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**QUALITY ACTIVITIES, OPERATIONS MANAGEMENT AND  
PROCESS ORIENTATION;**

**Experience from a benchmarking exercise**

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**Summary:** The report describes a benchmarking exercise of quality activities and operations management carried out as a co-operation between VTT, FKA and TVO within the LearnSafe project. The intent of this report is to share generic findings from the exercise among the LearnSafe partners. The selected areas have all an important position in safety management activities at the nuclear power plant. In the exercise views were also collected on the benefit of process orientation in the structuring of work activities. In the exercise relevant documentation concerning quality activities and operations management were collected and compared. This information was supported by semi-structured interviews in which a total of 8 persons from FKA and 8 persons from TVO were interviewed. The benchmarking proved to be a valuable exercise, because the resources spent were modest and the results were useful in many ways. Among the more generic results is an identification of the need to find a proper balance between a functionally oriented and a process-oriented view of work activities.

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# QUALITY ACTIVITIES, OPERATIONS MANAGEMENT AND PROCESS ORIENTATION; Experience from a benchmarking exercise

## 1 INTRODUCTION

One important goal of the LearnSafe project<sup>1</sup> is to establish a close interaction between researchers and plant people in addressing issues of organisation and management that are important for safety and efficiency. This goal has further been facilitated by initiating small spin-off tasks in which participating nuclear power plants bring issues that are interesting on a medium-term for investigation and discussions within LearnSafe. This report gives account of one such a spin-off task, which was carried out during the year 2002 as a co-operation between VTT, FKA and TVO.

The task consisted of a benchmarking exercise of quality activities and operations management. In addition, views on the benefit of process orientation in the structuring of work were collected. A small seminar reporting preliminary conclusions was held in Olkiluoto in October 2002. The intent of this report is to share generic findings from the exercise among the LearnSafe partners. This report has been amended with more specific reports to both FKA and TVO, which contain more targeted findings.

In assessing the results from the exercise it is important to understand similarities and differences between FKA and TVO. FKA operates three BWRs at the Forsmark site in Sweden, where the units F1 and F2 are practically identical and the unit F3 is larger and more modern. TVO operates two identical BWRs at the Olkiluoto site in Finland and the two units OL1 and OL2 are somewhat smaller, but otherwise very similar to the F1 and F2 units. These technical differences introduce differences in practices between FKA and TVO.

Another source of differences in practices is the differences in the regulatory oversight approach as applied in Finland and Sweden. In Finland the nuclear legislation is relatively detailed in such a way that for example the Nuclear Energy Decree (161/1988) sets a requirement for a supervisor in charge and administrative rules to be applied.<sup>2</sup> Similar requirements in Sweden are defined in the Swedish Nuclear Power Inspectorate's Regulations Concerning Safety in Certain Nuclear Facilities (SKIFS 1998:1) in a slightly different way.<sup>3</sup> These requirements set the frames for all activities at FKA and TVO.

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<sup>1</sup> The project FIKS-CT-2001-00162 "Learning organisations for nuclear safety" funded by 5th Euratom Framework Programme 1998-2002, Key Action: Nuclear Fission by the European Commission. For additional information see the web-site <http://www.vtt.fi/virtual/learnsafe/>.

<sup>2</sup> Chapter 16: Supervisor in charge and other personnel needed in the use of nuclear energy, Section 122: "The duties, powers and responsibilities of the responsible manager of a nuclear facility, his deputy and the rest of the personnel needed for the operation of the nuclear facility shall be determined in the administrative rules accepted by the Radiation and Nuclear Safety Authority (STUK)."

<sup>3</sup> Chapter 2. Basic Safety Provisions, 3 § point 1: "The licensee of a nuclear facility shall establish documented guidelines for how safety shall be maintained at the facility as well as ensure that the personnel performing duties which are important to safety are well acquainted with the guidelines."

## **2 ACTIVITIES INCLUDED IN THE BENCHMARKING EXERCISE**

Benchmarking of activities is often used as a method to improve performance. In a benchmarking exercise selected work practices are assessed and compared to find similarities and differences. When differences are found it is possible to assess respective merits of the practices and how they influence performance. The benefit of benchmarking as compared to other methods to assess and improve performance is that it is not necessary in advance to create a normative model of performance.

