EXTRAORDINARY NATIONAL REPORT OF BRAZIL

FOR THE NUCLEAR SAFETY CONVENTION

THE IMPACT OF FUKUSHIMA ACCIDENT

MAY 2012

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FOREWORD

On 20 September 1994 the Convention on Nuclear Safety was open for signature at the headquarters of the International Atomic Energy Agency in Vienna. Brazil signed the Convention in September 1994, and deposited the instrument of ratification with the Depositary on 4 March 1997.

The Convention objective is to achieve and maintain a high level of nuclear safety throughout the world. One of the obligations of the Parties to the Convention is the preparation of a periodical National Report describing the national nuclear program, the nuclear installations involved according to the Convention definition, and the measures taken to fulfill the objective of the Convention.

Brazil has prepared five National Reports by a group composed of representatives of the various Brazilian organizations with responsibilities related to nuclear safety, and presented them to the Parties of the Convention in due time

In March 11th 2011, a severe earthquake occurred close to the coast of Japan. This earthquake caused a large tsunami which killed tens of thousand people. The tsunami cause also a sever accident in the Fukushima Daishi nuclear power plant, affecting its 4 units and causing radioactive contamination of the surrounding areas, what required the evacuation of tens of thousand of people, still without the possibility to return to their homes.

The accident has been under study since then, and several reports have been issued by Japanese and other organizations, including the IAEA, to analyze and evaluate the accident and to consider the lesson to be learned by other nuclear power plants and all the international nuclear community.

At the conclusion of the Fifth Review Meeting of the Convention on Nuclear safety in April 2011, it was decided by the Parties to prepare an Extraordinary National Report describing the impact of the Fukushima accident in each country and the actions taken by the authorities and operator as a consequence of the accident.

This Extraordinary National Report of Brazil describes the actions taken by the National Commission for Nuclear Energy - CNEN, the nuclear regulatory body and by Eletrobras Thermonuclear – Eletronuclear, the operator of the two Brazilian nuclear power plants.

The Report follows the Guidance for National Reports specially issued by the officers of the Convention on Nuclear Safety in preparation to the Extraordinary Meeting to take place in Vienna in August 2012.

CONTENTS

LIST OF FIGURES

A. INTRODUCTION

A.1. The Brazilian nuclear policy

The Brazilian Federal Constitution of 1988 states in articles 21 and 177 that the Union has the exclusive competence for managing and handling all nuclear energy activities, including the operation of nuclear power plants[1]. The Union holds also the monopoly for the survey, mining, milling, exploitation and exploration of nuclear minerals, as well as the activities related to industrialization and commerce of nuclear minerals and materials. All these activities shall be solely carried out for peaceful uses and always under the approval of the National Congress.

A.2. The Brazilian nuclear program

The Comissão Nacional de Energia Nuclear (Brazilian National Commission for Nuclear Energy - CNEN) was created in 1956 (Decree 40.110 of 1956.10.10) to be responsible for all nuclear activities in Brazil. Later, CNEN was re-organized and its responsibilities were established by the Law 4118/62 with amendments determined by Laws 6189/74 and 7781/89. Thereafter, CNEN became the Regulatory Body in charge of regulating, licensing and controlling nuclear energy, and the nuclear electric generation was transferred to the electricity sector.

Eletrobras Termonuclear S.A. (Eletronuclear) is the owner and operator of the nuclear power plants. Currently, Brazil has two nuclear power plants in operation (Angra 1, 640 MWe gross/610 MWe net, 2-loop PWR and Angra 2, 1345 MWe gross /1275MWe net, 4-loop PWR), and one under construction (Angra 3, 1312 MWe gross/1229 MW net, 4-loop PWR). Angra 3, after the construction was temporarily interrupted in 1991, has restarted the construction activities in 2009 following a decision of the Federal Government. Angra 1, 2 and 3 are located at a common site, near the city of Angra dos Reis, about 130 km from Rio de Janeiro (See Fig. 1).

Brazil has also established a heavy components manufacturer, Nuclebrás Equipamentos Pesados (Nuclebrás Heavy Equipment - NUCLEP), a nuclear fuel manufacturing plant (Fábrica de Combustível Nuclear - FCN) and a yellow-cake production plant belonging to Indústrias Nucleares do Brasil (Nuclear Industries of Brazil - INB). Brazil has also the technology for Uranium conversion and enrichment, as well as private engineering companies and research and development (R&D) institutes and universities devoted to nuclear power development. Over 15,000 individuals are involved in these activities. Brazil ranks sixth in world Uranium ore reserves, which amounts to approximate 310,000 t U_3O_8 in situ, recoverable at low costs (See Fig. 2).

[1] In this Report the terms Nuclear Installation and Nuclear Power Plant are used as synonyms, in accordance with the definition adopted in the Nuclear Safety Convention (Art. 2 - i).

Recent energy studies carried out by the Energy Research Enterprise (Empresa de Pesquisa Energética – EPE) and published in the Decennial Energy Plan 2007-2016 have led to the decision to start working in the site and construction of new nuclear power plants in Brazil. The proposed program anticipated, besides the completion of Angra 3, the construction of additional two reactors of about 1000 MWe in the Northeast of Brazil, by the end of this decade, and possible another two reactors of the same size in the Southeast region. Preliminary site and feasibility studies were under way.

Also, a Committee for Development of the Brazilian Nuclear Program (Comitê de Desenvolvimento do Programa Nuclear Brasileiro – CDPNB) was established, with the participation of 12 ministries. This Committee has approved proposals in the areas of electric energy, fuel cycle, nuclear waste, medical, industrial and agricultural applications, organizational structure, human resources and international cooperation. These proposals include, among others, the construction of the additional 4 reactors beyond Angra 3, the self sufficiency in the fuel cycle by 2014, the construction of a waste repository for medium and low level waste by 2018, the design of a long term repository for irradiated fuel and the creation of a fully independent regulatory agency separating the regulatory and promotion activities of CNEN.

Figure 1 – From right to left, Angra 1, Angra 2 and Angra 3 being built

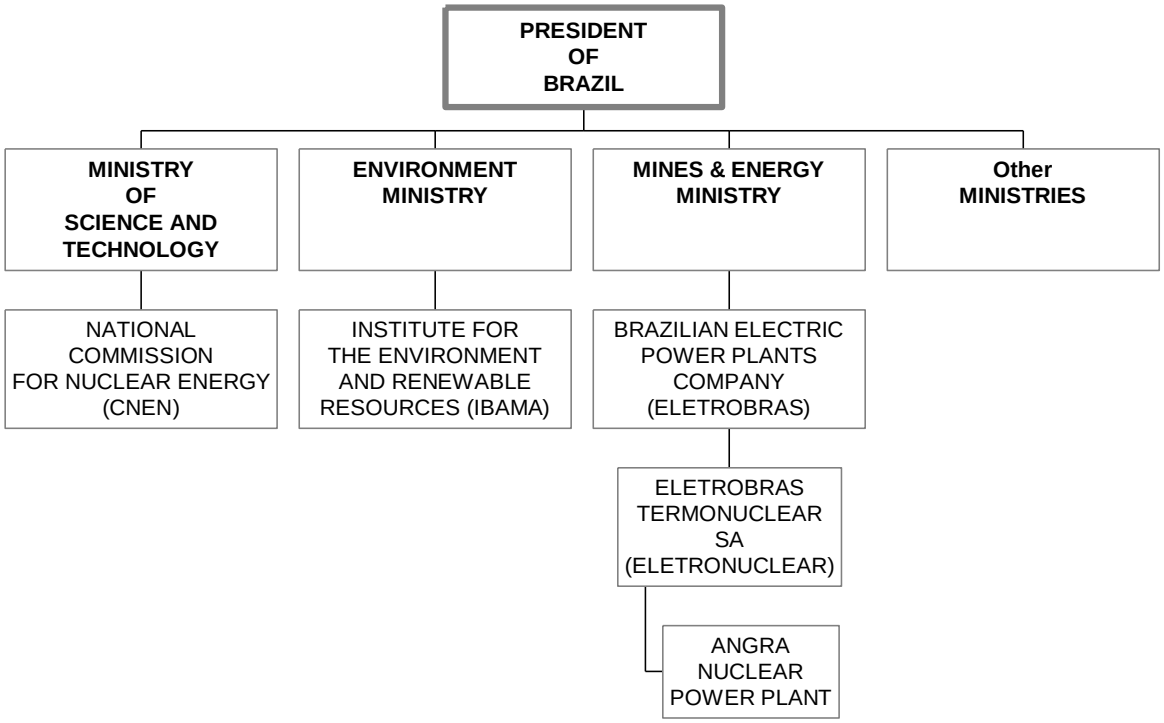

Fig 2. Brazilian organizations involved in nuclear power plant safety

A.3. The Immediate Impact of Fukushima Accident

Follow up of accident

As soon as it was identified the magnitude of the accident occurred in March, 11th 2011 at the Fukushima Daiichi Nuclear Power Station in Japan CNEN started a process of follow up of the technical information, from all possible sources, specially the Japanese authorities and the IAEA.

The aim was to understand the situation and the accident conditions, and to inform higher authorities in a precise and understandable language.

Information to public

Considering the enormous repercussion in the media, CNEN found necessary to provide factual, precise, clear and understandable information to the public. This was done through the participation on many interviews for printed and televised press. Additionally, a daily bulletin was published at CNEN homepage, described in singles terms the development of the accident in Japan and the measures undertaken by Japanese authorities.

Information to Brazilians in Japan

Special consideration was given to the large Brazilian population living in Japan, estimated in around 250 000 people. These persons are descendents of Japanese immigrants that have moved to Japan for better work conditions, but that have limited skills in the Japanese language, and usually very limited capability to read in Japanese.

Especially for them, CNEN established an information center via telephone and e-mail, which provided hundred of response to question formulated about the situation in Japan and the recommended protective measures. Information was also provided to the Brazilian embassy and consulates in Japan.

