MOBILE MONITORING UNIT FOR ASSESSING ENVIRONMENTAL RADIOACTIVE CONTAMINATION

A. Andrási, I. Fehér, I. Németh, J. Urbán and P. Zombori

Atomic Energy Research Institute of the Central Research Institute for Physics, Budapest P.O. Box 49, H-1525, Hungary

ABSTRACT

Mobile monitoring laboratory has been established for monitoring environmental radiation first of all in accidental conditions but which is also suitable for monitoring radiation in natural level. The applied equipments and devices ensure the measurement of dose and dose rate in wide range, nuclide specific activity concentration of ground deposition and in air /with special attention to iodine in aerosol and vaporous forms/ as well as in samples of soil, water, vegetation, foodstuffs, etc. The measured data are handled, evaluated and recorded by an on board computer which provides also rapid information for any further decision making or intervention.

INTRODUCTION

As a consequence of increased number of operating nuclear facilities, first of all nuclear power plants and the lessons drawn from the Chernobyl accident underlined the importance of establishing environmental monitoring systems for obtaining rapid information in accidental situation on the radiological conditions at the affected area and providing suitable data to the competent authorities for decision making. Mobile units suitable for monitoring radiological impact at any selected location in the field play an important role in emergency preparedness.

In Hungary the nuclear facilities at the Central Research Institute for Physics as well as the nuclear power plant at Paks necessitated the establishment of a mobile environmental monitoring unit as a part of the emergency preparedness programme. The main objective was to establish a mobile unit which is based on a reliable vehicle /preferably a cross-country car/ and is equipped with instruments and devices necessary for assessing environmental impact of a nuclear accident after initial information concerning the situation originating from the operators or from the early warning system becomes available. The requirement was also to provide measured data suitable for further decision making and intervention, if necessary. For better utilization the application field was intended to extend also for monitoring lower level of environmental radiation for instance from natural sources.

It has to be mentioned that the amount of finantial support made available for this project was also a limiting factor in the selection of the vehicle and its instrumentation.

METHODS AND EQUIPMENTS

After careful survey of the offers of vehicles being potentially available considering prices, delivery conditions and other practical aspects a Volkswagen Transporter type four-wheel driven microbus was selected with enlarged inside dimensions. The car has been specially furnished for the given task facilitating the fixation and transportation of the necessary equipments and devices as well as to provide comfortable and practical conditions for different activities to be carried out in the vehicle.

The mobile laboratory has been prepared for the measurement of dose and dose rate in wide range, ground surface contamination, nuclide specific activity concentration in air /with special attention to iodine in aerosol, in elementary and organic vaporous form separately/ as well as in other samples like soil, water, vegetation, food-stuffs, etc. The following equipments are available for the measurements of the above quantities

Dose, dose rate:
- High pressure ionization chamber
- Portable dose rate meters/GM counters/
- Portable TL reader with $CaSO_4$/Dy/ bulb dosemeters
- Personal alarm monitors
- HpGe gamma spectrometer for in situ nuclide specific dose rate measurement

Ground contamination:
- Portable surface contamination monitor /GM-counter/
- HpGe gamma spectrometer for in situ nuclide specific ground contamination monitoring

Activity concentration in samples:
- Shielded HpGe gamma spectrometer for sample analysis
- Shielded plastic beta-counter for samples of elementary and organic iodine from the air

The on board personal computer has multifunctional task namely it serves as a multichannel analyser for sample gamma spectrometry and as the central computer for spectrum evaluation as well as for data handling, recording, storing and searching. The computer also provides rapid information for the necessity of intervention. The scheme of the monitoring system can be seen in Fig. 1.

The mobile unit is equipped with a number of necessary devices like AC power generator, batteries, sampling devices and sample holders, tools for simple sample preparation, wireless communication system, etc.

The following equipments and methods applied in the mobile laboratory have been developed in our department

- Soil sampler,
- Aerosol and iodine sampler,
- PILLE portable TL reader with $CaSO_4$/Dy/ bulb dosimeters [1],
- G'PEAK WORKSHEET computer programme for gamma spectrum evaluation [2],
- Calculation method for determining activity distribution in the ground using only spectral information of in situ gamma spectra [3],
- Automatic evaluation of in situ gamma spectra,
- MOBSYS computer programme for unified handling, recording, storing and searching of all measured data.

The dose rate meters applied in the mobile unit enables to cover a measuring range from 10^{-9} to 5 Sv/h while in case of dose meters from 10^{-6} to 1 Sv

APPLICATIONS

The mobile laboratory plays an important role in the emergency preparedness programme in the country. There is no continuous inspection at present, however in case of emergency the mobile unit will be ready to start within a few hours and can act as an essential tool for surveying the radiation conditions in the intermediate phase of the accident.

The continuous preparedness of the equipments is ensured by their frequent use in the environmental laboratory after having been removed from the vehicle. The mobile unit is intended to be applied in normal situation also for different surveying programmes ensuring the proper use of equipments in field conditions and providing training for the staff.

