DOSE TREND ANALYSIS OF THE KRŠ KO NPP

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Abstract

Since the beginning of the ISOE programme, the annual average collective dose per reactor covered by ISOE worldwide demonstrates downward trend and reached 0.96 man Sv in 2000 [1] for PWR. The analyses of occupational dose trends in the period from 1990 to 2001 for the single Slovenian NPP NPP at Krško are given with the emphasis in relation between the job and the doses. Although the use of the collective dose as a suitable parameter has a limited applicability it can be successfully applied in the analysis of these trends.

1 Introduction

The implementation of individual occupational dose limits of safety standards [2] related to occupational exposures requires a comprehensive system. In the frame of this system operators of nuclear installations, outside undertakings and state authorities should act in a harmonised way. According to Article 38 of the 96/29/EURATOM directive [3] a country should also make all necessary arrangements to recognise the capacity of the approved dosimetric services and qualified experts in order to assure the implementation of the standards taken from [3]. In addition, individual monitoring results are subject of Article 29 of the 96/29/EURATOM as well as the arrangements under which the result of individual monitoring are conveyed. In Slovenia approximately 25% of occupationally exposed workers are workers in nuclear installations [4]. In order to improve radiation protection in nuclear installations of Slovenia and following the requirements of the directive, the *Central Dose Register of Workers in Nuclear Installations* has been established at the Slovenian Nuclear Safety Administration [5].

The main parameter which can be used in order to estimate the influence of the specific practice on occupational exposure is usually the individual annual effective dose averaged over a set of all workers. In addition, also the values of maximum annual dose or median annual dose can describe the distribution of number of workers as a function of occupational doses. In some cases subsidiary dosimetric quantities should be used (collective equivalent dose, collective effective dose, dose commitment…). The concept of the collective dose defined in Paragraph 34 from [2] has been well used in ISOE reports and it is also used in [6] in contrast with the directive [3]. The collective dose can be a suitable parameter in order to compare the implementation of the safety culture at different nuclear installations. However, we should take into account the fact that the details of this implementation are hidden.

2 Analysis of Dose Trends in the Krš ko NPP

In the period from 1996 to 1999 the nuclear power plant Krško (Westinghouse pressurised water reactor with electrical output 700 MW) performed a comprehensive maintenance of the ageing steam generators (sleeving, eddy current testing, reactor pump replacement…). In 2000 both steam generators were replaced.

Figure 1 shows the trend of the annual collective dose in the period form 1990 to 2001 as well as the reported dose from ISOE report. Due to maintenance works, plant modification and upgrading the annual collective doses in the Krško NPP in the period from 1997 to 2000 show a rising trend just opposite to the trend reported in ISOE reports. In the year 2000 the collective dose reached the maximum value of 2.60 man Sv due to steam generators replacement and dropped down to 1.13 man Sv in the year 2001. The major part of the dose reduction was related to the modernisation of the NPP and the reduction of outage duration. The minor part of the dose reduction could be also reached by the implementation of the work management principles (exchange of techniques and experiences in occupational exposure reduction).

The individual average effective dose in the year 2000 was 2.30 mSv and 1.27 mSv in the year 2001. These values represent less than 5% of the annual dose limit for the occupational exposure stated in legislation according which this dose limit is still 50 mSv. The internal annual dose limit of the NPP is 20 mSv. The expected annual collective dose of 0.8 man Sv in the Krško NPP in the year 2002 (*P 2002*) is also given in Figure 1.

