FRENCH GOVERNMENT REGULATION – NEW ENACTMENT ON OPTIMIZED RADIATION PROTECTION OF WORKERS EXPOSED TO IONIZING RADIATION – IMPLEMENTATION AT A FRENCH NUCLEAR POWER PLANT BELONGING TO THE EDF GROUP

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Optimization of radiation protection, a binding substantial commitment

The radiation protection system defined by ICRP 60 and included in European Directive no. 96/29 is based on the three general principles of radiation protection : the justification of practices, the optimization of radiation protection and the limitation of individual exposures.

Since 1988, French law requires for nuclear power plant an optimization approach (ALARA) in the case of maintenance activities (equipment, methods and work organization) relying on a specific structure: the department with special responsibility for radiation protection.

Recently, in December 1998, this general principle of optimization was enhanced by the obligation to take a predictive approach in order to implement it. For all operations carried out in Radiation Controlled Areas (RCA), the law requires a prior estimation of individual and collective doses to which workers might be exposed, followed by the measurement and analysis of radiation doses actually absorbed during the activity.

Implementation at an EDF nuclear power station : Tricastin

With a view to consistent implementation on all its plants, EDF has drawn up a set of specific reference guidelines. These guidelines define the activity and describe a procedure for carrying out individual and collective dose forecasts for each activity. They also include a set of activity grading criteria based on the activity's radiological risk factor, a procedure for dealing with each level of risk, and a procedure for monitoring operational radiation exposure.
They deploy the three phases of the ALARA approach: planning, implementation and experience feedback.

Definition of the activity

Nuclear power plant operators are entrusted with maintenance, monitoring or operational activities. These activities vary according to time and place. This is why EDF defines an RCA activity either as being structured by a procedure (e.g. maintenance) or as a non-structured activity (e.g. logistics, service facilities or operations).

Dose forecasting

In the case of structured activities, projected dose forecasts are conducted on the basis of a procedure (break-down into basic phases, exposure times, number of workers involved, etc.), expected radiological conditions (RP surveys) and any available experience feedback.

Dose forecasts for periodic activities are based on experience feedback. As of April 2002, dose forecasts for periodic activities carried out at Tricastin NPP will be conducted on a target basis of 0.01 mSv per hour spent in the RCA.

Radiological risk levels

Implementation of this optimized approach is adjusted based on the radiological risk factor. However, what criteria are applied? Collective dose level, individual dose level, radiological environment, recurrent nature of the activity, exposure time, staff numbers concerned.
At Tricastin NPP, three criteria are applied: collective dose, individual dose, and the activity's equivalent dose rate. Values for each of these criteria are determined by the site.

Example:

- Level-0 (non-rated) risk factor for a collective dose of < 1 man.mSv or an equivalent dose rate of < 0.1 mSv/h;
- Level-1 risk factor for a collective dose of 1 to 10 man.mSv or an equivalent dose rate of < 2mSv/h;
- Level-3 risk factor for a collective dose of > 30 man.mSv or an equivalent dose rate of > 40 mSv/h.

Activities performed during the last overhaul accounted for 1300 man.mSv. Of these activities, 5% were level 3, 3.11% were level 2 and 51% were level 1.

Optimization analysis: Devising actions liable to reduce exposure levels, while continuing to carry out "reasonable" actions.

Optimization analyses are adjusted according to the radiological risk factor. They are designed to identify elements contributing to dose (sources, work conditions: ergonomics, tools, handling, lighting, additional protective clothing, fallback area, radiological cleanliness, scheduling, etc.), as well as the means of reducing dose (technique, organization, shields, option performance assessment, classification, choice of options). They are conducted on the basis of gradually itemized checklists, either by the craft involved in the case of level 1 activities, or by the RP department in the case of level 3 activities. Once the analysis is completed, a dose target (individual and collective) is set and included in the work package distributed to the workers, including the chosen options. At Tricastin NPP, this phase will be implemented progressively for level 3 activities during the next outage (April 2002).

Dose monitoring and experience feedback analysis

During the activity, received individual doses are measured and recorded manually. Collective dose is calculated and compared with the target. Deviations from radiological or technical conditions liable to modify the dose target are identified. Once a deviation exceeds a threshold set by the plant, the RP department is alerted in order to implement appropriate actions, together with the craft concerned. Tricastin NPP thresholds are 5 man.mSv (collective dose) or 0.5mSv/h (equivalent dose rate).

Upon completion of the activity, expected individual and collective doses are compared with actual figures. In the event of significant discrepancies, depending on the individual and collective dose thresholds set by the site, an RP experience feedback analysis is requested.
Tricastin NPP has set the threshold at $\pm$20% and 2 man.mSv (collective dose), or at $\pm$50% and 0.5 mSv (individual dose).

Difficulties in implementation

Whenever activities are assigned to a contractor, the latter must be involved at every stage. Dose forecasting practices have been standardized.
End-of-job analyses have shown that RP survey measurements are sometimes taken at a fair distance from the work-site: a reference distance has been established.
The computerized radiological data collection program is not suited to operational dose monitoring (different zoning, identification at RCA entrance). Monitoring is performed via the manual collection of individual dose data.