NATIONAL PROGRAM FOR LOW-LEVEL RADIOACTIVE WASTE MANAGEMENT

E. Ne'eman, S. Brenner, Y. Tal
Institute for Environmental Research
The Ministry Of The Environment
Tel-Aviv University, Ramat-Aviv, 69978, Israel

ABSTRACT

Radioactive materials are used extensively in Israel. All of the radwaste produced is disposed off at a single national depository site. Reports concerning the amount of accepted radwaste are sent to the Chief Radiation Executive, who is the responsible authority for waste management in Israel. In order to enhance enforcement capabilities a theoretical model for the estimation of radwaste production by large institutions is needed. Such a simplified model is briefly hereby described.

INTRODUCTION

Radioactive materials are used extensively in labelled chemicals in hospitals, research laboratories, industrial and agricultural premises and for environmental studies. In many instances they provide scientists and technicians with unique methods of monitoring processes and measuring reactions. A by product of many of these methods is Low-Level Radioactive Waste (LLRW).

The primary concern in waste management is to implement an effective control and disposal system that ensures the safety of people and protection of the environment. Waste management practices vary considerably from one country to another, according to the regulatory system and inspection authorities that determine national policy and set criteria for the handling, treatment and disposal of wastes. The regulatory authorities should evaluate their options following detailed consideration of the environmental impact of releases of radioactive waste to the environment.

In exercising their responsibilities, all persons using radioactive materials have to take into account the possible conflict between scientific objectives and radiological protection criteria, and the costs of implementing waste management options. They must be able to demonstrate to the regulatory authorities compliance with legal requirements and good radiological protection practice.

During the course of work with radioactive isotopes, a variety of materials become contaminated and have to be disposed of. These materials range from ordinary paper, rubber gloves and broken glassware to large pieces of equipment. The activities and the half-lives of radionuclides present in them show wide variation.

In order to facilitate their subsequent handling, treatment and disposal, it is worthwhile to segregate waste as close as possible to the point of origin. If the implementation of this procedure cannot be ensured, a more feasible method would be to collect the waste to LLRW centers for categorizing into two groups: (1) compressible and combustible materials, and (2) non-compressible and non-combustible materials. The waste from the first group can be reduced in volume in order to make its handling more economical.

It is necessary that the licensing authority fix a limit on the activity level of the radioactive liquid waste for each location and facility, below which disposal to sewers and drains can be considered acceptable. Once this limit is fixed the volume of liquid radioactive waste which has to be handled is reduced considerably.

SURVEILLANCE OF LLRW DISPOSAL

Radioactive materials are used extensively in Israel in many areas and applications e.g. medical diagnosis and therapy, industry, agriculture, research and development and related subjects. A radiation protection infrastructure of regulations, educational facilities, licensing and supervision arrangements was developed in Israel including the formulation of radioactive waste disposal rules.

Legislation and Responsibility

The responsible authority for waste management in Israel is the Chief Radiation Executive (CRE) who is nominated by the Minister of the Environment according to the "Pharmacists Regulation - Radioactive Elements and Products Thereof". This regulations authorizes the CRE to issue a license for waste disposal services, after consulting with the Israeli Atomic Energy Commission (IAEC).

Each radwaste producing institute in Israel has to acquire a license for its operation. This license limits the amount of radioactive materials purchased by the institute and approves the nomination of a radiation officers. The radiation officer is liable for the appropriate handling of radwaste inside the institute.

Hospitals and research Institutes pose a unique radwaste problem. They produce a large amount of LLRW and their radiation officer are generally a physicist who perform this duty as a part time job. As a consequence, the adequate segregation of radwaste cannot be assured by these Institutions. A safety assessment of the above actual situation dictates a clear cut instruction for radwaste disposal: No radwaste of any sort will be disposed of through the ordinary waste system or through the general sewage.

Radwaste disposal services are offered by the IAEC's Nuclear Research Center -Negev (NRCN) which operate and monitors a National Radioactive Waste Disposal Site. The National Waste Disposal Site which is the only one in Israel is located in the Negev Desert in the southern part of Israel. However, most of the hospitals and institutions generating radioactive waste are located far away from the above site. The cost of transporting the radioactive waste is usually very high due to the large distances involved. In order to solve this problem we intend to install intermediate waste concentration sites in several zones of the country.

Supervision Enhancement by Modeling

Officials under the CRE control the flow of radioactive materials in Israel aided by a computerized Data Base

Management System (DBMS). This software comprised of the following modules: licensing module, import and distribution module, and waste disposal and transportation module. At the present time only the first module is completed.

