OSART Good Practices
RADIATION PROTECTION
Radiation Work Control

Kozloduy 1/4, Bulgaria

Mission Date; 11-28 January, 1999

In order to assess the airborne activity in the reactor hall small analytical filters are put on the grate of suction nozzles of the ventilation systems that maintain a negative air pressure in reactor halls. The sampling is to be used preferably in VVER power plants because of the design of the reactor hall ventilation system, although it can be used in other plants with similar arrangements The nozzles of the ventilation system are easily accessed and filter does not need mechanical means to hold it in place because negative pressure keeps the analytical filter in position. Filters are replaced monthly and more frequently during outages. The results are presented in annual reports. This is very simple and effective way to monitor the condition of the working environment and to determine the main isotopic contributor from the reactor hall to total aerosol discharges.

Lingao, China

Mission Date; 6-23 August, 2001

The LNPS RP department has established a radiation work control information system, which is integrated with the work request system. By a simple press on a button within the work request system, all necessary RP-related job information is shown, such as, exposure rates, existing contamination, pictures of equipment with indication of location (e.g. room number), hot spots, and links to experience feedback.
Further, this system also contains information on industrial safety risk. Touch screens were installed at the entrance as well as all the main passages in the RCA so that people on-site can research occupational safety risks, cautions and measures regarding their work. Information is also available at every office due to its Intranet web design. This system is called "Occupational Safety Risk Analysis Consultation System" (HPS).

Sta. M. Garona, Spain

Mission Date; 18 Feb.-2 Mar., 2002

Replacement of drainage network in the reactor building. Following an incidence study on the remaining contamination in the reactor building floor drainage network on the dose rate on several levels, this was replaced with a new one, made of stainless steel, which has a better cleaning capacity.

The project started in 1993 as one of the first initiatives that would make up the Dose Reduction Plan. The level of remaining contamination in some parts of the network was a consequence of 22 years of plant operation, together with the material used in the conduits (carbon steel) which limited the effectiveness of the cleaning agents and the existence of isolation siphons which had been systematically installed in each sump. This made it impossible to insert the cleaning jets.

The location of the network (under the floor on each level and not embedded in the floor) had a general effect on the lower floor dose rates (values which could vary around 43μSv/h) and on some drainpipes in zones frequently used by personnel.

First of all the hot points were identified and which of these would have more effect due to their location. A semi-empirical method was developed to assign the specific superficial activities of the different parts of the conduits and to identify the candidate parts.

Initial cleaning tests were carried out with pressurised water. The poor effectiveness in many of the parts was a determining factor in deciding on their replacement, improving their inclination, using stainless steel conduits and implanting cleaning connections at strategic points.

Finally a procedure was written for the measurement and immediate cleaning (if necessary) of the affected parts after a contaminating practice.

As a consequence of the systematic replacement of the drainage network the average dose rate has gone down from 43mSv/h to 22mSv/h. The general incidence has been so great that it has stimulated a "cleaner" behaviour in the use of the drainage network.

Tianwan, China

Mission Date; 26 Jan.-12 Feb., 2004

In order to prevent the contaminated gloves from leaving the fuel storage area, white gloves with red fingers are used. It is very easy to distinguish these from those are used in the clean areas. The team members observed during tour of the fresh fuel building TNPS staff were all using the white gloves with red fngers.

Zaporozhe, Ukraine

Mission Date; 6-23 Sept, 2004

At the ZNPP a dose planning system for collective effective dose (CED) prognoses and target CED calculation is used. The system is unique for the Ukrainian nuclear power plants and it is focused on equipment.
For the methodology, data from 20 years of operation were used. Coding of doses according to equipment and various jobs on the primary and auxiliary system components is used. It enables assessment not only of the total CED but also preset targets of CED for all departments working in the RCA during outage.
Dose rate prognoses on the primary system loops are used for the calculation. Work classification is divided into 4 groups according to radiation risk.
During the outage the real collective dose and the forecast dose are compared, actions are taken and followed. After the outage, real data are used as feedback to the ALARA system.

Philippsburg, Germany

Mission Date; 11-28 Oct., 2004

The portal monitors at the exit of the radiation protection area are able to measure simultaneously beta and gamma contamination. The total body surface including hands, head, and feet are measured by 14 beta gas flow proportional counters. Directly behind the beta counters additional two large area gamma plastic-scintillation detectors are positioned in the breast area (left and right side). As they are only gamma sensitive, they are able to detect incorporated gamma activity if any. The detection limit is about 1000 Bq (against Co-60, 3 sigma error) regarding measurement time of 10 seconds. In this way if some internal contamination exists the worker is immediately sent to WBC and the dose assessment is much more accurate.

Penly, France

Mission Date; 29 Nov.-16 Dec., 2004

The Prevention and Radiation protection Service (SPR) has organized a campaign for systematic eradication of radiological hot spots in order to optimize lower doses.

As part of plant radiological monitoring, the SPR organizes the mandatory monthly radiation survey of dose rates inside buildings. During this activity and based on changes in ambient dose rate, the SPR identifies radiological hot spots on the plant. As a result, hot spots are trended and the effectiveness of corrective actions can be assessed.

