**7. RADIATION PROTECTION**

**7.1. Organization and functions**

**7.1.1. Functions and responsibilities**

*How are radiation protection aspects covered by the plant management system? [SSR-2/2 Requirement 15; 4.52, Requirement 20; 5.10-5.16] [NS-G-2.7; 2.45, 2.46] [RS-G-1.1; 5.105, 5.107, 5.108]*

*How are organizational structure, responsibilities, levels of authority and functions defined and communicated within the radiation protection organization? Are they understood by personnel? [GSR Part 3 Requirement 4; 2.39-2.46] [SSR-2/2 Requirement 1; 3.2(b)(d), Requirement 3; 3.8, 3.9, Requirement 20; 5.14] [NS-G-2.7; 2.40, 3.69-3.75] [RS-G-1.1; 5.12-5.14]*

*How are goals, objectives and safety indicators related to radiation protection developed and managed? How are outcomes checked and measured within the organization? [NS-G-2.4; 5.20, 5.21]*

*How are radiation protection policies and programmes kept up-to-date with industry practices? What internal process is put in place in this regard? [SSR-2/2 Requirement 31; 8.1-8.3] [NS-G-2.11; 7.2]*

*How is the RP programme reviewed? [SSR-2/2 Requirement 20; 5.10] [NS-G-2.8; 4.27] [RS-G-1.1; 5.110, 5.111]*

*How is the RP group’s performance evaluated? [GSR Part 3 Requirement 9; 3.15(h)] [SSR-2/2 Requirement 9; 4.33] [RS-G-1.1; 5.110, 5.111]*

**7.1.2. Personnel**

*What is the staffing level, including the use of contractors, in the area of radiation protection? How does the plant ensure that there is enough manpower to cover outage and operation workloads? [SSR-2/2 Requirement 4; 3.11] [NS-G-2.6; 3.7, 4.6, 4.11, 4.12, 4.15] [GS-G-3.1; 4.1] [NS-G-2.4; 7.4]*

*How are radiation protection staff, including contractors, qualified for their assigned work? What measures have been taken to maintain adequate levels of experience, knowledge and proficiency? [SSR-2/2 Requirement 4; 3.10, 3.11, Requirement 7; 4.16-4.19] [NS-G-2.7; 5.2] [NS-G-2.8; 3.34, 5.27] [RS-G-1.8; 11.1-11.4]*

**7.2. Radiation protection policy**

*How are administrative limits, policies and appropriate radiological goals established? [GSR Part 3 Requirement 5; 2.47] [SSR-2/2 Requirement 5; 4.1-4.5, Requirement 20; 5.10-5.16] [NS-G-2.4; 3.19-3.24, 5.20, 5.21] [NS-G-2.7; 2.30]*

*How are ALARA principles defined and how are they understood? [GSR Part 3 Requirement 1; 2.10] [NS-G-2.7; 2.4, 2.14, 3.67] [RS-G-1.1; 4.8-4.10]*

*How is the independence and authority of the RP group ensured? [SSR-2/2 Requirement 20; 5.12] [NS-G-2.7; 2.39, 3.73, 3.74]*

*In what way is the radiation protection group involved in the development of standards and operational procedures addressing radiological issues? [GSR Part 3 Requirement 4; 2.42, Requirement 5; 2.52, Requirement 9; 3.15(f)(g), Requirement 21; 3.76(d), Requirement 24; 3.94] [RS-G-1.1; 5.32] [NS-G-2.7; 3.73]*

*How is the health of individuals taken into consideration when assigning work in the RCA? [GSR Part 3 Requirement 21; 3.76(f), Requirement 25; 3.108] [SSR-2/2 Requirement 20; 5.15] [RS-G-1.1; 7.5-7.8]*

*What special arrangements are in place to protect female workers and those under the age of 18 (who may be undergoing training)? [GSR Part 3 Requirement 28; 3.113-3.116]*

*What type of counselling could be provided to workers, if needed? [RS-G-1.1; 7.14, 7.15]*

*What types of interactions are in place with, for example, operations and maintenance groups, etc.? [SSR-2/2 Requirement 31; 8.11, 8.23] [NS-G-2.7; 3.41]*

*What are the different radiation concerns that have arisen in the past, and how were they resolved? [NS-G-2.7; 2.47, 3.2]*

**7.2.1. Training and qualification of non-radiation protection personnel**

*What RP training is provided to site personnel, including contractor personnel? [GSR Part 3 Requirement 21; 3.76(h), Requirement 26; 3.110] [RS-G-1.1; 5.92, 5.93, 5.95, 5.97] [NS-G-2.7; 3.55, 5.1-5.11]*

