

A Diagnostic of the Strategy Employed for Communicating Nuclear Related Information to Brazilian Communities around Uranium Mining Areas

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Abstract. This paper presents a diagnostic of the strategy used by the Brazilian uranium mining industry to communicate nuclear related information to communities around a mining area. The uranium mining industry in Brazil, which is run by the government, has been concerned with communication issues for quite some time. The need to communicate became more apparent after new mining operations started in the Northern region of Brazil. The fact that the government does not have a clear communication guideline made the operators of the uranium mining industry aware of the increasing demand for establishment of a good relationship with several types of Stakeholders as well as employment of personnel with experience in dealing with them. A diagnostic of the current communication situation in Brazil and an analysis of the approaches over the past years was done through interviews with employees of the mining industry and review of institutional communication materials. The results were discussed during a Consultant's Meeting organized by the IAEA's Seibersdorf Laboratory in October 2007 [1]. The output of the meeting included an overview of modern communication strategies used by different countries and a suggestion for new uranium mining operations in developing or under developed countries. The strategy for communicating nuclear related information to Brazilian communities varied according to the influence of different Stakeholder groups. One initiative worth mentioning was the creation of a "Mobile Nuclear Information Thematic Room", which was installed in several locations. This project was seen as one of the main tools to relate to community. Many Stakeholders were identified during the diagnostic phase in preparation for the IAEA's meeting on communication strategy: children, NGOs (Non Government Organizations), local churches, media, and internal Stakeholders, among others. An initial evaluation showed that the perception of a neighbouring community regarding an uranium mining industry is heavily dependent on the efforts of the industry in interacting with this community.

KEYWORDS: *Perception, Uranium Mining, Stakeholder, Communication.*

1. Introduction

There is an ongoing debate within the media and scientific reports about the use of radiation. In many cases, positions contrary to the use of nuclear energy are also presented and are not properly based on scientific evidence. Besides this, there is no evidence regarding the effects of low ionizing radiation levels on different organisms, including man.

One of the main issues discussed is related to the presence of uranium mining activities nearby urban areas. Nuclear energy is already known to be a reliable alternative (constant rate of fuel supply, good safety record, etc.) to electric energy generation as an increased concern about employment of fossil fuels is widespread. However, there is generally a poor understanding of the relevant science behind nuclear technologies, which is mainly due to irrational fear of radioactivity or "radiation phobia". There is no doubt that ignorance and fear are major impediments to reasonable debates on radiation issues [2].

Public perception of the hazards related to uranium mining and disposal of radioactive wastes is generally not very positive and the knowledge regarding the benefits of the nuclear industry is still poorly understood. Concerns about harmful effects of ionizing radiation and undesired consequences of exposure to human beings lead to fear of radiation. This was first introduced by the II World War that ultimately made use of nuclear bombs.

In addition, an incomplete model to calculate low radioactivity doses in regions of public concern is conservatively applied by the International Commission on Radiological Protection (ICRP). This model is known as Linear and

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Quadratic No Threshold (LNT) and it is still employed as guideline. Assumptions made through the model resulted in excessively conservative and expensive recommended dose limits for occupational and public exposures [2]. It is however worth mentioning that all available models for calculation of dose limits are somehow subject to criticism, due to the many difficulties in predicting radioactivity effects.

Radiation phobia is also being communicated by poor and often misleading media coverage. Many issues are being debated for decades, such as the safety of uranium mining, disposal of nuclear wastes, etc. Efforts towards improving the acceptance of nuclear issues are being implemented in Brazilian mining operations.

Concepts related to ionizing radiation and its effects in human beings are very difficult to communicate to the regular public. Therefore, there is a need to transform nuclear related information into simpler information using plain language. The task is not an easy one, but uranium mining companies need to deal with these challenges if nuclear technologies are to become more familiar to different groups of Stakeholders.

Great care is taken to guarantee that all procedures involving uranium mining are supervised to keep doses down to safe working limits established by Radiation Safety Officers or Radioprotection Supervisors. Protection from inhalation or ingestion of contaminated radioactive dust is essential to mining operations [2]. In Brazil, INB (Brazilian Nuclear Industries) has a constant concern in order to avoid unnecessary exposure of workers to radioactivity doses above those limits [3].

