Evaluation of safety culture of the Hanhikivi-1 project key organizations: Fennovoima, RAOS Project and Titan-2

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Evaluation of safety culture of the Hanhikivi-1 project key organizations: Fennovoima, RAOS Project and Titan-2

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Abstract
The Finnish Radiation and Nuclear Safety Authority (STUK) ordered from the Technical Research Centre of Finland Ltd (VTT) an independent safety culture evaluation concerning Fennovoima, its Plant Supplier RAOS Project Oy and the Main Building Contractor Titan-2. The objective of the independent evaluation is to gain a picture of the current status of safety culture at Fennovoima, the Plant Supplier RAOS Project Oy and the Main Building Contractor Titan-2, in order to provide information that supports STUK in its assessment of the Fennovoima’s construction license application. Furthermore, the evaluation provides information on how the coordination and communication between the three key organizations are arranged and carried out in practice. The evaluation of RAOS and Titan-2 was less extensive compared to Fennovoima and the amount of collected data does not cover all organizational aspects relevant for safety culture. Thus we do not take an explicit stance on their safety culture’s acceptability.

The data consists of 65 interviews out of which 28 interviews were carried out at Fennovoima, 21 interviews at RAOS and 16 interviews at Titan-2. Interviews were carried out in Helsinki, at Pyhähoki site and RAOS’ and Titan-2’s offices in St. Petersburg. In addition, the data consists of site observations and documents. The method of analysis is content analysis and analytical framework draws on the VTT’s Design for Integrated Safety Culture (DISC) model.

The results indicate that Fennovoima’s safety culture is at acceptable level. The strength of the organization are the working climate, employees have adopted safety as a genuine value quite well (DISC criterion 1) and organization is mindful in its practices (DISC criterion 4). Fennovoima has a strong project identity, focused on licensing and achieving a short-term goal. However, this needs to be balanced with long-term safety thinking. Fennovoima organization was established around the nuclear power project, which means that there is not a pre-existing strong organization to support the project. Instead, the company is simultaneously building its organization with adequate competencies to lead a large international nuclear power plant project. Identified areas for improvement are that Fennovoima needs to ensure that safety is understood as a complex and systemic phenomenon (DISC criterion 2), that the hazards and core task requirements are thoroughly understood (DISC criterion 3), responsibility for safety is taken for the functioning of the entire system (DISC criterion 5) and that the activities are organized in a manageable way (DISC criterion 6).

Overall, it can be stated that Fennovoima is learning and actively developing safety culture in their organization and supporting safety culture development in the project network.

The biggest challenge in Hanhikivi-1 project resides in the supply chain and the ability of Fennovoima to monitor, control and support it and to obtain a comprehensive understanding of the entire project and the integrity of design. The relevant problem that reverberates to this day is that the Russian stakeholders were prepared to build similar plant as Leningradskaya to Finland: they were not prepared to change the design according to the Finnish requirements. The mindset of Russian partners is that they have experience in building nuclear power plant, evolving around “Do it and describe it” mindset, whereas in Finland there is a strong reliance on thorough analysis and documentation, “Prove it and do it” mindset. These differences in mindsets cause major tensions in the project. The Plant Supplier, RAOS, has insufficient resources and recruitment process lags behind the recruitment plans. Titan-2 as Main Building Contractor needs also to recruit resources. The resources and ability of RAOS to control Titan-2 and other sub-suppliers is a challenge. Similarly, Titan-2’s ability to monitor and support multi-tier sub-contractor chain is
Safety culture concept is understood differently in Finland and Russia. Safety culture is a new concept in Russia and it takes time before it is adopted by employees. Safety culture was evaluated as being quite poor in RAOS and Titan-2's organizations according to the DISC criteria. However, those Russians who have nuclear technology background have good expertise in technical aspects of nuclear safety. Nevertheless, from safety culture viewpoint organizational aspects remain quite obscure at RAOS and Titan-2. On a positive side Titan-2 has been developing safety culture procedures. In addition, it came out that RAOS and also Titan-2 are motivated to learn and RAOS is working hard on preparing design documents to fulfill the Finnish requirements. For Fennovoima we suggest that it shall take a more firm stance on the project as a whole, concerning the supply chain and ensuring that RAOS acts correspondingly as the plant supplier. Fennovoima shall take a more active role in assuring the design integrity. It shall ensure that experts are listened to and that all units support questioning attitude and encourage people to express their concerns related to safety, decisions and the way activities are carried out. It shall delegate responsible tasks at top management level so that backup is ensured in all types of questions, including nuclear safety. This way risks related to person-dependent approach can be reduced.

