INTERNATIONAL JOINT CONFERENCE RADIO 2017
GOIÂNIA 30 YEARS LATER
25 - 29 SEPTEMBER 2017
CONVENTION CENTER GOIÂNIA, BRAZIL
Sharing Experiences
SBPR Sociedade Brasileira de Proteção Radiológica

Overview of Brazilian industrial radiography accidents with cutaneous radiation syndrome

C. M. A. Lima[a]; F. C. A. Da Silva[b]

[a] *Postgraduate Course Stricto Sensu in Radiation Protection and Dosimetry, Institute of Radiation Protection and Dosimetry/CNEN, 22783-127, Rio de Janeiro-RJ, Brasil*

[b] *Institute of Radiation Protection and Dosimetry/CNEN, 22783-127, Rio de Janeiro-RJ, Brasil*

dasilva@ird.gov.br

ABSTRACT

It is well documented that industrial radiography is related to radiological accidents, which makes it the highest potential risk for human health. More than 80 radiological accidents happened in the world that includes 6 Brazilian accidents with Cutaneous Radiation Syndrome. Five of them happened with ^{192}Ir and one with ^{60}Co radioactives sources. Nineteen members of the public and 8 radiographers were involved. All of them suffered severe hands and fingers injuries. The Brazilian radiological accident happened in 1985 with 16 persons is analyzed showing causes, consequences, radiation doses and lessons learned.

Keywords: Industrial radiography, radiological accidents, Cutaneous Radiation Syndrome.

1. INTRODUCTION

Industrial radiography is a non-destructive inspection methods used for material inspection. This method uses radioactive sources of ^{60}Co, ^{75}Se and especially ^{192}Ir. Industrial radiography is

classified as Category 2 in the IAEA Categorization System [1] because the sources have high activity and consequently greater radiological risk.

In the last 30 years, more than 80 radiological accidents in industrial radiography involving 120 radiation workers, 110 members of the public and 12 deaths happened in the world, including 10 accidents in Latin America. IAEA published three Latin America reports: Peru (1999), Bolivia (2002) and Chile (2005). In these events only members of the public were involved [2,3,4].

Brazilian data includes 6 serious radiological accidents affecting 8 radiation workers and 19 members of the public, resulting in development of Cutaneous Radiation Syndrome (also called by some as "local radiation injury" or "radiation burn") in hands and fingers.

Five accidents happened with ^{192}Ir radioactive source used in mobile industrial gamma devices (1985 (2 events), 1988, 1997, 1998) and one with ^{60}Co radioactive source in fixed device (2000). Nineteen members of the public were involved in two events (1985) and eight radiation workers in four events (1988, 1997, 1998 and 2000). All of them received high radiation doses and suffered severe local radiation injuries in hands and fingers [5,6,7,8].

2. MATERIALS AND METHODS

A detailed analysis of Brazilian radiological accidents with injuries in industrial radiography was made. This paper presents a summary of only one Brazilian event with main causes, consequences to involved persons, radiation doses and mainly lessons learned.

3. RESULTS AND DISCUSSION

Based on the analysis, the main aspects of radiological accident in industrial gamma radiography happened in Brazil in 1985 (the second event) is presented.

a) Event: An industrial gamma radiography device (Gammamat TIF), with a ^{192}Ir radioactive source with 0.88 TBq of activity, was stolen from the transport vehicle. A truck driver found a box at the road and took it to his company. At the company the truck driver opened the box and found the gamma radiography device with the key. He showed the device to his friends and opened it. The

radioactive source was removed and handled by all. At the end he put back the source inside the device. Ten persons were overexposure and 6 handled the source. The truck driver took the device to his home and showed to more 6 persons: wife, daughter and 4 friends. The gamma radiography device was kept on driver house during 10 days.

b) Main causes: to let the key attached in the gamma device and the vehicle unattended during the lunch time.

c) Main consequences for the members of public: injuries, loss of movement and atrophy on fingers.

d) Radiation doses estimated by mathematics calculations: for hands from 0.23 Gy to 162.24 Gy; for eye lens from 0.13 mGy to 17.72 mGy; for gonads from 0.25 mGy to 10.90 mGy.

e) Mainly lessons learned: The transport vehicle must be permanently attended during all time; the transport box must be fixed in the vehicle and the gamma device key must be kept with the radiation worker.

4. CONCLUSION

These radiological accidents with injuries showed that the industrial gamma radiography is really the industrial activity with the highest potential risk for human health.

To avoid these radiological accidents in industrial gamma radiography the primary responsible of the installation and radiation protection officers must maintain a continuous education and training in radiation protection, safety and security to radiation workers.

It is recommended to review the radiation doses to hands using Monte Carlo method.

5. ACKNOWLEDGMENT

The authors are grateful to CNPq/Brazil to grant a M.Sc. Scholarship that made this work possible.

REFERÊNCIAS

1. LIMA, C. M. A. Análise de acidentes e incidentes radiológicos em radiografia industrial. **Monografia Pós-Graduação IRD**, Rio de Janeiro, 2011.

2. IAEA. **The radiological accident in Yanango**, IAEA, 2000.

3. IAEA. **The radiological accident in Cochabamba**, IAEA, 2004.

4. IAEA. **The radiological accident in Nueva Aldea**, IAEA, 2009.

5. DA SILVA, F. C. A. Uma metodologia de análise de acidentes radiológicos em gamagrafia industrial. **Tese Mestrado IME**, Rio de Janeiro, 1990.

6. DA SILVA, F. C. A. Dosimetria reconstrutiva de acidentes radiológicos usando o método de Monte Carlo. **Tese Doutorado COPPE/UFRJ**, Rio de Janeiro, 2003.

7. DA SILVA, F. C. A.; HUNT, J. G.; RAMALHO, A. T.; CRISPIM, V. R. Dose reconstruction of a Brazilian industrial gamma radiography partial-body overexposure case. **J Radiol Prot** 25: 289-298, 2005.

8. C. M. A. Lima, A. R. Lima, A. L. Degenhardt, N. J. Valverde, F. C. A. Da Silva. Reconstructive dosimetry for cutaneous radiation syndrome. **Braz J Med Biol Res** 48(10): 895–901, 2015. doi:10.1590/1414-431X20144337