

## LICENSING ASPECTS OF THE BRAZILIAN MULTIPURPOSE REACTOR (RMB)

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### ABSTRACT

The Brazilian Multipurpose Reactor (RMB) is a project funded by the Brazilian Government by means of the Ministry of Science Technology Innovation and Communication. RMB will be the new Brazilian research reactor, constructed to attend three main purposes: radioisotope production, R&D and material testing. It will be sited 125 km away from São Paulo, strategically, at a Nuclear Compound, where a state owned pole of nuclear technology is located. To construct and operate the RMB facilities, as required by the National Environmental Policy, it is necessary, in addition to the nuclear licensing process of the National Nuclear Energy Commission (CNEN), to conduct all the environmental licensing stages with the Brazilian Environmental Agency (IBAMA). Given this regulatory scenario, based on the standards, guidelines and legal requirements of the IAEA, CNEN, IBAMA and other Brazilian official agencies, since 2012, the activities required to comply with the protocol for obtaining initial environmental and construction licenses is being implemented. This paper aims to show a timeline about this process, update the community and register further steps. The RMB entrepreneurs carried out the Environmental Impact Assessment issued the Local report for the radioprotection directory and held three public hearings. Those, among other efforts, resulted on the Local Approval License, which was issued by CNEN Deliberative Commission and on the Initial Environmental License issued by IBAMA. Both of these permits were placed in 2015. Since then some activities for complying with the permit conditions is being performed at the site and properly reported in order to obtain the installation license from the agency.

### 1. INTRODUCTION

The RMB enterprise is coordinated by the Brazilian Government through the Ministry of Science Technology Innovation and Communication and is executed under the responsibility of the Directory of Research and Development of Brazilian Nuclear Energy Commission (DPD/CNEN). The conceptual design, revision of basic design and licensing actions of the RMB are developed by DPD research units (Institute of Energy and Nuclear Research - IPEN; Institute of Nuclear Engineering - IEN; Center for the Development of Nuclear Technology - CDTN) [1]. For the detailed design, construction, assembly, commissioning, and support phases in environmental and nuclear licensing, the RMB enterprise also has

AMAZUL's technical partnership. INVAP is the responsible for the detailed design of the research reactor.

This research reactor will be part of a national research center located in Iperó SP, and in complement with the Brazilian Navy project for the nuclear prototype submarine, it will become a pole of nuclear technology of great importance to the country. This research reactor will be a 30 MW open pool type reactor with three main purposes: radioisotope production for use in Nuclear Medicine, Industry, Agriculture and Environment; materials and fuel testing; and research and development using a neutron beam source.

In Brazil, Nuclear Facilities, including reactors for electric power generation and research purpose, need to obtain the nuclear and environmental licenses in order to initiate its activities. These licenses are issued by two different regulatory agencies, specifically, the Brazilian Energy National Commission (CNEN) and Brazilian Environmental Protection Agency (IBAMA). The RMB licensing processes is presented in figure 1 [2]. IBAMA is supported by CONAMA, which is the Environment National Council, Brazilian authority responsible to implement the environment national policies.