### **2.1 Quality activities**

Quality activities at nuclear power plants are typically managed by a quality system. Early quality systems were often seen as separated from the management system, but they are today often integrated into them. Today a typical management system at nuclear power plants consists of a comprehensive set of documents starting on the highest level with the mission, values and applicable policies of the organisation. Lower level documents define directives and procedures for work processes, activities and tasks. At the lowest level within the system concrete instructions for operational manoeuvres and maintenance activities are found.

On a very basic level the quality system may be said to contain defined quality requirements for work activities together with descriptions of how that quality can be reached. The quality system also specify regular audits of important activities with the dual purpose to ensure that activities are carried out according to requirements and that possible quality deficiencies are identified, corrected and prevented in the future. One important function of the audits is also to produce objective information for review by the senior management. The quality system also contains a description of used practices for keeping the system up-to-date. The application and use of the quality system is sometimes seen as an administrative barrier to prevent work of inferior quality.

### **2.2 Operations management**

Operations management is directly concerned with the responsibility for nuclear safety as granted by the legislation. It is therefore the most crucial activity at the plants and should therefore be structured with very clear authorities and responsibilities. According to usual practices authority and responsibilities as defined in appropriate documents is given to one person, a responsible manager, who further delegates specific tasks down to a line organisation in according to defined principles. Lower levels in the line of delegation then implements operational tasks as agreed in corresponding administrative documents.

The delegation of operations management is typically done in steps from the responsible manager to a unit operations manager, who acts as the superior for the operational shifts consisting of the control room operators and other operators. The shifts have a 24-hour duty according to an agreed rotation schedule. To compensate for vacations, training, sickness and other duties the number of shifts is typically six or more per unit. The number of operators on a shift is typically 3 operators in the control room, whom are further supported by 3-5 field operators. The shift supervisor acts as the leader of the shift team.

### **2.3 Process orientation in work activities**

Thinking of work activities as processes is a relatively new management concept, which was introduced to ensure a smooth flow of errands between organisational units. Structuring work activities as processes places a special focus on the handing over of outputs from one work activity to form inputs of another work activity. Looking at interconnected work activities

gives the benefit of considering them as an entirety, which has certain goals and uses common resources.

Many nuclear power plants have initiated projects to investigate the applicability of the process concept as a way to structure work activities. Generally there is a large agreement that the concept is useful, but there is a larger divergence in views how the process concept should be reflected in the organisational structure. The hesitation in organising work according to processes is connected to the need for a very clear line of responsibility for safety i.e. a clear line for command and reporting.

## **2.4 The benchmarking method**

In a benchmarking exercise the main idea is to collect enough information on how selected work activities are structured and the resources they are using together with major performance indicators of the activities. Different sources of information can be used for that purpose such as observations, interviews and document reviews. The amount of information collected depends on the target and the scope of the exercise, but it should at least go down to a level on which actual differences in approaches can be found.

In planning the exercise it was decided that a restricted scope should be selected. Relevant documentation concerning quality activities and operations management was collected and compared. This information was supported by semi-structured interviews. In the exercise a total of 8 persons from FKA and 8 persons from TVO were interviewed. The interviews were around 1,5 hours long and they were recorded and transcribed.

## **3 QUALITY ACTIVITIES**

There were several reasons for selecting quality activities to be the target for the benchmarking exercise. Firstly FKA had experienced some difficulties in the implementation of improvements as found by regular quality audits. FKA had also gone through a reorganisation of the maintenance department and in that connection a new structure in their quality activities was introduced. At TVO there had been a rather large change in the quality activities, when the quality system had been modified extensively and integrated in the management system. In defining the goals for the benchmarking activity the level of ambition in the activities and how the auditing reports are brought to concrete improvements was emphasised.

### **3.1 Ways to work**

FKA and TVO have organised their quality activities somewhat differently. At FKA the quality activities are organised within a separate department, whereas the quality office at TVO is organised within the technical department. This difference is due to historical traditions and is also influenced by national differences in regulatory oversight in Finland and Sweden. The quality system at FKA is integrated into a management and quality handbook, which is structured in chapters that define requirements on activities and in corresponding chapters describing how these requirements are met. The quality system at TVO was to the end of the year 2000 described in a rather conventional quality handbook, which was rewritten and integrated in a new management system, which was introduced from the beginning of 2001. The formal acceptance of the new quality assurance programme was obtained from STUK the Finnish regulatory body at 1.7.2001.

