RADIOACTIVE WASTES AND THE ENVIRONMENT

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ABSTRACT

Radioactive wastes take about 1,000 to 10,000 years to be considered inactive; their treatment and disposal must comply with some rigid criteria of legislation and safety, with an adequate and safe site, preserving this way the environment and planet population.The problem to be solved is how to get in accordance about this place and how to have political and financial commitment for its construction.

1. INTRODUCTION

In a world that has being facing a continuous enlargement of population, the growth of industrial production, the economical expansion and, consequently, a raise in energy consumption, is a primary concerning capable to guarantee the supply of energy production, in a reliable way.

This discussion is particularly relevant when we take into account the great changes that have being occurred worldwide over the past 10 years, for example, the raise in oil price, international conflicts and environmental concerning.

To explore the nuclear technology contribution and future possibilities of the entire energy sources presently developed, encouraging the use of viable energy sources that gradually are capable to complement and later to replace the oil and the coal by energy sources less detrimental to the environment.

International Atomic Energy Agency (IAEA) has being insisting with governments worldwide to invest in nuclear energy. For the first time in 32 years of existence, the IAEA takes a strong position in favor of nuclear energy. The agency says that it is essential either to fight global warming or from the viewpoint of electricity supply guarantee, reducing the oil dependency from the Middle East.

Some countries, including USA, India, China and France are already planning new plants.
Germany and Spain are against that. In Brazil, the government seems to have changed its position, with the conversion of the minister Dilma Roussef and says about finishing Angra 3 and deploying new plants.

Within this context, we initiate to discuss and analyze the following questions, considering the world in a general way and Brazil, in a particular context: the treatment and disposal of radioactive wastes, as well aspects on nuclear safety[2].

2. THE POSITIONING OF ENVIRONMENTALISTS

The environmentalists question about solutions proposed by nuclear centers intended for the destination of radioactive wastes. According to them, there will be able to have air contamination caused by explosions or continuous gases leakage from a site (theoretically possible), or water contamination, caused by leakage in coverings which store the wastes and that could reach groundwater. Thus, in special related to high radioactivity wastes, the solution to be traced should take into account the large half-life of radioactive wastes, which attain to thousands of years.

Presently, the more feasible solution for large half-life radioactive wastes would be to keep them cool on the surface for 10 years and later to landfill them in a great depth of adequate geological layers (salt, clay, granite, schist), without underground water circulation and threat-less earthquakes. This solution, nevertheless, is not viable due to the high cost and lack of adequate sites for the construction of tanks[4].

3. CURRENT DESTINATION OF RADIOACTIVE WASTES

Highly radioactive nuclear fuel is removed from the reactor and, in a general way, is temporarily stored into cooling swimming-pools located inside the plant. While these swimming-pools are being completed, a lot of reactors have to be eventually disconnected, due to non-available local for the landfill of this mortal waste. In accordance with estimates from International Atomic Energy Agency (IAEA), the total amount of fuel spent was 125 thousand tons in 1992 and it should reach 200 thousand tons in 2000 and 450 thousand tons in mid-next century. Nevertheless, though various methods for destination have been discussed for decades – including emission to the space – there is not any solution, up to now, for nuclear wastes.

The most of "solutions" presently proposed for the final disposal of nuclear wastes involves their landfill in underground inside a special packing with a strong protection against escape of radioactivity. Nuclear industry means that after any way of processing, underground or sea bottom disposal will be enough safe. This philosophy was generated specially due to constraints to persuade a concerned public into knowing whether the nuclear industry knows how to give a final destination to these wastes. Nevertheless, this assertive is false.

To intend, as nuclear industry often does, that some experiences, test drillings or geological assessments mean everything required for handling nuclear wastes is dissimulation or scientific ignorance – or, possibly, both of them. Adequate tests would require thousand years[1].

3.1 Major risks in landfill of nuclear wastes: air and water contamination

- Air contamination

Explosive or slow gases releases from an underground site intended for final destination are theoretically possible. Unfortunately, there is not a reliable way to estimate this risk – there are too many variables related to actual disposal methods and to chemical possible interactions in a real environment.

