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# THE CONCERN WITH THE RADIOACTIVE WASTE AND THE REALITY OF THE URBAN WASTE

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## ABSTRACT

One of the greatest present urban challenges, faced by public administrators, legislators and technicians, is the management of urban waste. A significant part of it is still disposed of in an inadequate way that is aggressive to the environment and to society. Initially, this work starts with a brief history of aspects connected to urban waste, then, despite the lack of comprehensive information, quantities generated and associated factors, aspects and impacts referring to landfills, techniques related to the burning process and biological treatments, for specific types of waste, are analyzed. The final destination of almost the whole amount of waste collected worldwide is, also, approached herein. In parallel, after the discovery of radioactivity and its usage in different areas of activities, the destination of the radioactive waste, in a much smaller amount, however potentially much more dangerous, has also been an object of concern that is more in evidence than the problem related to urban waste, due to a strong negative media influence. After the comparison between volumes and impacts which are involved and considering that both represent environmental liability, a more detailed analysis of cases showing risks to the public should be initiated, showing the importance of the adequate management of both wastes and, mainly, the consequent real proportions regarding development, growth and demographic densification. The aim of this work is to analyze the present world situation regarding available information on the involved volumes in the process of urban waste disposal and its environmental impacts in medium and long terms, comparing these data to the same parameters applied to nuclear waste, showing that both activities present inherent risks and relevant impacts.
Key words: urban waste, final destination, nuclear waste, disposal.

# 1. INTRODUCTION

One of the greatest challenges for our modern civilization is the destination of urban waste, which has been disposed of in certain places without control, accumulated in landfills, incinerated or processed via other methods.

Every landfill generates gas emissions and a percolated liquid denominated leaching (chorume), which can contaminate the atmosphere, soil and waters besides causing other impacts that will be analyzed in this work.

The present incineration technology reduces impacts significantly; however, its costs of implementation and operation make it viable only for highly inhabited areas with a high economical level. They also present emissions, in small quantities, of toxic substances formed during combustion.

Another problem that is focused in the paper is the management of radioactive waste, which is much more in evidence than urban waste due to the strongly negative image passed to the public by the media.

Due to the difference between volumes and impacts involved and considering that both wastes represent an environmental burden, a more detailed analysis of cases showing risks to the public will be done. The importance of their adequate management and, mainly, the real effect proportions regarding development, growth and demographic densification should be, also, addressed.

The aim of this work is to analyze the present world situation regarding available information, the involved volumes in the process of urban waste destination and its environmental impacts in medium and long terms, comparing them to the same parameters applied to nuclear waste and showing that both activities present inherent risks and relevant impacts, independently on impressions or pre-determined judgments.

# 2. GENERATION OF WASTE BY HUMAN ACTIVITIES

Generation of waste has always been, in smaller or broader proportions, connected to, practically, every human activity. Since the beginning of civilization, wastes have been generated by men feeding, collection of objects and/or hunting.

The first register of a structure for the destination of wastes refers to a landfill, in Knossos, the capital of Crete, circa 3.000 B.C. Composting was already practiced in China in 2.000 B.C.

# 3. URBAN WASTE

The generation of waste nowadays has been assuming particularly high proportions in urban conglomerates, large cities and metropolitan areas, causing significant impact worldwide. Besides industrial, electronic and health service waste, which are toxic and hazardous, building and demolition activities and some others which are not addressed in this paper, the increase in the search of processed and industrialized products that are commercialized, are connected to a progressive elevation in the socioeconomic level, with subsequent increased consumption, aggravated by a demographic densification.

All these factors have made the management and destination of urban house and commercial waste a major present and future challenge for business administrators, technicians, legislators and other people involved.

It is known that, not only the per capita generation, but the composition of generated waste quantity as well, maintain a close relation with the social-economic level of the population here studied. Table 1, below, presents the main parameters of generation related to the level of the population income.

**Table 1. Per capita generation and basic composition of collected urban waste.**

| Level of income of the population | *Per capita* generation (Kg/inhabitant. day) | Organic material (% in totality) | Recyclable (% in totality) | Humidity (% in totality) |
|---|---|---|---|---|
| Low | 0.2 to 0.6 | 40 to 85 | 4 to 25 | 40 to 80 |
| Medium | 0.6 to 1.3 | 20 to 65 | 5 to 30 | 40 to 60 |
| High | 1.3 to 2.2 | 20 to 50 | 11 to 45 | 20 to 30 |

The UN [1] estimates that the world generation of urban solid waste is between 1 and 1.3 billion tons a year; in Brazil, this rate is 51.4 billion tons a year. [2].

