

# **F.A.K.E. NUCLEAR POWER STATION**

Self-Assessment against Best Practices Guide: Ensuring  
Engineering Quality in Digital Projects

**SELF ASSESSMENT SE 59807**

**January 2011**

## **INTRODUCTION:**

The **Generation Nuclear Engineering Manager** requested a Self-Assessment to be performed on **Engineering Quality in Digital System Projects** to determine its effectiveness.

A **13**-member team was established from FAKE.

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The Assessment followed the format and style of a typical Best Practices Assessment, appropriate personnel were interviewed and documents reviewed. During the Assessment period a number of issues were discussed with station personnel, and professional opinions were developed regarding the effectiveness of **Engineering Quality in Digital System Projects**.

These final Assessment results are intended to represent the consensus of opinion developed by the FAKE staff.

There was **2** Strengths (STR); **5** Areas for Improvement (AFIs) that resulted in **3** Corrective Actions identified during the assessment.

### **TITLE:**

**Self-Assessment of Engineering Quality in Digital System Projects** at FAKE Nuclear Power Station.

### **SCOPE:**

The scope of the self-assessment covers the engineering quality in digital system project for FAKE Nuclear Power Station. It included representation from Design Engineering, System Engineering and IMS personnel involved in digital systems.

### **SA OBJECTIVES:**

The purpose of the Self-assessment was to evaluate FAKE current practices against the recently released Good Practices document on "Ensuring Engineering Quality in Digital System Projects".

## **STRENGTH DEVELOPMENT SHEET**

### **STR-01**

**Strength Statement:** *FAKE performs almost all hot commissioning tests for their digital system installations. There is a tendency in the nuclear industry not to redo the original commissioning testing when digital control systems are replaced thereby potentially not qualifying the systems to the same level as during original construction.*

#### **Examples/Supporting Details:**

- *House load operation was retested.*
- *Turbine run-backs were retested.*
- *Governor valve configuration changeover was tested.*
- *Power changes to optimise PID settings*
- *AVR maximum import and export verification.*
- *RGL maximum rod speed verification.*

### **STR-02**

**Strength Statement:** *There is good Integration between human resourcing of the development phase and plant life cycle. The projects involved all the role players to form part of the team responsible for the design, installation and commissioning of the upgrades.*

#### **Examples/Supporting Details:**

- *Staff from different line groups were seconded to the project.*
- *The project consolidated skills all technical and project skills into one team.*

***NOTE:** These Areas for Improvement and completion dates have been agreed to by the Responsible Manager and will be tracked as Corrective Actions (CA) and/or Recommendations (RC).*

#### **AREAS FOR IMPROVEMENT**

**AFI-01:** Hardware, firmware and software management and oversight needs to be put in place.

**AFI-02:** Resource allocation and training, for both digital systems projects and ongoing maintenance, is not considered to be adequate.

**AFI-03:** Lack of strategy and process to ensure the continuity of the installed plant computer systems.

**AFI-04:** Monitoring of digital system performance can be improved.

**AFI-05:** The Cyber-Security strategy for the plant computer systems requires robust development.

#### **CORRECTIVE ACTIONS (CA):**

##### **CA 24516**

**Action:** Design Eng **Due Date:** 31/12/2011

Update the design processes (including equivalence process) to allow for small changes and updates to digital systems. These should cater for equipment upgrades, settings changes and parameter changes.

##### **CA 24517**

**Action:** Design Eng **Due Date:** 30/06/2011

Ensure that engineering configuration control considers version control for software, firmware etc.

##### **CA 24518**

**Action:** Design Eng (CPU), Eng Training **Due Date:** 31/08/2011

All contractors need to be informed and trained that changing of plant (including software and firmware versions) is to be performed under controlled process. 8

## **PROBLEM DEVELOPMENT SHEET AFI-01**

### **Hardware, firmware and software management and oversight need to be put in place**

**Performance Problem/Conclusion:** There is insufficient control of software and firmware versions, and the existing processes are inappropriate to effectively maintain and change firmware and software. On certain plant systems there is insufficient station oversight of vendors to prevent uncontrolled changes.

#### **Factual Basis:**

*1. During the design phase it is felt that changes to software and hardware is controlled. After design acceptance reviews, software and hardware changes are tracked by the design discrepancy report process which is not adequately formalised. There are further concerns around software and hardware changes once the system has been handed over. There is no existing process for small digital changes and upgrades, such as patches and anti-virus updates, after placing the system in service. The current modification process is too cumbersome for the rapidly changing equipment and software found in digital systems. Most suppliers advertise automated version control but this has proved not to be the case for all platforms.*

*2. When vendors are brought onto site to conduct maintenance activities IMS has a process to ensure that there is adequate oversight and prevents uncontrolled changes to software and hardware configurations. For systems supplied by PTM and PCT, the maintenance activities are conducted with no oversight.*

*3. It was noted that components with different firmware versions was installed on the plant by contractors.*

#### **Actual and Potential Consequences:**

Inadvertent or unknown software, firmware or hardware version changes could lead to unexpected response from the equipment, which could cause equipment or plant failure.

#### **Causes/Contributors:**

##### *Processes/Procedures*

- Lack of process to allow for small changes and update to digital systems.*
- Inability of current engineering systems to cope with tracking version control.*

##### *Management/Supervision*

- No centralised place to track existing software and firmware versions.*

##### *Training/Qualification*

- Lack of contractor awareness on the required process to perform changes to the plant, including digital systems.*

## **PROBLEM DEVELOPMENT SHEET AFI-02**

**Resource allocation and training for digital systems projects and ongoing maintenance are not considered to be adequate**

**Performance Problem/Conclusion: Factual Basis:**

*1. An inadequate number of resources are being trained in general digital systems in Design Engineering, Plant Engineering and IMS. Personnel do not feel that they have adequate knowledge to fulfil their responsibilities. There is a concern that adequate training is not provided, and a perceived belief that management has a lack of willingness to resolve the issue.*

*2. The training of support personnel (Plant Engineering and Maintenance) is not adequately identified, and sometimes sacrificed (especially when overseas training is required). Correct training is not supported. It was felt that the curriculum steering committee is not being used effectively.*

*3. Concerns were raised that incorrect personnel are being identified to go on training courses. Training opportunities are being squandered on the available, but inappropriate personnel. The best and most dedicated personnel don't appear to be receiving adequate training. It was felt that training should be focused on individual need to perform daily activities.*

*4. It was felt that the training received for Ovation was good, while the training for the RGL system upgrade was considered inadequate.*

### **Actual and Potential Consequences**

Due to resource constraints and lack of experience, the roll-out of new digital projects will be hampered and the maintenance of existing digital systems compromised.

