



School of Business  
Economics and Law  
GÖTEBORG UNIVERSITY

Management and Organization  
Spring 2008

# Isomorphic Learning at a Disciplined Nuclear Power Plant

Bachelor Thesis

Ola Borglin 1981  
Gunilla Lindell 1975  
Sara Lindström 1982

Tutor: Gill Widell



## **Abstract**

In this thesis we have examined the Swedish nuclear power plant Ringhals by asking three questions: *How does the search for legitimacy take shape at Ringhals?*, *What kinds of disciplining in Foucault's terms can we find, and how do these affect the organization?* and *Which types of learning can we find at Ringhals and how do they learn from experiences?* To answer these questions we have interviewed 24 employees, mainly about learning issues, but found indicators for legitimacy seeking and disciplining as well. The special characteristics of the nuclear power industry with its safety rules, authority control, terrorist threat, public fear, risk management and environmental issues, make it interesting to study. In line with our questions we have analyzed the material along three master tracks; new institutional theory, disciplining and organizational learning. We have been overloaded with ingredients, which we have tried to sort out, cook, package and serve in a delicious takeaway meal, provided in this thesis. We concluded that the search for legitimacy has many faces at Ringhals. Giving an old phenomenon a new costume brings attention to the issue and might speed up the change process, which always is slow due to inertia. We also found fractions of strong corporate culture (or brainwashing, depending on which mood you're in), separation from the outside world, division of space and functional locations. Although Ringhals has a substantial learning toolbox, we have considered high reporting frequency as a crucial prerequisite for learning, which turned our interest to factors contributing to reporting. Besides the reporting, we believe that their practice to ask "Why" is a good way of learning from experiences. If you think that it is enough to read the abstract or the conclusions to understand this thesis, we strongly recommend that you read the complete composition, since there are some grains of gold along the way...



## Table of contents

Introduction	7
Problem Analysis	7
New Institutional Theory	7
Disciplining	8
Learning	9
Nuclear facts	10
The Nuclear Power Industry	10
Ringhals	12
INES - The International Nuclear Event Scale	14
Wellknown incidents	14
Surveillance - Big Brother IRL	15
Learning tools at Ringhals	16
Introduction for new employees - newbie training	17
Simulator training - preparing for the worst case scenario	17
Competence Analysis - what do you know and need to know, anyway?	17
Operating Experience Feedback - avoiding hangovers	17
The program for competence transfer - newbies playin' with the big boys	20
Analysis	20
New Institutional Theory	20
Disciplining	23
Learning	24
Conclusions	28
Self-criticism	28
Acknowledgements	29
Abbreviations	29
References	30
Written references	30
Internet	30
Movies	31
Oral references	31



## Introduction

In the control room, there used to be two buttons placed right next to each other with the same color. One was right and the other completely wrong, in a certain situation. This kind of event could have stopped there by being merely a risk observation. What happened was that an operator in that situation pushed the wrong button causing a reactor trip.<sup>1</sup>

A reactor trip costs at least 4 million SEK in lost income<sup>2</sup>, and all the operators are painfully aware of this. Working at a nuclear power plant implies not only a big responsibility in terms of safety, there is also an everyday risk of causing huge costs for the plant.

The Nuclear power industry has special characteristics, such as safety rules, authority control, terrorist threat, public fear, risk management, environmental issues and the parliament's power to close the plant down, all of which make it interesting to study. All these characteristics also make it important to learn from mistakes, and to learn in order to be prepared for an uncertain future. Our initial focus was learning, which we have held on to during our journey in Thesis Wonderland. When studying the learning tools presented to us, we reflected upon how these tools were communicated. Even though we were truly interested in learning about their learning, we still needed a critical approach to make it more interesting and this was found in the new institutional theory and disciplining theory (which we will present in the problem analysis). In our problem analysis we have therefore chosen three different perspectives: new institutional theory, disciplining and learning.

## Problem Analysis

### New Institutional Theory

For those unfamiliar with Meyer and Rowan's (1977) new institutional theory one might say that they tried to find an alternative explanation to the traditional view that organizations are structured in response to pure economic efficiency. A key word in their reasoning is "institution", which is basically everything, or nothing if you prefer that since it is just a word. An institution is something taken for granted, that recombines people's daily functioning such as the idea of the use of money. You can go to a supermarket and receive a chocolate bar in exchange for money and both you and the cashier have a tacit agreement that nothing but money is valid to pay with, not even the rims of your car worth many times more than the chocolate bar.

In our thesis about nuclear power industry and particularly the plant at Ringhals it will be interesting to get an insight on the institutional environment that surrounds the nuclear power industry. Just like the example of money as an institution, there is a prevailing idea about how the nuclear power industry, in which Ringhals exists, should work. Meyer and Rowan call them "institutionalized organizations" and state that organizations seek legitimacy by designing the formal structure accordant to the prescriptions of myth in the institutional environment. For instance, we suppose that safety work is part of that myth and therefore emphasis on that sort of work is rewarded. Since the survival of the industry is tightly connected with the general public's confidence, the legitimacy ought to be of great importance to its existence. Meyer and Rowan argue that formal structures that follow the institutionalized myths differ from structures that act efficiently. The organizations realize that structures that give legitimacy imply decreasing level of efficiency. One solution is to decouple the formal structures from the ongoing activities (informal structures).

---

<sup>1</sup> Bengt Ljungquist

<sup>2</sup> As you will see in this thesis, a shut down reactor costs 170 000 SEK per hour, and since it takes about 24 hours to return to normal production, the cost should amount to at least 4 millions per stop.

A further development to the new institutional theory was written by DiMaggio and Powell (2002) where they tried to explain what makes organizations, in the same field, so similar. Being in the same field would in our thesis correspond to all the nuclear power plants. They had observed that rational actors trying to change the organization only made it more similar to the other organizations in their field. They called this process isomorphism (Greek: ison “equal”, and morphe “shape”). Digging even deeper in our brains and assuming that Ringhals seeks legitimacy and are willing to take measures to improve we figure that the idea of traveling recipes (Røvik 2000) would be a tool for organizations walking down that road. Røvik identified institutionalized standards for organization and leadership that travel in space and time. These ideas appear around the globe within a certain time and are adopted by organizations. The recipes have a limited duration and will eventually disappear (if they go out of fashion) or become modified (re-institutionalized) to be used again with a slightly changed packaging.

The nuclear power energy might not be the first thing that crosses one's mind when thinking of environmental sustainability, but a sustainable energy source is exactly what the nuclear power industry wants to market itself as. Compared to for example a coal power plant, the nuclear power plant emits no carbon dioxide, and this gives nuclear power advantages in today's debate about greenhouse gasses. Ahrne and Papakostas (2002) introduced the term *glade* to describe when companies find new unapplied spaces to conquer. We will try to apply this theory on the nuclear power industry. Has the climate change opened a glade for the nuclear power to regain legitimacy, after losing it through referendum, governmental decisions and Chernobyl? The fact that uranium mining is not an environment-friendly activity and the still unsolved question about where the final storage of radioactive waste should be located are issues that might bother the image of nuclear power as the perfect solution of the world's energy needs. With the energy debate in mind it is clear that nuclear power industry is dependent on its legitimacy.

To sum up our reasoning, we expect that in the study of a nuclear power plant organization, we will come across the phenomenon which Meyer and Rowan (1977:356) call *decoupling*. A nuclear power plant organization has an institutional environment to consider, and to keep the daily activities working they have to give a good picture of the organization to its environment. If they fail, they risk disturbing of the business by one or many of the factors mentioned in the introduction. We are curious to find out which signs of legitimacy seeking that can be observed at Ringhals. Therefore, our first question will be: *How does the search for legitimacy take shape at Ringhals?*

## **Disciplining**

It is also interesting to reflect upon what monitoring does to an organization. A nuclear power plant organization is highly regulated, has heavy administration, has no space to commit serious mistakes and has an institutional environment to pay regard to. Foucault (2003:139 ff.) discusses aspects of disciplining and surveillance. He states that the disciplining doesn't need any brutal methods to achieve desired results, and that details are not to be underestimated when it comes to disciplining. This suggests that one should look for small things when searching for elements of disciplining. The first kind of surveillance we think of is the authority control, performed by for example the Swedish Nuclear Power Inspectorate (SKI), but there are probably more - and more subtle - types of monitoring and disciplining present at the nuclear power plant. It is easy to state that the monitoring and disciplining forces deprive the organization of its creativity and acting space, but as Foucault (2003:195) states - why always describe the effects of power in negative terms? The power is productive! It creates a reality, subject areas, rituals of truth, and even individuals. One could question if the nuclear power industry would be able to learn anything at all without authority regulation and control, whereupon we assume that disciplining is important to them. Our second question will therefore be: *What kinds of disciplining in Foucault's terms can we find, and how do these affect the organization?*



## Learning

We believe learning is an important issue in a nuclear power plant organization, and are interested in finding out what kinds of learning one might find in such an organization. With disaster planning as in Czarniawska et al. (2007) in mind, our first plan was to study big catastrophic events that have occurred in the history of nuclear power. Those events should offer great opportunities for learning, which also was confirmed when we studied them. However, we soon realized that such events are (luckily!) not very common, whereupon we broadened our focus to smaller events like incidents which are not critical, but still means a difference from normal business.

We assumed that learning from incidents would be an important part of the learning process. People make mistakes daily<sup>3</sup>, but at a nuclear power plant a mistake can be devastating. Argyris (1990) states that there are two different kinds of learning, one that is more like trial and error learning (Single Loop Learning), and one that means a deeper reflection over the governing variables behind the acting (Double Loop Learning). We wonder whether Ringhals has managed to conduct Double Loop Learning with reflection over governing variables inbound in the process, or if they only have performed Single Loop Learning. (This of course assumes that there do prevail some kind of learning in the organization, but that is an assumption we make to be able to continue our reasoning.)

It is easy to think that the Double Loop Learning would be the better one of the two kinds of learning, but in occasional situations the Single Loop Learning satisfies the learning needs well enough. Argyris (1990) exemplifies with the thermostat, that switches the heat on or off depending on what temperature information it obtains. It doesn't have to reflect upon why the temperature has changed in either direction.

However, in some situations, reflection is necessary, and one such situation might be at a nuclear power plant when a mistake has been made. One doesn't want that mistake to be repeated, and it is a safety issue not to let it happen again. The first thing that has to be done in order to learn from mistakes is that the mistake becomes known, which calls for reporting. It is important to create an environment where one doesn't look for scapegoats and where the whistleblower feels safe after reporting disproportions. The second thing needed is that a Double Loop Learning is accomplished so that the reasons why the mistake was made are reflected over.