At FKA the maintenance department is as regards common activities e.g. accounting, personnel etc., governed by the company quality system. The responsibility for defining quality re-

quirement and other requirements on maintenance activities reside however on the production units and are forwarded to the maintenance department by a written agreement. This implies that there is no direct line of command and reporting, in this respect, between the CEO and the management of the maintenance department. The maintenance department uses the ISO 9000 standard series for the organisation and quality management of their internal work activities. For an outside viewer this system seems to be quite complicated.

At FKA and TVO there are small differences in how auditing activities are conducted. At FKA they are typically conducted in small groups in which, in addition to the professional auditors, also peers from the neighbouring units and sometimes outsiders are included. At TVO one or two professional auditors carry out the audits. At FKA the audits are carried out at an interval of once in three years. TVO has temporarily selected to go through all activities in a yearly cycle during the years 2001 and 2002 to anchor the new management system within the organisation. TVO has now moved back to the typical cycles of one and three-years depending on the activity in consideration.

Both FKA and TVO have recently adopted a system with formal reviews by the senior management group. At FKA they are performed once a year and at TVO two times a year. These inspections bring major performance indicators from different work activities up to a discussion among senior managers. Such discussions have earlier been conducted on an informal level, but in both organisations the step towards a larger formality was considered as advantageous in giving the inspections a better posture.

### **3.2 A development to the better**

Many of the respondents both at FKA and TVO gave as their opinion that there has been a large development of the quality activities over the years. From an earlier rather formal police like approach, quality activities have now developed to be service minded and focused on improvements. At FKA the inclusion of peers in the audits were considered as very valuable through the discussions between the auditors and the people audited.

In spite of the general satisfaction with present quality activities at FKA and TVO, also some concerns were voiced. The perhaps largest concern was connected to the need to bring observations and suggestions for improvements from the audits into concrete changes in the way of working. This concern has certainly to be qualified with the need to ensure that observations and suggestions for improvements really are relevant and are not only a play for the galleries.

### **3.3 Requirements on quality activities**

Considering the quality activities in a larger context, they are evidently important in bringing stability into the organisation. At the same time the quality system should not become a hindrance for necessary developments. It seems that both FKA and TVO have been successful in finding this important balance.

Another important characteristic is that the quality system should be well anchored in the organisation. The clear separation of the quality system at FKA into requirements defined by senior management and corresponding responses how they are met by the organisational units, seems to have been very efficient in an anchoring of quality thinking in the minds of people. At this time it is somewhat early to make judgements how the anchoring process of the new management system has succeeded at TVO, but the responsible managers seem to be well aware of the importance of this issue.

### **3.4 Regulatory connections**

Quality activities have many regulatory connections. Selected practices for regulatory oversight therefore have an important influence on selected solutions. In Finland regulatory guidance is for example more detailed than in Sweden and this influence could be sensed. Another difference is that STUK in Finland has resident site inspectors, which SKI in Sweden does not have. Regulatory inspections are in Finland carried to larger degree of detail, where in Sweden the regulator concentrates more on ensuring that the internal autonomous inspection activities at the nuclear power plants are efficient and trustworthy.

The quality department at FKA has due to the differences a slightly different role as compared to its counterpart at TVO. At FKA the quality department has an important role in building up and maintaining regulatory trust. This role at TVO is not equally distinct, because the Finnish regulatory guides provide a kind of norm, which should be fulfilled and regulatory inspectors are expected to ensure that this is the case. In this view it was not that surprising that TVO experienced comments and questions when their new management system was presented to the regulator.

### **3.5 Some reflections**

It is evident that the quality departments should have a large degree of integrity and independence within the organisation to be able to carry out their intended function. On the other hand it is equally evident that they should take their own share in developing organisational practices. The question is how these partly conflicting requirements can be balanced. A too close involvement in actually developing organisational activities can make the quality function toothless, but a too large independence may make their understanding of basic processes too shallow. It is the impression that both FKA and TVO have been able to find a satisfactory balance in this regard.