### **Causes/Contributors:**

#### *Processes/Procedures*

*Current training takes place on an ad-hoc rather than co-ordinated, based on the organisation needs. Groups do not currently have training programmes in place for digital systems. Currently identified training is not on any curriculum.*

#### *Management/Supervision*

*Management does not fully appreciate the training needs for digital systems.*

*Available training opportunities are not being applied to key personnel optimally.*

#### *Training/Qualification*

*There is difficulty in identifying required training, due to station inexperience and lack of clarity of individual roles and group responsibilities.*

## **PROBLEM DEVELOPMENT SHEET AFI-03**

**Lack of strategy and process to ensure the continuity of the installed plant computer systems.**

### **Performance Problem/Conclusion: Factual Basis:**

*1. There is no strategy on how to manage the diverse plant computer systems on the station. No consistent password management system exists on the plant. There is no policy, strategy or processes for the data back-up for the GSE and ovation databases. Imaging of plant computer hard-drives is required to ensure business continuity (e.g. KRT PC). There is no strategy on how to handle the anti-virus protection for the diverse computer systems.*

*2. No process or procedure exists for the storage of software or firmware in IMS, leading to concerns relating to the configuration control of firmware and software for in-service systems. Design Engineering may have a process but this has not been implemented by IMS. A FAKE procedure based on UTILITY policy is being developed. A suggestion was made to have a specialised satellite centre for IMS for ease of retrieval.*

*3. Some OEM software is inadequately stored, as well as there is concern around the updating of tools essential for the retrieval of the software. It was felt that there should be a central storage facility, as currently IMS and Design Engineering hold the OEM disks for different systems.*

*4. Inadequate firmware configuration control, especially for new components. It is essential to know what components are running which firmware version, and to define a strategy to deal with replacement of component supplied with updated firmware.*

### **Actual and Potential Consequences**

The long term health of the digital systems will be left unpredictable if proper and correct strategies are not implemented.

### **Causes/Contributors:**

#### *Processes/Procedures*

*No existing strategy or procedures for the general management of digital plant system. Specifically password protection, back-ups, hardware replacement, anti-virus protection and software/firmware storage for all digital systems.*

**CONCLUSION:**

In general what has been installed on the plant is adequate. However the processes required for managing, monitoring and maintaining these systems need to be developed. The actions identified in this report will adequately address the identified gap between good and excellent.



## Event reporting at F.A.K.E. NPP

### Summary of findings

#### Findings:

1. In 2008, the reporting criteria for issuing event reports (ERs) have been lowered (through revised reporting criteria), which means that more events are now to be reported.

This has led to a significant increase in the number of event reports about 145 % on a yearly basis. The number of people working with analysing these reports have not increased proportionally and it's the investigators' opinion that this part of the organization is severely understaffed. This might impact of quality as well as timely processing of reports, and thus inhibit learning.

2. From 2003, all staff at the F.A.K.E. NPP has to take the training course "Event reporting and analysis: Human factor issues" in order to increase the quality and accuracy of reporting. The training course is still mandatory for new employees. The inspectors have revised the content of the course (which has remained unchanged since its initiation) and has found structure and content acceptable.
3. When inspecting the content of ERs the inspectors has noted that the corrective actions tend to be similar, with only small variation between different types of events. The main type of corrective action suggested is training, assigned to those involved in the event.
4. In accordance with the ER procedure, events are classified into three categories: green, yellow and red ("traffic lights"). For red events, i.e. events with safety implications of a "severe" degree or higher, root cause analysis is undertaken.

It is the conclusion of the inspectors that the criteria for event classification should be revised as they are currently too subjective. In several cases, the inspectors would have made judgements different from those in the ER.

5. When reviewing the event reports, it is not clear whether all causes of the events analysed are clearly covered by the suggested corrective actions. This deficiency can be traced to a lack of clear procedure for this in the Root cause analysis procedure.
  
6. The documented ER procedure requires that if more time is necessary for analysis, there is room for an extension of the deadline, if this is documented and justified. The inspectors have found several cases where the deadline has been extended but where no such documentation exists.

## **F.A.K.E. NPP**

### **Overall plan of operations for Human Performance Improvement Unit 2012**

#### **Purpose**

The purpose of the Human Performance Improvement Unit is to provide training, tools and methods to help F.A.K.E. NPP to improve in every aspect of its operations, administration, and management.

#### **Activities**

The primary activities performed by the Human Performance Improvement Unit are the following:

1. Performance Assessment and Improvement
2. Processes and Project Management Tools
3. Human Resource Development and Training
4. Providing state of the art training tools and methods
5. Support the organization in applying tools and methods

The workgroups within the Human Performance Improvement Unit are the following (relation to activities in brackets):

- Tools and methods team (1, 4)
- Organizational development team (2, 5)
- Human resources team (3)
- External expertise/consultants (as required)

## **Relation to F.A.K.E. safety objectives**

The activities of the Human Performance Improvement Unit is primarily related to the following Safety Policy Points:

4. Safe and reliable operations are the responsibility of all employees at F.A.K.E. NPP.
6. Nuclear safety should be recognized as a primary consideration in all management controls, engineering controls, administrative controls and key performance indicators.
7. F.A.K.E. NPP shall adhere to available national and international standards in all operations and development work.
9. F.A.K.E. NPP shall undertake regular assessments of safety procedures as well as actual safety performance, taking in consideration best practices from other NPP:s as well as from other industries worldwide and from the international nuclear community.

## **Operations Planning**

In the planning of specific operations, the Human Performance Improvement Unit should always strive to make project handovers to the line organization as soon as possible. The Human Performance Improvement Unit is not responsible for ongoing operations.

Each project needs to consider (at least) the following interdependency issues in planning it operations:

- What interdependencies exist to the line organization?
- What internal organizational support is needed?
- What internal resource (finance, personnel, etc) support is needed?
- What previous learning points should be taken into consideration?
- Which external experience should be taken into consideration?
- How does the project goals contribute to the overall goals of F.A.K.E.?
- What learning for future improvements will be made?

