

OSART Good Practices

RADIATION PROTECTION

Radiation Protection Instrumentation, Protective Clothing and Facilities

Tricastin, France

Mission Date; 14-31 January, 2002

The Radiation Protection Department has assumed a leadership role in developing for EDF products and processes to improve the company's overall radiation protection practices.

The chemistry laboratory, working with a local commercial supplier, has developed and is using radioactive sources containing a water equivalent matrix type resin. This solid phase source is considered as a sealed source. As such, its lifetime (depending on the radio element contains) is 10 years rather than the 2-year life normally specified for unsealed sources. These sources are supplied in standardized shapes, identical to those currently used for measurements, and are available in 3 different sizes (3.0 l, 0.5 l and 50 ml).

Compared to liquid sources, the advantages of this product are as follows:

- No handling of liquid radioactive sources
- No radio element migration phenomenon within the source container
- Source retrieval by vendor (no destruction requirement)
- Longer period of use (depending on the radio element half life)
- No spread of contamination in the event of being dropped

Nogent, France

Mission Date; 20 Jan.-6 Feb., 2003

As part of a French national "Radioactive Source Management" action plan, a comprehensive organization and storage facilities have been implemented to manage sealed and non-sealed radioactive sources.

The main source storage room is a best performer with two separate rooms, each one individually monitored by an ARM with audible alarm in the outside of the rooms. In each room there are locked shelves where the sources are stored. Only an authorized person can get the key. There is one "person competent for source management" (SPR) that organizes source training courses, manages relation with the regulator, controls the inventory, checks permits of utilization and sets the procedures. The organization relays also in:

- Two persons in charge of sources (sealed and non-sealed), responsible for day to day management of sources
- One person in charge of each storage area, responsible for the management of sources of his storage area
- Trained users, with specific permit issued to each staff member concerned.

There is one register for each storage area. The entrance/exits are recorded in the register of the area by the end user and tracked systematically by those responsible for the storage area and sources. Computer monitoring (MANON) exists in addition to paper monitoring for all source movements with change of storage area. The source rooms and lockers locked with keys held by the person in charge. Also source safes used with a code (Medical Service). Double padlock for ARM and PRM sources (SPR + store responsible) and for contractor sources (SPR + contractor responsible). The sources on site are transported in type A cases.

Rigorous traceability (user and responsible) of the movement of each source, enables the location on the site to be known at all times and thus reduces the risk of loss or theft. The use of sources is limited to trained people who know the organization in place for the management of sources (specific permit). Transport is easier and safer (protection against knocks and falls, suitable posting and leak tightness) thanks to the use of Type A handling cases.

Krsko, Slovenia

Mission Date; 20 Oct. 6 Nov., 2003

The plant initiated a modification that included the development of on-line monitoring capability of the Reactor Coolant Sampling line, using electrically cooled low efficiency Gamma Spectrometry. This facilitates prompt and enhanced detection of changing trends in the reactor coolant, such as initial fuel leakage, or crud burst detection during reactor coolant system cleaning processes. This system also contributes to good ALARA practice, because it may reduce the need to collect as many reactor coolant samples as had previously been the case. This has also reduced the potential for associated contamination events.

Pickering-A's ALARA program includes an extensive teledosimetry system installation that has been successfully used to reduce worker dose during outages.

The system has also been used to provide visual indications for Operations staff during pressure tests or to confirm fire alarm indications, reducing the need for reactor building entries. The system will be available with the unit at power to reduce the need for on-power entries, further reducing dose to staff.

The system:

- transmits real time dose data (both whole body and skin) to a dedicated monitoring station staffed by Radiation Protection Technicians
- a minimum of 12 tilt-pan-zoom cameras per unit to provide staff with the ability to observe selected jobs in progress
- end user can customize the remote display to monitor all aspects of the job - personnel, maps and radiation monitoring equipment
- two-way wireless audio communications between staff in the reactor building and the monitoring station
- throat microphones to eliminate interference with respirators
- dedicated penetrations for immediate installation during outages
- interconnection with remote tritium monitoring system to transmit real time airborne hazard data
- all reactor units can be monitored simultaneously from a single location
- capability to transmit audio/video/dose data over a LAN or communications over phone lines
- junction boxes in the reactor building to enable 'plug and play' connectivity
- audio/visual recordings during work execution for review for future job iterations or lessons learned/OPEX

Two-way audio communications between the Teledosimetry Station RP Technician and a 'Roving RP Technician' in the unit enables prompt follow-up of alarms or anomalies. The use of this system resulted in a 60 mSv per year dose savings, and 10 person-years of labour.

