An Unusual Occurrence? Radiation Safety in India

This is not the first time there has been an accident involving radioactive material in India. Some incidents have received press attention and are widely known; others are not.

Loss, Theft and Misplacement at Radiological Facilities

A 'Radiation Facility' is defined by the AERB as 'Any installation/equipment or a practice involving use of radiation-generating units or use of radioisotopes in the field of research, industry, medicine and agriculture'

A review of 'unusual occurrences' contained within the AERB's annual reports reveals there have been 16 cases of loss, theft or misplacement of radioactive sources since 2000[1], in which radioactive material found its way into the environment. In 11 of these incidents, the source was never found. Details of each are listed below:

August 2009 An industrial radiography device containing an unidentified radioactive source fell from a moving vehicle during transport from Pune to Mumbai. The device was picked up by a group of young people and taken to a nearby village. It was recovered the following day.

September 2008 A radiographer boarding a train at Hazrat Nizamuddin railway station in New Delhi carrying an Industrial Gamma Radiography Exposure Device (IGRED) reported that it was stolen from him. The device, and the 74 GBq Ir-192 source within, were never found.

May 2008 Loss of a decayed Ir-192 radiography source (925 kBq) from Perfect Metal Testing and Inspection Agency in Kolkata. The AERB's report does not mention if the source was recovered.

January 2009 An employee of Wens Quality Assurance Pvt. Ltd in Chennai steals an unspecified radioactive source and throws it out. The AERB located the source and stated that the company would receive no regulatory consent for three months.

April 2007 A 1.85 TBq Ir-192 source contained within a radiography camera was reported stolen at Jagadishpur, 90 km from Lucknow. Despite extensive searching, the AERB were unable to locate the material.

August 2007 An IGRED containing a 0.6 TBq Ir-192 source was stolen from General Industrial Inspection Bureau in Jamshedpur. The source could not be recovered 'inspite of extensive search operations by using high sensitivity radiation survey instruments'.

2006 A trainee radiographer and his assistant left an IGRED containing a 0.5 TBq Ir-192 source in an auto rickshaw. The machine was never recovered.

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1 http://www.aerb.gov.in/cgi-bin/annrpt/annrptBody.asp

November 2006 An IGRED containing a 0.29 TBq Ir-192 source was stolen from a radiography agency after the machine was left lying unattended outside a dark room. The missing IGRED was never located.

November 2006 A nucleonic gauge containing a 9.2 GBq Cs-137 source was reported to be missing from a coal washery that had not been in operation since 2003. It was reported that the electronic parts associated with the gauge were stolen in 2005. Despite 'extensive radiation detection surveys' around the plant and in all scrap yards in the unspecified city, the material was never found.

May 2005 Two exposure devices with Ir-192 sources of 279kBq and 555MBq were lost from an unidentified institution, and never recovered.

August 2005 An employee of a radiography agency steals an Ir-192 source pigtail (1.87 TBq) from a rival radiography agency in Mumbai and throws it into the Vashi creek. The source was thought to have flowed down to the sea, and was never recovered.

2004 IGRED containing a 92.5 GBq Ir-192 source was stolen from a radiography institute. The source was later recovered from a scrap dealer.

2004 A nucleonic gauge containing a 7 GBq Co-60 source was sold at auction to a scrap dealer by an unidentified institution. The dealer cut open the device, leading to damage of the source capsule and radioactive contamination of the premises.

July 2002 A radiography camera containing a 0.73 TBq Ir-192 source is lost while being carried by a radiographer on a public bus. The device was either stolen or slipped from the improperly locked luggage compartment, and was never traced.

2001 A density gauge containing a 1.12 GBq Cs-137 source was lost in a coal washery, and never retrieved.

2000 A 'premier medical hospital' lost a 2.7 GBq Cs-137 source due to 'procedural lapses'. Despite systematic searching, the AERB was unable to recover the source.

There have also been many incidents of radioactive packages remaining uncollected at airports, including 67 unclaimed packages found at Mumbai, Delhi, Kolkata and Chennai airports in 2001[2], and three years later the discovery of 34 packages that had been lying in Delhi airport for over 15 years.[3] The most recent occurrence was a 6.539 GBq Y-90 source in 2004-2005, which was mistakenly handed to a waste disposal agency by staff at Mumbai airport. [4]

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2 http://www.aerb.gov.in/t/annrpt/2001/chapter3.pdf

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Export of radioactive material is also a problem, with radioactive material being recovered from factories associated with the steel industry after ships have been turned away from ports in the US, UK, France, Turkey, Spain and Germany. Cobalt-60 contamination of steel is a problem in India, believed to be the result of radioactive wastes finding their way into smelters through the scrap shop network.