# Knowledge Transfer Process

## Guidelines

The purpose of this process is to provide guidance to managers when capturing and transferring knowledge in the organization. These guidelines facilitate this process when undertaking major change programs in the organization, to ensure that no knowledge gets lost in the process.

The process focuses on three types of knowledge:

*Technical knowledge* – factual knowledge of facilities, equipment and machinery

*Process knowledge* – factual knowledge on the actual procedures used during work in the plant

*Informal knowledge* – undocumented knowledge, experience, ‘lessons learned’

### 1: Identify Areas of Safety Importance

Identify the areas of safety importance (high risk areas) where knowledge capture is of prior importance.

*Action: Complete Knowledge assessment sheet part 1*

### 2: Capture Knowledge

It is not possible to capture all knowledge an employee possesses. It is of importance however to capture specialized individual knowledge that can be of organizational importance. One or several interviews should be undertaken with the employees involved.

*Action: Complete Knowledge assessment sheet part 2*

This step can, when time permits, be complemented with obtaining documentation, correspondence and other materials to complete the picture. Video documentation of specific work procedures can be made.

### 3: Transfer Knowledge

Once the knowledge has been captured it needs to be transferred to those who will assume the responsibilities after the change process.

*Action: Complete Knowledge assessment sheet part 3*

The main method should be providing the documentation made in Step 2. In some cases specific training can be undertaken.

#### **4: Confirm Knowledge Transfer**

Before the change is initiated, confirmation should be made by manager and subordinate in order to ensure that both parties are satisfied with the level of knowledge capture. If satisfaction is not confirmed, repeat Step 2 as necessary.

*Action: Complete Knowledge assessment sheet part 4*

#### **Section 5: Monitoring**

After change has been initiated, management must ensure that the knowledge transferred is made operational as required by e.g. new procedures. It must be ensured that staff and management are adapting well to the change and that operations keep working. The following are some areas that should be monitored for potential impacts; other areas may exist and if so, should be included.

- Increasing backlog of tasks
- Key performance indicators not met as expected
- Issues not being resolved in expected manner
- Increasing number of event reports
- Increase in stress, workload or employee dissatisfaction
- Increase in sick leave or other health-related issues
- Gaps in knowledge transfer process
- Increased tension in management-worker relations

## **Roles and Responsibilities in the Knowledge Transfer Process**

### **Management**

- Provide clear expectations of knowledge transfer process
- Allocate adequate time for knowledge transfer process
- Assess the impact of knowledge transfer on other activities in the organizational unit
- Monitor the effects of the knowledge transfer process
- Ensure a trustful relation in the knowledge transfer process
- Support staff during the change process
- Evaluate the result of the knowledge transfer process
- Monitor and document the knowledge transfer process

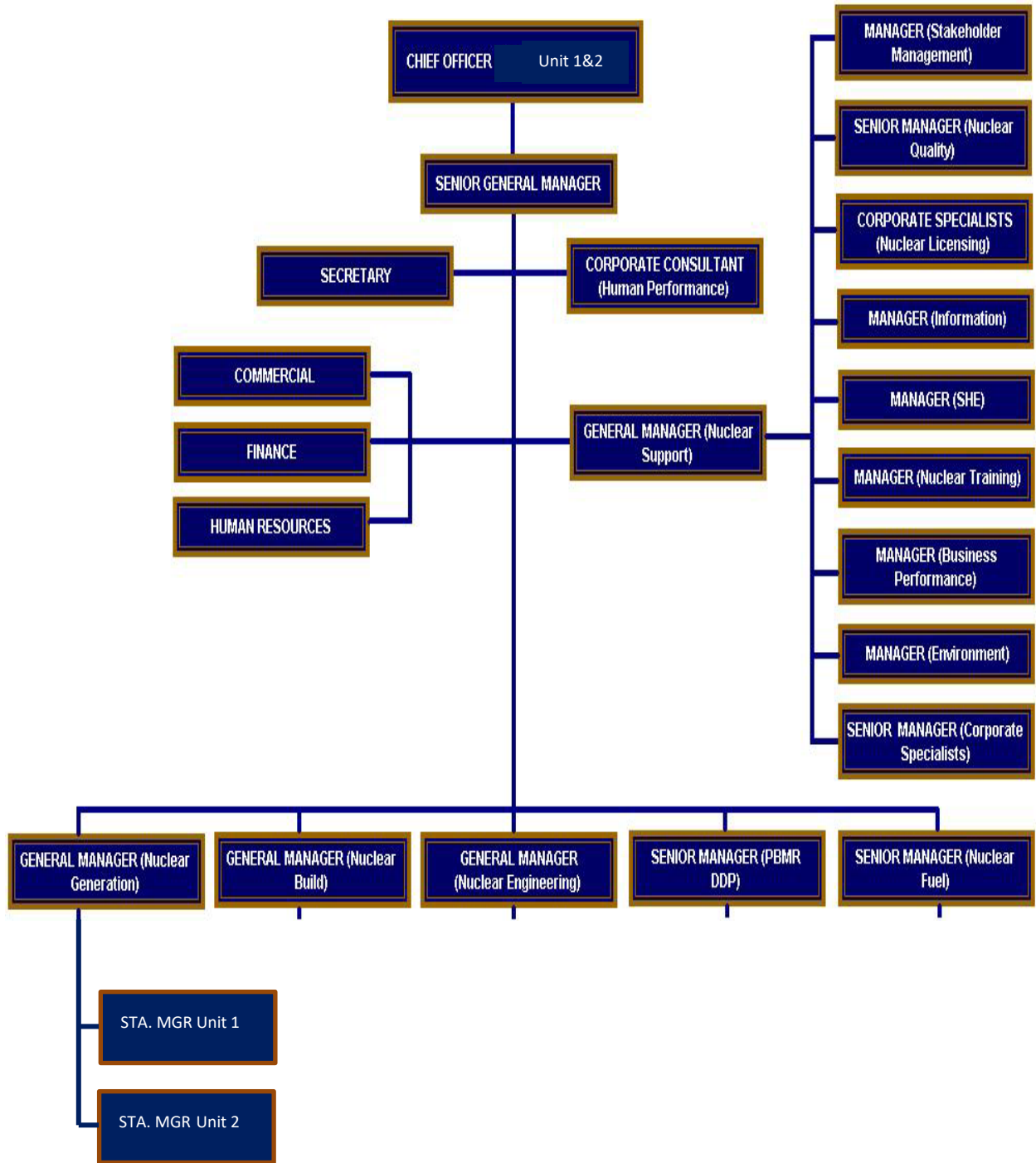
### **Employees**

- Participate in the knowledge transfer process in adequate time
- Ensure full documentation of all relevant knowledge is facilitated
- Ensure that areas for improvement and learning are addressed during the process

### **Personnel department**

- Ensure that the managers involved are well informed and trained in the procedures of knowledge transfer
- Provide support in documentation
- Provide training support if needed

# F.A.K.E. Nuclear Power Utility





## **Recent safety improvements at F.A.K.E. 1**

### **Report to regulatory body in response to inspection (Fall 2009)**

In response to some questions raised by visitors from the regulatory body in a site visit in Fall 2009, this document completes the verbal information given to the visiting team during the visit.

