WANO MC Corporate Peer Review for NPPD
15-24 May 2022

CORPORATE SUPPORT SERVICES (CO.5)

**Performance Objective**

Corporate managers and staff support nuclear stations by providing resources and services to organisations that execute or perform activities related to safe and reliable plant operation.

**Area for Improvement CO.5-1**

**In Equipment Reliability area, support provided by the Company to the plant in some cases is not sufficient to improve performance.** In addition, there are still shortcomings in some processes and procedures development, affecting reliable operation of the plant.

**Causes and Contributors**

1. It is difficult to find suppliers outside the country for western equipment.
	1. Some companies prefer not working with the NPPD.
	2. Some manufactures changed their profile or even stopped manufacturing of this kind of equipment.
2. None-completion of ageing management project.
	1. The plant is new in operation.
	2. Obtaining data take much efforts and time.
		1. There is no satisficated CMMS for obtaining data.
3. Not effective the preventative maintenance Program for increasing the ER (define the list of critic equipment needed for safety and generation → identify criteria for each of them → monitor operational trends → anticipate maintenance before unreliability).
	1. Identification of criteria for some cases are not going well.
	2. Unpredictable hiding defects, which reveals only after opening of equipment.
4. From original suppliers for some parts non-compliance of features of items with its technical requirements.

**Supporting Facts**

Equipment Reliability

1. Reactor scram caused by equipment reliability (manufacturing quality, weaknesses in design, technical issues):
2. Two events were related to component manufacturing quality and resulted in automatic reactor scram:
* Reactor automatic scram actuation by a spurious alarm “SG level decrease”. The hidden manufacturing defect in the control (power supply) circuit of the SG main level regulator led to the blowing of transistor in the power supply circuit. WER MOW 2020-0107, 27.09.2019
* Reactor automatic scram actuation at the reactor minimum control power level due to the failure of the neutron flux protection frequency converter module caused by a poor contact in a control card. The apparent cause was the hidden manufacturing defect of a control card. WER MOW 2020-0146, 04.12.2019
1. In one event, weaknesses in the pump design resulted in the reactor manual scram by pressing the emergency protection button due to losing all the main feed water pumps of the SGs. The sealing O-rings non-resistant against petroleum products, hot water and steam. Inadequate selection of the type of O-rings led to degradation and leaking feed water into the sealing water of the pump. WER MOW 2019-0208, 26.02.2019
2. During operations at 10 % power and while reactor power decreased to less than the minimum controlled level of power, the reactor automatic scram actuated due to a failure of the neutron flux monitoring equipment (NFME). There was a failure of transition of neutron flux measurement ranges from the working range (WR) to initiating range (IR) in 2 complexes of NFME. The direct cause was the loss of control on the neutron power measurement. The event was caused by the technical issue: existence of noise on the NFME due to tear and wear of the sealing parts of cable heads in the connecting casing, and oxidation and disconnection of the sockets (cable heads) due to temperature of environment of NFME operation being higher than the working temperature specified in the design of these equipment. NFME equipment is operated outside the design temperature limits. WER MOW 2018-156, 12.02.2018
3. Humidity in the main generator was cause of the last unplanned unit shut-down. The root cause is vibration of electric buses. There is defined action plan to reach sustainable reliability of the Main Generator, but it is not fully implemented yet. The plan is aimed on addressing the Root cause and it is expected to be finalized in 2022. (СO-01-PA-04) This vibration issue was escalated to the top level of the company 2 years ago. In addition to TAVANA, another Iranian company "PARS-generator" joined in solving this problem a year ago. According to the manufacturer, in order to eliminate vibration, it is necessary to slightly raise the stator of generator and fix it in a new position. Technical measures that could solve this problem will be taken at the end of this year during the next outage in 2022. (СO-05-FS-01)
4. According to the Deputy CEO for Technical Engineering, it is necessary to enhance equipment reliability. There is the relevant WANO Guideline (GL 2018-03 Rev 1 - International Equipment Reliability Index (I-ERI)) and currently the company has no plans to use an indicator such as ER index. (СO-01-FS-13)
5. After fuel leakages identified at the plant by increased values of FRI earlier, analysis of the primary system parameters, status, the potential options of solution were discussed. The nuclear fuel producer suggested change from the UTVS type to TVS-2M type which was accepted. The new fuel is more reliable, no problem is visible and will be capable to manage 18-month cycle. The leaking fuel assemblies in 2019 and 2021 were of the previous fuel type assemblies. (СO-04-HL-01)
6. There are cases of uncertainty regarding the equipment reliability: there is an issue with Spares for Safety Pumps – extra inventory of pumps from Unit #2 have been used as source of spares. For bearings and seals – they had to perform engineering and localize production of spares. (СO-02-SS-07)
7. The NPPD has vision and feasibility studies on capacity uprate to 104% and turn to 18-month fuel cycle. These Programs started a year ago. The scope of work to be done is currently being determined. In this issue, the company should act extremely careful, since the implementation of such plans may lead to a deterioration in the operating conditions of the equipment. (СO-05-FS-02)
8. The BNPP managing Director expect NPPD to provide the plant with new equipment for systems modernization and modifications. (СO-04-LG-02)
9. So far, large equipment has been covered by the Aging Program. Currently, information is being collected, so-called screening is being carried out. Obtaining of necessary data requires a lot of efforts due to lack of CMMS. (СO-05-FS-04)
10. There is Company document “Expectations and Requirements for Ageing Management of BNPP SSCs” RPA-4000-01 dated Jan 2019. The Plant has developed corresponding implementation procedure 99BU. 10 0AB.PRO. SEPAM-13784 dated Feb 2020. Nevertheless, during an interview with Manager responsible for AM and Equipment Reliability it was mentioned that additional training in ageing management and equipment reliability is needed. (СO-05-PA-06)
11. Sometimes modernization processes and maintenance are delayed due to long-term equipment and spare parts procurement, including long process of licensing. Also, sometimes the plant departments provide procurement request late. (СO-06-HL-07)
12. The plant identified additional work necessary to the IAEA stress test results, including program of application of emergency diesel-generators for Sever Accident Management (SAM) and development of the last SAM, revised version of SAM documentation. Due to the Covid-19 pandemic, the approval process was delayed by the NPPD. Now, final version of SAM documents after commenting is expected from the Russian contractor which will be followed by the NPPD approval planned in this year and implementation later. (СO-04-HL-03)

