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LOW LEVEL RADIOACTIVE WASTE MANAGEMENT AND DISCHARGE POLICIES

T. Özdemir, C. Özdemir, I. Uslu
Turkish Atomic Energy Authority, 06530, Ankara, Turkey

Abstract. *The legal infrastructure in Turkey for the management of low-level radioactive waste covers the liquid, solid and gaseous wastes. Management of these radioactive wastes is briefly described in this paper. Moreover, delay and decay tank systems that are used to collect and store the low level radioactive wastes as a part of low-level radioactive effluent discharge policy are introduced.*

1. INTRODUCTION

Radioactive substances are used in beneficial ways such as the generation of electricity, medical diagnosis and therapy, scientific research and specialized industrial applications. However, many of these activities generate radioactive waste, which occur either in gas, liquid or solid state, should be under an appropriate and robust regulatory control program. Airborne and liquid waste may be permitted for discharge into the environment, after treatment, which may include converting gaseous discharge to liquid or reverse, if necessary. Unplanned and/or uncontrolled exposure to radiation can be detrimental to health that is why the regulatory system in any country should be sufficiently robust [1]. An essential requirement of any sound regulatory' structure is to present a clear definition of its scope: certain sources or practices may be excluded from regulatory requirements or exempted from regulatory supervision. One reason for such exemption or clearance is when the radiological risk or detriment associated with the practice is so small as not to warrant the imposition of the system of reporting or prior authorization [2]. For the exemption of any source or practice from regulatory control, the general and widely accepted radiation safety requirements for a member of the public are as follows:

- The effective dose expected to be incurred by any member of the public due to the exempted practice or source is of the order of 10 μSv or less in a year,
- Either the collective effective dose committed by one year of performance of the practice is no more than about 1 man Sv, or an assessment for the optimization of protection shows that exemption is the optimum option [3].

For routine discharges of radioactive materials to the environment, the main types of control options are to provide either storage facilities for gaseous and liquid effluents, so that short lived radionuclides can decay before release, or treatment facilities that remove radionuclides from the effluent stream for disposal by other means. Within these two broad categories there may be a number of different options available. The various options should be identified and their features examined as far as possible, including capital, operating and maintenance costs, the implications for waste management, and the effect on individual and collective doses for both the public and workers. There may be a number of complex trade-offs between these various features [4].

The current global approach shaped with the international conventions is toward the limitation of radioactive discharges to the environment. In the **OSPAR Convention** [5], it is stated that; Contracting Parties shall require adopting programs and measures for the purpose of prevention and elimination of pollution from land-based sources, either individually or jointly, the use of:

- best available techniques for point sources,

- best environmental practice for point and diffuse sources, including, where appropriate, clean technology.

Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management [6] imposes a system of regular peer reviews of the policies and practices of radioactive waste management including discharges to the environment in each Contracting Party.

The limitation of the discharges of radioactive substances should be based upon the optimization of radiation protection, using best available technique.

2. LEGISLATIVE INFRASTRUCTURE and RADIOACTIVE WASTE MANAGEMENT IN TURKEY

Turkish Atomic Energy Act requires Turkish Atomic Energy Authority (TAEA) to manage radioactive waste. Turkish Atomic Energy Authority has issued a decree and legislations on radiation protection, which also cover radioactive waste management. Moreover, a new legislation [7], substituted the old one, covering the discharges of radioactive effluents from the licensed establishments was issued in September 2004.

Waste Processing and Storage Facility operating under Cekmece Nuclear Research and Training Center, a subsidiary of TAEA, is centralized waste processing facility where low and intermediate wastes are treated and/or conditioned and stored. The capacity of the waste interim storage facility has been enlarged.

2.1. Solid radioactive wastes

Part of the above-mentioned discharge legislation for the management of short-lived solid radioactive wastes with half – lives less than 100 days requires the disposal of these wastes as hazardous medical waste that is incinerated in the authorized incineration facilities, after the decay of package surface dose rate to 1 μSv/h. This approach enhances a practical approach for the management of low-level solid radioactive wastes. Sealed radioactive sources can not be disposed as the same way with the short lived low level solid radioactive waste, regarding to this legislation.

