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Expertise and Participation of the Population in the Context of Nuclear Risk: Democracy and Environmental Licensing of Angra 3 Nuclear Power Plant

Expertise e *participação* da população em contexto de risco nuclear: democracia e licenciamento ambiental de Angra 3

Expertise et participation de la population dans un contexte de risque nucléaire: démocratie et licence environnementale de la centrale Angra 3

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ABSTRACT

This article discusses the specificity of citizens' "participation" in contexts of decision-making on the acceptance of nuclear risk, demonstrating that such acceptance depends on mediation by professionals who are willing to translate the typical scientific jargon of technical reports and/or produce their own reports, by way of counter-expertise; otherwise, lay people are unable to confer scientific legitimacy to their arguments. The basic empirical references for the current analysis are the recurrent themes from public hearings organized for the licensing of two Brazilian nuclear power plants using German technology, Angra 2 and Angra 3, with emphasis on the latter, now undergoing prior environmental licensing. The forms of "social control" engendered in France serve as a counterpoint for developing the article's argument.

Key words: nuclear risk; people's participation; expertise

RÉSUMÉ

Dans cet article, on discute la spécificité de la "participation" des citoyens dans les cas de délibération sur l'acceptation du risque nucléaire, montrant que cette participation dépend de la médiation d'un professionnel capable de traduire le jargon scientifique des documents techniques ou

établissant lui-même ses propres documents, à titre de contre-expertise; sinon, les profanes ne sauront légitimer leurs arguments scientifiquement. Dans ce travail, on prend comme base empirique les thèmes récurrents des audiences publiques organisées en vue du permis de fonctionnement des deux centrales nucléaires brésiliennes de technologie allemande - Angra 2 et Angra 3 -, surtout pour cette dernière, en cours de licence environnementale préalable. Les formes de "contrôle social" patriquées en France servent de contrepoint à la construction de ce qui est ici exposé.

Mots-clé: risque nucléaire; participation de la population; expertise

INTRODUCTION

The objective of this article is to discuss the specificity of citizen participation concerning the monitoring of technological risks, especially “nuclear risks”, based on an empirical situation, namely the public hearing for the environmental licensing of the nuclear power plant Angra 3, the third unit in the Almirante Álvaro Alberto Nuclear Plant (CNAAA), located in the town of Angra dos Reis, in the state of Rio de Janeiro.

The public hearing for the licensing of polluting activities, as well as the studies on the environmental impact (the so-called EIA), became a legal requirement in 1986, when the National Council for the Environment (CONAMA) instituted a national policy comprising the evaluation of environmental impact. As such, the public hearing aims to allow the licensing body – in this case, the Brazilian Institute for the Environment (IBAMA) – a diagnosis of the impact the enterprise might cause. During the hearing, the population and sectors of government may voice their concerns, and IBAMA may grant or deny the environmental license.

Throughout 2007, four public hearings were held for the prior environmental license of the nuclear power plant Angra 3, all with the same content, aiming at discussing the Report on the Studies on Environmental Impact regarding the implementation of this unit[1]. I was present at the fourth public hearing, which took place on November 26th, 2007, in the city of Rio de Janeiro, to which I refer throughout this article[2].

The specificity discussed in this article, and which was expressed by the population in the favorable request for monitoring of the operation of activities at the nuclear plant, which arose during the public hearings for the licensing of Angra 3, refers to the fact that this monitoring necessarily implies mediation by an expert, since the type of pollution produced by a nuclear power plant –

radioactivity – cannot be perceived by the senses. For its detection and measurement, an expert must intervene with his measuring instruments – the "sensory organs of science" (Beck, 2001:355). Only then can the presence and amount of certain atoms be ascertained. It is this type of measurement, with experts and suitable instruments, which makes possible suspicions regarding the malfunction of a nuclear plant go beyond the level of mistrust. As such, the participation required by the surveillance of nuclear risks cannot dispense with the recourse of expertise (and also of counter-expertise), since, unlike what one finds in the exercise of the "science of the concrete" (Lévi-Strauss, 1976), the senses (smell, touch, taste, hearing and sight) are ineffective in establishing classifying criteria.

One of the predominant themes in the public hearing for the licensing of Angra 2 was the fragility of the External Emergency Plan (PEE) (Leite Lopes *et alii*, 2006), vital in granting the license to operate the plants. The poor condition of the highway (Rio-Santos Highway, BR-101), which would allow evacuation of the population neighboring the plant, in the event of malfunction, was really an Achilles' heel, capable of derailing the environmental license, which was granted on the condition that repair works take place on the highway. The analysis of this process and a detailed ethnography of that hearing can be found in a previous study (*idem, ibidem*), which showed how the mayor of the town of Angra dos Reis turned the problems in the Emergency Plan into a reason for the company to willingly engage with local associations and with City Hall.

To the extent that the space of the public hearing is used essentially by residents' associations and by the population to request urban services that the government is not able to provide, the existence of risk becomes secondary. Even though the PPE invokes the existence of risk, the discussions that took place during the licensing of Angra 2 were concerned with the good conditions of the highway, of great importance to the town, and not with some substantive aspect of the Plan. To plead in favor of popular control over operation of the plants is to see in the risk an issue in itself, and not only a means of improving living conditions. Therefore, this article considers the demand for "social control", which makes the mediation of an expert indispensable, meaning a change in the way this participation happens in that, when it demands the possibility of overseeing operations at the plant, it will end up "denaturalizing" (Leite Lopes *et alii*, 2000; Leite Lopes, 2004; Leite Lopes, 2006) the existence of nuclear risk. To make such an argument, the types of social control engendered in France will act as a counterpoint (see Silva, 2007).

This article also considers that discussing the change in the quality of participation implies dealing with the theoretical question invoked by the role of the expert in contentions of this kind. Based on

various authors, far from seeing the expert as a spokesperson for science, without ideological or political bias, the article will present, on the one hand, how the exercise of expertise highlights the loss of the monopoly on truth by science; on the other, how experts have become an indispensable party in disputes of interests.

The public hearings for building Angra 3 were part of a proceeding that took place after a complex decision-making process, analysis of which is beyond the scope of this review, and involved various different national policy-making agencies for the nuclear sector, culminating in approval of the construction of said power plant by the National Policy Committee for Nuclear Energy. It is also not my intention, in this article, to map out all the positions and outline an ethnography as was done for the licensing of Angra 2 (Leite Lopes *et alii*, 2006), since, on the one hand, the limits pursued by this report would be lost, and on the other, it would be a redundant effort since there are great similarities in both contexts. For example, the public hearing for the licensing of Angra 3, as well as the hearing for Angra 2, was organized to enable licensing of the project, and on both occasions the company mitigated the negative impacts (*idem, ibidem*: 371). The regulation of the events was likewise conceived to avoid an ideological discussion and favor a discourse considered "purely technical", as if the latter could exist independently of a political dimension. In previous studies, it was shown that such an opposition was carefully avoided by the promoters of this kind of event, be it in Brazil (Leite Lopes *et alii*, 2006), or in France (Silva, 2007).

The greatest difference between these two situations is that, in the hearings relating to Angra 3, as mentioned, a new theme arose with a clear political nature, in other words, the request for social control of the plant's operations. This innovation provides reflections on the adoption of this kind of technology, related both to the type of pollution it causes and the possibility of sectors of the population becoming linked with the scientists who would mediate the monitoring of activities in Brazilian nuclear power plants.

