A HIGH RELIABILITY PERSONAL ALARM DOSEMETER WITH A SEMICONDUCTOR DETECTOR

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SUMMARY

A personal radiation exposure dosemeter in nuclear power plants and other nuclear-related facilities was developed. This is equipped with a semiconductor detector and is provided with a wider measuring range and longer service life compared with a conventional one using a GM counter. This is also provided with data transmitting functions using an optical communication system.

FUNDAMENTAL COMPOSITION

Figure 1 shows a block diagram of the present dosemeter. The detecting part employs a-Si:H/C-Si heterojunction diode made by a plasma CVD (Chemical Vapor Deposition) process. An amplifying circuit, a discriminating circuit and a bias circuit (+15V) compose a hybrid integrated circuit with the diode. The whole circuit is controlled by a 4-bit one-chip micro-processor. Counting pulses from detecting part are arithmetically processed and displayed as an integrated dose by LED.

Alarm level setting can be made with a manual alarm setter. An electronic buzzer is put into operation when the integrated dose has reached the set alarm value. A data communication circuit connect the information with an external computer system through an optical communication system.

A power source using Ni-Cd chargeable batteries is normally monitored by a voltage drop detecting circuit.

CHARACTERISTICS

The present dosemeter is characterized as follows:

(1) Less than 2.8×10^{-2} %/10^3 hr in failure rate has been achieved.
(2) Two types of energy response are available. (See Figure 2)
(3) Continuous operation is ensured over 12 hours in the temperature range of 0 - 50°C
(4) All the information on the dosemeter conditions, including integrated dose, built-in battery voltage, operating status and set values, can be outputted to an external system.
(5) Accurate and stable measurement is ensured both in N-16 high-energy gamma-ray (6 MeV) atmosphere and in high dose rate conditions (up to 50 R/hr). (See figure 2, 3)
(6) The present detector is provided with self-diagnosing functions such as battery voltage drop detection as well as detector self-check in the natural background.

(7) The present detector, compact in thickness (see figure 4) and light in weight (approximately 200g), can be carried in a pocket of working clothes.

REFERENCE

(1) M. Yabe, et al.: Nuclear Instruments and Methods 193 63 (1982)

