**Objectives of the Visit to the Tianwan NPP in the Maintenance & Repair Area and operation Area:**

* Getting familiar with the methods and measures taken in planning and organization of the activities during the unit shutdown which has led to the decrease of Refueling time.
* Getting familiar with the modernizations performed on the Refueling Machine. These include the modifications made in the receiver of the Neutron Absorbent Holder, the Fuel Leak Detection System (Sipping System) and the working arms.
* Experience exchange related to the manner of making modifications (permanent and temporary) in the systems (modification in the algorithms, modernization, etc.).
* Getting familiar with the methods used for cleaning the bottom part of the Reactor Pressure Vessel during the overhaul of the reactor and when the internal vessel has been disassembled from the inside of the reactor. Type of equipment and facilities, and the manner of decontamination of these wastes.
* Getting familiar with the methods of repairing and removing the possible leakage defects of the Spent Fuel Pool. Particularly including the facilities and equipment for underwater repair of the Spent Fuel Pool.
* Getting familiar with the process of unloading the spent fuels from the Spent Fuel Pool and relocating them to the related pit and examining the type of transport containers for spent fuel, the manner of performing the operation and the relevant tests.
* Examining the manner of organization, planning and conducting the M&R activities of the Primary Circuit Main Circulation Pumps in order to decrease the repairs duration.
* Examining the modernizations done on the Radial-Axial Bearing of the Primary Circuit Main Circulation Pump.
* Getting familiar with the methods used for removing the possible defects and repairing the main flange of the Primary Circuit Main Circulation Pump.
* Examining the manner of organization of M&R administrative activities, organization of dispatcher, internal communications and interactions of this Unit with other Units of the plant, and methods and/or measures taken for decreasing the delays occurred during the performance of activities unit outage period.
* Experience exchange related to the Unit startup after the repairs and the ways to decrease the Unit startup time (reducing the tests during shutdown and startup).
* Experience exchange related to the manner of organization of the Unit operating activities.
* Getting familiar with the hydraulic wrench of the Steam Generators. The manner of wrench operation, its advantages, and information & experience exchange related to the manner of operation, repair and maintenance of this equipment.
* Examining the manner of performing tests of the Steam Generators’ Impulse Safety Valves. Including the test’s requirements, test’s time, manner of test performance, and conditions for safe performance of the aforementioned tests.
* Observing the manner of testing the performance, adjusting, inspecting and technical service of the Turbine over-Speed Protection bolt.
* Getting familiar with the tools for blocking the SG during the eddy current tests of the SG’s tubes and also during the refueling.
* Getting familiar with the M&R strategies taken in the Tianwan NPP in regard to mechanical equipment and manner of selecting each strategy for a specific type of equipment.
* Getting familiar with the manner of organization of activities in working on open equipment and the manner of complying with the FME requirements in the aforementioned NPP and obtaining valuable experiences.
* Discussion related to the manner of spare parts estimation and consumables, and the manner of supplying these items, and also the manner of determining the minimum critical inventory of NPP.
* Examining the repair documents in Tianwan NPP and using the experiences of this NPP in regard to the removal of documents problems. Including getting familiar with repairs technological documents, repairs quality control documents, case-based documents developed by the NPP regarding the related repairs and requirements, content and manner of updating these documents.
* Visiting and observing the rotary equipment repairs workshop of the Controlled Area and getting familiar with the equipment and tools and stands for repairing the Primary Circuit Main Circulation Pump.
* Exchanging experiences related to translation of operation documents and the manner of approving them, and how to use them in the control room in the first years of operation.
* Manner of making changes in the plant main documents such as technical regulations of operation.
* Examining the facilities and equipment existing for removal of serious defects on the valves and shell equipment which could not be corrected by performance of Lapping, and needs other methods like welding and heat treatment.
* Observing the manner of test and performance & proficiency control of the hydraulic shock absorbers, and the manner of performing the possible repairs of this equipment.
* Manner of planning and interaction between the operation and repairs for exit equipment to repairs.
* Manner of participation of personnel (control room) of older Units in the activities of the newer Units.
* Manner of training and obtaining the license for control room personnel including the method of training, training duration, On-the-Job Training (OJT) in the working places, promotion in the main control room and the manner of obtaining license in promotion from Control Engineer to Shift Supervisor position .
* M&R strategies including: examining the status of the predictive and preventive M&R strategies, and reliability based M&R strategies and also the M&R strategies based on the examination of the equipment conditions in the Tianwan NPP, requirements of necessities and administrative structure of these strategies and also the manner of exchanging and integrating information in these areas.
* M&R mechanized system including: state of installing and using the M&R mechanized system, type of software, applicable modules
* M&R planning- including: manner of planning the critical line and equipment repair, current planning during the unit operation period, weekly and daily planning, project control during the outage, updating the plans, mechanism and manner of updating the plans based on the problems occurred during the Unit outage, measures taken for decreasing and optimizing the outage duration.
* M&R organization- including: dispatching and organization and plan of meetings, organization before, during and after the outage, mechanism and manner of making decisions about the problems occurred during the Unit outage, measures taken for decreasing and optimizing the outage duration, technical supervision, management of materials and spare parts, contractors, access to the site, accommodation and control.
* List (bill) of M&R activities- including: number of all repair items during the outage and during the Unit operation, planning and organization of works during the outage and unit operation, strategies used for M&R.
* Executors of the M&R including: amount and manner of outsourcing the works, number and type of mechanics and electrical power repair teams, and the manner of their interactions, manner of performance of the work during the outage in terms of number of working shifts, number of external consultants and representatives of the equipment manufacturers.
* Refueling- examining and comparing the performance parameters of the Refueling Machine including: movement speed of the refueling machine’s arm, total time of refueling, relocation time for the fuel assemblies in the reactor well, time needed for conducting the sealing test of Spent fuels, executor of refueling work (Chinese or contractor), number of people and work shifts, modernization done on the refueling machine, examining the state of maintenance and operation of the machine, and the number of refueling machine failures in the previous outages and the experiences gained in this area.
* Technical inspections and control of metal and welding points- including: bill of inspections from the reactor and primary circuit pipelines and equipment, executor of inspection with the automatic devices, type of thermal insulation used, time period between these inspections and controls, manner of planning and coordination of these inspections and controls with other activities, number of people and work shifts, and the conditions of performing these activities during the year.
* Main equipment and safety channels- including: examining the secondary and primary circuit main equipment repair cycle, backup equipment or complexes used during the unit outage for replacement, examining the status of type and manner of performing the repairs, localization plan of the main buildings during the repair of these equipment, examining the conditions of contaminated equipment repair workshops inside and outside the controlled area, manner of displacement of the primary circuit and the spent fuel pool, number of safety channels and their equipment, time period between the tests of channels, requirements of putting the safety channels out of operation during the Unit operation, planning the repair of safety channels during the Unit operation or outage