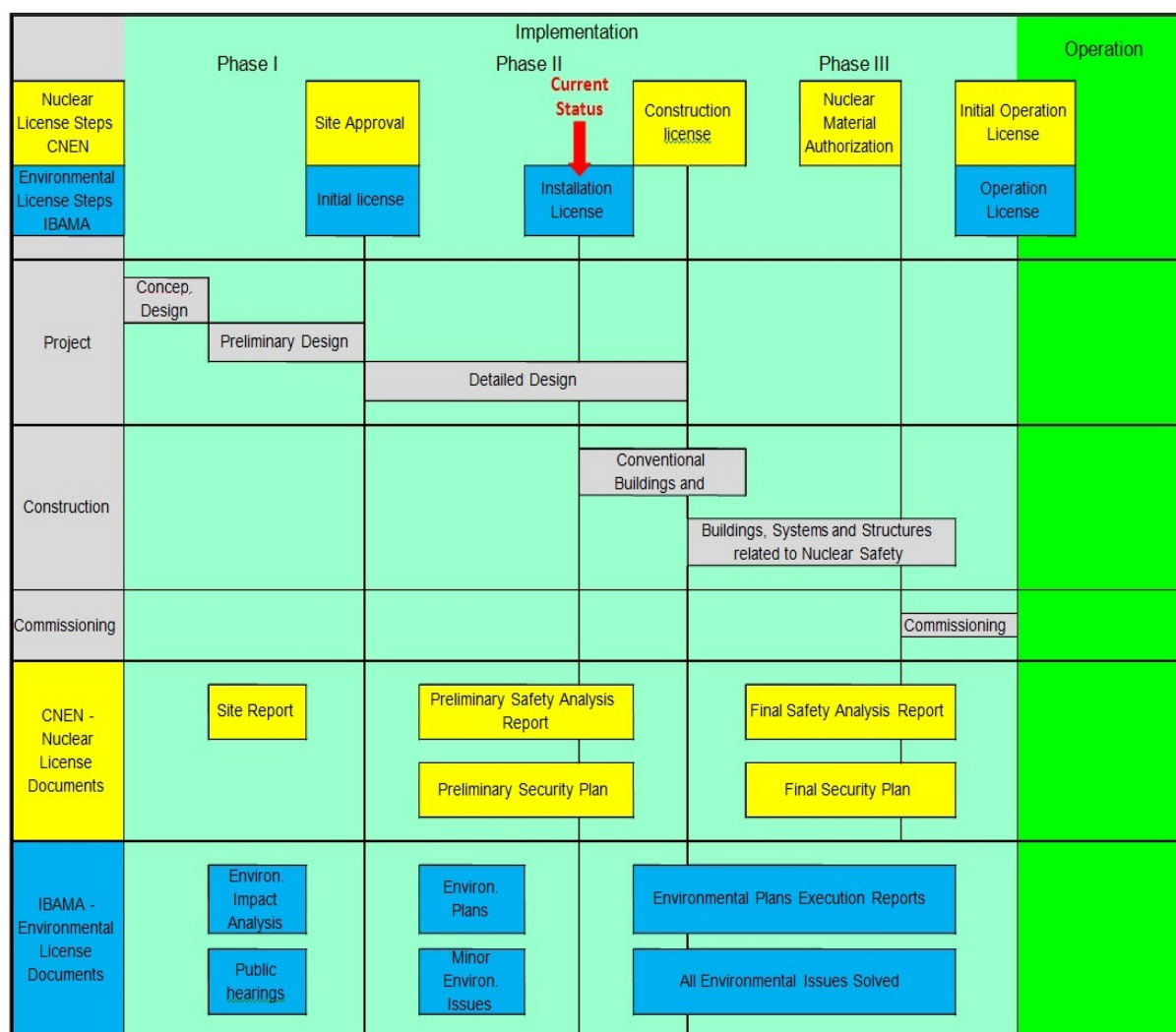


Figure 1: Overview of implementation steps for licensing processes.

This paper aims to present the license process focusing on the environmental aspects from

RMB project submitted to IBAMA to obtain its Installation License, which is a step taken after the Initial License that was issued in 2015.

## 2. LICENSING PROCESS

The Brazilian nuclear regulatory framework was established by CNEN-NE-1.04 standard [3]. This standard defines the nuclear licensing process by setting the necessary documentation needed to obtain it, specifically:

- (i) Site report;
- (ii) Construction license;
- (iii) Authorization to use nuclear material;
- (iv) Authorization for initial and permanent operation.

The Brazilian regulatory framework dealing with environmental licensing of nuclear facilities is defined in terms of Brazilian law and regulated by the National Environment Council (CONAMA). In order to obtain a full license to operate a nuclear facility, in this case a research reactor, IBAMA has defined three milestones, which are:

- (i) Preliminary License (LP);
- (ii) Installation License (LI);
- (iii) Operation License (LO).

### 2.1. Nuclear Facilities Licensing Process Overview

There are four main steps to accomplish a nuclear facility licensing process, which are site report, site approval, construction license, authorization to use nuclear material and authorization for initial and permanent operation.

The Site Report (SR) must be elaborated considering the nuclear reactor and all the nuclear and radioactive facilities nearby. This report evaluates the site and its capability to support the installation and infrastructure of the RMB in terms of protecting the environment and the population who lives nearby against the estimated radiological consequences of normal operation and possible accidental conditions.

As the initially chosen site is already next to a nuclear compound in operation, this report was carefully analyzed and the Environmental Impact Assessment was used to ensure that this new nuclear facility will meet all safety requirements.

The Construction License is an administrative action result which CNEN allows the construction of the nuclear facility after having verified the technical feasibility, project safety

plan and its compatibility with the Site Report. The Construction License can only be requested after the Site Report has been approved by CNEN. However, to have any construction activity started it is mandatory to have the Installation License issued by IBAMA.

The license application must include the Preliminary Safety Analysis Report (PSAR), Preliminary Security Plan (PSP) and information regarding the preliminary construction schedule. These documents are used to show, respectively, the fulfillment of all the technical information required and the acceptance of terms, based on submitted information stating that the facility can be built in the proposed site without risks to the health and safety of the population, the environment and the qualification in terms of construction management.

Once the construction license is issued by CNEN, the authorization for the use of nuclear materials and further licenses shall be granted after proof that the facility is ready to receive nuclear material and upon compliance with the requirements of specific Brazilian agency standard guide [3] [4].