The communication between Fennovoima and STUK goes fine. STUK could sharpen its action with regard to following three themes:

a) take a stronger role in intervening in clear drawbacks in the Hanhikivi-1 project
b) emphasize the overall picture when presenting requirements
c) STUK's view shall be expressed strongly, because now it is possible to influence the whole project

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1. Introduction and objectives of the evaluation work

Fennovoima aims to build its nuclear power plant Hanhikivi 1 (FH1) to produce electricity for its owners at production cost price. The plant will be built in Pyhäjoki in Northern Finland. The plant type is third generation evolutionary pressurized water reactor based on Russian VVER plants, which were developed by OKB Gidropress, a ROSATOM subsidiary. Fennovoima and RAOS Project, subsidiary of Rusatom Energy International, have a plant supply contract for the Hanhikivi 1 nuclear power plant. According to the schedule agreed with Rosatom, Hanhikivi 1 plant will produce electricity in 2024. The plant site on the coastal municipality of Pyhäjoki is located in Northern Ostrobothnia on the shore of the Baltic Sea. The name of the plant comes from Hanhikivi peninsula where the site is located in (Hanhikivi 1 Project 2017).

The Finnish Radiation and Nuclear Safety Authority (STUK) ordered from the Technical Research Centre of Finland Ltd (VTT) an independent safety culture evaluation concerning Fennovoima, its Plant Supplier RAOS Project Oy and the Main Building Contractor Titan-2. The order is part of the Framework Contract Agreement between STUK and VTT (dated 1.10.2015) concerning Expert services in nuclear safety oversight - evaluation and development of nuclear facilities' safety culture. The aim of the independent evaluation is to gain a picture of the safety culture status of Fennovoima, the Plant Supplier (RAOS Project Oy) and the main contractor (Titan-2), in order to provide information that supports STUK in its assessment of the Fennovoima’s construction license application. As far as applicable, also Fennovoima’s security arrangements and the role of the authority in affecting the organizations’ safety culture, are considered.

Organizational culture can be broadly defined as shared attitudes, values and practices supported by the organization’s structures. Typical of culture is that it develops gradually and is rooted in the action so that members of the organization are not even aware of the basic assumptions of the culture and take them as granted. Therefore, members of the organization are easily blinded to their organization’s culture. Previous literature indicated that the ability of organizations to make objective observations of their environment, i.e. their own culture, is questionable. A key benefit of the independent safety culture evaluation is that it complements the understanding of the current state of safety culture and the organizations’ internal efforts for safety culture self-assessment and development by providing an independent perspective, which avoids the biases that are naturally present at any culture that examines itself. An independent assessment is considered essential for enhancing safety culture because it reveals aspects and nuances of the culture that might be difficult to be perceived and acknowledged by the organizational members but which may nevertheless have a strong impact on safety culture and safety performance. This is especially relevant for large nuclear industry projects, where many different actors contribute jointly on safety performance and the influences on the overall culture and safety and non-linear and subtle.