**Number of people for participating in the visit:**

The following 15 people have been considered for this visit:

* M&R Division : 1- mechanical repairs manager 2- project control and planning manager 3- head of refueling machine and reactor repair group 4- head of controlled area rotary equipment repair group 5- static equipment manager
* Operation Division: 1- plant shift supervisor 2- deputy for reactor operation 3- deputy for turbine operation 4- senior process engineering manager 5- deputy for I&C operation
* M&R Organization and Planning Management: 1- M&R organization and planning manager 2- head of planning group 3- head of organization group 4- planning expert (responsible for outage planning) 5- planning expert (responsible for unit’s current planning)

**Duration of the visit:**

Considering the volume of the intended inspections and extensiveness of aforementioned areas, at least 5 working days for the visits and complete attendance at the Tianwan NPP without taking into account going and returning is appropriate.

**Proposed date for the visit:**

Conducting the visit would be appropriate in the interval from 01.Aug.2019 to 30.Dec.2019 (request of the M&R Division is that the visit should definitely be conducted during the outage period of one of the Units).

**Daily schedule of visit from NPP:**

* Maintenance and repair division:

| **Participants** | **Activity description** | **Time** | **Day** |
| --- | --- | --- | --- |
| All the team members | Familiarity with methods and measures taken in planning and organizing the Unit outage activities which have led to decrease of refueling period. | **8:00 - 10:00** | **First day** |
| All the team members | Reviewing how to organize administrative activities of maintenance and repair, organizing the power dispatcher, internal communications and interactions of this section with other sections of NPP and the measures taken for decreasing the halts occurred in the course of Unit outage | **10:30 - 12:30** |
| All the team members | Familiarity with M&R strategies taken in Tianwan NPP regarding mechanical equipment and how to select each strategy for a specific type of equipment | **13:30 - 16:30** |
| All the team members | Familiarity with how to organize activities performed on disassembled equipment and how to fulfill the FME requirements in the mentioned NPP and obtain useful experiences | **8:00 - 10:00** | **Second day** |
| All the team members | Discussion and exchange of views regarding how to estimate the spare parts and consumables and how to supply them and also how to determine the minimum critical inventory of NPP | **10:30 - 12:30** |
| All the team members | Reviewing the repair documents in Tianwan NPP and using experiences of this NPP regarding removing the problems of documents including familiarity with technological documents of repair, documents of repair quality control, case-based documents prepared by NPP regarding the related repairs and requirements, content and method of updating these documents. How to obtain approval of welding documents of equipment of safety class 2 and 3 | **13:30 - 16:30** |
| Manager of mechanical repairs and refueling group | Familiarity with modernizations carried out on the refueling machine such as measures taken in the receiver of the neutron absorbent holder, fuel sipping system, and working arms | **8:00 - 10:00** | **Third day** |
| Manager of mechanical repairs and refueling group | Familiarity with methods used for cleaning the bottom of reactor vessel during reactor overhaul and when reactor vessel was disassembled from inside of the reactor. The type of instruments, and filters and the rate of their sensitivity, method of removing contamination, how to maintain the repair these instruments | **10:30- 12:30** |
| Manager of mechanical repairs and refueling group | ( continuation of discussion….) including the type of equipment , instruments and materials and how to decontaminate these wastes | **13:30 – 16:30** |
| Head of group for repairing rotary equipment of radiation controlled area | Examine the method of organizing, and implementing the repair activities of reactor coolant pumps (RCPs) in order to decrease the time of repairs | **8:00 – 10:00** | **Third day** |
| Head of group for repairing the rotary equipment of radiation controlled area | ( continuation of discussion….) raising specialized questions regarding how to organize, plan and perform repair activities of reactor coolant pumps (RCPs) in order to decrease the time of repairs. Visiting the workshop of the RCPs repairs | **10:30- 12:30** |
| Head of the group for repairing the rotary equipment of radiation controlled area | Examining the modernizations performed on the RCPs and their impact on the function of radial-axial bearing of pump | **13:30-16:30** |
| Static equipment manager | Getting familiar with the hydraulic wrench of steam generators of Tianwan NPP , advantages and disadvantages, alternative methods and disadvantages of these methods | **8:00 – 10:00** | **Third day** |