Thus what we will look for at Ringhals is how their reporting of mistakes works, if there is a scapegoat or whistleblower culture, and if experiences of mistakes are used to decrease the risk of future incidents. With the decoupling theory in mind we cannot expect anything else than a picture of a well functioning organization, but we will try to see through the facade as good as we can and try to find out how the learning is pursued. Our third question is thus: *Which types of learning can we find at Ringhals and how do they learn from experiences?*

Compiling, our questions are:

1. *How does the search for legitimacy take shape at Ringhals?*
2. *What kinds of disciplining in Foucault's terms can we find, and how do these affect the organization?*
3. *Which types of learning can we find at Ringhals and how do they learn from experiences?*

---

<sup>3</sup> *Inside WANO* Vol 14 No 3 2006, page 8 [http://www.wano.org.uk/WANO\\_Documents/Inside\\_WANO/Vol14No3/Vol14No3\\_en.pdf](http://www.wano.org.uk/WANO_Documents/Inside_WANO/Vol14No3/Vol14No3_en.pdf)

To find answers to these questions we contacted Ringhals and their Information Centre helped us (or prevented us?) to come into contact with key functions. We wanted to interview people on different organizational levels, both managers and “blue collar workers”. We were helped by a nice gentleman (a gatekeeper?) who scheduled interviews with people mainly in management positions. In order to get the “blue collar workers” opinions we visited a kickoff and asked a few simple questions during the break. In addition we have made a number of phone interviews. Altogether we have spoken to 24 people from the Ringhals staff (see reference list for further information). Our interviewing tactic was to ask open-ended questions focusing mainly on learning and safety culture, and then carefully listen to elements of legitimacy, decoupling and disciplining. Broad questions generate broad answers, and one of our interviews was scheduled for one hour, but took three hours due to enthusiastic respondents. We have also found information in research reports, newsletters, articles, web pages and organizational literature. Besides the interviewing and reading we have also had an intensive e-mail struggle to confirm certain diffuse information from a web page belonging to a nuclear power authority. Another battle (which we also lost) was to obtain access to a questionnaire about attitude towards safety culture at Ringhals (which we did not get access to) and a bigger survey on the entire corporate group of Vattenfall, called My Opinion (see last parenthesis).

## **Nuclear facts**

In our opinion it is necessary to be confident with facts about the nuclear power industry to be able to discuss it in an interesting way. Our empirics therefore starts with a description of the nuclear power industry, Ringhals, International Nuclear Event Scale (INES), well-known incidents and surveillance.

### **The Nuclear Power Industry**

In Sweden there are ten nuclear power reactors in three different plants - Forsmark (3 reactors), Ringhals (4 reactors) and Oskarshamn (3 reactors). Approximately half of Sweden's electricity comes from nuclear power, the rest is mostly from hydro power and (a few per cent) from wind power and other kinds of power. In the world, nuclear power stands for about a fifth of the electricity and there are about 440 nuclear reactors worldwide.<sup>4</sup> Until 2005 Sweden had four nuclear power plants, but Barsebäck was closed down as a result of political decisions.<sup>5</sup> The oldest, and in a way also the newest, nuclear power reactor in Sweden is Oskarshamn 1, started commercial operation in 1972 and completed an extensive modernization in 2002.<sup>6</sup>

All the Swedish nuclear power reactors are so called light water reactors, which means that ordinary water is used to moderate and cool the reactors. Other moderation alternatives are graphite (as in Chernobyl, Ukraine and Ignalina, Lithuania) or heavy water. Nuclear fuel consists of uranium which is mined both from open pit and underground mines. Canada, Australia and Kazakhstan are the largest uranium producers in the world<sup>7</sup>. Uranium mining is associated with several environmental and health problems, for example lung cancer among workers (Gilliland et al. 2000) and contaminated groundwater (Valerie 2007). The uranium mined from the deposits around the world is not possible to use in its natural form in an ordinary nuclear power reactor without being enriched, i.e. increasing the proportion of the isotope uranium-235 from about 0,7% to 2-5%<sup>8</sup>. Sweden imports enriched uranium mainly from Canada, Russia and Australia and doesn't have any enrichment plants of its own. The enriched uranium is refined to nuclear fuel - formed

---

<sup>4</sup> <http://www.analys.se/karnOmkarnkr.htm>

<sup>5</sup> <http://www.ski.se/page/2/16.html?18700>

<sup>6</sup> [http://www.okg.se/templates/Page\\_\\_\\_160.aspx](http://www.okg.se/templates/Page___160.aspx)

<sup>7</sup> <http://www.world-nuclear.org/info/inf23.html>

<sup>8</sup> Anders Henoch and Nationalencyklopedin 2008; kärnbränslecykeln; [http://www.ne.se.ezproxy.ub.gu.se/jsp/search/article.jsp?i\\_art\\_id=235441](http://www.ne.se.ezproxy.ub.gu.se/jsp/search/article.jsp?i_art_id=235441) retrieved 2008-05-08

into small pellets like uranium oxide ceramics and organized in 4 meters long fuel bundles. In Sweden this process is performed at the nuclear fuel manufacturing facility in Västerås. Unused fuel is not especially radioactive and can be handled without radiation protection<sup>9</sup>.

In a nuclear power reactor uranium-235 atoms are split with the help of neutrons. The process is called fission and releases energy that is used for heating water which drives turbines and generators which generates electricity. Once started the process maintains itself until the fuel is used up. Every split atom releases new neutrons which thereafter split new atoms. When the uranium atom is split it no longer is a uranium atom. The parts of the uranium atom are called fission products and are radioactive. Two fission products which are important from the viewpoint of potential radiological impact on humans are iodine-131 and cesium-137.<sup>10</sup> After about five years the fuel is used up and needs to be exchanged. At Ringhals they change a fifth of the fuel once a year. To do that it is necessary to stop the reactor, which is done during approximately one month every year. The outage is preferably performed summertime when the electricity consumption in Sweden as well as the electricity prices are at its lowest. Used fuel is highly radioactive and needs to decay for 1000-100 000 years to become harmless.<sup>11</sup> The issue on where to store the used fuel is still unsolved, and in the meantime it is stored at Central interim storage facility for spent nuclear fuel (CLAB) outside Oskarshamn. There are plans to place it in the bedrock five hundred meters deep. Among other factors, two ice ages are taken into account when choosing the depth, since each ice age is estimated to wear down the ground 150-200 meters.<sup>12</sup>

Inside the reactor, around the fuel, is water, which becomes heated and is used in one of two ways depending on type of reactor. If the water level becomes too low, the cooling function disappears, and there is a reactor meltdown within two hours.<sup>13</sup> In Sweden we have two types of nuclear power reactors, Boiling Water Reactor (BWR) and Pressurized Water Reactor (PWR). The common feature is that heated water is led through a turbine, which drives a generator and generates electricity. With three PWRs (R2, R3 and R4) and one BWR (R1) Ringhals is the only Swedish nuclear power plant that has both kinds of reactors. PWR is the most usual reactor type internationally. US, France, Japan and Russia are countries which have many PWRs.<sup>14</sup>

When needed, it must be possible to stop the fission process quite fast. This is done by inserting control rods made of neutron-absorbing material.<sup>15</sup> After a sudden reactor trip it may take up to 24 hours before the plant is brought back into normal operation again. A halt in one reactor at Ringhals costs about 170 000 SEK per hour in lost incomes, which makes it very expensive to stop the reactor when not absolutely needed.<sup>16</sup>

The Three Mile Island (TMI) accident (more about this further down in this thesis) in 1979 contributed to the Swedish referendum on nuclear power in 1980. Unfortunately there were not only a yes- and a no-option in the referendum, there was also a third option: to phase out nuclear power with regard to welfare and energy need of Sweden. After the referendum the Swedish parliament decided to phase out the nuclear power plants during a time period lasting until 2010. The intention was to find new energy technologies until it was time to phase out the nuclear power. New reactors were taken in use and the oil dependence decreased a little. Then there was the Chernobyl accident in 1986, and people

---

<sup>9</sup> <http://www.ski.se/page/1/46.html?14606>

<sup>10</sup> Anders Henoeh

<sup>11</sup> [http://www.vattenfall.se/www/vf\\_se/vf\\_se/518304omxva/518334vxrxv/518814vxrxv/518844omxkx/519264radio/519294sxxta/index.jsp](http://www.vattenfall.se/www/vf_se/vf_se/518304omxva/518334vxrxv/518814vxrxv/518844omxkx/519264radio/519294sxxta/index.jsp)

<sup>12</sup> Sigvald Hallberg

<sup>13</sup> Sigvald Hallberg

<sup>14</sup> <http://www.world-nuclear.org/info/inf32.html>

<sup>15</sup> <http://www.world-nuclear.org/how/npreactors.html>

<sup>16</sup> Sigvald Hallberg

saw the dramatic consequences. The former nuclear energy friendly debate took another direction and in 1988 the Swedish parliament decided to start the decommissioning of the first nuclear power plants in 1995-1996. At the same time the importance of not to increase the carbon dioxide emissions was stressed, which evoked the question if Swedish energy policy really was possible to carry out: To phase out nuclear power, not to extend water power, not to increase carbon dioxide emissions and this without any negative consequences for employment and welfare. The decision of 1988 was however discarded and the next decommission decision came in 1997 when the parliament decided to shut down Barsebäck. That was also done, the first Barsebäck reactor was closed in 1999 and the second (and last) was closed in 2005. The owner of Barsebäck, EON (formerly Sydkraft) was compensated through a partnership in Ringhals of 30%.

When we visited Ringhals and spoke to the people working there we expected them to be troubled over the future of the nuclear power industry. We thought that they might be worried about a closedown of Ringhals power plant. Instead they surprised us by telling that they saw nuclear power as a future energy source and that they were expecting new nuclear power plants in Sweden since Sweden is dependent on its nuclear power. The Ringhals employees we spoke to seemed to have a great belief in the future.<sup>17</sup> We were told that Vattenfall has plans to build new nuclear power plants in Sweden and that they will maintain the current power plants as long as it is possible. For example, R2 will have a totally new control room in 2009 - a sign of that Vattenfall invests in Ringhals's future<sup>18</sup>. In their internal news letter their former communications manager is interviewed about the history of the nuclear debate and states that it felt like a knockout when the government decided to go through with the closing of Barsebäck.<sup>19</sup>

The events of 9-11 have influenced the nuclear power industry as well as the rest of the world. One aspect of this is the SKIFS 2005:1 (prescription from Swedish Nuclear Power Inspectorate, SKI) which were issued in 2005, but has gradually started to pertain. The prescription states more restrictive control over the nuclear power plant area to enhance security. The employees are no longer permitted to drive their cars inside the gates, biometric control with finger prints is used for those who shall access the control room, and it is carefully restricted who has right to access the plant area.<sup>20</sup> We experienced the strict rules when we went to Ringhals for this study as we weren't allowed to enter the gates. Luckily they have an information center outside the gates for those who aren't permitted to enter, so we didn't have to stay outdoors. No matter how hard we tried to assert our innocence and non-terroristicness, we had to stay outside the gates.