- Water contamination

Usually it is considered the mechanism of pollution most liable related to final disposal on rocks. Radioactive elements can leak from the packing and to attain underground water, contaminating this way potable water from local and far communities.

Besides the landfill of wastes, various storing outlines at local of use are being investigated. One of them, fuel storing used in large steel or concrete containers is of major interest. Even this type of storing keeps the material as such it was created and reduces transportation costs, hundreds of communities worldwide are really jeopardized due to the proximity of high level deposits. There are too plans to consolidate fuel used and stock them in containers in a few regional installations on surfaces, resulting in a great number of trips inside packages not safe against possible accidents.

The best solution for the future will be the discovery of a method to harness at 100% nuclear wastes produced in every part of the world[1].

4. DECOMMISSIONING OF NUCLEAR PLANTS

A great amount of nuclear wastes is produced too when a nuclear reactor is shut down. This happens due to a lot of their parts, including the fuel, become radioactive. They can not be simply thrown away. Treatment process of a nuclear plant, at this point, is called "decommissioning". However, besides the removal of the fuel used, there is not a consensus about future happenings. None reactor of normal dimensions was dismantled in any place worldwide. Even some countries make plans to remove the entire structure, including radioactive parts, remaining a flat space non occupied; others suggest to leave the building where it is, covering it with concrete or, possibly, landfill it under a lot of soil.

Decommissioning cost of nuclear wastes is a goal of much speculation. Costs estimates come from generic studies, from costs projection for the decommissioning of small research installations. Details and sophistication employed in the development of these estimates vary too much; the lack of standardization makes difficult the comparisons. Besides, the limited experience on decommissioning – none, when considering important reactors – make impossible to know whether estimates are reasonable, but it was already suggested that decommissioning costs could reach up to 100% of the cost of initial construction.

Next three decades, over 350 nuclear will be shut down. Since the first nuclear plant started up to produce electricity, nuclear industry just now does not have answers on how to dismantle a reactor, in a safe and economically efficient way[3].

5. ACTUAL ASPECTS ON NUCLEAR SAFETY

The storage of nuclear wastes in the plants is still provisory, because there is not a national politics about the final destination of this material. Not even Germany and United States, countries which supplied nuclear technology to Brazil, have definitive solutions for nuclear wastes. Since 1988, Legislative discuss about the destination of nuclear wastes without

attaining a consensus. After transacting by the Senate, the project remained standstill up to 1999 at *Comissão de Minas e Energia da Câmara.* Its relater, federal deputy Antonio Feijão (PST-AP), visited even nuclear plants worldwide, but never concluded his work.

Before the slowness in the transaction of the project, deputy Luiz Sérgio Nobrega (PT-RJ), was succeeded in convincing Chamber president to transfer the project to *Comissão de Meio Ambiente*. Before getting the court, the project transacted too by the *Comissão de Constituição e Justiça*. Federal deputy Fernando Gabeira (PV-RJ) announced that he was going to require to Chamber president, Michel Temer (PMDB-SP), to settle at urgency regime the voting of law project 189/91, authorship Itamar Franco senator, which regulate the destiny of nuclear wastes in Brazil. The project was not voted in 2000 April, but at the end of May. Navy, Army and Air Forces obstructed regular project course, because they do not want their sheds to be inspected by civil association.

Besides establishing a process for the selection of sites, it determines some kind of incentive to the municipality that is willing to shelter definitive deposits. In the project presently in the Senate, military installations are exempt of tax payments to the municipality where it is being developed nuclear activities connected to National Safety.

States which produce a higher amount of nuclear wastes are: Rio de Janeiro, São Paulo and Minas Gerais. In Rio de Janeiro there are wastes from both Angra plants and from *Fábrica de Combustível de Resende, Instituto de Engenharia Nuclear da Ilha do Fundão and Instituto de Radioproteção e Dosimetria,* besides those ones produced in clinics, hospitals and in some industry branches. In São Paulo there are radioactive wastes from *Instituto de Pesquisas Energéticas e Nucleares,* in USP and from *Centro Tecnológico da Marinha (ARAMAR)*, located in Iperó, located at approximately 20 kilometers from Sorocaba. In Belo Horizonte, there are nuclear wastes from *Centro de Desenvolvimento de Tecnologia Nuclear*, from an ancient uranium mine in Poços de Caldas. In Bahia, there will be to have a destination for uranium mine wastes from Caetité, inland State, and too in Pernambuco, where it is being built the *Centro Regional de Ciências Nucleares do Norte e Nordeste*.

