

# ORNL – SAFEGUARDS AND SECURITY

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# Introduction & the 8 Radionuclides

- Radiological Dispersal Device (RDDs a.k.a. “Dirty Bombs”)
- ORNL Nonproliferation Programs, David Lambert
  - Americium-241
  - Cesium-137
  - Iridium-192
  - Radium-226
  - Californium-252
  - Cobalt-60
  - Plutonium-238

# The search

- **Methodology:** Divided searches by continent- Africa, Asia, Australia, Europe, North America, and South America
- **Priorities:** What, Where, For Whom

# Nuclide Production Database

- MySQL Database
- PHP Front-end
- Currently at [falsedrop.com/566isotopes](http://falsedrop.com/566isotopes)
- Password Protected
- Easily Exported



# Nuclide Production Database

HOME CITATIONS + FACILITIES + YIELD + ISOTOPES SUMMARY ?

## Display Citation

(2002) International Isotopes Inc Announces Its Resumption of Reactor Isotope Production. *PR Newswire*,: Factiva Document prn0000020020709dy79000hz. (Jul 9)

[\[EDIT\]](#)

(1999) *Ritverc GmbH*. (May 13) <<http://www.atom.nw.ru/isotope/eritverc.htm>> [Accessed Apr 2004, 12]

Home page of Ritverc GmbH, commercial provider of isotopes based at Khlopin Radium Institute

[\[EDIT\]](#)

(1996) Hydro-quebec - Cobalt 60 Production At Gentilly-2 Nuclear Power Station. *Canada NewsWire*,: Factiva Document cnnw000020011013ds8l00bkm. (Apr 21) [\[EDIT\]](#)

Alimov, Rashid (2001) *Mayak plant to increase Cobalt-60 export*. (Apr 30)  
<[http://www.bellona.no/en/international/russia/nuke\\_industry/siberia/mayak/20208.html](http://www.bellona.no/en/international/russia/nuke_industry/siberia/mayak/20208.html)> [Accessed Mar 2004, 30] [\[EDIT\]](#)

CANDU Owners Group Inc. (2004) *COG Home Page*. (Jan 9) <<http://www.candu.org/>> [Accessed Apr 17, 2004] [\[EDIT\]](#)

Center for Nonproliferation Studies (2003) *Russia: Mayak Production Reactors*.  
<<http://www.nti.org/db/nisprofs/russia/fisssmat/pumayak/prodreact.htm>> [Accessed Apr 12, 2004]: Nuclear Threat Initiative. [\[EDIT\]](#)

Center for Nonproliferation Studies (2003) *Country Profiles: North Korea*.  
<[http://www.nti.org/db/profiles/dprk/nuc/fac/reactors/NKN\\_F\\_irtrct\\_GO.html](http://www.nti.org/db/profiles/dprk/nuc/fac/reactors/NKN_F_irtrct_GO.html)> [Accessed Apr 12, 2004]: Nuclear Threat Initiative. [\[EDIT\]](#)

Egypt Atomic Energy Authority. <<http://frcu.eun/eq/vwww/homepage/aea/mpr.htm>> [Accessed Apr 14, 2004] [\[EDIT\]](#)

Ferqusen, Charles D., Tahseen Kazi, and Judith Perera (2003) *Commercial Radioactive Sources: Surveying the*

**DISPLAY CITATION PAGE** [X]

Here you may view the complete list of citations maintained in the database, or instead view a single citation if you followed a citation link from another page.

To edit the information in a citation, click on the link for **[EDIT]** following the citation.

To add a new citation, click the **+** to the right of **CITATIONS** at the top of the page.

Links within citations will take you to the URL displayed in a new window.

[X]



# Nuclide Production Database

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[+](#)
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[SUMMARY](#)
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## Display Facility

Facility IAEA Name	Country	City	Owner	Operator	Facility Type	EDIT
<a href="#">AGN 201 SUWON</a>	<a href="#">Korea--Republic of</a>		Kyung Hee University	Kyung Hee University	reactor	<a href="#">EDIT</a>
<a href="#">AGN 211 P</a>	<a href="#">Switzerland</a>	Basel	UNIVERSITAET BASEL	INSTITUT FUER PHYSIK, UNIVERSITAET BASEL	reactor	<a href="#">EDIT</a>
<a href="#">Apsara</a>	<a href="#">India</a>	Trombay	Bhabha Atomic Research Centre	BARC, Reactor Operations Division	reactor	<a href="#">EDIT</a>
<a href="#">ATR</a>	<a href="#">United States of America</a>	INEEL Site (32 miles west of Idaho Falls, Idaho, between Sun Valley, Idaho and Jackson Hole, Wyoming)	USDOE (Sometime subcontracted to International Isotopes, Inc.)	INEEL	reactor	<a href="#">EDIT</a>
<a href="#">Atucha 1</a>	<a href="#">Argentina</a>	Cordoba	CNEA	CNEA	reactor	<a href="#">EDIT</a>
<a href="#">BER-II</a>	<a href="#">Germany</a>	Berlin	Hahn-Meitner-Institut Berlin GMBH	BER-II Reactor	reactor	<a href="#">EDIT</a>
<a href="#">BOR-60</a>	<a href="#">Russian Federation</a>	Dmitrovgrad	Ministry on Atomic Energy of Russian Federation	Research Institute of Atomic Reactors	reactor	<a href="#">EDIT</a>
<a href="#">BR-2</a>	<a href="#">Belgium</a>	Mol	S.C.K./C.E.N.	S.C.K./C.E.N.	reactor	<a href="#">EDIT</a>
<a href="#">Bruce B</a>	<a href="#">Canada</a>	Bruce	AECL	AECL	reactor	<a href="#">EDIT</a>
<a href="#">Rudanest</a>			Atomic Energy	Atomic Energy		

**DISPLAY FACILITY PAGE** X

Here you may view the complete list of facilities whose information is maintained in the database, or a selection of those facilities if you followed a link from another page.