Follow up of international community reaction

From the technical point of view, CNEN follow the same behavior of the international nuclear community, trying to obtain as much technical information as possible, evaluating the situation, and looking at the lessons to be learned from the Fukushima accident.

Actions required by the regulatory body from the operator

On May 13, 2011, CNEN issued a document nr. 082/11-CGRC/CNEN formally requiring Eletronuclear to develop a preliminary safety assessment report, including a specific set of technical aspects taking in account the Fukushima accident. These included:

1. Identify the major design differences between Fukushima and Angra Units;
2. Identify possible external initiating events (extreme) and the internal potential cause a common mode failure;
3. Control of concentrations of hydrogen in the containment;
4. Ensuring electricity supply emergency power;
5. Fulfillment of the requirements of station blackout;
6. Service water system, cooling chain;
7. Procedures for severe accidents;
8. Access to buildings and controlled area of the reactor after an severe accident
9. Development of Probabilistic Safety Analysis Level 1, 1 and 2;
10. Performance of "stress tests"
11. Emergency planning

Actions taken by the operator

As soon as it was identified the magnitude of the accident occurred in March, 11th 2011 at the Fukushima Daiichi Nuclear Power Station in Japan, the Board of Directors of Eletrobras Eletronuclear decided in March, 16th 2011 to constitute a Technical Committee, coordinated by the Presidency counting on senior staff members of all company's Directorates, with the following attributions:

→ To follow-up the accident evolution and measures taken to control it;

→ To follow-up the recommendations from international organisms related to nuclear, environmental, industrial, radiological safety and security as a consequence of the accident;

→ To help the Executive Board on nuclear safety related matters as a result of the event follow-up.

In April, 19th 2011, Eletronuclear responded to the World Association of Nuclear Operators Significant Operating Experience Report (WANO SOER 2011-2) issued in March 2011, including the results of the recommended verifications regarding Angra 1 and Angra 2 NPPs capability to face beyond design basis accidents, with emphasis on station black out, flooding and fire hazards.

Simultaneously to the follow-up and analysis of information about the accident, Eletronuclear began studies aiming to reassess the original condition considered in the design basis of the plants projects and/or to identify eventual vulnerabilities, focusing the activities in the following areas:

→ Reevaluation of design criteria for external events: considering earthquakes, waves, flooding, tornadoes and slope stability around the power plants in order to verify their impact on safety related structures, systems and components, with emphasis on protection against common cause failures.

→ Reevaluation of Stations resources to control beyond design basis accidents: evaluation of implemented or ongoing projects to control or mitigate the consequences of a beyond design basis accident, with emphasis on the plants behavior assessment in case of simultaneous loss of normal and emergency electrical power (station blackout) combined with loss of the cold source (feedwater systems).

Procedures adequacy to control beyond design basis accidents were also verified considering the implementation of the key measures (additional source of electrical power supply, passive hydrogen recombiners, post-accident containment pressure relief, post-accident instrumentation, etc.) as well as the need for additional resources, in particular the identification of additional sources of water and electrical power supply, and the use of portable equipment (pumps, generators, etc.).

Following up the international recommendations in progress, a special attention was paid to those from WENRA – Western European Nuclear Regulators Association, as well as the questionnaire developed by AREVA for the German plants and the results of the European plants stress tests that were already available.

On May 13th, 2011, while Eletronuclear was developing these studies, the Brazilian regulatory body, *Comissão Nacional de Energia Nuclear – CNEN* issued a document nr. 082/11-CGRC/CNEN requiring the company to develop a preliminary safety assessment report, including a specific set of technical aspects taking in account the Fukushima accident. The assessments conducted by Eletronuclear and the corresponding required actions have been laid down in a technical report, entitled "*Avaliação das Lições Aprendidas com o Acidente nas Usinas da Central de Fukushima no Japão e Suas Implicações sobre as Unidades da CNAAA - DT-006/11*" (Evaluation of Lessons Learned from the Fukushima Accident in Japan and its Implications on the Brazilian plants of CNAAA), issued on July 2011 and sent to CNEN.

To develop, implement and manage the studies and projects proposed by the program DT-006/11, the Board of Directors of Eletronuclear determined the creation of a Management Committee of Response to Fukushima through the document CGE-038/11, issued on September 20th, 2011. Consequently a detailed "ELETRONUCLEAR RESPONSE PLAN TO THE FUKUSHIMA ACCIDENT" was developed, encompassing 33 studies and 25 projects, structured according to three areas of assessment and the corresponding initiatives to be undertaken by the Company. For this Convention on Nuclear Safety

extraordinary report, these three areas of assessment were converted into the six topics as indicated by the Convention guidance documents.

For each of these initiatives, the plan includes the objective, responsibility for the execution, characterization as study or project, priority, scope of activities to be developed, milestone time schedule, contracts to be awarded and estimated costs. For this, Eletronuclear is working together with companies that participated in the design of Angra 1 and Angra 2 and with the assistance of other national and international organizations. It is expected that some of these studies lead to interventions in the site infrastructure, in the plants in operation as well as in design changes to be incorporated in Angra 3 during the construction phase. Part of the initiatives related to design improvements in Angra 2, mainly in relation to beyond design basis accidents, had already been considered in Angra 3 design before the Fukushima event. Besides, all actions started before Fukushima are identified in the field “schedule” in the tables from topics 1 to 6.

Prior to the event in Japan, Eletronuclear had already started studies to improve some safety related topics highlighted by the Fukushima accident. These include the initiatives taken together with the European Commission on developing Severe Accident Management Guidelines (SAMG) for Angra 2, once the one for Angra 1 was already done and the implementation of maritime wharves and multi-sports courts (which may serve as heliports) for complementing the process of evacuation of the local population.

The performance of the Stress Tests for Angra 1 and Angra 2 is also included as initiatives of the Eletronuclear Response Plan, and the time schedule for their completion takes into account two steps. The first step consists in the development of the required evaluations, considering only engineering judgment, and the second step comprises the performance of detailed calculations using computer codes. The first step was concluded only for Angra 2 by December 31st, 2011. The second step is planned to be completed until March 31st, 2012.

The Eletronuclear Response Plan shall be revised at intervals not longer than six months for follow up of the progress and the necessary adjustments. It should also consider the development the international initiatives and recommendations, and the requirements from CNEN, the national regulatory body.

The Eletronuclear Response Plan refers to investments on the order of US$ 100 million for the scope of activities already planned and a contingency of about US$ 130 million for possible interventions to be defined based on the results of the studies included in the Plan. Most of studies should be concluded along 2012. The projects are planned to be all implemented until the end of 2015. Nevertheless, the new interventions that may be determined by the studies in progress will have their schedule set accordingly to their scope and priorities.

The Eletronuclear Response Plan was submitted to the Brazilian Regulatory Body (CNEN) immediately after its approval by the Board, on December 5th, 2011, through the document P-409/11.

A.4. Structure of the Extraordinary National Report

This Extraordinary National Report of Brazil describes the actions taken by the National Commission for Nuclear Energy - CNEN, the nuclear regulatory body and by Eletrobras Thermonuclear – Eletronuclear, the operator of the two Brazilian nuclear power plants.

The Report follows the Guidance for National Reports specially issued by the officers of the Convention on Nuclear Safety in preparation to the Extraordinary Meeting to take place in Vienna in August 2012; covering the suggested List of Topics, which includes: External Events, Design Issues, Severe Accident Management and Recovery (On-Site), National Organizations, Emergency Preparedness and Response and Post-Accident Management (Off-Site) and International Cooperation. At the end of the report, a table summarizes the current situation, which is evolving all the time.

B. REPORTING ON LIST OF TOPICS

TOPIC 1 - EXTERNAL EVENTS

The combined effects of the March 2011 earthquake and tsunami in Japan presented significant challenges to the Brazilian Nuclear Program. Questions on appropriate protection from natural phenomena, the probabilities of occurrence of events including extreme weather conditions were strongly considered, as well as differences between the Brazilian and Japanese reactors and contingency plans to deal with natural disasters.

This topic presents the actions taken by Eletronuclear as result of the evaluation of design criteria for considering events like earthquakes, waves, floods, tornadoes and stability of slopes around the power plants site in order to verify their impact on structures, systems and safety components with emphasis on protection against common cause failures. From these studies, works resulted in the areas of meteorology (thunderstorms and tornadoes), hydrology (floods, waves, tides and their protections - drains, canals and jetties), geology, seismology and geotechnical engineering (slopes).

Activities performed by the operator (Eletronuclear)

NOTE: All actions started before the Fukushima accident are identified in the field “schedule” in the tables from topics 1 to 6.

CODE*	OVERVIEW	SCHEDULE	RESULTS**
		STUDIES	
PE111	Updating and reevaluation of geological data basis	To be concluded December 2014	A proposal for consulting services has been harmonized with the winning proponent. Eletronuclear is waiting the proposal document to be signed to begin the contracting process.
PE112	Updating and reevaluation of seismic data basis and seismic threatening	To be concluded December 2014	A proposal for consulting services has been harmonized with the winning proponent. Eletronuclear is waiting the proposal document to be signed to begin the contracting process.
PE113	Reevaluation of safety margins in the seismic design of Angra 1 and 2	To be concluded June 2013	Eletronuclear is currently analyzing the EPRI-NP-6041 report and has issued the report GAN.T BN/G/6980/120008 to assess the safety margins of the seismic design of Angra 1 and Angra 2. The first contacts with EPRI have been done to set up the consulting services.
PE121	Updating of site geological and geotechnical survey	To be concluded October 2012	Eletronuclear contracted Federal University of Rio de Janeiro COPPETEC Foundation for technological research, studies and projects coordination for the service. Field surveys (geological and geotechnical) have already begun.