F.A.K.E.1 is a modern installation striving to maintain the highest standards in reliability and safety. This is expressed in the Safety Policy (see separate document) and implemented through management control systems, procedures, personnel development and visible leadership.

During the last 2 years, the following safety improvements have been made:

- A project on replacing obsolete fire protection system is currently being carried out, engaging external fire management expertise.
- Improvement of the operating performance of major plant equipment including evaluation of redundancy of electricity supply system
- Improvement of human performance tools regarding error prevention and reporting
- Developing key performance indicators for safety culture performance in operations and maintenance
- A project for improving international exchange of operational experience has been initiated
- All diesel generators at the facility have undergone thorough maintenance procedures
- Battery banks for supplying emergency light has been upgraded
- A systematic overview of all visual plant communication (signs, information displays, etc.) has been made and improvement points have been identified
- In the area of operational experience the system for collection, trending and reporting of minor events and quasi-events has been developed and will be implemented

- A main transformer monitoring and diagnosis system has been installed
- World Association of Nuclear Operators (WANO) -supported best practices in the areas of human error prevention have been adapted and will be implemented subsequently through revised training courses

## **Safety policy – key points**

### **F.A.K.E. NPP April 1st 2012**

1. F.A.K.E. NPP's mission is to put customer satisfaction in focus by delivering safe and reliable nuclear power.
2. Safety is an overarching priority and F.A.K.E. NPP has the ambition to perform according to world-leading nuclear standards.
3. F.A.K.E. NPP is a learning organization and will adapt to the needs of stakeholders, the general public and to new knowledge available within the international nuclear community in order to maintain safe and reliable operations.
4. Safe and reliable operations are the responsibility of all employees at F.A.K.E. NPP.
5. F.A.K.E. NPP's management has the responsibility to ensure that nuclear safety is not circumvented for the sake of expediency, production, or economic pressure.
6. Nuclear safety should be recognized as a primary consideration in all management controls, engineering controls, administrative controls and key performance indicators.
7. F.A.K.E. NPP shall adhere to available national and international standards in all operations and development work.
8. It is the responsibility of F.A.K.E. NPP to ensure that all personnel (employees as well as subcontractors) working at the NPP have adequate training in task performance as well as in safety procedures.
9. F.A.K.E. NPP shall undertake regular assessments of safety procedures as well as actual safety performance, taking in consideration best practices from other NPPs as well as from other industries worldwide and from the international nuclear community.
10. F.A.K.E. NPP's commitment to the highest standards of nuclear performance includes the reduction of frequency and significance of nuclear events through continuous improvements and organizational learning.

**Executive summary of  
report from  
top management seminar**

**F.A.K.E. NPP**

*Assignment: Top management seminar facilitated by AdHoc Consulting, Inc., with the top management team at F.A.K.E. NPP around issues of safety culture, management and leadership.*

There is a strong feeling of trust from the top management team. Adherence to procedures is considered to be high and systematic in the organization. Several team members emphasise the importance of generating a feeling of trust and security among the personnel.

The top management team recognize that there is a need in the organization, particularly from middle management, for management training. They recognize the need for both specific tools and techniques for managing particular issues, as well as an increased need for personal development and development of leadership skills. There is a clear recognition that the organization needs to move from hands on management ("micro management") to a more inclusive form of leadership in order to facilitate commitment.

It is also recognized that middle managers as well as top management has severe time issues, and many work overtime in order to finish their tasks.

There is a perceived need for redesigning the management control system in order to increase transparency in resource allocation as well as cost analysis and budget follow-up procedures.

The top management has a clear image of the organization's culture and the potential pitfalls with developing a too strong culture.

The majority of the top management team recognize the need for increasing awareness of safety culture. There is wide-spread recognition of the importance of top management commitment. The managers also believe that the commitment to safety culture work and change is high among staff, although a few persons note the tendency to implement change programs without following through.

## **Results of group discussion on how to improve safety culture at F.A.K.E. NPP**

- Increased middle management visibility
- Incentive systems should prioritize safety
- Training efforts are too much oriented towards operative personnel, not including e.g. personnel dept. and finance.
- Management culture too focussed on finding faults rather than being supportive
- There need to be an increased level of understanding of the importance of safety culture in the organization
- Earlier, cost focus has been too emphasised ('cost hunting')
- Managers need to become leaders, setting examples
- Too much focus on 'here and now', too little communication of strategy and vision
- Reporting systems and procedures have to be revised to ensure quality and relevance
- Improved management of subcontractors, esp. regarding safety culture
- Improved management training in leadership skills and specific methods for e.g. project management and meeting management

The overall conclusion is that there is a strong top management commitment to safety culture and a realization that the organization has a lot to learn in the area, but also that the improvement potential is large.

