number of plant systems under the responsibility of Turbine Department Shift Supervisor. supervisory nature of this job position dictates to use combined JTA/JCA with some elements of Functional analysis. This sofisticated approach was rather difficult for plant personnel involved in first-run analysis activities.

E.13. JCA for WWER-1000 Engine Mechanics Maintenance Foreman (Russian Federation)

1 — Job position	Engine Mechanics Maintenance Foreman
2 — Country	Russian Federation
3 — Utility/NPP	Novovoronezh Training Centre (NVTC)
4 — Type of NPP	WWER-1000
5 — Type of analysis	Some kind of Job Competency Analysis (type of analysis was chosen by TACIS project)
6 — Total duration	8 weeks
7 — Resources needed	1 Training Consultant (total of 15 person-days) 2 instructors (total of 80 person-days) 2 Maintenance Foremen (total of 10 person-days) 1 Maintenance Dept. Deputy Manager (total of 3 person-days)
8 — Special tools	Templates, database, special tables, questionnaires
9 — Procedures/references	References: — NVTC manuals — EDF manuals
10 — Identification of attitudes	No special comments
11 — Strengths	Team approach to find correct competency. Cost-effective. Completed in short time. Not so much paperwork and no difficulty to maintain data and documentation. Method revealed that job positions analyzed had narrow competencies.
12 — Weakness/difficulties encountered	There were some difficulties to validate the list of competencies due to problems in interpreting and translation.

E.14. JCA for Training Instructor (Russian Federation)

1 — Job position	Training Instructor
2 — Country	Russian Federation
3 — Utility/NPP	ROSENERGOATOM, Novovoronezh Training Centre (NVTC)
4 — Type of NPP	WWER
5 — Type of analysis	Some kind of Job Competency Analysis (type of analysis was chosen due to time limitations and sufficient expertise in such kind of analysis)
6 — Total duration	7 weeks
7 — Resources needed	4 Training Consultants (total of 30 person-days) 7 instructors (total of 80 person-days) 1 psychologist (total of 10 person-days)
8 — Special tools	Templates, database, special tables, questionnaires
9 — Procedures/references	References: — NVTC manuals — EDF manuals
10 — Identification of attitudes	No special comments
11 — Strengths	Team approach to find correct competency. Cost-effective. Completed in short time. Not much paperwork, and no difficulty to maintain data and documentation.
12 — Weakness/difficulties encountered	None

E.15. JTA for WWER-440 Unit Shift Supervisor (Russian Federation)

1 — Job position	Unit Shift Supervisor (USS)
2 — Country	Russian Federation
3 — Utility/NPP	Novovoronezh Training Centre (NVTC)
4 — Type of NPP	WWER-440
5 — Type of analysis	Job and Task Analysis (type was chosen by TACIS project)
6 — Total duration	3 months
7 — Resources needed	4 instructors (total of 120 person-days) 1 Training Consultant (total of 15 person-days) 4 USS (total of 60 person-days) 2 MCR Reactor Operator (total of 20 person-days) 2 MCR Turbine Operator (total of 20 person-days)
8 — Special tools	Templates, database
9 — Procedures/references	Procedures for Analysis phase: ANA 01-05
10 — Identification of attitudes	No special comments
11 — Strengths	Very detailed Task List allowed the training objectives to be easily defined. Nothing was omitted.
12 — Weakness/difficulties encountered	Too much paperwork; it is very complicated to maintain the database and training materials. A lot of resources needed and it takes longer than JCA.