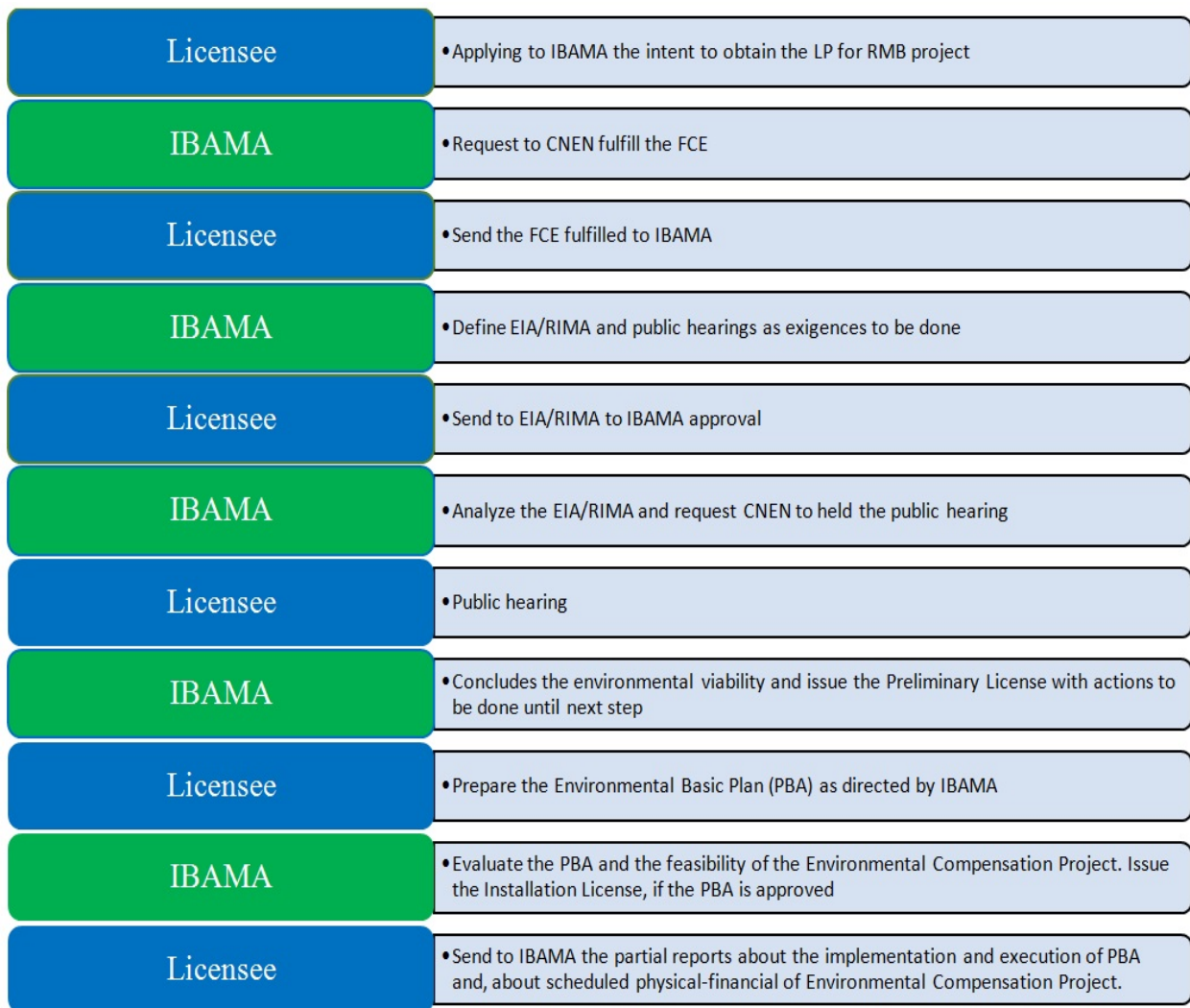
## **2.2. Environmental Licensing Process**

The following section presents details on the environmental licensing process that the Brazilian Multipurpose Reactor was submitted in order to obtain all the licenses required to be installed [5]. The figure 2 shows the updated timeline of the process mentioned above.

## **2.3. Preliminary License (LP)**

The Preliminary License is of utmost importance in the observance of what is called the precaution principle in Brazilian Law, which is related to the respectful and functional relationship between man and nature. It is in this phase that:

- (i) the likely environmental and social impacts of the enterprise are assessed;
- (ii) these impacts are evaluated, with respect to magnitude and scope;
- (iii) measures are formulated which, once implemented, will be able to eliminate or mitigate the impacts;
- (iv) the environmental agencies of the relevant spheres are heard;
- (v) sectorial agencies in whose acting areas the enterprise belongs are heard;
- (vi) environmental impact and respective mitigation measures are discussed with the community (if there is a public hearing) the decision on the environmental viability of the enterprise is taken, considering its location and its probable impacts, with respect to the mitigating measures of environmental and social impacts.