The objective of the evaluation of organization culture is to provide organization’s key actors with information on social, psychological or structural mechanisms which have implications on the decision-making and daily practices, and hence to the success of an organization. In the nuclear industry, the core success factor is the safety of the operation. Therefore in the nuclear industry organization’s culture, especially the features which create and maintain safety shall be emphasized. In the nuclear field there are clear safety culture related requirements, both national and international, and the authority needs to be able to draw conclusions on the state of the licensee/licensee applicant’s safety culture. In this independent safety culture evaluation also the plant supplier’s and main contractor’s status of safety culture are included although not with the same depth of analysis as to the license applicant.
The data was mainly collected by interviews and analyzing the Fennovoima, Plant Supplier’s and Main Contractor’s documents. The documents comprise of e.g. chosen parts of the management system, the safety culture programme and results of safety culture self-evaluations, the project plan including a description of roles and responsibilities, the channels and practices of cooperation as well as communication between the key organizations in the project network (licensee, plant supplier and the main contractor); see Appendix. Additional data was collected by observations.

In Finland, issuing general orders regarding nuclear safety has been transferred recently to the Radiation and Nuclear Safety Authority (STUK) by the amendment (676/2015) of the Nuclear Energy Act (990/1987). The STUK regulation concerning safety culture goes as follows:

"1. When designing, constructing, operating and decommissioning a nuclear power plant, a good safety culture shall be maintained. Nuclear safety and radiation safety shall take priority in all operations. The decisions and activities of the management of each organization participating in the abovementioned activities shall reflect its commitment to operational practices and solutions that promote safety. Personnel shall be encouraged to perform responsible work, and to identify, report, and eliminate factors endangering safety. Personnel shall be given the opportunity to contribute to the continuous improvement of safety.” (http://www.finlex.fi/data/normit/42574-STUK-Y-1-2016.en.pdf)

In addition to general orders, STUK has written Regulatory Guides on nuclear safety, called YVL-Guides where it specifies the requirements related to safety culture. Notably, YVL.A.3. related to Management system for a nuclear facility and YVL.A.5. concerning Construction and commissioning of nuclear facility include safety culture requirements.

The objective of the study is to evaluate the current status of safety culture at Fennovoima, its Plant Supplier RAOS Project Oy and the Main Building Contractor Titan-2.

The study focuses on three research questions, as follows:

1. What is the current state of safety culture at Fennovoima organization, and how good is the safety culture in terms of the DISC safety culture criteria? (Full-scale safety culture evaluation)

2. What is the current state of safety culture at Titan-2 as the Main Building Contractor, and RAOS Project Oy as the Plant Supplier for Hanhikivi 1 NPP project? (Focused safety culture evaluation)

3. How is the coordination and communication between the three key organizations arranged and carried out in practice?

2. Methods and implementation

2.1. Evaluation team

The evaluation team consists of four researchers from VTT Technical Research Centre of Finland Ltd: Marja Ylönén (Senior Scientist), Heli Talja (Principal Scientist), Nadezhda Gotcheva (Senior Scientist) and Merja Airola (Research Scientist).
2.2. Evaluation framework: Design for Integrated Safety Culture (DISC)

The safety culture assessment was performed by applying the VTT’s Design for Integrated Safety Culture (DISC) model (Reiman and Oedewald, 2009), which aims at understanding how different factors interrelate and contribute to safety performance. The DISC model (Fig. 1) is a *systemic approach* for analysing and understanding organizational culture and its effects on safety performance. We view organizations as complex adaptive systems and safety as an *emergent property of the system*, which is produced through everyday interactions between its technical, social and human components.

According to the DISC model, an organization has good potential for safety when the following six criteria are fulfilled:

1. Safety is a genuine value in the organization and that is reflected in the decision-making and daily activities.
2. Safety is understood to be a complex and systemic phenomenon.
3. Hazards and core task requirements are thoroughly understood.
4. The organization is mindful in its practices.
5. Responsibility is taken for the safe functioning of the whole system.
6. Activities are organized in a manageable way.

These are organizational level criteria, i.e. they do not evaluate individual worker’s values or understanding as such but whether these characteristics prevail in an organization. Safety culture should be evident in the feelings and conceptions of the personnel, in the social interaction of groups, and in the way organizational structures and systems are developed.

