COMPUTER AIDED RADIATION PROTECTION SYSTEM AT TOKAI REPROCESSING PLANT

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INTRODUCTION

Radiation control for workers and workforce has been carried out strictly and effectively taking into account ALARA principle at Tokai Reprocessing Plant(TRP) which has treated about 860 tons of irradiated fuels by now since 1977. The outline of radiation control method at TRP has already been described in (1), (2) and (3). This paper briefly describes our experiences and the capabilities of Radiological Information Management System (RIMS) for the safety operation of TRP, followed by radiation exposure control and activity discharge control as examples .

OBJECTIVES AND SCOPE

The main plant construction started in 1971 and was finished in 1974, since then waste treatment facilities and waste storage facilities were successively constructed together with locating the safety control rooms at several facilities separately. On the other hand various kinds and levels of radioactive materials are treated in TRP and the radiation fields are monitored for the purpose of avoiding excessive exposure of workers and of confirming that working environment is satisfactory for operations. Therefore all the data are to be centralized in the central safety control room for the effective radiation protection.

SYSTEM DESCRIPTION AND CAPABILITIES

The RIMS, which consists of several functions such as a radiological monitoring at workplaces, a radiological data base of past experience, a management of radiological work, etc., was designed and set up at the safety control rooms to reduce exposures associated with routine and special repetitive maintenance operations in TRP. The schematic diagram of RIMS is shown in Fig.1.

(1) Radiological Monitoring at Workplaces

The radiological monitoring at workplaces of TRP is conducted by using about 400 channels of continuous on-line monitoring equipment such as area monitors for gamma-ray and neutrons, dust monitors for alpha and beta particles, exhaust monitors for krypton-85, iodine-129,131, etc. which are located at each spot. The signals of all the detectors are centralized to the health physics panels in each safety control room and then are linked to the computer system of RIMS through the panels of the central safety control room. And to support these on-line monitors, manual radiation monitoring such as area survey of external radiation, airborne radioactive materials and surface contamination is carried out periodically. Dose equivalent rates at fixed points in each facility are measured with survey meters daily, weekly and monthly. Airborne radioactive materials in workplaces are weekly sampled by the air sampling system and then measured by low background proportional counters to estimate the concentration of radioactive materials in workplaces. Surface contaminations at fixed points in the workplaces are estimated by smear sampling daily and weekly. All these data except surface contamination are input to the computer of RIMS. There is no need to record surface contamination which is normally less than the detection limits except for the special maintenance period because the restricted area of TRP is essentially well controlled based on the principle of "Non-contamination". The off-line survey data are input to the RIMS through handy-terminals or radioactive measurement instruments.

By using the RIMS, each data is displayed in case of need, for example, every minute, hour, day or week.

The data are easily compared to the authorized limits to confirm the state of the facilities. If dose equivalent rate or concentration of airborne radioactive materials were raised over the control levels, they warn workers to evacuate from the room immediately.

(2) The Radiological Management System and Radiological Data Base of the Past Experiences

In case of the work done under high dose rate or in contaminated area such as the work in a cell, a special radiological work plan needs to be authorized by the director of TRP after checking by the staffs of radiation protection section and the safety superintendent. Advice on radiation protection is given to the plan in consideration of minimization and optimization of exposure to workers. On this occasion the staffs of radiation protection section refer to the past similar experiences from view points of the working process, the radiation monitoring programme, the choice of radiation protection apparatus, the education and training, the maximum individual dose, the total collective dose, the emergency planning etc.. Especially the prior check of the radiation levels and the procedures of the work is very important. So far these performance checkings have been done by the human sea tactics, and so it takes a lot of time and the products of the past experiences have not always been put to practical use. The RIMS includes many experiences of the past special radiological works, and the required data are gained quickly as factors of date, working room number, working unit, working group's name, species serial number and so on. During the work the exposure doses to workers are collected and added by every individuals and are compared with the planned exposure dose by using the alarmed personnel dosimeters and the RIMS. After the work the analysis report of the work is written and is input to the RIMS for the next similar works.

(3) Information on the Present Conditions of Plant Operation

The RIMS includes operational conditions such as shearing, dissolution, clarification, extraction, Pu purification, Pu concentration, acid recovery distillation, and so on which are needed now and then.

CONSEQUENCES OF RADIATION CONTROL

The number of workers have increased in keeping with increase of facilities. Higher collective dose equivalents, by way of example, 1.7 man-Sv in 1983, 2.0 man-Sv in 1984 and 4.5 man-Sv in 1988 were resulted from the large maintenance works such as the repair of dissolvers, the replace of acid recovery evaporator and so on. Under normal plant operation the average collective dose equivalent is about 0.5 man-Sv in a year and the average exposure of an individual is about 0.1 mSv recently. These values are mainly the external exposure because the internal exposure have rarely occurred.