**Figure 2: Steps of environmental licensing process.**

The term of validity of the Preliminary License must be, at least, equal to the timetable established in the preparation of the plans, programs and projects related to the enterprise or activity, that is, the time necessary to carry out the planning, and may not exceed five years.

### **2.3.1. Facility Characterization Report (FCE)**

The FCE supplied IBAMA with previous knowledge regarding the RMB project characteristic and the region proposed to be situated. These information were essential for IBAMA to define the requirements and the content of the studies that was developed by the licensee. The document have presented main elements, which characterized the nuclear facility and its insertion area. It contains justification of the enterprise, facility dimentions, technology to be used, location, main environmental aspects involved and information concerning the preexistence of any environmental reports issued by other agencies.

### **2.3.2. Environmental Impact Assessment (EIA)**

The Environmental Impact Assessment (EIA) and its respective Environmental Impact Report (RIMA) are technical multidisciplinary documents aiming to present an ample and complete assessment in terms of significant environmental impact and the proposed mitigating actions [6].

The EIA has, as main purpose, the diagnostic of the natural potentialities and socioeconomics, impacts of the nuclear facility and the measures designated to mitigate, compensate and control these impacts. This study is determined by IBAMA and must contain the following as minimal information, :

- (a) environmental diagnosis of the area of influence of the enterprise: should describe and analyze the potential of the physical, biological, and socioeconomic aspects of the area of influence of the enterprise, inferring the situation of these elements before and after the implementation of project;
- (b) analysis of the environmental impacts of the project and its alternatives: contemplate the magnitude and interpretation of the importance of probable impacts of the enterprise, by discriminating; positive and negative impacts (beneficial and adverse), direct and indirect, immediate and medium and long-term, temporary and permanent; the degree of reversibility if these impacts; their cumulative properties and synergistic; the distribution of social burdens and benefits;
- (c) mitigation measures of the negative impacts must have their efficiency evaluated from the implementation of the environmental programs predicted to be implemented during the life of the Installation License; and
- (d) monitoring program: should cover positive and adverse impacts, indicating the quality standards to be adopted as parameters.

### **2.3.3. Environmental Impact Report (RIMA)**

This report offers essential information for the population to have a knowledge of the advantages and disadvantages of the project implementation. In general terms, it can be said that the EIA is a technical document and RIMA is a management report presented in a popular language and terms. According to the CONAMA the RIMA should contain:

- (a) the objectives and justifications of the project, their relationship and compatibility with sectorial policies, governmental plans and programs;
- (b) the description of the project and its technological and locational alternatives specifying for each of them, in the construction and operation phases, the area of influence, raw materials and manpower, energy source, the operational processes and techniques, the likely efficiencies, emissions, energy waste and the direct and indirect jobs to be generated;

- (c) the synthesis of the results of the environmental diagnostic studies of area of influence area of the project;
- (d) the description of the likely environmental impacts of the activity, considering the project, its alternatives, the horizon impact and indicating methods, techniques and criteria adopted to their identification, quantification and interpretation;
- (e) the environmental quality characterization at the influenced area and its comparison in different future scenario, like technologies alternatives and the hypothesis of its non-achievement;
- (f) description of the expected effect of the planned mitigation measures in relation the adverse impacts, mentioning those that could not be avoided, and the degree of expected change;
- (g) monitoring program and monitoring of impacts;
- (h) recommendation on the most favorable alternative (conclusion and comments of general order).

## **2.4. Public Hearings**

Public hearings are expected to occur in the environmental licensing process to promote transparency and participation of the locals in order to ensure the dissemination of information about the project to be licensed regarding the possible risks to environmental quality of the area under enterprise's influence. This activity also objectivate to capture the expectations and concerns of the affected population, to allow the licensing agency to recognize the manifestations and interest of different social groups. It were held three public hearings in Ipero, Sorocaba and Sao paulo to compose RMB's environmental licensing process.

## **2.5. Environmental Constraints from the Preliminary License**

Environmental constraints are documentary clauses by which the licensor authority establishes the conditions, limitations, measures that serve to protect, preserve and improve the environment. Such items must be attended by the entrepreneur, individual or legal entity, aiming at minimizing or even compensating the impacts caused by the undertakings and/or their respective activities. The topics that can be subject of constraints are: full description of studies and projects, monitoring programs described in the Environmental Control Plan - PCA, supplementary mitigating measures and also presentation of further documentation. Social or political counterparts, environmental compensation not discriminated by law should not be matters to be dealt with constraints [7].