*What special training is provided, such as practice on mock-ups and rehearsals of planned work? [NS-G-2.7; 3.42, 5.4, 5.6] [RS-G-1.1; 5.96]*

*How are RP information and training programmes documented? [GSR Part 3 Requirement 26; 3.110(c)] [RS-G-1.1; 5.100]*

**7.2.2. Health surveillance**

*How is the health surveillance programme organized at the plant, and how are responsibilities assigned for making the necessary arrangements to assess and record occupational exposure and to survey the health of workers? [GSR part 3 Requirement 25]*

**7.2.3. Radiation protection records**

*Do the responsible organizations maintain a complete set of RP records that are readily available to the regulatory body or other interested parties? What are the retention times? [GSR part 3 Requirement 4; 2.43(e), Requirement 14; 3.38(d), Requirement 16; 3.47, Requirement 17; 3.54, 3.55, Requirement 21; 3.76(i), 3.80, Requirement 23; 3.87(c), Requirement 24; 3.98, Requirement 25; 3.103-3.107, Requirement 26; 3.110(c), Requirement 30; 3.127(g), Requirement 32; 3.135(e), 3.137(b)]*

*How are records from individual external contamination monitoring maintained and kept? [SSR-2/2 Requirement 15; 4.52] [RS-G-1.3; 8.3-8.10]*

**7.3. Radiation work control**

**7.3.1. Radiation work authorization**

*How is radiologically hazardous work planned? [GSR Part 3 Requirement 24; 3.94] [RS-G-1.1; 5.36, 5.37]*

*How does the radiation work permit (RWP) programme work? [NS-G-2.7; 3.43-3.47]*

*What RWP procedures are available, and how are they followed? [NS-G-2.7; 3.43-3.47]*

*What special provisions are made for exceptional, radiologically hazardous work? [NS-G-2.7; 3.6, 5.4]*

**7.3.2. Control of designated areas and individual worksites**

*What are the layout and markings of controlled and supervised areas? [GSR Part 3 Requirement 24; 3.88, 3.91] [NS-G-2.7; 3.14] [RS-G-1.1; 5.28-5.31]*

*How is access to the RCAs restricted, and what are the measures taken to control workers at the entrances to the RCAs? [GSR Part 3 Requirement 24; 3.90(a)-(f)] [NS-G-2.7; 3.5, 3.9, 3.10]*

*How does the plant manage visitors to controlled areas or supervised areas? [GSR Part 3 Requirement 24; 3.88, Requirement 30; 3.128]*

*What are the arrangements at the exits from the RCAs for protecting against the spread of contamination? [GSR Part 3 Requirement 24; 3.90] [NS-G-2.7; 3.11-3.13]*

*What local rules and procedures, to be followed in controlled areas, are available for the protection and safety of workers? [GSR Part 3 Requirement 24; 3.94(a)]*

*What are the investigation or authorization levels set in procedures, and what are workers required to do if a level is exceeded? [GSR Part 3 Requirement 24; 3.94] [NS-G-2.7; 3.16, 3.48-3.51] [RS-G-1.1; 4.22]*

**7.3.3. Workplace monitoring programme**

*How comprehensive, timely and accurate is the programme for workplace monitoring in the RCAs and supervised areas? [GSR Part 3 Requirement 24; 3.96, 3.97] [NS-G-2.7; 3.3, 3.19, 3.24-3.27]*

*How is the workplace monitoring programme used in the assessment of external and internal exposures? [GSR Part 3 Requirement 25; 3.100, 3.101] [NS-G-2.7; 3.30]*

**7.4. Control of occupational exposure**

**7.4.1. Implementation of the ALARA principle**

*How does the plant ensure that ALARA principles are followed for all work planning and execution? What ALARA practices do workers apply? [GSR Part 3 Requirement 21; 3.77(a), Requirement 22; 3.83] [NS-G-2.3; 4.11] [NS-G-2.4; 6.37] [NS-G-2.5; 2.28] [NS-G-2.6; 4.23, 4.34, 8.4] [NS-G-2.7; 2.18, 2.19]*

*What approaches are used in relation to the ALARA principle, and how are dose constraints set? [GSR Part 3 Requirement 1; 2.10, Requirement 21; 3.77(b)] [RS-G-1.1; 4.13-4.16, 4.17-4.21]*