E.16. Table-top JTA for BWR Turbine Operator (Sweden)

1 — Job position	Turbine Operator
2 — Country	Sweden
3 — Utility/NPP	Oskarshamn 1 NPP
4 — Type of NPP	BWR
5 — Type of analysis	Table-top Job and Task Analysis (JTA)
6 — Total duration	8 weeks
7 — Resources needed	1 Shift Supervisor, 2 Turbine Operators, 2 Training Specialists/facilitators and 1 secretary — part time
8 — Special tools	The database TASKMASTER for storage of the data. Templates for data collection.
9 — Procedures/references	— The IAEA Guidebook on "Nuclear Power Plant Personnel Training and its Evaluation", Technical Reports Series No. 380. — The DOE/ID 10435 and 10461. The seminar material from DOE including table-top job Analysis and table-top Training design.
10 — Identification of attitudes	-
11 — Strengths	Table-top technique was used for the Analysis and Design phases. It was cost-effective and gave expected results very quickly. Subject matter experts (SMEs) are the best guarantee that the content of the analysis are correct and meet the training needs for future courses.
12 — Weaknesses/difficulties encountered	The SMEs are away from ordinary workplaces for a long time.

E.17. JTA for all personnel working in zone divided plant areas (Sweden)

1 — Job position	All personnel who have the right to work in zone divided areas at the plant.
2 — Country	Sweden
3 — Utility/NPP	All Swedish NPPs
4 — Type of NPP	BWR and PWR
5 — Type of analysis	Job and Task Analysis (JTA)
6 — Total duration	2 weeks
7 — Resources needed	2 Training Specialists 3 radiological experts/instructors 1 training material specialist/senior editor
8 — Special tools	The database TASKMASTER for storage of the data
9 — Procedures/references	The IAEA Guidebook on “Nuclear Power Plant Personnel Training and its Evaluation”, Technical Reports Series No. 380.
10 — Identification of attitudes	Radiology is in many ways about having the right attitude, i.e. to follow current rules. In many cases, knowledge and attitude requirements merge into each other.
11 — Strengths	This was a creative way of working when the participants strove for the same goal. The brainstorming technique (table-top) also made the participants go in the same direction.
12 — Weaknesses/difficulties encountered	To have all experts away from their ordinary workplaces for so many days, even if it only was 2 days at a time.

E.18. Combined JTA/JCA for WWER-1000 Turbine Operator (Ukraine)

1 — Job position	Turbine Operator (TO)
2 — Country	Ukraine
3 — Utility/NPP	National Nuclear Energy Generating Company ENERGOATOM South-Ukraine NPP
4 — Type of NPP	Three units WWER-1000
5 — Type of analysis	Combined JTA/JCA This method was chosen taking into account several criteria such as availability of plant documentation and information, resources, time allocated, results from other projects, nature of job positions being analyzed, etc. Combined JTA/JCA was selected as a reasonable compromise between accuracy and labour consumption.
6 — Total duration	3.5 months Note: The duration of Analysis phase was longer than planned. The phase was prolonged to address more specifically the critical tasks as recommended by the IAEA Experts.
7 — Resources	14 person-months Note: The experts have been performing the analysis in parallel with their regular every-day activities and were not able to allocate much time for the analysis activities. The duration of Analysis phase would be much shorter if the experts worked full time for the analysis activities.
8 — Special tools	Database software
9 — Procedures/references	— SUNPP Training System Conceptual document (UKR/4/003/CON-01) — Overview of Systematic Approach to Training. Procedure (UKR/4/003/GEN-00) — Analysis Procedure (UKR/4/003/ANA-00) References: — IAEA-TECDOC-525 — INPO TSD 1985 — DOE Handbook "*Training Program Handbook: Systematic Approach to Training*" — DOE Handbook "*Table-Top Job Analysis*". — DOE Handbook "*Table-Top Training Program* Design" — DOE Handbook "*Alternative Systematic Approaches to Training*"
10 — Identification of attitudes	Our analysis did not provide any *particular* way to identify attitudes. However, when analyzing the Task Analysis Data we selected the competencies required. All the competencies related to human factors are selected in order to improve, somehow, the attitudes of job incumbents. We could mention the following competencies associated with this subject: communications, leadership, human error, stress control, self-verification, etc.