In safety-critical organizations, certain organizational functions need to be carried out for developing a healthy safety culture (indicated in the outer circle of Fig. 1). These include, for example, hazard management practices (e.g. risk assessments, redundancy of safety systems and personal protection equipment), competence management practices (e.g. trainings, mentoring of newcomers), pro-active safety development practices (e.g. collecting and analysing operating experience, regular organizational assessments), work condition management practices (e.g. assessing the adequacy of the staffing and listening to the needs of end users when purchasing tools and technical equipment). These organizational functions are necessary for fulfilling the safety culture criteria in safety-critical organizations. In the evaluation we focus on understanding typical everyday working practices and activities, reflected in personnel’s feelings and perceptions of the personnel, in the social interaction of groups, and in the way organizational structures and systems are built.
Safety is a genuine value in the organisation which reflects to decision making and daily activities. Safety is understood as a complex and systemic phenomenon. Activities are organised in a manageable way.

Figure 1. The DISC model (Reiman and Oedewald, 2009).

Each safety culture assessment method is developed in a certain institutional and national cultural setting, which frames both its benefits and limitations. However, VTT’s DISC model and its evaluation criteria have been developed based on multiple case studies on organisational culture, change management and event investigations in the nuclear and other safety critical industries in the Nordic countries, e.g. in Finland and Sweden. The DISC model draws from the theoretical perspectives of resilience engineering (Hollnagel et al., 2006), high reliability organisations (La Porte, 1996) and international perspectives on safety culture (e.g. IAEA, 1991). DISC criteria for a good safety culture are unique in a sense that they integrate three different types of criteria: mindset, understanding and organizational systems and structures, with understanding setting it aside from other existing safety culture models: understanding of shared knowledge, skills and abilities that are connected to the work and its hazards, and the shared ways of thinking about safety and risks.

Each of the six safety culture criteria is evaluated using a four-level scale: unacceptable - quite poor - quite good - very good.

2.3. The data and method

The data consists of three different sources: interviews, observations and documents. In total, 65 thematic interviewees were carried out at Fennovoima, RAOS and Titan-2 (Table 1). Interviews were conducted in Helsinki, at Pyhäjoki site and RAOS’ and Titan-2’s offices in St. Petersburg. The interviewees were selected by the researchers so that they represented different levels and units in the organizations. In context of interviews in Pyhäjoki the researchers also had an opportunity to observe activities at the construction site.
The interviews were conducted in English or Finnish. A few interviews were also done with an interpreter between Russian and Finnish or Russian and English. Also 6 representatives of the STUK were interviewed to gather background information. Most of the interviews were conducted by a pair of researchers. Apart from two interviews, each interview took about 1.5 hours. The number of the interviews are shown in Table 1.

Table 1. Number of interviews in each organization.

<table>
<thead>
<tr>
<th>Organization</th>
<th>Number of interviews</th>
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<tr>
<td>Fennovoima</td>
<td>28</td>
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<tr>
<td>RAOS Project Oy</td>
<td>21</td>
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<tr>
<td>Titan-2</td>
<td>16</td>
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<tr>
<td>STUK</td>
<td>6</td>
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</tbody>
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The themes of the interviews covered the interviewee’s background and role in the Hanhikivi 1 NPP Project, his/her conception on safety and safety culture, the current phase and challenges of the project, as well as the communication between project partners. An example of the interview questions is shown in Appendix 1. Memos were written of all interviews and most interviews were recorded with permission of the interviewee. The interview data was analyzed by the four researchers first using thematic content analysis and then according to the DISC model criteria. Data was analyzed first by each researcher individually and then the findings were discussed in series of joint workshops.

Documents that were reviewed for the evaluation comprised information on STUK’s inspections, Fennovoima’s organization, policies, processes and procedures. Manuals, instructions and the Project’s monthly progress reports were used as information as well. Further, the documents information on the roles of the project participants as well as the organization, competences and quality procedures of RAOS and Titan-2 was reviewed. Appendix 2 indicates a list of all used background documents.

