



# Report on Lost or Stolen Sealed Sources and Radiation Devices



## Lost / Stolen Report Categories 1-5

Event Date	Event ID	Event Type	Location	Province	Event Description	Sealed Source Category	Number of Sources or Devices Involved in the Event
2005-01-20	268	Loss	Shawinigan-Sud	QC	Loss of Co-57 Sealed Source	Cat 5	(1X Co-57, 1.9 MBq). Not recovered
2005-01-21	255	Loss	Ville St-Laurent	QC	Antistatic bar containing Polonium 210 source missing from analytical balance	Cat 4	(1X Antistatic bar). Not recovered.
2005-04-11	291	Loss	Montreal	QC	Liquid Scintillation Counter (LSC) possibly lost to landfill	Cat 5	(1X Liquid Scintillation Counter). Not recovered.
2005-06-09	319	Loss	Calgary	AB	Loss of Electron Capture Detector (ECD)	Cat 5	(1X Electron Capture Detector). Not recovered.
2005-07-05	316	Stolen	Edmonton	AB	Stolen vehicle containing exposure device involved in accident	Cat 2	(1X Exposure device). Recovered on July 5, 2005
2005-07-05	322	Stolen	Montréal	QC	Industrial portable gauge stolen at worksite	Cat 4	(1X industrial gauge). Not recovered.
2005-07-25	326	Loss	Burnaby	BC	Exposure device not secured during transport and lost	Cat 2	(1X Exposure device). Recovered on July 25, 2005
2005-08-22	336	Stolen	Montreal	QC	Vehicle containing industrial portable gauge stolen	Cat 4	(1X Industrial gauge). Recovered on Aug 30, 2005

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2005-09-13	343	Stolen	Edmonton	AB	Industrial portable gauge stolen from worksite	Cat 4	(1X Industrial gauge). Recovered on Sept 26, 2005
2005-10-31	371	Loss	Ottawa	ON	Cs-137 sealed source removed from liquid scintillation counter	Cat 5	(1X Liquid Scintillation Counter). Recovered on Nov 2, 2005
2005-11-22	380	Loss	Kerrobert	SK	Exposure Device left at jobsite	Cat 2	(1X exposure device). Recovered on Nov 22, 2005
2005-11-24	382	Loss	Peterborough	ON	Industrial portable gauge lost during transport	Cat 4	(1X Industrial gauge). Recovered on Nov 25, 2005
2005-11-26	385	Stolen	Mississauga	ON	Vehicle containing industrial portable gauge stolen	Cat 4	(1X Industrial gauge). Recovered on Jan 6, 2006
2006-01-15	404	Stolen	Olds	AB	Vehicle containing exposure device stolen	Cat 2	(1X exposure device). Recovered on Jan 16, 2006
2006-01-26	412	Loss	Ottawa	ON	Loss of Electron Capture Detector	Cat 5	(1X Electron Capture Detector). Recovered in March 2006
2006-02-11	416	Stolen	Fort St. John	BC	Vehicle containing two industrial fixed gauges stolen	Cat 3	(2X Industrial gauges). Recovered on Feb 12, 2005 and March 3, 2005
2006-07-04	479	Loss	Vancouver	BC	Iodine-125 seed used in medical application lost	Cat 4	(1X I-125 seed). Not recovered.

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2006-07-25	477	Loss	Toronto	ON	Loss of Cs-137 low activity sealed source	Cat 5	(1X Cs-137 source). Not recovered.
2006-08-04	483	Stolen	Anzac	AB	Vehicle containing exposure device stolen	Cat 2	(1X Exposure device). Recovered on Aug 4, 2006
2006-10-04	567	Stolen	Edmonton	AB	Industrial portable gauge stolen	Cat 4	(1X Industrial gauge). Recovered on Oct 4, 2006
2006-10-12	558	Stolen	Thetford Mines	QC	Vehicle containing industrial portable gauge stolen	Cat 4	(1X Industrial gauge). Not recovered.
2006-10-19	556	Loss	Kanata	ON	Exposure device source unaccounted for after shipment	Cat 2	(1X Exposure device source). Recovered on Oct 30, 2006
2006-12-08	577	Loss	Saint Jerome	QC	Co-57 low activity marker source lost	Cat 5	(1X Co-57 source). Not recovered.
2006-12-19	582	Stolen	Montréal	QC	2 Industrial portable gauges stolen from storage location	Cat 4	(2X Industrial gauges). Not recovered.
2007-01-16	584	Loss	Montreal	QC	Electron Capture Detector (ECD) lost	Cat 5	(1X - Electron Capture Detector). Recovered in December, 2007.
2007-01-19	728	Stolen	Cold Lake	AB	Vehicle containing three logging sources stolen	Cat 3	(3X logging sources). Recovered on Jan 19, 2007
2007-02-08	614	Loss	Copper Cliff	ON	Fixed gauge discovered missing during storage cleanup	Cat 3	(1X Industrial gauge). Not recovered.

