LESSONS OF THE RADIOLOGICAL ACCIDENT IN GOIÂNIA

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Abstract

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On the basis of the lessons learned from the radiological accident of Goiânia, actions are described which a nuclear regulatory body should undertake while responding to an accident of this nature.

1. INTRODUCTION

The lessons learned by a person after any unusual event depend on his or her position during its occurrence. Specifically with regard to the 1987 radiological accident of Goiânia, the lessons described herein derive from the observations of the regulatory body responsible for the production, trade, licensing and surveillance of nuclear materials and radioactive sources, as well as for decontamination. Ten years after the accident, knowledge has been consolidated in four areas: prevention, minimization of the response time (the time between the occurrence of the accident and the initiation of remedial actions), intervention and follow-up.

2. CLASSES OF ACTIONS

2.1. Prevention

Preventive actions have been characterized as the steps aimed at reducing (minimizing) the probability of a radiological accident. This minimization is subject to the hierarchy in the areas of control and responsibility, the frequency and types of control, the audit of these controls and the difficulties encountered in the process. The hierarchy in control and responsibility includes the participation of the operator, of the regulatory research institute and of other governmental organizations at the city, state and federal levels. Since the operator is the only entity with permanent control over the installation, it should bear the primary responsibility. Therefore, it should have the technical abilities to enable it to understand all the facets of its responsibility.

By analogy, there is a presumed shared responsibility between a car driver and the governmental institution that verifies the driver's ability as well as the mechanical and safety conditions of the vehicle he or she uses. It is also understood that, at some point in time, this driver might either suffer or cause an accident. In the event of an accident caused by a negligent driver, e.g. owing to the driver's failure to maintain the brakes properly, it is this driver who could have avoided causing the accident, and not an organization involved in issuing drivers' licences or vehicle registration papers. This reality, however, does not lessen the need for

governmental organizations to establish rules and set the frequency and types of controls in order to diminish the likelihood of accidents.

Radioactive sources, in particular, should be controlled daily by the operator, and the verification of their integrity should be periodical. Significantly, this routine check becomes tedious to the operator, and the reliability of the check suffers as a consequence. A periodic report to the regulatory body can improve the credibility of the quantitative information provided by the operator. Quality controls as to source integrity and to optimization of operational procedures, which result in visual qualification of the installation used by the general public, can be added to this governmental control.

However, preventive actions of this kind are difficult to implement, especially in developing countries, because of conflicts between legal requirements and the technical actions needed. The lack of qualified professionals, the extended geographical areas involved and the growing use of radioactive sources also contribute to transform preventive actions into difficult endeavours. It should be remembered that social problems in developing countries, some of them very urgent, collide with the safety actions necessary. These difficulties are compounded by the fact that the technically skilled operators are employed predominantly in the nuclear medicine and radiotherapy sectors of the hospital system and that a large number of governmental bodies, particularly in smaller cities, lack technically qualified staffs to implement legal controls. It should be emphasized that in many countries, as well as in Brazil, the medical use of radioactive sources started more than a decade before the establishment of the system to control their use and to assess the risks involved. Even today, the use of radioactive sources in smoke detectors, though their numbers are limited and they are localized, represents a new risk to non-qualified maintenance personnel. Similarly, the slow pace of legislative change makes it difficult to keep up with the fast evolution of the applications of radioactive sources.

2.2. Minimization of the response time

If, despite all preventive measures, a radiological accident occurs, the magnitude of the area, the number of victims and the psychosocial effects will be affected by the time elapsed between the occurrence of the accident and consequent identification and intervention. Clearly, saving time is closely linked to preventive action. Therefore, the type of control and its frequency constitute the first accident indicators. The established system of control must preserve its reliability and must allow immediate action.

Operators do not always realize the risks involved with sources on which affixed visual symbols of danger might be lacking or ineffective in warning the general public of the hazards of unprotected handling. Warnings which are not effective should be eliminated in favour of other clear and easily understandable visual messages of danger consistent with local symbolism and popular recognition. Better working warnings can be designed with, e.g., the participation of radiological protection specialists, medical doctors, pharmacists and firemen.

In the case of stolen material, another link — a receptor — is needed midway between legality and illegality. An intermediary entity of this kind, though it would not act as a reliable information source, would play a key 'tracing' role in the national distribution network, as stolen objects are not usually negotiated in the region where they were illicitly obtained.

2.3. Intervention

Although it is possible to determine some accident scenarios, these will never include all the aspects of a real-life intervention. The type of installation, its geographical location, the social classes involved and their contamination vectors are all correlated. In this regard, certain

basic practical principles, gained from the experience of the decontamination of Goiânia, are described below.