Past media coverage about nuclear technologies in Brazil was based on insufficient knowledge and it did not present possible benefits to the general public. Nuclear technology is for example employed in cancer treatment (radiopharmaceutical medication, radiotherapy, etc.). This is the other side of the nuclear area that is rarely presented.

A mixed economy company connected with the Brazilian Nuclear Energy Commission (CNEN – a regulatory authority) and under the Science and Technology Ministry, INB is present in the states of Bahia, Ceara, Minas Gerais and Rio de Janeiro, actively participating in the development of major technological projects for the generation of nuclear-electric power [5].

INB answers for uranium exploration, from mining and primary processing, to production and assembly of fuel elements that power reactors in nuclear plants. Such activities form the “Nuclear Fuel Cycle”. It also operates in the area of physical treatment of heavy minerals with prospecting and research, mining, industrialization, and marketing of monazite sand and acquisition of rare earths.

The complex mineralogical formation and unique characteristics of the ore found in Brazil led to the development of an original extraction process for uranium and associated elements, which was successfully performed by INB personnel. Open sky mining enabled a better use of the uranium ore. Only the installations of INB Caldas and INB Caetite will be mentioned in this paper due to the scope of the diagnostic conducted during 2007 regarding communication strategies with local Stakeholders.

INB Caldas was the mining unit that started-up the development of the nuclear fuel cycle technology for generation of electric power, processing the uranium through chemical treatment and its transformation into yellowcake. Once INB Caldas economically feasible uranium was exhausted, the priority was the extraction and processing of the mineral at INB Caetite (Bahia State). From its start-up, control operations have been in place to minimize, reintegrate and stabilize the potential pollution in the area, through the development of Environment Protection and Control Programs. INB Caldas mine is now under decommissioning and its facilities, equipment and mainly the knowledge of its technical staff, are being used for the development and feasibility of new projects.

2. Communication Initiatives and Approaches

Uranium mining workers were interviewed in preparation for a Consultant’s Meeting held in Austria during 2007. During these interviews, it was possible to meet with the INB Caldas Decommissioning Manager and the Processing Manager (Minas Gerais State). Both employees agreed that INB faces an enormous challenge regarding the decommissioning process and pointed out to the fact that the company still lacks a market vision.

First of all, INB Caldas is in the process of preparing and submitting an official document, named PRAD, explaining in details and proposing a decommissioning plan for the whole area, shown in Figure 1. The area about to be decommissioned includes an open mine pit, waste rock piles, and uranium processing installations. This PRAD will be the first remediation plan to be applied by a Latin American country since uranium mining operations started in the 70's. It will be very important for INB to work along with mining companies that have previous experience with decommissioning processes and it will be necessary to promote a structured action that will involve operators and regulatory agencies so that this remediation plan can effectively be carried out.

So far, experience in communication and strategic approaches employed in Brazilian uranium mining operations are very limited. Only after 2006, INB Caldas started to seriously interact with the communities nearby their facilities. One of their first initiatives included a visiting program at INB Caldas that reached approximately 3,000 students (among small children, high school, and undergraduate students). The program was very successful and other initiatives were implemented later on, reaching as much as 1,500 students in 2007. One of these projects, known as the CEVA project (Environmental Awareness) is currently taking place within the uranium mining facilities and has a partnership with a local socio-environmental NGO and bauxite mining companies that also operate in the region. The objective of the CEVA project is to make young students aware of environmental issues and to have them educated in order to multiply environmental awareness within their communities.

INB Caetite has been organizing an essay competition in Brazil since 2004 with participation of local private and public schools. This communication strategy proved to work well with the community. The children are asked to write about their perception of the mining organization. The winners are chosen among the participants and they win a tour that includes a visit to one of the Brazilian Nuclear Power Plants, in Rio de Janeiro State. In addition, a pilot project involving local schools was implemented and supported by the Bahia State Museum. The goal was to present to Stakeholders the importance of radioactivity and its application in modern technologies. The coordinators reported high participation from community representatives in the seminars that were held. However, they observed some minor problems, mainly due to the lack of infrastructure in many schools that were visited.