## **Ringhals**

Ringhals, located 60 kilometers south of Gothenburg, Sweden, is owned by Vattenfall (70%) and EON (30%). Today Ringhals produces 28 TWh each year (which is as much as five or six times the annual energy need of Gothenburg), but are heading towards a production capacity of 32 TWh in a couple of years. Ringhals employs 1480 people, but the number of people working there is actually higher since there are many entrepreneurs at the plant during the annual outages, and also at other times of the year.<sup>21</sup>

With the delivery of the reactor the manufacturer hands over a manual for the power plant. This manual is called Safety Analysis Report (SAR), and it states how the reactor is constructed and what safety levels that are needed. From the

---

<sup>17</sup> Christer Axelsson and Bengt Ljungquist

<sup>18</sup> Sigvald Hallberg

<sup>19</sup> *I strömmen* nr 7

<sup>20</sup> Anders Henoeh, Sigvald Hallberg

<sup>21</sup> Sigvald Hallberg

SAR another document is derived, namely the Safety Technical Specifications (STF)<sup>22</sup>, which is a very important document also called "the Bible" at Ringhals.<sup>23</sup> The STF is recurrently updated by the reactor operators so that it is always up-to-date. Updates of the STF are often motivated by exchange of a component where the new component has other specifications than the former. Every change of the STF must be signed by the reactor manager and announced to SKI.<sup>24</sup> When any of the prescriptions in the STF is violated it becomes an RO (Reportable event), which has to be reported to SKI. Violation of the STF doesn't have to emanate from a human mistake, it is often some limit value of pressure or temperature that has been overridden and therefore has to be reported and adjusted.

However, one human related regulation in the STF is that the minimum number of control room operators allowed is seven. If it falls below seven they have to stop the reactor. Therefore the control room is staffed by eight to ten people 24 hours a day. The control room staff has the global responsibility over the nuclear power reactor. A couple of them are not allowed to leave the room and one of them - the shift supervisor - is in charge over the reactor and the people working there. At R2, the reactor we received most information about, they have seven shift teams with about 10-12 people in each who operates the reactor.<sup>25</sup> The shift teams usually become very close-knit since they work so tightly and sometimes experience stressful situations together.<sup>26</sup>

Every task at Ringhals is highly specified. It might be enough with a high school exam to become a reactor operator, but you have to pass years of internal education before you can be on duty in the control room.<sup>27</sup>

It is quite heavy administration at Ringhals, where mostly tasks mustn't be done without authorization from the control room.<sup>28</sup> As one of our informants says: *The person who wants to just go ahead and fix things immediately, doesn't fit in at Ringhals.*<sup>29</sup> The control room staff has rigorous check lists to go over before they can start again after an annual outage.<sup>30</sup> Despite the heavy instruction dependence, it might still be a space for creativity, not in the performing of tasks, but in the discussion about working methods.<sup>31</sup>

The people we spoke to bore witness about different cultures at the four reactors.<sup>32</sup> There are several explanations to this, but one is that the people of the different reactors work quite isolated from each other. R3 and R4 have the most similar cultures, and this is not surprising since the reactors are identical, so called Mirror Plants. R1 is of another kind than the other three, a BWR reactor, giving them more in common with the reactors at Forsmark and Oskarshamn.

---

<sup>22</sup> Sigvald Hallberg

<sup>23</sup> Sigvald Hallberg, Per Therén

<sup>24</sup> Per Therén

<sup>25</sup> Per Therén

<sup>26</sup> Sigvald Hallberg

<sup>27</sup> Bengt Ljungquist

<sup>28</sup> Sigvald Hallberg

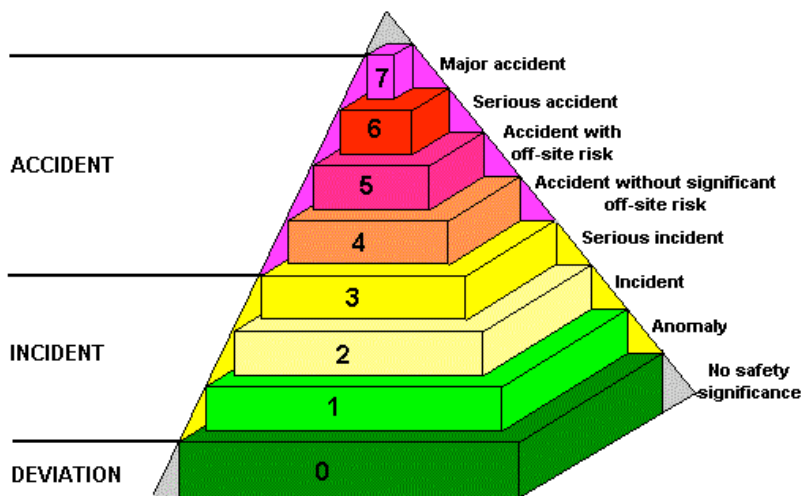
<sup>29</sup> Per Therén

<sup>30</sup> Sigvald Hallberg

<sup>31</sup> Per Therén

<sup>32</sup> Anders Henoeh, Christer Axelsson, Bengt Ljungquist, Sigvald Hallberg, Annika Bergquist, Per Therén

## INES - The International Nuclear Event Scale



INES was introduced by the International Atomic Energy Agency (IAEA) in the 1990s, and is used for facilitating fast communication to the media and the public regarding the safety significance of events at any nuclear installation associated with the civil nuclear industry, including events involving the use of radiation sources and the transport of radioactive materials. Events are classified on the scale at seven levels: levels 4–7 are termed “accidents” and levels 1–3 “incidents”. Events without safety

significance are termed “deviations” and are classified below scale at level 0. Events without relevance to radiological or nuclear safety are termed “out of scale”.<sup>33</sup>

### Wellknown incidents

The accident at Three Mile Island (TMI) near Harrisburg, Pennsylvania (rated 5 on INES) on March 28, 1979, was triggered by a disturbance leading to a reactor trip. A relief valve got stuck in open position, causing a cooling water leakage, which was unnoticed by the operators. The safety system went off, and started to pour out more cooling water. The operators were unable to diagnose or respond properly to the unplanned automatic shutdown of the reactor, and shut the water supply. The core boiled dry and partly melted and the reactor was completely destroyed. There was some radioactive gas released but no human being was injured. The cleanup of the damaged nuclear reactor system took nearly 12 years and cost nearly US\$ 1 billion.<sup>34</sup>

After the TMI accident the industry learned the importance of having several safety systems working independently from one another. Deficient control room instrumentation and inadequate emergency response training was proved to be root causes of the accident. The need for better educated workforce led to the building of simulators permitting operators to learn and be tested on all kinds of accident scenarios. The sad fact is that a similar incident occurred at a reactor at Davis-Besse only six months earlier. With a better system for operating experience feedback, the TMI accident might have been prevented.<sup>35</sup>

The movie *The China Syndrome* had its premiere twelve days before TMI<sup>36</sup> and was considered prophetic by the public.

In Chernobyl the 26<sup>th</sup> of April 1986 (rated 7 on the INES scale) the operators performed a test to determine how long turbines would spin and supply power following a loss of main electrical power supply. The aim was to increase safety. Unfortunately, something went wrong and the reactor was forced to decrease its effect, which makes that kind of reactor less stable. In spite of the risks, they continued experimenting, and had to disconnect some of the safety systems. Within

<sup>33</sup> <http://www-ns.iaea.org/tech-areas/emergency/ines.htm>

<sup>34</sup> <http://www.world-nuclear.org/info/inf36.htm>

<sup>35</sup> <http://www.world-nuclear.org/info/inf36.htm>

<sup>36</sup> <http://www.imdb.com/title/tt0078966/releaseinfo>

seconds, the effect was increased 400 times<sup>37</sup>, the fuel elements ruptured and the resultant explosive force of steam lifted off the cover plate of the reactor, releasing fission products to the atmosphere. A second explosion threw out fragments of burning fuel and graphite from the core and allowed air to rush in, causing the graphite moderator to burst into flames.

Within a week all 161 000 inhabitants living within a 30 kilometer radius were evacuated and later relocated. In the following years a further 210 000 people were resettled into less contaminated areas. Relocations of people were very traumatic and did little to reduce radiation exposure. Psychosocial effects among those affected by the accident can be compared to those arising from other major disasters such as earthquakes, floods and fires. Reliable information about the accident and resulting contamination was not available to affected people for about two years following the accident. This led to major distrust and confusion about health effects.<sup>38</sup>

The lesson learned from the Chernobyl disaster was the need to implement safety culture within the nuclear power plants. The concept of safety culture brought attention to the impact of human factors.<sup>39</sup> There has been thorough experience exchange between nuclear operators in east and west following Chernobyl.<sup>40</sup>

On July 25<sup>th</sup> 2006 a reactor was shut down after an incident at the Swedish Nuclear Power Plant Forsmark. It all started with a loss of offsite power. Within seconds, both turbines tripped, causing a complete reactor scram. The critical issue was to keep the reactor cooling running. This part of the safety system at Forsmark had three independent weaknesses, and all three happened at the same time!<sup>41</sup> Talk about bad luck... Fortunately, the shift team had dealt with situations similar to what actually occurred, in the simulator training, and applied their knowledge correctly (according to the company responsible for the simulator training). Within 22 minutes the whole thing was over. There was a happy ending to the incident, which was classified INES 2, but the public was concerned about the weaknesses in the safety systems. Vattenfall later admitted safety shortcomings<sup>42</sup>, and the Swedish government decided to let the IAEA supervise Forsmark.<sup>43</sup> Besides the bad publicity, this incident was very expensive, since four reactors<sup>44</sup> had to close for almost two months at a total cost of nearly 2 000 000 000 SEK<sup>45</sup> in lost incomes.

### **Surveillance - Big Brother IRL<sup>46</sup>**

A decade after the atomic bombings that ended the WW2, the U.S. President Eisenhower's "Atoms for peace-speech" to the UN General Assembly led to the creation of IAEA. This initiative was a signal that it was time to release the secret knowledge of nuclear technology for peaceful use, also knowing that a supervising authority would be required to maintain that state. Although IAEA is under the wings of the United Nations and reports annually, it is an independent organization.

