

EXPERIENCE OF DOSE REDUCTION PROCEDURE USING TARGET DOSE MANAGEMENT

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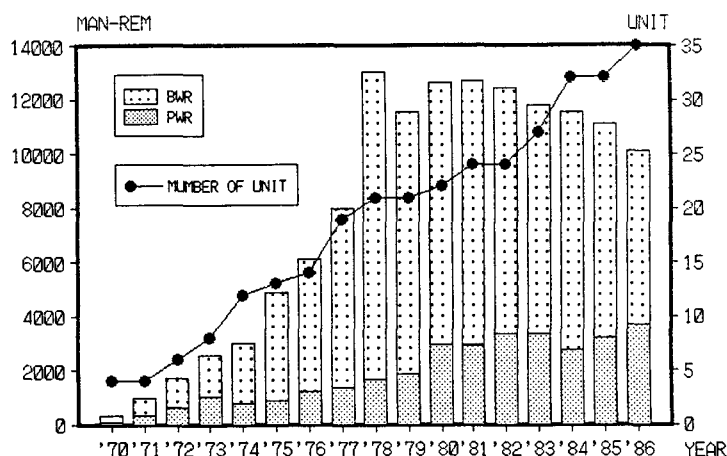
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INTRODUCTION

In Japan, 35 units of nuclear power plant are now under operation. The exposure dose of plant workers showed a tendency toward increase year by year along with the increase of number of operating units. However, the tendency has shown a slight decrease of late (See Fig.1). The annual collective dose per reactor in 1986 was approx. 360 man·rem at BWR and approx. 230 man·rem at PWR.

The dose could be limited to such a low level as a result of various dose reduction measures implemented in order at the existing plants as well as newly constructed plants. The efforts of concerned parties toward further reduction the dose and, at the same time, establishment of dose management and control system are requested.

Fig. 1 Trend of annual collective dose in Japan



DOSE REDUCTION MEASURES IMPLEMENTED AT TOKAI No. 2

At Tokai No. 2 power plant (BWR 1100MWe - start of commercial operation in 1978), various dose reduction measure have been positively implemented ever since the start of commercial operation, based on the actual results of preceding plants. These measures included crud reduction measures such as control of feedwater oxygen concentration, filling water during shutdown, introduction of CRD remote exchanging device, automatic ISI device, etc. and, furthermore, employment of such measure as improvement of the work environment including pipe shielding.

As a result of implementation of these measures, the collective dose at Tokai No. 2 power plant now ranks in a middle level among all operating BWR plants in Japan, and the dose at this plant keeps the same level rather than a slight increase.

The program for facility-wise measures necessary for reduction is now under study so that the dose at this plant can be further reduced. On the other hand, it is a matter of the first importance for reduction of the dose during the work to implement the dose management and control system, so that radiation

protective measures can be systematically and surely executed from the work planning stage.

On basis of such a viewpoint as stated above, arrangement and strengthening of target dose management organization and method have been recently executed at Tokai No. 2 power plant. The current status of the execution is as follows:

DOSE REDUCTION BY TARGET DOSE MANAGEMENT

a. Establishment of ALARA Coordinate Group

ALARA Coordinate Group (ACG) was established at site from the 7th Annual Maintenance Outage for the purpose of collectively control and reduce the dose during the annual maintenance work, which shares a greater part of the annual dose. ACG consists of the members of the plant and contractors assigned for radiation control and work management sections, and the meeting of ACG is held periodically starting from about 2 months before the annual maintenance work begins and throughout the maintenance work.

An objective of ACG activity is to introduce target management and connect result of the management with the actual dose reduction in the work control in accordance with the Plan-Do-Check-Action procedure and, at the same time, to promote ALARA philosophy through its activity.

The target management concept has been formally incorporated in Quality Control and Quality Assurance activity of general industrial field, and it is a common procedure used in the QC circle in our country. ACG just applied its concept into the dose reduction measures.

b. Scope of ACG Activity

The following activities are performed by ACG at each step from start of maintenance work and after completion of maintenance work:

Prior to start of maintenance work, anticipated man·rem for the whole work is calculated and the calculated result is studied and evaluated from a viewpoint of ALARA program (according to the "ALARA Check List"). In particular, for the work items involving the total dose of 5 man·rem or more the dose reduction measure items for each work step are studied and evaluated (See Flow Chart 1). The target value and weekly target value assigned to each contractor by each work item are established, based on the result of study mentioned above.

During maintenance work, weekly meeting is held for checking the actual result against target value and recommendation and warning for dose reduction purpose are given to contractors as necessary so that they can be reflected into such actions as flushing, decontamination, etc.