*What postings, labelling and special provisions are provided to make sure staff are aware of radiation hazards and of the need to keep dose ALARA? [GSR Part 3 Requirement 21; 3.76(d)] [NS-G-2.7; 3.14, 3.42, 3.43, 3.54, 3.57, 3.74]*

*How are workers motivated to adhere to the ALARA principle? [NS-G-2.7; 2.31, 2.32]*

*How are supervisors/managers involved in controlling and optimising occupational exposures? [NS-G-2.7; 2.29-2.33]*

*What are the results and feedback of occupational exposure in terms of application of the ALARA principle? [NS-G-2.7; 2.14, 3.67]*

**7.4.2. Internal contamination monitoring**

*How is the internal contamination assessment programme established? [NS-G-2.7; 3.37] [RS-G-1.1; 5.67] [RS-G-1.2; 3.3-3.43]*

*What measures are used to protect workers from internal contamination? [NS-G-2.7; 3.48-3.51, 3.54, 3.55]*

*How does workplace monitoring support assessment of internal contamination? [NS-G-2.7; 3.27, 3.29, 3.30]*

*What methods are used to calculate dose commitments? [RS-G-1.2]*

**7.4.3. External radiation monitoring**

*What is the programme for the monitoring of external radiation exposures? [NS-G-2.7; 3.33] [RS-G-1.3; 3.6-3.16, 9.11]*

*What types of dosimeters are provided to radiation workers for routine monitoring? [NS-G-2.7; 3.34]*

*What additional dosimeters are available? [NS-G-2.7; 3.36] [RS-G-1.3; 3.38]*

*What procedures and methods are in place to obtain a formal dose assessment in the event of the loss of a dosimeter and in the event of unexpected or unusual dosimeter readings? [RS-G-1.3; 8.7]*

**7.5. Radiation protection instrumentation, protective clothing and facilities**

**7.5.1. Portable, fixed dose rate and contamination measurement instrumentation**

*What are the inventories and locations of portable and fixed dose rate measurement instrumentation? [GSR Part 3 Requirement 21; 3.76(g)] [NS-G-2.7; 3.23, 3.25, 3.28, 3.29, 3.31, 3.32]*

*What are the inventories and locations of portable and fixed contamination measurement instrumentation? [GSR Part 3 Requirement 21; 3.76(g)] [NS-G-2.7; 3.23, 3.25, 3.28, 3.29, 3.31, 3.32]*

*How are instruments calibrated, and what is the schedule for routine calibrations? [NS-G-2.7; 3.22, 3.23, 3.29] [RS-G-1.3; 7.5, 7.6]*

*What is the procurement system for RP equipment, and how is new equipment tested? [RS-G-1.1; 5.108, 5.109]*

**7.5.2. Individual dose monitoring equipment**

*What are the facilities and equipment for internal contamination monitoring and assessment of external exposures? [GSR Part 3 Requirement 21; 3.76(g)] [NS-G-2.7; 3.29, 3.30]*

*If other laboratories are contracted to provide monitoring services for internal contamination or assessment of external exposures, what are the contractual conditions, and the reporting and quality requirements, for the services supplied? [RS-G-1.2; 9.18] [RS-G-1.2; 1.3; 9.2-9.13; 9.17]*

*As regards internal contamination monitoring, what checks are undertaken to confirm the reliability of monitoring equipment? How is the performance of this equipment evaluated? [NS-G-2.7; 3.31, 3.32] [RS-G-1.2; 9.13-9.17]*

*As regards external contamination monitoring, what checks are undertaken to confirm the reliability of monitoring equipment? How is the performance of this equipment evaluated? [NS-G-2.7; 3.31, 3.32] [RS-G-1.3; 9.14-9.16]*

**7.5.3. Gaseous and liquid effluent monitoring equipment**

*What type of instrumentation is used, and what is the condition of the installed continuous monitoring system for gaseous and liquid effluents? [NS-G-2.7; 4.52, 4.53]*

*What is the range of key instrumentation, and is it sufficient for monitoring normal discharges, possible abnormal discharges and accidental releases? [RS-G-1.8; 5.22]*

*How is monitoring equipment calibrated and how are QA standards applied? [NS-G-2.7; 3.22] [RS-G-1.8; 9.5]*

*What monitoring equipment is available, and what sampling procedures are in place to detect and to measure releases through normally unmonitored effluent pathways? [NS-G-2.7; 2.3-2.5, 4.2, 4.53, 4.55]*

**7.5.4. Environmental monitoring instrumentation and equipment**

*What equipment is available for environmental monitoring? [RS-G-1.8; 5.23-5.25]*