## 4. RADIOACTIVE WASTE

Nuclear refuses, also known as nuclear waste, come from several different applications of nuclear energy: electric power generation; preparation of radioactive sources for industrial use; production and usage of radiopharmaceuticals for diagnosis and treatment, in the medical field; usage of radioisotopes in Agriculture and Environment, as well as for Research and Development; recovery of areas which underwent radiological accidents (example: Goiânia).

Nuclear waste from electric power generation (Nuclear Facilities Angra I and Angra II) is stored in the sites of those facilities, in the state of Rio de Janeiro. On the other hand, waste generated n the cycle of nuclear fuels (mining; acquisition of Uranium concentrate; production of burnable elements) remain in the facilities of this cycle. Radioactive waste from other nuclear applications are stored in the institutes of the National Nuclear Energy Commission (Comissão Nacional de Energia Nuclear – CNEN), which is the responsible institute, in Brazil, for receiving, treating and storing such waste.

These institutes are located in the cities of Belo Horizonte (Centro de Desenvolvimento da Tecnologia Nuclear – CDTN), Rio de Janeiro (Instituto de Radioproteção e Dosimetria – IRD; Instituto de Engenharia Nuclear – IEN) e São Paulo (Instituto de Pesquisas Energéticas e Nucleares – IPEN). In the city of Abadia, in the state of Goiás, it is stored the radioactive waste generated in the radiological accident that happened in Goiânia (1987), when there was the violation of a $^{137}Cs$ source, what resulted in a high volume of radioactive, requiring people and places decontamination. Picture 1, below, shows the Repository of Abadia in Goiás. The fuel elements used in the nuclear power reactors, as well as in the research, are not considered radioactive waste, because the possibility of using their fossil material has not been discarded.

The National Nuclear Energy Commission (Comissão Nacional de Energia Nuclear – CNEN), in a partnership with ELETRONUCLEAR shall develop an Intermediary/Final long term Waste Storage Facility (500 years), for the fuel elements used. For this purpose, the following goals have been established: Presentation of proposal (2009); Validation in prototype (2013); Beginning of the project (2014); Selection of place/site (2017); Beginning of building (2019) and Beginning of operation (2026).

**Figure 1. Repository at Abadia de Goiás.**

**Table 2. Inventory of Radioactive Waste in Brazil, as to March 2008.**

| Source/Type | Situation | Inventory |
|---|---|---|
| | | |
| **ANGRA I NUCLEAR POWER PLANT** | | |
| Spent Fuel | Storage inside reactor pool | 650 fuel assemblies |
| Filters | Stored in 200 l drums at plant site | 449 packages/ 93.4 $m^3$/ 2.3E+13 Bq |
| Evaporator concentrates | Stored in 200 l drums and 1000 l liners at plant site | 2855 packages / 878,1 $m^3$/ 5,3 E+12 Bq |
| Non-compressibles | Stored in 200 l drums and 1000 l liners at plant sites | 772 packages/ 438.3 $m^3$/ 1.2 E+ 13 Bq |
| Resins | Stored in 200 l drums and 1000 l liners at plant sites | 1051 packages/ 354,4 $m^3$/ 2.3 E+14 Bq |
| Compressibles | Stored in 200 l drums | 511 drums/ 106,3 $m^3$/ 1.9 E+12 Bq |
| | | |
| **ANGRA II NUCLEAR POWER PLANT** | | |
| Spent Fuel | Storage inside reactor pool | 272 fuel assemblies |
| Filters | Stored in 200 l drums at plant site | 2 drums/ 0.4 $m^3$ |
| Evaporator concentrates | Stored in 200 l drums plant sites | 142 drums/ 28.4 $m^3$/ 1.6 E+10 Bq |
| Compressibles | Stored in 200 l drums at plant site | 58 drums/ 11.6 $m^3$/ 3.5 E+11 Bq |
| | | |
| **RADIONUCLIDE APPLICATIONS IN MEDICINE, INDUSTRY AND RESEARCH** | | |
| Waste generated by radioactive installations, research institutes (including those belonging to CNEN) and lightning rods | Stored in the institutes of CNEN: IPEN(SP), CDTN(MG) and IEN(RJ) | IPEN:583m3/5.07E+14Bq<br>CDTN: 133m3/1.7E+14Bq<br>IEN: 114m3 / 7.6E+12Bq |
| | | |

