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Abstract

GOIANIA 1987: SEARCHING FOR RADIATION.

The founding of the Searching for Radiation Group following the radiation accident in Goiânia, Brazil, in 1987, is described. Particulars on the equipment and detector used, the number of people monitored, the techniques used to gather information on the probable date of the accident, about possibly contaminated places and people are provided and communicating with the general public is addressed. The discussion is divided into three main parts: 1) how the Searching for Radiation Group was formed; 2) the participation of the state Health Secretariat and the street children in the Group and 3) the lessons learned.

1. INTRODUCTION

In the month of September 1987, a Cs-137 radiotherapy unit was removed in an unauthorized way from an abandoned clinic in Goiânia, a city situated in the central part of Brazil. The 50.9 TBq source was subsequently broken up and contamination ensued. The singular aspect of this case of contamination was the involvement of many persons who contributed to the spreading of contamination by distributing fractions of the source among relatives and friends within the city and surrounding towns. Consequently, the accident did not have a locally confined character, but aspects which gave rise to the fear that it might entail severe consequences for public health. In the following reference is made to these fears and the actual contamination situation, the search for contaminated spots and people and the detectors used.

Another aspect considered is how such an accident could cause a chain of events that could seriously affect the economy, stigmatize the population and disrupt social relations throughout the community.

2. THE ACCIDENT

Even though notification of the accident was made as late as September 28, 1987 there is enough evidence to reconstruct the chronology as follows. In the early part of September, two young male residents of Goiânia entered an abandoned clinic in the centre of the city to remove a large metallic object to sell it as scrap metal. The object was fairly large and heavy (close to 450 kg) and was made of iron. It contained a stainless steel cylinder filled with lead, making it quite difficult to transport. Since the price paid for lead as scrap metal was approximately eight times more than that paid for iron, they decided to dismantle the device and retrieve only the part containing lead, which weighed some 120 kg. This part of the device was taken home on a wheelbarrow and, after several days, was broken open with a sledgehammer, and a 2.5 cm platinum capsule containing the Cs source was found. They then sawed open the capsule itself, revealing approximately 100 g of luminescent material, described by the witnesses as "carnival glitter".

Seeing that this did not have any commercial value, they decided to sell the whole lot to a waste paper dealer who was very attracted to the bluish halo emitted by the material at night. He then decided to cut the platinum cylinder into pieces to distribute to his relatives and friends. Children playing in his scrap paper storage area were also attracted to the material and began to play with it, spreading it to their hands and bodies. The children and workers, in turn, took the contamination home with them and spread it on clothing, paper, walls, floors, and in one special case even consumed some of the material that had spread through the manipulation of food. The child involved began to vomit after just 10 minutes. Within a few days, many others began to feel ill. Nearly two weeks would go by, however, before their illness was diagnosed as caused by radiation contamination, and the source of the problem identified as exposure to ^{137}Cs .

After the first symptoms of radiation sickness began to appear, some concerned people transported the highly contaminated stainless steel cylinder by city bus to a public health service, contaminating the bus stop, the bus and the health service office itself. This piece of metal was giving off more than 6 Gy/h on contact! Further details on the development of the accident can be found in the literature [1].

3. FOUNDING THE 'SEARCHING FOR RADIATION GROUP'

In the first days following the accident and its detection, a number of heavily contaminated victims visited various medical doctors and hospitals due to their poor state of health and unknown symptoms of sickness (acute radiation syndrome), contaminating medical practices (three) and hospitals (five). In some cases the patients were treated for dehydration and tropical diseases (burns) due to the lack of proper diagnosis. It was in one of these hospitals, the Tropical Diseases Hospital, that one of the medical doctors suspected that these symptoms were related to radioactive disease, so he contacted a physicist who was able to verify the fact and give the alarm to the Brazilian Nuclear Energy Commission. The identification of the victims was then immediately started by taking the first steps to register and isolate them at the Olympic Football Stadium, located close to the centre of the city.

In the field of the Olympic Stadium, on September 29, the day after the accident had been detected and the source identified as being CsCl_2 , which is very soluble, many of the victims were installed in tents supplied by the civil defence organization. Outside of the stadium many people stood in the hope of receiving information, some of them awaiting news about relatives or friends who had been isolated.

In order to detect contamination and limit its transfer, a special monitoring group (the 'Searching for Radiation Group') was set up and based at the Olympic Stadium. The tasks of the group were to make contamination checks on the people that had been isolated there, to measure members of the population who came to the stadium for contamination checks, to perform the first external decontamination on the victims and to search for other contaminated areas and people, based on information gathered with the aid of a 'hot line' telephone set up at the stadium and interviews with the victims. The population was informed of this possibility by the media (radio, television and newspapers) and increasingly availed itself of this check-up option and 'hot line' telephone. Thousands of people were controlled in queues during the first days, their numbers exceeding 125 000 by the end of the operation in February, 1988.

Initially the people were measured with Saphymo Srat[®] scintillation detectors and Geiger counter monitors. These instruments were chosen because of the great sensibility and efficiency of the scintillation detectors and the immediate availability of Geiger counters.