In addition, a Thematic Room was organized in the Bahia State Museum in order to display nuclear related information to Stakeholders (Refer to Figure 3), presenting ore samples, personal protective equipment, information on individual radioactivity doses, and communication material (posters, pamphlets, etc.) from the mining organization. This activity soon became so successful that INB and the Museum decided to form a partnership in order to take the Thematic Room to local Municipal and State schools. Themes such as the origin of electrical energy (thermoelectrical, hydroelectrical, and nuclear), the uranium atom, application in the medical and agricultural fields, as well as the disposal of radioactive waste, were discussed with Stakeholders within the scope of this communication effort [1].

Communication facilitates the traceability of decisions, allows feedback from the public and/or their representatives, and helps to promote the strengthening of public and political confidence in the mining project along with trust in the competence of the operator [1]. In the case of mining activities, it is relevant to state to a Stakeholder that the activity will stop in the future. Expectations should include the fact that the ore deposits are finite and therefore the company will eventually leave the area. The general trend is to facilitate involvement of Stakeholders in decision making processes and in defining issues such as end-state, future uses for decommissioned mining sites, among others.

3. Results and Discussion

There are many issues that surround uranium mining operations at INB Caldas, one of which being the current plan for site remediation and decommissioning. Communities from nearby cities are unaware of such activities to a level that may impair the final closure of the site. One of the main complaints is the Waste Disposal Program, which is barely understood by regular members of the population or Stakeholder groups (such as local NGO's, churches, public and municipal schools, etc.).

Despite the existence of Municipal, State, and Federal Environmental Agencies that regulate or supervise uranium mining activities performed by INB units in Caldas and Caetite, such as CNEN (Brazilian Nuclear Energy Commission), IBAMA (Brazilian Environmental Agency), Minas Gerais State Environmental Agency and Bahia State Environmental Agency, Municipal Environmental Councils, and Municipal Halls, none of these agencies or institutions have proven expertise or the capability of aiding INB with communication related issues. Their main

role is to make sure mining companies are in conformity with established limits for toxic and radioactive elements in drinking water, underground water, and atmospheric emissions. It would be very interesting if an integrated working plan could be set up with these Environmental Agencies, which could even aid in the development of new research activities, among other items.

It is interesting to mention that both INB sites, at Caldas (Minas Gerais State) and Caetite (Bahia State) have environmental monitoring programs in place. The data collected are kept within the sites and results are routinely reported to Control Agencies (Refer to Figure 2 as an example). However, little technical data is communicated to the population due to the difficulties in interpreting numerical values as well as their meaning. INB has a responsibility to develop and implement communication tools that are appropriate for nearby communities, respecting their ability to process and use information.

It is worth mentioning that INB Caldas was not yet able to contract any company with previous decommissioning experience. Two attempts were done in the last few years and involved partnerships with Brazilian and foreign companies. However, there are many bureaucratic steps that need to be taken prior to decommissioning and are unfortunately delaying the whole process.



Figure 1. Uranium mining site about to be decommissioned - INB Caldas General View.

It is expected in the near future that pressure from national and international agencies, media, NGOs, and communities will direct mining companies to program new communication and business strategies, not only to conform to current regulations, but also to conform to new rules of the international market, improving their image and increasing business and profits at the same time [4].