| FUEL CYCLE INSTALLATIONS | | |
|---|---|---|
| Poços de Caldas Mining and Milling Industrial Complex – uranium and thorium concentrates | Stored in shed and trenches | 7250 m3 / 119288GBq (3224 Ci) (Low level waste) |
| Poços de Caldas Mining and Milling Industrial Complex – Waste Generated in the Process | Tailings dam | 2 111 920 tons (Low level waste) |
| | | |
| **MONAZITE SAND PROCESSING INSTALLATIONS** | | |
| Interlagos Facility (USIN/SP) – uranium and thorium concentrates | Stored in plastic drums | 325 $m^3$ /5069 GBq(137Ci) |
| Interlagos Facility (USIN/SP) – Mesothorium | Stored in plastic drums | 39 $m^3$ / 222 GBq(6Ci) |
| Botuxim Desposiy (São Paulo) uranium and thorium concentrates | Stored in concrete silos | 2.190 $m^3$/ 32856 GBq(888Ci) |
| | | |
| **RADIOLOGICAL ACCIDENT IN GOIÂNIA** | | |
| Low level wastes (137Cs) below exemption level | Final disposal concluded | 1525 $m^3$ / 2 Ci |
| Low level waste (137Cs) above exemption level | Final disposal concluded | 1975 $m^3$ / 1338 Ci |

Source: National Report of Brazil 2008 for the 3rd Review Meeting of the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management.

Table 2, below, presents the non-exhaustive inventory of stored radioactive waste, until the end of March, 2008, in Brazil. This waste shall remain stored in the sites where they are today, until the National Nuclear Energy Commission (Comissão Nacional de Energia Nuclear – CNEN) establishes the Final Waste Storage Facility (National Repository) with this aim.

The implementation and operation of this Storage Facility will be under the responsibility of a Brazilian Company of Nuclear and Radioactive Waste Management, Empresa Brasileira de Gerenciamento de Rejeitos Nucleares e Radioativos – EBGR, connected to the Ministry of Science and Technology, in 2018, which will be created in Brazil as it happened in Spain, Sweden, Finland, France, and other countries.

The National Repository of Low and Middle Activities Radioactive Waste is foreseen to start operating in 2018. Picture 2, above, shows one of the initial radioactive waste, next to Angra I and Angra II Nuclear Facilities.

The only common point between radioactive waste generated in nuclear facilities and that from medical and industrial applications is that none of them have a definite site (repository) for their disposal. Therefore, they are stored in the sites of Angra I and Angra II nuclear facilities, in the institutes that belong to CNEN, as well as in their locations that comprise the nuclear fuel cycle.

**Figure 2. Angra I and Angra II Radioactive Waste Storage Facilities.**

## 5. DESTINATION OF URBAN AND NUCLEAR WASTE

### 5.1 Destination of urban waste

Between 16 and 20% of world urban waste and 16 % of the Brazilian generation of waste is estimated not to be collected, at least in a formal or controlled way, and this may happen due to, either the lack of structure, or to the fact that this waste is destined to its own sources. Alike the generation and composition of waste, the way the collected waste is destined, also varies according to the socioeconomic level, development degree, environmental awareness, availability of places, existing legislation and some other specific characteristics. The procedures for waste destination, characteristics and derived impacts are commented below; a summary of destined quantities is presented in the end of this item.

#### 5.1.1 Landfills

Landfills represent the continuity given to the oldest form of disposing of solid wastes. Some of their advantages are their simplicity and a relatively low cost, what allows them to be the most largely used way of destination, even though they have several negative impacts. As time went by, landfills have been improved and, even though there is not a classification worldwide accepted, they can be divided into three main groups:

- *Open dumping*: the oldest way of disposal, consisting of a simple disposal of waste in a given site, without a previous technical selection; waste is not isolated by fences or walls, allowing the access of humans and/or animals; there is not a posterior coverage or collection the solid waste; emerging leaching and gases are not treated; there is no contention of rainfall or monitoring of superficial and ground water; its underground is not impervious or has any kind of layer preventing the deep leaching percolation through ground water.
- *Controlled landfill*: it is usually built with installations belonging to the first group, mentioned above, but presents some partial corrections, such as: isolation of the site; possible restriction to third parties access to the site; possible solid coverage; some rainfall contention and monitoring of superficial and ground water; occasional collection of emerging; this landfill, however, does not have any kind of water monitoring or layer preventing the deep leaching percolation.
- *Sanitary landfill*: it refers to installations that have been, specifically, designed for previously selected sites, with adequate characteristics as to stability and low permeability of the soil and deep layers; there are ponds for the monitoring of superficial and ground water; the area is isolated: the handling is mechanic; there is daily coverage of the solid waste; collection and burning are carried out with or without the energy usage of the gas from the landfill.