A feedback seminar to discuss the preliminary findings was organized in STUK on 24th of April 2017. Fennovoima’s representatives were invited to the event. A second seminar atSTUK was held on 29th of June 2017 to present the final results and discuss them with representatives of STUK and Fennovoima.

3. Short introduction to Fennovoima and Hanhikivi 1 (FH1) project

Fennovoima was founded in 2007 by a group of Finnish electricity consumers: industrial companies and energy utilities. The company aims to build a nuclear power plant Hanhikivi 1 (FH1) at the Hanhikivi peninsula in the Pyhäjoki municipality on Finland’s western coast to "produce electricity for its owners at production cost price" (Mankala principle).

There have been several turning points in Fennovoima’s short history. The decision-in-principle was granted by the government to Fennovoima in 2010. At that time, the German company E.On was involved in the project. After the Fukushima nuclear accident in 2011

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Germany decided to phase-out from the nuclear power and E.On withdrew from the FH1 project. Fennovoima needed to find a new project partner quickly. The Russian Rosatom company appeared a relevant candidate and in 2013 negotiations started with Rosatom. In the end of 2013 an agreement was concluded with Rusatom Energy International, (according to the comments on the draft report by Fennovoima representatives, the name of the company was at that time RAOS Overseas) a subsidiary of Rosatom, on turn-key delivery of the nuclear power plant. The chosen nuclear technology is Rosatom’s AES-2006 pressurized water reactor, based on the VVER technology. Several reactors of the AES-2006 type are currently under construction in different countries; however, none is yet in operational phase. The main owner of Fennovoima, with 66 % of the shares, is Voimaosakeyhtiö SF. In March 2014, 34 % of the shares were transferred to RAOS Voima Oy, a subsidiary of Rosatom.

In May 2014 Fennovoima made an agreement with Rosatom Overseas and labour market organizations on the collaboration and employment arrangement at the construction site. The agreement stated that the employment issues will be handled according to Finnish legislation and practices. Further, the site agreement deals with information exchange, ways of handling problematic situations and practical means, e.g. a site register on sub-supplier companies and their personnel, for preventing grey economy.

When the licencing phase started in the beginning of 2014, Fennovoima employed around 80 persons. The aim has been to increase the number to 400 persons, 100 of them in-house consultants, till the licencing phase ends in 2017.). During the planned construction phase (2018-2023) the structure of Fennovoima’s organization is envisioned to remain roughly the same as in the current licencing phase. Particular areas of emphasis within Fennovoima’s organization include the expertise required for the supervision of construction work and the supervision of the manufacturing and installation of equipment and systems, and the expertise on quality management and authority correspondence. At this phase the personnel is expected to increasingly move from Helsinki to the plant site at Pyhäjoki. Towards the end of construction phase the focus will shift as recruiting and training the operators is planned to begin. When the construction phase ends the number of Fennovoima’s own personnel is estimated to be 500.

**Fennovoima’s organizational structure**

During the negotiations on a turn-key-delivery contract, the so-called EPC contract, with Rosatom, Fennovoima was still a small, informal and quite an organic company. As one of the interviewees described it, it "resembled a family business". Soon after that phase Fennovoima was focused on steady growth with new tasks and responsibilities concerning oversight of plant design, quality and project management, and the application of necessary permits and licenses. This required renewal of the organization structure and defining appropriate working principles and procedures.

A matrix-like structure was created in 2014 (Fig.2). The organization consists of departments that are divided into areas and units. The Project Department is the largest department with approximately 200 employees, and it is supported by other departments such as Nuclear Safety and Quality.
Further, also the Project Department is organized in a matrix-like form (see Fig. 3). The various engineering disciplines form competence centers that are organized as subunits of the Engineering unit. An exception is the Reactor unit at the Nuclear Island that acts as the competence center for reactor systems. Still, according to an interviewee, most of Fennovoima’s reactor experts belong to the Nuclear Safety department.