<p>1</p> <p>During one focus group, participants answered question about the safety culture:</p> <p>"Safety culture changes when you can show benefit, when you see that things change faster or when things get done."</p> <p>"The top management need to trust employees and that they are doing their best. Employees must trust top management, that it is doing what's best for the company. Otherwise there can be no safety culture." FG</p>	<p>2</p> <p>About the work environment:</p> <p>"All things are of course not up to date, but I really like that the company invests in new technology. The new phones are one example."</p> <p>"Being in a nice place is also good for the spirit, the feeling of being where someone cares about you." FG</p>
<p>3</p> <p>Leadership:</p> <p>"Leaders here are technically skilled, but not good at managing people. They have no communication capacity. They know how to deal with equipment and that's great, but they must also know how to deal with people."</p> <p>"To be a good leader here is about motivating and keep the team together. To make sure the team gets space to do its job. And it is about being fair, to not pick their friend in the plant and promote them. That has happened." FG</p>	<p>4</p> <p>On career:</p> <p>"Sometimes it is difficult to work here, because work life and private life is so much the same. Sometimes you can really wonder why some person made it to the top, to a manager position."</p> <p>"One reason why people leave is career politics. You know you have no future because someone up there doesn't like you. And that's bad. We lose the good ones, those that really question things." FG</p>

<p>5</p> <p>One focus group listed their top 5 important leadership skills and recorded F.A.K.E:s score (1=low, 5=high):</p> <p>Communication competence: 2  Technical skills: 4  Administrative skills: 1  Power and respect: 4  Control over finance issues: 3</p> <p>FG</p>	<p>6</p> <p>One group discussed the importance of managers being present at work and expressed that it was displeased with the current situation.</p> <p>“They call the maintenance manager ‘the phantom’ as everyone know who he is but no-one has seen him.”</p> <p>FG</p>
<p>7</p> <p>In one focus group this story was told:</p> <p>”I heard about a maintenance guy, I think he worked in maintenance; anyway he was not happy about how the company was dealing with exchange of some safety equipment. He thought the new part installed would actually degrade the safety, so he talked to his supervisor about it. The supervisor did not show any interest. I don’t know maybe he got mad or only was concerned. Anyhow he wrote about it on Facebook. And from what I heard they found out about it. And he lost his job.”</p> <p>FG</p>	<p>8</p> <p>At the start of a focus group with a management team, the senior manager immediately spoke for several minutes about the organization’s approach to safety. He interrupted people often to reframe the participants’ comments, and in one case stated that what a person had just said was incorrect. Participants watched the senior manager closely, especially when they wanted to introduce a new topic. The feeling in the room was reserved and cautious.</p> <p>FG</p>

<p>9</p> <p>When asked about competence and competence development, one focus group started to talk about learning from other plants. One participant suggested that “we need more opportunities to learn from other plants, many of us have been at this place for all too long”. Several agreed to this and one said “benchmarking trips are reserved for the ‘special people’.” Another suggested that those trips were mainly used as a reward system, when you have done well in somebody’s view you get to take a nice trip.</p> <p>FG</p>	<p>10</p> <p>In one focus group, participants were asked what three things they would like to see changed in order to improve safety. One participant said: “I’d put an end to the corporate purchasing process - it takes too much time and we can’t choose what we want”. Another responded: “Different personal protective equipment should be purchased. We don’t get the right stuff”.</p> <p>FG</p>
<p>11</p> <p>In an all-staff focus group comprising Operations, Maintenance, Medical, Radiation Protection, Engineering, and Nuclear Safety staff, the group cautiously responded to the established questions with the two Operations participants consistently assuming the lead. At no point did the more vocal members directly address or prompt the largely silent representatives from Maintenance to participate. The vocal members laughed, joked, and bantered with the facilitators.</p> <p>FG</p>	<p>12</p> <p>In one focus group this story was told:</p> <p>“Last year we had to use parts that had been ordered for outage work to fix emergent maintenance issues. And then we were accused of not having ordered new components for the outage work. But that’s procurement’s job. But they don’t know the state of things here. It happens all the time. They don’t know what we need and they don’t care to find out. Once a maintenance guy went up to the procurement head office to complain, and he was literally thrown out because he had just come from a job, and he was like really upset and so, but he had dirt all over and they didn’t want their fine offices to get stained.” FG</p>



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In one group, when asked about examples of situations where safety had been put to the test, there was a long silence. Then someone started talking about an event at a sister plant, and the discussion took off from there.

FG

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One focus group talked about project management, and a project manager went on:

“When I went to the project management course, they said that projects are limited in time. Well, easy then, we have no projects. We have lots of things going on but there’s no time limit whatsoever.”

Other participants joined in and gave examples of projects that dragged on forever. When asked about why, none seemed to be able to suggest a reason. “I guess we’re not better than that” the project manager joked. FG

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During a mixed focus group session, when participants were asked the question “Can you give an example of how an event in the plant was handled?” the discussion quickly moved from in-plant to how contract staff demonstrated use of personal protective equipment when conducting construction work at a manager’s home. The manager went on to explain “They learned the importance of fall arrest and I felt very proud of how well we taught them”. FG

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In one focus group with the management team, time and meetings were brought up:

“Managers are very stressed, there are meetings all the time. You really have to prioritize which ones to attend. There’s no time for reflecting.”

“Taking care of people becomes hard when you have to take care of meetings. I can have five different project managers subordinate to me, and I have to attend meetings in all those projects every week to see what’s going on there and make sure they’re on track.” FG

<p>17</p> <p>In one focus group this story was told:</p> <p>“There is this guy at operations, he spent I don’t know how much time on reading and reviewing procedures. And at some point his manager brought him in and asked him if he did any work. And he was like trying to show him all the documents he had reviewed but the manager was really not impressed. ‘Be more efficient’ he said, ‘or it will come back at you’. Guess if he ever did a proper review again?”</p> <p>FG</p>	<p>18</p> <p>Reporting was discussed in one group:</p> <p>“In our team we report everything that happens. But I know of several that are really low on this.”</p> <p>“Well it’s not that easy. It may be your ass that goes down if it comes out.”</p> <p>FG</p>
<p>19</p> <p>In one group, the responsibility of employees was discussed. One radiation expert said:</p> <p>“Well, I know my job, I’m really good. I think. (Laughs) But if I’m supposed to be responsible for what I do I also need to be in control. If I just follow orders and such, and then something goes wrong, it is still my responsibility.”</p> <p>FG</p>	<p>20</p> <p>In one group they discussed reporting. A manager said:</p> <p>“Of course things get reported. We work with nuclear. We know how critical this is, that we must learn. Right?”</p> <p>A maintenance engineer replied: “That easy to say when you’re far away from what’s going on. Not that I haven’t held back any issues, but I know some really are scared to report. Because understanding of what happens is not always good. Event investigations always end up with ‘the human factor’. And that means someone’s done a shit job. And that may be yourself.” FG</p>