THE HEARINGS FOR THE ANGRA PLANTS: FROM ENVIRONMENTAL COMPENSATION TO SOCIAL CONTROL

Since the 1970s, Brazil has been building its nuclear plant called Almirante Álvaro Alberto, located in the town of Angra dos Reis[3], which, in addition to disposing of other large scale industries, has also the singularity, in the past few decades, of being home to various different experiences considered "participatory", such as the directive plan for the town[4] and the implementation of

Agenda 21, initially successful. The center has two power plants - Angra 1 and Angra 2 - and has started building Angra 3, the last unit planned for this location.

The running of these nuclear-electric plants was, until August 1997, the responsibility of Furnas Centrais Elétricas S.A., a company created in 1957 and which, initially, was included in the privatization program started in the 1990s by the government of Fernando Henrique Cardoso (1995-2002). Nuclear activities are under a state monopoly, guaranteed by the Federal Constitution, and the sector was not included in the privatization program. The Nuclear Energy governing board was then dismantled, originating Eletronuclear (ETN), a mixed capital company - "state-owned"- which incorporated the nuclear sector of Furnas, and also Nuclebrás Engenharia (Nuclen)[5]. Even though Furnas was not privatized, ETN was established as an independent company and its employees saw its creation as an important achievement:

> The existence of Eletronuclear was extremely important for the nuclear sector. The nuclear sector used to be considered the ugly duckling of Furnas. Today it is a major company, and effectively completed unit 2. Probably, if the company had not been established, it would have taken much longer to build this unit. So for the nuclear sector it was important to create this company and also, luckily for us, Furnas was not privatized. The company has financial problems; when the split happened, a tariff was established which was below its needs. This is a problem, but in actual fact, the tariff was created only to fund its operational costs. So there was never a risk regarding the running of the plant. Now the problem is that there are other costs. We are now a company subsidized by Eletrobrás; as is Furnas (statement by a senior employee at ETN)[6].

When it was first being built, its promoters considered the CNAAA a beneficial project for the "development" of the country and that region. That idea was enough for the military government to decide in favor of its construction (cf. Oliveira, 1989; Malheiros, 1993). However, in the 1980s, with approval of environmental legislation and the creation of Conama, ETN had to deal with a new way of approving its projects[7]. For the licensing of Angra 2, which started operating in January 2001, the company had to submit to proceedings that didn't exist in 1985, when Angra 1 was launched. The Organic Law of the City of Angra dos Reis, amended in 1990, determined that new plants, in order to be established there, would have to apply to the municipality for a license to operate.

The town wouldn't receive any financial contribution from the nuclear plant, a state-owned company, which had so much altered its scenery. The first mayor to look for a formula that would ease this absence was João Luiz Gibrail (1983-1985). Furnas (through the board which now

constitutes ETN) started "agreements" with the Town Hall of Angra dos Reis, which have been renewed, with some interruptions, since Gibrail's administration.

The company initially signed a cooperation agreement to ensure organization of the town's Civil Defense, according to the Emergency Plan, necessary in case of accidents with radioactive leakage. It also sought to help the town in building infrastructure (health centers, schools and sewer systems) in towns near the nuclear plant - Frade, Mambuca and Perequê. In this way, the agreement turned establishment of the plant into the solution for the new problems, at least to some extent.

From the beginning of construction, when only the positive aspects were presented associated with "development", until the signing of this first agreement, there was growing recognition that there were "negative" aspects to building these plants there. Although those most felt were urbanistic, caused by the influx of immigrants from other cities and states who would work in building the plants, there was the nuclear risk itself, which wasn't receiving the same attention. The PEE, for example, only received more careful treatment when Angra 2 was built, to comply with new legislation.

When Neirobis Nagae, a member of the Labour Party (Partido dos Trabalhadores - PT) and a politically-active member of the local environmentalist and antinuclear movement, was elected mayor of Angra dos Reis (1989-1992), he demanded a practicable Emergency Plan. However, on the so-called grounds of his political past, the plant suspended the agreements it had been keeping with City Hall until then, and only slowly returned to them. During the following administration, Nagae's successor, Luiz Sergio Nóbrega (1993-1996), also from PT, signed an even broader agreement (cf. Ribeiro, 2005:84) with ETN (then Furnas). Town Hall, on the other hand, asked for assistance from COPPE (now called the Alberto Luiz Coimbra Institute - Graduate School and Research in Engineering / Federal University of Rio de Janeiro, UFRJ) to propose a new PEE.

On the one hand, new legislation, which guarantees the involvement of the township and of the population in the process of licensing; on the other, the aforementioned agreements, which can be suspended at any moment. Both created an ideal context for negotiations between City Hall, the general population and the company whenever it expanded its plant. So, when Angra 2 was being built, City Hall was able to embargo the construction works judicially, based on the fact that it legislates over the town's territory. The company then had to request licensing of the construction from City Hall and had to submit to the licensing process required by law. With this power struggle, the company and City Hall initiated a new understanding, at the time, where the latter demanded

compensation for "impacts", through other "agreements" and feasibility for the PEE, while the former started expanding its premises.

However, one could see that, while the board of directors admitted to the existence of negative urban impacts, over time, no payment of fees (such as royalties) to the town had been established. To a few councilmen and local leaders, the payment of such fees would be a way of easing the so-called urban impacts. Still in 1999, the Angra dos Reis municipal environmental committee promoted a forum specifically to debate this issue and create awareness within National Congress of the need for a law which stipulated the payment of royalties by the plant, with the participation of congressmen Laura Carneiro (Partido da Frente Liberal - PFL) and Antônio Feijão (Partido da Social Democracia Brasileira - PSDB), without, however, any practical outcome.

The instrument for “environmental compensation”, according to what was established by IBAMA throughout the environmental licensing process, refers to allocating a percentage of the industry’s income to maintaining Indian reservations and conservation units[8]; nothing is stipulated for the so-called urban impacts on the town. The company argues that it follows the law rigorously, allocating a percentage of its income to financing preservation and conservation areas.

Therefore, with no legal mechanism to specifically regulate for an easing of the so-called urban impacts, it is a constant effort for the mayors to try and replace the agreements (optional) by fees or taxes (mandatory), which is the core of the tension between the nuclear plant and City Hall. After three terms of the PT, the election of a mayor from the Partido do Movimento Democrático Brasileiro (PMDB), Fernando Antônio Ceciliano, for the period between 2001-2004, reelected for 2004-2008, did not alter the existing tension on the continuing, or not, with the 22 agreements signed between the company and City Hall in previous administrations.

Even before the subsequent agreements with the town, the CNAAA, as it was being installed in the 1970s, had already built schools and health centers for the residents of the residential villages. Even today, two state schools are kept by the plant and the hospital at Praia Brava – currently a foundation – became part of SUS, the National Health Service, complementing the town’s health network. These services were thus gradually being made available to the residents in neighboring communities, in accordance with one of the agreements signed. Therefore, what was once destined to the service of employees is now incorporated into a group of benefits – or “offsets” –, which the company directs to the population of Angra dos Reis, and is always a matter of renegotiation whenever the plant expands.