The main task of the Project Department is to “manage the design and construction of the nuclear power plant project including the related permits and licenses, within the set time schedule and budget and fulfilling the specified safety, quality and plant performance requirements, and to mitigate the project risks thereof. Particularly, the Project Department is accountable e.g. for nuclear power plant project execution, meeting established Owner’s requirements as well as supply chain of the project, including procurement” (Ref. Paragraph 163 of the Organization manual). The Project Areas are accountable for that Fennovoima and the main Supplier and other suppliers under other contracts of the Project and their sub-suppliers fulfill the EPC contract requirements, the Owner’s requirements and the YVL-requirements, their agreed duties and other contract responsibilities of Fennovoima related to the Area (Ref. Paragraph 177 of the Organization manual).
Figure 3. The organization structure of the Project Department (Source: Fennovoima Organization Manual, Rev. 10)

To facilitate communication and collaboration throughout the Fennovoima organization, a number of cross-organizational teams have been formed (Organization manual Rev. 10). For instance, the Area Management teams comprise representatives from other units (e.g. Engineering unit and units of Nuclear Safety department).

The documents differentiate between the terms Program and Project in such a way that the Program is understood to cover all activities to create an operation-ready nuclear power plant, including also the nuclear fuel and organization development, (Ref. Program Plan), while the Project as part of it seems to cover the activities for design, construction and licensing the plant.

The Organization Manual contains a detailed description of the goals and responsibilities of the various departments and units. Correspondingly, in Paragraphs 114-118 the responsibilities of personnel and supervisors are defined in detail: these lists, however, seem rather to describe working ways of a traditional hierarchical organization than those of a matrix organization.

4. Results: Coordination and communication between the three key organizations in the FH1 project
8. Discussion and conclusion

The purpose of the current study was to evaluate safety culture of the Hanhikivi-1 project, i.e. Fennovoima as a License Applicant, RAOS Project Oy as Plant Supplier and Titan-2 as the Main Building Contractor.

From a safety culture perspective we identified five main challenges in the Hanhikivi-1 project, which concerns all the key organizations.

First, one of the main challenges in this complex project relates to understanding and managing the design integrity in the project, and obtaining the overall picture of it. This is challenging because the design is divided between different organizations and further divided into successive parts and it is not clear how their interdependencies are taken care of. Therefore concerns about understanding of the totality of the plant are justified. Procedures to monitor and ensure the design integrity have been created, however procedures are not fully in use. It is also a matter of top managers' decisions whether they allocate adequate resources for supporting design integrity. In all companies involved in design, attention should be paid to the design integrity. Similarly, adequate flow of information between the companies is important as well as openness and transparency. Configuration management is one relevant
tool for ensuring design integrity but attention should be paid that it is not superficially understood.

Second, another challenge which concerns all key organizations is the management of the supply chain. Ability to monitor and control the suppliers is challenged by the asymmetry of power between the organizations. Asymmetry of power relates to decision-making, different resources, experience and competences between the companies. In addition, the longer the supply chain the more difficult it is to control. There is a power asymmetry between the well-established companies such as Titan-2, and new or recently-established companies such as RAOS and Fennovoima. The results indicated that in Russia the size and the age of the company is important in terms of decision-making power and it may be difficult for a new company to monitor and control large and experienced companies. These kinds of assumptions and attitudes may prevent from efficient management of the supply chain. Hence the problem is fact-based but also cultural-based. For instance, Fennovoima should monitor and control RAOS, which is a new company as well. However, RAOS is a subsidiary of the Russian state-owned corporation Rosatom. When the attitude is that younger and less-experienced companies are not credible with regard to monitoring and controlling the more experienced company, then the monitoring and controlling becomes difficult. Also, RAOS as a Plant Supplier should be able to monitor Titan-2. A serious question arises whether RAOS has resources and capability to monitor and control Titan-2, Atomprojekt, Gidropress and Atomenergomash, all of which are well-established large companies. The results indicated that RAOS has insufficient resources and capability to monitor and control Titan-2. With regard to Titan-2’s ability to monitor and control the subcontractors the problem resides in the long subcontractor chain. Furthermore communication and language difficulties seems to affect possibilities to monitor, oversee and support the sub-contractors.