---

<sup>37</sup> Anders Henoeh

<sup>38</sup> <http://www.world-nuclear.org/info/chernobyl/inf07.html>

<sup>39</sup> Christer Axelsson

<sup>40</sup> <http://www.world-nuclear.org/info/chernobyl/inf07.html>

<sup>41</sup> Ringhals had already fixed the problem with the safety system shortfall, long time before the Forsmark incident...

<sup>42</sup> <http://www.mandarinab.com/windowsmedia/HansvonUthmann.wmv>

<sup>43</sup> <http://www.analys.se/lankar/Bakgrunder/2007/Bkg%201-07%20Forsmark%20Eng.pdf>

<sup>44</sup> Forsmark 1, Forsmark 2, Oskarshamn 1 and Oskarshamn 2. Since other reactors were supposed to have the same safety weakness, they had to be stopped for reconstruction.

<sup>45</sup> SVT Rapport 2007-01-15, <http://mobil.svt.se/svt/jsp/Crosslink.jsp?d=22620&a=762256>

<sup>46</sup> IRL is short for In Real Life

The agency works with its 144 member states to promote secure and peaceful nuclear technologies. Over time the prospects for nuclear power have been varying. According to IAEA, nuclear power held a strong position in the mid 70's as a result of commercially available technology and the oil crises, with a drastic decrease of public acceptance in the wakes of Chernobyl.<sup>47</sup> Others would say that the resistance against nuclear power was significant at an earlier stage, especially after the TMI-accident.

On national level in Sweden the supervision is mainly carried out by the Swedish Nuclear Power Inspectorate (SKI). Since 1974 SKI have worked on behalf of the government to ensure that the power plants follow the regulations of the Act on Nuclear Activities (SFS 1984:14). Inspections and reviews are important tools for SKI to ensure that the power plants take their responsibility to perform the operations in a safe manner. If the power plant fails to live up to the standards set, SKI can decide to cancel the licensee's right to conduct nuclear activities, until they have taken the measures needed. SKI is also the agency responsible for reviewing the planned waste program.<sup>48</sup> In June 2008 SKI will merge with SSI, Swedish Radiation Protection Authority.<sup>49</sup>

Partly because of the Forsmark incident 2006, the Swedish government mandated SKI to request an international safety inspection from IAEA, according to a press release in March 2007. The Operational Safety Review Team (OSART) will visit all Swedish power plants, for approximately three weeks each, to study steering documents and to interview staff on each plant.<sup>50</sup>

Consequently, IAEA and SKI are external inspectors, the former on international and the latter on national Swedish level. Besides that, WANO (World Association of Nuclear Operators) was created after Chernobyl as the nuclear operators realized that what happens in one country affects other countries. WANO consists of almost all the nuclear power plants in the world and allows the members to exchange operating experiences without feeling the pressure from external authorities. Therefore, WANO has no governmental associations or commercial ties. The members pay a fee and can then with open mind do peer reviews and exchange knowledge across the borders. An inspection from WANO is performed on initiative from the power plant itself. Not even SKI is allowed to read the full report, although they are the ones in position to set back the entire operation if needed. However, according to our respondents, the nuclear power plant usually serves on the relevant information to SKI.<sup>51</sup>

To put it short, IAEA inspect the plant in more general terms while WANO aim to cover the activities all the way down to "blue-collar workers". In June 2009 Ringhals will welcome WANO for a voluntary inspection.<sup>52</sup>

## Learning tools at Ringhals

Since our initial question for this thesis was how learning is occurring at Ringhals, it would appear irrational not to present our findings in this topic. These five explicit learning tools were presented to us at Ringhals: Introduction to New Employees, Simulator Training, Competence Analysis, Experience Feedback and the Program for Competence Transfer. Some of the sections contain many abbreviations, see footnotes for explanation. There is also an abbreviation list in the end of the thesis.

---

<sup>47</sup> <http://www.iaea.org/About/history.html>

<sup>48</sup> [http://www.ski.se/extra/tools/parser/index.cgi?url=/html/parse/index\\_en.html&selected=2&mainurl=/page/5/2.html](http://www.ski.se/extra/tools/parser/index.cgi?url=/html/parse/index_en.html&selected=2&mainurl=/page/5/2.html)

<sup>49</sup> Christer Axelsson and Bengt Ljungquist.

<sup>50</sup> <http://finans.regeringen.se/sb/d/8827/a/78854>

<sup>51</sup> Christer Axelsson

<sup>52</sup> Christer Axelsson



### **Introduction for new employees - newbie training**

When new employees are recruited to the plant, there is a compulsory introduction program spread on 12 occasions as a minimum, but it is not uncommon with more. Every training course last for everything from a few hours to a couple of days. The compulsory program contains courses about protection, environment, safety culture and cardiopulmonary resuscitation. Depending on what position the new employee is to attend further courses are assigned.<sup>53</sup>

### **Simulator training - preparing for the worst case scenario**

Simulator training is an important part of the education of the control room staff, and they have to do simulator training at least twice a year. The simulator is an copy of the control room, thus there are three simulators, since R3 and R4 are mirror plants.<sup>54</sup>

In the simulator the reactor operators practice different kinds of events. The control room staff is never prepared to what kind of event will be practiced, but the training is usually based on some recent event at nuclear power plants around the world. For example, all the Swedish reactor operators have practiced the Forsmark incident. The situation in the simulator is designed to be as realistic as possible, and the Ringhals employees we spoke to confirm that sometimes you don't know if you are in the simulator or in a real situation.<sup>55</sup> The training is filmed and a training leader is watching the control room staff to give feedback later.<sup>56</sup>

### **Competence Analysis - what do you know and need to know, anyway?**

After pressure from SKI, Ringhals reestablished their competence management system and made it more structured. Today there is a requirement profile for each position, where it is stated what kind of skills are needed for the position and to what extent the employee needs to master the skills. This is compared to the competence profile of the employee. The competence profile is followed up regularly in dialogue with the employee and the employee's boss. If a gap is found between current skills and needed skills, the employee is assigned to appropriate courses.<sup>57</sup>

Creating the competence profiles was a voluminous work. The personnel department held group sessions for a couple of days with every division of the organization where the division's mission, responsibility and knowledge and skills needed to accomplish that mission and responsibility were discussed. The discussion then boiled down to which positions that were needed and what kind of knowledge and skills that were needed on those positions. Goal profiles were created for every position in the organization. In the requirement profile every skill is measured on a 0-6 scale. The massive work seems to pay off since the concept works well, according to our respondent.<sup>58</sup>

### **Operating Experience Feedback - avoiding hangovers**

WANO stands for a good deal of the international experience feedback, through its four main programs: Operating Experience, Peer Reviews, Professional and Technical Development and Technical Support and Exchange.<sup>59</sup> We will focus on Operating Experience Feedback as it is carried out locally at Ringhals. Our main information source is interviews held with Ringhals employees.

---

<sup>53</sup> Annika Bergquist

<sup>54</sup> [http://www.vattenfall.se/www/vf\\_se/vf\\_se/518304omxva/518334vxrxv/518814vxrxv/518844omxkx/518874sxker/519054simul/index.jsp](http://www.vattenfall.se/www/vf_se/vf_se/518304omxva/518334vxrxv/518814vxrxv/518844omxkx/518874sxker/519054simul/index.jsp) retrieved 2008-05-09

<sup>55</sup> Bengt Ljungquist and Christer Axelsson

<sup>56</sup> Anders Hénoch

<sup>57</sup> Annika Bergquist

<sup>58</sup> Annika Bergquist

<sup>59</sup> [http://www.wano.info/WANO\\_Programmes/Programmes.asp](http://www.wano.info/WANO_Programmes/Programmes.asp) retrieved 2008-05-12

At WANO's inspection of Ringhals in 2005, the internal experience feedback at Ringhals was criticized. After WANO's report the management of Ringhals decided to create a new division, which was launched in March 2008 and got the name RQH<sup>60</sup>. RQH's main working areas are internal experience feedback, safety culture, deviation management, analysis, process development, MTO<sup>61</sup> investigations and error prevention. The plan is to make Ringhals the leader of operating experience feedback in the nuclear power industry within five years. Of course these issues have been alive in the organization also before the start of RQH, but now those people who have shown big interest in the issue of experience feedback are gathered under one roof. SKI sees RQH as a help in its work with inspecting the nuclear power plant, since RQH will cooperate with SKI.<sup>62</sup>

The RQH people we spoke to are enthusiastic about the task to improve internal experience feedback at Ringhals. More than half of the things WANO pointed at in their report was things that the internal audit already knew, but it hadn't been taken seriously by the rest of the organization. SKI's complaints are also taken more seriously than complaints from the internal audit. The Forsmark incident in July 2006 has given additional weight to the internal experience feedback issues.<sup>63</sup>

An ERF<sup>64</sup> group consisting of representatives from different parts of the organization is meeting every week. The ERF group considers several kinds of input:

- Work related injuries and mishaps.
- RIO<sup>65</sup> - when someone has observed something that might become a risk. RQH hopes to soon implement Near Miss, which is when someone is close to make a mistake, but luckily didn't.
- An MTO investigation is done when an INES-1 incident is caused by human error. (Since such severe incidents are unusual, the reactor management can decide that an MTO investigation has to be done anyway.)
- Internal audit.
- RO<sup>66</sup> means an event that violates the STF<sup>67</sup>, for example open fire doors. When an RO happens a Licensee Event Report must be written and distributed to SKI. At Ringhals 200-300 ROs use to happen each year.<sup>68</sup>
- Internal Experience Feedback
- External Experience Feedback

RQH produces ERF leaflets once a week containing information about important experiences and how to avoid common errors. The ERF leaflets are stored at the local intranet, visible to the entire Ringhals organization. RQH has made an explicit decision not to e-mail it out to the employees, since they don't want to flood people with information. RQH's expectation is that people who are about to do a specific job enters the intranet and reads the specific ERF leaflet that concerns the job. The ERF leaflets then will work as a database of information. According to Christer Axelsson the

---

<sup>60</sup> short for Ringhals Quality Human Performance

<sup>61</sup> short for Man, Technology and Organization

<sup>62</sup> Christer Axelsson and Bengt Ljungquist

<sup>63</sup> Christer Axelsson and Bengt Ljungquist

<sup>64</sup> ERF is short for the Swedish word for Operating Experience Feedback