PE122	Reevaluation of slope stabilization works and slope monitoring system	To be concluded October 2012	Eletronuclear contracted Federal University of Rio de Janeiro COPPETEC Foundation for technological research, studies and projects coordination for the service. Follow-up reports have been updated to allow COPPETEC work of data assessment to begin. Field inspection for slope instrumentation evaluation has already begun.
PE123	Evaluation of extreme slope rupture conditions	To be concluded October 2012	Eletronuclear contracted Federal University of Rio de Janeiro COPPETEC Foundation for technological research, studies and projects coordination for the service. Studies of the Southeast slope integrity have already begun.
PE124	Evaluation of stability and integrity of pre-treated water reservoir in case of landslides	To be concluded December 2012	The evaluation report of the stability of the Pre-Treatment Water Station storage tank against sliding was issued in October 2011. The evaluation report of the water tank integrity had been already issued in August 2010 (inspection of the concrete structure of the Eastern Tank). Geotechnical investigation activities and report assessment for foundations design are still to begin.
PE132	Reevaluation of maximum sea wave height at NP Station shore	To be concluded September 2012	Eletronuclear is reevaluating the proponent proposal for contracting services.
PE133	Reevaluation of mole integrity	To be concluded December 2012	Services are on going but the contract had to be revised to cover the static and dynamic stabilities calculations of the protection piers of the water intakes of Angra 1, 2 and 3.
PE141	Revision of site flooding study for extremely severe weather conditions	To be concluded September 2012	Activities are in full development. The two first previewed simulation cases are already in results analysis step of and elaboration of flooding maps, while the third case continuous the work of modeling and cell division.
PE151	Evaluation of impact of tornadoes on Angra 1 and 2 safety related structures, systems and components	To be concluded June 2013	The Eletronuclear report SE.T/3/BP/011006 presenting the tornado concept proposed for Angra 3 was already submitted to CNEN. The follow up of activities depend on Regulator's answer. Then the approved concept will be applied to Angra 1 and 2.
PE152	Reevaluation of threatening by hurricanes	To be concluded December 2013	Studies were not proposed yet.
PROJECTS			
PE131	Implementation of acquisition, processing and monitoring systems for ocean and meteorological data	To be concluded December 2014	The scope to be contracted is still to be defined by Eletronuclear areas of environmental licensing and engineering, so as to fit the needs of updating oceanographic and meteorological data base in order to attend the defined environmental licensing programs.

(*) As referred in the "Eletronuclear Response Plan to the Fukushima Accident".

Activities performed by the regulator (CNEN)

CNEN reviewed the proposal by Eletronuclear and presented comments and some additional requirements.

With respect to earthquakes (PE111, PE112, PE113), CNEN request an updating of the fault map of the region and revision of the response spectrum according to the current state of the art.

With respect to flooding (PE141), CNEN requested that the study uses a recurrence time of 10 000 years for the maximum wave, and the investigation of possible siltation of the site drainage channels.

TOPIC 2 - DESIGN ISSUES

Internal events analyzed in the licensing of nuclear plants are caused by poor or non-functioning equipment operating systems and/or security. They can affect the normal operation of the plant, causing abnormal operations, operational transients or even accidents.

To ensure the ability to control the event consequences, external or internal, which endangers the safety of the installation, Eletronuclear power plants safety systems were designed with redundant equipments, so that their functions are ensured even in case of failure or unavailability of one of the redundancies.

Nevertheless, the Fukushima accident demonstrated that the ability of the NPP's prevention and mitigation systems to respond and operate under extreme scenarios need to be re-evaluated. This chapter is focused on actions to prevent severe damage to the reactor and the spent fuel pool, including any last resort means, as well as an evaluation of the time available to prevent severe damage.

Activities performed by the operator (Eletronuclear)

CODE*	OVERVIEW	SCHEDULE	RESULTS**
		STUDIES	
PE221	Conclusion of the revision of Angra 1 "Fire Hazard Analysis - FHA"	Started before the Fukushima event - to be concluded September 2013	EPRI is in charge of project development. Documents of the last assessment made in 1982 were sent by Eletronuclear to EPRI in order to provide source for comparison between current situation and the previous one. Since then, only two technical visits were done and the activities have not begun yet.
RF111	Verification of Angra 1 plant conditions for performing "feed-and-bleed" operation through the Steam Generators, under beyond-design-basis conditions, including station black out.	To be concluded December 2012	The study to survey the possibilities of meeting the technical power of the steam generators of Angra 1 was already initiated and it is expected the issue of a specific report for analyzing each of the alternatives considered.
RF121	Verification of Angra 2 plant conditions for performing "feed-and-bleed" operation through the Steam Generators, under beyond-design-basis conditions, including station black out.	To be concluded December 2012	Conceptual report being elaborated.
RF132	Feasibility study of alternative water supply for the nuclear power station from Mambucaba river	To be concluded March 2013	The service contract for energetic and hydric inventory survey was not yet authorized.
RF133	Feasibility study of alternative water supply for the nuclear power station from Praia Brava.	To be concluded June 2013	Studies have just begun.
RF134	Study of alternatives for a new water reservoir at site.	To be concluded June 2013	Studies have just begun.
RF211	Verification of existing conditions for "feed-and-bleed" operation in Angra 1.	To be concluded June 2013	Studies have just begun to assess Angra 1 possibilities of feed-and-bleed operation in Station Blackout.

RF222	Conceptual study on passive reactor cooling using heat exchangers inside the containment	To be concluded December 2012	AREVA is expected to give Eletronuclear a work proposal to issue a report based on studies made for German plants. In addition, Eletronuclear is studying the possibility of changing the reactor building layout in order to connect rooms, to establish maximum flooding levels, etc. in order to allow the primary system cooling by natural convection processes.
RF311	Calculation of Angra 1 spent fuel pool water temperature increase in case of loss of cooling systems	Concluded December 2011	Calculations done and information is available for Operations.
RF311-A	**New initiative on Feb 15th, 2012:** to assess the Angra 1 SFP water level decreasing in case of failure of all cooling systems.	To be concluded September 2012	Activities have been already initiated.
RF312	Study on alternative cooling possibilities for the Angra 1 spent fuel pool.	To be concluded September 2012	Studies were initiated considering the use of a mobile emergency cooling device, energy self-supplied, with all equipments needed for an emergency cooling, to be located outside fuel building. Westinghouse was contacted to develop a conceptual design.
RF321	Calculation of Angra 2 spent fuel pool water temperature increase in case of loss of cooling systems	Started **before** the Fukushima event: to be concluded December 2011	Calculations done and information is available for Operations.
RF321-A	**New initiative on Feb 15th, 2012:** to asses the Angra 2 SFP water level decreasing in case of failure of all cooling systems.	To be concluded September 2012	Activities have been already initiated.
RF322	Study on alternative cooling possibilities for the Angra 2 spent fuel pool.	To be concluded October 2012	Eletronuclear is waiting AREVA to deliver a work proposal to issue a report based on studies made for German plants.
RF412	Study on extension of Angra 1 batteries autonomy.	To be concluded December 2013	The studies of charges survey and connection times were initiated in February 2011.
RF422	Study on extension of Angra 2 batteries autonomy	To be concluded December 2012	Eletronuclear initiated the studies of charges survey and connection times and will ask AREVA a proposal for more detailed studies.
RF433	Feasibility study for a small hydroelectric power plant at Mambucaba river	Started **before** the Fukushima event: to be concluded September 2012	The service contract for energetic and hydric inventory survey was not yet authorized.
PROJECTS			
PE211	Conclusion of internal flooding study for Angra 1	To be concluded March 2013	Eletronuclear is contracting Westinghouse and defining internal teams to work on the development studies.
RF131	Implementation of improvements in the NP Station Pre-Treated Water Supply System	To be concluded June 2015	The bidding process for acquisition and implementing of a new backup water line is waiting approval by the legal department.
RF221	Implementation of systems and equipment for "feed-and-bleed" operation in Angra 2	To be concluded in the second half of 2012	Eletronuclear contracted AREVA for project services and supplying of all equipments and systems needed for full accomplishing of F&B operations in SBO conditions. Basic project is already approved and executive project is ongoing. All equipments are being concluded to be delivered.

RF411	Implementation of manual interconnection of emergency power busbars in Angra 1	Started before the Fukushima event: to be concluded December 2014	Eletronuclear is concluding a preliminary report on Angra 1 busbars interconnection conditions.
RF421	Implementation of power supply to Diesel System 2 consumers by Diesel System 1	Started before the Fukushima event: to be concluded September 2013	Eletronuclear issued technical reports on charges balances, short circuit, selectivity and accident description. Currently, is contracting AREVA for project detailing and electronic modules supply. Installation is planned for Outage 2P11 in 2013.

(*) As referred in the "Eletronuclear Response Plan to the Fukushima Accident".

(**) Status according to report Eletronuclear P-001/11, updated February 15th, 2012.

Activities performed by the <u>regulator (CNEN)</u>

CNEN reviewed the proposal by Eletronuclear and presented comments. However, each individual design modification will be evaluated under the normal licensing process which involves licensing of plant modification. Some minor modification can be performed under normal plant modification control and with notification to CNEN. Some other modifications will require prior approval by CNEN before implementation.

In relation to RF 111, 121 and 211, the proposal to extend of "feed and bleed" for conditions beyond the design basis were considered adequate, but CNEN waits for the final report to issue its final review.

In relation to the RF 400 series, related to electric supply, CNEN has requested an additional study about the reliability of the external grid and the establishment of a protocol between Eletronuclear and the National Electric System Operator (ONS) to give priority to the recovery of the electric supply to Angra NPPs in case of grid disturbances. The RF400 series was considered preliminarily adequate, but CNEN waits for the final report to issue its final review. RF 433, related to installation of a small hydroelectric plant nearby has not been evaluated by CNEN.

The report on the "stress test" was received by CNEN on April 2nd, 2012, and is under review.

TOPIC 3 – SEVERE ACCIDENT MANAGEMENT AND RECOVERY (ON-SITE)

This topic presents the actions taken by Eletronuclear in terms of reassessment of the resources deployed or being implemented to control or mitigate the consequences of accidents beyond the design basis, with emphasis on evaluation of the plants performance in case of simultaneous loss of normal power and emergency power (station blackout) and cold source (cooling water systems), including the assessment of the beyond the design basis procedures adequacy to this scenario, and considering the implementation of key measures for the mitigation of severe accidents.