Third, in the Hanhikivi-1 project communication between the companies and within each company is a challenge. Communication challenges refer to problems in data transfer between the companies and within different units of the company. There are lot of interfaces and therefore efficient transfer of data, not to mention the ability to interpret the data and cultural frames would be crucial. However, there are deficiencies in English language skills in all organizations. Using interpreters is not a sustainable solution to complex communication and language problems, neither using a glossary. If language errors and misinterpretations are shown in documentation, they may have an effect on safety.

Fourth, availability of resources and recruitment problems are among the biggest challenges in the key organizations. RAOS has quite scarce resources, and similarly Titan-2 and Fennovoima need to recruit new competent persons. Partly resources and recruitment is managed by the organizations, but partly recruitment is out of reach of organization’s management. By the latter we refer to market situation, since there are not many nuclear technology experts available and not all of them have adequate English skills. In addition, financial resources can be critical in all key organizations. Financial issues have sometimes been separated from safety considerations, even though finance provides a framework within which the organizations can function. Therefore financial aspects should be paid attention to in this project. We did not ask about financial issues during the interviews but because they can have strong effects on the project and safety, they are relevant aspects.

Fifth, cultural differences and especially different mindsets by which we refer to the “paper vs. iron” mindset are prevailing in each company and between the companies. These opposite mindsets create tensions among the stakeholders. Belief in thorough analysis and documentation vs. belief in proven existing technology and experience and experts’ tacit knowledge is one core identified tension in the project. It would be good if these mindsets can be identified and discussed to find solutions how they could be balanced so that joint understanding of safety can be gradually achieved. There are indications that mutual understanding and ways of working between Hanhikivi-1 project organizations are developing, yet there is work to be done to overcome the difficulties indicated in the story about the “cat
and dog baking a cake” and achieving a situation where it is possible to utilize the difference as enriching resources.

Limitations of the study

Although the evaluation is using three different types of data - interviews, observations and documentation analysis - this is a qualitative study which poses certain limitations. In the evaluation team we had an expert who understands Russian, which was very beneficial yet to ensure good quality and understanding the Russian interviews were conducted with the help of an interpreter, which also has certain limitations. Based on the methodology, this evaluation paid attention as much as possible to several aspects in the studied organizations and activities at the project level simultaneously, which is challenging: a) attitudinal aspects (e.g. personnel’s perceptions indicated in attitudes and values), b) cognitive (e.g. understanding of safety and hazards) and structural aspects (e.g. organizational and inter-organizational practices related to safety, and structures and systems in the project for creating preconditions for carrying out activities with high quality, as well as collaboration and communication between the key project actors in FH1). The VTT’s DISC methodology has been originally developed from a single organizational perspective, hence it refers to “organizational functions”. Nevertheless, it contain also inter-organizational aspects. The framework has been previously successfully used for safety culture evaluations where the unit of analysis can be referred to as multiple organizations. Since the current study is not a safety culture evaluation of a single organization, we are utilizing the DISC model as a generic guiding framework to gain insights on safety culture in the three key organizations and collaboration and communication between them in the project setting; therefore the organizational functions as such serve as an orientation for researchers but a systematic review of their fulfilment is not part of this safety culture evaluation.

9. Recommendations for Fennovoima
10. Recommendations for STUK

Fennovoima’s personnel was mainly satisfied with STUK as a regulatory body: STUK is seen as a strong authority by all three key organizations in the project. When it requires improvements, Fennovoima is making its best to make improvements and to provide good documents.

Communication and co-operation goes smoothly. Interviewees praised STUK especially for its cooperative approach. STUK has been constructive in its communication with Fennovoima. It has been possible for the Fennovoima employees to approach STUK even in informal way and to ask specifications and clarifications concerning, for example some YVL-guides. STUK inspectors have also said if Fennovoima is going to wrong direction. This kind of feedback is appreciated by employees of Fennovoima.