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2007-02-19	622	Stolen	Vaudreuil	QC	Industrial portable Gauge stolen from storage location	Cat 4	(1X Industrial gauge). Recovered on Feb 19, 2007
2007-04-13	722	Loss	Nothern Alberta	AB	Loss of a Cs-137 sealed test source	Cat 5	(1X Cs-137 test source). Not recovered.
2007-06-20	752	Loss	Lethbridge Alta	AB	Industrial portable gauge lost during transport	Cat 4	(1 X Industrial Gauge) Recovered on June 21, 2007.
2007-07-27	775	Stolen	Strathmore	AB	Vehicle containing exposure device stolen	Cat 2	(1 X exposure device). Recovered on July 27, 2007
2007-08-24	809	Loss	St-Laurent	QC	Static eliminator sources missing following inspection	Cat 4	(2 X static eliminator sources). Not recovered.
2007-08-31	810	Loss	Mercier	QC	Package containing exposure device not delivered by courier	Cat 2	(1 X Exposure device). Recovered on Sept. 7, 2007.
2007-09-07	840	Loss	Ottawa	ON	Iodine-125 seeds used in medical application lost	Cat 4	(1 X package of I-125 seeds). Not recovered.
2007-09-10	844	Loss	Kanata	ON	Missing Ir-192 sealed source in bulk shipment	Cat 5	(1 X Ir-192 decayed source). Recovered on Oct 5, 2007.
2007-09-19	818	Loss	Fort McMurray	AB	X-Ray Fluorescence Analyzer (low activity Fe-55 source) lost at oil sands site	Cat 5	(1 X X-Ray Fluorescence analyzer and Fe-55 source) Not recovered.
2007-09-25	837	Loss	Calgary	AB	Neutron slimline source out of transport container.	Cat 3	(1 X Am-241/Be source) Recovered on Sept 25, 2007

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2007-10-12	848	Stolen	Edmonton	AB	Industrial portable gauge stolen from vehicle	Cat 4	(1 X Industrial gauge). Recovered on May 20, 2008.
2007-10-28	861	Stolen	Montreal	QC	Vehicle containing industrial portable gauge stolen	Cat 4	(1 X Industrial gauge). Recovered on Oct 29, 2007
2007-10-29	875	Loss	Burnaby	BC	Missing Cs-137 Source shipment imported from USA	Cat 3	(5 X source holders and Cs-137 sources) Recovered on Nov 22, 2007.
2007-10-31	869	Stolen	Mississauga	ON	X-Ray fluorescence analyzers stolen from repair facility	Cat 5	(2X X-Ray Fluorescence analyzers) Not recovered.
2007-11-01	867	Stolen	Toronto	ON	Vehicle containing industrial portable gauge stolen	Cat 4	(1 X Industrial gauge) Recovered on Nov 2, 2007.
2007-11-07	874	Loss	Montreal	QC	Industrial fixed gauge lost during transport	Cat 3	(1 X Industrial gauge) Recovered on Nov 16, 2007.
2007-12-12	891	Loss	Ottawa	ON	Shipment of I-131 Lost in Transit	Cat 4	(1X lost package of I-131). Recovered on Dec 13, 2007.
2007-12-12	892	Stolen	Burnaby	BC	2 Packages containing low activity Tc-99m stolen from transport vehicle	Cat 5	(2 X Packages with Tc-99m) Not Recovered.
2007-12-13	895	Loss	Vancouver	BC	Lost Cs-137 Check Source	Cat 5	(1 X Cs-137 check source). Not Recovered.

