Safety culture in the nuclear power plant construction – lessons learned from the Hanhikivi-1 project

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Teemu Reiman
Facts about Fennovoima

- Established in 2007
- Currently employs approximately 250, in operation phase approximately 500
- Head office in Helsinki, local office in Pyhäjoki
- Fennovoima will build its Hanhikivi-1 (AES-2006) nuclear power plant on Greenfield site located in Pyhäjoki, Northern Finland
- The total cost of the project € 6,5 – 7 billion
- Fennovoima is owned by Finnish Voimaosakeyhtiö SF and Rosatom's subsidiary RAOS Voima Oy.
- Rusatom Overseas’ subsidiary RAOS Project Oy is Fennovoima's plant supplier.
# A decade of construction

## Preparation phase
- Rosatom chosen as the plant supplier
- Environmental Impact Assessment EIA
- Supplement to the Decision-in-Principle DIP
- Preparatory works at the site begin

## Infrastructure and licencing
- Construction License Application
- Extensive construction work of infrastructure and auxiliary buildings
- Development of the organization
- Construction License

## Construction phase
- Construction of the nuclear power plant begins
- Development of the organization
- Installation works
- Fuel loading
- Operating License

## Commissioning
- Electricity production begins

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<td>Preparation phase</td>
<td>Infrastructure and licencing</td>
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Key sub-suppliers selected

- Main building contractor Titan-2 is in charge of the construction and installation works of the power plant
  - Operates also as the main building contractor of Hanhikivi 1’s reference plant
- Atomenergomash* supplies the long-lead items such as the reactor pressure vessel, steam generators and turbine
- OKB Gidropress* is responsible for the basic design and other necessary services for the nuclear island equipment
- Atomproekt* is in charge of development of the NPP design documentation

* Subsidiary of Rosatom
Fennovoima has developed its safety culture from the beginning, with more activities each year. After 2007, there have been significant changes in the ownership – also the plant supplier has changed. In 2013 the Russian company Rosatom was chosen as the plant supplier. In parallel, there has also been a revision of the regulatory guidelines, with the new guides published in 2014. Fennovoima will be the first power company in Finland that needs to comply in full with the new legislation. For the other companies, a separate decision is made about the applicability of the new guides. The new regulatory guides put a lot of emphasis on safety management and safety culture in the early phases of the construction. Fennovoima needs not only develop its own safety culture but also assure (as the future license holder) the safety culture of the Supplier. Finally, Fennovoima is also growing very fast which creates its own challenges in terms of culture development.
Fennovoima has a safety culture program and an annual implementation plan (part of the Fennovoima management system).
The program was revised early 2015 as planned, to take into account the new project phase.
During the revision also Fennovoima’s six safety culture principles (originally created when E.ON was one of the main owners) were reconsidered with two aims:
- To make them more concise and easy to remember
- To align them with the principles that RAOS will apply in the FH1 project
A safety culture survey was administered asking how Fennovoima employees perceived the six principles.
A workshop with RAOS safety culture manager was arranged to discuss and agree on the principles, also a workshop with Fennovoima top management.

As a result, four principles and a joint FV-RAOS nuclear safety culture policy statement were issued.
FH1 nuclear safety culture policy statement

Fennovoima and RAOS are building together a nuclear power plant that must operate safely for at least 60 years. The top management of the companies are proud to undertake this challenge and recognize the vital importance of nuclear safety. To ensure nuclear safety, a strong nuclear safety culture is essential from the very beginning.

Top management is fully committed to a high level of safety culture and expects the same commitment from all participants in the project. This means that nuclear safety has an overriding priority in all actions and decisions within the project. To facilitate the priority of nuclear safety, the following safety culture principles have been set, which everyone is expected to follow:

1. Commitment (put safety first, take responsibility, and show a good example)
2. Awareness (know what you are doing and why)
3. Transparency (communicate and co-operate)
4. Continuous Improvement (take initiative and seek to learn more)
Fennovoima’s Nuclear Safety Culture Program elements

"Nuclear safety culture" is defined as the shared values, beliefs and assumptions relating to nuclear safety.