| Static equipment manager | How to operate and work with this wrench and exchange information and experiences regarding maintenance and repair of this instrument | **10:30:12:30** |
| Static equipment manager | Familiarity with instruments which block steam generator when performing eddy current tests of steam generator pipelines and also refueling | **13:30- 16:30** |
| Manager of project planning and control | Examining the repairs quality control documents | **8:00- 10:30** | **Third day** |
| Manager of project planning and control | Case-based documents prepared by this NPP regarding the repairs (notifications, orders and other similar documents….). | **10:30-12:30** |
| Manager of project planning and control | (Continuation of discussion…….) about requirements and the level of approval of these documents and related requirements in the manner of updating these documents. | **13:30 – 16:30** |
| Manager of mechanical repairs and refueling group | Familiarity with methods of repairs and removing possible leakage defects of spent fuel pool | **8:00- 10:30** | **Fourth day** |
| Manager of mechanical repairs and refueling group | (Continuation of discussion……) about familiarity with facilities and equipment for repairing the spent fuel pool under water. procedures, method of operation and type of activities performed in this field | **10:30-12:00** |
| Manager of mechanical repairs and refueling group | Familiarity with removing the spent fuel from the spent fuel pool and transferring it to related well and getting familiar with the type of spent fuel transfer casks , method of doing the work and related tests | **13:30-16:30** |
| Head of the group for repairing the rotary equipment of radiation controlled area | Familiarity with methods used for removing possible defects and repairing the main flange of RCP | **8:00-10:00** | **Fourth day** |
| Head of the group for repairing the rotary equipment of radiation controlled area | Familiarity with instruments and equipment used for repairing main flange of RCP | **10:30-12:30** |
| Head of the group for repairing the rotary equipment of radiation controlled area | Visiting and observing the repair workshop of the rotary equipment of radiation controlled area and getting familiar with equipment and instruments and stands of repairing RCP | **13:30-16:30** |
| Static equipment manager | Examining how impulse-related safety valves of steam generators are tested | **8:00-10:00** | **Fourth day** |
| Static equipment manager | ( continuation of discussion…) about requirements of test, time of performing test, requirements for safe implementation of the mentioned tests | **10:30-12:30** |
| Static equipment manager | Familiarity with how to test the function, setting, checking and technical service of the overspeed bolts for protection against overspeed of the turbine | **13:30-16:30** |
| Manager of project planning and control | Familiarity with the power dispatcher structure, job description, and its establishment in Tianwan NPP | **8:00-10:00** | **Fourth day** |
| Manager of project planning and control | Visiting the working locations , documents and documentations | **10:30- 12:30** |
| Manager of project planning and control | Familiarity with schedules of mechanics and power and their communications | **13:30-16:30** |
| Head of the group for repairing the rotary equipment of radiation controlled area | Familiarity with types of mechanical shock absorbers of primary circuit equipment and how to perform possible repairs of these equipment | **8:00-10:00** | **Fifth day** |
| Head of the group for repairing the rotary equipment of radiation controlled area | Visiting the repairs workshop and familiarity with how to perform test and monitor function and efficiency of hydraulic shock absorbers | **10:30-12:30** |
| Team members | Final recapitulation and raising questions by team members | **13:30-16:30** |
| Static and rotary | Examining the existing facilities and equipment for removing the serious defects of valves and shell equipment which cannot be corrected by lapping and other corrective methods like welding and heat treatment are needed. Familiarity with instruments and related equipment and methods | **8:00-10:00** | **Fifth day** |
| Static and rotary | Familiarity with test machinery test and stand of rotary equipment, balance equipment, types of heaters and heat furnaces and types of turners and portable milling machines and visiting the workshop of testing the function, setting, checking and technical service of overspeed bolts for protection against overspeed of turbine | **10:30-12:30** |
| Team members | Final recapitulation and raising questions by team members | **13:30-16:30** |
| Manager of project planning and control | How to make sure of the qualifications of contractors | **8:00-10:00** | **Fifth day** |
| Manager of project planning and control | How to organize the activities of contractors during the outage of Unit | **10:30-12:30** |
| Team members | Final recapitulation and raising questions by team members | **13:30-16:30** |