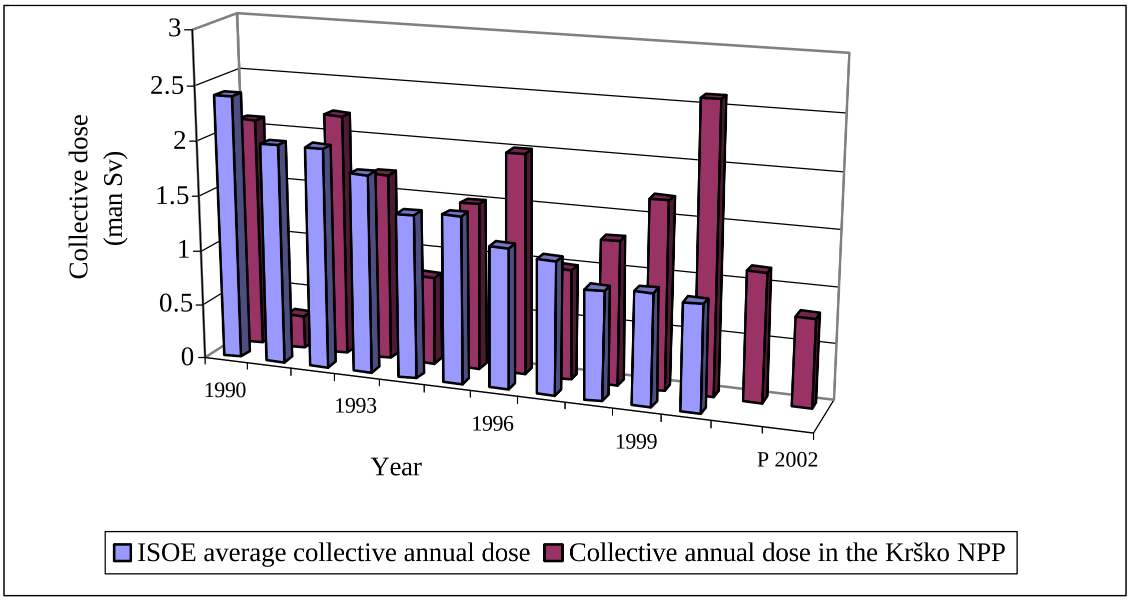

Figure 1. The annual collective doses in the Krško NPP and the annual average collective doses per PWR taken from ISOE reports are given. The expected annual collective dose in the Krško NPP in the year 2002 is denoted by *P 2002*.

The analyses of doses from 1996 to 2000 point out that the major part of the collective dose is due to plant outage works (from 75 to 95%) while the contribution of the normal operation is much smaller. In the year 2000 approximately 70% of all workers were outside workers as they are defined in [7]. Those workers received approximately 87% of the total collective dose. The annual collective doses in Krško NPP for plant personnel as well as for outside workers which were received during planned outages from 1996 to 2000 are given in Figure 2. The total collective doses during outages are also shown.

The collective dose of the plant personnel in the whole period showed quite constant values in contrast to the dose changes belonging to outside workers. This implicates that the special attention should be given to outside workers.

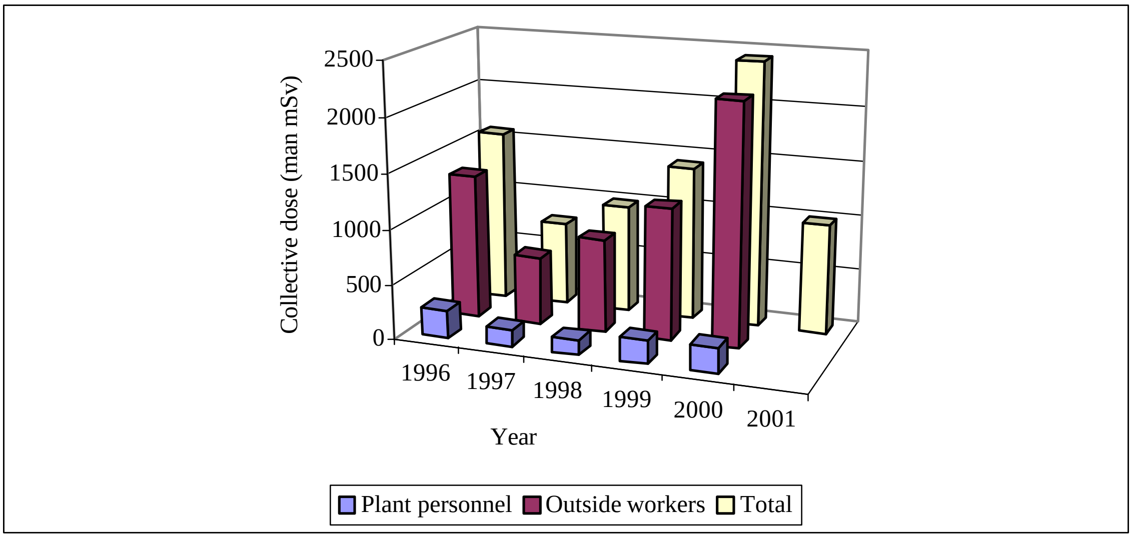

Figure 2. The annual collective doses in the Krško NPP for plant personnel as well as for outside workers in Krško NPP which were received during outages from 1996 to 2001. The total collective doses during planned outages are also given