In defining a level of ambition for the quality activities, a recurring question is if nuclear quality is required for all activities. On one hand one may argue that all activities may have at least an indirect influence on safety and therefore should be governed by the same stringent requirements as all other activities. This interpretation is however not fully practical, because there are always activities at some level, where the normal industrial quality can be considered satisfactory. The quality of standard products may also actually be higher than tailored one-of-a-kind products. It is the impression that both FKA and TVO are in line with the general tendency within the nuclear industry that sometimes unnecessarily high quality requirements are placed on simple activities. On the other hand, the general motivator for this tendency is that it may be cheaper to handle only one quality level defined for activities and items.

A general requirement for the quality system is that it is accepted and followed within the organisation. There should be an understanding of why quality requirements are necessary, they should be simple enough for people to comprehend and people should trust the fairness in how deviations are handled within the system. When these preconditions are fulfilled it should be relatively easy to find corrective actions to deviations, to institute proper follow up and enforcement in the system to ensure that decided actions are carried out. In this way it should be possible to continuously renew the quality activities to prevent them from moving into empty routines.

## **4 OPERATIONS MANAGEMENT**

The operations management was selected for the benchmarking exercise because of its importance. Further people both at FKA and TVO had a feeling that there existed some differences in thinking, which could be beneficial to lift into the open. Focus was placed on the daily supervision including authorisation and ordering of operation. The reporting and auditing of operations management were also considered to be of interest.

### **4.1 A decision structure**

International regulation places the full responsibility for safety on the operator of the nuclear power plant. This is according to both Finnish and Swedish legislation channelled through a responsible manager at the facility. The responsible manager may delegate parts of this responsibility down to specific persons in his or her organisation. To be functional such delegation has to be well understood by both the person giving and the person receiving the delegation.

The CEO at FKA is the responsible manager and at TVO it is the director of operation. The delegation on the next level at FKA is given to the unit managers and at TVO to the operations manager. At FKA the unit managers have a production manager who is the superior of the shifts. At TVO the production manager have two sections, one for each of the units, and the section heads are the superiors for the shifts. Both FKA and TVO have thus implemented a delegation on three levels from the responsible manager down to the shifts. At FKA there is a very explicit reconsideration of the correctness of operational decisions, when they are reported from lower operational levels to a higher. At TVO this practice is not as explicit, but decisions will evidently be assessed informally in a similar way.

Both FKA and TVO are using engineers on duty, whom may be called at any time to the control room. At FKA engineers on duty rotate with half a week interval and at TVO with a one-week interval. The engineers on duty at FKA are selected among the responsible operations managers and other senior engineers with extensive experience. At TVO the engineers on duty are selected among a group of former shift supervisors, who are working in various day-time positions.

### **4.2 Meetings for communication and decisions**

Operations management has to be supported by efficient channels of communication both within the line of people between the responsible manager and the shifts and within the whole organisation. Regularly held formal meetings are one important part of this communication. Some of these meetings emphasise an information sharing function and other decisions that are to be made.

At FKA there is a weekly production meeting on Mondays led by the CEO in which all production units, engineers on duty, the maintenance department and the safety department are participating. On that meeting the previous week is reported and the most important activities of the oncoming week are summarised. Further each of the units at FKA conduct weekly meetings on Fridays to summarise the outgoing week, reiterate plans for the weekend and take a look on activities within the two upcoming weeks. These meetings are further supported during workdays with daily operations meetings held in the morning of the day.

At TVO a site meeting is held once a month and the director of operations chairs it. Meetings of the operations department as well as the operations office are held with an interval of two weeks. The weekly meetings have mainly an informative function and they are chaired in turn



by the two section heads. Representatives of different sections and offices attend the weekly meetings quite broadly. Daily meetings to summarise events from the last 24 hours and to look at upcoming activities are held at TVO during workdays and various people attend them from both units.

The safety committee is an institution that is used both at FKA and TVO. At FKA the CEO chairs it and meetings are held two times a month. At TVO the safety committee is chaired by the technical director and meetings are held whenever necessary and at least every third month. Decisions made in the safety committee are both at FKA and TVO given a kind of normative status.