11 — Strengths	— Reasonable resources demands — Enough attention is paid to the critical tasks — The method is not difficult for SMEs to understand — Suitable for MCR personnel — Cost-benefit rate is good. The time needed to perform a combined analysis is shorter than the one needed for JTA — The analysis made is much more thorough than the one made by JCA; the information concerning each job position is more comprehensive — The results obtained through this method, taking into account the initial availability of plant documentation and information, are quite satisfactory
12 — Weaknesses/difficulties encountered	The weaknesses/difficulties listed below are related to both Analysis and Design phases: — Current database management programme does not allow a convenient interface to be established which directly relates a task to the training objectives and, especially, back from an objective to the task. — Having compiled all the competencies for a particular job position it is sometimes not easy to recall from which tasks these competencies came. This make it difficult to write good performance-based objectives to address the competencies. — There is no convenient mechanism to ensure that the list of simulator sessions is comprehensive and covers all the competencies required. — A group of SMEs is required for each activity.

E.19. Combined JTA/JCA for WWER-1000 Unit Shift Supervisor (Ukraine)

1 — Job position	Unit Shift Supervisor (USS)
2 — Country	Ukraine
3 — Utility/NPP	National Nuclear Energy Generating Company ENERGOATOM/ South-Ukraine NPP
4 — Type of NPP	Three units WWER-1000
5 — Type of analysis	Combined JTA/JCA This method was chosen taking into account several criteria such as availability of plant documentation and information, resources, time allocated, results from other projects, nature of the job positions being analyzed, etc. Combined JTA/JCA was selected as a reasonable compromise between accuracy and labour consumption.
6 — Total duration	3.5 months Note: The duration of Analysis phase was longer than planned. The phase was prolonged to address more specifically the critical tasks as recommended by the IAEA Experts.
7 — Resources	14 person-months Note: The experts have been performing the analyses in parallel with their regular every-day activities and were not able to allocate much time for the analyses. The duration of Analysis phase would be much shorter if the expert worked full time for the analysis activities.
8 — Tools	Database software
9 — Procedures/references	— SUNPP Training System Conceptual document (UKR/4/003/CON-01) — Overview of Systematic Approach to Training. Procedure (UKR/4/003/GEN-00) — Analysis procedure (UKR/4/003/ANA-00) References: — IAEA-TECDOC-525 — INPO TSD 1985 — DOE Handbook "*Training Program Handbook: Systematic Approach to Training*" — DOE Handbook "*Table-Top Job Analysis*". — DOE Handbook "*Table-Top Training Program* Design" — DOE Handbook "*Alternative Systematic Approaches to Training*"
10 — Identification of attitudes	Our analysis did not provided any *particular* way to identify attitudes. However, when analyzing the task Analysis phase we selected the competencies required. All the competencies related with human factors, are selected in order to improve, somehow, the attitudes of job incumbents. We could mention the following competencies associated with this subject: communications, leadership, human error, stress control, self-verification, etc.

11 — Strengths	— Reasonable resources demands — Enough attention is paid to the critical tasks — The method is not difficult for SMEs to understand — Suitable for MCR personnel — Cost-benefit rate is good. The time needed to perform a Combined analysis is shorter than is needed for JTA — The analysis made is much more thorough than the one made by JCA; the information concerning each job position is more comprehensive — The results obtained through this method, taking into account the initial availability of plant documentation and information, are quite satisfactory
12 — Weaknesses/difficulties encountered	The weaknesses/difficulties listed below are related to both Analysis and Design phases: — Current database management programme does not allow a convenient interface to be established which directly relates a tasks to the training objectives and, especially, back from an objective to the task. — Having compiled all the competencies for a particular job position it is sometimes not easy to recall from which tasks these competencies came. This makes it difficult to write good performance-based objectives to address the competencies. — There is no convenient mechanism to ensure that the list of simulator sessions is comprehensive and covers all the competencies required. — A group of SMEs is required for each activity.

