Fortum’s actions to Loviisa NPP due to Fukushima accident

Early own initiatives, national requirements, EU stress test, future

NKS Fukushima seminar, 8-9.1.2013

Mika Harti, Fortum Power and Heat Oy

Introduction

- Fortum’s communication to public
- Safety assessments
- Safety upgrades
- Participation to Fukushima cleanup
  - CsTreat®, SrTreat® and CoTreat®
- Summary

Communication to public

- Immediately after Fukushima accident there was concern related to safety of NPP's in Finland
- Fortum responded by publishing information in the web pages and by giving interviews related to following issues:
  - Flood level
  - Severe accident management
  - Loss of power
  - Fuel pools
  - Oil slicks
  - Past safety improvements
- Delivery of safety assessments were published by Fortum as press releases and by STUK.
- Speculations to situation at Fukushima was left to STUK

Safety assessments

- Two sets of safety assessments: Ministry safety assessments and EU stress test. These assessments had partly the same scope.
- Ministry safety assessement
  - Immediately after Fukushima accident, Finnish Ministry of the employment and the economy requested assessment, how Loviisa NPP can cope with natural events and loss of electrical power.
  - More clarifications were requested by STUK in two accasions.
  - The results of these assessments were also used as input by STUK for the national report of the stress test.
- Stress test
  - Scope: Earthquake, flood, extreme weather conditions, SBO, LUHS, severe accident management.

Safety assessments, timeline

		2011										2012											
Party	Work	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Fortum	Ministry safety assessment																						
Fortum	Stress test																						
Fortum	Continuation of ministry safety assessment																						
Autohorities	Stress test, national report																						
Autohorities	Stress test, peer review																						
Autohorities	Stress test, conclusions																						
Fortum	Continuation of ministry safety assessment																						

Stress test conclusions

- Peer review conclusions
  - No immediate need for plant changes
  - The requirements and guidelines are more stringent than usually established in legislation of other countries or in relevant International Atomic Energy Agency (IAEA) Safety Standards.
  - More study proposed:
    - SAM systems and severe accident in shutdown states
    - Flooding (spreading of flood inside the plant, drainage capacity of rainwater)
    - Earhquake resistance
    - Multi-unit accidents

Safety upgrades

- Action plan was set within the safety assessments
  - Several ideas, final actions based on further studies
- Safety improvements are implemented in separate projects
  - One project consists of one safety upgrade
  - Oversight of separate safety upgrade projects
  - Why to organize this way ?
    - The projects have very little to do with each others
    - Easier implemention
- New regulatory requirements are being prepared in Finland
  - The aim was renewal of requirements for construction of new NPP’s
  - Some changes to requirements because of Fukushima
  - Impact to plant design is not yet clear

Safety upgrade projects

Project name	Prevention of fuel damage	Severe accident management
Independent heat sink	X	
Improvement of fuel pool cooling and I&C	X	X
Protection against high sea water level	X	X
Mobile pumps and generators	X	X
Diesel fuel storage and distribution	X	X

Independent heat sink

- Two cooling towers for each of the plant units.
- One removes the decay heat of the reactor via secondary circuit.
- The other removes decay heat of the fuel pools via intermediate cooling circuit.
- Pumps of existing systems utilised.
- Initiating event: Loss of ultimate heat sink (LUHS)

Example of cooling tower

Improvement of fuel pool cooling and I&C

- New cooling / make-up water system for in-containment fuel pools. The purpose of this new system is to ensure that fuel located in the fuel pool is not uncovered if there is fuel damage in the reactor.
- For fuel storages outside the containment (spent fuel storages 1 and 2) we plan to add make-up water lines from external sources and steam vent lines.

- For surface level and temperature measurements:
  - Qualifition of current measurements and their cabling against accident conditions or replacement with qualified equipment.
  - New instrumentation for severe acciddent conditions

Protection against high sea water level

- Considered modifications:
  - Construction of flood dike together with modification of sewage and drainage water systems
  - Alternatively tightening of separate buildings and rooms
- Re-evaluation of possible water level ongoing, technical solution will be decided after re-evaluation.

- In 2012 first gate renewal in sea water channels was implemented. The gates prevent water ingress with open seawater systems in outages in connection with high seawater. Gate renewal increases the allowed water level. One gate is planned to be renewed each year, total 4 gates.

Mobile pumps and generators

- Strategy is to use mobile pumps and generators for selected actions
- Complimentary to existing fixed systems that can operate without plant AC power sources. Protection of these fixed systems is a separate issue.
- The aim is to
  - ensure decay heat removal in power operation and outages to prevent fuel damage and to ensure severe accident management
  - Supporting functions: Lighting, access routes, refueling, lube oil, communication etc.

Diesel fuel storage and distribution

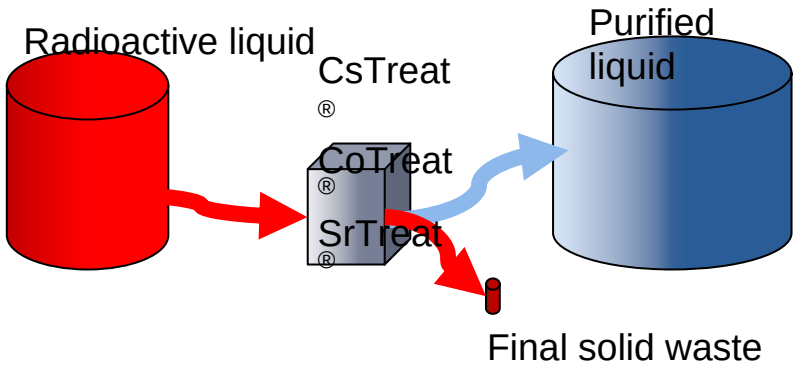
- New storage tank with distibution piping is under consideration.
  - Adding diesel fuel storage capacity at site
  - Distribution of diesel to day tanks of different diesel engines

