Poster No.: P35 - 26

RADIATION VOICE MONITORS

N. Suzuki
JGC Corporation
Yokohama, Japan

1. ABSTRACT

Radiation voice monitors, which serve to announce the dose equivalent (or dose rate) by voice to a worker wearing bulky protective clothing in high-radiation level and high-contamination areas, were developed to reduce the exposure to radiation of the worker. Examples of the applications of such monitors are introduced hereunder.

2. PURPOSE OF DEVELOPMENT

In developing radiation voice monitors, the aim was to enable a worker and his supervisor, while working in high-radiation level and high-contamination areas, to hear the dose equivalent (or dose rate) in real time and select working locations which would minimize the dose equivalent, increase working efficiency and reduce the collective dose equivalent (man Sv).

3. BACKGROUND

In Japan where the utmost efforts are being made to reduce exposure to radiation, the average yearly dose per worker at nuclear power stations is as low as 1.0 mSv/year. However, the need inevitably arises for workers wearing heavy protective clothing to perform duties at certain times in high-radiation level and high-contamination areas.

In the past, an alarm meter carried inside the pocket of the protective clothing sounded when the specified period of time was completed, whereupon the worker ceased working and exited from such areas. Time controls were in place to prevent the worker's dose rate from exceeding the planned dose. However, the dose rate in the working environment varied widely depending on both location and time.

4. PERFORMANCE

Radiation voice monitors enable the worker to continue his duties while being informed through his earphone of the changing dose equivalent or dose rate encountered, this being particularly convenient in cases where, due to the bulky clothing, it is difficult to see the dose equivalent or dose rate displayed on the dosimeter. As the new type of monitor transmits such audio-data wirelessly, a supervisor far away can hear the dose equivalent of the worker in real time and provide him with adequate instructions.

The radiation voice monitor is equipped with an additional audio-communication function enabling communications to be exchanged between workers and their supervisors.

The specifications of the radiation voice monitor are shown in and Table-1.

5. EXAMPLE OF APPLICATION

Place	:	Nuclear facility A
Dose equivalent	:	0.5 ~ 20 mSv/h
Surface contamination density	:	$\sim 8 \times 10^2$ Bq/cm^2
Noise	:	70 ~ 90 dB
Protective clothing	:	Anorak suit, full-face mask
Planned collective dose equivalent	:	13-man mSv/period
Actual collective dose equivalent	:	8-man mSv/period

6. STUDIES ON REDUCTION OF DOSE EQUIVALENT

It was determined that the dose equivalent in the application example given in the above section 5. was reduced as a result of the following:

(1) Workers could perform their duties while constantly being informed by earphone of their dose equivalent. Therefore, work was not suspended as it became unnecessary to exit the radiation area merely to satisfy the time control of the dose equivalent. 40%

(2) As the high-dose equivalent locations were known, workers were able to avoid working in these locations. 20%

(3) Because the supervisors heard the workers' dose equivalents in real time, they were able to supply adequate instructions.20%

(4) Workers were able to carry out work while hearing other co-workers' dose equivalents; that is to say, respective dose equivalents could readily be identified. 20%

100%

Furthermore, studies on the following index were conducted from the standpoint of optimization of radiation protection.

$$\frac{\Delta X}{\Delta S} \leq \alpha$$

ΔX: Cost of radiation voice monitor (¥)

ΔS: Collective effective dose-equivalent (man Sv)
α : Dimensional constant expressing monetary cost assigned to a unit of collective dose for radiation protection rate (¥/man Sv)
Δ : Finite increment

Application time (total time) of radiation voice monitors will affect the index ΔX .

7. CONCLUSION

Radiation voice monitors were developed to optimize radiation protection and have been used over the past five years. The results of the application of the monitors indicate a very satisfactory reduction of dose equivalent.

Table 1: SPECIFICATIONS
(FM RADIATION VOICE MONITOR)

Detector	Silicon semiconductor
Radiation detected	γ (X) ray (80 Kev - 2 Mev)
Measuring accuracy	+/-20%, 662 Kev for Cs-137
Measurement range	0.01 ~ 99.99 mSv, 0.01 ~ 99.99 mSv/H
Audio	Speaker, earphone, FM radio
Audio output	Max. 0.2W
Transmission frequency	FM radio, 70 ~ 100 MHz
Power	Four dry batteries
Battery life	8 hours
Size and weight	2.5W x 32D x 103H (mm), 250g