Instead of simply shielding, which is the most current practice, preference is given to investigate measures to eradicate the hot spots. The SPR and operations service jointly analyse the hot spots, identify their possible origin and define eradication strategies. This can be the flushing of the systems, clearing of pipes, removing unnecessary pipe sections, installation of permanent shields with integration of seismic resistance and other safety-related concerns.

Recording, monitoring and the results of corrective actions are tracked according the plant quality assurance system.

Blayais, France

Mission Date; 2-19 May, 2005

Combined radiological work permit and dose forecast database facilitates detailed ALARA planning. The team calls attention to other plants that the plant's organization of operational dosimetry and work activities in a readily accessible data base facilitates detailed and efficient ALARA planning.
The combined radiological work permit and dosimetry database forms an integral part of the planning process for jobs carried out in radiation exposure conditions. The information needed to describe a job and create a dose optimisation and monitoring document has been determined on the basis of RP reference standards. The radiological work permit issued by the computer programme ensures that all workers-employees and contractors-use a standard document that includes radiological data for all workers, including targets, and limits. It also specifies optimization measures. The database enables access to the list of craft representatives within the area of radiation protection, a direct view of the processing status of the radiological work permits, quick access to specific requests for information on work permit information, access to common job planning databases, and the build-up of RP experience and feedback from activities.

Blayais, France

Mission Date; 2-19 May, 2005

A central display panel and large, flashing amber light at the plant's main access entry post informs personnel entering the plant that radiographic shots are in progress and provides notice of their exact locations. This notification practice is formalized in a written procedure and is implemented within a short time of the radiographic shots. The team acknowledged that this is a good practice and should be brought to the attention of other plants.
The display of information related to radiography shots at the main access entrance is part of the process for preparing for the shots. This display is a means of providing information and communication used by the site to inform EDF and contractor personnel of the radiography shot schedule and its location, along with prohibited access maps during the shots. A large, flashing amber beacon ensures that attention is called to the notification. This central display accompanied by the flashing beacon ensures:
-That a large number of persons entering the site, but not taking part in the radiography shots are informed. It should be pointed out that the main access post is the only access open during outside of normal working hours—the time when the great majority of radiographic shots are made.
-A rapid association between the presence of the flashing beacon and the ongoing radiographic shot.
-Direct visualization, by marking a map of the shot location and the areas of prohibited access.
-Rapid access to operational information on shots taking place, such as, shot operator pager number, countermeasures applied, radiological characteristics, and starting and finishing times.

Brunswick, USA

Mission Date; 9-26 May, 2005

Activities requiring a RWP are identified through the planning process. Work orders are generated in the plant information system and routed to the ALARA planner for review. Radiological planning is incorporated into the work order task, including an exposure estimate and the assignment of the task to the appropriate RWP.
Once the planning is complete, the scheduled activities can be queried by the computer to determine the radiological impact for a given time period. For example, a weekly or project exposure estimate can be generated using values previously captured in work order tasks. These projections are shared with the site work force prior to beginning the work. The actual exposure is tracked against the estimate and discussed with management at the daily morning meeting. The exposure history is useful information in future planning and projections. It is also a good tool for goal setting.
The work schedule is reviewed 10 weeks prior to implementation to ensure that the necessary radiological planning requirements can be implemented prior to performing work. This advanced look allows the RC group to be proactive instead of reactive, for example, in setting up areas for future job support.
The RWP instructs the worker on actions to take if an alarm is received or if radiological conditions change. If an alarm is received the dosimeter is locked until data can be retrieved.

Borssele, Netherland

Mission Date; 8 Nov.-7 Dec., 2005

Since October 2000 the whole NPP site (roofs including) has been surveyed annually for radioactive contamination and dose rate. Up to October 2000 this survey was performed at about 35 predetermined positions. The results of the measurements are very well documented in user friendly and illustrative database. Several hot spots with artificial activity and variation of natural background were found. Based on the findings of 2000 and 2001 the working method and procedures with respect to monitoring of contamination of equipment and material leaving the controlled area were improved and extended. In addition the exits and their surroundings, here the equipment is brought out of the RCA, are subjected to quarterly monitoring for radioactive contamination.

In 2005 no contamination from the NPP was found outside the RCA during the site contamination survey.

Mochovce, Slovak Rep.

Mission Date; 4-20 Sept., 2006

The plant monitors extensively the effectiveness of the barriers against contamination propagation and statistically analyzes all revealed cases of personal contamination including contamination of protective clothing and tools. Analyzing trends in contamination of individual rooms and corridors, the plant can take effective measures to further improve radiation work control.
Automatic personnel contamination monitors alarm levels are set up on the lowest possible value (0.3 Bq/cm2 if possible regarding to dose rate). This creates an effective barrier against contamination spread.
Personal contamination is measured by several types of devices; any discovered contamination is to be reported by a prescribed form to the RPU. Moreover, alarms of the PCM2 devices (personal monitors) and from tool monitors in change rooms are signalled in RP control room and automatically recorded into a database. Workers are not punished when an alarm occurs, but they are obligated to report the circumstances. They are encouraged to notify all cases of contamination. This helps to keep reports as complete as possible and to make the analyses more valuable.
Permanent places for collecting waste are equipped with device for dose rate/contamination monitoring. It helps to keep dose and possible contamination as low as possible.
Floor washing water from corridors and rooms in RCA is sampled and measured on gamma spectrometry in order to analyze contamination spread. This practice is not frequently used in NPPs.
All records are statistically analyzed in order to map contamination sources, keep the contamination in RCA as low as possible, and evaluate the effectiveness of the barriers against contamination propagation and the effectiveness RP measures.