In the last seven years, aiming at greater acceptance of its presence there, ETN has tried to approach the population directly through a practice called “care”. The company sponsors local initiatives, such as shirts for football teams, buses for school trips and various festivities. Research on the social responsibility programs of the company (Ribeiro, 2005) have shown, though little emphasized or divulged, that an important criterion for the approval of requests made by residents is their proximity to the reactor. The closer the residents are to the plant, the greater the chances of their requests being granted. A possible interpretation of this criterion is that the reactor leads to a naturalization of risk when the advantages to living close to the plant are increased. In addition to the proximity of schools and the hospital, one can also enjoy the services of the local initiatives (*idem, ibidem*).

With president Luiz Inácio Lula da Silva’s election (2003-2006), a former mayor of Angra dos Reis, belonging to the same political party as the president-elect (PT), was invited to be part of the board of ETN. With twelve years’ experience at City Hall (as municipal secretary, as deputy mayor, and finally, as mayor), the former mayor took on the role of Administrative and Financial Director at ETN. An advisory body was created, focused especially on dealing with the actions that sought to compensate the impacts with City Hall at Angra dos Reis, Rio Claro and Paraty. A sector inside the company was then formed to specifically deal with compensatory actions. This initiative seems to result from a specific use of “politics” that then becomes a mechanism authorized and privileged to forge a relationship between the company and local residents.

Although the company has made huge efforts to become closer to the population of Angra dos Reis, the PEE remained the Achilles’ heel for ETN. As evidence has shown in a previous study (Leite Lopes *et alii*, 2006), in the licensing hearings for Angra 2, the main theme was the practicability of the Emergency Plan, whose feasibility was threatened by landslips on the Rio-Santos highway, caused by rainfall. Nevertheless, as will be shown next, this situation has discernibly changed in the prior licensing hearings for Angra 3, in which the matter of “compensations” and the PEE has shared space with that of “social control”. This change is of capital importance in order to understand the nature of citizen participation in regards to nuclear risk, as is shown here.

As opposed to what happens in Brazil, in France there is no form of material compensation for the risks arising from nuclear-electric plants. Even if one considers the great sums of taxes paid by the plant to the town as having the same function, the practice of explicit compensation is not well

regarded, as stated by a union leader, a retired employee of the Electrical Company of France [Électricité de France – EDF], in an interview:

> The EDF said: "Let's trace a perimeter around a certain area and whomever is within this area will have a cheaper electricity bill". But the State Council, which is a national body, said: "No. That goes against the principle of equality. There is no reason why a person who lives near the plant should pay less than someone that lives a few kilometers away". Maybe they also said: "If we do this for people who live nearby, maybe we will have to do it for a train that passes, and well, then we are stuck in a never-ending situation". So in France there is no individual financial compensation (Mr. M.; translated by the author).

We may understand the expression "individual financial compensation" as a mechanism that creates distinctions between sectors of the population, who would then be victimized, and in need of indemnity. What the interviewee ironically observes is that, beneath such a commendable argument, another may exist, of an economic order. If the neighbors closer to the plant are compensated regularly, this could give rise to other kinds of claims from residents farther away, but still likely to be affected.

In France, therefore, there are no economic mechanisms expressly declared for nuclear risk, since this compensatory practice is seen as going against the principle of equality among its citizens. However, in addition to previous measures that ease the negative social effects of establishing a plant, there is great financial advantage to the cities that host the plants, because they receive taxes, calculated based on the energy produced in the nuclear plants. But these taxes relate to all industrial activity, without any correlation to possible compensation for environmental impact. Since the plants are installed in small towns, these raise their tax revenues so that a town with five thousand inhabitants generates the equivalent of a town with fifteen thousand (Silva, 2007).

Until a law is created which regulates the payment of royalties, the debate over different forms of monetary compensation owed by the company to the town of Angra dos Reis will continue, as will the suspicions on the practicability of the PEE as long as there are nuclear plants. The building of a sense of citizenship in Brazil, however, makes it possible to expand on these issues brought to the fore in these collective learning spaces (Leite Lopes *et alii*, 2006:387).

During the fourth public hearing for the environmental licensing of Angra 3, members of Ecological Protection Society of Angra dos Reis (SAPE) made repeated interventions in order to manifest their suspicions on the practicability of the Emergency Plan, although they also argued favorably on the existence of mechanisms for social control of the activities of the plant, accompanied by the

representative of the Association of Quilombolas (community of descendants of slaves) of Campinho da Independência. Nevertheless, the director of ETN, who was co-chairing the hearing, argued the futility of such monitoring, since it would require technical knowledge of the functioning of the reactor. The director's statement was implicitly contested when representatives of both the Federal Public Prosecutor's Office (PGR) and the State of Rio de Janeiro (MP) Public Prosecutor's Office gave important support to the request. The Secretary for the Environment of the State of Rio de Janeiro, present at the hearing, in addition to requesting information on the fulfillment by Eletrobrás of the compensations stipulated by the MP, also was in favor of monitoring of the plants by society.

As was seen at the public hearing for the environmental licensing of Angra 2, which took place in 1999 (Leite Lopes *et alii*, 2006), the event in focus here, from November 2007, also extrapolated its main objective – to discuss the Report on Environmental Impact –, allowing for various different manifestations by the associations present. It was completely surprising, however, that it also became the stage for exposing internal issues of the nuclear realm, which also points towards the change this article seeks to highlight. The hearings for the third unit of the plant did not abandon the matters relating to "compensation", whose history was briefly discussed earlier, and which were in evidence in the licensing proceedings for the second unit. These matters, however, broadened the range of problems, incorporating specific discussions to the specifically-technological dimension of the project.

A physicist from the National Nuclear Energy Commission (CNEN), seated in the area of the hearing reserved for employees of CNEN and ETN, and, therefore, swelling the ranks of those favorable to the project, used the microphone to, in an exalted tone, criticize the overlapping of tasks performed by CNEN: produce and inspect. The physicist said that is was unacceptable, from the point of view of the functioning of nuclear activities in Brazil, that there should be no complete institutional independence for the inspection. He added that the inspectors, like he himself, did not have any power in the exercise of their work, and that because of this, irregularities observed during audits frequently went unpunished. What the employee – and union representative for the sector – was exposing then was an alleged inadequacy in the functioning of the institutional risk management. Thus, along with the sharper conformation to the demand for means of social control, the voices of the disgruntled nuclear world also gained ground.

Even though the Brazilian institutional inspiration relating to the organization of nuclear activities is American[9], in the United States, nuclear-electric plants are managed by private companies; just as

inspection is done by private companies, independent of each other (Bourrier, 2004). In Brazil, the State produces, through ETN, and at the same time, inspects, through CNEN. Therefore, while ETN is responsible for energy production, supervision of all activity and all the nuclear facilities on Brazilian soil is the responsibility of CNEN, a government agency established in 1956 and currently attached to the Ministry of Science and Technology. CNEN, however, besides being the supervisory body, is also the owner of Indústria Nuclear Brasileira, in the town of Resende, which, among other functions, produces fuel pellets for the plants of Angra dos Reis. This overlap, however, is not a specificity of Brazil, it also occurs in France.

THE ROLE OF THE EXPERT

Many authors discuss the role and importance of the expert – also referred to as technician, scientist, specialist or even appraiser – in the monitoring process of contemporary risks resulting from industrialization, as well as in disputes concerned with the so-called "environmental issue". The matter is extremely varied because its examination necessarily relates considerations concerning the forging of democracy and its limitations with issues of an epistemological order, including criticisms of the assumption that science is the only way of producing true knowledge about the world and their disciplinary model. Among the views of authors referred to here, there are as many points of consensus as there are of divergence, some of greater and others of lesser importance that would deserve an accurate confrontation in a study focused especially on such an examination. Thus, to maintain analytical focus, works that would be indispensable in a broader epistemological discussion (for example, Bourdieu, 2000; 2007), will remain only as a source of implicit inspiration. In this article, it will suffice to outline useful points for the understanding of the exercise of expertise.

