Availability analysis of the Argonauta nuclear instrumentation system

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The maintenance of systems and equipments is a central question related to Nuclear Engineering. Although systems are not fully reliable, it is often necessary to minimize the failure occurrence likelihood [1]. The failures occurrences can have disastrous consequences as in the case of the Three Mile Island, Chernobyl and Fukushima nuclear accidents. The elaboration of a maintenance plan has as objective the prevention and recovery from system failures, increasing reliability and reducing the cost of unplanned shutdowns. It is also important to consider the issues related to organizations safety, especially those dealing with dangerous technologies. In the case of nuclear systems, it is essential for security related issues.

The objective of this report is to propose a method for maintenance analysis of the Argonauta nuclear instrumentation system, using a socio-technical approach, and focused on existing conditions in Brazil [2]. The specific objective of this report is to develop the availability analysis of one of the principal systems of a research reactor, the nuclear instrumentation system. In this analysis, human and organizational factors [3] that could affect the availability of this system were also taken into account, besides the technical aspects of the electronic modules related to the nuclear instrumentation system.

In the Figure 1 is showed the block diagram of the electronic modules related to the Argonauta nuclear instrumentation system.
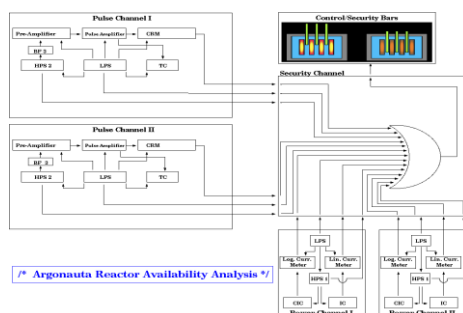

Figure 1. Block diagram of the Argonauta nuclear instrumentation system

In the Figure 2 is showed the results obtained for the availability of the Argonauta nuclear instrumentation system.

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R E W A R D S   R E S U L T S
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Simulation time: 4500000.000000 hours
Number of runs: 30
Total simulation time: 135000000.000000 hours
Confidence interval: 95%
Simulation execution real time: 1178985.211 milliseconds

Measure: Whole System Availability

- ACR(t): - mean = 9.0213999917e-01
- var = 2.4412092341e-06
- interval = \B1 5.59110883e-04
[9.01580888e-01 , 9.02699110e-01]
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Figure 2. Availability of the Argonauta nuclear instrumentation system

Finally, the Figure 3 shows the availability as a function of the mean time to repair (MTTR) for the Argonauta nuclear instrumentation system.
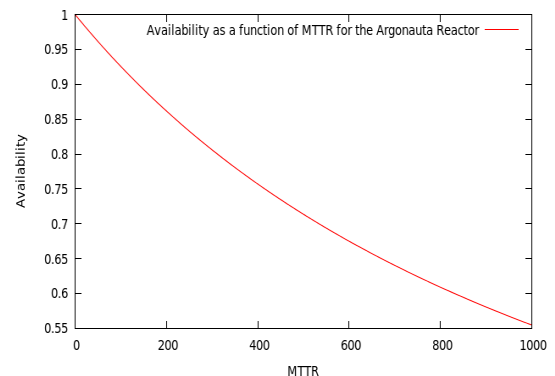

Figure 3. Availability as a function of MTTR for the nuclear instrumentation system

The results showed the influence of the human and organizational factors on the availability of the Argonauta nuclear instrumentation system.

The method proposed may assist in the development of maintenance plans of systems and equipments in similar industrial plants.

References

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