Some equipment for connection for SAM are still not supplied to the plant. In fact, this equipment will not be operational when it is needed. (СO-07-VE-05)

1. BNPP needs support from NPPD for Infrastructure for practical training (laboratories, workshop, mock ups). (CO-09-LG-01)

**Current Perspective**

The support of the plant is being provided by the company in the areas of infrastructure preparedness, ageing management and procurement. In some areas such as equipment reliability improvement is required. More requests for technical support come from the station than the company offers its services.

Even though BNPP is in operation for eight fuel cycles now, the pumps of all safety system are much older. All Safety Pumps have been produced in 1978. During the construction of the plant, the Program for the Integration of German Equipment was implemented. And from that moment, this equipment began to be considered as a new one. The most difficult problem is the supply of spare parts for German equipment. The NPPD is planning for localization, in other words, to manufacture such equipment in Iran.

Fuel damage occurs at the Plant. The company explains this by the specifics of the structure of the fuel assembly and thermal hydraulics. By initiative of the manufacturer, the company has decided to replace the nuclear fuel from TVS-U to TVS-2M.

It is important is to improve WANO index by reducing the duration of outages, complete replacement of the nuclear fuel from UTVS to UTVS-2M, switching to an 18-month fuel cycle, fostering ageing management and so on.

The following important technical issues of NPP operation are awaiting implementation: vibration of the generator bus bar; modernization of the refueling machine.

The company monitors the manufacture of equipment and materials for the Plant at manufacturers.

The challenge for the technical support process is the lengthy assessment of the documentation.

Resolving reliability issues of the Main Generator: joint commission (Electrosila, RAS, NPPD, BNPP, MAPNA, etc.) analyzed the root causes and developed a programme addressing the root causes. According to preliminary estimations the repair requires 60-day outage. There is hope, that proposal of Electrosila will solve the issue, however this approach was not yet tested at any other NPP having same issues.

The company has a program to improve the equipment reliability. As an example, a year ago, the modernization of a refueling machine began. The equipment is included in this program based on the results of monitoring and analysis performed by the NPP personnel. There is a Modernization and Modification Committee at the plant, which identifies the priorities (timing) and shares its proposals with the company. The NPPD analyzes this information and makes a decision on the modernization depending on priority and funding.

It would be beneficial for the company to get international experience in ER area, including benchmarking, technical cooperation, rendering of more qualified services for enhancing ER.

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