Before the accident in Japan, the units of CNAAA already considered external events scenarios of extreme low probability in the development of their projects, procedures and resource allocation to control or mitigate the consequences of accidents beyond the design basis. This included the interaction with the European Commission to develop the Severe Accident Management. As part of the lessons learned from the accident at Fukushima, evaluations of international organizations that have issued recommendations, including the provision of mobile equipment that can be quickly connected and aligned to the plant systems and equipments to ensure safety functions necessary to control and mitigate the consequences of severe accidents.

In the situation of total loss of the reactor cooling, the time available until the beginning of core degradation (just a few hours) makes it recommendable that the plants are provided with mobile equipment that can be used to quickly restore this function. Ongoing trials in ELETRONUCLEAR included sizing and specification of mobile diesel generator sets and motor pumps, as well as the design of connections that allow fast alignment and activation of these resources. Some of these actions are already referenced in the tables of this report.

The resources (power plants equipment and systems) were analyzed as well as procedures and analysis tools available in the plants and the site to control accidents beyond the design basis, including probabilistic safety analysis, severe accidents management procedures, reactor cooling systems, fuel pools cooling systems, electrical energy emergency supply, requirements for station black-out, and post-accident instrumentation.

In conducting these studies, the recommendations were taken into consideration, in particular the specifications for the "Stress Test" issued by WENRA - Western European Nuclear Regulators Association and the questionnaire prepared by AREVA for the German plants. The analyses were developed considering the specific design of each of the two operating plants, Angra 1 and Angra 2.

Activities performed by the operator (Eletronuclear)

CODE*	OVERVIEW	SCHEDULE	RESULTS**
PROJECTS			
RF511	Development of PSA Level 2 for Angra 1	To be concluded December 2015	Work will be initiated in 2013.
RF512	Preparation and implementation of Severe Accident Management Guidelines for Angra 1	Started **before** the Fukushima event: to be concluded September 2012	Eletronuclear and Westinghouse have already signed the service contract and a first work order is being prepared for the beginning of the activities.
RF513	Development of PSA for Low Power and Plant Shutdown conditions in Angra 1	To be concluded December 2015	Work will be initiated in 2013.
RF521	Complementation of PSA Levels 1 and development of PSA Level 2 for Angra 2	To be concluded September 2013	AREVA has already presented a proposal and the hiring is ongoing.
RF522	Preparation and implementation of Severe Accident Management Guidelines for Angra 2	Started **before** the Fukushima event: to be concluded December 2013	Eletronuclear has already issued a report on SAMG approach and Angra 2 modeling and calculations via MELCOR code is ongoing. Preliminary calculation and training in Germany and a workshop in Brazil were done in 2011. It was initiated the work for structures identification, and components and systems to be used for mitigating severe accidents.

(*) As referred in the “Eletronuclear Response Plan to the Fukushima Accident”.

(**) Status according to report Eletronuclear P-001/11, updated February 15th, 2012.

Activities performed by the regulator (CNEN)

CNEN reviewed the proposal by Eletronuclear and presented comments. The additional PSA studies were already requested by CNEN before the Fukushima accident, and will be reviewed by CNEN on due time. Each individual procedure will be evaluated under the normal licensing process. CNEN will also follow the training program for plant operators before implementation of new procedures.

TOPIC 4 – NATIONAL ORGANIZATIONS

This chapter presents the results of the participations and collaboration with many different Brazilian organizations (government, regulator, technical support organizations, vendors, service providers and other stakeholders) involved in maintaining and enhancing nuclear safety, and efforts made to achieve and maintain or strengthen a high level of nuclear safety in these organizations.

CNEN and Eletronuclear participated in, and in certain instances led, discussions through the media and directly with the several organizations, including governmental and public in general through seminars and open meetings. In these opportunities, the Fukushima accident, corresponding consequences, comparison of project and operations characteristics, and how nuclear safety was jeopardized were discussed. The safety of the Brazilian reactors and concerns about the continuity of the National Nuclear Program were also recurrent discussions during several opportunities. In almost all of these opportunities there were programmed visits to the plants site.

Activities performed by the operator (Eletronuclear)

Since the information in this topic is not part of the Eletronuclear Response Plan, the resulting table has a little different format.

OVERVIEW	SCHEDULE	RESULTS
GOVERNMENTAL ENTITIES Since the Fukushima accident, Eletronuclear intensified its normal relations with different governmental entitites, participating on public sittings, meetings, pupporting regional projects for public defense or simply lecturing, including visits to Angra Nuclear Power Station. These entities include:		
Federal Senate of Brazil Federal Account tribunal (*Tribunal de Contas da União – TCU*) Federal Houses of Representatives State Houses of Representatives City Hall of the City of Angra dos Reis City Hall of the City of Paraty	Done through 2011	Public sittings for explanation or technical consulting about the Fukushima accident and the safety related matters regarding the Brazilian nuclear program.
Ministry of Defense of Brazil	July 2011	The President of Eletronuclear participated in the seminar "The Transformation of the National Defense – Structure, Resources and Capabilities to Face the Challenges of the XXI Century" where debated the Brazilian nuclear program and Japan-Brazil nuclear safety related matters and concerns.
	July 2011	The Assistant of Eletronuclear Presidency participated giving a lecture at the Brazil National War College (ESG).
Ministry of the Environment of Brazil	March 2012	Presentation of the Eletronuclear Response Plan to the Fukushima Accident at the National Council of the Environment (CONAMA) plenary in Brasília/DF.

Civil Defense of the State of Rio de Janeiro	December 2011	Technical meeting held at the Rio de Janeiro City Hall Operations Center between Civil Defense and Eletronuclear engineers about contingency plans for natural disasters and crisis situations, with the presence of Mr. Yosuke Yamashiki, Associate Professor at the Kyoto University Disaster Prevention Research Institute, talking about Fukushima.
	June 2011	Discussion about the Emergency Plan strategies and comparisons with the Fukushima case, held at the State Center for the Management of a Nuclear Emergency Situation (CESTGEN) in Rio de Janeiro during a coordination meeting in that institution.
	October and November 2011	Training course for elementary school teachers of the city of Angra dos Reis in Nuclear Energy and the Protection of the Community sponsored by the School of Civil Defense (ESDEC).
REGULATOR BODIES Eletronuclear has already established mechanisms for reporting and consulting the regulators according to Brazilian Law. Besides, due to the accident of Fukushima, there were taken some initiatives from both sides that imposed further contacts than those of routine.		
National Commission of Nuclear Energy (CNEN)	Done through 2011 and 2012	▪ Technical meetings and lectures at the Regulator's Headquarters on the impacts of the Fukushima accident. ▪ Presentation of the drafts and final report of the Eletronuclear Response Plan to Fukushima Accident.
Brazilian Institute of Environment and Renewable Natural Resources (IBAMA)	April 2011	Eletronuclear made a presentation in Rio de Janeiro, transmitted via videoconference to the institution units in the cities of Brasilia and Vitória, addressing the Brazilian nuclear power plants, nuclear safety, emergency plan, and comparing the Brazilian reactors with those of Fukushima Daiichi, in Japan.
	October 2011	Presentation at the Bocaina Mountains National Park.
UNIVERSITIES Eletronuclear made presentations in different meetings, technical seminars and other events promoted by Brazilian universities and their research institutes in respect to the consequences of the Fukushima accident and corresponding action plans.		
São Paulo State University – USP (State of São Paulo)	▪ Round table: "Nuclear Energy: from the anathema to the dialogue" at the Institute for Advanced Studies, São Paulo, March 2011. ▪ Institute of Biology, São Paulo, June 2011. ▪ Polytechnic School, São Paulo, October 2011.	
Federal University of Rio de Janeiro – UFRJ (State of Rio de Janeiro)	▪ Coordination of Post-Graduation in Engineering (COPPE), Rio de Janeiro, June 2011.	
Federal University of Pernambuco - UFPE (State of Pernambuco)	▪ Seminar at the 1st anniversary of the UFPE Nuclear Science Museum, Recife, July 2011.	
Fluminense Federal University – UFF (State of Rio de Janeiro)	▪ First International Conference on Risk Management and Civil Security, Niterói, December 2011.	
São Carlos University – USC (State of São Paulo)	▪ Second Meeting on Nuclear Energy and Environmental Protection, co-promoted by Eletronuclear, at the University of São Carlos Institute of Physics, São Carlos, June 2011.	

Rio de Janeiro State University – UERJ (State of Rio de Janeiro)	▪ "Nuclear Energy Seminar: Political, Economical and Environmental Aspects", UERJ Institute of Geography, Rio de Janeiro, April 2012.
Federal University of Minas Gerais – UFMG (State of Minas Gerais)	▪ *I SENCiR – Semana de Engenharia Nuclear e Ciências das Radiações* (First Week of Nuclear Engineering and Radiations Science) at the Nuclear Engineering Department of UFMG, Belo Horizonte, May 2012.

NUCLEAR ENERGY SPECIFIC EVENTS

Eletronuclear participated in or sponsored several national nuclear related activities with many different counterparts (universities, enterprises, government, military, nuclear design and equipment supplier, etc.) were the Fukushima event was part of the discussion, updating knowledge on the event, consequences trends in action plans. Also were considered the partnerships on projects and common actions, even those being started before the Fukushima accident but related to it.

World Nuclear University – WNU Training course: Key Issues in the world nuclear industry Today (two applications)	Rio de Janeiro and Angra dos Reis, March 2012
International Conference on Nuclear Energy at the 41st Engineering Week at the Armando Álvares Penteado Foundation (FAAP)	São Paulo, May 2011
International Nuclear Atlantic Conference with participation of IAEA (INAC 2011)	Belo Horizonte, October 2011
III National Nuclear Energy Seminar, with participation of CNEN, AREVA, Westinghouse, GE-Hitachi, representatives from several countries from South America, etc.	Rio de Janeiro, February 2012
Lecture "Perspectives of Nuclear Energy in Brazil and in the world" as part of the course "History and Perspective of Nuclear Energy in Brazil" at the Research Institute of Nuclear Energy (IPEN)	São Paulo, June 2011

TECHNICAL SEMINARS IN GENERAL

In different cities in Brazil actions were taken with direct participation of Eletronuclear in respect to the consequences of the Fukushima accident and corresponding action plans. There were events (meetings, technical seminar, lectures and others) to which Eletronuclear contributed adding the Fukushima theme as part of the agenda. Also through 2011, increasing participation on press and communication media events. (Interviews on television, radio, newspapers, etc.)