Other safety related work

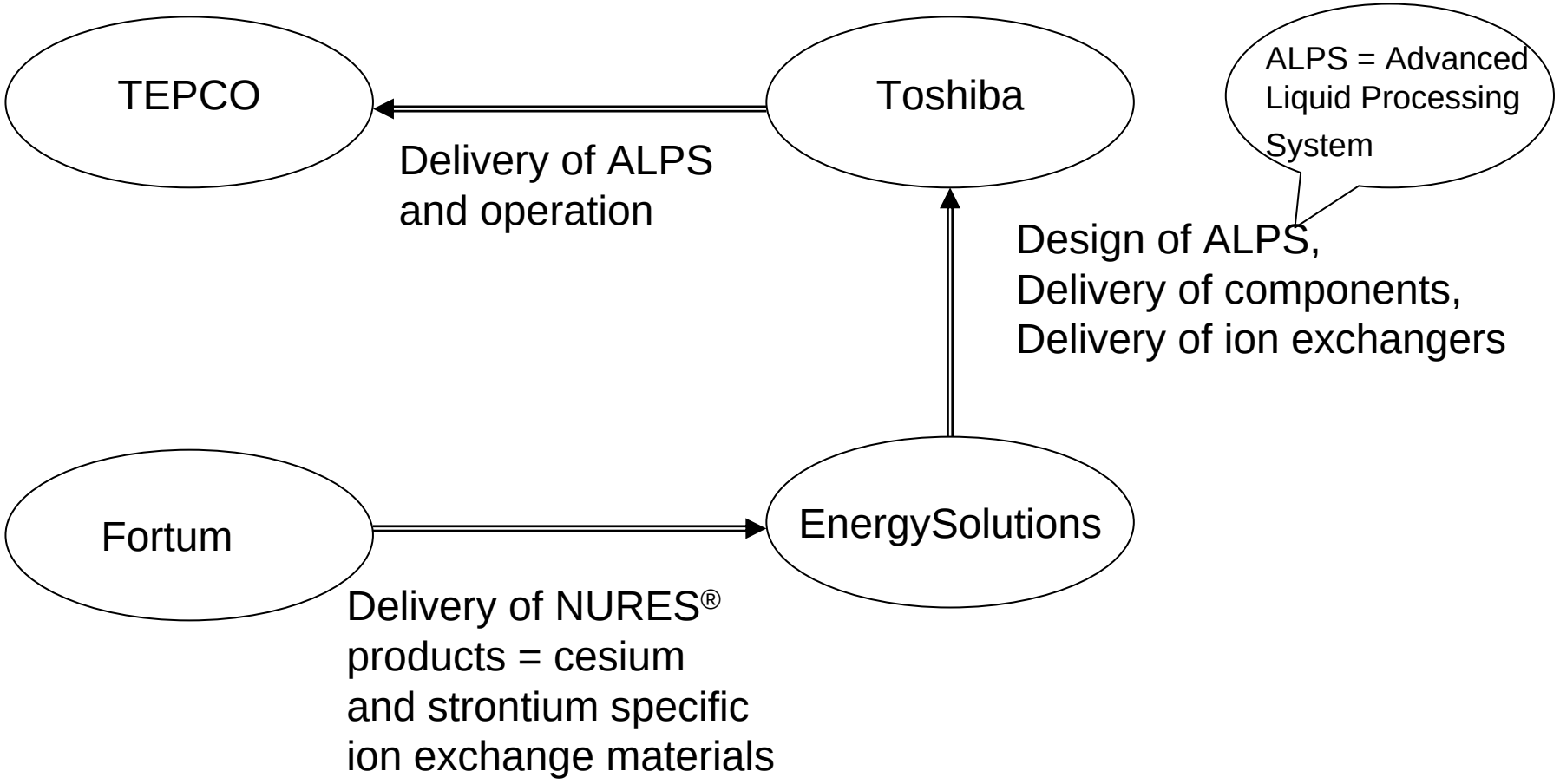
- Emergency preparedness arrangements
- Analyses
  - Earthquake
  - Condition of cabling
  - Water availability
  - Usability of biofuel
- Battery capacity extensions
  - Plant DC
  - Diesel engine start-up batteries
- Independency studies of and improvements of diesel driven auxiliary emergency feedwater system

Fukushima cleanup: Fortum CsTreat®, SrTreat® and CoTreat®

- Materials for highly effective cleaning of radioactive liquids
  - **Removes the most significant radionuclides (cobalt, caesium, strontium)**
  - **Based on extremely efficient selective ion exchange materials**
  - **Treat with CsTreat®, SrTreat® and CoTreat® results a small amount of solid, inorganic waste to final disposal and the liquid can usually be released e.g. into sea.**
  - **More information: http://www.fortum.com/en/products-and-services/power-solutions/products/nures/pages/default.aspx**



Latest application - Fukushima



Conclusions

- Huge interest to plant safety immediately after Fukushima accident: Communication and interviews. Speculation of Fukushima situation was done by STUK.
- Several safety assessments were done to Loviisa NPP
- Safety upgrades
  - Cooling towers, Fuel pools (decay heat removal and I&C), protections against high sea water level, mobile devices, diesel fuel storage and distibution, battery capacity
  - Several analyses ongoing: possible modifications depending on the results
- Fortum is participating the Fukushima clean-up by providing ion exchange materials