PUBLIC PERCEPTION OF RADIATION SAFETY — A CASE STUDY IN BRAZIL

P. WIELAND
Department of Nuclear Safety,
International Atomic Energy Agency,
Vienna

F. STEINHÄUSLER
Institut für Biophysik und Physik,
Universität Salzburg,
Salzburg,
Austria

A.M. XAVIER
Comissão Nacional de Energia Nuclear,
Rio de Janeiro,
Brazil

U. UNTERBRUNER
Institut für Didaktik der
Naturwissenschaften,
Universität Salzburg,
Salzburg,
Austria

Abstract

PUBLIC PERCEPTION OF RADIATION SAFETY — A CASE STUDY IN BRAZIL.

Since the early 1980s, Brazil has been operating installations which run the gamut of the nuclear fuel cycle, from uranium mining and milling to a nuclear power plant. A second power plant is under construction and is planned to come on stream in 1999. In 1987, Brazil was shaken by the largest radiological accident on record involving a unit of radiotherapy equipment. This accident contaminated large areas of Goiânia, a city of some 1 million inhabitants, and generated 3500 m^3 of radioactive waste. At present, apart from the facilities involved in the nuclear fuel cycle, close to 2600 installations in Brazil utilize radioactive materials in medicine, industry and research. Following the Goiânia accident, the Brazilian authorities built a final subsurface disposal facility, which is currently in operation, for the waste generated by the cleanup of the city. Studies are now under way for the selection of a national waste repository. However, in spite of all the activities mentioned, the Brazilian public is largely unaware of both the benefits and the real risks of radiation. In order to assist in the development of an appropriate communication strategy focusing on radiation issues and directed at the public, a survey was undertaken. The survey contained questions on basic knowledge, the credibility of information sources dealing with radiation issues, recollections of the Goiânia accident, reacting to an emergency situation in general and Goiânia in particular and on waste related risk comparison. An analysis of this survey is presented. Practical issues are reviewed, including a target oriented communication programme involving the nuclear community, the regulatory authority, educational centres, the media and the public. The topics addressed are the present crisis of confidence, limitations, misconceptions and requirements, and communicating in a situation of crisis.

1. COMMUNICATING NUCLEAR ISSUES: THE CURRENT DEFICIT

The present situation surrounding the communication of nuclear issues to the public and political decision makers is unsatisfactory for all parties involved. The nuclear community finds itself frequently portrayed as a dubious source of information. The nuclear regulatory body quite often does not comment publicly on its role in the control of radiation sources. The media face the temptation of sensationalizing anything 'nuclear', tempered only by their professional mandate of unbiased reporting. Media reports reflect frequently what journalists are told to be the facts, rather than the outcome of research on what the facts really are. Hence, the public finds itself unable to judge which criteria apply to obtain trustworthy information and often ends up distrusting both the nuclear experts and the journalists.

This lack of constructive communication among all parties involved impacts negatively on the decision making process covering a wide range of nuclear issues. The situation is even more challenging in times of a nuclear crisis, such as a large-scale accident with off-site consequences. Local, regional and national interests can take preeminence over objective scientific arguments when it comes to communicating about the risks associated with countermeasures taken as part of emergency management decisions. At the radiological accident in Goiânia [1, 2], insufficient understanding of basic radiation matters caused excessive emotional stress among residents during the mitigation of the consequences of the accident, especially during the burial of the contaminated victims. A large amount of resources were spent to build a repository for 'waste' with a very low specific activity (less than 87 kBq kg^{-1}); these materials could have been disposed of using the conventional landfill option [3].

A major repercussion of the Goiânia accident was to bring to the attention of Brazilian society the negative aspects of radioactivity. The risks associated with the peaceful uses of radiation, ranging from energy production to industrial and medical applications, were magnified by the Brazilian media and the fear of radiation spread in the country, adding to the level of anxiety of the population. The Brazilian Regulatory Authority recognized the need for prompt action, both to put the understanding of radiological risk by the public in the right perspective and to diagnose the real situation concerning the safe use of radiation sources in all of Brazil. Soon after the accident, once conditions of normalcy had been re-established in the city of Goiânia, a broad inspection programme was carried out nationally for all existing radioactive installations with the aim of collecting updated information on the inventory of radiation sources, radiological protection practices, available monitoring devices and other relevant data. Between 1989 and 1991, some 4500 radiation sources no longer in use were collected at the request of users [4].