*How is the equipment calibrated and what QA standards are applied? [NS-G-2.7; 3.22, 2.45, 2.46] [RS-G-1.8; 9.5]*

**7.5.5. Instrumentation and equipment for emergency situations**

*What types and numbers of fixed and portable instruments are available for emergency situations, and where are they situated? Can they reasonably cover the needs of all personnel who would be involved in an emergency response? [GSR Part 3 Requirement 21; 3.76(g)] [NS-G-2.7; 2.47, 2.48]*

*What monitoring ranges are available for emergency purposes? [NS-G-2.7; 3.22]*

*How are instruments calibrated and maintained? [SSR-2/2 Requirement 18; 5.7]*

**7.5.6. Protective clothing and equipment**

*What types and quantities of protective clothing and respiratory protective equipment are available? [GSR Part 3 Requirement 24; 3.95(a)] [NS-G-2.7; 3.48-3.51]*

*How and where is all personal equipment, including equipment for use in an emergency, maintained and, if necessary, tested? [GSR Part 3 Requirement 24; 3.95(d)]*

*What instruction do workers receive on the use of protective respiratory equipment? What format does this instruction take? [GSR Part 3 Requirement24; 3.95(b)] [NS-G-2.7; 3.55]*

*What additional equipment is available for radiological control and how is it maintained? [NS-G-2.7; 3.57, 3.59, 3.60]*

**7.5.7. Facilities**

*What are the different plant facilities, necessary for effective radiological control in the operation and maintenance of the plant? [GSR Part 3 Requirement 21; 3.76(e)] [NS-G-2.7; 3.56]*

*How are change- and shower-rooms, stocks of protective clothing, personnel decontamination facilities and laundry all maintained? [GSR Part 3 Requirement 24; 3.90(h)]*

*What calibration facilities are available? [NS-G-2.7; 3.22, 3.56, 6.8] [NS-G-2.6; 4.29, 8.6-8.8]*

*How is the temporary storage of radwaste and contaminated materials, equipment and tools, arranged and maintained? [NS-G-2.7; 3.54, 4.21]*

*How are decontamination facilities arranged and maintained? [NS-G-2.6; 8.12-8.14] [NS-G-2.7; 3.56]*

**7.6. Radioactive waste management and discharges**

**7.6.1. Radioactive waste management**

*How is the radioactive waste management programme established and implemented? [SSR-2/2 Requirement 21; 5.18] [GSR Part 3 Requirement 9; 3.15(j), Requirement 31; 3.131]*

*What are the goals and objectives for minimizing radioactive waste? [SSR-2/2 Requirement 21; 5.17] [NS-G-2.7; 4.6, 4.8, 4.15, 4.20]*

*How is radioactive waste classified and segregated? [NS-G-2.7; 4.9-4.16, 4.22]*

*What procedures are available for waste to be cleared from regulatory control? [NS-G-2.7; 4.10]*

*How are storage areas or special storage locations, containers or other provisions, used to ensure that personal exposures are minimized? [NS-G-2.7; 4.21]*

**7.6.2. Gaseous and liquid effluents**

*What are the authorized limits for gaseous and liquid releases, and what are the results of monitoring? [GSR Part 3 Requirement 31; 3.133] [NS-G-2.7; 4.46, 4.48]*

*What is the monitoring programme for gaseous and liquid releases? [SSR-2/2 Requirement 21; 5.19] [GSR Part 3 Requirement 32; 3.137(a)] [RS-G-1.8; 5.15-5.22, 6.2, 6.3]*

*What are the goals and objectives for gaseous and liquid effluents? [GSR Part 3 Requirement 31; 3.134(a)] [NS-G-2.7; 2.30]*

*What procedures are in place to control effluent releases? [SSR-2/2 Requirement 21; 5.19]*

*How are effluent release results reported and records maintained? [SSR-2/2 Requirement 15; 4.52] [GSR Part 3 Requirement 32; 3.137(b)(c)(d)] [RS-G-1.8; 10.2-10.7, 10.12]*

**7.6.3. Environmental monitoring**

*How is the environmental monitoring programme established? [SSR-2/2 Requirement 21; 5.20] [GSR Part 3 Requirement 32; 3.137(a)] [NS-G-2.7; 2.13, 4.55] [RS-G-1.8; 5.23-5.30, 6.4-6.7]*

*What are the methods used for assessment of doses to members of public? [RS-G-1.8; 7.1-7.16]*

*How are environmental results reported and records maintained? [GSR Part 3 Requirement 32; 3.137(b)(c)(e)] [RS-G-1.8; 10.2-10.5, 10.8, 10.9 10.12]*