Funtowicz and Ravetz (1985; 1993) argue that there is a normal depletion of science, considering the definition proposed by Thomas Kuhn. The authors work on the idea of the possibility of producing science in another way, a post-normal science, which tries to organize the complementarity between social and scientific rationality, and that which is proposed by the much-vaunted interdisciplinarity, in vogue with regard for said environmental problems whose complexity requires the confluence of several specialists. For Roqueplo too (1992), the interdisciplinary approach cannot base its objectivity on the methods for validation of classical science: interdisciplinarity owes its authority to the subjective qualities of those who prepare it, also pointing to the need for new foundations for scientific production.

In the same sense of epistemological critique, Beck (2001; 1994; 1995) and Latour (1994; 1998; 2002; 2004) present in their respective works a dense analysis on science and the role it plays in a democratic society. For Beck, science is today one of the causes of industrial risk, as well as being a way to define and solve it (2001:341). As such, it opens new markets to itself. Beck says that science used to deal with the "given" world and now, reflexively, deals with its own products, generating a process of self-demystification and loss of the monopoly as knowledge producer: thus, science has become increasingly necessary and increasingly insufficient in producing truths. He also explains that this change is a product of the reflexivity of techno-scientific development in the conditions of a "society of risk" (*ibidem*: 52; author's translation). This scenario characterizes what Beck calls "secondary or reflexive scientification".

For the author, the sciences have abandoned their foundation of experimental logic and maintain a "polygamous marriage with the economy, politics and ethics", living a sort of permanent concubinage with them (*ibidem*: 53; author's translation); viewing this polygamy as something harmful, he believes that the Enlightenment project of modernity is unfinished. The primary scientification, which characterized the modernization of industrial society through the first half of the twentieth century, took its dynamic from the opposition, in doubt today, among the secular (laymen) and experts. Beck concludes that risk, the center of attention during the "reflexive modernization" period, ushers in uncertainty, destroys the pattern of interdisciplinary transformation made by errors, and dissolves the model of primary scientification, with its harmonious relations of power, between jobs, business, politics and the public sphere. Beck calls for a "second Enlightenment" (2003: 203), which surpasses the first, adding a reflexive dimension to the project of an investigative science. The risks are no longer "externalities" that should be alienated from the final product of science: "I am convinced that the sciences need internal movement, and even division which would absorb more of the reflexivity of the society of risk in the logic of investigative and technical scientific action […]. For me, this would be a very important part in creating a second Enlightenment" (*ibidem*: 208; author's translation).

Latour (2004) claims that the so-called "environmental crisis", a characteristic of Beck's "society of risk", is really a "crisis of objectivity", since science has lost its ability to produce a unique and undoubtedly true knowledge of nature, which guaranteed its capacity for objective explanation. Though his view resembles that of Beck in regards to the central role science occupies in the midst of the reported "crisis", he rather sets himself apart when he argues the impossibility of separating facts from values. Latour says that, even though science supposes such a separation, it remains restricted to the realm of discourse, never being realized in practice (see especially Latour, 1994;

2004). The criticism he makes in regards to political ecology is based precisely on the fact that this discipline stands on such an opposition, and therefore, is absolutely incapable of defining the common good for a dehumanized nature. Nevertheless, for Latour, it does better than defending nature when it questions certainties relating to the common good, understood as either that of men (social good), or that of things (natural good) (2004:37). Though political ecology, when it declaredly speaks on behalf of nature, keeps this dichotomy alive, which, according to Latour, brings us the current deadlocks called "ecological", it also provides the questioning of these compartmentalizations.

The criticism Latour makes of modern thinking (and science) cannot be mistaken for that found among constructivists, since it declares that, the more one speaks of the "construction" of nature, the greater the distance from what really happens in nature abandoned to science and to scientists. For the author, reality cannot be reduced to its representation, neither is the representation a filter for reality as if they were two separate entities: "Why must we speak of things or their symbolic representations? […] To believe that there are two positions, realism and idealism, nature and society, is the main source of power symbolized by the Cave allegory,[10] and this political ecology must today demystify [*laïciser*]" (*ibidem*: 53; author's translation).

For Latour the "collectives" – groups of humans and non-humans, in which a common good is determined – can ensure overcoming the modern dichotomies, including that which separates science and representation or reality and symbolism. For the author, it is not a matter of a threatened society, through expertise, resorting to an objective nature, but of a collective in the process of expansion: the proprieties of human beings and non-humans, over which this collective should determine, are never irreversibly limited; they can always be expanded. He says that, in fact, there is an external reality, but this externality is never defined; it only demonstrates the existence of new non-humans, previously excluded from the collective's work (*ibidem*: 57). The collective assumes the inseparability between facts and values. He concludes: "Nature is objective, but domesticated, and that is a new form of externality. The facts do not serve as proof, only as complicators" (*ibidem*: 55).

If the facts do not serve as proof, then how can we view the role of experts?

While there is widespread criticism in relation to science as the sole source of producing truth, many authors have observed that it has become the common language, constituting the

indispensable form of knowledge for solving matters considered "environmental". The generalization of the co-scientific discourse by various sectors of society is, therefore, indisputable:

> Let's first reveal a paradox. During the 1960s, collective action organized around the issue of environmental protection profoundly criticized scientific and technical knowledge, as well as the social developments they proposed; the translation of these claims into public policy, on the contrary, led to a greater resource of experts, engineers and technicians, real owners in an equally-growing realm of ecopower (Lascoumes, 1994: 8; author's translation).

Nowadays, anyone who wants to protest against nuclear plants, global warming or genetically modified organisms must do it based on scientific arguments. Beck (2001) considers that the objectives and themes of the environmentalist movement have been gradually separated from concrete situations, and isolated claims gave rise to broad protests against the conditions and pre-requisites of industrialization. The protests started to target threats invisible and intangible to the lay public, threats affecting the demonstrators and their descendants (Beck, *ibidem*: 354).

Like Lascoumes (1994), Beck also notes that many environmental threats require an appeal to experts because they cannot be perceived directly. This does not diminish the importance of a lay protest, but does show its dependence on scientific mediations and measurements. Another finding, also a consensus among the authors referred to, is that scientists are often called in to decide a debate, starting others, since the degree of uncertainty about scientific objects increases, giving rise to schisms between different experts' points of view. Replacing the monopoly of a scientific view, an appeal to its plurality takes place, propitiating the confrontation between expertise and counter-expertise, namely measurements and hypotheses of scientists who may be at odds with each other:

> The uncertainty does not establish problems only with decisions […], with the proliferation of controversy, it is one of the factors which contribute to the entry of science into the midst of social debate and to blur the boundaries between culture and nature, carefully erasing the boundaries between fear and knowledge. It contributes to the positivist dream of a society governed by true and false to confront an image of science as a hostage, the instrument of a social game played by government, pressure groups and scientific organizations, where experts and the media henceforth occupy a central position (Theys and Kalaora, 1992:5; author's translation).