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2008-01-16	933	Loss	Gatineau	QC	Lost low activity Co-57 sealed source	Cat 5	(1 X Co-57 source). Not recovered
2008-01-18	930	Loss	Etobicoke	ON	Loss of 5 Nuclear Medicine I-129 check sources	Cat 5	(5 X I-129 check sources). Not recovered.
2008-01-21	919	Stolen	Brampton	ON	Vehicle containing industrial portable gauge stolen	Cat 4	(1X Industrial gauge). Recovered on Jan 24, 2008.
2008-02-02	928	Stolen	Fort McMurray	AB	Theft of vehicle containing 3 Well Logging sources	Cat 2	(3 X logging Sources of Am/Be, Cs-137 & Th-232) Recovered on Feb 3, 2008
2008-03-06	950	Loss	St-Laurent	QC	Lost low activity Po-210 static eliminator source	Cat 5	(1 X Po-210 source). Recovered on March 12, 2008.
2008-03-25	978	Stolen	Bowmanville	ON	Stolen Industrial Portable Gauge from construction site	Cat 4	(1 X Industrial gauge). Recovered on May 12, 2008
2008-05-15	1002	Loss	54 Ave SE and 53 St SE, Calgary	AB	Unsecured exposure device lost during transport	Cat 2	(1X Ir-192 exposure device). Recovered on May 15, 2008.
2008-08-16	1060	Stolen	Camrose	AB	Industrial Portable Gauge stolen from vehicle	Cat 4	(1 X Industrial gauge). Not recovered.
2008-10-09	1108	Stolen	Mississauga	ON	Industrial portable gauge stolen from construction site	Cat 4	(1X Industrial gauge). Not recovered

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2008-12-01	1100	Loss	Windsor	ON	Patient left hospital wearing low activity check source	Cat 5	(1 X Co-57 source). Recovered on Dec 1, 2008.
2008-12-02	1097	Stolen	North York	ON	Industrial portable gauge stolen from vehicle	Cat 4	(1X Industrial gauge). Not recovered
2008-12-03	1098	Stolen	2670 Boul. Industrie, Laval	QC	Stolen industrial portable gauge	Cat 4	(1 X Industrial gauge). Cs-137 source and handle recovered from scrap metal facility on 30 April 2009. Am-241 source not recovered
2009-02-05	1113	Loss	Centre de recherche Guy- Bernier	QC	Missing liquid scintillation counter	Cat 5	(1 X Ra-226 sealed source). Not recovered
2009-03-10	1120	Loss	Bécancour	QC	Loss of nuclear substance	Cat 5	(1 X Ba-133 source). Not recovered



## Appendix

### **Categorization of sources**

Radioactive sealed sources are used throughout the world in medicine, industry, agriculture, research and education, and vary widely in radiological risk.<sup>1</sup> In 2005, the IAEA published a risk-based ranking of radioactive sources and practices, which uses five categories. The category assigned to each practice or radioactive nuclear substance (which the sealed source is made of) takes into consideration factors such as the radiological risk associated with the source, the nature of the work (or application for which the source is used), the mobility of the source, experience from reported accidents, and typical vs. unique activities within an application. These factors were used to assign sources and practices to one of five categories. Category 1 sources are considered to pose the greatest risk to human health (if not managed safely and securely), while Category 5 sources pose the lowest risk.

<sup>1</sup> IAEA, Categorization of Radioactive Sources, RS-G-1.9, (2005), p.1

**Category 1 sources are classified as “personally extremely dangerous”.**

***Category 1 (Very High-risk)***

This amount of radioactive material, if not safely managed or securely protected, would be likely to cause permanent injury (in some cases, be fatal) to a person who handled it, or was otherwise in contact with it for a period of a few minutes (or be fatal if close to it in an unshielded manner for a few minutes to an hour).<sup>2</sup>

Category 1 sources are associated with licensed activities to which the CNSC *Class II Nuclear Facilities and Prescribed Equipment Regulations* mostly apply.

**Examples of a Category 1 source usage:**

- **Self Shielded Irradiators:** Gamma sources are used in these irradiators for experimental purposes or as a means of sterilization. Gamma irradiation kills bacteria by breaking down bacterial DNA and inhibiting cell division. Blood products, for example, are sterilized in self-shielded irradiators.



Image #1: Cobalt-60 Gammacell.

<sup>2</sup> IAEA, Categorization of Radioactive Sources, RS-G-1.9, (2005), Table 3

- **Gamma Knife Radiosurgery:** An advanced form of surgery, performed with highly focused beams of radiation. As many as two hundred and one radioactive sealed sources create intersecting beams of gamma radiation which deliver a concentrated dose of radiation to a precise area of the brain. These radiation beams form the “knife”.



Image #2: Elekta *Gamma Knife*



Image #3: *Gamma Knife* in use

- **Radioactive Source Teletherapy:** External beam radiotherapy otherwise known as “teletherapy” is the most frequently used form of radiotherapy. Radiotherapy is the medical use of radiation (produced by a radioactive sealed source mounted inside the machine) as part of cancer treatment, to control malignant cells.