1. **Establishment** of shared nuclear safety culture goals and expectations first for the FH1 program and then for the operation phase.
2. **Facilitating** nuclear safety culture in Fennovoima as well as all other organizations performing safety critical work and/or having access to the construction site.
3. **Monitoring** of the nuclear safety culture.
4. **Continuous improvement** (preventive actions, corrective actions & review) of the nuclear safety culture and the NSCP.


Nuclear Safety
Teemu Reiman

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Four settings for Fennovoima’s safety culture work

1. Fennovoima’s own organization & personnel
2. The main contracting partners (RAOS, Atomproekt, Gidropress, Titan-2, Atomenergomash, …)
3. The construction site (with Titan-2 as the main contractor)
4. The subcontracted engineering and manufacturing sites

- For all the settings, the following SC methods are used:
  - Safety culture training (induction training, task-specific training)
  - Communicating of requirements and best practices by different means (SC booklet, posters, pre-job briefs, seminars etc.)
- In addition, several setting-specific methods will be used, e.g.
  - Leadership seminars
  - Nuclear safety culture working group with FV, RAOS and all main subsuppliers
The theoretical model underlying Fennovoima’s safety culture program

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The theoretical model underlying Fennovoima’s safety culture program – tools and influence targets

1. Inherent risks
2. NS long-term multilevel
3. NS abstract
4. NS complex
5. NSC created by us

Knowledge sharing

Participative & transformative leadership

Organizational structures

Openness and trust

Collaboration

Tools and technology

Production technology
Safety systems
IT systems

Concerns – reporting tool
OPEX-tool (2016-)
Facilities

Technical decision making
Auditing and self-assessment
Handling of concerns
Document review
Trainings, campaigns
Seminars, workshops, working groups
Safety observations

Daily work practices
Strategic decision making

Wellbeing
Responsibility
Motivation
Knowledge
Attitudes

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Safety culture development project at Fennovoima assisted by Trainers’ House

- Due to the many complexities involved in the culture development (a new company, fast growth of the company, tight schedules, national cultural differences between Finland and Russia, many employees coming outside the nuclear industry to Fennovoima, ‘pilot case’ for the new regulatory requirements) a consultancy company specializing in complex change projects was wanted to facilitate the culture development
  - Trainers’ House (TH), a Finnish change management company, was selected for the job

- TH made a brief safety culture review in September 2015 by
  1. Familiarizing with relevant material
     - Organization structure, Organization Manual
     - Nuclear Safety Culture Program
     - Safety culture surveys and other reports
  2. Interviewing 20 key people
     - 7/8 FMT members
     - From all areas and functions, from different levels
Progress of development

- Fennovoima Management Team safety culture day in October
  - Full day away from the workplace devoted to safety culture, facilitated by TH and me
  - Agreed on a list of actions to make nuclear safety more visible inside Fennovoima and to involve the top management in safety culture improvement
- Recruitment of more ambassadors
  - Currently 5 safety culture ambassadors => 15 by the end of the year
- Safety culture reception for the entire personnel in December
  - CEO, project director and nuclear safety director present the safety culture principles from three viewpoints (what they mean to me, what they mean to you, what they mean to us)
  - Ambassadors will have a major role in making the principles concrete in each work team after the reception
- Ambassadors meet monthly to act as a “people’s voice” and the communicate safety messages to their teams
Several questions remain

- The role of communications? How could the communications department best support safety culture promotion?
- Balance between focus on the positive (successes, we-spirit, stories) versus negative (concerns, deviations)
  - How to be constructive in a negative situation, e.g. when there are clear leadership problems or work overload?
- The “over-expansion” of nuclear safety culture into the organization
  - Safety and nuclear safety can become associated with the safety culture specialist
  - Danger of too much focus on the “soft stuff”, when what would be needed is better technical expertise, better project management etc. => systemic view
- Safety culture and projects: the possibilities and constraints in influencing temporary partners, changing workforce, distant manufacturing companies etc.
Several questions remain 2

- Balance between standardizing and encouraging diversity / innovation
  - A new company without pre-existing procedures and ‘ways we do things around here’ naturally has diversity, which should be cultivated
- Challenge with benchmarking: can lead to copying without understanding (especially when starting with a clean slate)
- Balance between analysis and action
  - In dynamic and complex settings, action and analysis are intertwined
  - Action with continuous analysis rather than analysis then action..
- How to make nuclear safety more concrete during pre-operational phases?
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