It must be noted that the scintillation detectors already started to indicate the presence of radiation at distances of up to 150 m from the main contaminated areas. This presented a problem, since we had to be very careful to choose the right emplacements to set up the queues to measure individuals. On two occasions people who had been considered contaminated had to be rechecked: it was determined that the presence close by of contaminated vehicles during the first measurement had distorted the readings and given erroneous indications of personal contamination.

A confirmation of the high sensitivity and quick response of the scintillation detectors was obtained by two teams (two technicians and one driver) equipped with dedicated instrumentation (one scintillator for road survey, one dose rate meter for quantitative assessment of exposure levels and one surface contamination monitor). Additional equipment and implements for on-the-spot decontamination were sent to verify the results of the readings obtained on the people at the stadium. The teams maintained their instruments permanently on, with the audio alarms set at the lowest levels. In this way they were able to detect contaminated spots on the streets and sidewalks, and even contaminated cars passing by.

In one instance, the central waste paper depository of Goiânia (COPEL) was identified when one of the monitoring teams travelling with the scintillometer switched on passed a truck loaded with contaminated scrap paper travelling in the opposite direction on the highway. The truck was on its way from Goiânia to a toilet tissue factory (ANAPEL) in Anapolis (100 km from Goiânia, on the road to Brasília). One of the team members drove back to the truck's point of departure (COPEL) in Goiânia. The other went on to the truck's destination (ANAPEL), where he found 50 000 rolls of contaminated toilet tissue (according to calculations with 0.67 TBq of Cs-137). After this incident, all the paper deposits in Goiânia were routinely checked for contamination.

From the information obtained at COPEL, we were able to detect that contamination was also being transferred as far as to São Paulo when contaminated paper goods, especially scrap paper (to be recycled to low grade toilet tissue) and wrapping paper, were commercialized. The Brazilian Nuclear Energy Commission's institute in São Paulo, IPEN, was immediately notified and they were able to locate and recover the contaminated paper.

Within the city of Goiânia, one of the main contamination routes started with the contamination of several waste paper deposits by paper scavengers who had been contaminated at the two deposits where the distribution of the fragments of the source and contaminated waste paper had originally started.

The Geiger counters, although they were less sensitive than the scintillators, proved to be extremely useful, due to their resistance to the highly humid and hot conditions. Indeed, the accident occurred at a time of year when heavy rains fall in the afternoons and temperatures climb above 30 °C.

Each person who presented some degree of contamination in the queues was asked to indicate how this may have come about and to provide as much information as possible to help identify other contaminated people and areas. During the five-month period of the cleanup phase, the teams measured altogether more than 125 000 people and registered 260 cases of contamination. Of these, 77 presented contamination only on their clothes or shoes and 183 were found to have skin contamination. Of this number, 59 showed very slight external contamination, so they were easily decontaminated and released after their homes had been checked for possible contamination spots. The remaining 124 were decontaminated externally, and, depending on whether they were contaminated internally or not, were sent to one of three isolation areas: 1) the Central Hospital, where the highly contaminated victims were being treated; 2) an intermediate contamination level lodging house; or 3) a house

where very slightly contaminated victims, or people who had not been contaminated but who had been evacuated from their homes due to the high levels of radiation in the area, were accommodated.

The information gathered from the people found to have been contaminated and the information conveyed through the emergency 'hot line' set up at the Stadium were used to track down potentially contaminated spots and people. This method proved to be quite effective, as contamination was traced in this manner to at least 30 people, 15 homes, five pigs, three buses and 14 cars.

The discovery of the contaminated pigs and of contaminated banknotes (four notes emitting $0.8 \text{ mGy}\cdot\text{h}^{-1}$ each) in the purse of a school director who had just received her payment at the Caixa Economica Federal bank presented further complications for the group in charge of the cleanup: had these facts come to public knowledge, they could have caused panic in the population, which was already traumatized by the accident (as evidenced by the great number of people waiting in queues to be monitored — 3000 to 4000 per day!). As a result, this information was withheld from the press until the teams had regained complete control over the situation by isolating the pigs and sending technicians to measure the money at the main agency of the Caixa Economica Federal of Goiânia (a personal savings bank) and of the Banco do Brasil in Brasilia, since most of the money from Goiânia is handled by the main banks there, for reasons of proximity. Several banknotes had to be withdrawn from circulation during this operation.

Not only was contamination carried by people from its point of origin to families living nearby, but also to places as distant as Anapolis, Aparecida, Trindade and Goiás Velho, some of these localities lying more than 100 km from Goiânia.

One of the most serious contamination transfers occurred when the highly contaminated lead from the original shielding was sold to a scrap metal yard, which in turn sold it to another scrap metal dealer in the city of Goiás Velho, at a distance of some 250 km from Goiânia. This information was obtained from one of the contaminated people found in the queues, who happened to be one of the workers of the principal scrap metal dealer of Goiânia.

Many requests for radiation monitoring by the population (more than 1400 per day), forwarded mostly through the public communications system set up by the state's Health Secretariat, had to be classed by order of priority; the Searching for Radiation Group immediately proceeded to check the most urgent requests. The other calls were eventually followed up as a matter of thoroughness. Such numbers are clear evidence of the level of panic which prevailed in the population of Goiânia at the time.