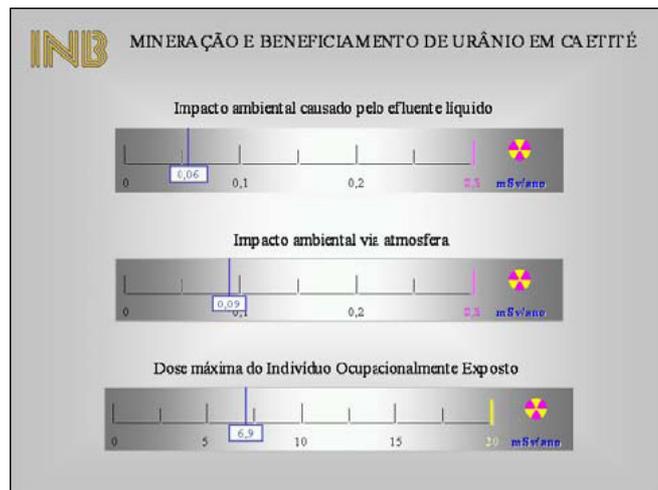


Figure 2. Diagram showing radiological doses from INB Caetite. The diagram shows doses due to liquid effluents, atmospheric pathway, and the maximum dose for a person exposed occupationally (mSv/year).



Figure 3. Example of an information display for the general public at INB Caetite.

4. Perception Studies

Concerns about environmental quality, global weather conditions, and biological diversity are also emerging and require innovations, which should occur at the social and institutional level, as well as in technical levels. In a scientific level, researchers from several areas are contributing to study, minimize, and indicate manners for solving environmental alterations that were introduced by mankind. Studies that survey perception of the general public regarding several issues are becoming more common and tend to evaluate how different groups of people or Stakeholders perceive places and landscapes in which they are born, grow up, work, live, etc.

Human beings need all senses to communicate with the world that surround them and their perception is then defined as the meaning attributed to all information received, such as sensations. Perception is therefore highly selective, exploratory and implies in a set of perceptive activities, such as explorations, comparisons, transpositions, among others.

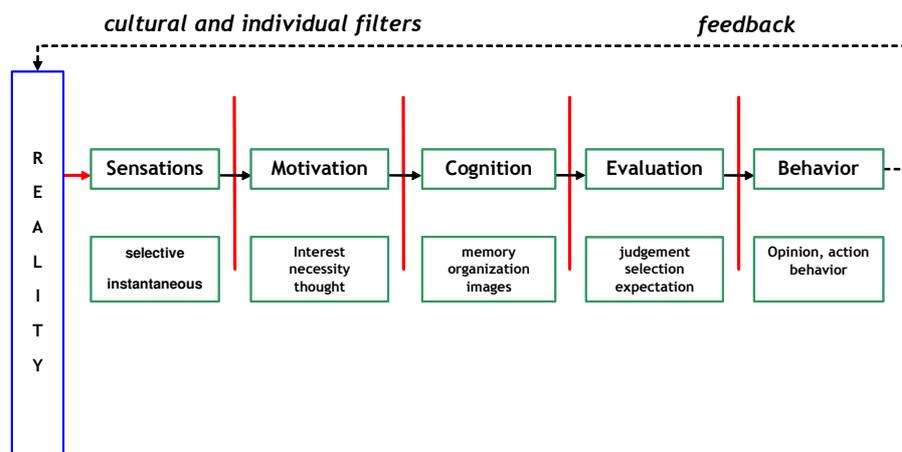
It is important to state that “Perception Studies” or “Acceptance Surveys”, before uranium mining project-start or also during the operational and decommissioning phases, are useful to identify major social issues and should be combined with statistical information on the present and changing infrastructure of the region. Researchers that conduct perception studies need to be well trained regarding observation techniques and be aware of the ambiguous

meaning of key words. Topics to be monitored may include: demographic characteristics, status of Stakeholder groups affected by the uranium mining industry (for example: farmers, minorities, women, aboriginal people, etc.), economic livelihood within the region (number of permanent or seasonal staff, labor migration, unemployment rates), changes in land tenure and use (natural resources), improvement in health care and medical provisions, improvement in education (number of training possibilities, scholarships), and number and type of support given to the community (e.g. financial subsidy for cultural and sport events).

In projects which are likely to impact significantly on people and the environment, these socio-economic aspects need more attention to identify, already in an early stage, problematic, vulnerable, culturally different or potentially disadvantaged communities, and to increase communication with Stakeholders [1]. Outcomes of these evaluations are important to be included in communication strategies.