Depending on the degree of implementation of the improvements introduced, their disadvantages, in higher or lower intensity, can be specified through the following impacts:

- Atmospheric impact: it consists of gases emission, mainly from the decomposition of organic matter composed of methane (40 to 60%), carbonic gas (40 to 60%), nitrogen (2.5%), oxygen and ammonia (0 to 1%), besides traces of sulphite, dissulphite, mercaptans, hydrogen, toluenes, dichloromethane, aceton, vynil acetate, vynil chlorate, metiletilceton, tricloroetilen and benzene.
- Impacts to soil, superficial and ground water: they consist of the soil and water contamination by infiltration and percolation of leaching and other substances.
- Social impacts: presence of people that survive searching for recyclable materials, other specific materials or even food, for their own use or commercialization, with risk to their health, doing these activities in degrading conditions, and, consequently, being socially stigmatized.
- Urban impacts: they appear due to the degradation and devaluation of the neighboring areas, as a consequence of visual aspect, smell, intense vehicle traffic, insertion of irregular installations used to benefit from material and dwellings of the involved people. These sites, even though they have been designed for a certain timeframe, generally between 5 and 20 years, require a long term monitoring after the exhaustion of their capabilities, generating a liability for, practically, indefinite time. The usage of an area after its exhaustion is very restrict, limited by the degree of gas emission and leaching, occasional mechanisms of impounding or soil instability: in a remote possibility, the lot could be used as a park or recreational area. There is one register of an attempt to build a Shopping Mall, but it did not succeed.
- Impacts on public health: Proliferation of flies, mosquitoes, disease transmission vectors, rodents, and so on.
- Other impacts: Risk to aerial traffic, due to the presence of vultures, risk of spontaneous or provoked burning, with emission of particulate material and possibility of poisoning or injury to people who are at reach range, risks of explosion of occasional methane pockets, which are not adequately drained, risks of earth sliding and covering, obstruction of water courses, and other related accidents.

### 5.1.2 Incineration

This is one of the oldest forms of waste disposal and it was used until the first half of the twentieth century, without any control of emissions or energy use; then, this process had its application reduced, due to gas emissions and particulate material production. Around the seventies, burning started being used again, with energy good use and treatment of emissions.

Its advantages consist in the reduction of waste volume and mass, respectively 90 and 80%, while its major disadvantages are the high implementation and operation costs, making this alternative used only in densely crowded areas and with a high social economic level (Europe, part of the United States and a developed part of Asia). In Brazil, this method is not used yet, but 10% of the waste is estimated to receive this treatment in the world.

### 5.1.3 Composting and bio-digestion

This process is applied to predominantly organic materials and presents, as an advantage, the fact of resulting in organic manure and/or gases that are possible of energy good use. It is applicability to urban waste is harmed by the difficulty in the selective collection of this material; its use with mixed urban waste can create difficulties; there is a high quantity of refuses/wastes, with consequent restrictions to the agricultural usage of the produced mixture.

Some other disadvantages are the necessity of large treatment areas; the low market value for the mixture; long distances between the places generating waste and the mixture consumers, besides relatively high investments in the case of large-scale installations, compatible with urban environments. These factors make the process restrictive to small towns or specific applications, where there are huge amounts of vegetable and organic waste, which are not contaminated by

### 5.1.4 Other processes

In addition to the other processes mentioned above, there is a large diversity in the development, as well as in the specific applications amongst which some may be highlighted: pyrolysis, gasification, thermal destruction by plasma, "cold" plasma, enzymatic digestion, mechanic-biological treatment, and others, which will not be dealt with in this paper since they are still the destination of a very small amount of all the generated urban waste.

### 5.1.5 Reduction, reutilization and recycling

These three terms are usually known as the “3 R’s” and there are references to them in almost every campaign related to preservation and sustainability: they are applied in different degrees, depending on the social-economic and cultural characteristics of the studied region. Even though they do not constitute ways of destination/disposal, the initiatives related to the reduction of generated waste, reuse of material, selective collection and recycling, application of reverse logistics, and so on, have a favorable impact on the amount of generated waste, reducing the destination problem.

### 5.1.6 Quantities processed by way of destination/disposal

Considering the non-existence of global statistics, one will find presented, on the table below, as guidance, the percentages of waste generated and processed by the main forms of destination estimated by the authors of his paper, base on partial data, correlation to population distributions, socioeconomic and development levels.