Image #4: Co-60 Teletherapy

**Category 2 sources are classified as “personally very dangerous”.**

***Category 2 (High-risk)***

This amount of radioactive material, if not safely managed or securely protected, could cause permanent injury to a person who handled it, or was otherwise in contact with it for a short period of time (minutes to hours) – or be fatal if close to it in an unshielded manner for a few days. Category 2 sources are associated with licensed activities to which the CNSC *Nuclear Substances and Radiation Devices Regulations* mostly apply.

**Example of a Category 2 source usage:**

- **Industrial radiography** is a non-destructive testing (NDT) application that uses gamma radiation from a highly radioactive source, and photographic film, for the detection of internal physical imperfections (such as voids, cracks, flaws, segregations, porosities and inclusions) in pressure vessels, pipelines, ships and reactor components. Radiography produces images on photographic film, similar to X-ray images, that show varying densities according to the amount of radiation absorbed in the material.



Image #5: Industrial radiography camera which contains the radioactive sealed source



Image #6: NDT pipeline inspection, using industrial radiography equipment

**Category 3 sources are classified as “personally dangerous”.**

**Category 3 (Moderate-Risk)**

This amount of radioactive material, if not safely managed or securely protected, could cause permanent injury to a person who handled it, or was otherwise in contact with it, for some hours. It could possibly — although it is unlikely — be fatal to be close to this amount of unshielded radioactive material for a period of days to weeks.<sup>3</sup> Category 3 sources are associated with licensed activities to which the CNSC *Nuclear Substances and Radiation Devices Regulations* mostly apply.

**Examples of a Category 3 source usage:**

- **Industrial gauges:** These gauges are usually installed in fixed positions for measuring and process control purposes. These include density gauges, level gauges, belt mass meters and thickness gauges. The radioactive sealed source is mounted inside the gauge and projects a radiation beam, through the material, which is picked up by a detector to provide a measurement.
- **High dose rate (HDR) brachytherapy** is the placement of a small, highly radioactive sealed source, directly into cancerous tissues, for a short period of time. The procedure is sometimes guided by ultrasound or 3D computerized mapping techniques. Brachytherapy delivers a concentrated dose of radiation to cancerous tissue from within.



Image #7: Industrial fixed gauge



Image #8: HDR Brachytherapy

<sup>3</sup> IAEA, Categorization of Radioactive Sources, RS-G-1.9, (2005), Table 3

**Category 4 sources are classified as “unlikely to be dangerous”.**

***Category 4 (Low-risk)***

It is very unlikely that anyone would be permanently injured by this amount of radioactive material. However, this amount of unshielded radioactive material, if not safely managed or securely protected, could possibly — although it is unlikely — temporarily injure someone who handled it or was otherwise in contact with it, or who were close to it for a period of several weeks.<sup>4</sup> Category 4 sources are associated with licensed activities to which the CNSC *Nuclear Substances and Radiation Devices Regulations* mostly apply.

**Example of Category 4 source usage:**

- **Low dose rate industrial gauges**, such as moisture/density gauges, are used to measure the density of asphalt, soil, aggregate or concrete, as well as the moisture content of soil or aggregate.



Image #9: Portable gauge



Image #10: Portable gauge in use

<sup>4</sup> IAEA, *Categorization of Radioactive Sources*, RS-G-1.9, (2005), Table 3

### **Category 5 (Very Low-risk)**

No one could be permanently injured by this amount of radioactive material.<sup>5</sup> Category 5 sources are associated with licensed activities to which the CNSC *Nuclear Substances and Radiation Devices Regulations* mostly apply.

#### **Examples of a Category 5 source usage:**

- **Electron capture detector Ni-63 sources**, used in gas chromatography instruments. They are used to detect minute amounts of chemical compounds, such as halogenated organic chemicals in environmental samples. Pesticide levels in foodstuffs, for example, are measured with these detectors.
- **Low dose rate (LDR) brachytherapy** involves exposure to small radioactive sealed sources for hours to days. Ocular melanoma is one example of a tumor that can be treated with LDR brachytherapy. In another example, radioactive seeds of iodine-125 are surgically implanted to treat prostate cancer.



Image #11: Electron Capture Detector



Image #12: LDR Brachytherapy

<sup>5</sup> IAEA, Categorization of Radioactive Sources, RS-G-1.9, (2005), Table 3