As earlier stated, the large numbers of people (3000–4000 per day) who stood in queues during the first days of monitoring were an additional indication of panic amongst the public. Of the first 60 000 individuals measured, 8.3% or so presented skin reddening (rashes around the neck and upper body), vomiting, diarrhoea, etc. This was initially thought to be an allergic symptom (2), but ultimately considered a phenomenon of acute stress. This manifestation was no longer observed during the remainder of the measuring campaign.

Another indication of the concern shared by the public was when the queues of people waiting to be measured at the stadium had decreased from several thousand per day to less than 100 per day and a national television programme set up in São Paulo interviewed someone who declared that radiation from caesium could be detected up to 300 km away. On the following day, the number of people waiting in queues at the stadium climbed back to 1000! This problem set back the whole programme of the Searching for Radiation Group, since several of the field teams had to be retained at the stadium to tend to the monitoring of people in the queues.

4. STREET CHILDREN'S PARTICIPATION

It soon became evident that the main cases of contamination were concentrated in the waste paper deposits and in the street children who collected this paper. Because the technicians from the Searching for Radiation Group based at the football stadium were all from Rio de Janeiro and São Paulo and did not know Goiânia well, it was decided to incorporate several street children into the group.

Due to their economic and social situation, these street children are generally very shy and maintain a certain distance from the rest of the society. They have their own rules, maintain their own code of honour, and do not trust anybody. To gain the confidence of these street children was very difficult, since from the beginning of the operation they were considered responsible for the accident, and also because many of them had previously run into problems with the police, a situation which made them very reserved and wary. This difficulty was overcome owing to the voluntary participation of a social worker who was taking part in a programme that had been set up by the state government in an attempt to integrate the street children into society. As the social assistant knew the street children and was greatly respected by them, a special scheme to attract their attention and confidence was set up. The accident had deprived them of their source of income, since many of the secondary waste paper deposits had been shut down due to contamination — these children were penniless and hungry. But they were also very curious: they could be seen daily in the vicinity of the Olympic Stadium. They would never enter onto the stadium grounds, though, probably due to the presence of the police sent there to help maintain order. With the aid of the social assistant, we were able to approach one of them and guarantee that no actions would be taken against them and that they would receive free meals if they collaborated with us. After a few days it was possible to engage two of them in the Searching for Radiation Group.

The participation of these street children was extremely important. They knew of potentially contaminated spots and people and had 'inside information' they could volunteer: they belonged to a group which had initially tried to remove the metal object (the teletherapy machine) from the building that was being demolished and were scrap paper scavengers themselves — they knew all the people that were contaminated. Besides the information they offered, the street children were very valuable in the cleanup phase, during which they always worked under the supervision of a radiological protection technician.

On the basis of the information obtained from these street children, it was possible to identify most of the contaminated areas: 42 residences, four hospitals and five scrap paper deposits. The street children also provided information on the — impossible to control — ongoing transactions among scrap dealers of Goiânia in installations that were known to be contaminated. These operations apparently went on even after the dealers had been warned by technicians that transactions were not allowed until after the items to be traded had been measured with detectors and declared harmless.

5. THE STIGMA ATTACHED TO THE INHABITANTS OF GOIANIA

Owing to public ignorance, certain authorities set up physical barriers at the borders of the state of Goiás and hindered cars proceeding from Goiânia from leaving the state. More than 8000 residents requested and received official certification that they were not contaminated. These certificates were requested in an effort to counter the stigma attached to the area of Goiânia, as evidenced by: 1) hotels in other parts of the country refusing to allow Goiânia residents to register as guests (e.g., in São Paulo, Cuiabá and Manaus); 2) airline pilots refusing to fly aircraft with Goiânia residents on board; 3) bus drivers refusing to allow

Goiânia residents on their buses; 4) the stoning of automobiles with Goiânia license plates and 5) virtually all conventions originally scheduled for hotels in Goiânia during this period being cancelled or rescheduled elsewhere.

5. LESSONS LEARNED

Clearly, three important lessons emerge from the experiences suffered in Goiânia.

- First: the high number of individuals presenting acute stress or allergic symptoms. The majority of these individuals claimed that their symptoms began after the capsule was broken but before the announcement of the accident by the news media. Of these persons, not a single one was contaminated! This has profound implications for the study of perceived risk in general and 'special' nuclear related impacts in particular.

- Second: in any accident, the participation of local people in tasks associated with remediation is extremely important to obtain vital inside information and to gain the confidence of the residents. When locals are part of the teams, this avoids creating the feeling among residents that people from the outside are intruding on their territory.

- Third: the institutions responsible for the management of a crisis must be knowledgeable about the needs of the media in times of crisis, and must be prepared to meet these needs. Unfortunately, paying attention to the media may mean that because of an incorrect report, certain delays or problems may arise. Yet it is obvious and important that in any event of this type, specialized people must stand ready to issue press releases, if possible even before the reporters arrive at the scene!

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