Interviewees mentioned also the pilots and trainings, which have helped them to understand how documents are approved, and this way Fennovoima is better prepared to submit the documents to STUK.

Support provided by STUK to employees of Fennovoima was also appreciated. Interviewees shared the opinion that when STUK brings up some issues, Fennovoima will listen. In some safety related things STUK’s support has been necessary: without STUK’s support, concerns raised by single employees would not have been acknowledged at Fennovoima. Hence support from STUK is relevant in terms of enhancing safety.

Related to the need of support from STUK, concerns about the STUK’s distant position were expressed. STUK was expected to have a stronger role. That refers to that STUK should not remain as an observer but intervene in the situation immediately when it sees some drawbacks. Possible situations where stronger role would be needed are related to e.g. safety related concerns which are not taken seriously at Fennovoima due to the power hierarchies, or non-questioning culture in some units, or in the Plant supplier.

We recommend that STUK could reflect upon its role in the Hanhikivi-1 project. Despite the characterizations of an effective regulator by OECD NEA’s report (2014) that emphasizes the equal treatment of the different regulated companies, it may be worth of pondering whether in a new situation where there is a company that has no earlier experience in operating or constructing a nuclear power plant, it would be necessary to be more involved in and not too distant.

Our understanding is that STUK is very much involved in supporting the personnel of Fennovoima. Based on our results, it seems that there is also an urgent need for similar strong support in this kind of complex project.

With regard to critical comments, STUK was criticized for sometimes too black and white attitude and too strict demands. There was one wish for STUK that it would provide letters in
English, that would ease the translation work in Fennovoima and would speed up the communication with non-Finnish speakers.

As mentioned the communication and collaboration between Fennovoima and STUK goes well. STUK's work was appreciated. STUK could sharpen its action with regard to following three themes:

a) take a stronger role in intervening in clear drawbacks in the Hanhikivi-1 project
b) emphasize the overall picture when presenting requirements

c) STUK's view shall be expressed strongly, because now it is possible to influence the whole project

11. Concerns expressed in the interviews
References


Appendix 1

Examples of interview questions

1. Background information
   - Could you tell us about your work? What is your position, when did you join?
   - Background? Experience from the nuclear industry?
   - What is most exciting about your work here?

2. Contents of the work, role and responsibility
   - What is your scope of responsibility? Whom do you work with in your company and in the other companies in the project?
   - (If coming from another sector) How does working at the nuclear sector differs from working at some other industry sector?

3. Safety
   - How is your work related to safety? How do you see the relation between your work and safety?
   - How would you describe nuclear safety?
   - What about safety culture: what is it for you?
   - How does it appears in your work? In your company?

4. Current state of the project & main problems & supply chain
   - How would you describe the current state of the project?
- How would you characterize the main problems in the project?
- What are the reasons for them?
- How to resolve them?
- How the project is organized?
- Could you describe the roles and responsibilities of the key project actors?

5. Role, pressures
- How do you handle the demands in your work? Whom do you turn for help, what is the role of your superior?
- What kinds of pressures do you have related to your work?

6. Management and communication inside one’s own company and between the key organizations of Hanhikivi-1 project?
- What is the role and responsibility of your company in this project?
- How do you communicate in your company - what kinds of meetings/emails, etc. do you have, official and unofficial ways of communicating, how often, with whom?
- How much attention is focused / how much time do you spend on safety issues during these meetings/other ways? What issues do you handle during these meetings, can you give an example?
- How would you describe the main differences between national cultures of Fennovoima/RAOS/Titan-2?
- What are the main differences between organizations and people’s
- How do you handle the changes in the project? How these changes affect safety?

7. Understanding the role of Finnish regulatory body and the YVL-guides
- How do you see the role of the regulatory body in general and in the project?
- How do YVL guides affect your work? Please, specify
- What kinds of challenges there are?
- Whose task is to guarantee that safety in the supply chain is high?
- How would you like to improve the communication?

Thank you for the interview!