**7.7. Radiation protection support during emergencies**

*What are the RP department’s responsibilities in an emergency, and how are its staff involved in the emergency response organization? [NS-G-2.7; 2.4-2.48, 2.50]*

*What RP emergency procedures are available?? [NS-G-2.7; 2.4-2.48]*

*What is the environmental monitoring plan for an emergency exposure situation? [RS-G-1.8; 5.64-5.108]*

*Which RP personnel are involved in emergency training, and what is the frequency of their training? [NS-G-2.7; 5.10] [RS-G-1.8; 11.1-11.4]*

*How often are emergency drills and exercises run? [NS-G-2.7; 5.4, 5.5, 5.7]*

**7.8. Use of PSA, PSR and OEF**

*How does the radiation protection department use the PSA or some of its applications (e.g. risk monitoring) to optimize radiation protection activities? [SSR-2/2 Requirement 31; 8.5, 8.6] [NS-G-2.6; 7.10] [SSG-3; 10.36, 10.37, 10.52]*

*How is the PSR used to enhance the radiation protection programme? [SSR-2/2 Requirement 12; 4.44] [SSG-25; 3.8, 5.29, 5.41, 5.47, 5.86] [NS-G-2.3; 2.2, 3.8] [NS-G-2.6; 7.7, 7.9] [NS-G-2.12; 5.5, 7.1, 7.9-7.11]*

*How does the radiation protection department use the OEF from radiation protection activities to drive continuous improvement? How are radiological events reported and analysed? [SSR-2/2 Requirement 24; 5.27-5.33] [GSR Part 3 Requirement 4; 2.43(c), Requirement 9; 3.15(g), Requirement 16; 3.45-3.48, Requirement 21; 3.80] [NS-G-2.7; 6.12]*

FACTs Requirements:

September 2016

Format

* Date format: 8 June 2016 (DD MM YYYY)
* Use The Plant instead of The Station
* Do not include procedure number , but the name of the procedure, such as the Working instruction to calibrate the pressure transmitter 1XXX
* Numbering (no numbering, use – as in this format
* Spell out all the abbreviations, such as: Main Control Room (MCR), and consistent throughout the report
* Use English words in the report, no local language words in the report

Exchange with the Counterpart

* Every night, write the facts in the format as specified (refer to the examples below)
* Save it on the last page of your Working Notes Outline
* You will have a printed out copy of the facts in your tray before lunch and you can give the facts to your counterpart for verification
* Revise the facts with the inputs from discussions with your counterpart, and finalize the facts.
* Make sure your counterparts understand the potential safety consequence of your facts (ask yourself so what)
* When you have enough facts for a theme, develop the issue per the example of issue and give it to team leader and deputy team leader early

Facts (for reference only, please delete it and add you own)

**Maintenance Work Practices**

* Work on Essential Service Water (ESW) pump C outlet venting Valve (1EF-V0054)
  + Floor grates at the worksite were not covered with canvas to prevent small items from falling through to the floor below.
  + Wrenches, spanner, bolts and nuts in plastic bags and lubricants for bolts were placed on the Pump inlet pipe with the potential to slip off.
  + The plastic bag containing bolts and nuts was broken during the work, and the bolts and nuts fell through the floor grates down to the floor below.
  + A soft Foreign Material Exclusion (FME) cover was used as bag for used bolts and nuts.
  + The worksite was not fenced off.
  + The above situations were not challenged by the three workers within the group.
* The pre-job brief for the test of the Load Shedding Sequencer logic check for 3.3kV essential electrical board 3 was not conducted in a structured manner as outlined in the Green Card Brief. Although most of the elements were covered, key points were not emphasized in a concise manner.
* Three way communication was not used as intended during the test of Load Shedding Sequencer logic check for the 3.3kV essential electrical board 3. The worker and the team lead did not challenge each other for not using three way communication.
* On 16 September 2015 during the leak testing on the condensate system, the test equipment used for this activity had been connected to the incorrect Condenser Extraction Pump (CEP). Not using human error prevention tools (such as pre-job briefing, point touch verbalize, peer check, and three way communication) has been identified as the main cause.
* On 4 August 2014, when working on the controller (1AB-PC0277) for the loop 2 steam generator Power Operated Relief Valve (PORV) (1AB-PV0277), an unauthorized parameter setting was used. This caused the manual close button to open the PORV and the open button to close the PORV. This condition was not identified from 4 August to 26 September 2014 as the automatic control worked correctly.