EMPLOYEE DOSE REDUCTION AT BRITISH NUCLEAR FUELS plc

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ABSTRACT

Average workforce doses in uranium fuel fabrication plants are a small percentage (about 6% or 3 mSv pa) of UK regulatory limits. In uranium metal casting, and uranium oxide production plants, doses are somewhat higher than the average. Dose reduction methods have, however, resulted in these being reduced to 20%, or less, of the same limit. Major future investment should reduce doses in oxide production plants to about the current average level.

INTRODUCTION

British Nuclear Fuels plc (BNFL) sets stringent Company targets for employee dose uptake and, in addition, has always vigorously employed the principle of ALARP. Thus, the current design targets for new plant are 5 mSv per calendar year (average) and 15 mSv per calendar year (maximum individual). For existing operational plants, the relevant targets are 20 mSv per calendar year (maximum individual) and 75 mSv maximum individual over any five consecutive years. All targets are the sum of effective dose equivalent and committed effective dose equivalent. These targets are the outcome of a response to a growing emphasis on the application of ALARP since 1975 and, more recently to the added impetus provided by the "Gardner Report" (Ref 1) and ICRP 60.

Employee dose reduction at the Sellafield reprocessing plant has been the subject of previous papers (Refs 2 and 3). This paper describes trends in dose reduction, and methods of achieving that, at the Springfields nuclear fuel fabrication plant, from 1986 to 1991.

DOSE REDUCTION TRENDS

By comparison with the above targets, average doses at Springfields have always been low (Table 1).

TABLE 1

Average Whole Body, and Collective Doses
(all Classified Workers)

Year	Average Dose (mSv)	Collective Dose (manSv)
1986	4.0	12.6
1987	3.8	11.9
1988	2.4	7.0
1989	2.6	7.0
1990	3.1	7.4
1991 (projected)	2.5	6.0

The slight increase in 1990 was a result of some increase in programme with a workforce strength at about 75% of the 1986 figure. Further emphasis on ALARP has since reversed this trend.

Against this background, dose reduction policies and practices have been focused primarily on reducing dose in areas of the plant where these have been highest by comparison with the above averages. The two areas receiving the greatest attention have been the Uranium Casting Plant and the Oxide Powder and Pelleting Plants. Springfields is a multi-purpose Site, providing a wide range of finished fuels and intermediate products. It incorporates major production lines for the fabrication of metal fuel for Magnox reactors and Oxide fuel for AGR and PWR reactors. The Casting Plant is one of the stages in the production of Magnox fuel.

Recognising the eventual termination of the UK Magnox programme, major capital investment in new plant to service this programme could not be justified. Therefore, the casting, and other, stages of the fuel fabrication process have undergone extensive refurbishment of which dose reduction has been a significant, but not the only, feature. The cost of the casting renovation project was £2.5M (1981 MV) ie £4.5M (1991 MV). New, and modified, equipment and procedures were installed to bring about reduction in both internal and external doses.

For Oxide fuel production, the situation is different. In the UO_2 Powder Production plant, extensive modifications to existing cubicalised plant items had been carried out progressively from the mid 1970s to the mid 1980s (total cost in 1991 MV, £0.9M). Improved ventilation of, and operator access to, the cubicles, together with other engineered features, had resulted in significant reduction in airborne contamination levels in the working areas. Following this, nothing further by way of major renovation of existing facilities was practicable. Similar, though less extensive, work was carried out in the UO_2 Pellet

Plant. However, future potential Oxide fuel business, in both UK and worldwide, has justified investment (£145M, 1991 MV) in a major new plant, the New Oxide Fuel Complex (NOFC) to completely replace all existing Oxide production facilities and allow continuation, and expansion, of this side of the business into the 21st century. NOFC is currently under construction and will come on line, in phases, from 1994. Again, dose reduction is a prominent design feature. In the meantime, existing plants have continued to operate at high proportions of capacity but, by attention to good housekeeping and making modifications to reduce dose wherever reasonably practicable, doses have been steadily driven down (Table 2).

TABLE 2

Whole Body Doses, Casting and Oxide Plants

	Casting		Oxide Powder		Oxide Pelleting	
Year	Ave Dose (mSv)	No. > than 15 mSv	Ave Dose (mSv)	No. > than 15 mSv	Ave Dose (mSv)	No. > than 15 mSv
1986	18.8	35	13.9	33	11.3	12
1987	17.2	32	9.6	NIL	7.9	NIL
1988	13.4	10	8.8	NIL	5.6	NIL
1989	8.5	1	8.2	NIL	6.3	NIL
1990	6.6	NIL	10.6	NIL	7.9	NIL
1991 (projected)	3.3	NIL	8.0	NIL	6.3	NIL

In addition to average dose, the other important indicator of the dose uptake position is the number of workers whose dose exceeds the UK Ionising Radiations Regulations investigational level of 15 mSv per calendar year. This number, also, has been reduced from the mid 1980s figure to a position in which there are now no such cases.

THE FUTURE

NOFC has, of course, been designed to meet Company dose targets. In practice, it is assessed that actual doses will be well below target (about 3 mSv pa or less as an average) due, mainly, to sophisticated methods of containment of any airborne UO_2 powder, internal dose uptake being the dominant potential factor in Oxide plants. In other areas, the now well established Joint (Management/Workforce) Dose Reduction Working Parties will continue to identify dose reduction methods for implementation wherever they can be justified on ALARP grounds. These Working Parties now operate throughout the Works including areas where dose has always been very low, with the objective of reducing doses still further wherever reasonably practicable.

CONCLUSION

Average, and maximum, doses at Springfields Works are well within Company targets which, themselves, are well within regulatory requirements. Future developments will continue to drive doses down to levels that are significantly below ICRP 60 recommendations.

REFERENCES

1. Gardner, M.J. et al. Results of a case control study of leukaemia and lymphoma among young people near Sellafield Nuclear Plant in West Cumbria. British Medical Journal Vol 300 pages 423-429, February 1990.

2. Dose reduction and the application of the ALARP principle to occupational exposure at the nuclear fuel reprocessing plant at Sellafield in Cumbria. R.W. Anderson and R. Coates, Occupational Radiation Protection, BNES Guernsey, 1991.

3. Past trends in occupational exposure in nuclear fuel reprocessing at Sellafield, R. Strong and C. Partington, Occupational Radiation Protection, BNES Guernsey, 1991.