

Occupational exposure trend and the radiological protection
optimization criteria in spanish nuclear power plants
in operation: present and future.

O'Donnell, P.

NUCLEAR SAFETY COUNCIL STAFF

ABSTRACT

Occupational collective dose per reactor evolution in the operating nuclear power plants in Spain has shown in the last years a tendency to stability, within a range of values similar to the average of the OECD countries.

In this presentation the main indicators to assess the present development level of this criteria are reviewed and the basis to improve the effectiveness of the practical application of it is proposed.

INTRODUCTION

In this presentation the lecturer reviews the present situation in the application of the radiological protection optimization criteria in Spanish nuclear power plants and proposes the basis to improve the effectiveness of the practical implementation, within the framework of the role played by the regulatory body.

The terms in which this review is done are the following: first, the collective doses and the average individual doses as indicators of the occupational dose trends and, second, the basic components of an ALARA programme, i.e., commitment, organisation, tools and procedures.

OCCUPATIONAL DOSE CONTROL

Concerning dose control two main areas of interest are described within the international context: first, the control of sources of exposures, and second, the control of exposure duration.

A third approach to control doses is to introduce efficient work management programmes including work planning, training, optimization of work forces, etc.

COLLECTIVE DOSE

Occupational collective dose per reactor evolution in the operating nuclear power plants in Spain has shown in the last years a tendency to stability, within a range of values similar to the average of the OECD countries.

Surely, this tendency of the collective occupational dose for Spanish LWR's is far from reaching an ALARA plateau, which is not cost effective to reduce exposure with the current nuclear reactor design and technology.

Comparing the situation for PWR's within the international context, size and age taken into account, we can see according with the data of the table I that while collective occupational exposure in the last generation of spanish PWR's is in a very advantageous level, the behaviour of the second and first generation is different. In this sense,

the third generation incorporates in its designs more ALARA considerations than the others.

TABLE I.- AVERAGE ANNUAL COLLECTIVE DOSES OVER PLANT LIFETIMES AS A FUNCTION OF REACTOR SIZE AND AGE FOR PWR'S (man.mSv).

COUNTRY	OLD & SMALL PLANTS	INTERMEDIATE & MEDIUM	MODERN & MEDIUM
SPAIN (82-90)	5,190 (01)	2,790 (04)	750 (02)
INTERN.AVER. *	2,990 (18)	2,100 (34)	1,660 (22)

* Belgium, France, Finland, W. Germany, Holland, Japan, S. Africa, Spain, Sweden, Switzerland and USA PWR's > 400 Mwe gross output. During the period 1969-88 (Ref. 1).

NOTE: The values in parenthesis are the numbers of reactors in each class. The small plant of Spain is only 160 Mwe gross output.

Similar terms of comparison can be established for BWR's, but, in this case, with the supplier's country of origin. Again, the relative situation on occupational exposure is more advantageous for the new plant than for the old one (Table II).

TABLE II.- AVERAGE ANNUAL COLLECTIVE DOSES OVER PLANT LIFETIMES AS A FUNCTION OF REACTOR SIZE AND AGE FOR BWR'S (man.mSv).

COUNTRY / PERIOD	OLD & SMALL PLANTS	INTERMEDIATE & MEDIUM
SPAIN / 87-89	6,290 (1)	2,600 (1)
USA * / 87-89	5,430 (6)	4,710 (6)

* The lecturer has considered most similar plants in size and age to the Spanish ones (Source: Ref. 2).

NOTE: The values in parenthesis are the numbers of reactors in each class.

TASK RELATED COLLECTIVE DOSE

In order to homogenize dosimetric data, the CSN recommends in its safety guide nº 1.5 " Documentation on refuelling outage in LWR's", Appendix III, a codification system which is the one recognised by the CEC (Doc. nº 3650/90/ES MC/ae), and at the same time the one also included in the data base of the ISOE, coordinated by the NEA/OECD.

Following the recolected data up to date, although with various codifications, some of the jobs involving higher average collective doses for PWRs are steam generators (45%), insulation/scaffold (15%), waste and decontamination (8%), open/close vessel(8%), RC pumps (4%), reactor components (2%), refuelling (1%) and others (17%).

INDIVIDUAL DOSES

In Spain this parameter is stabilized on the same order during last five years as the international medium (3 mSv). According to a study developed by the Radiation Protection Working Group of AMYS-UNESA, and the dosimetric data reported to the CSN, only about 5% of the workers were, at least once, over 20 mSv/year during the period of time 1985-89. The average being in the last five years about 2% of the workers

exceeding 20 mSv/year, i.e., between 100 and 170 workers each year. During the mentioned period only 0.25% of the workers were overpassed 100 mSv of cumulative dose, i.e., 42 workers.