<sup>65</sup> RIsk Observation

<sup>66</sup> Reportable Events

<sup>67</sup> Safety Technical Specifications

<sup>68</sup> Christer Axelsson and Bengt Ljungquist

ERF leaflets have been positively received, but none of the eleven people we spoke to at the kickoff before the annual outage had read them. Perhaps the phenomenon is still too new to be evaluated.<sup>69</sup>

The RQH people also states the importance of discovering errors at an as early stage as possible. By referring to the Bird triangle<sup>70</sup> they showed that for every severe event there are 10-30 less severe events, and for these there are 30-600 minor events, and for these there are 600-1000 really trivial events, like near misses or risk observations. If the trivial events are dealt with at an early stage, more severe events can be prevented. By asking 'why' and follow the origins of the errors one can prevent the serious events. According to WANO it is recommendable to have 1000 Near Miss Reports each year per reactor. At Ringhals they currently have about 500 for the entire plant. The goal is to reach 5000 Near Miss Reports in a near future. In order to increase the reporting RQH is working with education (for example a course named "Five times why"), coaching and culture (they have identified a Nordic culture based on similar problems within the Nordic power plants). They try to establish an atmosphere without need for scapegoats. In Sweden they call it "no blame culture", a Swedized variant to the counterparts in the UK and US where they call it a "blame tolerant culture".<sup>71</sup> Same same, but a little different perhaps? In reality you cannot disregard the fact that the word will spread and soon many people inside the plant will know if someone makes a mistake, but the formal picture is that blaming doesn't occur since no one will benefit from that. The question about anonymous reporting was raised at the kickoff before the annual outage at R2. The questioner was suggested to choose the paper form, instead of reporting on the intranet, and leave the name field blank. On the other hand one of the fundamental ideas with submitting one's name on the report is the possibility to follow up the errand. The gathering of people at the hall were assured that there will occur no sanctions for those who report RIOs and other events.

At the kickoff previously mentioned the employees were told about last year's outage when a communication problem caused 4,5 days longer outage time. With the help of HU-cards<sup>72</sup>, the employees will improve their communication so that such errors won't be repeated. The HU-cards consists of three plastic cards of credit card size that is to be carried around the neck. The cards include check lists on what to consider when attending a PJB<sup>73</sup> and what alphabetic names to use when spelling a word for someone in a noisy environment. The HU-cards are a brand new tactic to improve communication, increase reporting of RIOs and to give the employees the courage to stop a project if they sense something wrong. At the same occasion as this message was communicated, the employees were encouraged to make a safe and fast annual outage. One funny thing about the HU-cards is that one of the cards states that one should use well-recognized nomenclature, a word few of the people attending the kickoff understood. To use well-recognized nomenclature is to use words that other people understands, which obviously wasn't done on the HU-cards.<sup>74</sup>

The operating manager whom we have spoke to welcomed the new division by saying that experience feedback is difficult but important, and that it is good with a separate division to handle those issues. Since the four reactors have significantly different cultures the new division can help to work with experience feedback in a similar way. He is not sure that RQH will unburden the managers, on the contrary it might generate more work for them too.<sup>75</sup> But, as everybody says: safety first!

---

<sup>69</sup> Christer Axelsson and Bengt Ljungquist, people at the R2 outage kickoff 28th April 2008

<sup>70</sup> [http://www.ski.se:80/dynamaster/file\\_archive/070514/84a47ac0b5305268da2cb2fe2bedd5d0/web%5f2007%2d16.pdf](http://www.ski.se:80/dynamaster/file_archive/070514/84a47ac0b5305268da2cb2fe2bedd5d0/web%5f2007%2d16.pdf)

<sup>71</sup> Christer Axelsson and Bengt Ljungquist

<sup>72</sup> HU is short for Human Performance

<sup>73</sup> PJB is short for Pre Job Briefing, a meeting held before starting a new project.

<sup>74</sup> Christer Axelsson at R2's kick-off before the annual outage 2008

<sup>75</sup> Per Therén

## **The program for competence transfer - newbies playin' with the big boys**

No matter how good experience feedback works, it won't serve the organization if the knowledge walks out the door inside a retiring person's head. The need for a program for knowledge transfer, to keep the tacit knowledge within the corporation, originated from an increasing need to bridge the generation gap. Lars Nylander, manager at the division RUM<sup>76</sup> and Mats Eriksson from the University of Gothenburg formed a project where thirteen elderly employees were involved in recruiting their successor (an engineer or technician usually aged between 20 and 35, newly employed at Ringhals or, in some cases, formerly working with different functions). For approximately a year the tutor and the successor will work side by side. The tutors are educated in order to communicate their tacit knowledge before their retirement and the successors should document what they learn.

The competence transfer program focuses on three levels:

1. The successor's learning process, where he (so far there are no females involved) should, through theoretical and practical education, obtain the skills from an experienced employee and make them his own skills.
2. A group oriented learning process, where the specific competence of every employee becomes available and useful for the entire team's competence development.
3. The tutor's learning process during the elicitation of the specific tacit knowledge.

At present, the project is half way through and it seems to work out very well for most of the participants. When the pilot year ends in November, the project will be evaluated and improved. The plan is to make it permanent.<sup>77</sup> So far, the most obvious weaknesses are, that the successors are not trained to ask the right questions to enable the knowledge transfer, and that there are no time set apart for the documentation. The documentation binder was supposed to become the employee's "Bible", which may be threatened by the fact that acute problems always win over documentation.<sup>78</sup>

The program for competence transfer has been positively received by the retiring employees, even though several of the participants have expressed anguish over how to explain the unseen problems at the plant. Leif Bosson, one of the participating tutors, feels very content and honored to be given the opportunity to end his long career in this fruitful way. He feels that he has done his best, and that Ringhals has appreciated his contribution.

## **Analysis**

On our journey through a scrubby landscape of fission, field studies and learning we have now arrived to the analysis part of this thesis, which we have chosen to separate into three parts in line with our problem analysis. We want to pour down our observations, mixed with additional theory and own thoughts, into a pressure cooker where an explosive meltdown hopefully will result in some interesting conclusion. Enter at own risk!

## **New Institutional Theory**

We assume that most nuclear power plants would like to appear as the top of the line. At the same time they want the complete line to be on top, since the whole industry will benefit from that. The nuclear power industry is good at benchmarking<sup>79</sup>. Through control agencies, e.g. WANO, they receive feedback on how well they are doing. Røvik

---

<sup>76</sup> RUM is short for Ringhals maintenance and mechanics.

<sup>77</sup> Lars Nylander

<sup>78</sup> Mats Eriksson and Leif Bosson

<sup>79</sup> Benchmarking means comparing to competitors and best practice, with the intention to improve the own organization.

describes organizational recipes as management trends traveling across the globe. The recipes are seldom total solutions for an entire complex organization, but rather building blocks. These are often general ideas and must be interpreted and clarified within the organizations before taken in use (Røvik 2000:16). The division RQH serves as a recipe interpreter for Ringhals, catching and sorting traveling recipes and deciding which ones to implement. With their general view over the international nuclear power industry WANO and IAEA serve as a recipe database for the industry. By distributing trends and recipes they contribute to conformity and isomorphism in the nuclear power industry. The recipe distributors also have power to decide what is correct and rational. Jackson and Carter (2000) argue that knowledge cannot be separated from power, i.e. if we assume that agencies like IAEA have the superior power over the power plants, they also have the power to dictate what knowledge is (i.e. they rule the discourse<sup>80</sup>) and therefore what recipes should be used. The internal audit got no response when they highlighted disproportions, but when WANO said the same thing - measures were taken relatively fast, which is another example of that WANO is powerful in the discourse.

As you probably already have noticed, we have been inspired largely by the old-established<sup>81</sup> new-institutional thoughts from the late 1970s. An interesting issue linked to Meyer and Rowan's idea of *decoupling* (Meyer and Rowan 1977:357, 359) is that a decoupled organization is likely to avoid inspections, or at least make the inspections more ceremonial. When we compared this with Ringhals's welcoming of the WANO inspection in June 2008 we initially became confused. But there are possible explanations as we soon realized. One is that the WANO report will not be public. Not even SKI will have access to it, which makes the report less "dangerous" in institutional terms. Another explanation might be that Ringhals uses the same strategy as IKEA's founder Ingvar Kamprad; to tell the "whole" truth to avoid further questions (Kamprad 1999). A third aspect is that the correct answer to our question about the WANO inspection of course would be that WANO is very welcome. To keep the good facade and give the correct answers to curious thesis-writing students is the least duty the Ringhals employees should fulfill to be good organizational participants.

When a new-institutional perspective is planted on organizational theory emphasis is put on organizational structures and processes within organizational fields. These fields are characterized by organizations that are in some way related to each other, for instance as competitors in the same business, producers, suppliers, customers et cetera. DiMaggio and Powell suggest that "the field idea comprehends the importance of both connectedness and structural equivalence" (DiMaggio and Powell 1991:64). Based on that, we consider the nuclear power plant industry as an organizational field, where all the nuclear power plants are equal organizations connected to each other through their collective mission and values. One might dare to say that the field is almost a world on its own where the participants are more dependent on each other than the surrounding world. We found one sign of this in the staff magazine at Ringhals, where the former head of the information department commented that the closedown of the nuclear power plant in Barsebäck was like a hit in the face.<sup>82</sup> Taking into account that the closedown was hammered by the government already in the 1980s, the unexpected effect could seem a bit odd. On the other hand, decisions made by the government have been changed before and could therefore explain the glimpses of hope that seemed to exist in that matter. When we asked Bengt Ljungquist how the uncertain future of nuclear power plant affects the daily activities and planning at Ringhals he looked at us like he did not understand the question. Apparently no threat was in sight and the world's uncompromising demand for electricity combined with environmental advantages (speaking of carbon dioxide emissions) granted the continued existence for the nuclear power industry.

---

<sup>80</sup> Discourse in the sense of "who can say what, where and how - and why" Jackson and Carter (2002:65ff)

<sup>81</sup> Two thirds of our group are born after the release of Meyer and Rowan's classic article. The third of us was two years old at that time.

<sup>82</sup> *I strömmen*, nr 7, 2007, page 11

Since Ringhals doesn't sense any threats, they can fully focus on the search for a balance between safety and profitability. We got the impression from our respondents that the executive group earlier have favored being profitable but have now started to sway over to focus on safety work. The strongest argument from the safety advocates appears to be that money spent on safety work leads to higher profitability. One may also guess that WANO's report perhaps has contributed to this development. However, a company cannot survive without being profitable in the long run - but without a safety work (especially in this industry), no profit will be gained. Being rational could mean to communicate to external parties that both safety and profitability are given full attention, while some kind of golden balance between the two is held internally, e.g. as in the idea of decoupling.<sup>83</sup> As Jackson and Carter (2002) reckons, rationality is one of the most important, and at the same time criticized ideas when studying organizations, yet so little explored. In the search for legitimacy, being rational is crucial since it is the keystone to acceptance. Most people consider themselves as being rational and that it is a desirable quality. Since everyone has different preferences, it might not be easy to know whose rationality is the most rational one. According to Jackson and Carter (2002) the most rational rationality to adopt is the one belonging to the most powerful authority.