### **4.3 Procedures, practices, methods and tools**

Operations management relies on principles established in appropriate administrative documents and further elaborated the final safety analysis report (FSAR) and the safety technical specifications (STS). These documents provide the basis for all operational practices as laid out by control room and other procedures. Control room procedures are further subdivided into start-up and shutdown procedures as well as in disturbance and emergency procedures. Control room procedures are followed literally. Nuclear plants typical use a formal work order system to ensure that the control room all the time is aware of ongoing activities in the plant. Daily operational tasks are determined by many interacting cycles of testing, preventive maintenance and the refuelling outages.

The FSAR, STS and control room procedures are very similar at FKA and TVO and they are also used very similarly. The shift practices are very similar and both organisations use a paper based work order system. At both FKA and TVO computerised tools are used for the planning of recurrent tasks such as testing activities and preventive maintenance. There seems to be a slight difference in the use of this system, because FKA assembles tasks into a weekly plan where TVO is using it on a more day to day basis.

The annual refuelling outage is at both FKA and TVO used to do inspections, plant modifications and other tasks, which cannot be done during power operation. The planning for this period starts both at FKA and TVO when the earlier refuelling period has been brought to a close. TVO has divided outages into three general groups (refuelling only, short and long outages), which follow each other cyclically. TVO has systematically had shorter refuelling periods than FKA, which to a large extent can be explained by benefits obtained by investing in an accurate planning.

### **4.4 Audits and reviews**

Operations management is included in audits and reviews in the same way as other activities that are important for safety. Audits may take slightly different points of view depending on the situation to concentrate for example on some part of the decision structure. Reviews often take a broader look on the activities and are less frequent, but they may sometimes be initiated as a response to certain events.

As noted above there are certain differences between the auditing practices at FKA and TVO. The formal reconsideration<sup>4</sup> of operational decisions at FKA as compared with TVO seems to give a certain difference in how responsibility is perceived. Finally the organisational structure at FKA with a larger independence of the safety and quality department as compared

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<sup>4</sup> The Swedish word "överprövning" is used to characterise this reconsideration.

with TVO is also due to increase the stringency of the safety oversight. On the other hand the larger independence at FKA may sometimes in the organisation be perceived as division between "them and us".

With respect to the analysis of events and incidents there are no major differences between practices at FKA and TVO. One slight difference seems however to be in how the recommendations from an event analysis are brought into concrete improvements. At TVO the follow up system that improvements actually are made, seems somewhat more efficient than at FKA.

#### **4.5 Some reflections**

Operations management is very similar at FKA and TVO, but there are also some subtle differences. The authorisation and ordering of operational decisions at FKA with the system of reconsidering them on the next organisational level seems to be more formal than at TVO. This does not say that decisions at TVO are taken without consultations with the next level in the organisation, but that they take place without this kind of explicit systematic.

Also in the planning of weekly and daily activities there seems to be differences in formality. At FKA a coming week of operation is considered at the first time already five weeks in beforehand. The next time the week gets a consideration is two weeks before and the plan for the week is finalised at the end of the week before on the operations meeting at Friday morning. At TVO it seems enough to consider the plan for an incoming week on the operations meeting on Fridays the week before.

The frequency and the level of the meetings are also different at FKA and TVO. At FKA there is a weekly production meeting chaired by the CEO, where a meeting on this level is held only once a month at TVO. For meetings, but also more generally, there seems at TVO to be a more explicit policy of delegating responsibility down in the organisation. The intent of this practice is to increase participation and commitment at lower levels in the organisation.

A final issue, where there seems to be difference in thinking between FKA and TVO is how operations is viewed for instance in comparison with the technical department. At FKA the unit managers are seen as responsible for both financial results and the technical condition of the units. According to this view the technical and the maintenance departments are seen as suppliers of services ordered by the units. At TVO the technical department is to a much larger extent seen as responsible for maintaining the whole plant in an excellent condition and no internal ordering system is used.

## **5 PROCESS ORIENTATION IN WORK ACTIVITIES**

The concept of process orientation as a way to structure work activities has got an increased attention at many nuclear power plants. The concept was introduced in the conventional industry as a response to observations that organisations sometimes have difficulties in ensuring a smooth flow of errands over organisational borders. The applicability of the concept has been pondered both at FKA and TVO and there was therefore an interest in comparing views on its usefulness and possible paths of introduction.