In the last ten years, efforts have been made to keep under strict control all nuclear installations and the radiation sources used in all applications. In 1997, nearly 2600 installations were registered in the data bank of the Brazilian Nuclear Energy Commission (Comissão Nacional de Energia Nuclear–CNEN). A national inventory of radiation sources is available and its content is constantly updated and transmitted to all institutes and offices of CNEN as well as to other Governmental sectors. Moreover, CNEN has a training programme for inspectors and other staff who perform activities related to the system of notification, registration, authorization and control of radiation sources.

Notwithstanding all the progress made in the field of radiation safety and control of radiation sources, public opinion in Brazil is still very sensitive to radiation issues. Exaggerated and technically incorrect information often reported by the media finds its way to readers and listeners and the use of nuclear energy always causes polemics.

At present, CNEN maintains regional offices in several geographical areas of Brazil, in order to carry out more efficiently its duties regarding the national control of radiation sources, the provision of faster assistance concerning radiation safety and information to the population on radiological questions.

2. HOW ARE RADIOLOGICAL RISKS PERCEIVED IN BRAZIL?

In order to obtain objective information about the public perception on radiation risks in Brazil, a questionnaire-based survey was conducted in several cities from September 1996 to August 1997. This preliminary assessment on public risk perception is intended to assist in the development of communication programmes by the Regulatory Authority and nuclear facilities, as well as in the improvement of educational programmes.

2.1. Methodology

The seven-page questionnaire was designed and revised by lay persons and by professionals from the nuclear, communications and teaching areas. The principal objective of the questionnaire was that it be neutral and self-explanatory.

Respondents were selected at random among the population in several cities of Brazil. The statistical samples were stratified and controlled for gender, age, education and occupation. All samples were selected to follow the demographic distribution of the Brazilian population [5]. To avoid biased results, samples of people working in nuclear activities were excluded from this analysis. The total number of respondents was 227 (116 female and 111 male).

Data from the questionnaire were checked, encoded and processed using the Access database. As the sampling of the general public was non-probabilistic, the results of this research cannot be construed to be fully representative of the perceptions of the entire Brazilian population. However, it provides valuable preliminary information about the general understanding, misconceptions and informational needs of the population on nuclear issues.

2.2. Results of the pilot research

2.1.1. Importance of the applications of radiation in medicine, industry and research and on the production of nuclear energy in relation to the needs of Brazil

Eighty per cent or so of the interviewees considered the applications of radiation in medicine, industry and research as indispensable or very important/important. While some 55% shared equal views on the use of nuclear energy, they expressed doubts as to whether Brazil could handle this technology safely and without undue risk to the population and environment. Some recalled the large hydropower potential of Brazil. Others mentioned that the production of nuclear energy depended on which region of Brazil a nuclear power plant would be planned for.

2.1.2. Knowledge of basic concepts

Although 81% knew or had heard about the subject of radioactivity, 35% did not know what the symbol indicating the presence of radiation meant. The acronym 'CNEN' was not familiar to more than half of the respondents. However, the acronym 'IBAMA' (the governmental organization responsible for environmental matters) was known by close to 90% of those questioned.

2.1.3. Interest in nuclear matters and sources of information

The interest in nuclear matters was very high. Some 90% of the respondents said they would like to obtain more information on the basic concepts relating to radiation. The preferred sources of information were: school (46.7%); media — newspaper, TV (43.6%); CNEN (38.8%); Ministry of Health, Civil Defence, or nuclear energy plant (2.2%).

2.1.4. The radiological accident in Goiânia

Ninety-two per cent remembered the accident and had found out about it through TV reports. Only seven per cent didn't know about the accident and of those questioned, half had been younger than 15 years old at the time of the events. Recollections of the accident were to be described freely, based on personal experience, without prior explanation. The answers demonstrated that even ten years on, the population still had vivid memories of the occurrences and in several cases, expressed a high degree of emotion. Although varied, the replies could be broken down into subjects as illustrated in Table I.