The enthusiasm of the qualified RP technicians has resulted in a number of proposed innovative applications of the system to reduce dose expenditure beyond the normal applications including:

- Performing detailed reactor face surveys on shutdown units by mounting telemetry on a fuelling machine head
- Hot particle personnel contamination surveys using telemetry mounted on a frame at exits from hot particle contamination areas
- Underwater surveys of spent fuel

Quinshan3, China

Mission Date; 5-24 May, 2005

Good computerized dosimetry information system for bioanalysis and dose management is in use at the plant. The computerized system was developed at TQNPC. The purpose of the system is to organize bioassay sampling in desirable time period of urine sampling. The planned period of sampling is checked and in case of any deviation, workers and managers are contacted without delay. For improvement of efficiency of urine sample processing bar coding of the samples is used. Sample analysis and result reporting are integrated into dosimetry database system.

The system consists of data from TLD dosimeters, Bioassay results, and whole body counting system, EPD system. All data have automatic input into the database but EPD results are acquired as batch files.

All dose information including gamma external exposure dose, neutron dose, WBC dose, tritium internal exposure dose are displayed. For the external exposure dose comparison results from TLD and EPD are listed for evaluation and comparison. Three screen touch terminals are provided on site for workers access. Workers can also access the system from any computer connected into Intranet. For identification of worker his badge is used. Managers can query dose information of their department workers via computer client software.

The station uniquely uses equipment to reduce exposure, provide information, and improve productivity:

-The BNP Camera Programme fosters increased productivity, improved exposure monitoring capabilities, exposure reduction, and has led to significant site improvements. BNP has installed over 70 cameras strategically throughout the station.

-The BNP Area Radiation Monitoring Programme fosters increased productivity, improved monitoring capabilities, exposure reduction, and has led to significant site improvements. BNP has installed over 220 remote detectors throughout the station. The enhanced radiation monitoring is in addition to plant installed radiation monitoring and is available for viewing at a central location or locally within the building where the detectors are installed.

-The BNP Personnel Remote Radiation Monitoring Programme fosters increased productivity improved monitoring capabilities, exposure reduction, and has led to significant site improvements. BNP actively utilizes over 100 remote detectors during outages and in high radiological or high collective dose situations. The personnel radiation monitoring utilizes a centrally-distributed concept that allows for viewing by either a central location or any monitoring station on the plant site.

-At Brunswick four basic types of high efficiency particulate air (HEPA) filter units are utilized. The HEPA units are typically used to support small scale work in contaminated areas but large scale units are typically utilized during outage periods to support large scale work. Additionally, these units are shared among NGG and other utilities as the need arises.

Large HEPA units can maintain a negative pressure on vessels or filter housings. Negative pressure helps to control particles within the vessels, keeps a constant airflow to support hot work, smoke removal, and when used in conjunction with charcoal filtration units, mitigates iodine airborne

St. Laurent, France

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

Management of radioactive source control was improved by implementation of new software.

The management has delegated to a competent person appointed by the plant manager. His qualifications are defined by the regulations. He has access to the software tool MANON which is a unified programme accessible to all EDF nuclear plants, as well as to the regulator. In this way he monitors the inventory, activity and movements of all sealed and non-sealed radioactive sources, including spare parts containing radioactive sources. The software automatically generates alerts for overruns of activity, dates for leak tightness or inventory checks, etc.

The competent person coordinates a network of responsible persons in the different departments related to control of local storage areas.

Several types of check are done on radioactive sources: radiation protection checks at the arrival or departure of a radioactive source, annual technical checks, periodic checks carried out by those responsible for managing rooms, monthly surveys of rooms and storage safes, annual regulatory checks of storage room protection equipment. A binder with photos of sources has been compiled.

Sources are carried in special cases marked with a trefoil. At the acquisition of a radioactive source, the analysis of the need is traced in a standard form and approved by the holder of the authorization or a delegated person. Sources entering or leaving the site as well as movements on site are tracked on specific forms.

Mihama 3, Japan

Mission Date; 15 Jan.- 5 Feb., 2009

The personal dosimeters worn by workers at the MIHAMA NPP are of the glass badge type (GB) which displays better performance than thermo luminescence dosimeters or dosimeters of film badge type and are easy to manage and use.

The personal dosimeter GB, used at the MIHAMA NPP, has wider energy range, 10 keV - 10 MeV, and dose measurement range, 0.1 - 10 mSv, than other types of personal dosimeters, and offers better energy characteristics, margin of error, and directional characteristics.

It is a stable unit with minimal variability between different units, better resilience to heat and moisture, and almost no phasing.

The use of GB enables accurate measurements of workers' personal dose, thereby providing effective radiation protection.