### **5.1 The concept and its interpretations**

Process orientation could be interpreted in a restricted way to provide a tool only, by which work activities can be analysed and made more efficient. In a broader view it could be interpreted to imply a management structure by which work activities are organised according to

identified work processes. If the broader view is applied it is often assumed that processes owners are appointed with the responsibility to manage them.

Both at FKA and TVO there seem to be a large span of opinions on how the concept should be interpreted. These opinions seem to range from one extreme that process orientation is only the newest management whim to the other that it will solve all problems. This difference in opinions is also reflected in the relatively slow pace of formally introducing the concept both at FKA and TVO. The concept has however been utilised to a relatively large extent in the structuring of the maintenance department at FKA and of the new management system at TVO.

## **5.2 A selection of processes**

In applying process oriented thinking in the structuring of work activities one of the crucial steps is in agreeing on which work processes should be considered as the main business processes and which should be considered as support processes. The second step is then to break down the main processes into sub-processes that are easier to manage.

At FKA the initial discussion of work processes was triggered by the need to become more efficient in various work activities as a response to the deregulation. In the initial phase three processes were selected for a more thorough consideration, maintenance, renewal and procurement. Further work has surveyed the following processes: Operations, production planning, fuel procurement, safety inspection, waste handling, communication, and research and development, but further development has been put on a hold. Insight obtained in this work has led to several changes at FKA.

At TVO the discussion of work processes rapidly identified three major processes, operations, maintaining production capability and development of new production capacity. These processes actually are well adapted to the present organisational structure at TVO.

## **5.3 Assignment of responsibility**

It is a common view among management scholars that process orientation should be reflected in the organisational structure by giving selected managers responsibility for developing the processes by assigning them as process owners. At nuclear power plants it is however somewhat difficult to introduce an organisation that relies entirely on the management of processes, due to two reasons. Firstly the regulatory requirement for a very clear undiluted line of command and reporting on issues concerned with reactor safety would imply that a process oriented organisation at least should be amended with some kind of line organisation. Secondly maintaining and developing competency in certain functional areas would imply the creation of functional ties between people working at different units at a multiunit site. In practice this implies the construction of some kind of matrix organisations in which process responsibility is blended with line and/or functional responsibility.

FKA is by historical tradition organised with three production units, which have been rather self-sufficient with respect to the resources needed to operate and maintain the units. To combat a too large focus on the individual units and to develop and maintain a focus on common practices, FKA has used a concept of functional responsibility in selected areas. The former independence of the production units was been changed relatively recently when technical support and maintenance were centralised at a company level. At FKA there seems to be a need for a discussion of the best way to combine a responsibility for the production units with the responsibility for common practices, because the interviews revealed ambiguities in views

on how defined functional responsibilities should be interpreted and combined with a responsibility for work processes.

TVO operates a site with two identical units and has therefore not been involved in this kind of discussions. Instead there has been a very explicitly expressed policy to keep the two units as identical as possible. Over the years there have been some changes back and forth in the location of the operational maintenance. Some ten years ago it was considered beneficial to locate operational maintenance within the unit operations. At that time this arrangement stirred some discussions, but it was evidently successful in strengthening the ties between operation and maintenance. Presently TVO has moved back to the system with a centralised maintenance department for the whole site.

#### **5.4 Some reflections**

Based on the interviews and consecutive discussions, some generic reflections can be made. Firstly the concept of process orientation is certainly very useful, but the question if it should be used only as a work development tool or if it should be reflected also in the organisational structure. As noted earlier the requirements placed on the nuclear industry turns this discussion to a discussion of pros and cons of line and matrix organisations. A matrix organisation is more complex than a simple line organisation, but it can correspondingly be assumed to provide better means for assigning authority and responsibility adapted to more complex needs. The higher complexity of a matrix organisation would on the other hand be more difficult to communicate to people and would therefore propose a need for higher maturity of the organisation.

Looking at the work activities at a nuclear power plant there are many, which fit well into the concept of processes, but there are also important activities that are more difficult to force into this frame. The yearly operations cycle from one refuelling period to another is one set of activities, where the process concept fits quite well. Plant modifications from perceived needs to a completed installation are another. Work activities that fit less well into the concept are for example projects that are executed for some specific purpose and that by definition have a start and a stop. The work done by various specialists and certain support activities may also be difficult to force into the process frame.