The creation of RQH is a way of showing rationality and power of action. Since all the divisions until now have worked with safety issues more or less like isolated islands, it seems very rational to have someone coordinating them and make them strive in the same direction. If RQH creates legitimacy, does that make the previous way of working illegitimate? There is a prevailing idea in our society, that the new is better than the old, which makes change preferable to status quo. Some scholarly critics argue that the myth of the rapid rate of change legitimates frequent organizational changes. They also question whether the rate of change really is that rapid (Ohlsson and Rombach 1998). Ahrne and Papakostas (2002:88) uses the term inertia to describe organizations, which implies that change occurs slower than people think. Inertia is disliked by both conservatives and radicals (to the conservatives even a slow change is too rapid, and the radicals want more drastic changes). Without necessarily being better, the new gets more attention than the old, which might make it more legitimate. Since RQH is a new function they can initially work undisturbed without pressure to present immediate results. They can argue that it is so new that the effects of their work<sup>84</sup> will not show until later (whenever later is). Maybe when the day called later comes, it is time to launch a new division to improve the safety work and at the same time create legitimacy. Røvik's (2000) thoughts of traveling recipes could be a way to explain this phenomenon with basically the same product but with a new denotation (which Ringhals likes). RQH does not yet have an extended menu, but at the kickoff we were served a delicious antipasto shaped like HU-cards. This recipe won't make the hunger disappear, but it works as an appetizer.

The fact that SKI claimed a more structured competence management can be interpreted in two different ways, in accordance with Røvik's instrumental and symbolic perspectives. The instrumental perspective is derived from the rational-instrumental tradition with a strong belief in change. According to the instrumentalists the legitimacy of organizations is inevitable linked to its ability to be efficient. The symbolic perspective, on the other hand, means that the legitimacy of the organization depends on its capability to incorporate modern institutional ideas. The instrumentalist identifies a problem, and then finds a solution that fits, while the symbolist finds a recipe that generates legitimacy, and implements it into the organization. So, if we apply the instrumental perspective on SKI's requirements and try to see it "the way it is": SKI wants Ringhals to structure its competence management in order to enhance the control over the competence. But, one could also see it in a more symbolic or semiotic way: SKI wanted Ringhals to

---

<sup>83</sup> Even though it seems fantastic to find a golden balance, it is difficult to avoid ambiguous messages, e.g. when the people at the kickoff were told that they had unlimited time for reporting, but still were to perform a really quick outage.

<sup>84</sup> Like people using the ERF leaflets. The RQH people stated that the ERF leaflets had been positively received, but we suspect that the number of people reading and using them is still quite modest.

use an appropriate and legitimate recipe for competence management. That would generate legitimacy for the Swedish nuclear power industry, as well as for the surveillance agencies like SKI.

## Disciplining

By its very nature, the nuclear power industry is characterized by “low probability-high consequence” in terms of risk. As we have seen, this has led to a rigorous surveillance, both for the Ringhals organization and its individuals. The organizational surveillance is carried out by SKI and IAEA et al. There is a broad spectrum of different kinds of disciplining and surveillance, but we have chosen to focus on the disciplining on the individual level. Foucault (2003:139-140) sees the modern disciplining as an indirect mean of power practice. The disciplining aims to school the employees, and in order to do so several methods are used. Foucault’s disciplining (2003:143) starts with the art of distribution, in which the first step is separation from the outside world. This is easily seen at Ringhals, where we weren’t even allowed to get inside the gates. The new restrictions from SKI (SKIFS 2005:1) that among other things forbid the employees to park their cars inside the gates is another example. When you approach a nuclear power plant, the difference of being inside and outside becomes extremely clear, which is a part of the disciplining according to Foucault. To create a difference between in and out, uniformity is created through introduction to new employees. This is made in order to learn explicit knowledge, but also to be introduced to the culture. Or to the cult? Senge (1990) writes about alignment, where the employees are schooled into a cult(ure?). After receiving isomorphic answers from everyone we have been speaking to, we suspect that there might be a pinch of “brainwashing” at Ringhals. Another sign of this is a movie on YouTube, where Vattenfall employees perform the “Vattenfall Song”<sup>85</sup>. How did they make the people dance like that? We can’t understand it in other terms than with the help of brainwashing (or a strong corporate culture if you prefer) and group pressure. A good way of marking that people belong to the same organization is to make them carry three colorful plastic cards (remember the HU-cards) around their necks. This might generate a pride of belonging to the cult(ure) and shows the outer world that you are an important member. At least, we felt very important and grew two inches when were given the cards! If only they had used adequate nomenclature, the happiness would have been overwhelming...

The second step of the art of distribution, according to Foucault (2003:145), is the division of space. Every individual has a place, and every place has an individual, and the constant knowledge of where every individual is located is an important issue to the disciplining. To get inside the control room you need to pass a biometric control, where your finger prints will be identified, which reminds you of the fact that someone knows where you are (or Big Brother is monitoring you). Another sign of this is that the simulator training is filmed and analyzed, and that the control room staff is aware of being monitored. The monitoring and measuring of everyone’s behavior and the appreciation, rewarding or punishment of it is an important part of disciplining according to Foucault. Traits of these are seen in the Competence Analysis system, where a tremendous measuring is performed. A structuring and standardization of knowledge, such as Gap analysis, could also be seen as a way of making the competence management appear more technical, as the engineers did according to Shenhav (1999)<sup>86</sup>. Thus, rationality, and with that legitimacy, is obtained.

Inside the control room, the operators (at least some of them) are not allowed to leave their posts, which comports with Foucault’s (2003:145) third step of the art of distribution: the functional locations. If there are not enough operators

---

<sup>85</sup> See for yourself: <http://www.youtube.com/watch?v=mi4gL9HnokA>

<sup>86</sup> At the same time this thesis is written, Forsmark is recruiting a “MTO engineer”, but according to the Job Ad, relevant education is a degree in behavioral sciences. <http://pb.ams.se/Standard/SokViaYrke/VisaPlatsannonserViaYrke.aspx?ids=1326592&yo=1&yg=2414&returntour!http%3a%2f%2fplatsbanken.arbetsformedlingen.se%2fStandard%2fSokViaYrke%2fSokresultatViaYrke.aspx%3fq%3ds>

available, the reactor must be shut down. This fact in itself has a disciplining impact on the operators, who feel obliged to be present and punctual.

The fourth part of the art of distribution means that everyone is interchangeable. Since the required qualifications for the employees are very specialized, we don't see the disciplining here. Specialization should counteract interchangeability, since it takes a long time to create a specialized employee, who then becomes unique and hard to replace. However the specialization might lead to a greater extent of power over the workforce, since the employees might become less attractive on the general labor market after a certain time period in the Ringhals organization. The advantage for Ringhals is enhanced control over the employees, while the employees might have more disadvantages, i.e. they get stuck in the system.

When writing this thesis we discussed whether control of activities, Foucault's second part of disciplining, is relevant in this context, but came to the conclusion that this kind of disciplining is omnipresent in most of today's organizations. It is thus nothing that distinguishes the nuclear power industry, whereupon we chose to exclude it.

Foucault mentions the "God sees you"-text written in black charcoal on the wall<sup>87</sup>, but in this modern organization it's more likely written in their minds - or perhaps written in invisible ink on the glass window facing the control room. Rather than "God sees you" it states "a reactor trip costs 4 millions SEK". Wessblad (1998:191 ff.) writes about the operator who caused a reactor trip and in spite of the outspoken no-blame culture felt terribly guilty. This "invisible" and mental punishment is probably worse than corporal punishment.

We have also been able to watch elements of panopticism at Ringhals. Foucault (2003:196 ff.) writes about the panopticon as a way of surveillance, where the surveilled people are aware of being surveilled, but they never know exactly *when* the surveillance is active. In the panopticon, which is the architectural expression of panopticism, there is only one inspector, but in reality the number of inspectors might exceed that widely, since every colleague is a potential inspector. The program for knowledge transfer is also a seedbed for mutual surveillance, since the tutors and newbies walk side by side, supposedly watching each other. Every step should be monitored, classified and documented...

## Learning

Even if people are isomorphic and disciplined they still make mistakes, they still have a free will which in some situations might be problematic. According to WANO's newsletter *Inside WANO*<sup>88</sup> the human being on average commits six errors per hour. Since mistakes are unavoidable they have to cope with that fact and try to do the best of it. There are two possible strategies: to ignore mistakes or to learn from them. As we already stated in our problem analysis, the prerequisite for learning from a mistake is that it is known. The reporting is therefore crucial and it is important that people know how to report, and feels comfortable with it. This requires information on how the reporting should be done, but also a culture where people dare to report.

People afraid of reporting is not a new issue. So called whistle-blowers - people who alerts on disproportions in organizations - often experience discomfort.<sup>89</sup> The shift supervisor Jack Godell, in the movie *The China Syndrome* (1979), who lost his life in the struggle for safety is a drastic and imaginary example. An indication of that it might be

---

<sup>87</sup> Foucault (2003:296)

<sup>88</sup> *Inside WANO* Vol 14 No 3 2006, page 8 [http://www.wano.org.uk/WANO\\_Documents/Inside\\_WANO/Vol14No3/Vol14No3\\_en.pdf](http://www.wano.org.uk/WANO_Documents/Inside_WANO/Vol14No3/Vol14No3_en.pdf)

<sup>89</sup> [http://www.fas.forskning.se/fas\\_templates/Page\\_\\_\\_1369.aspx](http://www.fas.forskning.se/fas_templates/Page___1369.aspx) retrieved 2008-05-19



worse in other industries can be found with Ödegård (1999), who compares health care with the nuclear power industry and the offshore industry. She concludes that the two latter has a far better safety climate than the former. The nuclear power and offshore industries try to fix the errors, while the health care is concerned with trying to find a scapegoat. Perhaps Ödegård's results tell us more about how the health care works (or doesn't work), than how the nuclear power industry works. The lame rabbit still wins over the turtle. (Borglin, Lindell and Lindström 2008:25)<sup>90</sup>

The design of the reporting system might as well influence the reporting tendency. SKI has identified three types of reporting; anonymous, open and confidential.<sup>91</sup> One could argue that it would be wise to have an anonymous reporting system, to maximize the reporting tendency. At Ringhals they have chosen to have an open reporting system, which in some cases can become anonymous i.e. if the employee chooses the paper form and leaves the name field blank. The argument for the open reporting system is that it should be possible to follow up errands. However, even if the reporting system would have been anonymous, there are indicators of that people anyway would find out who did the mistake, or left the crucial report. This problem will always prevail in an industry where one single mistake can cost 4 MSEK<sup>92</sup>. A fundamental prerequisite for a great will of reporting is the "no-blame" culture, it is crucial that the reporter is granted immunity and there must be neither disciplinary nor legal consequences for him/her.<sup>93</sup> An interesting idea would be to flip the reasoning: Perhaps legal consequences for the person omitting reporting would be a tool to increase the number of reports?