Corroborating the respective views of Latour and Beck in relation to the existence of a science in crisis or questioned for its reflexive effects, Ravetz (1992), Theys and Kalaora (1992), Roqueplo (1992) and Ewald (1992), in articles specifically dealing with the issue of expertise, show how the expert cannot be regarded as the holder of the truth anymore, in fact he is one of the many actors involved in its constructions. For these authors, the representatives of science have gone beyond the original task of producing knowledge for a despotic power, typical of a primary scientification (to

use Beck's term), over other forms of knowledge. The expert, therefore, should not be regarded by the other parties involved in this dispute as the one who can give a final answer: "[…] to give unconditional faith to the words of the expert, due to his competence, is to assume a risk, also huge, of submitting to a kind of enlightened despotism, which this time, extends all over the planet (Theys and Kalaora, 1992:5-6; author's translation).

Resorting to expertise and to counter-expertise can lead to real confrontation between the information divulged by industries, such as that from a nuclear plant, and information which can be gathered elsewhere, such as laboratories considered "independent". It is true that the divergence may result from bad faith – an industry interested in maintaining its profit levels will deny the damaging effects caused by pollution – but this is not the point in question. Frequently, dissimilar views result from the great degree of uncertainty that scientists have to deal with today. Accordingly, Nelkin and Pollak (1981) say, with some irony, that there are always scientists to speak in favor and others against. Added to this is the fact that there are, beyond science, other rational forms in play that must be taken into consideration in order to make a political decision, as Theys and Kalaora well observe:

> As soon as the scientific community accepts as plausible the idea that general opinion may have its own reasons that are not necessarily the same as theirs – as in Sweden, where three quarters of the population were against nuclear power, while three quarters of the scientific institutions were in favor – a dialog between cultures (of the visible and invisible) may be established and serve as the foundation for a truly enlightened democracy (1992: 40; author's translation).

Thus, there are many divergences between scientists and their peers, among lay people, and between lay people and scientists, to be reconciled. For this, there are many alternatives of democratic meetings held expressly for the purpose of consultation, such as the public hearings. Callon, Lascoumes and Barthe, pondering the French reality, suggest the creation of a "technical democracry" (2001:326), understanding that laymen and scientists can contribute to the advancement of science by comprehensively discussing problems where there is great uncertainty in spaces called "hybrid forums", the basis for the aforementioned "technical democracy", where scientific jargon is translated into a language accessible to lay people. Callon believes, with other authors (Callon and Rip, 1998; Callon, Lascoumes and Barthe, 2001), that there is a growing tendency to create these kinds of spaces so-called

> forums, because they are open spaces, where groups can mobilize to debate technical choices that implicate the collective. Hybrid, because the groups implicated and their spokespersons are heterogynous; gathered in them are experts, politicians, technicians and lay people who consider themselves concerned with the problem. Hybrid also because the problems addressed and the issues raised fall within various registers ranging from ethics to economics, passing through physiology, atomic physics and electromagnetism (Callon, Lascoumes and Barthe, 2001: 36; author's translation).

Hybrid forums are, therefore, clarifying devices and, to work, must presuppose that the truth is never only on one side of the argument. For this same reason, appreciation of the exercise of plurality, Callon, Lascoumes and Barth note that the actors committed in a socio-technical controversy cannot accept the monopoly of experts (*ibidem*:60). To Callon and Rip (1998) it is still preferable to talk of expertise rather than the expert, because expertise is the product of the work of a hybrid forum in which lay and expert views, methods and instruments are confronted:

> The expertise involves not only humans (actors in the hybrid forum), but also the technical artifacts (skilled systems, measuring instruments…) in which legitimate processes of analysis, plausible knowledge and real protocols are incorporated and stabilized. The expertise is a set of socio-technical devices that create conditions for the production of agreement (ibidem: 181; author's translation).

One of the concerns of Callon and Rip is to show how lay people can also incorporate technical language and expand scientific knowledge in unorthodox "laboratories", set up informally by citizens involved in environmental conflicts, in the wide sense of the term. Lay people can acquire knowledge on the subject and add their efforts to those of researchers.

For the authors mentioned in this section, the consensus is that democratic participation cannot be reached if science cancels out other forms of rationality. The accusations of ignorance against the laity are arguments of authority on the part of entrepreneurs and scientists in the political dispute over their interests. This motivates considerations such as those of Beck, Funtowicz, Ravetz, Callon and Laucomes, in their attempts to idealize forms of construction of science in which other forms of rationality serve as complements.

Frequently, the opposition to the project of implementing and expanding the Brazilian nuclear plant is seen by its developers as a product of "unfamiliarity" and "ignorance" (Silva, 1999a). However the public hearing that took place on November 26th, 2007, for the prior licensing of the nuclear plant Angra 3 was not so striking due to this kind of posture by the technicians, revealing a change in behavior on the part of the representatives of the company when dealing with opponents to the project. At the event, the scientists/engineers of the nuclear plant were able to zigzag deftly among the "facts" and "values", adding to their technically-founded arguments others of a social order, such as the commitment to offer new jobs to local residents. The laity, on the other hand, needed an expert for their zigzag, who would translate, as was requested by the representatives from the Association of Quilombolas of Campinho da Independência, from Paraty, from the Environmental Protection Society of Angra dos Reis (SAPE)[11], from PGR and the MP, and also the Secretary for the Environment of the State of Rio de Janeiro. The generalization of the perception that the

mediation of an expert is fundamental for the "social control" of industrial activities considered dangerous does not only occur among theorists concerned with the matter, but is also shared with the laity.

The role of this expert would be, according to the proposition by Ewald (1992), less to supply solutions and more to propose terms that make possible a negotiation on the values that the environmental subject establishes. He would be a key part in the monitoring of activities at the plant, confirming the terms of its daily reports and giving the population the opportunity to position itself in the event of possible malfunctions. Or, as Callon and Rip would have it, "the experts contribute, through their activity, to establishing commitment: they are true mediators" (1998:167; author's translation).

ASPECTS OF THE DEMOCRATIZATION OF CIVIL NUCLEAR ACTIVITIES

The Presence of the State

In France, the nuclear-electric plants belong to the state-owned *Électricité de France* (EDF), which, despite demonstrations against it by unions and leftist parties, was opened up to private capital in 2004. With a function analogous to the National Commission of Nuclear Energy (CNEN) in Brazil, is the Nuclear Safety Authority (ASN), which is also a French public administration institution, whose role is to inspect the working conditions of the employees at the plants and the operation of the reactors. There, this kind of "endogamy" has been severely criticized, even by scientists in favor of the French nuclear program. So if there is any similarity between the Brazilian and French nuclear programs[12], it is that, in both cases, the government accumulates the roles of entrepreneur and inspector. Such an overlap of positions has always been criticized by the United States, which has condemned this practice since the 1950s, when its nuclear-electric industry was privatized, shortly after its first reactors started operating. Thus, over there, as production and inspection are done by private and independent companies, it is expected that there is, in principle, greater objectivity in supervisory procedures.

In the 1970s, in European countries, this overlap was a reason for citizens to question the nuclear programs, as showed by Nelkin and Pollak (1981). The authors report that in Germany, a teacher revealed that there was an informal relationship between a plant that was being planned and the authorities responsible for its licensing. She started a movement against the project alleging

collusion between the plant and the licensing authorities; after a five-year long process, she was able to stop construction of the plant at that location (*ibidem*:60).