TABLE I. RECOLLECTIONS SURROUNDING THE RADIOLOGICAL ACCIDENT IN GOIANIA

Recollections	Female respondents (%)	Male respondents (%)
Victims, death, family segregation, children involved, panic, contamination	30.2	37.8
Ignorance of the population to deal with radioactive matters; the source was manipulated by innocent persons who were unaware of the great risk they were incurring	20.7	13.5
No particular recollection	12.1	6.3
Lack of care with radiation, irresponsibility of the radiotherapy clinic	11.2	9.0
Other issues (discrimination of the population; lack of preparedness to deal with emergencies; radiation victims and radioactive waste; the theft of a radioactive source; tragedy in a quiet city such as Goiânia)	10.3	9.0
No governmental control over radiation sources	6.7	9.9
Media sensationalism	6.7	9.0
Complaints about the lack of information on the accident	3.4	0.9
Positive impression about the actions to remedy the situation (e.g. CNEN monitoring and decontaminating, area control, etc.)	3.4	6.3
No reply	28.4	30.6

The next question was "did you know that ..." followed by a list of specific facts about the accident and the mitigation of the consequences. The results of the replies to these factual questions were as follows: the source involved contained caesium-137 (80.6%); the radiotherapy clinic was abandoned (53.7%); several areas of Goiânia had to be evacuated (52.9%); some houses had to be demolished (43.3%); there were four fatalities (46.7%); by Christmas the situation in the city had returned to normalcy (4%); there is a Foundation in place to take medical and social care of the population involved (22.5%).

The results suggest that the causes and consequences of the accident were remembered with far more acuteness than were acknowledged the tremendous efforts undertaken by the authorities to return the situation to normalcy. This can be seen as an example of the lack of proactive communication.

2.1.5. Reaction in the event of an accident involving radiation

The question on reacting to an accident went as follows: "If someone told you that an accident with radioactive material occurred nearby and there is a possibility that you may be affected, what would your immediate reaction be?" Sixty-four per cent of the respondents indicated they would call CNEN or the Civil Defence; 18% said they would go home and listen to the radio and TV in search of more information; 8% stated that they would continue their current activity but would start to get worried. Other answers (14%) were: "go immediately to another place, preferably another city"; "run to the telephone and call friends to ask about the problem"; "would not believe the person and continue current activity"; "call fire brigade"; "call family doctor"; "pray"; "don't know"; 4% of the persons interviewed didn't respond to this question.

2.1.6. Comparison between perceptions of the environmental impact of different types of waste

Fig. 1 shows the results of the analysis of the responses to this question. Although there is great concern about radioactive waste, wastes from hospitals and from the chemical industry are also considered by the respondents to be dangerous to human beings and to the environment. The perception of the respondents as to why radioactive waste would be more dangerous to the environment is that: "it is difficult to condition, immobilize, isolate and

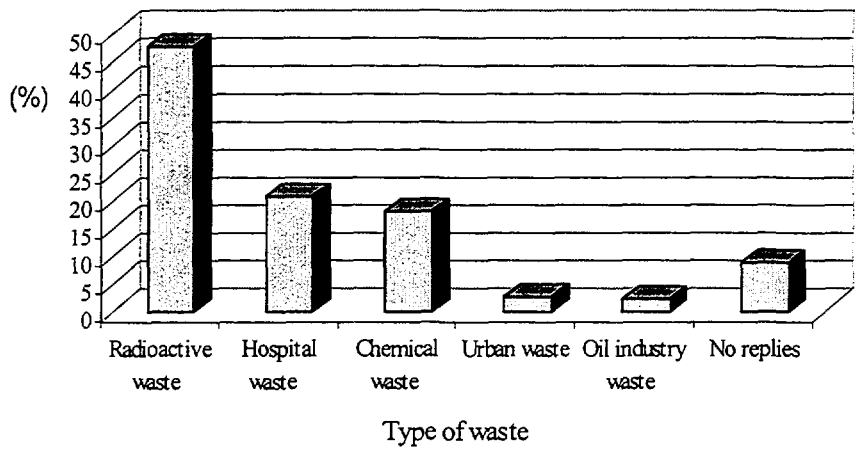

FIG. 1. Comparison of perceptions on the environmental impact of different types of waste.

control it; it cannot be eliminated, reprocessed or recycled; it remains active for a long time and contaminates large areas; it can damage human health; there is no international consensus or knowledge on how to manage it".