E.20. Combined JTA/JCA for WWER-1000 Senior Duty Electrical Technician (Ukraine)

1 — Job position	Senior Duty Electrical Technician (SDET)
2 — Country	Ukraine
3 — Utility/NPP	National Nuclear Energy Generating Company ENERGOATOM/ South-Ukraine NPP
4 — Type of NPP	Three units WWER-1000
5 — Type of analysis	Combined JTA/JCA This method was chosen taking into account several criteria such as availability of plant documentation and information, resources, time allocated, results from other projects, nature of the job positions being analyzed, etc. Combined JTA/JCA was selected as a reasonable compromise between accuracy and labour consumption.
6 — Total duration	3.5 months Note: The duration of Analysis phase was longer than planned. The phase was prolonged to address more specifically the critical tasks as recommended by the IAEA Experts.
7 — Resources	10.5 person-months Note: The experts have been performing the analyses in parallel with their regular every-day activities and were not able to allocate much time for the analysis. The duration of Analysis phase would be much shorter if the experts worked full time for the analysis activities.
8 — Tools	Database software
9 — Procedures/references	— SUNPP Training System Conceptual document (UKR/4/003/CON-01) — Overview of Systematic Approach to Training. Procedure (UKR/4/003/GEN-00) — Analysis Procedure (UKR/4/003/ANA-00) — References used as the basis for the analysis procedure: — IAEA-TECDOC-525 — INPO TSD 1985 — DOE Handbook "*Training Program Handbook: Systematic Approach to Training*" — DOE Handbook "*Table-Top Job Analysis*". — DOE Handbook "*Table-Top Training Program* Design" — DOE Handbook "*Alternative Systematic Approaches to Training*"
10 — Identification of attitudes	Our analysis did not provide any *particular* way to identify attitudes. However, when analyzing the task Analysis phase we selected the competencies required. All the competencies related with human factors, are selected in order to improve, somehow, the attitudes of job incumbents. We could mention the following competencies associated with this subject: communications, leadership, human error, stress control, self-verification, etc.

11 — Strengths	— Reasonable resources demands — Enough attention is paid to the critical tasks — The method is not difficult for SMEs to understand — Suitable for MCR personnel — Cost-benefit rate is good. The time needed to perform a Combined analysis is shorter than is needed for JTA — The analysis made is much more thorough than the one made by JCA; the information concerning each job position is more comprehensive — The results obtained by this method, taking into account the initial availability of plant documentation and information, are quite satisfactory
12 — Weaknesses/difficulties encountered	The weaknesses/difficulties listed below are related to both Analysis and Design phases: — Current database management programme does not allow a convenient interface to be established which directly relates a tasks to the training objectives and, especially, back from an objective to the task. — Having compiled all the competencies for a particular job position it is sometimes not easy to recall from which tasks these competencies came. This makes it difficult to write good performance-based objectives to address the competencies. — There is no convenient mechanism to ensure that the list of simulator sessions is comprehensive and covers all the competencies required. — A group of SMEs is required for each activity.

E.21. Table-top JTA for RBMK Control Room Reactor Operator (Ukraine)

1 — Job position	Control room Reactor Operator
2 — Country	Ukraine
3 — Utility/NPP	Chernobyl Nuclear Power Plant
4 — Type of NPP	RBMK
5 — Type of analysis	Job and Task Analysis, table-top
6 — Total duration	31 weeks Average time per system about 40 hours
7 — Resources needed	1 training department person 1 subject matter expert 1 Training Consultant (advice on and review of the materials)
8 — Special tools	MS WORD, formatting templates, computers
9 — Procedures/references	— Plant procedures and technical information — Basic understanding of SAT — Templates
10 — Identification of attitudes	Affective learning objectives (attitudes and values-awareness, reinforcement, promotion, and defence) are developed and included in general employee training, safety culture training, and other courses.
11 — Strengths	A complete Task Analysis enabled the plant to identify all the skills and knowledge needed to perform the job tasks and enabled more precise and measurable learning objectives to be developed. Nothing was forgotten.
12 — Weaknesses/difficulties encountered	Dedicated personnel are needed for the effort. It was time-consuming. There was not sufficient number of computers initially.