The theoretical diagram below shows the process by which a person perceives an issue or problem. The focus of a communication plan relies in the “Cognition Step”, specifically when a person searches for information within his/her memory or uses images to access perception [4]. The theoretical diagram also points out the importance of cultural and individual factors that will ultimately affect perception.

Theoretical Diagram of the Perception Process



Perception surveys of Stakeholders can be conducted through data collected in questionnaires or personal interviews. The typical survey must include three methods:

- 1) observation method - questions that simply collect information about a certain subject;
- 2) comparison method - emphasizes the differences between different points of view;
- 3) statistical method - applies a probability calculation.

The data collected from a perception survey is qualitative and consists of names, categories or classifications, for example, Yes/No/I don't know, etc. This type of data cannot be organized by normal ordination (from the highest to the lowest, for example). Since they do not have numerical significance, it is necessary to quantify them by categories, in negative or non-negative results.

The intention is to verify if the company has an impact in Stakeholder groups. Therefore, some questions can be submitted to a person and his/her answer can be placed into a defined category. In some cases, it is useful to simply use two categories, such as approved or non-approved, in order to facilitate calculations and the formulation of conclusions. After a certain question is defined and the data is organized, it is necessary to choose a Probability Distribution that can be employed (for example, a Normal Distribution Statistical Method with Approximation of the Binomial was employed in a perception study conducted in Brazil) [4].

A proper mathematical equation has to be applied to calculate the size of the sample. Usually social researchers use an equation for finite populations. A level of confidence must be chosen and expressed as standard deviation numbers. In addition, the maximum allowed error need to be chosen in the interval between 3 to 5 %, so that statistical data has significance [4].

5. Concept of Conservation Society

Consumption issues and life styles are first identified as basic sources of conflict worldwide. This is characterized by global stratification. Some aspects of the growing conflict are: the relationship structure between natural resources and mankind, the expansion of first world life styles to third world countries, problems regarding access, distribution and control of industrialized goods.

Alternative consumption patterns and less costly technologies, emphasizing environmental balance, should be put into place. The excessive social, cultural, and environmental costs are being profusely questioned. The concept of a "Conservation Society" is clearly in favor of continuous growth in terms of human development and life quality, which can be obtained through modern applications of science and technology [6], including nuclear energy technologies.

In a widespread context, companies from all areas, including mining companies, are currently more concerned in reaching and demonstrating a correct environmental performance through controlling the impact of their activities, products or services. This vision is inserted into more demanding regulations and increasing concern from Stakeholders regarding sustainable development (economic, social, and ecological). This term should actually be dismembered into a socially included development, environmentally sustainable, and economically supported in time [7].

6. Conclusion

Intense mining activities in Brazil have become the object of serious discussion. Uranium is extracted from ores found in areas near urban developments (Minas Gerais and Bahia State). The population is aware of such mining activities, however, there is no clear understanding regarding social and environmental impacts. Previous research [4] with general population living close to mining activities in Brazil made clear that there is a common understanding among members of the general public regarding the fundamental right of mankind to use raw materials provided by nature, such as mineral ores (uranium and bauxite, for example), but this right should not include damaging the environment during extraction or processing phases.

During scheduled visits to INB Caldas (including mine sightseeing, waste rock piles, greenhouse, and mills), a visitor is able to learn about nuclear related technologies through a 1 hour seminar which is held by a trained worker. However, the site does not take advantage of communication personnel that are stationed in another Brazilian state (Rio de Janeiro). A partial diagnostic done by the paper's main author regarding communication strategies in INB uranium mining also pointed out to this issue. It seems that would be of greater efficiency to have personnel trained specifically in the communication area aiding nuclear experts. In general, previous experience in Brazil showed that communication is ineffective probably due to limitations of having associations between communication professionals and nuclear area experts.

Tools to improve communication with Stakeholders within communities nearby uranium mining sites still need to be designed and implemented. Current efforts should be directed towards a clear and objective management approach, in which radioactivity monitoring data can be easily communicated. It might help to know that in developing countries, such as Brazil, many communication approaches normally consider that more populated areas have people with lower schooling levels, while less populated areas have people with more schooling years. This leads to different possible levels of involvement with mining and processing operations, depending also on economic stress, social, and political factors, which may all influence the views about controversial subjects.