Specifically for the RMB project, when the initial license was issued, a set of constraints were reported that must be met to continue the process to obtain the Environmental Installation License (LI). Considering that most of these requirements refers to the presentation of a detailed "environmental compensation program" proposed in the EIA, it was decided to consolidate a Basic Environmental Plan of the RMB. The restrictions are

grouped into three characteristics: physical, biological and socioeconomic. The agency licensor has pointed restrictions for the recovery, conservation and/or improvement of the physical environment through three items to be attended. These items are comprehensive and require: the presentation of measures to ensure the integrity of the water supply, the presentation of measures to contain erosive processes during all phases of the project and the proposal for a decommissioning plan of installation at the end of its activities. Therefore, conventional potentially polluting substances were required to be inventoried and, for each identified product, their environmental risks, contingency actions in accidental scenarios and their risk management measures should be detailed.

The other group of constraints is aimed at the biophysical components and is organized into nine items to be attended to. Specific activities for monitoring fauna, flora and water bodies located internally on the project site were required, proposals should cover all phases of the project and should be confronted with the situation of biotic factors prior to RMB implementation. In this context, compensation programs resulting from these environmental implications include continuous monitoring activities, such as the quality of groundwater and surface water, tracking and management of the surrounding wildlife, the maintenance of ecological corridors of the region and its connectivity with the Ipanema National Forest located next to RMB's area. An important part of this set of constraints is the establishment of partnerships and agreements with other institutions in the region, implementing actions for the preservation of the natural resources presented in the areas with direct and indirect influence of the reactor.

Large facilities with a nuclear characteristic can generate doubts and concerns among the locals, they often put pressure on the infrastructure of local services, affect the dynamism of the service sector, increase the supply of jobs, increase traffic on roads and local access, among other positive and negative impacts to the socioeconomic means. The conditions for mitigating the adverse impacts and increase positive effects of this group were addressed in four items of the initial license. These include the presentation of a land use and occupation map of the project surroundings, a study of trafficability and safety on the Iperó city roadway, the elaboration of a social communication plan for expropriated families and another dedicated to property owners in the vicinity of RMB [8].

The requests made by the licensing authority mentioned above resulted on the detailed description of plans and programs for control and environmental compensation all of them described on the document called PBA, abbreviation in Portuguese for Basic Environmental Plan. This plan presents the executive activities divided into twenty-three programs focused on management, monitoring, control and recovery of environmental aspects before, during and after the works of implementation of the multipurpose reactor. Some of the environmental monitoring and enhancement activities will be maintained throughout the lifetime of the reactor and also for a certain period after decommissioning.

## **2.6. Installation License (LI)**

Only the LI issuance permit the enterprise to begin its installation. Activities like earth-moving, civil works and further actions must follow the guidelines registered on this official document. To request the Installation License the licensee must elaborate a Environmen-



tal Control Plan to attend all the constraints from the LP. Specifically for RMB this control plan was named PBA Basic Environmental Plan.

In RMB's scope the Basic Environmental Plan it is a group of twenty three programs and has its activities organized following the milestones as (i) pre construction: period between the LI emission and the effective start of work; (ii) Construction; (iii) Operation and maintenance. The following text describes these programs and addresses their particularities.

- **Environmental Management Plan**

According to the Environmental Impact Report (RIMA), the Environmental Management Program aims to provide tools for the enterprise to have efficient mechanisms that ensure the correct conduct of the works and other related environmental programs for this phase, providing higher quality standards in its installation and operation.

- **Environmental Program for Construction**

According to Environment Impact Report (RIMA), this program aims to prevent and control the direct impacts of works and implementation activities, avoiding processes that may trigger some type of environmental degradation.

- **Noise Control and Monitoring Program**

According to Environmental Impact Report (RIMA), this program should be implemented with the objective of limiting and monitoring the impacts caused by the noise emission in the area of influence of the tasks, affecting the population surrounding the enterprise and the construction workers.

- **Particulate Material Control and Monitoring Program**

According to the Environment Impact Report (RIMA), this program aims to monitor the concentration of pollution of the urban region next to the polluting activities, verifying the efficiency of the mitigating measures proposed.

- **Erosive Process Control and Monitoring Program**

According to Environment Impact Report (RIMA), this program should propose measures to mitigate and prevent the outbreak of erosive processes, implementing actions to monitor the efficiency of measures to avoid erosive processes in the land environment.

- **Liquid Effluent Management Program - Installation Phase**

The Liquid Effluent Management Program aims to guarantee during the installation phase the correct management, treatment and final destination of industrial effluents and domestic sewage generated by the constructor's facilities, in order to comply with current environmental legislation.