The overlap found in European countries, in which the State concentrates the functions of construction, licensing and inspection, is due to economic reasons. Also the "strategic" character of nuclear activities, in virtue of the uranium, which can be used to produce weapons after it has been used to produce electricity in thermonuclear plants, is a factor against the privatization of the sector for many countries. Nelkin and Pollak observe that, in Europe, governments and industry are necessarily partners in the costly venture that is nuclear energy. They state, moreover, that the size of the cost of a nuclear enterprise tends to reduce the autonomy of government in the political realm, limiting its availability to meet the requests from the population, because the initial investment is always so great that it justifies subsequent investments, in an attempt to soften the previous expenses (*ibidem*:188).

Nuclear policies in France, Germany and Sweden are seen, by Nelkin and Pollak, as an area in which the theory of state monopoly capitalism is applied. In 1974, when the rise in oil prices created pressure to generate energy through alternative sources of production, these three countries quickly became promoters of nuclear power nationally and internationally. Also in 1974, Belgium, Holland and Italy created a consortium (only Austria, Denmark and Norway renounced nuclear technology). In these cases, the lack of commitment to a national nuclear industry and relatively limited economic bonds between government and the nuclear plants, allowed the governments to keep greater independence in regulation and a greater possibility of responding to appeals from the population.

If, as Nelkin and Pollak analyze, in industrialized countries, the investments in a nuclear plant are so high as to become an embarrassment to the democratization of the sector, this situation in other countries is no different, and this only reinforces the importance of achieving a formula of participation that leads to social control through the access of counter-expertise. The realization that state involvement with nuclear production restricts the possibility of concession in regards to social demands does not mean at all that the privatization of nuclear plants in a country like Brazil would guarantee greater social control of activities. On the contrary, the State could be less committed financially, but more unable to intervene favorably in such claims.

The Legitimacy of Risk

As seen among the residents of French cities which house plants, also in Angra dos Reis, the majority of inhabitants are not interested in the monitoring of risk. There is, however, a portion of the population, numerically less expressive, that manifests itself in an organized manner and is concerned with the issue of nuclear risk. These are the citizens who are against the plant, because they see this risk as something to be avoided. They are self-styled "environmentalists" and strive to gather evidence from the company that the reactors are working well. It is plausible that citizens favorable to the enterprise also want the right to access information about what happens in the plant, but this concern ends up being associated with the "anti-nuclear" citizens by businessmen.

The suspicions nurtured by associations (environmental and others) in regards to the information given by the technicians from the plant stems, at least partially, from the attitude of the engineers from Eletronuclear (ETN). For years, this attitude was of never submitting to any test or dialog and of staying away from the nearby population. All over the world, nuclear industrial activity evokes, to the majority of people, the idea of great danger (Chiva, 1970; Zonabend, 1989). However, the fear and distrust are not necessarily manifested into actions to impugn or oversee.

Recently in France, the conflict between the views of the engineers/scientists from the nuclear plants and of those called "independents" for not belonging to the official institutions that make up the French nuclear program, has been considered an important step for monitoring the risks from nuclear reactors. In France, the Local Information Commissions (*Commission locale d'information*, or CLI) were created with the the main purpose of monitoring the operations of French nuclear plants, formed by representatives of the population, the nuclear company and members of the inspecting agency. The CLI meet once or twice a year. During the meetings, engineers give their reports on their activities at the plants, as well as technicians from the inspecting agency (Silva, 2007). Out of thirty CLIs in existence, roughly five are "active", i.e. try to understand and debate the reports presented; others work in a manner considered "formal". The "more active" commissions are the ones responsible for making it more usual to confront expertise and counter-expertise[13].

In Brazil, the hearings, which are spaces very different from the CLIs in nature, are above all used to discuss compensations and reimbursements that the company owes to the town. In them, many residents' associations come with banners to manifest their support for ETN, with the expectation that the company will bring "improvements" to their neighborhood. This exchange is explicitly expressed by a few representatives; others deny they are there in exchange for benefits, stating that their presence is driven by a higher ideal, such as the "progress" that the plant represents. The

appearance of a new type of claim – social control – referring specifically to the issue of risk points to a change in the quality of participation being created there.

Unlike what happens in a peripheral country such as Brazil, in France, the non-recognition of a "liability" can be explained by the fact that in a "nuclearized" central country the social function of wealth production accomplished by industrialization is legitimate with respect to a common good. The risks are a necessary evil (Beck, 2001), thus the participation should be pragmatically directed mainly towards monitoring compliance with the safety rules by the company. In Brazil, since the social function of wealth production for a common good, and therefore enjoyed by all, is not clear, the participation of citizens revolves primordially around, looking for an "arrangement" (Boltanski and Thévenot, 1991:163) in which some financial advantage will benefit the population already threatened by risk. However, the fact that in France the participation intends, notably, to access information about what happens inside the plants does not mean, as has been said, that the establishment of a plant there does not bring financial advantages to the town where it is located, but only that there is no legal or institutional device that ensures the reimbursement of a "liability" to be redeemed.

The adoption of this type of space for participation can only be explained by a wide variety of factors – historic, economic, social and cultural. These same factors constitute notable differences between countries like Brazil and France; for example, the legitimizing effects arising from decades of development directed towards social welfare. If in industrialized countries we find better conditions for the exercise of citizens' rights, and consequently, the possibility of the presence of organized social movements, it is also in these countries that the risks have found their most well-rounded form of morally justified legitimization: not such unequal wealth production and distribution. This rationale endorses the statements by Beck, according to which between risk and famine, we prefer risk (2001:72), which is morally negative because it is not really an option.

The Use of Expertise

In France, the practice of *bénévolat*, i.e. of work offered voluntarily and free of charge, is very widespread, above all, among the large number of well-educated retired people, who are willing to keep active. This way retired scientists contribute to the debate regarding nuclear risk by taking part in commissions like the thirty CLIs in existence and also their National Association of CLIs (ANCLI). At the heart of these commissions, access to information about what happens inside the plants can become routine. It is part of these associations' activities to "educate" its lay members,

who are then initiated in the type of specific knowledge required to monitor nuclear risks (Silva, 2007). This kind of agreement requires a great political effort from those involved, because in that country, the "nuclear" subject is considered "sensitive"[14] and the metaphor for "civil war" (cf. Touraine *et alii*, 1980, and Nelkin and Pollak, 1981) frequently describes the clash between those favorable to this alternative energy and those who are against, also called the "antis".

The existence of a good number of experts who bring forward controversies is related to the conditions of schooling and the level of education within the population. The size of the nuclear power stations should also be taken into account, because it depends on the development of specialized professionals and affords the expansion of teaching and research institutions in the specific area. Maybe it can also explain, although only partially, the creation of institutionalized channels of participation for monitoring. The economic importance of the French nuclear power stations, initially established by president Georges Pompidou, with all the social and political implications that this great presence brought to France, was indisputably a relevant factor considered when the Mitterrand administration created the French CLIs. The number of plants and the consequent waste generated makes it inevitable, in a democratic country, to create a strategy for the promoters of the "nuclear world" to respond to the concerns of the population.

In Brazil, the lack of specialized professionals certainly imposes a problem for the effectiveness of the social control demanded. With the intention of enabling monitoring, the Secretary for the Environment of the State of Rio de Janeiro, in the hearing of November 2007, suggested that the company should make measuring instruments available to the population neighboring the plant, so that the people interested might have the autonomy to make measurements that certified the absence of substances harmful to the environment. Using these instruments, however, as well what to measure, is not an easy task.