Lecture "Perspectives of Nuclear Energy in Brazil and in the world" as part of the course "History and Perspective of Nuclear Energy in Brazil" at the Research Institute of Nuclear Energy (IPEN)	São Paulo, June 2011
"Seminar on Nuclear Energy post-Fukushima" promoted by the Studies Group for the Electric Sector (GESEL)	Rio de Janeiro, August 2011
Presentation to the Eletrobras Administrative Board (the holding company)	Rio de Janeiro, April 2011

NON NUCLEAR SPECIFIC EVENTS AND OTHER INSTITUTIONS

Technical or non technical events in which the Fukushima accident was discussed.

World Management Forum promoted by the Latinamerican Institute of Quality (Instituto Latinoamericano de la Calidad – INLAC)	Rio de Janeiro, May 2011
XXVI Meeting of the Brazilian Association of Maintenance - ABRAMAN Congress	Curitiba, September 2011
Electrical Engineering Meeting, held at State University of Campinas (UNICAMP)	Campinas, August 2011

Thermal Power & Fuels 2011, a congress for thermal energy producers promoted by the International Quality & Productivity Center (IQPC)	Rio de Janeiro, September 2011
XVI Annual Meeting of the Chemical Industry at the Brazilian Association of Chemical Industry (ABIQUIM)	Rio de Janeiro, May 2011
Brazilian Energy Conference	Brasilia, December 2011

OTHERS:

- Federal Council of Engineering and Agronomy (CONFEA) - São Paulo, March 2011
- Industry Federation of Rio de Janeiro (FIERJ) - Rio de Janeiro, April 2011
- Brazilian Institute of Finance Executives (IBEF) - Rio de Janeiro, April 2011
- Fernando Henrique Cardoso Institute (IFHC) - São Paulo, April 2011
- Union of Chemistry Industry of Rio de Janeiro - Rio de Janeiro, May 2011
- General Confederation of the Brazilian Workers (CGT) - São Paulo, June 2011
- Naval Club of Rio de Janeiro - Rio de Janeiro, July 2011
- Industry Federation of Bahia (FIEBA) - Salvador, September 2011
- Agulhas Negras Military Academy (AMAN) - Rezende, September 2011
- National Academy of Engineering (ANE) - São Paulo, September 2011
- Getúlio Vargas Foundation (FGV) - Rio de Janeiro, February 2012

MIDIA INTERFACES

The history of the Fukushima event, from the point of view of the Eletronuclear Press Coordination, can be divided in four moments:

- The first one, in the very day of the accident, Eletronuclear released a preventive press note assuring the safety of Brazilian power plants and through some of its high staff engineers acting as spokesmen, explanations to the public.
- In the second moment, when situation in Japan became seriously worsened, interviews were requested in order to compare Brazilian and Japanese technologies, contingencies against tsunamis and earthquakes and general safety of Angra plants, as well as increased the number of press members visits to the plants site.
- In the third moment, discussion on the future of the Brazilian nuclear program arose and
- The fourth moment the focus was directed toward the future of the Brazilian nuclear program, emergency preparedness, licensing, and waste processing. As consequence, the number of public audits and visits from government authorities to the plants site increased.

In one month after the Fukushima accident, Eletronuclear responded to 122 journalists, a number five times higher than usual in the previous months. It was published more than 500 news, in all kinds of media, almost twice the routine average number.

It was noticed that a great number of press stakeholders was unaware of the subject (nuclear matters), specially those that usually are not related to scientific coverings. In addition, Eletronuclear proactive attendance and transparency to the press softened the tone of the negative stories and gave the company credibility.

As a result of Eletronuclear efforts to promptly interact with media requests, considering all work done in the first months after the accident, important actions were taken: to continue the process in place for press interface, to increase the number of spokesmen and to reinforce constantly the media training.

Eletronuclear Spokesmen Training Cycle	Rio de Janeiro, October 2011
Workshop for journalists on the scene of nuclear industry after the accident of Fukushima	Rio de Janeiro, November 2011

Activities performed by the regulator (CNEN)

CNEN also participated in most of the above activities together with Eletronuclear, such as:

- Federal Senate of Brazil Public Siting

- Federal Account tribunal (*Tribunal de Contas da União – TCU*)
- Federal Houses of Representatives Public Hearings
- State Houses of Representatives Public Hearing
- City Hall of the City of Angra dos Reis Public Information Hearing
- City Hall of the City of Paraty Public Information hearing
- Training course for elementary school teachers of the city of Angra dos Reis in Nuclear Energy and the Protection of the Community sponsored by the School of Civil Defense (ESDEC).
- International Nuclear Atlantic Conference with participation of IAEA (INAC 2011)
- Seminar on Nuclear Energy post-Fukushima" promoted by the Studies Group for the Electric Sector (GESEL)
- Nuclear Energy Seminar: Political, Economical and Environmental Aspects", UERJ Institute of Geography, Rio de Janeiro, April 2012.

Regarding Media Interface, CNEN staff also participated in numerous interviews and round tables, first to clarify the Fukushima accident situation and latter to discuss the impact in the Brazilian nuclear power plants and the Brazilian nuclear program.

TOPIC 5 – EMERGENCY PREPAREDNESS AND RESPONSE AND POST-ACCIDENT MANAGEMENT (OFF-SITE)

Among important actions taken regarding Emergency Preparedness and Response and Post-Accident Management, it can be mentioned the improvement in the actions of the Emergency Plans exercise conducted at the region of the plants. An exercise of the External Emergency Plan was scheduled for 2011, including evacuation of population and effective participation of external organizations. Due to the Fukushima event, for the first time the exercise was extended for two days, with events assumed to occur in both units. Some of the activities were enhanced such as: the communication of the details of the exercise was improved, distribution of potassium iodine pills and improvement and increase of supporting military emergency and local coordination centers.

A simulation of total loss of Emergency Local Coordination Center, and use of an auxiliary Emergency Center, with necessary facilities was exercised. Improvements related to communications were carried out to allow extensive use of Internet, with video-conference among the several emergencies centers. During the exercise, graphics and diagrams of the Meteorological and Radiological System of CNEN (ARGOS) were received in the Emergency Coordination Center each hour, showing the real conditions and the location of the simulated release.

In the case of an emergency in CNAAA classified as Area Emergency or General Emergency coincident with an obstruction of the state highway (BR-101) in a passage that impact the evacuation of a given population the protective measure may be the sheltering. Even though, Eletronuclear decided on a feasibility study for the construction of wharves (docks) as alternative for population evacuation. The operability of these docks will be studied in conjunction with the State Secretariat of Civil Defense of Rio de Janeiro and submitted to the Committee for Planning and Response to a Nuclear Emergency in the city of Angra dos Reis - COPREN / AR. In addition, Eletronuclear is developing studies on several areas such as the construction of a small hydroelectric plant in the region of plants as a backup in case of a total loss of external and emergency (12 diesel generators) power supply.

Activities performed by the operator (Eletronuclear)

CODE*	OVERVIEW	SCHEDULE	RESULTS**
STUDIES			
CR311	Enlargement of wharves around the site for transportation of personnel and equipment	To be concluded March 2013	Although Eletronuclear contracted studies for developing projects of wharves in Praia Vermelha and Frade, both regions located 10km from the plants (towards south and north respectively), the definition of the places of construction is delayed, being discussed with Angra dos Reis City Hall representatives.
RF432	Study on additional emergency power supply unit for the site	To be concluded June 2014	Studies not yet initiated.
RF434	Study to define alternative schemes for oil resupplying for the emergency power diesels	To be concluded March 2013	Studies not yet initiated.

RF613	Study on alternative radiological control equipment for extreme emergency situations	To be concluded December 2012	A mobile radiological control station is being studied to be built on a truck to be located next to the Medical Centre for Ionizing Radiations in Mambucaba. The company chosen is the Scania do Brasil Co., specialized in trucks, buses and military vehicles. Basic layout is ready and being revised to allow equipment specification until June 2012.
PROJECTS			
CR111	Implementation of H_2 passive recombiners in Angra 1	To be concluded June 2014	Eletronuclear asked Westinghouse a proposal for the project, equipment supply and installation.
CR112	Implementation of filtered containment venting in Angra 1	To be concluded December 2014	Eletronuclear asked Westinghouse a proposal for the project, equipment supply and installation.
CR121	Implementation of hydrogen passive recombiners in Angra 2	Started **before** the Fukushima event -Mar 2014	Eletronuclear received from AREVA a proposal for the project, equipment supply and installation and is analyzing it to start implementation.
CR122	Implementation of filtered containment venting in Angra 2	Started **before** the Fukushima event -Dec 2014	Eletronuclear asked AREVA a proposal for the project, equipment supply and installation.
CR211	Implementation of containment sampling system in Angra 1 qualified for beyond design basis accident conditions	To be concluded December 2014	Eletronuclear asked Westinghouse a proposal for the project, equipment supply and installation.
CR221	Implementation of primary circuit and containment sampling system in Angra 2 qualified for beyond design basis accident conditions	To be concluded December 2014	Eletronuclear asked AREVA a proposal for the project, equipment supply and installation.
CR312	Implementation of local alternative evacuation routes for emergency planning	To be concluded December 2012	The Brazilian National Department of Roads Infrastructure has completed the work in the Road BR-101 that give access to the plants, only remaining the definition of the pathway material in between Praia Brava and the Road BR-101.
CR313	Implementation of improvements in the Emergency Centers	To be concluded June 2013	Work started with visits scheduled yet for the month of February in order to meet the Operations Center of the Municipality of Campinas and also the security systems manufactured by Bosh in the installations of this manufacturer.
RF112	Implementation of mobile water pumping units to feed Angra 1 Steam Generators	To be concluded March 2013	Eletronuclear elaborated a preliminary list of equipments to be specified, according to studies done to accomplish initiative RF111, including mobile power supply for the feedwater auxiliary pumps and an independent Diesel generator to feed the Steam Generator with see water or other alternative water sources. It is pending the specification of pipings, isolation valves, connections, etc.
RF122	Implementation of mobile water pumping units to feed Angra 2 Steam Generators	To be concluded March 2013	Eletronuclear is defining the system requirements for further specifications of the mobile pumps to be used in the Steam Generators emergency water supply.
RF431	Implementation of manual interconnection of emergency power busbars of Angra 1 and Angra 2	To be concluded December 2013	Eletronuclear is concluding a preliminary report on Angra 2 busbars interconnection conditions.