- **Solid Waste Management Program - Installation Phase**

According to the Environmental Impact Report (RIMA) of the Brazilian Multipurpose Reactor (RMB), this program should establish routine's procedures, control and management of waste generated during the installation of the enterprise in such a way that each type of waste receives classification, segregation and appropriate destination.

- **Surface Water Quality Monitoring Program**  
This program aims the monitoring the effects of the enterprise on the water quality of the area of influence of the RMB.
- **Degraded Areas Recovery Program**  
This program aims to provide for the adoption of practices for the rehabilitation of soil conditions and vegetation cover affected by the installation's activities.
- **Underground Water Monitoring Program**  
This program aims to monitor the condition and groundwater standard that may be affected during the installation and operation phase of the enterprise.
- **Waste Water Management Program - Operation phase**  
The Liquid Effluent Management Program seeks to ensure the correct management, treatment and final destination of liquid effluents, industrial and domestic to be generated during the enterprise operation. Therefore, the pertinent environmental legislation will be attended with a permanent monitoring program on the treated water and also on the water quality standards.
- **Solid Waste Management Program - Operation phase**  
This program will enable to identify alternatives for minimizing the generation of waste, compatible with the operational requirements, including waste generated by third-party services carried out in the company's premises, as well as minimizing the waste load to be disposed of in landfills, considering the technical and economic viability of its reuse or of its reprocessing, internal or external to the company.
- **Flora Conservation and Management Program**  
This program has the main purpose of document, recover and preserve representatives of the main vegetal species existing in the area, in addition to the existing fragments of the Directly Affected Area (ADA).
- **Rescue Program, Management and Conservation of Land and Aquatic Fauna**  
This program aims to ensure the monitoring of land and aquatic fauna in the ADA (Directly Affected Area) areas throughout the installation phase.
- **Roadway Warning Sign Program**  
A signaling program for the RMB that addresses the basic assumptions of safety and conduct for affected workers and population. In this way, this Program seeks the adoption of measures to reduce and/or mitigate impacts from fauna trampling and others arising from the increase of traffic in the municipal road Bacaetava - Sorocaba.
- **Road System Mitigation Program**  
There will be compromise of accessibility and traffic conditions during the installation of the project, especially in the Bacaetava-Sorocaba municipal road, which gives direct access to the RMB. Therefore, this program should: Perform a previous inspection on the roads to verify the need for maintenance; Include information in the Social Communication Program, for the purpose of prior disclosure in cases of changes in traffic; Encourage the use of alternative routes in periods of greater traffic avoidance; Carry out prohibitive, indicative, educational and warning signs

(horizontal and vertical) for vehicles and pedestrians, according to the Signaling Program; Ensure the guarantee of access to all properties (housing and commerce) in the affected areas; Perform periodic maintenance of access roads.

- **Environmental Education Program for Construction Workers**

The Environmental Education Program for Construction Workers will be destined to the direct and outsourced workers of the enterprise, and it must also have a continuous characteristics. Its main objective is to avoid/mitigate environmental damage or discomfort in the community around the RMB by the routine activities and behavioral nature of workers as well as to enhance the opportunities for them to act as self-regulating agents of local environmental quality.

- **Environmental Education Program for the Local Community**

The Environmental Education Program should be targeted to people directly affected by the enterprise. The main proposal is to demystify the nuclear issue, in order to clarify the population about the enterprise and its various applications. In addition, it is proposed to include the population in the ecological and environmental context of Iperó city.

- **Strengthening Program of Public and Private Infrastructure**

The program should propose the reinforcement of local infrastructure from the orientation or reorientation of public and private investments to the region in question. The strengthening of municipal services should be carried out, in particular at Iperó city, focusing on the George Oetterer District and the Bacaetava District.

- **Local Manpower Training Program**

For the impacts mitigation such as Pressure for Local Services, Demographic Attraction and Demobilization of Manpower, it is proposed that in the phase of installation of the enterprise, priority be given to the hiring of local labor. With the end of RMB activities, skilled workers trained by RMB may be able to work in other ventures.

- **Social Communication Program**

The Social Communication Program is the main tool that the entrepreneur will possess to reduce the negative effects that the population may have under the perception and understanding of the RMB. In this way, this program has as main objective to mitigate the anxiety of the population in relation to the enterprise, establishing means of dialogue with the regional community, keeping it informed and aware about the enterprise.