A 1.11 TBq Am-Be source was also recovered from a ship in Jawaharlal Nehru Port Trust, Maharashtra, after an alert from US Custom**s.**

Accidents at Nuclear Power Facilities[5]

The following is an incomplete selection of notable incidents at nuclear power facilities over the last 19 years. Numerous other examples of oil leaks, hydrogen leaks, fires and high bearing vibrations have often shut plants, and sometimes not[6].

November 2009 Fifty-five employees consume radioactive material after tritiated water finds its way into the drinking water cooler in Kaiga Generation Station in Karnataka. The NPCIL attributes the incident to "an insider's mischief".

January 2003 Failure of a valve in the Kalpakkam Atomic Reprocessing Plant (KARP) in Tamil Nadu results in the release of high-level waste, exposing six workers to high doses of radiation (Anand 2003). The leaking area of the plant had no radiation monitors or mechanisms to detect valve failure, which might have prevented the employees' exposure. A safety committee had previously recommended that the plant be shut down.

2001 Turbine blade failures, cracks in end shields and leaks in tubes in a plant at Rajasthan

November 2001 A leak of 1.4 tonnes of heavy water at the Narora II reactor in Uttar Pradesh, resulting in one worker receiving an internal radiation dose of 18.49 mSv.[7]

April 2000 Leak of about seven tonnes of heavy water from the moderator system at NAPS Unit-2. Various workers involved in the clean-up received 'significant uptakes of

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[5] As nuclear affairs – be they military or civilian - are not subject to the Right To Information Act of 2005, we have no way of knowing if the list below is comprehensive.

[6] For more details, please see the article 'Safety First? Kaiga and Other Nuclear Stories' by M.V. Ramana and Ashwin Kumar, *Economic & Political Weekly*, Vol XLV No. 7, February 13 2010

[7] http://www.aerb.gov.in/T/annrpt/2001/annrpt2k1.pdf)

tritium', although only one had a radiation dose over the recommended annual limit [8]. Three years later, there is another, six tonne, leak at the same plant.

March 1999 Somewhere between four and 14 tonnes[9] of heavy water leaks from the pipes at Madras Atomic Power Station at Kalpakkam, Tamil Nadu, during a test process. The pipes have a history of cracks and vibration problems[10] . Forty-two people are involved in mopping up the radioactive liquid.

May 1994 The inner containment dome of Kaiga Power Station, Karnataka, collapses while under construction. The 130 tonne concrete dome had already been completed, and formed the part of the reactor designed to prevent escape of radioactive material into the environment in the case of an accident.

March 1993 Two blades of the turbine in Unit I of the Narora Power Station in Uttar Pradesh broke off, slicing through other blades and indirectly causing a raging fire which took two hours to control and another three to put out. As the power cables were not encased in separate and fire resistant ducts, the fire lead to a blackout in the plant, including of the secondary cooling system. Operators had to manually actuate the primary shutdown system, and climb onto the roof to open valves to cool the plant by hand. The incident was rated as a Level 3 on the International Nuclear Event Scale.

January 1992 Four tons of heavy water spilt at Rajasthan Nuclear Power Plant[11]

February 1992 Tube leak causes a radioactive release of 0.44 TBq form Tarapur Nuclear Power Station (http://archive.greenpeace.org/comms/nukes/chernob/rep02.html)

December 1991 A leak from pipelines in the vicinity of CIRUS and Dhruva research reactors at the Bhabha Atomic Research Centre (BARC) in Trombay, Maharashtra, resulted in severe Cs-137 soil contamination of thousands of times the acceptable limit. Local vegetation was also found to be contaminated, though contract workers digging to the leaking pipeline were reportedly not tested for radiation exposure, despite the evidence of their high dose[12].

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8 http://www.aerb.gov.in/t/annrpt/2000/chapter2.pdf

9 The figure is contested – see "An Incident at Kalpakkam", T. S. Subramanian, *Frontline*, 23 April 1999

10 Rethinaraj, 1999

11 Pandve H, Bhuyar PA, Banerjee A. Indo-US nuclear deal: A challenge for occupational health. Indian J Occup Environ Med [serial online] 2007 [cited 2010 May 12];11:47-9. Available from: http://www.ijoem.com/text.asp?2007/11/2/47/34527

12 "Radioactive Leakage at the Bhabha Atomic Research Centre", *The Sunday Observer*, 6 September 1992

July 1991 A contracted labourer mistakenly paints the walls of Rajasthan Atomic Power Station (RAPS) with heavy water before applying a coat of whitewash. He also washed his brush, face and hands in the deuterated and tritiated water, and has not been traced since[13].

March 1991 Heavy water leak at Madras Atomic Power Station (MAPS) takes four days to clean up[14].

[13] A Heavy Whitewash", translated from Hindi, *Rajasthan Patrika*, 21 August 1991

[14] BARC-1992