IAEA
International Atomic Energy Agency
Atoms for Peace and Development

Occupational Radiation Protection during High Exposure Operations

Lessons Learnt from Occupational Radiation Protection in Past Accidents

Radiological Accidents – Samut Prakan Accident

Contents

1. Overview of the Samut Prakan accident

What happened?

- In late January and early February 2000 a disused ^{60}Co teletherapy head was partially dismantled, taken from an unsecured storage location and sold as scrap metal in Samut Prakan, Thailand.

- Individuals who took the housing apart and later transported the device to a junkyard were exposed to radiation from the source.

- At the junkyard the device was further disassembled and the unrecognized source fell out, exposing workers there.

- The accident came to the attention of the relevant national authority when physicians who examined several individuals suspected the possibility of radiation exposure from an unsecured source and reported this suspicion.

3

1. Overview of the Samut Prakan accident

What happened?

- Altogether, ten people received high doses from the source. Three of those people, all workers at the junkyard, died within two months of the accident as a consequence of their exposure.

Elevated view of the junkyard.

4

1. Overview of the Samut Prakan accident

Overview

- The radiation accident occurred in the Samut Prakan provinces of Thailand in February 2000.
- An accident that happened because the long term management of a disused remote radiation therapy machine was neglected.
- The teletherapy unit installed Co-60 radioactive sources was dismantled without permission by the people who did not have any knowledge concerning the radiation.
- The whereabouts of the therapeutic instrument that installed the radiation source was uncertain for about 20 days from 1 February 2000 according to the investigation.

5

1. Overview of the Samut Prakan accident

The source

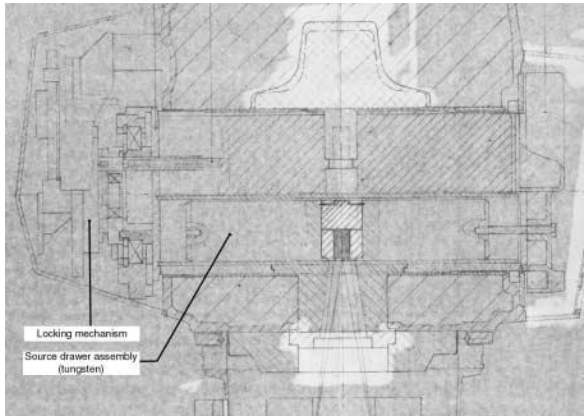
- The device involved in the accident was a Gammatron-3 teletherapy unit, manufactured by Siemens of Germany.
- It was originally exported to Thailand in 1969 and had undergone at least one source change.
- The last change occurred in 1981, when a source of 196 TBq (5300 Ci) was installed.
- At the time of the accident, the activity was estimated to be 15.7 TBq (425 Ci).

6

1. Overview of the Samut Prakan accident

The source

The source holder (and shield) is of lead surrounded by stainless steel. It is cylindrical, 42 cm long by 20 cm diameter. The lead is 5 cm thick, with a weight of 97 kg, within a stainless steel casing that weighed an additional 30 kg.



The Siemens Gammatron-3 teletherapy head (cutaway side view). The lighter area inthe centre is the source.

Cylindrical pieces from the source assembly (the item at left is hollow; it previously surrounded the 60Co source)

7

2. The emergency response

Discovery and notification

- The Office of Atomic Energy for Peace (OAEP) is the body responsible to the Thai Atomic Energy Commission for Peace (AEC). The AEC is the regulatory authority for Thailand.

- The OAEP upon receipt of the call from the physician immediately dispatched two officers (health physicists) who arrived at the Samut Prakan Hospital to investigate the cases further.

- OAEP officers while driving through one of the streets of Samut Prakan district in the direction of the junkyard have noted a significant increase in radiation levels (about 20 times normal background)

- There, a radiation level of about 1 mSv/h was measured at the side entrance of the yard, confirming the presence of an intense gamma source.

8

2. The emergency response

Response and recovery

- An emergency response team was called by OAEP officers after recognizing the seriousness of the radiological situation.
- Contamination surveys were carried out.
- The radiation level survey found a dose rate of up to 10 Sv/h in the junkyard around the pile of scrap where the source was located.
- Evacuation was not necessary.
- The local area was cordoned off at a radiation level of 300 μSv/h, which occurred about 10 m from the junkyard. Access to the junkyard was restricted and the street outside was closed to traffic.
- Further field operations to locate the source continued

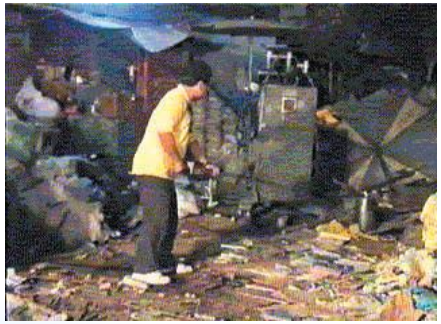
9

2. The emergency response

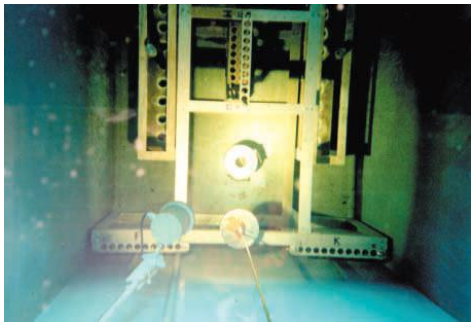
Response and recovery

Back hoe/front loader moving a lead barrier for use in recovery operations

A luminescent screen was used to determine the location of the source accurately



Transfer of the retrieved source to a shielded transport container



Storage location of the retrieved source

10

3. Radiation monitoring and protection

- The Samut Prakan Provincial Public Health Care Unit resumed recovery operations at the junkyard.
- At approximately 150 m from the junkyard, a dose rate of 1.7 μSv/h was measured.
- This level increased to 200 μSv/h on the sidewalk across from the junkyard at a distance of approximately 20 m from the source.
- OAEP planned the retrieval operations, and gathered the necessary tools and equipment for the source recovery.
- The Samut Prakan Provincial Civil Defence Unit assisted in making available the necessary machines and equipment (a mechanical excavator, a back mechanical grab and large spotlights).

11

4. The worker and members of the publics' doses

Dose control of workers

- Individual thermoluminescent dosimeters (TLDs) were employed for dose control purposes during the source recovery operations.
- The maximum individual dose recorded for the emergency workers was reported as 32 mSv.

Dose range [mSv]	Number of individuals in group
<1	11
1-5	18
5-10	11
10-20	6
20-32	6
>32	0

12

5. Lessons learned

- Regulatory control over Radiation Sources/Radioactive materials needs to be effective with strategies for detecting and shielding/storing of Orphan Sources.
- The sequence of events leading to this accident was similar to the IAEA reports on an event at Istanbul. The accident at Samut Prakan could have been easily averted by applying the lessons learnt.
- Emergency Response Mechanism and plan with coordination among local services was reportedly effective, though the representatives from media hampered with the various operations.
- Physicians need basic training and information on radiation induced symptoms and various acute/chronic exposures.
- Photographs of radiation injuries/symptoms due to acute radiation exposures are to be made available for medical communities through e-training.

13