E.22. JTA for WWER-1000 control room Reactor Operator (Ukraine)

1 — Job position	Control room Reactor Operator
2 — Country	Ukraine
3 — Utility/NPP	National Nuclear Energy Generating Company ENERGOATOM Khmelnitsky NPP
4 — Type of NPP	One unit WWER-1000
5 — Type of analysis	Job Task Analysis. This method was chosen taking into account several criteria such as availability of plant documentation and information, resources, time allocated, results from other projects, nature of job positions being analyzed.
6 — Total duration	6.5 months
7 — Resources	13 person-months Note: 2 experts have been working constantly through the above mentioned period of time, one of them being a control room Reactor Operator, the other — a training methodology expert.
8 — Tools	Standard WordPerfect software
9 — Procedures/references	KhNPP Training Procedures Manual KNPP-INST-0001-TM SAT Study Guide references used: — IAEA-TECDOC-525 — INPO TSD 1985 — DOE Handbook "*Training Program Handbook: Systematic Approach to Training*" — DOE Handbook "*Table-Top Job Analysis*". — DOE Handbook "*Table-Top Training Program* Design"
10 — Identification of attitudes	Our analysis did not provide identification of attitudes. The job Task Analysis only has been performed.
11 — Strengths	— Enough attention is paid to the critical tasks — The method is not difficult for SMEs to understand — Suitable for MCR personnel — The results obtained by this method, taking into account the initial availability of plant documentation and information, are quite satisfactory
12 — Weaknesses/difficulties encountered	The weaknesses/difficulties listed below are related to both Analysis and Design phases: — It is a rather time-consuming method. — A group of SMEs is required for each activity.

E.23. Unique analysis for WWER-1000 I&C Technician (Ukraine)

1 — Job position	Technician of the I&C Department, electrical measurements
2 — Country	Ukraine
3 — Utility/NPP	National Nuclear Energy Generating Company ENERGOATOM Khmelnitsky NPP
4 — Type of NPP	One unit WWER-1000
5 — Type of analysis	Another type of analysis. Analysis has been performed taking into account Job Analysis results from the Standard Qualification Reference Book (ETKC) and KhNPP Electrical Measurements Operations Procedure.
6 — Total duration	6 months
7 — Resources needed	7 person-months Note: 2 experts have been working throughout the above-mentioned period of time, one of them being an instructor, the other a training organisation Department Head.
8 — Special tools	Standard WordPerfect software WP document template Standard Qualification Reference Book (Ukraine) (ETKC)
9 — Procedures/references	-
10 — Identification of attitudes	The analysis did not provide identification of attitudes.
11 — Strengths	— Large amount of operational and technical documentation — Simple analysis technology — Document template development
12 — Weaknesses/difficulties encountered	The weaknesses/difficulties listed below are related to both Analysis and Design phases: — It is a rather time-consuming method. — A group of SMEs is required for each activity.

E.24. Table-top JCA for Reactor Physicist (United Kingdom)

1 — Job position	Reactor physicist (term used for the Head of the NPP Reactor/Station Physics Department)
2 — Country	United Kingdom
3 — Utility/NPP	BNFL Magnox Generation
4 — Type of NPP	Magnox
5 — Type of analysis	JCA, table-top
6 — Total duration	12 months
7 — Resources needed	1 NPP Reactor Physicist + 3 Physicists instructors from the training function, concurrently undertaking other training-related tasks and responsibilities.
8 — Special tools	No special tools
9 — Procedures/references	Internal procedures followed
10 — Identification of attitudes	Attitudes identified during the analysis from the practical experience of the SMEs.
11 — Strengths	Power plant personnel (SMEs) involved in conducting analysis (and later phases of SAT) and so — training function confident of analysis outcome — NPP personnel committed to subsequent training Analysis phase statements written in objective terms are readily converted into training aims and objectives.
12 — Weaknesses/difficulties encountered	Arranging a convenient time for reactor/station physics departmental heads from 14 npps to attend a seminar to review the JCA document.