- **Archaeological Prospecting and Heritage Education Program**

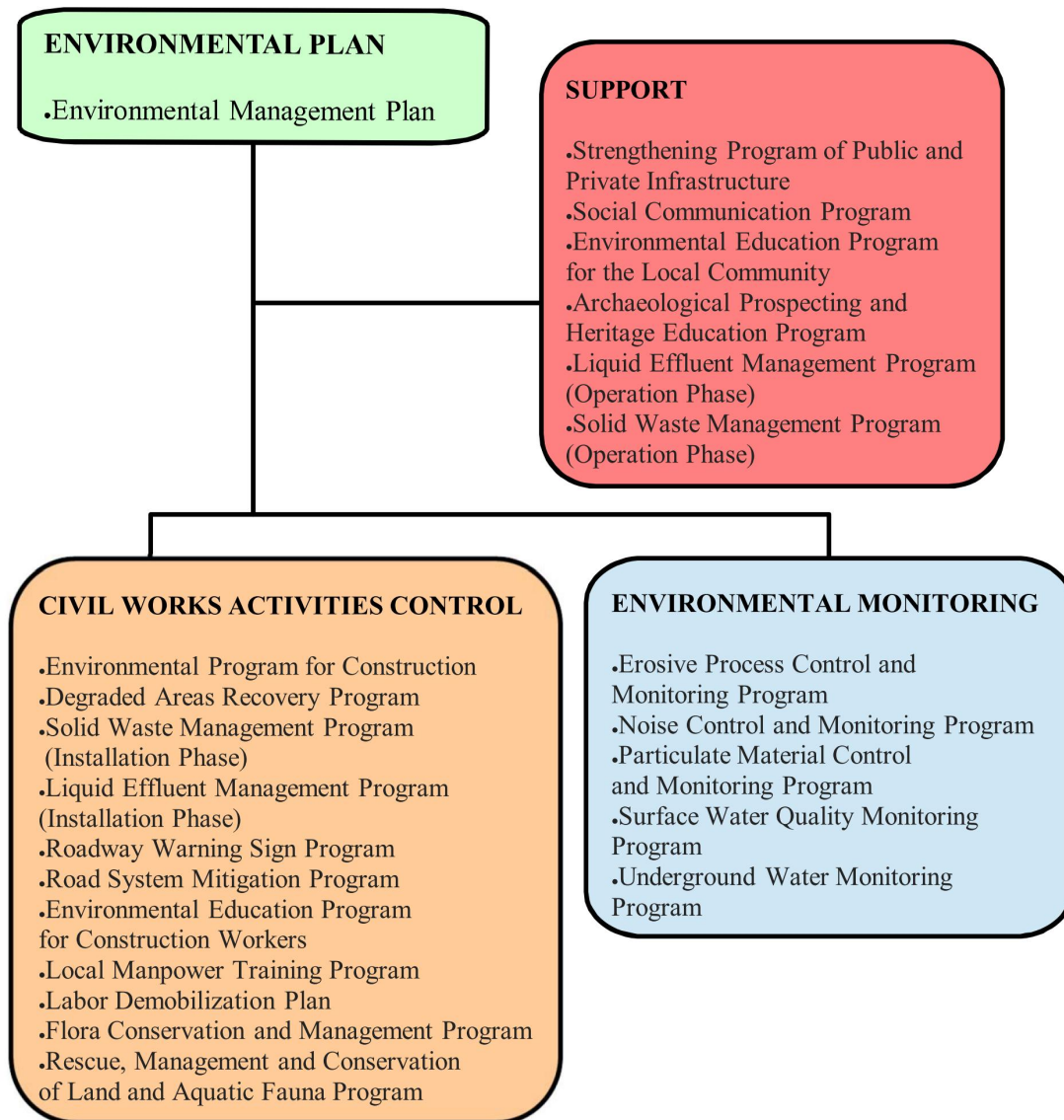
Archaeological prospecting should be carried out in order to identify the occurrence or not of archaeological remains in the area of the project by means of systematic surveys in its Directly Affected Area - ADA and non - systematic in the Area of Direct Influence - AID, applying methodologies involving obligatory sub-surface investigations. This program should also provide actions to be taken if archaeological remains are found, such as measures for local registration and spatial delimitation of occurrences, and for laboratory treatment of identified traces.

- **Labor Demobilization Plan**

With the end of the construction activities of the RMB and start of its operation

there will be the demobilization of the workers employed in the installation phase. Thus, the Demobilization Plan aims to provide strategies so that the effects of the interruption of labor activity are minimized.

The plans and programs described above were divided in four categories, that are (i) Environmental management (ii) Civil works activities control (iii) environmental monitoring (iv) Support. All of them can be observed on the figure 3.