3. MAJOR CAUSES OF THE NUCLEAR COMMUNICATION CRISIS

The primary cause is the obvious deficit of established professional contacts between representatives of the nuclear community (scientists, industrialists, regulatory agency officials), the media (journalists, news agencies) and the public. The lack of trust experienced by the nuclear community often results in a reluctance to co-operate caused by past experiences of having been misinterpreted or even misused. Similarly, the media tend to distrust information originating from within the nuclear community for being biased or, at best, representing only half-truths. Again, negative experiences play a major factor here since in the past some nuclear incidents were communicated to the media too late, with insufficient detail, or falsely altogether.

In addition to mutual distrust one must add the tendency of the nuclear community to overburden the media with a multitude of complex scientific details. In contrast to this decade-old communication problem of the nuclear community [6], professional pressure groups opposing nuclear technology usually excel in delivering their critique to the public in a format especially well suited to the media: catchy "sound bites" for interviews and action-packed footage particularly geared towards prime time TV presentation.

Most journalists often have inadequate technical backgrounds to evaluate the scientific assessment of a complex nuclear issue. In addition, the ultimate target audience itself is largely ignorant about science in general and nuclear matters in particular. However, despite this justified critique it must be remembered that the primary objective of the media is not to compensate for any potential educational deficit of the public, but simply to increase the number of TV viewers and newspaper readers.

Another important reason for the current communication difficulties is the lack of understanding of the constraints which exist for the members of the nuclear community as well as for the media. In serving the public, both groups have as their primary responsibility its basic right to be informed objectively about nuclear matters. In case of a nuclear or radiological accident, the situation can become even more difficult. The emergency response team is challenged to manage the technical aspects of the crisis. Additionally, via the media, it must intensify all its efforts to optimize the provision to the public and its political decision makers of objective and technically correct information on the emergency. This route needs to be established and tested well before an actual emergency. This process should have a high degree of transparency, with the use of a language easily understandable by the end users of the information and should be tailored for the specific needs of the different target groups (political decision makers, medical profession, general public, media, etc.).

However, inherent shortcomings frequently obstruct the unbiased flow of information to the public:

a) The nuclear community (workers, operators and researchers in nuclear field); regulatory authority:

- insensitivity about the — frequently scientifically unwarranted, but nevertheless perceived as threatening — safety concerns of the public (e.g. unfamiliar ecological risks with considerably delayed environmental effects; potential of harm to next of kin; risks due to human failures);
- inconsistencies in the approach to the management of nuclear issues directly affecting the private sphere of the public, e.g. largely differing recommendations even between

neighbouring countries, such as limits for radon indoors (USA: 150 $Bq \cdot m^{-3}$; Canada: 800 $Bq \cdot m^{-3}$) or the use of stable iodine in case of a nuclear accident (Austria: provided over the counter to all citizens; Czech Republic: in store only for residents near a nuclear power plant);

- communication with public, media, decision maker is usually done only in reaction to a crisis. Regular and proactive programme of communication is inadequate compared with the national need of information on nuclear safety issues.

b) The media:

- unwillingness to provide sufficient space and time for an in depth coverage of complex nuclear issues;
- tendency to dwell on scientific uncertainties, interpreting them as a lack of knowledge (e.g. low dose-effect relationship);
- emphasizing differences of opinion between nuclear experts as 'contradictions' (e.g. probabilistic safety assessments with different assumptions);
- reporting selectively on aspects of human drama, irrespective of the existence of a dose-effect relationship (e.g. victims of atomic bombs; "Children of Chernobyl" phenomenon).

d) Educational centres:

- there is no regular curriculum on nuclear matters for primary education. Instead of providing updated and factual information on nuclear matters, some basic schoolbooks contain scientific mistakes or are a priori biased against nuclear technology in that they show its dangers and military uses only [7].

e) The public:

- inaccurate perception of "everyday risks" vs. unfamiliar risks associated with nuclear technology (e.g. traffic accidents are considered less risky than nuclear accidents);
- inherent aversion to risk-related information presented as probabilistic event (e.g. a risk equal to 10^{-6} is not commonly understood as "acceptable", although in reality even higher risks are accepted routinely during spare-time activities).