RF435	Purchasing of mobile emergency diesel unit and connections to supply both Angra 1 and 2	To be concluded June 2013	Studies for dimensioning the Diesel generators have been already initiated.
RF611	Implementation of additional means to assure door opening possibility under extreme emergency situations	To be concluded December 2013	Studies have been already initiated.
RF612	Implementation of additional means to assure internal building lighting under extreme emergency situations	To be concluded September 2013	Studies have been already initiated.

(*) As referred in the "Eletronuclear Response Plan to the Fukushima Accident".

(**) Status according to the report Eletronuclear P-001/11, updated February 15th, 2012.

Activities performed by the <u>regulator (CNEN)</u>

CNEN reviewed the proposal by Eletronuclear and presented comments. The proposals involving design or procedure modifications will be evaluated under the normal licensing process.

The proposals related to the RF 400 series, RF 600 series, CR111, CR112, CR121, CR122, RF112 and RF122 were considered, preliminarily, adequate, but CNEN waits for the final report to issue its final review.

Activities performed by the <u>Brazilian Nuclear Protection System – Sipron</u>

The Nuclear Program Protection System (Sipron) is a comprehensive structure for nuclear emergency preparedness and for protection of the Brazilian Nuclear Program. This structure comprises organizations from the federal, state and local levels involved with emergency planning, health, energy, intelligence, public safety and security matters. The central organization of Sipron is the Institutional Security Cabinet of the Presidency of Republic of Brazil.

After the Fukushima accident some activities have been performed to improve the emergency preparedness and planning. The most important initiatives are:

I. Frequency of the Nuclear Emergency Exercises

The frequency of the emergency exercises has been considerably increased and Sipron is now performing at least one emergency communication training activity per month. Besides that, every other year a complete emergency drill is conducted by all the organizations involved in a nuclear emergency situation.

II. Duration the Nuclear Emergency Exercises

After the Fukushima Nuclear Accident, the length of time of the nuclear emergency exercise and training has been increased from one to two days. This allows for a better evaluation of the practices and procedures of the various institutions involved with an nuclear accident situation.

III. Maritime Population Evacuation

The evacuation of the population from regions closed to the nuclear power plant by a Navy landing craft is being considered after the Fukushima accident. To test this emergency procedure, a specially designed withdraw exercise has been planned and performed within the nuclear emergency exercise of 2011.

IV. Distribution of Potassium Iodite Tablets

Potassium Iodine tablets have been distributed for a sample population as part of the procedures for emergency situation. Although the tablets were stored at Eletronuclear Center for Ionizing Radiation Medicine, its distribution was tested by the first time in 2011 nuclear emergency simulation exercise.

V. Simultaneous Accident Simulation in Nuclear Two Power Plants

At Angra dos Reis site, there are two nuclear power plants in operation and a third one under construction. Before the Fukushima accident, Sipron used to simulate a nuclear accident only in one of the two reactors at a time. The events in Japan demonstrated that there is a possibility of an accident involving both reactors at the same time and, as a consequence, this new scenario is now being studied and simulated.

VI. Simulation and Exercise Methodology Improvements

After the evaluation of the nuclear emergency training in 2011 and considering the lessons learned from Fukushima accident, Sipron decided to convey an extensive review of the simulation methodology. This review comprises the development an electronic and computerized tool to support the decision making and evaluation processes during a nuclear emergency. This new simulation support tool will allow the development of different nuclear accident scenarios that will be presented to the various decisions levels and ultimately evaluate their responses to diverse situations.

VII. Activation and Interconnection of Four Nuclear Emergency Centers

After the Fukushima accident, a review on the Sipron procedures demonstrated the need for voice, image, telephone and internet connection between our four nuclear emergency centers:

- Center for the Management of Nuclear Emergency Situations (**CNAGEN** - Brasília, DF)
- Rio de Janeiro State Center for the Management of Nuclear Emergency Situations (**CESTGEN** - Rio de Janeiro, RJ)
- Center for Nuclear Emergency Coordination and Control (**CCCEN** - Angra dos Reis, RJ)
- Nuclear Emergency Information Center (**CIEN** -Angra dos Reis, RJ)

All connections are going to be implemented during 2012 and 2013.

TOPIC 6 – INTERNATIONAL COOPERATION

In this chapter Eletronuclear presents the results of the efforts to establish a high level of international cooperation with many different organizations involved in maintaining and/or enhancing nuclear safety, by interacting directly (by promoting visits to the country or sending people outside in technical exchange missions) or indirectly (by consulting documents and other actions as well), and efforts made to achieve and maintain or strengthen a high level of nuclear safety as well as using the operational and corporative experience from the impacts of the Fukushima accident to the Brazilian nuclear industry.

International organizations, such as GDFSuez, AREVA, Westinghouse and Rosatom were invited to discuss with Eletronuclear professionals aspects related to the Fukushima event and improvements needed.

Although no specific actions have been taken or planned to enhance the capability to offer or receive assistance to another country should a severe accident occur, Brazilian Government has established open channel with its neighbours that are, at the same time, nuclear partners, including the IAEA Regional Latin America project with Argentina and Mexico and a term of cooperation with Argentina.

Many different actions have been taken by Eletronuclear, even before the Fukushima event, to strengthen the global nuclear safety regime: a continued and increased use of IAEA safety standards, the host and participation in meetings and review missions from the IAEA and WANO, enhancement of the transparency and effectiveness of communication among operators, regulators, international organizations and the public. Since 2008 discussion and programmes have been developed with the European Commission.

CNEN on the other hand has established contacts with other regulatory bodies in Latin America, through the Ibero-American Forum of Nuclear Regulators, and participated actively in several international meetings, such as the Ministerial Meeting organized by the IAEA and the International Meeting organized by the UN Director General. More recently, in March 2012 Brazil has sent a 5 man delegation to the meeting organized by Japan authorities to review the emergency actions after the tsunami.

Activities performed by the operator (Eletronuclear)

OVERVIEW	SCHEDULE	RESULTS
5th Meeting of the Convention on Nuclear Safety (Austria)	April 2011	Eletronuclear participated in the discussions of the actions to be taken by the other Contracting Parties to improve world nuclear safety in light of Fukushima accident. Besides, there was a presentation by the Japanese delegation with following discussion about the event in Fukushima.

IAEA SAGNE - Standing Advisory Group Meeting on Nuclear Energy (Austria)	October 2011	The Assistant of the Eletronuclear Presidency, member of SAGNE, participated in the meeting discussing the consequences of the accident at Fukushima Daiichi for the development of nuclear programs worldwide. Also on the agenda there were the results of the ministerial meeting on nuclear safety held in June by the IAEA, the Director General's report and the post-Fukushima action plan outlined by the entity.
IAEA Workshop on Final Inputs for Design and Implementation of Safety Culture Oversight Programmes (France)	April 2011	Eletronuclear participated in several international nuclear related activities were the Fukushima event was part of the discussion, updating knowledge on the event, consequences and trends in action plans.
IAEA OSART Mission, Seabrok NPP (USA)	July 2011	
AREVA Nuclear Executive Meeting (France)	September 2011	
American Nuclear Society Winter Meeting, including "Nuclear Safety in a Post-Fukushima World", (USA)	October 2011	
IAEA Workshop on Establishing the Safety Infrastructure for a National Nuclear Power Programme (Brazil)	October 2011	
WANO Biennial General Meeting (China)	November 2011	
WANO Fukushima Forum, (USA)	November 2011	
Visit of the President of Eletronuclear to the Fukushima site with meetings in TEPCO and METI (Japan)	January 2012	
International ISOE ALARA Symposium (USA) *ISOE - Information System on Occupational Exposure*	January 2012	
American Nuclear Society (ANS) Winter Meeting (USA)	October 2011	
Response to the WANO Significant Operating Experience Report - SOER 2011-2 (Brazil)	December 2011	Response to WANO SOER 2011-2 (document P-409/11)
Follow up of WENRA stress tests recommendations and corresponding results by European plants	Since April 2011	Comparing and adjusting as necessary Eletronuclear plants stress test in light of the WENRA recommendations and results.
Meetings with: ROSATOM GDF Suez WESTINGHOUSE (Brazil)	May, October and November 2011, respectively	Technical meeting at Eletronuclear Head Office about actions and opportunities of cooperation on resulting actions and design modification changes due to the Fukushima accident.
IAEA Workshop on Establishing the Safety Infrastructure for a National Nuclear Power Programme (Brazil)	October 2011	Lectures at the cities of Rio de Janeiro, and Angra dos Reis.
Technical and/or scientific interchanges between Eletronuclear and Nucleoelectrica Argentina S.A. – NA-SA (Brazil and Argentina)	Since 1992	Contract for technical and scientific cooperation interchange during outages, congresses and other technical or scientific activities.