Therefore, the independent expert (in France, called in for counter-expertise) seems indispensable for the effective social control of industrial and polluting activities. As mentioned before, the support of institutional and politically important players, such as that afforded by the (public prosecutors) PGR and MP for the implementation of mechanisms for social control, echoing the claims from associations such as SAPE and of the residents from Quilombolas do Campinho da Independência and from Paraty, represents an innovation for the public hearings in 2007 related to Angra 3, which did not exist in the hearings for the licensing of Angra 2 at the end of the 1990s.

The Desire for Transparency

Both in France and in Brazil, the answers from the promoters of nuclear energy to the double accusation that the nuclear industry is one of the most dangerous and secretive permeates three points: (1) emphasizing the dangers in other kinds of activities, productive or of another nature, advocating a stochastic comprehension of the world; (2) diminishing the importance of events that happened at nuclear facilities. Hence, the leaking of harmful substances is always a "small leak", and the incidents are always "incidents of no importance". When recognition of the gravity of an accident is inevitable, a comparison is made with a catastrophe that happened somewhere else, in a part of the world where security measures are precarious or the technology, less reliable; and (3) recognizing, at least in discourse, the need for democratization of the industry.

The "participation of the population" became a legal requirement[15] and the political ambitions of the agents involved in the disputes became "environmental". The increase in "formulas of participation" that increasingly make up the administration and political sociability can be understood basically from the standpoint of two aspects. The first, as a demand of organized society itself and a consequence of the conflict, inherent to democracy, between representation and representativity. The second, as a mechanism which comes to facilitate the reported shrinking of the State. These wide-ranging interpretations are indispensable to articulate the work in a specific situation with a more varied reality; however, they are inspirations that only partially explain the local processes. Therefore, studies on the phenomenon of "participation" by social scientists has consisted in its qualification, as the works of Ashforth (1980), Defrance (1988), Beynon (1999) and Leite Lopes (Leite Lopes, 2004; Leite Lopes *et alii*, 2006) attest, which address specific cases of public hearings.

Ashforth (1980) considers that the hearings are spaces where the power of the State (in this case, the company ETN) is reaffirmed with the compliance of groups contrary to the enterprise. Unlike Ashforth, Benyon (1999) admits that, in these contexts, the possibility of negotiation can be established between the parties, opening up chances for segments of the population to gain with the establishment of these projects. For Defrance (1988), there is an oscillation between two situations: at times, it is a channel of communication between the parties gathered, in others there is the possibility of negotiation. If we understand the space of the hearings as a place for negotiation, the remark made by Lascoumes (1994) is also especially pertinent:

> Negotiation is a very seductive social practice to avoid shadows, highly prized today for not concealling the new games of domination. It is necessary to say clearly that nothing is more alienating than an unequal negotiation,

> nothing is more misleading than an improvised negotiation, nothing more deceptive than an alleged adjustment of interests devoid of any context that structures and limits it (*ibidem*:287; author's translation).

The nature of the public hearings referred to in this analysis cannot be defined as a negotiation process about what is being discussed, but of secondary negotiations that might possibly replace the main one, already defined. For example, in the hearing for the prior licensing of Angra 3, a representative of the MP (prosecutors) insisted on the unconstitutionality of deciding the licensing without taking the discussion to Congress. The ETN defended that there was no need for approval from Congress, since this unit, being part of the agreement made with Germany in 1975, had already been approved before the Constitution of 1988, on which the prosecutor based her demand. In any case, this discussion did not polarize the hearing. Most of the time of the meeting, which lasted six hours, was dedicated to statements from local entities favorable to the expansion of the nuclear site and who requested actions, of various kinds, related to urban improvements for Paraty and Angra dos Reis, and the use of local workforce. The opposing entities also played their part by questioning the reliability of the Emergency Plan and demanding social control. At the end of the hearing, the prosecutor said: "Don't worry, Angra 3 will happen in any case; that has already been defined by the government. What I am saying is that, if it's not approved by Congress, it will be an unconstitutional process"[16].

From informal conversations with some employees at ETN, I understood that the representatives of the MP, in the defense of diffuse rights, are perceived as criticizing the Brazilian nuclear program. To extend the debate and take it to Congress, and running the risk of it being denied by legislators, is seen as opposition, and not as a democratic or constitutional *démarche*. On the other hand, the opponents believe that expanding the site is visibly a bad deal in environmental terms, and the logic of the engineers, which quite often still works in terms of "primary scientification", is confused with bad faith. How to reconcile, in one selfsame collective or forum, such discrepant interests? A catchphrase used by ETN in the previous hearing, for Angra 2 (Leite Lopes *et alii*, 2006), illustrates the expectations of those meetings. "Everything out in the open" ("Tudo às claras") was the phrase that summed up the social function of the company (electricity production) and its inclination to abandon the old secretive practice, intrinsic to the "nuclear world". For Theys and Kalaora (1992), the relationship between knowledge and democracy is:

> "currently entirely over-determined by the fact that we live in a society of generalized communication and that attributes a central role – an almost magical one – to the greater "myth": of transparency. Inseparable from a certain conception of public participation in decision-making, the notion of transparency covers in fact various different orders of reality. In a first sense, it is almost an extension of the role of the media – and in any case a reduction of secrets to a bare minimum. In a second sense, it evokes an open democracy: the desire to establish social relations based on an adult treatment of opinions, i.e. with truth and responsibility. In third place, it further refers to the ability societies have to know and govern themselves, with lucidity, from what they know of themselves and the evolution of the world. It is the Enlightenment's ideal of self-transparency" (*ibidem*: 35-36; author's translation).

However, as the same authors conclude, the proliferation of information does not necessarily create transparency; on the contrary, it produces a blurring effect (*ibidem*: 37-38). They admit, nevertheless, that transparency is a social necessity to be created in a voluntary manner, in other words, as a form of "social contract" (*ibidem*: 39). This blurring effect can be explained by the impossibility of separating facts from values, as Latour repeatedly states in his works. Theys and Kalaora also explain that recognition of the impossibility of transparency does not mean that the information is superfluous; on the contrary, it continues to be fundamental for the establishment of pacts and agreements.

Taking nuclear activities as an example of what is being said, I can mention the measuring practices. The nuclear plants, to function, need to comply with international agreements that stipulate the amounts of various substances to be released outside the plants (atmosphere, rivers or seas). The plants therefore undertake constant measurements to verify if there are any undue leaks, whose results, although not accessible to lay comprehension, can be debated with the help of an expert. Even allowing for the multiplicity of measuring methods, transparency is not, in this specific case, something unattainable. The questioning begins when the normal operation of the plant and measurements, hitherto accepted, for some reason forfeit their legitimacy. Thus, the problem of expertise goes beyond the issue of pure information since it includes a discussion of what is acceptable, clouding the transparency of reports with disparate interests and values.

It has been mentioned that Latour (2004) associates this process of composing the empirical references (the so-called facts) and values with the creation of a collective. This collective would be the product, on the one hand, of the recognition that objective reality is never only objective, because it is also represented and narrated; on the other hand, of the concurrent overcoming of modern dichotomies, such as nature/culture. The author states: "Democracy can only be thought of with the condition that it can freely cross the frontier between science and politics" (*ibidem*: 107; author's translation).

While this epistemological revolution is not generalized in political and scientific practices, or while Beck's second Enlightenment does not find, in various points around the planet, the possibility of effectiveness, associations favorable and unfavorable to the establishment of Angra 3 represent another step toward the construction of citizenship and democracy in Brazil, calling for monitoring conditions independent from the operation of CNAAA.