Dealing with technical problems have been a speciality at Ringhals in the past, but in fact, it is the human factor that commits most mistakes, and the most serious ones. TMI, Chernobyl and the Forsmark incident were all caused by the human factor. With a good reporting system from the Davis Besse reactor, TMI would have been prevented, and Ringhals had already fixed the problem with the safety system shortfall causing the Forsmark incident. Obviously there has been a lack of communication. Afterwards, the incidents mentioned above have led to a certain extent of organizational learning in the industry and has probably prevented other major incidents and accidents. But is it possible to react before an accident or incident occurs? The people at Ringhals believe it is, if near misses are dealt with at an early stage, and if every incident or risk observation is followed by several "Why's?". This can reveal more complex liaisons, where one sometimes can question the entire organization's ability to learn from experience and knowledge.<sup>94</sup> It all comes down to the famous balance between profitability and safety. On the message board at RQ, they have a note that says:

Those striving for safety shall receive a cost-effective plant. But those striving for cost-effectiveness will encounter catastrophe.

In hindsight, you don't have to be Einstein to agree with this statement. Mistakes tend to be expensive to repair, money better spent on operating experience feedback. However this is obviously not always that easy in reality. As Eriksson-Zetterquist (2007) writes (referring to Turner and Pidgeon), some occurring threats will be discovered and prevented, while others are neglected. The reasons why the threats are neglected, are that they are not discovered, too heavy

---

<sup>90</sup> As long as you have a correct reference, you are entitled to say whatever you want, right? This is something we have learned during 49 years of education, of which 12 years were at the university.

<sup>91</sup> Bo Renborg, Klas Jonsson, Kristoffer Broqvist and Sven Keski-Seppälä (2006) SKI Rapport 2007:16 Hantering av händelser, nära misstag, p 23. Available: [http://www.ski.se:80/dynamaster/file\\_archive/070514/84a47ac0b5305268da2cb2fe2bedd5d0/web%5f2007%2d16.pdf](http://www.ski.se:80/dynamaster/file_archive/070514/84a47ac0b5305268da2cb2fe2bedd5d0/web%5f2007%2d16.pdf) retrieved 2008-05-19

<sup>92</sup> 170 000 SEK times 24 hours is approximately 4 millions.

<sup>93</sup> Bo Renborg, Klas Jonsson, Kristoffer Broqvist and Sven Keski-Seppälä (2006) SKI Rapport 2007:16 Hantering av händelser, nära misstag, p 8. Available: [http://www.ski.se:80/dynamaster/file\\_archive/070514/84a47ac0b5305268da2cb2fe2bedd5d0/web%5f2007%2d16.pdf](http://www.ski.se:80/dynamaster/file_archive/070514/84a47ac0b5305268da2cb2fe2bedd5d0/web%5f2007%2d16.pdf) retrieved 2008-05-19

<sup>94</sup> Bo Renborg, Klas Jonsson, Kristoffer Broqvist and Sven Keski-Seppälä (2006) SKI Rapport 2007:16 Hantering av händelser, nära misstag, p 34. Available: [http://www.ski.se:80/dynamaster/file\\_archive/070514/84a47ac0b5305268da2cb2fe2bedd5d0/web%5f2007%2d16.pdf](http://www.ski.se:80/dynamaster/file_archive/070514/84a47ac0b5305268da2cb2fe2bedd5d0/web%5f2007%2d16.pdf) retrieved 2008-05-19

workload, if the threats were discovered, they would cost too much time, money and energy to fix and most people consider the threat unlikely to develop into something really dangerous. Thus it is difficult to distinguish which near misses, risk observations and other early signs that should be taken seriously - if they are even observed.

Walking side by side, learning what to consider important to deal with, is one of the goals with the program for knowledge transfer. One challenge with such a “transfer” is that it is impossible (maybe not even desirable) to transfer knowledge in the same way as you transfer money, e-mail or electricity. What is received is an interpretation of the sent package, and therefore not identical. Neither is it possible to control the individual factors that contribute to learning, such as motivation, interest and learning pace. Von Krogh, Ichijo and Nonaka (2000) stress the fact that knowledge can only be enabled, not managed. Knowledge enabling includes a mixture of deliberate decisions and going with the flow<sup>95</sup>. They suggest three actions for building a good foundation for knowledge enabling<sup>96</sup>:

1. Creating trust - breed a sense of mutual dependence, make reliable behavior part of performance reviews and increase individual reliability by formulating a “map” of expectations.
2. Increasing active empathy - emphasize and invest in listening behavior for the organization’s members and teach them to appreciate attempts at active empathy when they experience it.
3. Fostering helping behavior - practicing pedagogical skills and intervention techniques.

Getting some extra attention and having a person to rely on are factors that we can see, in von Krogh et. al.’s ideas as well as at Ringhals. It seems as the program for competence transfer is on its way towards a knowledge enabling. On the other hand, the knowledge transfer might be interpreted as a way of standardizing the organization. The new employees are in the hands of one single tutor, which might constrain the width of their learning. This can be compared to Kipling’s Baloo bear in the Jungle Book, who takes his tutorship with Mowgli very seriously. When Bagheera questions Baloo and asks how Mowgli is supposed to survive, Baloo answers: *He’s with me, ain’t he? And I’ll learn him all I know.*<sup>97</sup>

We cannot be 100 per cent certain whether Annika Bergquist has read the Jungle Book or not, but we do believe that she has been influenced by the good old men above (von Krogh et al.). The competence profile could be interpreted as a map of expectation, in accordance with the first action mentioned. By stating what competence is required (or desirable), it is possible for the employee to strive towards the learning needed. As we see it, this is a way of competence management, which according to von Krogh et al. is impossible. Ringhals have implemented this concept thoroughly, and according to our respondent it seems to function quite well. It would be interesting to discuss this matter with von Krogh, Ichijo and Nonaka.

The surveillance might be a prerequisite as well as an obstacle to the organizational learning process. On one hand, SKI blamed Ringhals for being unstructured and made them launch a competence profile program, on the other hand, the massive bureaucracy might constrain the learning. In the same way, WANO demanded a better internal operating experience feedback which made Ringhals create a new division; RQH. The creation of RQH might constitute a risk since there is a possibility that other people and divisions of the organization relax and don’t see the operating experience feedback as their own responsibility. They fully rely on the new division to handle these matters. A similar

---

<sup>95</sup> Von Krogh, Ichijo and Nonaka (2000:17)

<sup>96</sup> Von Krogh, Ichijo and Nonaka (2000:61 ff)

<sup>97</sup> [www.imdb.com/title/tt0061852/quotes](http://www.imdb.com/title/tt0061852/quotes) retrieved 2008-05-30

reasoning can be found in Czarniawska (2007:26-27), where Power is referred to. However, the launch of RQH is an important statement by Vattenfall that the safety work is taken seriously.

The practice of asking why and seeking the origins of errors on many levels is a step towards Double Loop Learning, since it searches deeper roots instead of just correcting the obvious (Single Loop Learning). An MTO-investigation is a good opening for learning, since a mistake is done and the investigators are asking “why”-questions and giving recommendations. Unfortunately we got the impression that the MTO-investigations seldom lead to more than a report, which hardly gives the opportunity to change governing variables. Argyris (1990) argues that changing governing variables is hard, but not impossible. When speaking to employees at Ringhals we got the picture that the nuclear power industry historically has been better at fixing technical problems than working with behavioral issues. Severe incidents (like Chernobyl and TMI) have acted as eye-opener for the industry and have improved the safety work. Much of the technical correction can be characterized as Single Loop Learning, since the questions asked are “Does this problem concern our reactor?” and if so, they just fix it. Human errors are by their nature more complex, which makes them harder to understand and adjust.

The new department, RQH, wants to change the culture at Ringhals towards a greater extent of awareness of safety in every operational step. Unlike many typical leaders that speak highly about heavy organizational changes, Christer Axelsson surprised us by not giving the support to that kind of rhetoric. Instead he was convinced of that to realize a cultural change, which imbues just about everything of the organization, the right way to go is to *sneak in the changes so that no one notice the change until they look back and realize how much has happened*. He sounded just like the senior manager, quoted in Kunda (1992:5): *The idea is to educate people without them knowing it. Have the religion and not know how they ever got it!* This kind of thinking has certain similarities to what Clarke (1999) calls “direct and indirect influence”. She conceives that the attitude and behavior of the managerial staff has a direct influence on the staff and its behavior. As with kids, they don’t do what you tell them to do, they do what you do. The indirect influence refers for instance to safety education that is arranged for the staff. But without these “telling/showing what to do’s” (read: managerial staff working with safety issues) the negative effects will show, according to Clarke (1999), and refers to when the executive group focus more on profitability than on safety for the staff.

All this thinking has made us hungry, and reminded us of the well known story of the steak. It is easy to slip into old habits and follow the routines without reflecting upon them. Reflection is necessary to achieve learning, which we have discussed. We have chosen to close our analysis with this story, as a reminder of the power of habits:

One woman would always cut off both ends of the steak and throw them away before placing the steak in the oven. Her husband asked her why she did this and she replied; “That’s how you’re supposed to make steak, that’s how my mother always made it”. Curious, her husband asked his mother-in-law, only to get the same answer from her. Puzzled, he asked his wife’s elderly grandmother, who replied “I had to cut the ends off, or else the steak would not fit in the oven”. The old ovens used to be smaller than they are today...

## Conclusions

So, Armageddon is here! Time to sum up...

The search for legitimacy has many faces at Ringhals. We have stated that WANO holds the discourse which gives them the power to hand out legitimate recipes. This recipe factory makes the nuclear power plants isomorphic, i.e. they become similar. Since the recipes might affect the efficacy, it is crucial to decouple the formal structures from the informal structures to keep a good facade. This is a survival tactic in a world where the industry is not in control over its own future. What they can do is adjusting to the institutional environment, which we have seen signs of. We have interpreted the launch of RQH in terms of legitimacy searching. The phenomenon in itself is not new, but giving it a new costume brings attention to the safety issues and might speed up the change process, which always is slow due to inertia.