Follow up of NRC recommendations	October 2011	Reassessment of external events causes: earthquakes, floodings, station black-out, emergency water supply, containment relief, integration between emergency procedures, BDBA and mitigation after core degradation, etc.
Indication of Eletronuclear experts for WANO special projects on lessons learnt from the Fukushima accident (Brazil)	February 2012	As per WANO request, November 2011, Eletronuclear indicated experts to support developing WANO projects based on lessons learnt from the Fukushima accident.
JAIF/ICC Seminar: the Fukushima NPP Accident (Brazil)	March 2012	Seminar organized by Eletronuclear and the Japan Atomic Industrial Forum International Cooperation Center (JAIF/ICC) on the Fukushima event and its consequences in Japan and worldwide. In the opportunity the Eletronuclear Response Plan to Fukushima was presented to the company's main stakeholders and employees.
Response to the WANO Significant Operating Experience Report - SOER 2011-3 (Brazil)	2011 and 2012	Recommendations for checking the fuel pools on the possibility of cooling and water level maintenance. (Several items to be responded in 90, 120 and 150 days).
International Network for Safety Assurance Fuel Cycle Industry – INSAF (France)	March 2012	Presentation made by Brazilian Nuclear Industries (INB), the manufacturer of the Angra NPP fuel, about the Eletronuclear Response Plan to the Fukushima Accident at the international meeting in Paris.
WANO Paris Centre – Stress Tests Results Conference (Italy)	April 2012	The main objective of this conference held in Rome was to enable senior Nuclear Power Plants Experts and Managers to share their experience of managing the new challenges of required changes in operation and modifications in the design following Fukushima events. Participated in this event the Eletronuclear Operation and Commercialization Director and the Technical Advisor for the company's CEO.
ATMEA Safety Review Conference (Brazil)	April 2012	Seminar given to Brazil by ATMEA (a joint venture between AREVA and Mitsubishi Heavy Industry) about the ATMEA reactors safety basic design characteristics and operational performance, together with a discussion on "Beyond Design Basis External Events" and how the ATMEA1 reactor would face the extreme situations like those from Fukushima.
WANO Nuclear Oversight (Brazil)	April 2012	The WANO Nuclear Oversight seminar intended to establish a process which measures and assesses plant performance through a combination of independent monitoring activities (audits, surveillances, inspections, etc.) and objective reviews of plant performance indicators. Both closely focused on those plant activities having the greatest impact to safety and overall risk.

Activities performed by the regulator (CNEN)

CNEN also participated in international activities, as mentioned in the introduction. In special, CNEN participated in the Ministerial Meeting organized by the IAEA in June 2011, in Vienna, and the Heads of States Meeting organized by the UN in New York.

Under the sponsorship of the Ibero-American Forum of Nuclear Regulators (FIARN), also has organized a meeting in Madrid, in September 20112, and has requested a formal report from its members in 2012.

Annexes

Annex I.– EXISTING INSTALLATIONS

I.1. Angra 1

Thermal power	1876 MWth
Gross electric power	640 MWe
Net Electric power	610 MWe
Type of reactor	PWR
Number of loops	2
Number of turbines	1 (1High Pressure/2Low pressure)
Containment	Dry cylindrical steel shell and external concrete building.
Fuel assemblies	121
Main supplier	Westinghouse El. Co.
Architect Engineer	Gibbs & Hill / Promon Engenharia
Civil Contractor	Construtora Norberto Odebrecht
Mechanical Erection	Empresa Brasileira de Engenharia
Construction start date	March 1972
Core load	20 September 1981
First criticality	13 March 1982
Grid connection	1 April 1982
Commercial operation	1 January 1985

I.2. Angra 2

Thermal Power	3765 MWth
Gross electric power	1345 MWe
Net electric power	1275 MWe
Type of reactor	PWR

Number of loops	4
Number of turbines	1 (1High Pressure/3Low pressure)
Containment	Dry spherical steel shell and external concrete building.
Fuel assemblies	193
Main supplier	Siemens KWU
Architect Engineer	ELETRONUCLEAR/Siemens KWU
Civil Contractor	Construtora Norberto Odebrecht
Mechanical Erection	Unamon
Construction start date	1975
Core load	30 March 2000
First Criticality	14 July 2000
Grid connection	21 July 2000
Commercial operation	January 2001

I.3. Angra 3

Thermal Power	3765 MWth
Gross electric power	1312 MWe
Net electric power	1229 MWe
Type of reactor	PWR
Number of loops	4
Number of turbines	1 (1High Pressure/3Low pressure)
Containment	Dry spherical steel shell and external concrete building.
Fuel assemblies	193
Main supplier	Areva
Architect Engineer	ELETRONUCLEAR
Civil Contractor	na
Mechanical Erection	na
Construction start date	1978

Construction restart date	1 July 2010
Core load	(2015)
First Criticality	(2015)
Grid connection	(2015)
Commercial operation	(2016)

Annex II - SUMMARY TABLE

ACTIVITY*	ACTIVITIES BY THE OPERATOR		
	(Item 2.a) Activity	(Item 2.b) Schedule or Milestones for Planned Activities	(Item 2.c) Results Available
Topic 1 – EXTERNAL EVENTS			
PE 111: Updating and reevaluation of geological data basis.	Ongoing	To be concluded December 2014	No
PE 112: Updating and reevaluation of seismic data basis and seismic threatening	Ongoing	To be concluded December 2014	No
PE 113: Reevaluation of safety margins in the seismic design of Angra 1 and 2.	Ongoing	To be concluded June 2013	Yes
PE 121: Updating of site geological and geotechnical survey.	Ongoing	To be concluded October 2012	Yes
PE 122: Reevaluation of slope stabilization works and slope monitoring system.	Ongoing	To be concluded October 2012	Yes
PE 123: Evaluation of extreme slope ruptures conditions.	Ongoing	To be concluded October 2012	Yes
PE 124: Evaluation of stability and integrity of pre-treated water reservoir in case of landslides.	Ongoing	To be concluded December 2012	Yes
PE 132: Reevaluation of maximum sea wave height at NP Station shore.	Ongoing	To be concluded September 2012	Yes
PE 133: Reevaluation of mole integrity.	Ongoing	To be concluded December 2012	Yes
PE 141: Revision of site flooding study for extremely severe weather conditions.	Ongoing	To be concluded September 2012	Yes
PE 151: Evaluation of impact of tornadoes on Angra 1 and 2 safety related structures, systems and components.	Ongoing	To be concluded June 2013	Yes
PE 152: Reevaluation of threatening by hurricanes.	Planned	To be concluded December 2013	No
PE 131: Implementation of acquisition, processing and monitoring systems for ocean and meteorological data..	Ongoing	To be concluded December 2014	Yes
Topic 2 – DESIGN ISSUES			
PE 221: Conclusion of the revision of Angra 1 “Fire Hazard Analysis - FHA".	Ongoing	Started **before** the Fukushima event - to be concluded September 2013	Yes
RF 111: Verification of Angra 1 plant conditions for performing "feed-and-bleed" operation through the Steam Generators, under beyond-design-basis conditions, including station black out..	Ongoing	To be concluded December 2012	Yes
RF 121: Verification of Angra 2 plant conditions for performing "feed-and-bleed" operation through the Steam Generators, under beyond-design-basis conditions, including station black out.	Ongoing	To be concluded December 2012	Yes

RF 132: Feasibility study of alternative water supply for the nuclear power station from Mambucaba river.	Ongoing	To be concluded March 2013	Yes
RF 133: Feasibility study of alternative water supply for the nuclear power station from Praia Brava.	Ongoing	To be concluded June 2013	No
RF 134: Study of alternatives for a new water reservoir at site.	Ongoing	To be concluded June 2013	Yes
RF 211: Verification of existing conditions for "feed-and-bleed" operation in Angra 1	Ongoing	To be concluded June 2013	Yes
RF 222: Conceptual study on passive reactor cooling using heat exchangers inside the containment	Ongoing	To be concluded December 2012	Yes
RF 311: Calculation of Angra 1 spent fuel pool water temperature increase in case of loss of cooling systems	Taken	Concluded December 2011	Yes
RF311-A: To assess the Angra 1 SFP water level decreasing in case of failure of all cooling systems.	Ongoing	To be concluded September 2012	No
RF 312: Study on alternative cooling possibilities for the Angra 1 spent fuel pool .	Ongoing	To be concluded September 2012	Yes
RF 321: Calculation of Angra 2 spent fuel pool water temperature increase in case of loss of cooling systems.	Taken	Started **before** the Fukushima event: concluded December 2011	Yes
RF 321-A: Study on alternative cooling possibilities for the Angra 2 spent fuel pool.	Ongoing	To be concluded September 2012	Yes
RF 322: Study on alternative cooling possibilities for the Angra 2 spent fuel pool .	Ongoing	To be concluded October 2012	Yes
RF 412: Study on extension of Angra 1 batteries autonomy.	Ongoing	To be concluded December 2013	Yes
RF 422: Study on extension of Angra 2 batteries autonomy.	Ongoing	To be concluded December 2012	Yes
RF 433: Feasibility study for a small hydroelectric power plant at Mambucaba river.	Ongoing	Started **before** the Fukushima event: to be concluded September 2012	No
PE 211: Conclusion of internal flooding study for Angra 1.	Ongoing	To be concluded March 2013	Yes
RF 131: Implementation of improvements in the NP Station Pre-Treated Water Supply System.	Ongoing	To be concluded June 2015	Yes
RF 221: Implementation of systems and equipment for "feed-and-bleed" operation in Angra 2.	Ongoing	To be concluded June 2012	Yes
RF 411: Implementation of manual interconnection of emergency power busbars in Angra 1.	Ongoing	Started **before** the Fukushima event: to be concluded December 2014	Yes
RF 421: Implementation of power supply to Diesel System 2 consumers by Diesel System 1.	Ongoing	Started **before** the Fukushima event: to be concluded September 2013	Yes
Topic 3 – SEVERE ACCIDENT MANAGEMENT			
RF 511: Development of PSA Level 2 for Angra 1	Planned	To be concluded in December 2015	No