Figure 3 shows the relationship between partial collective doses and the different jobs during outage period from 1996 to 2000. Only those types of work are analysed where the annual collective dose was at least once higher than 100 man mSv in that period. The work related to the maintenance, control and replacement of both steam generators resulted into highest partial collective doses. The next highest dose values belong to the refuelling but in contrast to the work related to steam generators do not show any big variations. It can be seen from the figure that in the year 1999 the works at the reactor coolant pumps and the reactor vessel resulted also in a significant increase of the annual collective dose.

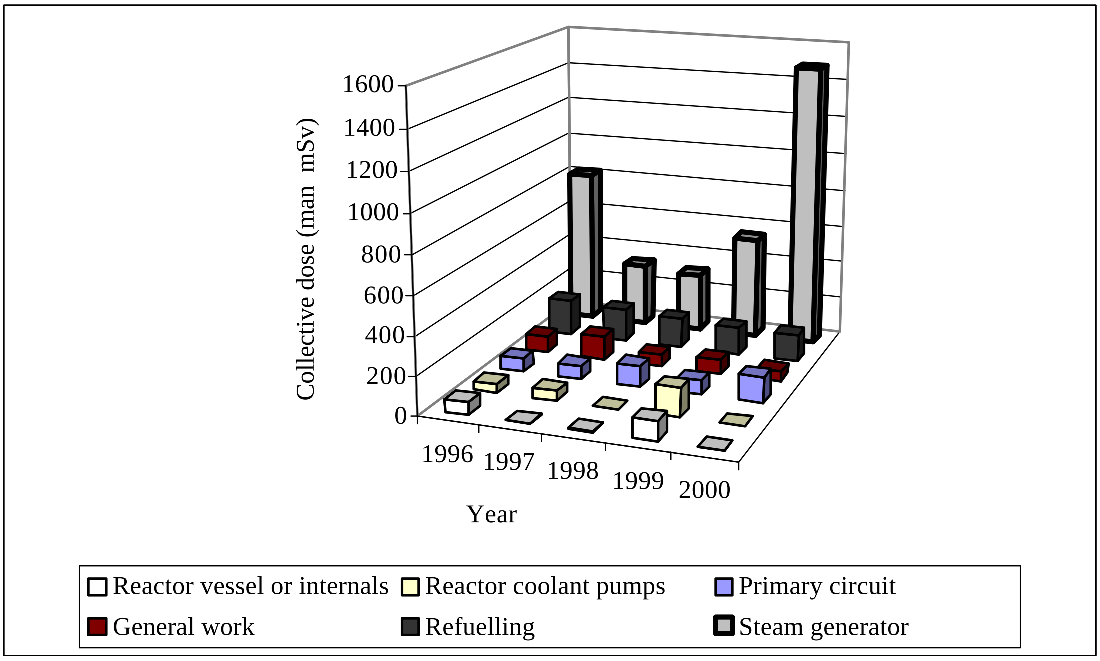

Figure 3. The annual collective doses in the Krško NPP from 1999 to 2000 related to different tasks during outages are given. Only those types of the work are given where the annual collective dose was at least once higher than 100 man mSv in that period.

3 Conclusions

The control of occupational doses in the NPP is an exciting issue due to diversity of radiation sources as well as diversity of jobs which are performed in the NPP. Besides primary dose quantities also the subsidiary dosimetric quantities as for example the collective dose can be used in order to follow the implementation of safety standards. However, the use of subsidiary dosimetric quantities has limitations which should be taken into account.

The general trend of the annual collective dose in the Krško NPP in the period from 1990 to 2000 was manly driven by the maintenance works at the ageing steam generators and by the replacement of both steam generators in the year 2000. In the future, a substantial dose reduction can be expected. This expectation relies already on the dose data from the year 2001. However the dose reduction plan related to the specific sources and specific jobs still remains a challenging issue in the modernised and upgraded NPP.

4 References

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