<p>21 One focus group talked about competence. All agreed that the level of competence in the organization was high. One said:</p> <p>“To me it’s all about trusting you co-worker. You must know they know what to do because you well-being depends on it. And in this organization I can really say I do.”</p> <p>FG</p>	<p>22 In one focus group they discussed what safety culture is. Some answers were:</p> <p>“It is what is in the safety policy.”          “It is how we think about procedures and regulations.”          “It’s about the organization’s survival, we need the trust of the public and the regulator.”          “Mainly it’s what they do on those courses. And then there’s real work.”          “It’s a top management priority and it must be. Only they can set the safety culture right.”</p> <p>FG</p>
<p>23 When talking about competence development, one participant said:</p> <p>“This is really an issue for the HR department. They should be more involved there. It’s what they can do for safety. Otherwise they quite remote.”</p> <p>Another replied:          “We have limited resources. Top management should make sure they end up where they matter and not spend money in the periphery.”</p> <p>FG</p>	<p>24 In one focus group there was great consensus on the importance of safety culture and following procedures. After the session was over, however, one of the participants privately told the facilitator that part of what had been said was not true, but since the chief technical officer was there, no one had objected. “We know his influence and that is not the person you want for an enemy”, he said.</p> <p>FG</p>

<p>q</p> <p>And well you know, generally you know what to do. We do have goals and visions and stuff and we talk about those, but you know, like... Everyday work is what it is. Sure if you're going to do something extraordinary, a manager might interfere, but generally no. You do what you should. That's what you're hired for after all, right? (Maintenance engineer) IN</p>	<p>2</p> <p>(Interviewer:) "What about leadership? Is there any leadership?"  (Respondent:) "No...There's management, but leadership... no..."  "The distinction is...?"  "Manager is a title. A leader is someone who actually leads. Someone who makes sure you know where you're going and make sure people work from this."  "But it's not there?"  "I don't think so, no."  "Should it be there?"  "Yes... You know, we really don't know where we're headed. The next week we know about, that's keeping the station on the grid, but then... In five years, ten years, where do we want to be? I don't know." (Power plant operator) IN</p>
<p>3</p> <p>Well I know there's a top management team, some old men you recognize when you see them on pictures, but apart from this, I don't know... (Recently employed radiation control employee) IN</p>	<p>4</p> <p>I don't know, are you going to sit and try to boss other managers around? I'm not so sure about that. We are rather autonomous, most of us, and we can trust each other on knowing what to do. We're trained and experienced. There's not much leadership to do, then. (Manager of Nuclear safety department) IN</p>

<p>5</p> <p>Of course in the beginning it was hard, just coming here, getting an office and not know what to do. But you know after some time you get things sorted. But it's hard in the beginning, sure, it's difficult. (Operations trainer) IN</p>	<p>6</p> <p>What is quite clear is that some people become managers, but the real leaders are those who are really good at what they do. And they continue to be involved even after they've become managers. (Operations trainee) IN</p>
<p>7</p> <p>(Respondent:) "The thing is. I know people are doing their job, following rules. I have great trust in this. I have to have, it's nuclear safety after all." <i>(Interviewer:) "But when you get these event reports showing that rules have been challenged, what do you think?"</i> "Yes, well, these things happen and we really have to get to that. I think we have to get even better at root cause analysis and try to understand why things happen. People do their best. We must believe in this. There has to be trust." (Operations manager) IN</p>	<p>8</p> <p>It's not easy, you know. We're stuck in the middle in a way. The regulator wants this, the shareholders that. You have to keep up an image as well. We know that there are things to improve, and I'm having people look into this. It's important to make sure that everyone in the organization can trust that we in top management are doing a god job. (Chief Executive Officer) IN</p>

<p>9</p> <p>Sometimes, it's so much hypocrisy. Some years ago, we could get the equipment we wanted. Now it's always too expensive. We must always look for a cheaper option. I'm having a hard time with the guys on maintenance on this. It's really really hard to convince them that the stuff we're getting is good enough. And really I can't tell, I can look at the specification from the supplier but hell, how can I know the quality of every last screw? (Procurement engineer) IN</p>	<p>10</p> <p>I think that we have much more sense now. We must realize it's a financial crisis, we must realize that we must deliver. For shareholders, sure, but even more so for the public. Electricity costs are up, and we are here to help keeping them down and deliver, to stay on the grid. Because when it comes to it, no money means less safety, right? (Nuclear safety engineer) IN</p>
<p>11</p> <p>To me, it's all about balance. Sure we must have the right stuff, but if I need a Fiat I shouldn't buy a Ferrari. We used to have Ferraris all over, but really, there's gotta be some sense to it. (Maintenance engineer) IN</p>	<p>12</p> <p>The thing is, it's really tricky. We want to stay on the grid, we want to stay safe, and sure this can be a contradiction. But I feel, well, these things should be decided at top level. Really. They carry the weight of responsibility, right? Then they should step in and take that responsibility. It's this that I can feel that they don't do sometimes. (Operations engineer) IN</p>

<p>13</p> <p>I don't know. I really feel that we are so much in the hands of other people. It's the economy in general, it's contractors, there's consultants... Where are we? It's hard to who is setting the direction. But still, things work out, so I guess it can't be that bad after all! (Laughs) (health physicist) IN</p>	<p>14</p> <p>Well, sometimes you have to be pragmatic. Really. You know your job, right? And you know a job's gotta be done too. So when you know what you're doing, there's really no need to check every little detail again. Procedures are a great help when you're not sure though. (Maintenance engineer) IN</p>
<p>15</p> <p>I really do thing that you have to know your stuff. Every machine is unique, you shouldn't forget this. There only so much you can put into writing. I know my turbines, it sounds silly I know but, you know, it feels as if I can hear them talk to me. They tell me when things are wrong. (Maintenance engineer) IN</p>	<p>16</p> <p>Of course we want things to end up right, but at the same time, it's an enormous amount of work to manage all deviations. There are piles of them and you have to be practical. What should you do with it all? (Radiation control technician) IN</p>

<p>17</p> <p>It's so hard with the economy issue. People just don't seem to grasp that there is no tension between safety and economy. We must have safe operations in order to stay on the grid, Otherwise we'll lose money. There is no conflict. None. (Chief Financial Officer) IN</p>	<p>18</p> <p>[Referring to a specific accident:] Distraction was an important part of why it happened. It is part of our culture to be noisy and talkative. Some do not feel comfortable with this. But that is always a part of the process, so strong attention is important. But some cannot make it. That's the way it is. (Maintenance technician) IN</p>
<p>19</p> <p>Technicians here have to fill in procedures, and there a lot of mistakes happen. I sometimes take a copy to check randomly. So I know. Why it happens? Some jobs are too routine. You lose attention. (Rad Protection manager) IN</p>	<p>20</p> <p>We often have to do temporary modifications in order to be able to wait with more substantial modifications. Buying new things takes a lot of time around here. Long, long procedures. Why? You ensure safety by buying good quality. And when it turns out quality is not the best, we have to start the process again. It can take more than 3 months. And this does not lie in our area of responsibility. It's out of our control. Another part of the company that does this. So we have to make it work meanwhile. (Project manager) IN</p>