CONCLUSION

By operating the RIMS, the conditions of workplace such as dose equivalent rate and air-contamination are easily and rapidly grasped to take prompt countermeasures for radiological protection, localization and elimination of contamination, and also the past experience data are properly applied to new radiological works to reduce exposures associated with routine and special repetitive maintenance operations at TRP. Finally, authors would like to emphasize that the form and system for radiological control of reprocessing plant has been established throughout our 15-year-experience at TRP.

REFERENCES

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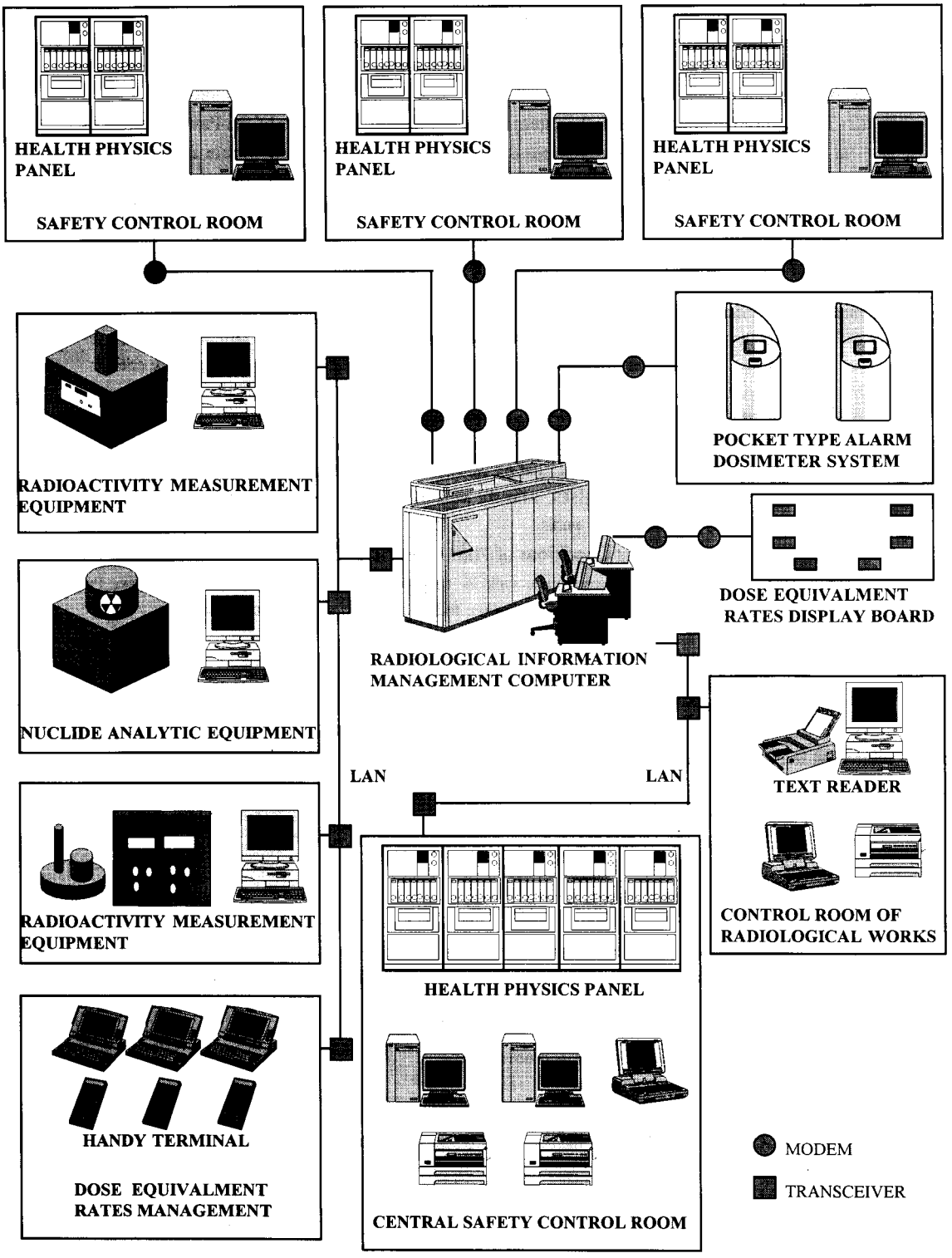

Fig.1 Schematic Diagram of the Radiological Information Management System (RIMS)