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RELIABILITY IMPROVEMENT OF THE EVACUATION ROUTE OF FUEL ELEMENTS OF PHENIX

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INTRODUCTION

PHENIX is a French fast breeder nuclear power plant which went critical in 1973 and ceased power operation in 2009. The decommissioning project started in 2005, in order to start immediately after the final shutdown and achieve the dismantling operations as soon as possible in accordance to the French Safety Authorities principals. The critical path of the plant dismantling is the evacuation of the fuel elements and after the evacuation of the Lateral Neutron Shielding Assemblies (LNSA).
The "Commissariat à l'Energie Atomique et aux Energies Alternatives" (CEA) is the PHENIX operator.
The decommissioning project is headed by the CEA.

STATEMENT

The evacuation of the fuel elements and of the lateral neutron shielding assemblies uses the same route to get out of the plant. This way, called handling route, needs the availability of several equipments, mainly handling equipments.
This handling route has been used around 1800 times already. It will be used around 1600 additional times till the end of evacuation. So this handling route is only at half of its life.
The schedule of evacuation is planned for five years for fuel assembly and 7 years for LNSA. This schedule is based on two teams per day and a reliability of 80% of the handling route.
In 2009, the main crane of the hot cell of the handling route broke down (presented in HOTLAB 2013); in 2010 the heavy manipulator in the cell failed too (presented in HOTLAB 2014), other equipments may face problems. Crane and heavy manipulator failure and replacement stopped the evacuation during around 3 years. The reliability of the handling route is estimated at 50% of availability.

ROADMAP

In 2013 a working group was created to analyze the handling route and specify a roadmap.
The work was done in 2 steps:

- First step analysis of the concerned equipments. It consists of inventory of the concerned equipements, documentary statement, maintenance and operation feedback, technical analysis of the reliability problems,
- Second step definition of an action plan. It consists of the best solution determination according to the cost, technique and schedule.

For each equipment, the adopted analysis approach identifies 3 types of breakdown:

- Standard failure possible to be repaired with the existing means,
- Blocking failure which needs new means to come back in operation and a long loss of operating time,
- Aggravating factor, the failure leads to a non-safety position.

RESULTS

47 equipments are linked to the handling route.
The first step of analyze shows two main causes of possible failure: old age especially for the electrical part and low maintenance. The end of first step defines 16 equipments to be treated in priority due to the important impact of their failure on availability and safety.

To increase the reliability of each equipment, 3 main methods have been analyzed: optimization of the maintenance (procedure, spare part …), refurbishing (simple or important) and replacement (partial or total). The second step analyzes these different solutions according to cost, interruption of operations (due to a blocking failure or to the reliability work). It takes into account the difficulties of realization (assembly on site, qualification, dust…). The second step finished in April 2014.
The optimization of the maintenance has already started for all equipements even if they will be replaced in a near future.
The work has started to specify and manufacture the 16 highest-priority equipements.
The estimated cost for the manufacturing is around 10 M€.

CONCLUSION

In parallel to the beginning of evacuation of fuel elements, a project has been launched to increase the reliability of the equipements concerned by the handling route.
The manufacturing is starting and the implementation for the 16 equipments will held during 2016 and 2017.

Abstract HOTLAB 2015 to be sent to HOTLAB2015@sckcen.be before June 1, 2015