The CRE gets monthly reports from the national agency for waste disposal of the NRCN which specify the quantities of drums arrived from each hospital and research center in Israel (Fig. 1-2). As can be seen from these figures, the volume of radwaste produced by large institutions decreeses in time. However no such decreese was found in their consumption of radioactive materials. In order to achieve safe and efficient waste disposal control, the CRE should have the ability to estimate whether the reported waste quantities are reasonable.

The waste disposal module of the DBMS described above, will include a theoretical model for the estimation of the volume of radwaste production by large institutions. This model will provide a "first guess" that can be used to validate the information given by the waste disposal agency.

The amount of LLRW produced by each laboratory in a hospital depends on the various kinds of tests performed there, the work load, and the specific technique used by the personnel. We assumed, as a first order approximation, that this dependency is linear. Since hospitals' laboratories in Israel exercise similar technique for the same kind of test, it is possible to consider a limited number of hospitals in calibrating the coefficients of a linear simplified model. Typical values for the number of tests needed to produce one LLRW drum as a function of labs' discipline is listed in Table I.

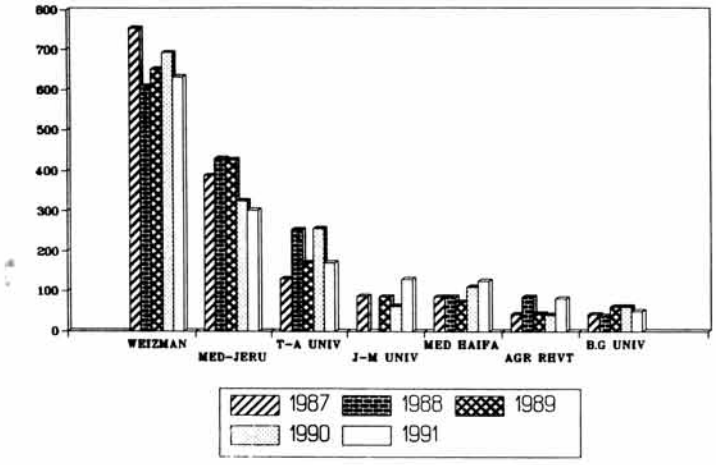

Fig. 1. Radioactive waste disposal (in drums) from res. inst., '87-'91.

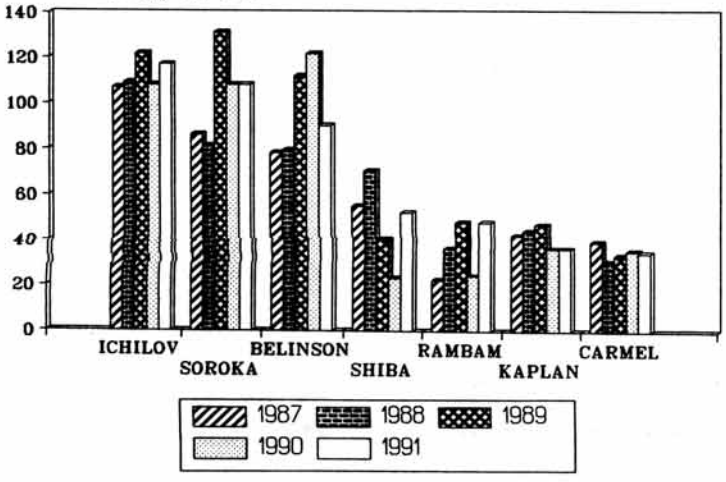

Fig. 2. Radioactive waste disposal (drums) from hospitals, '87-'91.

The number of the drums N produced each month by a hospital according to such a model will be given by

$$N = (\Sigma n_i / a_i) + b_m + dk,$$

where the summation is carried over all the laboratories of the institute, and

- n - is to quantity of tests done per month for each laboratory;
- m - is the number of licensed radioactive facilities in the hospital;
- k - is the total activity in millicurie of radioactive materials purchased by the hospital each year, not including Tl-201 and Mo-99 - Tc-99m.

The set of coefficients a_i, b and d are the constants of the model.

The constants a_i are taken from Table I. The values of b and d were estimated to be 0.08 and 0.0035 respectively.

CONCLUSIONS

We have described how LLRW disposal is managed and supervised by the CRE, the responsible authorities in Israel. An important part of the enforcement capabilities of the CRE is his ability to independently validate the reports concerning the amount of waste produced by large users of radioactive materials. This can be partially achieved by the use of the model we presented here.

TABLE I
Typical Values for the Number of Tests Needed to Produce one LLRW Drum as a Function of Labs' Discipline

Discipline	a
Gastroanthrology	400
Bacteriology	2,200
Nuclear Cardiology	200
Hemmatology	800
Genetics	2,400
Endocrinology	5,800