5. 1 Angra 1 and 2 nuclear complexes

Wastes produced in Angra 1 and 2 can be classified into three levels of radioactivity: high, medium and low. There is not, in Brazil, a place selected for the definitive storage of nuclear wastes, resulting in storage in intermediary depository.

For low and medium radioactivity wastes (That should remain in an intermediary depository for three years, at maximum), the destination includes two concrete sheds inside the rocks, close the plant. In these sheds there are drums stored that either have boots, coveralls and other contaminated clothes (low radioactivity wastes, with half-life around 60 years) used for workers or reactor metal pieces and chemical wastes (medium radioactivity wastes). The most part of drums have low radioactivity wastes that can be reused. According to Kleber Cosenza, production Superintendent from Angra 2, in a periodical surveillance, stored material changed from 1,400 drums to 400, due to the evidence that those objects had lots the radioactivity. Some clothes parts were reused.

High radioactivity waste, called byproduct in the industry, is consisted by the fuel element previously irradiated inside the reactor. This waste has a half-life very long, capable to reach thousands of years, making the question on destination much more relevant. Almost

incredible, the fuel element is capable to be reused. Usually, it is removed from the reactor at 15% of its used capacity. If the plant receives fuel elements with any type of problem, it can resort to the fuel stored to be used combining it with the new one. Storage site for high radioactivity wastes from Angra are their swimming pools. For Angra 2 plant it was constructed a swimming pool inside a reactor (different from Angra 1, that remains outside) with capacity for storing wastes produced for half of its utile life, 20 years. Angra 1 swimming pool is capable to store wastes from its 40 years of predicted activity. Both of them keep wastes submerse more than 10 meters of depth, being the water the used shielding.

Major concerning on nuclear energy are related to the risk of accident, as that occurred in Chernobyl plant, and treatment and final disposition of its wastes. Besides, possibilities of attacks against nuclear installations and deviation of fissile materials are taken into account.

Nuclear wastes problem is not exclusive in nuclear area; it results from every human activities. Nuclear one has storage and disposal rigorously controlled, resulting in the practice of a lower aggression to the environment, while other wastes are found everywhere.

Nevertheless, nuclear wastes are being produced every year, and more and more, while the depositories in some countries are still precarious and there are not enough places to keep this material. Just the creation of serious politics which restricts the use of radioactive material and determines strict rules will be able to impede the multiplication of radioactive wastes depositories, once there are not yet effective means for their treatment and reuse within a 100% degree of efficiency and safety. A challenge for this generation and further ones, to find this solution, in the name of well-being of planet and human beings who inhabit it[5].

6. ARTICULATED CONCLUSIONS

1. In a world that has being facing in a continuous way a raise in energy consumption, it is possible to use a contribution from nuclear technology, to guarantee the supply of a viable energy, which gradually can complement and in the future to replace oil and coal as a energy source less aggressive to the environment.

2. Nowadays we find radioactive wastes in research laboratories and treatment centers on nuclear medicine (15%) or from nuclear energy plants (85%), means used for their treatment and reuse are safe and effective, but efficiency and safety are questionable.

3. Decommissioning of a nuclear reactor will be able in a near future to become less expensive and more safe, on account of technological studies developed and the interest on a more comprehensive use of nuclear energy as an alternative energy source.

4. The storage of nuclear wastes in country plants is still provisory because there is not a national politics on the final destination of this material. It is being actually analyzed by the Senate a Law Project which establishes definitive sites for the arrangement of nuclear wastes, as well the inspection process of these depositories.

5. Nuclear wastes problem is not exclusive of the nuclear area, it results from every human activity. Nuclear wastes have storage and disposal strictly controlled, resulting in a practice of a lower aggression to the environment, but there are not yet effective means for their treatment and reuse within an efficiency and safety 100% degree.

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