* **Operation Division**

| **Participants** | **Activity description** | **Hour** | **Day** |
| --- | --- | --- | --- |
| operation team | Getting familiar with Tianwan NPP – familiarity with Tianwan NPP- reviewing the operation structure ( power operation division) of Tianwan NPP | **8:00-10:00** | **First day** |
| operation team | Operating experiences regarding how to organize the activities of Unit operation | **10:30-12:30** |
| operation team | * Exchange of experiences regarding how to make changes (temporary and permanent) in systems (change in algorithms, modernization, etc.) * Changes made in the MCR of the plant regarding preventing the staff errors (“off” panels and reducing the “on” alarms and ….). * Visitation from MCR | **14:00-16:30** |
| operation team | Exchange of experiences regarding startup of the Unit after repairs and reducing the time of starting up the Unit | **8:00-10:00** | **Second day** |
| operation team | The method of planning and interaction of operation and repairs in order to taking equipment out of operation for repairs (during overhaul, Planned Preventive Maintenance and planned current repairs). | **10:30-12:30** |
| operation team | Examining the technical regulation of operation  and examining the tests which should be done at the time of Unit startup and outage in order to decrease outage and startup duration , how to obtain the necessary permits for reducing the tests at the time of startup and outage | **14:00-16:30** |
| operation team | Exchanging experiences related to translation of operation documents and the manner of approving them, and how to use them in the control room in the primary years of operation. | **8:00-10:00** | **Third day** |
| operation team | How to make changes in the main documents of NPP such as Technical Regulation of Operation | **10:30-12:30** |
| operation team | Familiarity with how to perform switching and tests during NPP operation – schedules of performing tests- switching cards | **14:00-16:30** |
| operation team | * Familiarity with the disturbance procedures of disturbance in normal operation and emergencies * Examining the performance of the staff during disturbance in operation and during emergencies and using the related procedures | **8:00-10:00** | **Fourth day** |
| operation team | Examining the participation of control room staff in reviewing the accidents and deviations occurred in NPP | **10:30-12:30** |
| operation team | * Examining the reactions of the staff of control room regarding alarm signals and how to use the related procedures * How to control and direct reactor reactivity   Solutions and tools for preventing the human errors and practically use them | **14:00-16:30** |
| operation team | Primary trainings and qualification maintenance of staff ( licensed and non-licensed) – position of fundamental operation skills in training the staff | **8:00-10:00** | **Fifth day** |
| operation team | * How to train and obtain the licensed staff of control room including method of training, duration of training, on the job training in working places, promotion in MCR and how to obtain license in the promotion from control engineer to shift supervisor job * Manner of participation of staff ( control room) of old units in the activities of new Units | **10:30-12:30** |
| operation team | Visiting the simulator and supervising the conduct of drill for dealing with accidents by control room staff | **14:00-16:30** |

* **Management of M&R planning and organizing**

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| --- | --- | --- | --- |
| Participants | Activity description | Hour | Day |
| All the team members | M&R strategies | **-** | **First day** |
| All the team members | Mechanized system of M&R | **-** | **Second day** |
| All the team members | M&R planning | **8:00-12:30** | **Third day** |
| All the team members | M&R organizing | **13:30-16:30** |
| All the team members | M&R bill of quantities | **8:00-10:00** | **Fourth day** |
| All the team members | M&R executors | **10:30-12:30** |
| All the team members | Refueling | **13:30-16:30** |
| All the team members | Technical inspections and controlling the metal and weld points | **8:00-10:00** | **Fifth day** |
| All the team members | Main equipment and safety channels | **10:30-12:30** |
| All the team members | Visit | **13:30-16:30** |