Regulatory Response to Lessons from Operating Experience - Examples from Finland

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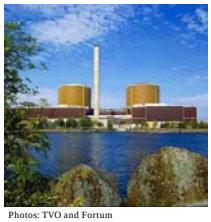
Content

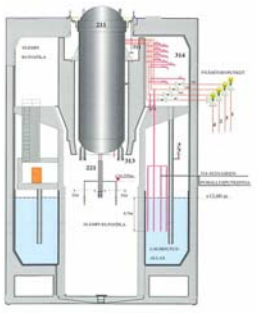


Photos: TVO and Fortum

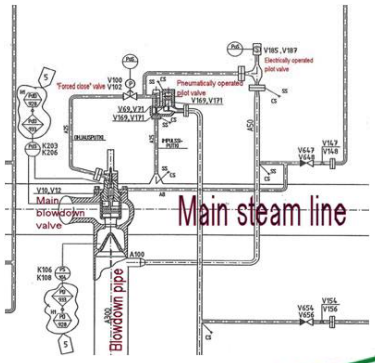
- Olkiluoto 1 & 2 Failure of Safety System Components due to inadequate qualification of slightly modified replacement parts
- Loviisa 1 and 2 Emergency Diesel Generator Connecting Rod Bearing failure

Olkiluoto 1 & 2 Failure of Safety System Components due to inadequate qualification of slightly modified replacement parts

- Description of the event
  - Periodic test of blowdown / overpressure protection system (314) prior OL1 outage in May 2010
  - Two main valves failed to close due to jamming of their electrically operated pilot valves – main valves were forced to close
  - In addition, a third valve was found to be stuck in the closed position
  - Event was rated to INES 1 due to CCF possibility

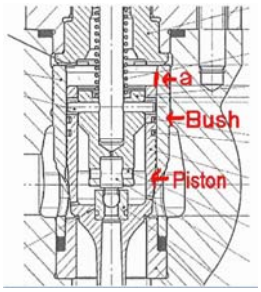


Olkiluoto 1 & 2 Failure of Safety System Components due to inadequate qualification of slightly modified replacement parts



Olkiluoto 1 & 2 Failure of Safety System Components due to inadequate qualification of slightly modified replacement parts

- Background
  - In May 2009 outage new electrical pilot valves (5 out of 10) were changed at OL1
  - New valves had a changed guide bushing design to enable replacement of the bushings at site
  - In Nov 2009 periodic tests were done, but slightly longer opening times of the modified pilot valves went unnoticed
  - 10 out of 10 pilot valves were replaced at OL2 in May 2010 prior OL1 outage
  - Jammed valves were detected in OL1 outage in May 2010



Olkiluoto 1 & 2 Failure of Safety System Components due to inadequate qualification of slightly modified replacement parts

- Cause for jamming
  - New valve had a guide bushing made of a new material (martensitic steel) with chromium coating for lubrication - change was made by the manufacturer but not specified in the manufacturing documentation
  - At the operating conditions (different to reference plant), chrome surface had started slowly to dissolve and dissolved corrosion products precipitated locally forming a firm layer to the valve piston
  - Gap between the valve piston and bushing was filled with a corrosion product jamming the valve

Photo: TVO

Olkiluoto 1 & 2 Failure of Safety System Components due to inadequate qualification of slightly modified replacement parts

- Actions taken
  - After discovery in May 2010, all modified pilot valves were replaced with old valves at OL1
  - Discussions between Licensee and STUK on the continued operation of OL2 with modified valves
  - Licensee decided to shut down OL2 to replace modified valves in June 2010
  - However, OL2 has now 2 re-designed valves (and 8 old valves) to gain operating experience with a new coating material (similar to reference design)

Modification made at OL1 in May 2009

Periodic tests done at OL1 in Nov 2009

Modification made at OL2 in May 2010

Malfunction discovered at OL1 prior to outage in May 2010

OL2 shut down to replace modified valves in June 2010

Olkiluoto 1 & 2 Failure of Safety System Components due to inadequate qualification of slightly modified replacement parts

- Lessons Learned
  - Diversity in design provides safety – main valve has both electrical and spring loaded pilot valves
  - It is a good practice not to introduce modifications simultaneously in all safety trains
  - Importance of management and oversight of manufacturers
  - Importance of Qualification programme - especially long term exposure in real operating conditions
  - Importance of receiving inspections at site
  - Careful attention to periodic testing and programme results after modifications
  - For more information see IRS 8150

Loviisa 1 and 2 Emergency Diesel Generator Connecting Rod Bearing failure

- Description of event
  - In January 2011 licensee's staff identified a similar type of EDG under maintenance at subcontractor's premises in Finland
  - It was found out that the EDG had had a connecting rod bearing failure
  - Similar bearing type were in use at one of the eight EDGs in Loviisa plant
  - Licensee inspected the EDG and discovered damaged bearings
  - Bearings were changed during the next week
  - Reason for bearing failure is being studied

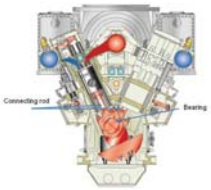


Photo: Fortum

Loviisa 1 and 2 Emergency Diesel Generator Connecting Rod Bearing failure

- Recent similar events elsewhere
  - NEWS notification from France on the 18th of February 2011 – INES 2 event at Tricastin
  - IRS report 8147 from Germany on the 24th of February 2011 – Brunsbuettel NPP in 2009
  - Reference was made to other similar events from 2008 and 2009
  - Similarities with events in Finland and Germany
    - Same Diesel manufacturer Wärtsilä France (Previously SACM) - Diesel type SACMV16UD45S5D
    - Same bearing type

Summary and Regulatory actions

- Response to events after discovery and evaluation of the event reports
- Changes to
  - Legislation for event reporting (Similar to 10CFR Part21)
  - Regulatory guides on event reporting, procurement, subcontractor management
- Additional inspections at both sites in 2011 on the spare part management process
- OECD/NEA/CNRA/WGOE&WGIP Workshop in Finland 14-16 June
  - Utilization of operating experience in the regulatory inspection programme and of inspection findings in the operating experience programme
  - Operating experience and inspection insights from non-conformance of spare parts