**Table 3. Percentages of waste generated under the view of destination/disposal procedure.**

| Ways of destination | Brazil | World |
|---|---|---|
| Not collected | 16 % | 16 to 20 % |
| Non-controlled landfill | 16 % | 28 to 32 % |
| Controlled landfill | 25 % | 18 to 22 % |
| Sanitary landfill | 34 % | 12 to 16 % |
| Incineration | - | 10 % |
| Recycling | 8 % | 2 to 8 % |
| Composting and biodigestion | < 1 % | 1 to 3 % |
| Others | < 1 % | < 1 % |

## 5.2 DESTINATION, QUANTIFICATION AND COMPARISON BETWEEN IMPACTS

### 5.2.1 Impacts of urban waste

The volume occupied by the amount of buried waste may be easily estimated. Considering that 70% of the world generated waste is destined to landfills, with low compaction to a density of 500 kg/m$^3$, the annual requirement per volume will be 2.3 billions m$^3$.

Gas emissions in landfills are mainly composed by methane and carbonic gas. The impact, mainly due to methane, is significantly lessened in sanitary landfills where there is gases collection and burning and, especially, where there is good use of energy, with emission control. As this technology has been recently developed, generating Credits of Carbon, only a few sanitary landfills, which are technologically updated, have implemented it. Nowadays, landfills without gas collection are considered the third greatest anthropogenic source of methane (created by man) in the world, with an estimated release of 750 million tons of $CO_2$EQ every year, what corresponds to 2.5% of GEEs global emissions in terms of $CO_2$EQ. [4]

Present burning technologies eliminate all the methane that would be generated in landfills, allowing a reduction of 1 ton of $CO_2$EQ by ton of burnt waste, in comparison with the same amount of landfill emissions. Therefore, this incinerated waste generates emissions of dioxins, furans and mercury although in considerably reduced amounts and is not retained by the systems that treat emissions from these facilities.

Quantification of impacts due to leaching is more complex than for gases and global estimates have not been found, not even for the amount of waste produced. This quantification is even difficult to set, as it depends on a series of factors, such as: composition and degree of waste compaction, physical landfill characteristics (dimension, depth, geometry, drainage and coverage, besides local climate (temperature, humidity, and rainfall/precipitation volume). Once volume has been quantified, the concentration of toxic substances has to be quantified; the existence or non-existence of collection and treatment mechanisms have to be found out; at last, their efficiency and the final destination of the collected products have to be verified.

As a guidance, an estimate by the authors, considering that: 70% of the waste generated worldwide are destined to landfills; 60% of these landfills do not have collection or treatment mechanisms; there is a reference rate of leaching generation of 0.45 m3/ton of waste [5], resulted in a world release of leaching to the environment of 220 million of m3/day. The final destination and the impacts will depend on the characteristics and particularities of each landfill, the type of soil, geographical situation, proximity of superficial and ground water body, and other factors.

Evaluation of other impacts associated to waste is deficient, due to the complete unavailability of global systematized information. Nevertheless, this information is relevant, as it could be verified from some occurrences, such as the explosion of the Abbeystead Landfill, England, in 1986, with 16 fatal casualties and 17 injured people; the explosion of Quezon, in the Philippines, when a landfill collapsed and killed more than 150 people, in 2000; and the explosion in Bandung, Indonesia, in 2005, when another landfill collapsed during heavy rain and killed more than 100 people. Furthermore, some other impacts have caused indirect effects, not directly associated to urban waste, such as diseases, urban degradation and human marginalization, to mention some, which make quantification almost impossible, both for the complexity of effects as well as for the lack of information.

### 5.2.2 Destination and Impacts of Nuclear Waste

Nuclear applications potential impacts from radioactive waste are polemic topics that are treated negatively by questioners of nuclear power use. The first issue that is always remembered is related to atomic bombs. The risk of nuclear facilities accidents, similar to those occurred in Chernobyl, Ucrania (1986) and Three Mile Island (1979) are, also, mentioned. At last, the potential impact of nuclear waste storage is always discussed.

The public, badly informed, associate the operation of all nuclear-electric facilities to the production of atomic bombs, as if there were only one type of nuclear reactor, susceptible to the same possibility of accidents and with the same capacity to produce material for nuclear weapons.

