

THE LESSONS FROM THE RADIATION ACCIDENTS IN CHINA OVER THE PAST 40 YEARS



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Abstract

A brief introduction and analysis of the radiological accidents in China during the past 40 years have been made in this paper. Statistical data provided by the competent authority show that a number of cases of radiological accidents and events happened in China from 1954 to 1994. Quite a few persons received abnormal exposure. Some serious accidents resulted in death of 8 victims. The reasons of these accidents are analyzed and some recommendations for reduction of potential exposure and accidents involving radiation sources and equipment generating ionization radiation have been given, such as perfecting and improving radiation safety infrastructure and system for the control of radiation sources. It is suggested that safety culture shall be fostered, each individual must be suitably trained and qualified and the management of spent sources should be strengthened.

1. Introduction

With the development of nuclear technology, the application of radiation sources in industry, agriculture, medicine, research and teaching is wide-spread, and increasing in China. The use of radiation brings huge benefits to the Human, and meanwhile it produces some radiation risks. The radiological accidents occurred sometimes during the past 40 years in China. According to radiological accidents management regulations^[1] issued jointly by the Ministry of Public Health and the Ministry of Public Security, radiological accident defined as the abnormal events dealing with lost control of radioisotopes or apparatus that generates ionization radiation, resulting in over exposure to people or radioactive contamination. Investigation carried out by relevant competent authority shows that a number cases of radiological events and accidents happened in whole country from 1954 to 1994, resulting in over exposure to quite a few persons. Among them 90% cases were first and second level accidents or events. Third level accidents were about 10%^[2]. Very serious accidents causing death are shown in Table 1.

In addition, because of the failure of ^{60}Co therapeutic equipment and a medical accelerator, two accidents had happened which resulted in indirect death of 2 and 13 patients respectively. The radiological accidents mentioned above not only made many persons received abnormal exposure, but also resulted in huge economic losses. Obviously it is necessary to analyze the reasons of the accidents and learn from the lessons to prevent similar accidents.

Table 1 Causing death radiological accidents

| NO | Years | Place | Reason | Number of death |
|----|---------|--------------|--------------------------|-----------------|
| 1 | 1963 | Anhui | Source lost | 2 |
| 2 | 1985 | Heilongjiang | Source lost | 1 |
| 3 | 1990 | Shanghai | Safety interlock failure | 2 |
| 4 | 1992.11 | Shanxi | Source lost | 3 |

2. Analysis of the accidents

- 1) About 80% of the accidents happened during the past 40 years were liability accidents related to human factors. About 20% cases were caused by the failure of equipment.
- 2) More than 50% of the radiological accidents belong to events or accidents due to theft and loss of small sources with low activity. From 1981 to 1992, several hundred of radioactive sources were lost owing to the poor management. To enforce radiological protection management and to avoid radiological accidents, "Regulations on the protection of radioisotopes and radiological equipment" was issued by the State Council^[3]. However, the regulations were not be observed strictly. Notification, registration, and licensing were not carried out strictly according to the regulation. Operational guides and health physics programs were not established too. For instance, in the radiation facility in Xinzhou where a major radiation accident took place, the facility was operated for many years without license, the sources were not registered and filing correctly. This situation led to a major accident when the facility was decommissioned, the number of sources transferred only based on the memory of people in the facility, as a result, one source was left in the well for source storage and out of control, a major accident happened^{[4][5]}.
- 3) Regulation authorities were short of powerful supervision and monitoring. There was no effective monitoring measures to discover and treat the accident instantly in the institutions where accident had happened.
- 4) About 20 accidents happened for irradiation equipment from 1985 to 1994, 5 people died in these accidents (including the accident in Xinzhou). The main causes of the accidents in the facilities are the poor management system and the low technical level of individuals. Moreover, it is also an important cause that the workers entered accidentally into irradiation rooms due to lacking defense-in-depth measures in design and no safety interlock system or failure of the system in some facilities^[6]. In some radiation facilities, the interlock system was dismantled and not recovered when the facilities were put into operation again. This kind of mistakes caused some accidents, "6.25" accident belongs to this kind, in this case, 7 people were exposed (2-12 Gy) and 2 of them died^[7].
- 5) Radiation workers had not got enough knowledge on radiation safety and protection. Without accepting proper training previously, they were not familiar with the regulations and procedures on radiation protection. The operational guides were even violated sometimes. These cases existed in almost all the accidents mentioned above.

3. Suggestions

- 1) It is necessary to establish and improve national radiation safety infrastructure, perfect the system for the control of radiation sources. Standards and regulations relating to radiation sources safety should be reviewed and improved. The detail guidance of radiation sources safety should be worked out also.
- 2) Radiation protection standards and procedures, especially the system of notification, registration and licensing etc., should be carried out completely.
- 3) Sources shall be kept secure so as to prevent theft or damage. Registration and licensing should have an accountability system, including records of the location and description of each source, to ensure that all of the sources are under control all the time.
- 4) Safety culture shall be fostered to ensure that the protection and safety responsibilities of each individual, including those at management level, be clearly identified and each individual be suitably trained and qualified.

- 7) At present, there are large amount of spent sources in China and most of them are out of use. To prevent the sources from loosing and resulting in radiation accidents and events, the spent sources management (such as registration, storage and filing) must be strengthened. It is necessary to research on the conditioning, management and disposal of spent sources. It is suggested to centralize the storage and management of spent sources.

4. Conclusion

Extensive experience have been learnt from the radiation accidents occurred over the past 40 years. At present, referring to IAEA Safety Series NO 115 (BSS), basic safety standard of radiation and standards related to radiation application are being revised and drafted in China. The lessons from the accidents will be considered and fed back in the new standards.

5. Reference

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