An adoption of process owners in addition to a line organisation introduces the problem of two superiors, which is common in all matrix organisations. The extent this two directed loyalty will have disruptive effects on the organisation depends on the extent conflicts will develop between line managers and process owners. A simple solution is to appoint the same person both as a line manager and a process owner, but it may create a too heavy workload for the persons in consideration.

## **6 OTHER ISSUES**

The main target of the benchmarking exercise was the quality activities and operations management, but these activities do not obviously appear in isolation. The issues briefly described below are such related activities, which were brought up during interviews and discussions.

### **6.1 Systems of instructions**

Written instructions are a necessity in nuclear power operation. The control room procedures provide the backbone of these documents. The need to document and review work practices used at the nuclear power plants have in addition brought a large amount of other instructions

of which administrative instructions is a large part. The volume of administrative instructions has typically been increasing considerably over the years.

The number of administrative instructions was considered to be a problem both at FKA and TVO. The reason for the growth of administrative instructions is connected to the ease of writing a new instruction as the solution to any upcoming problem. This situation has resulted in a wild grown flora of instructions, where it is difficult to find some specific instructions searched. One problem is also that it is necessary to know that an instruction exists to be able to search for it. There was a large agreement both at FKA and TVO that this problem should be tended to, but so far no easy solutions have been found.

## **6.2 Requisition and supplier systems**

In large organisations a common area of conflict is to what extent different organisational units contribute to performance and how much of common resources they are using. One management solution for this conflict has been to introduce some kind of requisition and supplier system by which services bought and sold. This arrangement is sometimes also seen to have an educational function to ensure cost awareness in the organisation. Sometimes the requisition and supplier systems have been used to expose internal service units to outside competition as a step of enforcement towards better competitiveness.

Requisition and supplier systems are applied at all Swedish nuclear power plants in various forms, but they have never been used at the Finnish nuclear power plants. FKA is using this kind of system, to control internal transactions and invoicing between organisational units. At FKA the system is seen as providing a very distinct view on the roles of being a subscriber on or a supplier of a certain service. At TVO a common view is that this kind of system may dilute important responsibilities in reducing them to supplier and customer relationships.

## **6.3 Competency**

Presently many power plants in Europe are faced with a generation change, where people who originally took the nuclear power plants into operation are retiring. At the same time the attractiveness of the nuclear industry as an employer has decreased among young people entering the work force today. This has brought a general concern for the possibilities to maintain competency in the long term within the nuclear field.

This issue has been identified as a challenge both at FKA and TVO. Both companies have carried out competency inventories together with projections of competency needs in the future. Presently FKA and TVO do not find that large difficulty in recruiting new staff, but fears were expressed that the situation may change. More generally TVO sounded more optimistic than FKA, which also is due to their upcoming project of building a new reactor unit.

## **6.4 Registrations and documentation**

Traceability of decisions is one issue that is very important within the whole nuclear industry. To meet the requirements in an acceptable way it is important to have a registration and an archiving system, which is comprehensive and easy to access. Documents brought into the system should be self-standing and include cross-references to make it possible to search through chains of related documents.

The importance of these systems is clearly recognised both at FKA and TVO and both companies have various computerised systems to support this function. One difference between the companies seems to be that FKA to a larger extent is relying on large standardised sys-

tems used within the Vattenfall group of companies, where TVO to a larger extent is relying on own development activities based on commonly available platforms. The impression is that there was a larger satisfaction with these systems at TVO than at FKA.

One of the respondents voluntarily brought up the issue of documenting also things, which may be considered almost self-evident. In his views the organisational culture at FKA is more supportive to this practice than the culture at TVO. In his mind it would important to stress this need more generally in the organisations, because it supports the traceability in the documentation and also makes them supportive from an educational point of view.

## **6.5 The management process**

The management process in large is evidently one of the most important processes in any organisation. The nuclear industry is different as compared with other safety critical industries in two interconnected aspects. Firstly it has become highly political with the consequence that there is a zero tolerance for errors and failures. Secondly it highly regulated on a quite detailed level with the explicit requirement that the society through the regulator is given insight in all activities that are connected to safety. These requirements govern much of the selected structure of management processes at the nuclear power plants. Everyday tasks are however, like in most organisations, mostly involved with people, resources, plans, events, performance, etc.