21

Every year it's a challenge to make the outage shorter. Safe but more efficient. In order to do this, we keep to the same people, the same contractors. They know what need to be done, they know our plant and our organization. (Procurement manager) IN

22

Our objective is to be the world leader in this. Running a plant I mean. Safely. We always discuss if our goals are realistic, and the performance indicators are communicated through monitors in the plant and also managers have a copy. It's also mentioned in the yearly speech by the CEO. (A senior engineer) IN

23

Violations are treated by first time, someone talk to the one who has done the mistake. Second there is a form to fill in and give to the person's manager. There is also a written warning, but no sanctions like cut off salary or working time. It's not a problem for us. (Operations manager) IN

24

But of course, during outage we must work more then 12 hours, otherwise we're never able to pull it off. So we need to discuss with the union and agree about overtime and extra payment and all to solve the situation. (Maintenance manager) IN

<p>25</p> <p>The thing is, of course there's a pride in staying online. That's how you become a hero here, you solve the issue, work around it, and keep production up. (Control room operator) IN</p>	<p>26</p> <p>Managers around here do not really care about the staff. There is a broken shower, the lunch area is very small and there's paint coming off the walls. Just some of the signs. (Radiation control technician) IN</p>
<p>27</p> <p>We are like a big family. (Manager in procurement) IN</p>	<p>28</p> <p>As manager I look after my staff. Every week I visit them at their workplaces and see how they are doing. It's just part of being a manager. (Maintenance manager) IN</p>

<p>29</p> <p>Operations are our clients. We must do the best for them. We see them as clients. We try to do what they say. I try to manage so their jobs work well and prioritize what they want. They are responsible for everything. (Maintenance manager) IN</p>	<p>30</p> <p>People are proud. And rightly so. This is a very competent organization. On an average, people have 25 years of nuclear experience and this is of course good. (Personnel dept. manager) IN</p>
<p>31</p> <p>I don't know but since I have been in charge we had five international safety reviews and they all come up with about same deficiencies. (Chief Executive Officer) IN</p>	<p>32</p> <p>This organisation is like a huge ship. It just keeps moving in the same direction and it's impossible to turn around. (Chief engineer) IN</p>

33

Our manager really cares about our views and how we feel about things. Changes and such. But I feel that the decisions don't go in our favour anyway. It's like her view is not important. Maybe she doesn't have any power or... I don't know. Maybe she just doesn't communicate what we think to her manager? (Personnel dept. employee) IN

34

Well, I think the project manager for that particular project was dismissed because she did not have control over the project budget. But I think that the real thing was that the project was badly planned in the first place. The preconditions were misapprehended. It was a huge project after all. (Project manager) IN

35

You know, the effort we have put in implementing error prevention tools. It's like... wow. And still workers are making mistakes. I really can't tell what the problem is around here. (Training officer) IN

36

But on the other hand. It's not we who deal with radioactive materials. We help in managing people, we train and we hire and fire. But our work here doesn't have any direct safety implications. (Personnel department employee) IN

<p>37</p> <p>To me, a problem is that I don't have time to participate in workshops or training. There's simply too much to do. (Project manager) IN</p>	<p>38</p> <p>The thing is, I really can't feel that the top managers care. Of course there are meetings where they turn up but hey, when did they ever get dirt under their nails? They drink coffee and write reports and analyse things, but we have to take the shit. So to speak. (Team leader, maintenance) IN</p>
<p>39</p> <p>Top management really do not know what's going on around here. If they did, things would be different. Better. (Security specialist) IN</p>	<p>40</p> <p>We always put safety first. This is our core value. We have just updated our safety policy and I think we got it really good this time. It is important to declare what the values are and communicate them. (Chief engineer) IN</p>

41

But then again, the fire doors. They always come up in inspections. There's always open fire doors it seems. I can't see why this has to be, it's their own lives that are at stake! We have literally covered the walls with warning signs, but nothing seems to help. (Fire safety officer) IN

42

Sometimes I feel there's this macho attitude here. It's not cool to admit that you made a mistake. (Maintenance technician) IN

43

I've spent most of my working life here. I know this place and the plant, and I can tell you there's really no better place to work. I can't imagine that. (Manager in Operations) IN

44

My team really works well together. We are problem solving oriented, if there's something we need to fix, we fix it. Immediately. We know what to do and we do it. There's great comfort in that, I know I can depend on my team. (Team leader, maintenance) IN

<p>1</p> <p>Observed 20 workers at the coolant water intake performing different work, all using PPE OB</p>	<p>2</p> <p>One person was seen working on the fence to change barbed wire. He was working on a ladder and was reaching sideways. His colleagues were peer-working OB</p>
<p>3</p> <p>10 years ago sent technical specifications to regulatory body. The technical specification translation and adoption to standard format is still not approved. There is going to be another meeting about the comments. OB</p>	<p>4</p> <p>Radiation Protection exit area has multiple stop points; barrels for clothing on both sides of the hallway; signage and footmarks at cross-over from one zone to the next. OB</p>

<p>5 Directors meeting: OB</p> <ul style="list-style-type: none"> <li>• Not clear what the agenda is</li> <li>• Lively discussion (only one) on the number of lightning strikes - how it could disturb some components</li> <li>• Problem with chlorine injection – work is going on</li> <li>• Cite 48 temporary modifications</li> <li>• 22 spare parts</li> </ul>	<p>6 Work management meeting: OB</p> <ul style="list-style-type: none"> <li>• Meeting starts with discussing safety issues</li> <li>• Planned work re-scheduled to be performed during outage.</li> <li>• The only red indicator is the back log spare parts – not much discussion</li> <li>• Long discussions related to spare part problems, estimation 70 % of the discussions related to spare parts (several people started to look at Blackberries)</li> </ul>
<p>7 Directors Meeting: OB</p> <ul style="list-style-type: none"> <li>• Spare parts in coming in which will recover the WANO indicator. Starting reducing power until outage shut down.</li> <li>• Manager explains systems health status - 67% preventative maintenance due to spare parts issues</li> <li>• WANO/IAEA and plant health indicators are presented</li> <li>• Little challenging of opinions</li> </ul>	<p>8 Directors Meeting:</p> <ul style="list-style-type: none"> <li>• A work order got lost – discussion if they should proceed with doing the work anyway. No final decision made.</li> <li>• New quality assurance (QA) resources added to each unit. Trained and will support each unit with QA, but belong to QA department</li> <li>• Discussion if isolation or not is needed when performing routine preventive maintenance on battery supply</li> </ul>