We believe that Ringhals is largely affected by disciplining in terms of Foucault. This has been an exciting journey, and seen in hindsight we are not that sad anymore over the fact that we weren't entrusted to enter the gates. We have found fractions of strong corporate culture, separation from the outside world, division of space, functional locations and interchangeability. We have also compared Ringhals with Foucault's panopticon and concluded that the disciplining probably makes the employees isomorphic and tractable.

Ringhals has a thorough learning toolbox. As a new employee you are incorporated through a twelve-step program, and in some cases you get your own tutor. A competence analysis is done regularly and if you are a control room operator you will receive simulator training. The operating experience feedback imbues the entire organization. We have considered high reporting frequency as a prerequisite for learning, which turned our interest to factors contributing to reporting. Such factors are a good and easy accessible reporting system, adequate information to the employees and the absence of a scapegoat culture. SKI has concluded that legal consequences for the reporting employee would decrease their reporting. We think that legal consequences for the non-reporting employee might increase the reporting tendency. Besides the reporting, we believe that their practice to ask "Why" is a good way of learning from experiences.

## Self-criticism

In this thesis we have heavily relied on two visits at Ringhals power plant. With the limited empirics in mind, our conclusions may seem far-fetched and drastic. Our motto has been that even if our conclusions are not revolutionary, we still wanted to serve an entertaining text. If you have managed to read this far, and have yawned less than twenty times, that's the best grade we can get.

The fact that our respondents were chosen for us might have contributed to the uniform answers, but also created a desire inside of us to see through the facade. We don't believe that we got the full picture, but at least we have tried to keep a critical approach. We could have interviewed a greater number of people, but considering the uniform answers, we're not sure that it would have given a broader perspective. We don't think that people would have revealed any serious disproportions, even if there were any. With these prerequisites we still think that we have been able to produce a relevant analysis.

The social scientist is a part of the world he or she studies. We have used much electricity during the work on this thesis. How is it then possible for us to be objective?

## Acknowledgements

We have arrived to the end of our journey, it's time to go out and play. From disciplining ourselves to leave the sunshine and voluntarily cage in the cave of KTB, we will now turn our faces towards the sun and enjoy the life outside the library. However, before we run out of the library like frisky calves, there are some people we would like to thank. Without their help and support, this thesis would never have been what it is. First of all we would like to thank Sigvald Hallberg at Ringhals for providing us with information, interview objects (thanks to them as well) and coffee. Gill Widell has been supportive all along the way even when we were completely lost (as if that state ever disappears). Thanks to Östen Ohlsson for the “ant story” and the ?→! thing (we are not sure whether our ant survived or if we were too kind in the dissection). Business owners within 1 kilometer from School of Business, Economics and Law (as well as the husbands of the female part of our group) have provided us with food, which has proven to be essential to keep our brain cells alive. Ringhals has provided us with decoupling, disciplining, learning, not to mention the “Vattenfall Song”, which brightened an entire afternoon for us (and haunted us in the nights). Thanks to tyda.se for being a friend when the English vocabulary runs out. Hats off to supporting friends (if you read this, you know you're one of them!) adding comments on the text and asking questions, forcing us to clarify what we really meant to say. Second last but not least we want to thank our families for the patience and support they have shown, and last but by no means least we want to thank each other for being disciplined and avoiding isomorphic reasoning. But the thing we will remember most is that we have had a really good time writing this thesis together.

## Abbreviations

ERF	Erfarenhetsåterföring, Operating Experience Feedback
IAEA	The International Atomic Energy Agency
INES	The International Nuclear Event Scale
MTO	Man Technology Organization
PJB	Pre Job Briefing, a meeting held before starting a new project
R1	Reactor 1 at Ringhals
R2	Reactor 2 at Ringhals
R3	Reactor 3 at Ringhals
R4	Reactor 4 at Ringhals
RIO	Riskobservation, Risk Observation
RO	Rapportervärd Omständighet, Reportable Event
RH	Ringhals Human Performance
RQ	Ringhals Quality
RQH	Ringhals Quality Human Performance
SAR	Safety Analysis Report. The manufacturer's manual for the nuclear power reactor.
SKI	Statens kärnkraftinspektion, the Swedish Nuclear Power Inspectorate
SSI	Statens strålskyddsinspektion, Swedish Radiation Protection Authority.
STF	Säkerhetstekniska föreskrifter, Safety Technical Prescriptions. A document derived from the SAR
TMI	Three Mile Island. The name of the nuclear power plant outside Harrisburg, Pennsylvania, that had a reactor meltdown in March 1979.
WANO	World Association of Nuclear Operators

## References

### Written references

- Ahrne, Göran , Papakostas, Apostolis (2002). *Organisationer, samhälle och globalisering : tröghetens mekanismer och förnyelsens förutsättningar*. Lund: Studentlitteratur
- Argyris, Chris. (1990). *Overcoming organizational defenses : facilitating organizational learning*. Boston: Allyn and Bacon.
- Borglin, Ola, Lindell, Gunilla & Lindström, Sara. (2008) *Isomorphic Learning at a Disciplined Nuclear Power Plant*. Göteborg: Göteborg university. Bachelor Thesis.
- Brown, Valerie J. (2007). Uranium in Drinking Water. *Environmental Health Perspectives*, vol. 115:12, p A595.
- Clarke, Sharon (1999) Perceptions of organizational safety: implications for the development of safety culture. (Elektronisk) *Journal of Organizational Behavior*, vol. 20: 2, pp. 185-198.
- Czarniawska, Barbara. (2007). *Organisering kring hot och risk*. Lund: Studentlitteratur.
- DiMaggio, Paul J. & Powell, Walter W. (2002). The iron cage revisited : institutional isomorphism and collective rationality in organizational fields. *Organisationer*. p 224-237
- Eriksson-Zetterquist, Ulla (2007). Risk och organisering - framväxten av ett forskningsfält. In Czarniawska, Barbara (ed.) *Organisering kring hot och risk*. Lund: Studentlitteratur.
- Foucault, Michel (2003). *Övervakning och straff : fängelsets födelse*. 4., översedda uppl. Lund: Arkiv
- Gilliland, Frank D.; Hunt, William C.; Pardilla, Marla; Key, Charles R. (2000). Uranium Mining and Lung Cancer Among Navajo Men in New Mexico and Arizona, 1969 to 1993. *Journal of Occupational and Environmental Medicine*, vol. 42:3, pp 278-283.
- Jackson, Norman & Carter, Pippa (2000). *Rethinking organisational behaviour*. London: Financial Times
- Kamprad, Ingvar. (1999). *Historien om Ikea : Ingvar Kamprad berättar för Bertil Torekull*. Stockholm: Wahlström & Widstrand.
- Krogh, Georg von, Ichijo, Kazuo & Nonaka, Ikujiro (2000). *Enabling knowledge creation : how to unlock the mystery of tacit knowledge and release the power of innovation*. New York: Oxford University Press
- Meyer, John W. & Rowan, Brian. (1977). Institutionalized Organizations: Formal Structure as Myth and Ceremony. *The American Journal of Sociology*, vol. 83: 2, pp. 340-363.
- Ohlsson, Östen & Rombach, Björn (1998). *Res pyramiderna : om frihetsskapande hierarkier och tillplattningens slaveri*. Stockholm: Svenska förl.
- Røvik, Kjell Arne (2000). *Moderna organisationer : trender inom organisationstänkandet vid millennieskiftet*. 1. uppl. Malmö: Liber
- Shenhav, Yehouda A. (1999). *Manufacturing rationality : the engineering foundations of the managerial revolution*. Oxford: Oxford University Press
- Wessblad, Hans (1998). *Omständigheter på ett kärnkraftverk : organisering av risk och institutionalisering av säkerhet*. Diss. Lund : Univ., 1999
- Ödegård, Synnöve. (1999) Säkerheten i världen bör fokusera på prevention. Lär av flyget, kärnkraftsverken och offshore-industrin! *Läkartidningen*, vol. 96:25, pp 3068-3073.

### Internet

- Analysgruppen: [www.analys.se](http://www.analys.se)
- Encyclopaedia Britannica Online: <http://search.eb.com>.
- International Atomic Energy Agency, IAEA: <http://www.iaea.org/>
- International Movie Database: <http://www.imdb.com>
- Nationalencyklopedin: <http://www.ne.se>
- Oskarshamn's Power Group, OKG: <http://www.okg.se/>
- Swedish Government, <http://www.regeringen.se>
- Swedish Nuclear Power Inspectorate, SKI: <http://www.ski.se>
- Vattenfall: <http://www.vattenfall.se>
- Wikipedia: <http://en.wikipedia.org/>
- World Association of Nuclear Operators, WANO: <http://www.wano.org>
- World Nuclear: <http://www.world-nuclear.org>

## **Movies**

The China Syndrome (1978), Columbia Pictures Industries, Inc.

## **Oral references**

**Christer Axelsson** has worked with Human Relations for the latest eight years, and works now at RQH. We spoke to Christer Axelsson and Bengt Ljungquist at the same occasion, 2008-04-18.

**Annika Bergquist** has been working with Human Relations at Ringhals since the first spit in the 1970s. She is now working at RH. 2008-04-28.

**Leif Bosson** retired on May 1<sup>st</sup> 2008, participant in the program for competence transfer. Phone interview 2008-05-05.

**Mats Eriksson** is a university lector who has been engaged in the program for competence transfer. Phone interview 2008-05-05.

**Sigvald Hallberg** has been at Ringhals for thirty years, and works at the information department. He has earlier worked in the control room of reactor two for ten years. 2008-04-18 and 2008-04-28.

**Anders Henoeh** is a specialist at RTA, Ringhals Technical Analysis and has worked at Ringhals since 1987. 2008-04-17.

**Bengt Ljungquist** has a substantial Ringhals experience and is now manager at RQH We spoke to Bengt Ljungquist and Christer Axelsson at the same occasion, 2008-04-18.

**Lars Nylander** has been working at Ringhals since 1980, and is now manager for the mechanic maintenance division. Phone interview 2008-04-29.

**Per Therén** has been at Ringhals for thirty years and is operating manager at R2 since three years. 2008-04-28.

Eleven employees and entrepreneurs at the kickoff before the annual outage at R2.

Four additional employees who we have interviewed on phone regarding the program for competence transfer.