IMPACT OF REDUCED EXPOSURE LIMITS AND ALARA IMPLEMENTATION

New ICRP's recommendations emphasize the need to focus the efforts in reducing the sources of exposure and the duration of exposure, by incorporating more means as crew for high dose work, restriction in use contractor's key worker, etc. not implying necessarily an increase in total collective occupational exposure, taking into account that both, individual doses and number of persons exposed, must be optimized.

The optimization criteria is implemented in Spain through "Dose Reduction" programs. The terms under which these programs are going to be reviewed are commitment, organization, tools and procedure.

A key factor then to a succesful ALARA programe is the commitment at all levels, but mainly at management level.

Although a strong commitment from management and the workforce can be enough, a specific management structure are very usefull to strengthen operating efficiency of ALARA program.

In my opinion, must be required the presence in the plants of a specific and permanent structure to cover the following roles and profiles:

- * Multidisciplinar structure at the management level
- * Expert group
- * The radiation protection manager in all plants has direct access to the plant manager and is independent of the operating organization.

On the other hand, the "Dose Reduction Programs" includes the guidelines of an ALARA job review, involving pre-job review, follow-up, post-job review and process review, in similar terms as the INPO considers as a good practice.

Nowadays, the CSN has started a process in order to homogenize the procedures that implement the ALARA program, in accordance with the last requirements related.

Examination of the evolution of exposures associated with routine or special maintenance operations in nuclear power plants normally shows a decreasing trend for collective doses throughout successive operations. This evolution is generally accompanied by a simultaneous reduction of the average individual doses for the various categories of workers involved.

One of the aspects that has an influence in this evolution is the "learning" effect which allows operator to integrate the lessons from previous operations. Studies have also shown that the dosimetric burden of the first operations can be substantially reduced if radiation protection considerations are present at the preparatory stages, as well as during work performance.

When carrying out ALARA assesments during plant operation it is essential to make the maximum use of operating experience. This can only be achieved if plant operator has all available information to estimate the consequences of their choices.

Computerised data base of collective doses and job related doses has been established by the CEC and the NEA/OECD is taking the last steps to set up an International Information System on Occupational Exposure (ISOE), which will process data from America, Europe and Japan utilities.

In Spain, utilities and the CSN will participate in the ISOE project. In addition, the CSN is supervising a historic study of recopilation of data in occupational exposures, job related doses and dose reduction techniques applied in order to provide the initial input to a similar data base on a national context, compatible with the CEC and ISOE data bases.

DOSE CONSTRAINTS

According to the ICRP-60 it may be necessary to establish dose constraints at the national level for operation, inspection and maintenance of nuclear power plants. From my personal point of view, the collaboration among the regulatory organization and utilities is essential to achieve the proper values.

CONCLUSIONS

ALARA must be regarded primarily as a "state of thinking" that should pervade the various levels of management and workforce.

The possibility of specifying valuation of detriment by the national authority is under consideration, but at the moment other actions, as mentioned above, to improve the framework in which the ALARA criteria is developing have been considered more urgent.

REFERENCES

- 1.ANS-1990. "The Control of Occupational radiation Exposure and the Application of the ALARA Principle in Pressurised Water Reactors: an Update for 1989". Burholt, G.D. ANS Report N° 2182-R2, Epsom. Surrey, 1990.
- 2.NRC-1990. "LWR Occupational Dose Data for 1989." Hinson, C., NRC, Washington, 1990.
- 3.ICRP-60."Recommendations of the International Commission on Radiological Protection". Annals of the ICRP. Pergamon Press, Oxford, 1.991.
- 4.CSN-1991."Documentación sobre Actividades de Recarga en Centrales Nucleares de Agua Ligera". Guía de Seguridad nº 1.5. CSN, Madrid, 1991.
- 5.GPR-AMYS/UNESA."Sectorial Studies for Dose Reductions in Spanish NPP". Carmena, P., Iñiguez, J. INPO-WANO Workshop. CN Almaraz, 1991.
- 6.Viktorsson, C., Lochard, J., Benedittini, M., Baum, J. and Khan, T., "Occupational Dose Control in Nuclear Power Plants- An Overview." Proceedings of the International Workshop on New Developments in Occupational Dose Control and ALARA Implementation at Nuclear Power Plants and Similar Facilities. Brookhaven National Laboratory, Upton, New York, September 18-21, 1989.
- 7.Baum, J., "ALARA- Past, Present and Future." Proceedings of the International Workshop on New Developments in Occupational Dose Control and ALARA Implementation at Nuclear Power Plants and Similar Facilities. Brookhaven National Laboratory, Upton, New York, September 18-21, 1989.