**Figure 3: RMB Environmental Plan Articulation**

### 3. DISCUSSION

The Brazilian nuclear regulatory framework was established in the CNEN-NE-1.04 (2002) standard guide, defining the processes for issuing the necessary licenses and authorizations with regard to the nuclear aspects of the project. In addition to the nuclear license, Brazilian law N° 6.938/81, N° 7.804/89, N° 140/2011, provides the guidelines of National Environmental Policies, introducing the concept of environmental licensing. Nowadays, the environmental licensing represents the recognition, by the Brazilian Government, that the construction and/or the modifications of enterprises and activities considered effective or potential polluters must adopt able criteria to ensure its sustainability under the environmental point of view. Table 1 presents the analogy between the two regulatory agencies that evaluate RMB.

**Table 1: Analogy between Brazilian regulatory framework: Nuclear and Environmental**

NUCLEAR LICENSING	ENVIRONMENTAL LICENSING
<p><b>Site report</b> As presented in item 2.1, it is through this report that CNEN approves the proposed location of the RMB project. It is a determinant factor to move forward with the project.</p>	<p><b>Preliminary License</b> This license does not authorize the project installation, but approve the environmental feasibility and, authorize its location and the technological conception. RMB project must present: - FCE - EIA - RIMA - Public Hearings</p>
<p><b>Construction License</b> The RMB project can start its construction after obtaining this license as presented in the item 2.2, and it is compost of: - PSAR - PSP</p>	<p><b>Installation License</b> It authorizes the start of the installation. The deadline of this license is established by the project installation schedule, to grant this license the RMB project must have: - PBA</p>

These set of 23 socio-environmental plans and programs may include subprogrammes, which makes up the PBA are characterized as a management tool that has as a general objective to guarantee the fulfillment of the commitments assumed by the entrepreneur with regard to the correct environmental and social management of the enterprise and applicable environmental legislation.

## 4. CONCLUSION

As previously stated, there are two Brazilian government agencies directly involved in the nuclear licensing process, CNEN and IBAMA. The synergy between them guarantees a careful assessment of a nuclear facility, capturing the complexity of the subjects related.

The site license was issued by CNEN in 2015. The RPAS is a document that subsidize the request for construction license as can be seen previously in figure 1 and it was presented to the licensing authority in the end of 2018 .

Regarding the environmental licensing process, the preliminary license was issued in 2015 by IBAMA allowing the enterprise continuity and made official a set of constraints that is mandatory to be attended during next projects steps. Nowadays Environmental Plans situation have been informed to the agency by entrepreneur's semester report.

This paper seeks to clarify all stages of a nuclear facility licensing, and especificaly for the RMB the completed steps, the current license status and the future actions.

## REFERENCES

1. RIMA - Relatório de Impacto Ambiental. “Relatório de Impacto Ambiental do Reator Multipropósito Brasileiro”, *RIMA*, Brasília, 2013, Available at [https://servicos.ibama.gov.br/licenciamento/consulta\\_empresendimentos.php](https://servicos.ibama.gov.br/licenciamento/consulta_empresendimentos.php).
2. J. A.Perrotta, I. J.Obadia, A.J.Soaes “The RMB Project – Development Status and Lessons Learned.”, *IAEA-CN-231-32*,
3. CNEN - Comissão Nacional de Energia Nuclear. “Resolução CNEN-NE-1.04-Licenciamento de Instalações Nucleares.”, Brasília, 2002, Available at <http://appasp.cnen.gov.br/seguranca/normas/pdf/Nrm104.pdf>.
4. CNEN - Comissão Nacional de Energia Nuclear. “Resolução CNEN-NE-2.01-Proteção Física de Unidades Operacionais da Área Nuclear”, Brasília, 2011, Available at <http://appasp.cnen.gov.br/seguranca/normas/pdf/Nrm201.pdf>.
5. IBAMA - Instituto Brasileiro de Meio Ambiente e Recursos Naturais. “Guia de Procedimentos do Licenciamento Ambiental Federal”, *IBAMA/MMA*, Brasília, 2002, Available at [http://www.mma.gov.br/estruturas/sqa\\_pnla/\\_arquivos/Procedimentos.pdf](http://www.mma.gov.br/estruturas/sqa_pnla/_arquivos/Procedimentos.pdf).
6. L. Silva Jr., M. I. N. Alvarenga, S. R. Garcia “Quality evaluation of environmental licensing processes of mining enterprises in Minas Gerais”, *Ambiente e Sociedade*, **Volume 21** (2018).
7. IAIA - International Association for Impact Assessment. “Environmental Permitting License - Core guidance for the environmental permitting (England and Wales)”, *IAIA*, London, 2013, Available at [www.iaia.org/resources](http://www.iaia.org/resources).
8. DEFRA - Department for Environment Food and Rural Affairs. “Environmental Permitting License - Core guidance for the environmental permitting (England and Wales)”, *DEFRA*, London, 2013, Available at [www.defra.gov.uk/environment/quality/permitting/](http://www.defra.gov.uk/environment/quality/permitting/).