In Brazil, there is the proposal for the creation of a Brazilian Company of Radioactive Waste (Empresa Brasileira de Rejeitos Radioativos - EBRR), with the attribution of managing the waste in the country, based on the National Policies of Radioactive Waste (Política Nacional de Rejeitos Radioativos - PNRR).

In the meantime, the management of radioactive waste is under the responsibility of the National Nuclear Energy Comission (Comissão Nacional de Energia Nuclear - CNEN) to whom the definitions of the PNRR policies belong. Therefore, CNEN authorizes nuclear and radioactive installations in the country, including those which are destined to the temporary and definite storage of radioactive waste.

The environmental licensing of these facilities is under the responsibility of IBAMA (Instituto Brasileiro do Meio Ambiente e Recursos Naturais - Brazilian Institute of Environment and Natural Resources) and there is the need for the elaboration of an Environmental Impact Study (EIA) and an Environmental Impact Report (RIMA), for nuclear facilities.

Therefore, IBAMA is, also, dealing with the environmental licensing of the Abadia Repository (Abadia de Goiás) and of the nuclear facilities of Angra I and Angra II, including the sites of radioactive waste storage of these installations. IBAMA is, also, in charge of the environmental licensing of the radioactive waste storage sites located in IPEN (Institute of Nuclear and Energetic Research - Instituto de Pesquisas Energéticas e Nucleares), in São Paulo, and in CDTN (Center of Nuclear Technology Development - Centro de Desenvolvimento da Tecnologia Nuclear), in Belo Horizonte.

Brazilian nuclear industry manages stores and monitors all the radioactive waste generated in its facilities, ensuring the waste isolation from the environment. Other industrial sectors cannot be said to have the same commitment or be referred to by the same assertions.

## 6. CONCLUSION

As it can be seen in chapter 5 of this paper, urban waste needs large areas for its displacement, contrary to what is needed to the displacement of radioactive and nuclear waste. This fact, associated to the impacts caused by leaching, methane, carbonic gas and all the present toxic substances, result in urban degradation of the site chosen for urban waste disposal.

In addition, as indirect impact, the population segments that live from exploiting the residues contained in urban waste (leftovers of food and materials that can be recycled) undergo health problems to their families, overloading the public health system costs. Urban degradation, direct and indirect negative impacts and the opposite manifestation to the presence of landfills cause city halls to have difficulties for the disposal of urban waste. On the other hand, the burning of gases generated in sanitary landfills, with the generation of electricity, reduces environmental and financial problems to cities, where the landfill is located. Technical and economical issues should be solved in order to know the viability of gas operated thermal facilities in sanitary landfills.

Therefore, sanitary landfills that burn the gases which are generated, with or without the production of electricity, reduce environmental impacts in these places. On the other hand, sanitary landfills which do not burn these gases contribute to atmospheric pollution, with the increase of greenhouse effect gases. Radioactive and nuclear waste do not need extensive areas for storage, but they can cause environmental impacts and present problems to people who may have contact with them. The nuclear sector is the only sector that manages, monitors and stores ALL of its waste, reducing the possibility of environmental impacts and harm to people's health.

The cost of management of radioactive waste management is transferred to products and services rendered. At present, the responsibility for the management of all this process belongs to CNEN (Comissão Nacional e Energia Nuclear - National Nuclear Energy Comission), but there is a proposal for the creation of a Brazilian Radioactive Waste Company, under the name of Empresa Brasileira de Rejeitos Radioativos – EBRR, and this company would be responsible for the management of all activities. The main problem with radioactive waste is radiologic, but there are also radionuclides which are radiotoxic, such as the $^{241}Am$. An example of a radiological accident is that occurred in Goiânia (1987), which left consequences to present days.

Radioactive and nuclear waste generated at Angra I and Angra II facilities are stored at the sites of the facilities and do not present risks, either to the population or to environment, as they are isolated and properly monitored. Fuel elements, which have been used, have to be monitored by hundreds of years, since they contain long half-life radionuclides. Radioactive waste stored at the CNEN institutes in some Brazilian states, mainly at IPEN, in São Paulo, are generated in hospitals, clinics, industries and other radioisotopes users. Part of the radionuclides contained in the radioactive waste, at CNEN institutes, have short half-life, but there is also the presence of waste containing long half-life radionuclides that require monitoring for hundreds of years. This radioactive waste shall be transferred to CNEN Final Repository as soon as it is available and operating in the country. As it happens to the radioactive and nuclear waste at the nuclear-electric Angra I and Angra II facilities, radioactive waste stored at CNEN institutes do not pose any problems for environment of for people, since they are properly managed.

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