Popularization of useful units to measure radiation is also a very important part of an effective communication process. Numerical values can be interpreted before communication activities. For example, it would be useful to the general public to know that local drinking water is within acceptable limits. Easy and clear scales, using available units, need to be prepared in order to be presented to Stakeholders. The commonly used millisievert unit (mSv) accounts for differences in the biological effect of several types of radiation and could be readily communicated. This type of information can be useful to build the trust between uranium mining companies and population, as well as spread the benefits of nuclear related technologies.

Modern strategies that can help to improve the relationship between mining companies and local population should be proposed and guide other similar projects involving diverse mining activities near urban areas. Available government databases should be employed to gather information about local mining concession areas. In addition, identification of the population media habits can be evaluated with more depth and aid in the communication process. Data such as frequency of newspaper reading, content of radio programs, follow up of local, regional, and national news, are important to characterize Stakeholders and their needs. This knowledge can be especially useful in situations involving communication of potential risk or emergency situations.

There are countless advantages offered by the media, such as ideological strengthening of companies, brands or products, with new opportunities to link companies to environmental action, innovation and creativity to motivate popularization of companies and products of interest, establishment of communication channels with communities (influence on formation of opinions, increased awareness, etc.).

Fruitful interaction between Stakeholders and mining companies can also be fostered through public meetings, organized in a routine basis to clarify issues that may raise during the life cycle of a mining facility or nuclear installation. Participation of NGOs is especially important since it can be used as a monitoring tool. Companies and governments could observe and monitor NGO actions, which would ultimately function as an indicator and be useful to manage social impact in regions nearby mining activities. Good Stakeholder management must weigh the claims of all Stakeholders, all who will be affected by the decisions of mining companies.

Perception of a neighbouring community regarding an uranium mining industry is heavily dependent on the efforts of the industry in interacting with Stakeholders within the community. There are several manners of interaction, some of which were already mentioned, such as sport events, public meetings, scheduled visits to uranium mining and processing installations, technical seminars, among other initiatives. Communication strategies also need to take into account that an individual member of the general public could be very concerned about health matters and possibly contaminated foodstuff. So far, little information was communicated in Brazil about health related to uranium mining activities, perhaps in order to avoid panic or an increase of radiation phobia.

Although communication needs may be different in several countries and in each project, international experience and successful examples can help achieve solutions relevant for specific sites. A structured communication strategy is needed to start an effective interaction with the Stakeholders. The main goal of interaction is to overcome opposition and to gain active support of relevant organizations, companies, and individuals. A proactive Stakeholder communication policy has the power to prevent unnecessary legal challenges and boycotts. In addition, a good communication policy can positively enhance the company's reputation and provide greater transparency of the project, which in turn can make the company a more attractive investment. Effective communication of the company's mission to the employees and labor union helps maintain "social peace". Moreover, employees who are members of the local community can become proponents for the company's message in the community. Regularity in informing Stakeholders about mining operations and their environmental performance is essential for reinforcement of the standing of the operator in the community [1].

Creation of "friendly to use" georeferenced databases can help to gather nuclear related information. Such online and/or library type databases can also be made available to Stakeholders, facilitating their access and understanding of activities that take place next to their living area. Numerical data obtained in previous research [4] showed that economic and social development of a city and its community nearby mining activities is closely related to the presence of such activities, which even contributes to an increase in taxes and benefits to the population.

Finally, uranium mining activities may always face an issue of problematic coexistence between the mining company and local community. In this case, communication personnel and the operators need to emphasize the need for the mineral being mined or extracted, which means presenting its demand, possible uses, and benefits that will eventually result from the operation. There is no doubt that any mining operation will take place in geographic

locations where ores appears in sufficient or economically viable concentrations, so it is pointless to argue the presence of a mining company without understanding the main concepts that are involved in improving the quality of life for mankind.

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