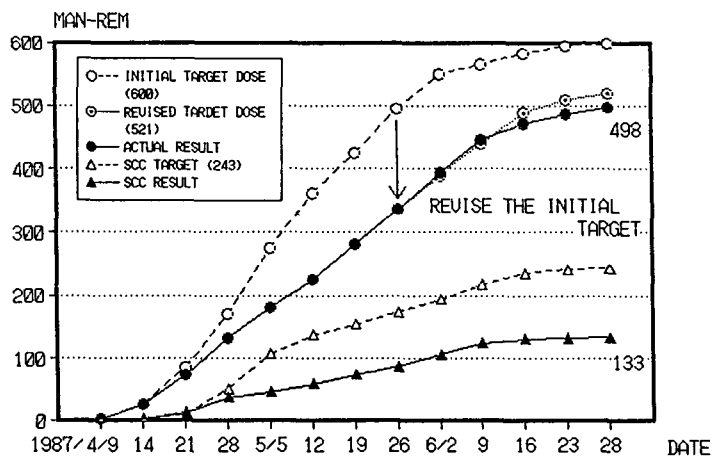
After completion of maintenance work, execution status of ALARA program is confirmed in order that the actual status can be reflected into the next maintenance work. In particular, for the work item which involved 5 man·rem or more, evaluation of comparison between target dose and actual dose as well as the difference thereof are studied in detail (See Flow Chart 2). In addition, for the work to be performed every year, the model cases have been properly arranged and consolidated in order for standardization of ALARA techniques.

c. Actual Result of Dose

Fig. 2 shows the actual dose received during 8th annual maintenance outage. For this maintenance work, ALARA study was made on the initial value of 650 man·rem estimated based on the past actual results and, as a result of study, a target value of 600 man·rem, which was about 10 % less than the estimated value, was established. The actual dose however was 498 man·rem, which was far less than a target value. This was because the effect of dose reduction measures applied to the work of SCC countermeasures, which was the largest modification work item done during this maintenance outage, was far greater than expected. These measures included chemical decontamination of the pipe performed prior to the pipe replacement work and, as a result, the dose received during pipe cutting and removal work was successfully reduced to a low level. In a midway of the maintenance work, a target value was revised to a lower value of 520 man·rem, but the actual result was far below even the revised value.

Evaluation of results of each of dose reduction measures applied during this maintenance outage indicated such effects as reduction of 19 man·rem by installation of a temporary shielding and reduction of 11 man·rem by adjustment of work location, in addition to reduction of 120 man·rem resulted from chemical decontamination mentioned above.

Fig. 2 Accumulated exposure dose in Tokai No.2 8th annual outage

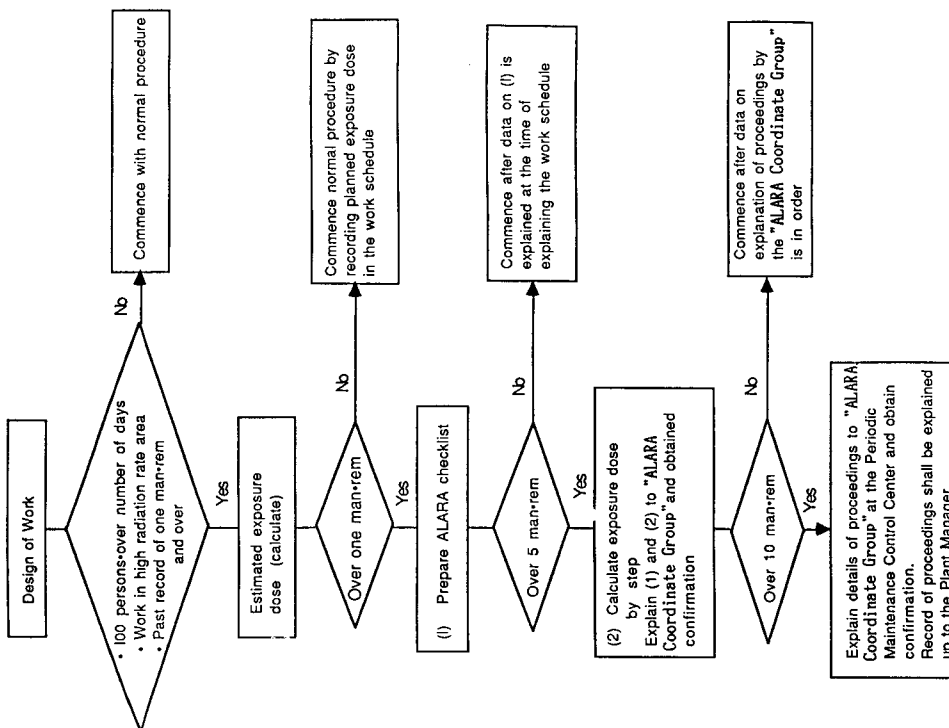


CONCLUSION

Though estimation method of the dose in special cases like a large plant modification work remains unresolved, expected effect of dose reduction measures is obtained through the work management, by setting up a target value and performing careful and refined integrated dose control. It is of extremely importance to firmly fix and maintain such dose management and control system in the future.

Further, in order to drastically reduce the dose to a half or more of the current dose, we are planning to set the long/medium - term target dose and application programs of necessary measures, such as installation of permanent and/or temporary shielding for primary loop recirculation piping, duplexed condensate cleaning system using hollow fiber filter, etc.

Flow Chart 1 ALARA plan procedure before initiating work



Flow Chart 2 ALARA plan procedure after work

