



LOW AND INTERMEDIATE LEVEL RADIOACTIVE WASTE IN MEXICO

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Abstract.

Currently, it is necessary to establish, in a few years, a definitive repository for low and intermediate level radioactive waste in order to satisfy the necessities of Mexico for the next 50 years. Consequently, it is required to estimate the volumes of the radioactive waste generated annually, the stored volumes to-date and their projection to medium-term. On this subject, the annual average production of low and intermediate level radioactive waste from the electricity production by means of nuclear power reactors is 250 m³/y which consist of humid and dry solid waste from the 2 units of the Laguna Verde Nuclear Power plant having a re-use efficiency of effluents of 95%. On the other hand, the applications in medicine, industry and research generate 20 m³/y of solid waste, 280 m³/y of liquid waste and approximately 10 m³/y from 300 spent sealed radioactive sources. The estimation of the total volume of these waste to the year 2035 is 17500 m³, corresponding to the 46% of the volume generated by the operation and maintenance of the 2 units of the Laguna Verde Nuclear Power plant, 34% to the decommissioning of these 2 units at the end of their useful life and 20% to the waste generated by applications in medicine, industry and research.

1. Introduction

During the last years the subject of the radioactive waste has had great interest, because of the increased concern about the protection and recovery of the environment, as well as to the necessity to have in Mexico, in a few years, a definitive repository with enough capacity to receive the produced radioactive waste from the applications in medicine, industry, research and in the production of electrical energy by nuclear means for the next 50 year.

In this paper, the volumes of low and intermediate level radioactive waste stored until the year 2001 and their tendency to the year 2035 are shown considering the useful life of the 2 nuclear reactors in operation at the Laguna Verde Nuclear Power plant and the annual generation of these waste, in order to have the base volumes needed for the design and construction of a definitive repository in Mexico.

2. Generators of radioactive waste

2.1. *Laguna Verde nuclear power plant*

The Laguna Verde Nuclear Power plant (LVNP) consists of 2 units producing 654 MWe each, which have been in commercial operation since July 1990 (Unit 1) and since April 1995 (Unit 2), generating 5.3% of the electrical energy that is consumed in the country. The power plant, during its operation, produces low and intermediate level radioactive waste as well as spent fuel, which will be a high level radioactive waste when it is so classified [1].

The low and intermediate level radioactive waste in the Laguna Verde nuclear power plant are divided in two great groups. The humid solid wastes that are generated during the treatment of the liquid radioactive waste and the dry solid wastes that are basically the result of the maintenance operations.

At the moment, the annual average production of low and intermediate level radioactive waste from the two units is 250 m³. The stored total volume of these waste, that were generated up to December 2001, is 2643 m³ which are collected, processed, prepared in containers and stored in the same power plant, where the 78% of the containers are dry, 19% are humid and 3% are liquid radioactive waste.

The annual production of solid radioactive waste by unit, fulfils the goal programmed for the 2001. which is 125 m³/unit. In the case of the effluents reuse, for the same year, a 95% of 85% programmed were got [2,3,4].

At the Laguna Verde Nuclear Power plant are implanted programmes of personnel awareness for the reduction of radioactive waste from their origin, as well as a programme for continuous improvement for the treatment processes to increasing the percentage of effluents re-use. It is evaluated for the future, the use of new technologies for the volume reduction, such as drying and the supercompaction, in order to reach a production goal below 74 m³/y-reactor of solid waste, which corresponds, to the average of the World Association of Nuclear Operators [3].

2.2. Applications of radioisotopes in medicine, industry and research

The radioisotopes demand during the year 2001 was constituted by 89% in medicine, 9% in industry and 2% in research.

The main radioisotopes used as open sources are: a) diagnosis ^{99m}Tc, ¹³¹I, ⁶⁷Ga, ²⁰¹Tl, ¹³³Xe; b) therapy ¹²⁵I, ¹³¹I, ³²P, ⁹⁰Y, ¹⁵³Sm, ¹⁸⁶Re; c) industry ¹³¹I, ⁸²Br, ²²Na, ³H; d) research ¹⁴C, ³H, ¹²⁵I, and in smaller percentage a great variety of radioisotopes of short half-life where some of them were produced in the research reactor TRIGA Mark III of the Instituto Nacional de Investigaciones Nucleares (ININ), the national nuclear research institute. During the period 1998-2001, increases of 23% and 75% in the radioisotopes demand used for diagnosis and therapy have been observed respectively. The wastes generated in these applications are sent to the ININ for their decay, conditioning and storage. There are around 1300 licenses for the use of radioactive material in the country granted by the regulatory organ, showing during the last years an annual increase of 5%. There are approximately 120 licenses for x-ray, 210 for nuclear medicine, 250 for industrial plants, 400 for radioimmunoassay laboratories and the rest for research and superior education institutions [5].