Additional information

A former Head of a NPP Reactor Physics Department was seconded to the utility's central nuclear training centre in the mid-1980s to undertake a table-top Job Competency Analysis (JCA) for all posts in Reactor/Station Physics Departments. In conjunction with three instructors, trained in SAT and themselves qualified physicists formerly working in NPP reactor physics departments, and so subject matter experts (SMEs), a draft JCA was prepared, written in objective terms using verbs at pre-defined performance levels in the cognitive, psychomotor and affective (knowledge, skills and attitudes) domains.

The draft JCA was circulated for comment to Reactor/Station Physics Department Heads at each of the 14 NPPs then operating in the United Kingdom. After six weeks, a seminar was convened of the 14 SMEs from the NPPs plus the four originators of the draft JCA, to review, amend and enhance the analysis document. Following minor improvements the JCA was approved by the NPPs and adopted for use within the training function.

This method was subsequently used for other job positions in departments such as Health Physics (Radiological Protection), Chemistry and all disciplines of Maintenance Engineering, and was found to be transferable to PWR NPP jobs.

E.25. Table-top consensus analysis for Radiation Protection Technician (USA)

1 — Job position	Radiation Protection Technician
2 — Country	USA
3 — Utility/NPP	US Department of Energy (DOE)
4 — Type of NPP	Weapons production and research facilities
5 — Type of analysis	Table-top consensus
6 — Total duration	Two (2) weeks
7 — Resources needed	Ten (10) people from different department sites; two (2) weeks each for a total of 20 weeks
8 — Special tools	WordPerfect
9 — Procedures/references	— Industry-wide JTA for RPT — ASTM Standard E-1168-87, *Radiological Training for Nuclear Facility Workers* — TRADE (Training Resources And Data Exchange) Publications: *Radiation Protection Technician Job Task Analysis Manual*, 1990 and *Guide to Good Practice in Radiation Protection Training*, 1989
10 — Identification of attitudes	Values and attitudes taught on other courses
11 — Strengths	Simple process, more immediate results which helps maintain management support. Many common-topics for RPTs across department facilities. development of a department wide core training program is cost-effective.
12 — Weaknesses/difficulties encountered	Wide application of training material across all facility types makes it difficult to develop material that is useful for everyone. Site and facility specific adaptation must be permitted.

Additional information

A department-wide core curriculum has been developed.

The 13 generic tasks performed on the job are presented below. Each site develops additional facility specific tasks.

- Response check portable hand held instruments
- Response check radiation detection counting equipment
- Perform contamination survey
- Perform beta-gamma Radiation Survey
- Obtain air samples
- Perform leak test on a radioactive source
- Post radiological area to reflect associated hazards
- Perform radioactive material shipment survey
- Respond to high airborne activity alarm
- Respond to uncontrolled release of radioactive material
- Respond to radiation alarm
- Respond to injured person in radiological area
- Direct and monitor personnel decontamination.

The radiation protection core curriculum contains academic training material including standardized lesson plans, student study guides, practical training tasks, guide for oral board examinations, and implementation procedures. All of the training material is accessible on the Internet at http://tis-hq.eh.doe.gov/.

E.26. Table-top Job Analysis for waste receiving and processing facility operator (USA)