The improvement of the methods applied and their regular control including participation in intercomparison exercises also in international level are regarded as a necessary and important part of the emergency preparedness. A meeting of several teams operating mobile units in the Central European region /Workshop on Mobile Laboratories for Monitoring Environmental Radiation, held in Paks, Hungary in the period 16-20 September 1991/ was organized to establish a cooperation between the participating institutions and to be a base of an international network to react in emergency.

REFERENCES

1. P.P. Szabó, I. Fehér, S. Deme,B. Szabó, J. Vágvölgyi: Dosimetrical properties of the portable, wide dose range TLD reader "PILLE". Rad. Prot. Dosimetry, 17 279 /1986/

2. P.Zombori: Application of G'Peak-Worksheet /a New Software for Gamma Spectrum Analysis/ in Environmental Monitoring /to be published/

3. P. Zombori A. Andrási, I. Németh: A New Method for the Determination of Radionuclide Distribution in the Soil by In Situ Gamma-Ray Spectrometry /to be published/

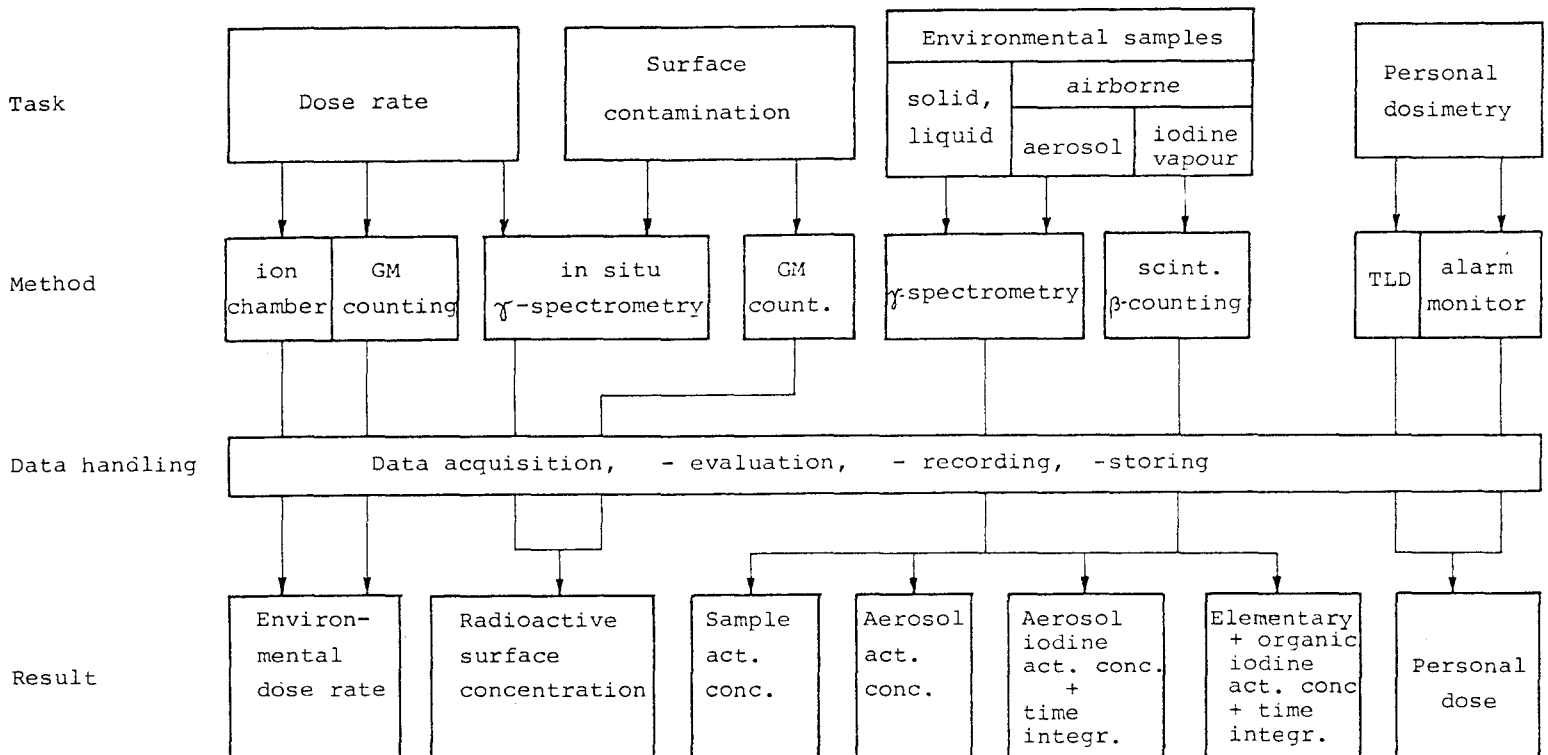

Fig. 1 Scheme of the monitoring system of the mobile unit