2.2. Liquid radioactive wastes

The liquid radioactive wastes can be discharged to the sewage system according to the concentration limits set by the legislation. Short-lived solid radionuclides with half – lives less than 100 days can be discharged to the sewage system regarding to the current legislation. Discharge limit set by the current legislation is 25 ALI_{min}/month for each licensed establishment and con not exceed 2.5 ALI_{min} for each occasion.
However, hospitals having therapeutic I-131 treatment can discharge I-131 with a maximum concentration of 10 Bq/ml. The legislation requires monitoring of I-131 discharges for hospitals.

2.3. Gaseous radioactive effluents

The legislation covers also the release of gaseous effluents to the environment with the constraint of not exceeding the effective dose of 10 μSv that could be incurred by any member of the public during one year.

2.4. Spent Radioactive Sources

Conditioning of spent radioactive sources is done in the Waste Storage and Processing Facility in Cekmece Nuclear Research and Training Center in Istanbul. The conditioned SRS are stored there. Radiation Safety Legislation requires source return policy.

Management of Spent radioactive sources (SRS) is achieved by conditioning in a matrix, which is rather a simple way to manage. The SRSs are transported to radioactive waste management facility. The operational capability of the facility includes treatment and conditioning of low-level solid, liquid and SRS wastes. All of the sources are registered. Verification and/or identification tests for the type

of radionuclide and activity may sometimes required especially for the case of illegible label of source. Mostly the sources are coming from the application areas of industrial gauges (e.g. level, well logging, thickness and moisture content gauges), radiography, tele-therapy, lightening preventors, and smoke detectors. The sources are normally conditioned in 200 L drums. In case the source is placed in big equipment, e.g. spent tele-theraphy sources, and the retrieval of the source is not possible with the available technology, a specially designed waste package should be used for the storage of SRS and it is conditioned in this package and some assembly devices are dismantled to decrease volume.

3. DECAY AND DELAY TANK SYSTEMS

As one of the best available technique, waste tanks are used to collect and decay radioactive waste before the discharge of effluents into the sewage system. The single waste tank system makes use of the "**decaying while filling**" principle. Therefore, by the time that the tank is filled, the total activity in the waste tank is many times lower than the total input activity. The multiple tank system takes the advantage of physical decay without input so that the overall capacity requirement can be greatly reduced. The use of multiple waste tanks resolves most of the problem of single waste tank system. However, it is important to design waste tank system with optimum tank number and capacity. Typical design of waste tank system is shown in Figure I.

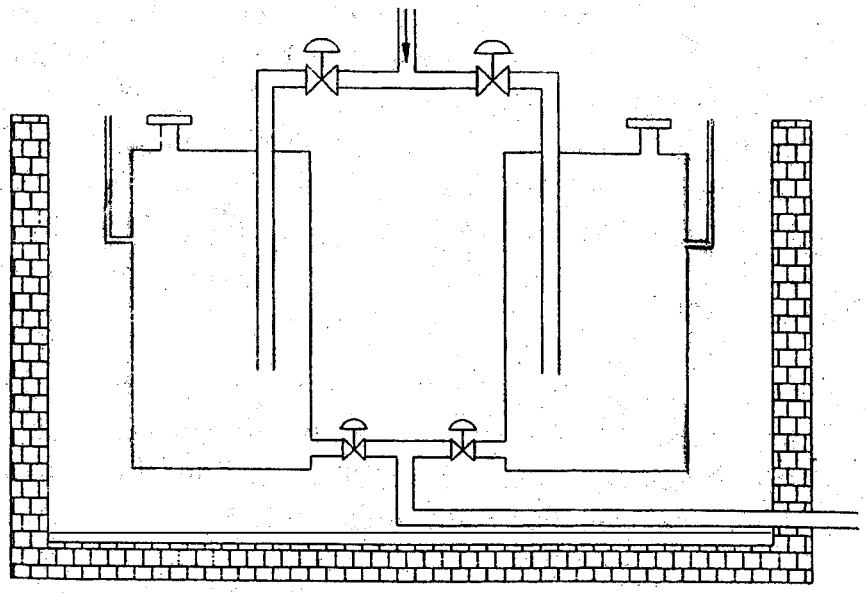

Figure I. Typical design of biomedical radioactive waste tank system.

4. CONCLUSIONS

Turkish Atomic Energy Authority as the regulatory body of Turkey has mostly completed its legislative infrastructure on the disposal of short-lived low-level radioactive waste. All the trends in the disposal of low level wastes and discharges of low-level radioactive effluents are closely followed. There is an on-going study to issue a new legislation on the management of radioactive waste from non – power applications.

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