2.3.1. Intervention levels

The recommendations of ICRP Publications 26 and 60 provide that actions for radiological protection should be based on as low as reasonably achievable limits, taking economic and social aspects into consideration.

After intervention has started at a site, the local population, moved by its natural curiosity, becomes the main controlling agent, demanding in practical terms that the levels of exposure return to the original values. Therefore, the levels of intervention and recording, as defined in the Basic Standards for Radiological Protection, become only reference values.

In Goiânia, the return of the exposure levels to their original values resulted in the removal of an excessive amount of waste compared with the quantity which should have been removed to prevent radiological damage.

The lack of conceptual knowledge about the basis of intervention levels contributes to the discrimination of sites, people and products. This discrimination can be reduced by the specialists involved in the decontaminating procedures. The credibility of the technical staff involves purely personal considerations and, if it is used inappropriately, can work counterproductively, thus causing even further discrimination. The actions undertaken should reflect local characteristics. In Goiânia, residents living near the contaminated areas offered water, juice, coffee and fruits to the technicians of the Brazilian Nuclear Energy Commission (CNEN) in attempt to identify rejections which would indicate possible contamination.

2.3.2. Co-ordination and unified action

Although an intervention plan should exist, some characteristics should be anticipated and legally consolidated to reduce and facilitate intervention.

The lack of previous knowledge of the area involved in the accident, the number of victims, the contaminating material and the characteristics of the site make it impossible for a single institution to possess all the means necessary for an intervention. The collaboration of several organizations with neatly differentiated hierarchic subordination is necessary and demands co-ordination at the federal, state and city levels under a unified command.

This unified command should have legal authority to perform all necessary actions. Further to the existing overall plan, daily procedures should be proposed which are consistent with the ongoing response activities. Moreover, the unified command should remain in the area for the duration of the process of intervention.

2.3.3. Legal aspects

Intervention takes place whenever emergencies demand urgent decisions. These include exceptional procedures for the acquisition and import of materials, the hiring of services and the disposal of materials. Customs barriers should be waived to import medical products, equipment and consumer materials. Moreover, the authorities should grant powers to isolate areas, retrieve contaminated goods, decontaminate or demolish houses, select areas to store waste temporarily and co-ordinate relief to the victims.

The lack of these legal tools, resorted to on an exceptional basis, can hinder or delay an effective action to minimize the consequences of an accident.

2.3.4. Site for waste disposal facilities

As soon as it starts, the decontamination of an affected area produces a large amount of waste that should be removed immediately. The choice of a nearby site for temporary storage is therefore very necessary. This area should have features which will allow it to become a permanent site for the construction of waste disposal facilities in the future, in order to avoid transport accidents and the unnecessary exposure of personnel.

2.3.5. Verification of local products

The social phenomenon of discrimination occurs not only in the vicinity of the affected area, but also in faraway regions.

At the time of the accident, discrimination against vehicles with license plates from Goiânia was commonplace.

Furthermore, unethical financial interests led to discrimination against products from the whole area surrounding Goiânia, as well as from unaffected regions farther away. In this respect, in order to avoid discrimination, it is important to create groups with powers to inspect and analyse products and issue certificates of integrity, hence reducing the psychosocial impact of accidents. The results of product analyses should have legal support and should be final.

2.3.6. Care of victims

The classification of victims, sites and rescue teams should be initiated immediately. During the selection of the medical staff to look after the victims of the Goiânia accident, a lack of nurses, paramedical workers and cleaning personnel with a sufficient background in radiological protection was observed.

Additional problems encountered were the deficiency of (i) laboratory support to perform clinical analyses, (ii) laundry, (iii) a system for the collection and disposal of hospital and decontamination wastes and (iv) medical equipment.

2.4. Follow-up

The insufficiency of funds in developing countries makes it necessary to set priorities for future actions once the root cause of an accident has been dealt with. Well established rules to allow the continuous monitoring of victims, the reconstruction of homes and the payment of indemnifications are very important and should be formally drawn up.

3. CONCLUSION

Despite the lack of knowledge about all the conditions which had prevailed prior to the accident, the rapid decontamination of the affected area and the assistance to the victims of Goiânia resulted in positive reports by specialists and international organizations. This success may be credited to the solidarity of the various institutions involved at the federal, state and city government levels, backed by the technical ability of the staff of CNEN.

In retrospect, the greatest lesson learned was the solidarity demonstrated by the professionals of the Brazilian Nuclear Energy Commission and all the other organizations involved, which became an example of efficiency in the shortest time possible and enabled the response teams to act in an integrated fashion, swiftly and effectively.