The ININ counts on a treatment plant for radioactive waste where activities of reception, harvesting, transport, conditioning, treatment and immobilization of the radioactive waste only generated in the applications in medicine, industry and research in all the country are done. Annually, there are produced 20 m³ of solid radioactive waste, 280 m³ of liquid low and intermediate level radioactive waste where 5 m³ are organic mixed waste and approximately 300 spent sealed radioactive sources (10 m³). The short half-life wastes are stored to decay and those of long half-life are prepared in this treatment plant and later they are sent to the Storage Center of Radioactive (SCRW) for their storage [6].

3. Volumes of projected radioactive waste to the 2035

The estimation of the volume of low and intermediate level radioactive waste projected to the year 2035 is 17500 m³, where the 46% corresponds to the waste generated from the operation and maintenance of the 2 units of the LVNP, 34% to the decommissioning of the 2 units at the end of its useful life and 20% corresponds to the waste generated by applications in medicine, industry and research [4].

4. Repositories for low and intermediate level radioactive waste

There are three interim repositories for the radioactive waste generated by the operation of the two nuclear reactors in the LVNP.

The ININ operates the SCRW for the storage of radioactive waste generated in medicine, industry and research in the country. Based on the annual volume of waste received by this facility, it is estimated that the saturation of its capacity will be reached in 7 years [7,8].

At the beginning of the 70's a test facility was operated for uranium production, which was closed some years later. Approximately 65000 ton of uranium tailings and contaminated soil with uranium mineral were generated in 1984 which were transferred and stored completely in a definitive repository located in the mountain range of Peña Blanca in the state of Chihuahua.

The La Piedrera repository in the state of Chihuahua, was exclusively designated for the radioactive waste, such as rod, process material, scoria and soil contaminated with ⁶⁰Co, produced by the accident happened in Juárez, Chih. on December 1983. Its closure was in 1985. On the other hand, in the San Felipe repository in the state of Baja California Norte, a small amount of rod contaminated with ⁶⁰Co resulting from the same accident mentioned above, was stored. It is considered that within 22 years, the material stored in these sites will not represent risk for the population and the environment.

5. Necessity of a definitive repository for radioactive waste

The necessities of our country demand the construction of a definitive repository for radioactive waste, reason why one of the high-priority objectives of the organism responsible for the management of the radioactive waste, is the construction of a facility of this type, with enough capacity to receive the waste produced in the industry, medicine, research and in the generation of electrical energy by nuclear means. This repository must fulfil the appropriate standards with a 50 years projection.

The site selected for the definitive repository construction for low and intermediate level radioactive waste, will have to fulfil the national and international normative and to satisfy social and political necessities of the region where the repository is located. The characterization of this site, will have to guarantee that this one can conserve the integrity of the radioactive waste and its geologic stability, at least during 500 y, considering the principle of not inheriting undue loads to the future generations.

6. Responsibility of the Government

The radioactive waste management is the responsibility of the Mexican Government, through the Ministry of Energy [9]. Considering the real capacity of the facilities for interim storage

for radioactive waste in the country, a group of specialists from different national institutions has constituted and it is co-ordinated by the Ministry of Energy for the elaboration of a proposal of National Policy for the Radioactive Waste Management, the main purpose of which is to settle down the technical bases and the normative for the national planning in this matter, as well as to elaborate a project for the selection and construction of a definitive repository of low and intermediate level radioactive waste in order to satisfy the necessities for next 50 years. In parallel, there has been progress in the elaboration of the national normative appropriate to this type of waste.

7. Conclusions

The responsibility of the Mexican Government in this subject is very important to impel the establishment of a National System for the Radioactive Waste Management in Mexico.

The establishment of a definitive repository for low and intermediate level radioactive waste is a real necessity in the country to medium term, taking into account the stored, the generated annually and the projected volumes to the year 2035.

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