FINAL CONSIDERATIONS

In this article, the specificity of citizens' "participation" in the context of nuclear risk has been discussed, demonstrating that this participation depends on the mediation by professionals who are willing to translate the typical scientific jargon of technical reports and/or produce their own reports, by way of counter-expertise; otherwise, lay people are unable to confer scientific legitimacy on their arguments. The recourse to scientific language and rationality is a condition for diagnosing an evil and opposing it. The supremacy of science as a producer of the ultimate truth remains, though no longer as a monopoly.

If hitherto the controversies between experts and laymen were quickly converted into a dispute between the holders of knowledge versus ignorance, currently that has changed in two aspects: 1) the laity increasingly appropriate scientific knowledge to enforce their demands; 2) scientists themselves disagree among themselves due to the uncertainty that now pervades the stabilization of knowledge, or the "closing of the black-box" as Latour (1998) would call it.

The central role of the expert or, in other words, the growing importance of a plurality of expertise can be attested by the widening of associative speeches by representatives of governmental institutions – MP, PGR (prosecutors) and the Environment Secretariat of the State of Rio de Janeiro (SEA/RJ) – towards the demand for social control over the nuclear activities at CNAAA. Therefore, the sought-after "citizens' participation", fundamental to democracy in Brazil, changes quality as it is not restricted to expressions by those discontented for purely compensatory claims, indispensable, but easily manipulated in favor of legitimacy of the company.

As much as the relations of domination may constrain the results of the hearings, which discuss the expansion of the nuclear power plant of Angra dos Reis, making the dispute between the nuclear supporters and the segments of the population opposed the presence of the industry in the Brazilian energy matrix a lost cause, and even though there are scientific arguments in favor of either side, the complexity of the debate is likely – with the arrival of the demand for social monitoring – to revise the asymmetries, making room for changes. Therefore, the objective of this article was to note this small and important change as a piece in the construction of the relatively young Brazilian democracy.

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NOTES

1. The approval of the site for construction of the Angra 3 nuclear power plant, originally granted in 1980, was ratified by Resolution no. 11 of the National Commission of Nuclear Energy (CNEN), on September 19, 2002. The National Energy Policy Council (CNPE), linked to the Secretariat of Strategic Affairs, approved on June 25 2007, resuming construction of Angra 3, which should start operating in 2014.
2. The first hearing took place in the town of Angra dos Reis (June 19, 2007); the second in Paraty (June 20, 2007); the third in Rio Claro (June 21, 2007). There were also about seventeen small intermediate meetings to prepare for the three main ones. I also consulted for this study documents relating to hearings at which I was not present, made available to the public by both IBAMA and by company Eletronuclear (ETN).
3. I had the opportunity to visit the town for consecutive surveys. Initially, between 1992 and 1994, I conducted a study for my thesis, along with workers from the nuclear power plant Angra 1 and their families, by addressing the issue of social construction of technological risk (Silva, 1999a; 1999b). Later, already incorporating the research team coordinated by José Sérgio Leite Lopes (Universidade Federal do Rio de Janeiro - UFRJ / National Museum - MN), I returned to Angra dos Reis concerned with the issue of "public participation", attending residents' association meetings and checking on implementation of the directive plan (which had been drawn up between 1990 and 1992) under the effervescence of the PT municipal governments, jealous of the "popular participation" (Leite Lopes *et alii*, 2000; 2006; Leite Lopes, 2004).
4. Other anthropologists also developed studies there on related themes, such as Prado (2002; 2003) and Bezerra (1995; 1999).
5. Company established in 1975 to design and build nuclear power plants.
6. This and other interviews with workers from ETN were held during a project called Environmental Degradation, Pollution and Technological Risk: A Case Study on the Coast of Angra dos Reis, which I coordinated between 2000 and 2004.
7. As mentioned in the introduction, in 1986 CONAMA established a national policy on the assessment of environmental impact, requiring environmental impact studies and public hearings for the licensing of polluting activities. Moreover, in 1985, the law of civil actions had been created, which is an instrument whereby civil society can seek compensation for damage caused to the environment, among other things.

It ensures the right of private associations, non-governmental organizations and the Public Prosecutor's Office (MP) to act, in court, against polluters.

8. The instrument of compensation is specifically addressed in law no. 9985, article 36, of July 18, 2000, establishing the National System of Conservation, regulated by Decree 4340 of August 22, 2002, as amended by Decree 5.566/2005. It is a financial mechanism to compensate for the effects of non-mitigable impacts occurring when implementing projects, identified in the environmental licensing process. These resources are aimed at the Conservation Units to consolidate the National System of Conservation Units (SNUC).
9. This is explained by the multiple agreements established between Brazil and the United States, in the nuclear area, since 1940, and that included, in the 1960s, the purchase of the first nuclear plant to be established on Brazilian soil, Angra 1, from the American company Westinghouse (Silva, 1999a).
10. Reference to Plato's Allegory of the Cave in *The Republic*.
11. SAPE brings together militants who still continue a movement called "Hiroshima never again", first started in 1980.
12. France exemplifies what is called a "nuclearized country": besides its nineteen nuclear-electric plants, there are also nine plants of the Commissariat à l'Energie Atomique (CEA), two plants for storing radioactive waste, one treatment center, a few installations for fuel manufacture and conditioning, a research laboratory for underground storage, the Marcoule Complex, and finally, the secret base at Valduc. The fact that Brazil only has two commercial reactors in operation until now, while France has 58, already shows that the production of electricity from uranium has very different degrees of importance within these countries. Therefore, here aspects of two nuclear programs of hugely varying magnitudes are being contrasted.
13. The measurements in the reports given by employees of the nuclear plants are compared, by citizens, with those given by scientists and technicians not connected with the nuclear plant. In case of disparity in the results, it is within the CLIs that the discussions between representatives of the population, of the company and inspectors take place.
14. The reaction of some French people listening to the content of my study is useful to assess how controversial the subject is: "aren't you afraid of ending up in a concrete box in the Seine?", "Aren't you scared?" and "Here in France, nuclear is taboo" were some of the comments I received from people of various different professional backgrounds and who were not related to my research. One antinuclear militant that I interviewed for my study said he had suffered an attack: "[…] they swerved their car onto me […], they cut off the electricity at my house many times, when I was more actively involved with the movement".
15. In many articles of the Federal Constitution the right to "democratic participation in the formulation of public policies" is provided, an administrative principle that inspires the demand for public hearings for the licensing of public projects, as well as the creation of councils, such as municipal, statewide and their management.

16. The speech made by the representative of the MP in the hearing was a clear denunciation and manifests a contradiction, if not of purpose, at least with respect to the means to achieve it, between the State that licenses (IBAMA), the State that defends diffuse rights (MP) and the entrepreneur State (ETN). The latter has support from the Federal Government, committed to enabling the Program for Accelerated Growth (PAC). While the Attorney General's Office ruled the construction of Angra 3 constitutional, dispensing with manifestations from Congress, the MP annulled, by legal action in a court at Angra dos Reis, the hearings held on June 19, 20, 21, 2007, for taking place without the presence of representatives of the MP. IBAMA scheduled new hearings for March 25, 26, 27, 2008, respectively in Angra dos Reis, Paraty and Rio Claro (Federal Official Gazette, January 25, 2008).

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