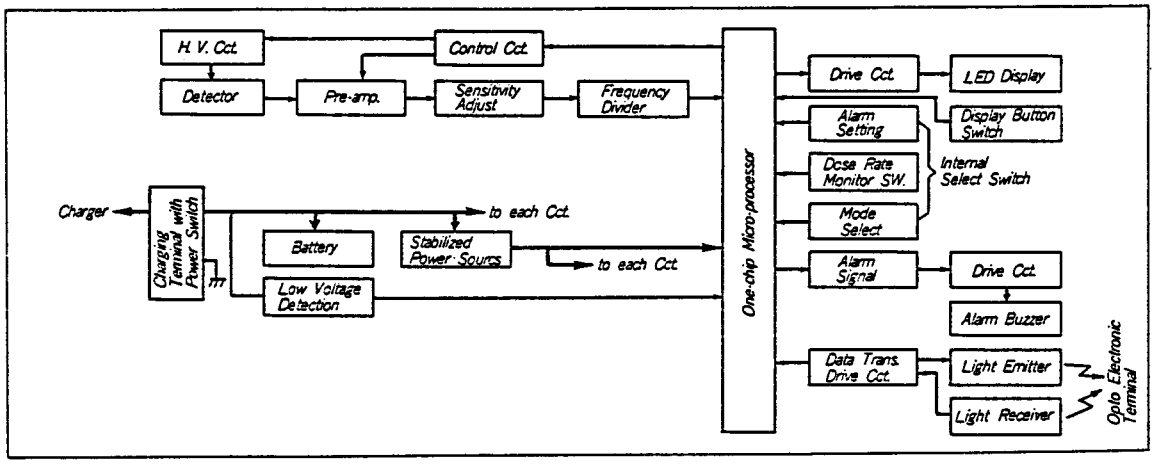

Fig.1. Block diagram

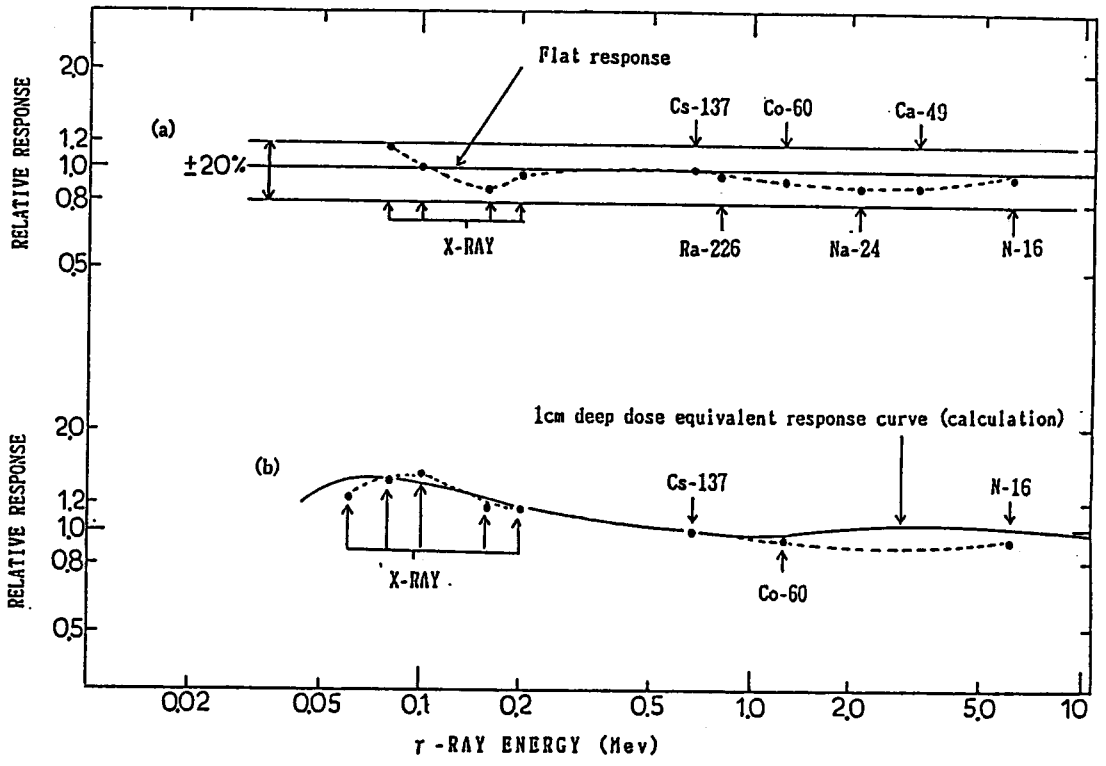

Fig-2 Energy Dependence of the present detectors normalized at Cs-137

(a) Flat response type detectors (b) 1cm deep dose equivalent response type detectors

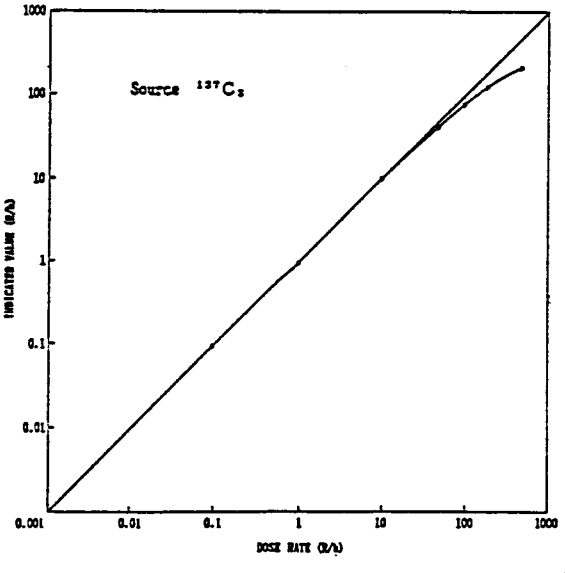

Fig.3. Dose rate dependency

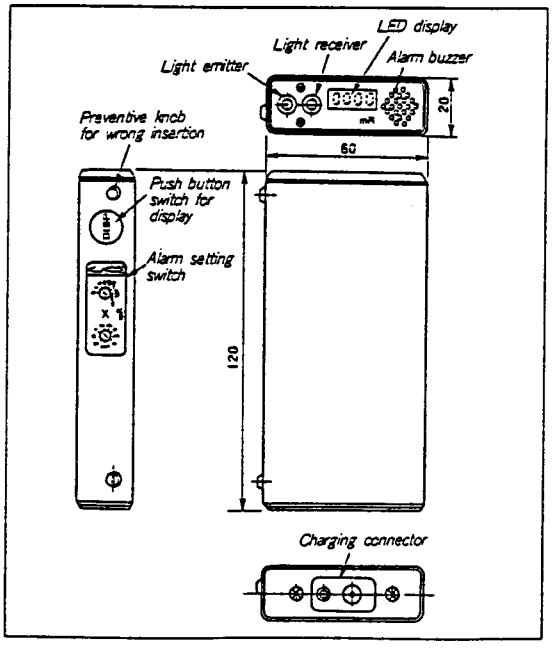

Fig.4. Dimensional drawing