St. Laurent, France

Mission Date; 27 Nov. - 14 Dec., 2006

A laser pointer is used in carrying out radiation and contamination surveys in application of the ALARA principle of optimization of individual radiation exposure. A technician with an audio link indicates the points to be surveyed to another technician doing the survey in a hostile environment such as reactor cavity. Dose saving is reported to be about 30 %.

Yongwang, Korea

Mission Date; 17 Apr. - 4 May, 2007

YGN 5&6 uses advanced radiation monitoring system which serves for comprehensive and easily accessible information for radiation workers regarding radiation situation, provides complete operations regarding radiation work permit and ensures detailed environmental information to the public.
The RIS (Radiation Information System) is a very advanced system carrying out many functions. The RIS has been made as:
・Radiation information system as a part of the environmental management of knowledge information society.
・Advanced radiation safety control such as a reduction of the exposure of workers inside YGN 5&6 RCA.
・Improvement of credibility and reliability of submitted information from YGN 5&6 under domestic and foreign conditions.

The system provides a unique feature easy access the following:
・Direct access to this information by each worker at the entrance/exit of RCA
・Linking with the operating radiation control system (ERP/RAM)
・Ensuring requirements for workers to access and exit the RCA
・Dose database in break down to every single entry to RCA
・Informing each worker of his dose during a certain month or period
・Informing each worker of the radiation situation inside RCA
・Ensuring that the Radiation Protection Permit contains the latest information so that the workers can work inside the RCA safely by providing latest information on real-time basis
・Maximization of efficiency for the radiation control such as convenience of work service
・Information on the dose rate of total 632 monitoring points.

The system offers as follows:
・Direct data exchange with ERP system at KHNP Headquarters and resulting security of handling speed and safety inside RCA
・Provision of more rapid and stable information by securing mass storage server systems
・Unification of system operation equipment and personnel
・Systematic system integration control (unification of server computers and also information on the personal dose for YGN plants 1,2 &3, radiation information by regional groups, homepage of the RP Section)

The Radiation Information System used to support access of and provide doses of radiation workers at YGN 5&6 is a powerful tool which enhances ALARA approach and reducing doses.

Yongwang, Korea

Mission Date; 17 Apr. - 4 May, 2007

YGN 5&6 uniquely uses a camera system as an additional supervisory tool to follow workers' actions in order to reduce exposure, optimize working time of radiation workers inside RCA and reduce radioactive waste production.

In addition to the regular monitoring system the so-called CCTV system is managed by the RP Section. The system has been developed as a tool for instant feedback with fast response. The system provides instant real time information regarding people's movement and behavior inside workplaces where radiation risk activities are expected. The connection between workers and operators is organized by all kinds of connecting links (pager phones or other ways).

The system consists of fixed cameras and portable cameras which are located as required to support important or high radiation work. Fixed cameras of CCTV system are located at workplaces and entrances and exits from the RCA, and whole system allows additional control of the efficiency of the radiation works. Operation of the system has brought effective collective dose reduction, reduction of radioactive waste production and reduction in working time. Reduction in working time means reduction of exposures, as well.

The team assessed the contribution of CCTV as very useful tool which significantly enhances radiation protection.

Balakovo 4, Russia

Mission Date; 19 May - 6 Jun., 2008

The plant use a computer and portable equipment based radiation survey system which allows easy accessible and retrievable information on radiation situation in every room of the RCA. Survey can be carried out periodically or on demand. During a survey is no need to fill tables or to take notes of values.

The needed software is commercially available and easy to set for plants.

The computer database consists of sketches of all RCA rooms together with main technological components. In selected points of the sketch is possible to show values of radiation characteristic entities as dose rates and contamination values. Data are available to all technical positions on the plant. Access and retrieve ability of the information is via intuitive graphic interface.

Radiation survey is performed by a set of pocket personal computer (PPC) and dose rate/contamination measuring device. During a survey RP technician check visually survey points on screen of the PPC as singular pre-planned tasks (detailed pictures of the room in proportional scale are available) and confirm storing of the measured values to the MPC memory. Time stamp of every particular measurement is automatically added.

Data from PPC are later transferred to the PC net computer. The ORACLE database enables to check tasks of radiation technicians, values of radiation survey, trends of values, graphics etc...
The system enables:
- To reduce time in performing the survey
- To present actual information to the workers, work planners and group leaders on radiation characteristic in rooms and on equipment
- To improve quality of survey
- To create database of characteristic radiation values
- To create graphic presentation of rooms and equipment with points of measurement