RF 512: Preparation and implementation of Severe Accident Management Guidelines for Angra 1	Ongoing	Started **before** the Fukushima event: to be concluded in September 2012	No
RF 513: Development of PSA for Low Power and Plant Shutdown conditions in Angra 1	Planned	To be concluded in December 2015	No
RF 521: Complementation of PSA Levels 1 and development of PSA Level 2 for Angra 2	Ongoing	To be concluded in September 2013	No
RF 522: Preparation and implementation of Severe Accident Management Guidelines for Angra 2	Ongoing	Started **before** the Fukushima event: to be concluded in December 2013	Yes
Topic 4 – NATIONAL ORGANIZATIONS			
Public Sittings requested by Federal and State levels and by Representatives in the cities of Angra dos Reis and Paraty	Taken	Not Applicable, Completed through 2011	Yes
Technical Seminar with the Ministry of Defense of Brazil	Taken	Not Applicable, Completed July 2011	Yes
Technical meeting at the Rio de Janeiro City Hall Operations Center between Civil Defense and Eletronuclear engineers about contingency plans for natural disasters and crisis situations, with the presence of Mr. Yosuke Yamashiki, Associate Professor at the Kyoto University Disaster Prevention Research Institute, talking about Fukushima.	Taken	Not Applicable, Completed December 2011	Yes
Lectures to the Civil Defense of Rio de Janeiro at CESTGEN	Taken	Not Applicable, Completed June 2011	Yes
Training course in Nuclear Energy and the Protection of the Community for elementary school teachers in the city of Angra dos Reis.	Taken	Not Applicable, Completed November 2011	Yes
Meetings at the Brazilian Nuclear Regulator (CNEN) Headquarters on the impacts of the Fukushima Accident.	Taken	Not Applicable, Completed through 2011	Yes
Meetings at CNEN for presentation of the drafts and final report of the Eletronuclear Response Plan to Fukushima Accident	Taken	Not Applicable, Completed through 2011	Yes
Lectures at the IBAMA Headquarters	Taken	Not Applicable, Completed April 2011	Yes
Eletronuclear Spokesmen Training Cycle	Taken	Not Applicable, Completed in two applications in 2011	Yes
Eletronuclear Workshop for journalists	Taken	Not Applicable, Completed November 2011	Yes
Technical meetings at Coordination of Post-Graduation in Engineering of the Federal University of Rio de Janeiro (COPPE)	Taken	Not Applicable, Completed through 2011	Yes
Participation in UNICAMP Congress	Taken	Not Applicable, Completed August 2011	Yes
Lecture at UFPE Nuclear Science Museum	Taken	Not Applicable, Completed July 2011	Yes
Interviews for major midia steakholders (tv, radio, journal, internet, magazines)	Taken	Not Applicable, Completed through 2011	Yes
Lectures at the First International Conference on Risk Management and Civil Security at UFF	Taken	Not Applicable, Completed December 2011	Yes
Lectures at the INLAC Congress	Taken	Not Applicable, Completed June 2011	Yes
Technical papers presentation and lectures at the INAC Congress	Taken	Not Applicable, Completed October 2011	Yes
XXVI Meeting of the Brazilian Association of Maintenance - ABRAMAN Congress	Taken	Not Applicable, Completed September 2011	Yes

Participation in the Thermal Power & Fuels 2011, promoted by the International Quality & Productivity Center (IQPC) in Rio de Janeiro.	Taken	Not Applicable, Completed September 2011	Yes
Brazilian Energy Conference, in Brasilia.	Taken	Not Applicable, Completed December 2011	Yes
III National Nuclear Energy Seminar, with participation of CNEN, AREVA, Westinghouse, GE-Hitachi, etc. in Rio de Janeiro	Taken	Not Applicable, Completed February 2012	Yes
World Nuclear University – WNU Training course: main concerns in the current world nuclear industry	Taken	Not Applicable, Completed March 2012	Yes
International Conference on Nuclear Energy - Federal and Regional Council of Engineering and Agronomy (CONFEA/CREA)	Taken	Not Applicable, Completed May 2011	Yes
Brazilian Association of Chemical Industry (ABIQUIM)	Taken	Not Applicable, Completed May 2011	Yes
National Academy of Engineering (ANE)	Taken	Not Applicable, Completed September 2011	Yes
"Nuclear Energy Seminar: Political, Economical and Environmental Aspects" held at the Rio de Janeiro State University – UERJ.	Taken	Not Applicable, Completed April 2012	Yes
First Week of Nuclear Engineering at the Federal University of Minas Gerais – UFMG, Belo Horizonte.	Taken	Not Applicable, Completed May 2012	Yes
Topic 5 – EMERGENCY PREPAREDINESS AND RESPONSE AND POST-ACCDENT MANAGEMENT			
CR 311: Enlargement of wharves around the site for transportation of personnel and equipment.	Ongoing	To be concluded March 2013	Yes / No
RF 432: Study to define alternative schemes for oil resupplying for the emergency power diesels.	Ongoing	To be concluded March 2013	Yes
RF 434: Study on additional emergency power supply unit for the site.	Planned	To be concluded June 2014	No
RF 613: Study on alternative radiological control equipment for extreme emergency situations.	Planned	To be concluded December 2012	No
CR 111: Implementation of mobile water pumping units to feed Angra 1 Steam Generators	Ongoing	To be concluded March 2013	Yes
CR 112: Implementation of mobile water pumping units to feed Angra 2 Steam Generators	Ongoing	To be concluded March 2013	Yes
CR 121: Implementation of manual interconnection of emergency power busbars of Angra 1 and Angra 2	Ongoing	To be concluded December 2013	Yes
CR 122: Purchasing of mobile emergency diesel unit and connections to supply both Angra 1 and 2	Ongoing	To be concluded June 2013	Yes
CR 211: Implementation of additional means to assure door opening possibility under extreme emergency situations	Ongoing	To be concluded December 2013	Yes / No
CR 221: Implementation of additional means to assure internal building lighting under extreme emergency situations	Ongoing	To be concluded September 2013	Yes / No
CR 312: Implementation of local alternative evacuation routes for emergency planning	Ongoing	To be concluded December 2012	Yes / No

RF 112: Implementation of hydrogen passive recombiners in Angra 1	Ongoing	To be concluded June 2014	Yes / No
CR 313 : Implementation of improvements in the Emergency Centers	Ongoing	To be concluded June 2013	Yes / No
RF 122: Implementation of filtered containment venting in Angra 1	Ongoing	To be concluded December 2014	Yes / No
RF 431: Implementation of hydrogen passive recombiners in Angra 2	Ongoing	Started **before** the Fukushima event: to be concluded March 2014	Yes / No
RF 435: Implementation of filtered containment venting in Angra 2	Ongoing	Started **before** the Fukushima event: to be concluded December 2014	Yes / No
RF 611: Implementation of containment sampling system in Angra 1 qualified for beyond design basis accident conditions	Ongoing	To be concluded December 2014	Yes / No
RF 612: Implementation of primary circuit and containment sampling system in Angra 2 qualified for beyond design basis accident conditions	Ongoing	To be concluded December 2014	Yes / No
Topic 6 – INTERNATIONAL COOPERATION			
5th Meeting of the Convention on Nuclear Safety (Austria)	Taken	April 2011	Yes
IAEA SAGNE - Standing Advisory Group Meeting on Nuclear Energy (Austria)	Taken	October 2011	Yes
Workshop on Final Inputs for Design and Implementation of Safety Culture Oversight Programmes (France)	Taken	April 2011	Yes
IAEA OSART Mission, Seabrok NPP (USA)	Taken	July 2011	Yes
AREVA Nuclear Executive Meeting (France)	Taken	September 2011	Yes
American Nuclear Society Winter Meeting, including "Nuclear Safety in a Post-Fukushima World", (USA)	Taken	October 2011	Yes
IAEA Workshop on Establishing the Safety Infrastructure for a National Nuclear Power Programme (Brazil)	Taken	October 2011	Yes
WANO Biennial General Meeting (China)	Taken	November 2011	Yes
WANO Fukushima Forum, (USA)	Taken	November 2011	Yes
Visit of the President of Eletronuclear to the Fukushima site (Japan)	Taken	January 2012	Yes
International Information System on Occupational Exposure (ISOE) ALARA Symposium (USA)	Taken	January 2012	Yes
American Nuclear Society (ANS) Winter Meeting	Taken	October 2011	Yes
Indication of Eletronuclear experts for WANO special projects on lessons learnt from the Fukushima accident (Brazil)	Taken	February 2012	Yes
Response to the WANO Significant Operating Experience Report - SOER 2011-2 (Brazil)	Taken	December 2011	Yes
Follow up of WENRA stress tests recommendations and corresponding results by European plants	Taken	Since April 2011	Yes
Meetings with: ROSATOM, GDF Suez and WESTINGHOUSE (Brazil)	Taken	May, October and November 2011, respectively	Yes
IAEA Workshop on Establishing the Safety Infrastructure for a National Nuclear Power Programme (Brazil)	Taken	October 2011	Yes
Meeting with JAIF/ICC - Japan Atomic Industrial Forum International Cooperation Center (Brazil)	Taken	March 2012	Yes
Technical and/or scientific interchanges: Eletronuclear and Nucleoelectrica Argentina S.A. – NA-SA (Brazil and Argentina)	Taken	Since 1992	Yes
Follow up NRC recommendations	Taken	Since April 2011	Yes
WANO Paris Centre – Stress Tests Results Conference (Italy)	Taken	April 2012	Yes

ATMEA Safety Review Conference (Brazil)	Taken	April 2012	Yes
WANO Nuclear Oversight	Taken	April 2012	Yes

This Extraordinary National Report was prepared by a Working Group from the following organizations:

Comissão Nacional de Energia Nuclear (CNEN)

Eletrobrás Termonuclear S. A (ELETRONUCLEAR)

Central Organization for the Protection of the Brazilian Nuclear Program (SIPRON)

Rio de Janeiro – Brazil

May 2012.

Ministério da
Ciência, Tecnologia
e Inovação

Ministério de
Minas e Energia