In the discussions at FKA and TVO the management process was touched on at several occasions. One of the issues was possible conflict between the managerial responsibility for the well being of the personnel on one hand and the technical condition of the plant on the other. A second issue was the possibility to find indicators that could provide early signals of warning that the organisation is moving in an unwanted direction. One of the persons interviewed stressed the importance of an understanding of various roles in the organisation and their implications in terms of responsibility. Leadership becomes also an important virtue in the management process, which has been identified by both FKA and TVO in their training of personnel.

## **7 A DISCUSSION**

In this chapter the more general issues connected to the benchmarking exercise carried out at FKA and TVO are discussed. The discussion includes further development in the three selected fields at both companies, a short evaluation of the usefulness of the study and a discussion of the method used.

### **7.1 Further development**

The benchmarking exercise was both at FKA and TVO seen as one component of a continuously quest in striving for excellence. The involvement of an outside organisation was at the initiation of the exercise seen as beneficial both for the possibility to involve fresh eyes and for the provision of additional resources. Both companies expressed also a wish to get feedback on specific activities that might be improved.

Some of the more specific feedback to FKA and TVO has already lead to changes in practices. For example the use of peers during a part of the audits at TVO has been placed under consideration. Differences in operations management have been noted and will influence future ways of structuring the work. The discussion concerning process orientation has also

been considered valuable and there seems still to be that much divergence in views to warrant a slow progress with this issue.

## **7.2 An evaluation of the usefulness of the study**

A benchmarking exercise of this type can, properly executed, be useful in several ways. Firstly it may give clear indications of improvements necessary. Secondly it has the possibility to lift up certain issues connected to performance for a more detailed pondering. The interviews themselves can provide a forum for reflection and insights. Finally this kind of exercise also has the benefit to bring generic issues of organisation and management for a general reflection.

The exercise has been considered well worth the effort both at FKA and TVO. Some of the concrete suggestions for improvements were discussed within the companies already before the exercise, but they were through the exercise given more weight to be tackled in an appropriate manner. Participants in the interviews have agreed that they provided an important time for reflections. Finally a reader of this report should provide his or her own evaluation of the usefulness of the generic issues discussed in this connection.

## **7.3 The method**

The method used for the present benchmarking exercise may not fulfil all requirements on reliability and validity that typically are placed on methods used within behavioural sciences. For example the set of questions asked during the interviews was not validated before the exercise and they varied from one interview to another. The interviews were restricted to a very small sample of people in both organisations. Furthermore semi-structured interviews rely on the ability of the interviewer to follow up interesting threads in the discussion. It is therefore to be expected that the results obtained have been influenced by the questions asked the persons selected for the interviews and the person doing the interviews.

The interviews were taped and transcribed, which gives a good basis for the analysis. This is possible only if the discussion atmosphere is very open and if the interviewer is trusted by the persons interviewed. If the interviewer is known from earlier co-operation and has insights and status this is relatively easy to achieve. The method may therefore be less useful in countries and at plants in which this kind of openness cannot be achieved.

In assessing the reliability and validity of the results it is necessary to understand that they due to restrictions in the methods are impressions and that they are subjective in their nature. The results should therefore be used more as indications for areas where more in-depth studies may be initiated than as initiators of forceful remedial actions. With these methodological qualifications it is the firm opinion of the authors that the used method gives good insights with a limited investment of resources. The method functions especially well in its possibility to lift up issues for a more detailed consideration.

## **8 CONCLUSIONS**

The benchmarking as carried out at FKA and TVO proved to be a valuable exercise. The resources spent for the exercise were limited and the results obtained proved to be useful in many ways. The selected areas in the exercise have all an important position in safety management activities at the nuclear power plant. The exercise also gave a number of insights of a more generic nature, which are believed to be useful within the nuclear community.

Among the more generic results is an identification of the need to find a proper balance between a functionally oriented and a process-oriented view of work activities. The selection of a management model in this regard has evidently to be based on local conditions and should therefore be precluded by an in-depth discussion of the best way to balance the two views. In such a discussion it may also be possible address the question of which work processes should be considered as core processes, over which the plant has to maintain full control.