<p>9 Weekly planning meeting: OB</p> <ul style="list-style-type: none"> <li>• “Talk about 16 week programme. Will start 18 April - no isolations. Holiday for the holy week. Only 3 day week. We start period test. Routine test, nothing we must mention. On page 2 period test done in our routine way. This last way, I can record this task, can you remember. . . So we have to check for accessibility”</li> </ul>	<p>10 Weekly planning meeting: OB</p> <ul style="list-style-type: none"> <li>• “Can you make a summarisation of safety related items? Is there anything that can affect production?”</li> <li>• “Here we have a problem with spare parts. Is it an instrument? No it’s a pump. I don’t know but I think it is a pump. We have to reschedule due to spare part. Discussion if we need to drain or not. We have to go out and check. Please check this out for me.”</li> </ul>
<p>11 Weekly planning meeting: OB</p> <ul style="list-style-type: none"> <li>• “OP diesel 5 we must paint the pump, let’s check later. We have preventive maintenance to be performed. Battery inspection needs to be done even if we have 3 days that week. In this we will have isolation? No we will not have isolation. (load discussion)”</li> </ul>	<p>12 Weekly planning meeting: OB</p> <ul style="list-style-type: none"> <li>• “This is only a routine test. No isolation needed. There are 2 work requests on the accumulator. Are we going to measure vibrations and temperature? You must ensure, it has to be done Monday or Thursday. Do you want me to put in on Monday? Okay then I put it on Monday. (planned for Tuesday)”</li> </ul>

<p>13</p> <p>Cigarette butt found beside an oil barrel OB</p>	<p>14</p> <p>Flammable liquid and cloth found in the turbine hall at many work places when people left for lunch. OB</p>
<p>15</p> <p>8 of the 15 participant of the training did not come to the re-training on Human Performance OB</p>	<p>16</p> <p>Two persons standing under a heavy lift directing the lift-operator. OB</p>

17

7 of 10 Fire doors could not be closed properly.  
Long standing problem. OB

18

Material made from wood found at various areas  
in the controlled area. OB

19

Dust and dirt by the spent fuel pool. Also many  
small particles floating on the surface of the water  
in the spent fuel. OB

20

All lifting gear in order, properly marked and in  
orderly stored. OB

<p>21</p> <p>Emergency escape routes blocked. OB</p>	<p>22</p> <p>Shift manager and reactor operator talking and drinking coffee just by the panel. OB</p>
<p>23</p> <p>Meeting starts with thanking everyone for good achievements. OB</p>	<p>24</p> <p>The maintenance manager opens the Human Performance training and talk about how human and organisational factors contributes to 90 % of all events. He emphasizes the importance to work proactively – events are possible to prevent. OB</p>

<p>25</p> <p>The manager did not arrive for the interview... OB</p>	<p>26</p> <p>People in the meeting stayed quiet when the manager asked questions about the safety. (It felt funny – like people did not want to speak up) OB</p>
<p>27</p> <p>In the Managment Review Meeting all indicators was presented. Names of each group manager were also presented. Five of the indicators were red. OB</p>	<p>28</p> <p>On the wall in the control room there is a human performance clock showing with the date of the last reset and the shift team involved. OB</p>

29

In a meeting to discuss whether to shut the unit down due to problems with a transformer the plant manager actively solicited each participant's views and concerns, and summarized the issues and thoughts expressed by all parties. After a decision was taken, he continued by asking each person around the table "How do you feel about this decision?" Review of actions by the minute taker indicated that the decision had been taken with consensus by the team. OB

30

During observation of a training session the assessor observed the Plant Manager open the session with a story that emphasized the importance that a fall arrest harness had played in a recent near-miss in the plant. When asked by a contractor about the general availability of the harnesses, he immediately asked whether the individual had any concerns about availability. Later in the session, a supervisor remarked that "things would work a lot better around here if somebody cleaned up the purchasing process so materials could be replaced when needed". Several participants nodded their heads in agreement. The Plant Manager asked for specific examples to discuss with the head of procurement. OB

31

Training instructor asks class member to take feet off the desk OB

32

Missing telephone number list at OPS station in offsite emergency centre OB

33

Brush growing up gravel zone in fire grounds OB

34

Parking across pedestrian way blocks passage. People walking under construction staging. OB

35

Student left standing unattended in controlled area during family day OB

36

Chief Executive Officer opens town hall meeting with congratulations for good plant performance in the preceding year OB

37

Mechanical maintenance training review group meeting cancelled due to low attendance OB

38

Joint union – management safety bulletin on correct way to move suspended loads OB



39

Security officer talking with driver of one car.  
Two people walk through the gate without being  
stopped OB

40

Manager blames corporate purchasing for slow  
parts ordering leading to deferred work orders  
OB

41

Supply cabinet in clean room out of stock on  
several listed items OB

42

Young engineer leaves challenge meeting in anger  
OB

<p>43</p> <p>OPS trainers assigned to cubicles along windows in new training facility OB</p>	<p>44</p> <p>Overtime list reviewed at HR update to managers. 3 operations staff exceed policy limit OB</p>
<p>45</p> <p>Operating Experience (OpEx) person comments/concerns ignored three times in work planning meeting OB</p>	<p>46</p> <p>Blurry, unreadable tags on standby generator OB</p>

<p>47</p> <p>HR manager presentation on employee satisfaction survey results – ‘very good’ rating for question ‘I feel safe at work’ OB</p>	<p>48</p> <p>HR manager presentation on employee satisfaction survey results – majority answered ‘poor’ for question ‘I get the development opportunities I need to grow in my career’ OB</p>
<p>49</p> <p>Leader of cross-functional user group summarizes feedback on ‘Documents and Records’ process. 490 steps to complete the process from initiating a document to deletion of document OB</p>	<p>50</p> <p>Operations manager publicly criticizes procedure writer OB</p>