1 — Job position	Waste receiving and processing (WRAP) facility operator
2 — Country	USA
3 — Utility/NPP	US DOE Hanford Site — Waste Receiving and Processing Facility (WRAP)
4 — Type of NPP	Non-reactor nuclear facility
5 — Type of analysis	Table-top Job Analysis
6 — Total duration	Analysis required 3 days. Completion of report required 2 days. Total: 5 days
7 — Resources needed	Process required 4 subject-matter experts and 1 observer. Each attendee participated in the analysis for 3 days. Total: 15 person days
8 — Special tools	Laptop computer with WordPerfect 6.1 or Microsoft Word software, and disk copy of Task List template
9 — Procedures/references	• DOE Order 5480.20A, *Personnel Selection, Qualification, Training and Staffing Requirements at DOE Reactor and Non-Reactor Facilities* • DOE-HDBK-1078-94, *DOE Training Program Handbook: A Systematic Approach to Training* • DOE-HDBK-1076-94, *DOE Handbook: Table-Top Job Analysis* • DOE-HDBK-1074-95, *DOE Handbook: Alternative Systematic Approaches to Training* • DOE Course (SAT Lesson 1997): *Management and Oversight of Training and Qualification Programs* • DOE Course, DOE/ID 10327, 1991: *Instructional Analysis and Design, Lesson 1 Introduction to Analysis and Design* • Norton, Robert E. *DACUM Handbook*, The National Center for Research in Vocational Education, Ohio State University 1985
10 — Identification of attitudes	Table-top Job Analysis is directed at developing a list of tasks for a given position. Learning objectives and knowledge, skills, and attitudes are identified during the table-top training design process.
11 — Strengths	The table-top job Analysis and Training design process is self-validating. Participants buy into the process and the content that will form their training program. The quality of the Task List makes later analysis and design processes much less time consuming, with better results.
12 — Weaknesses/difficulties encountered	Personality conflicts can sometimes make it difficult to work together as a team. It is occasionally difficult to get subject matter experts to make the time commitment to complete the process. Inaccurate job information can sometimes invalidate the end product.

Additional information

Ten operators perform the duties at any one time. There are 11 Duty Areas and a total of 58 tasks.

E.27. Table-top Job Analysis for plutonium facility operator (USA)

1 — Job position	Plutonium facility operator
2- Country	USA
3 — Utility/NPP	Lawrence Livermore National Laboratory, Plutonium Facility
4 — Type of NPP	DOE non-reactor nuclear facility
5 — Type of analysis	Table-top Job Analysis
6 — Total duration	Analysis required 3 days. Completion of report required 2 days Total: 5 days
7 — Resources needed	Process required 4 subject-matter experts, 2 trainers, and 1 supervisor. Each attendee participated in the analysis for 3 days. Total: 21 person days
8 — Special tools	Laptop computer with WordPerfect 6.1 or Microsoft Word software and disk copy of Task List template
9 — Procedures/references	— DOE Order 5480.20A, *Personnel Selection, Qualification, Training and Staffing Requirements at DOE Reactor and Non-Reactor Facilities* — DOE-HDBK-1078-94, *DOE Training Program Handbook: A Systematic Approach to Training* — DOE-HDBK-1076-94, *DOE Handbook: Table-Top Job Analysis* — DOE-HDBK-1074-95, *DOE Handbook: Alternative Systematic Approaches to Training* — DOE Course (SAT Lesson 1997): *Management and Oversight of Training and Qualification Programs* — DOE Course, DOE/ID 10327, 1991: *Instructional Analysis and Design, Lesson 1 Introduction to Analysis and Design* — Norton, Robert E. *DACUM Handbook*, The National Center for Research in Vocational Education, Ohio State University 1985
10 — Identification of attitudes	Table-top Job Analysis is directed at developing a list of tasks for a given position. Learning objectives and knowledge, skills, and attitudes are identified during the table-top training design process.
11 — Strengths	The table-top Job Analysis and training design process is self-validating. Participants buy into the process and the content that will form *their* training program. The quality of the Task List makes later analysis and design processes much less times consuming, with better results.
12 — Weaknesses/difficulties encountered	Personality conflicts can sometimes make it difficult to work together as a team. It is occasionally difficult to get subject matter experts to make the time commitment to complete the process. Inaccurate job information can sometimes invalidate the end product.

Additional information

Two operators may perform the duties at any one time. There are 11 Duty Areas and a total of 107 tasks.

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Consultants Meetings

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Advisory Group Meeting

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