4. COMMUNICATION AS PART OF EFFECTIVE MANAGEMENT

This preliminary study indicates that communication should be considered as part of effective management and some practical measures are to be taken by the nuclear community, the regulatory authorities and the public to improve communication, including:

Nuclear community: an adequate infrastructure with dedicated staff and electronic communication network should be in place to promote at large the updated information on the benefits and risks of nuclear technologies in a public-friendly language that can actually reach the public (e.g.: advertisements, visitor centres at nuclear installations, brochures, home page on the Internet).

Regulatory Authorities: they should be open to questioning and provide reliable, factual, independent, balanced and timely information about nuclear issues; they should establish an adequate infrastructure to implement a programme of nuclear communication with dedicated and trained staff, focusing on the different audiences (nuclear community, media, decision makers, lay persons, etc.); they should evaluate the communication programme addressing specifically the concerns of the different audiences, making use of public opinion research vehicles.

Media: acting as a messenger between the nuclear community and the public, they should emphasize technical correctness and balance in their reporting rather than favour the access of information from unverified sources; they should use preferentially trusted contacts with the nuclear area, e.g. through dedicated sources of information (Regulatory Authorities, IAEA — http://www.iaea.or.at/worldatom, OECD-NEA, ENS-NUCNET, and USCEA INFOWIRE, ACCESS TO ENERGY).

Educational centres: they should revise their regular curriculum for primary education, in order to provide updated and factual information about radiation.

Public: it has to accept and be accepted in its role as solution oriented partner. This will allow for informed decisions on nuclear topics with potentially far reaching socioeconomic consequences. The public should look for reliable sources of information and compare options against what makes sense and not against a generalized, preconceived idea.

REFERENCES

[1] INTERNATIONAL ATOMIC ENERGY AGENCY, The Radiological Accident in Goiânia, IAEA, Vienna (1988).

[2] SILVA, L.H.C.; WIELAND-FAJARDO, P., ROSA R., "Radiation Protection During the Assistance to the Victims of the Accident in Goiânia" (Proc. International Radiation Protection Symposium, Dubrovnik, October 1989).

[3] INTERNATIONAL ATOMIC ENERGY AGENCY, Exemption of Radiation Sources and Practices from Regulatory Control, IAEA-TECDOC-401, IAEA, Vienna (1987).

[4] SALGADO A.G., BRANDAO, R.O., XAVIER, A.M., Operação "Arrastão": Recolhimento de Fontes Radioativas Consideradas sem mais Utilidade (Proc. IV Congresso Geral de Energia Nuclear, Rio de Janeiro, 1994) 499–501.

[5] INTITUTO BRASILEIRO DE GEOGRAFIA E ESTATISTICA, Census, 1996, http://www.ibge.gov.br .

[6] NUCLEAR ENERGY AGENCY OF THE OECD, Nuclear Energy: Communicating with the Public, Paris (1991).

[7] ASSOCIAÇAO BRASILEIRA DE ENERGIA NUCLEAR, Revista Brasil Nuclear ano 3 n°12 (1997).

BIBLIOGRAPHY

INTERNATIONAL ATOMIC ENERGY AGENCY, Nuclear Communications: a Handbook for Guiding Good Communications Practices at Nuclear Fuel Cycle Facilities, IAEA, Vienna (1994).

INTERNATIONAL ATOMIC ENERGY AGENCY, International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources, Safety Series No. 115, IAEA, Vienna (1996).

INTERNATIONAL ATOMIC ENERGY AGENCY, Communication of Nuclear, Radiation, Transport and Waste Safety, A Practical Handbook, IAEA TECDOC in preparation.