You can sort the displayed records by any column by clicking on the linked column header.

Clicking on any link within the "Facility IAEA Name" column will open a new window containing the IAEA Research Reactor Database profile of that facility.

Clicking on any link within the country column will narrow the display to include only facilities in the county you clicked.

You may edit a facility record by clicking on the EDIT link in that row.

You may add a new facility record by clicking on the [+](#) to the right of "FACILITIES" in the banner.

X



# Nuclide Production Database

HOME CITATIONS + FACILITIES + YIELD + ISOTOPES SUMMARY ?

## Display Facility Isotope Yield Citations

<a href="#">facility iaea name</a>	<a href="#">country</a>	<a href="#">isotope</a>	<a href="#">output amount</a>	<a href="#">citation</a>	<a href="#">year</a>	<a href="#">citation page</a>	<a href="#">link</a>	<a href="#">EDIT</a>
<a href="#">AGN 211 P</a>	<a href="#">Switzerland</a>	<a href="#">Cobalt-60</a>		<a href="#">1. Fergusen, Charles D., Tahseen Kazi, and Judith Perera</a>	2003	A2-5	<a href="#">#</a>	<a href="#">E</a>
<a href="#">ATR</a>	<a href="#">United States of America</a>	<a href="#">Iridium-192</a>		<a href="#">1. Fergusen, Charles D., Tahseen Kazi, and Judith Perera</a>	2003	A2-6	<a href="#">#</a>	<a href="#">E</a>
<a href="#">ATR</a>	<a href="#">United States of America</a>	<a href="#">Cobalt-60</a>		<a href="#">35.</a>	2002			<a href="#">E</a>
<a href="#">ATR</a>	<a href="#">United States of America</a>	<a href="#">Cobalt-60</a>		<a href="#">1. Fergusen, Charles D., Tahseen Kazi, and Judith Perera</a>	2003	A2-6	<a href="#">#</a>	<a href="#">E</a>
<a href="#">Atucha 1</a>	<a href="#">Argentina</a>	<a href="#">Cobalt-60</a>		<a href="#">1. Fergusen, Charles D., Tahseen Kazi, and Judith Perera</a>	2003	A2-1	<a href="#">#</a>	<a href="#">E</a>
<a href="#">BER-II</a>	<a href="#">Germany</a>	<a href="#">Cobalt-60</a>		<a href="#">23. Green, Jim</a>	1994		<a href="#">#</a>	<a href="#">E</a>
<a href="#">BER-II</a>	<a href="#">Germany</a>	<a href="#">Iridium-192</a>		<a href="#">23. Green, Jim</a>	1994		<a href="#">#</a>	<a href="#">E</a>
<a href="#">BR-2</a>	<a href="#">Belgium</a>	<a href="#">Iridium-192</a>		<a href="#">1. Fergusen, Charles D., Tahseen Kazi, and Judith Perera</a>	2003	A2-1	<a href="#">#</a>	<a href="#">E</a>

### DISPLAY YIELD PAGE

Here you see a list of the citations for a given facility producing a given isotope. The facility's country is also displayed for your convenience.

You can see a complete list of all yield records by clicking on the "YIELD" link in the banner.

You can see limited lists of yield records by clicking on various links throughout this page and other pages on this site.

Click on the linked header of any column to sort the record by that column.

Click on any link within the Facility IAEA Name column to view the IAEA Research Reactor Database record for that facility in a new window.

Click on any link within the Country column to view a list of yield records restricted to that country.

Click on any link within the Isotope column to view a list of yield records restricted to that isotope.

Click on any link within the Citation column to view the details of that citation.

Click on any linked octothorpe in the Link column to go to the Web page containing evidence of the facility's isotope yield in a new window.

Click on the EDIT link for a record to alter its output amount, citation page, citation direct link year month and/or date



# Nuclide Production Database

HOME CITATIONS + FACILITIES + YIELD + ISOTOPES SUMMARY ?

## Summary: Number of Facilities Producing Isotopes by Country

facility country	Am-241	Cf-252	Co-60	Cs-137	Ir-192	Pu-238	Ra-226	Sr-90
<a href="#">Argentina</a>			2					
<a href="#">Australia</a>			1		1			
<a href="#">Bangladesh</a>	1		1					
<a href="#">Belgium</a>					1			
<a href="#">Brazil</a>	1		1	1	1			
<a href="#">Bulgaria</a>			1					
<a href="#">Canada</a>			3					
<a href="#">China</a>			1		1			
<a href="#">Czech Republic</a>					1			
<a href="#">Dem. P.R. of Korea</a>			1					
<a href="#">Egypt</a>			1					
<a href="#">Germany</a>			2		2			
<a href="#">Hungary</a>			1					
<a href="#">India</a>			1		2			
<a href="#">Indonesia</a>					1			
<a href="#">Japan</a>			1		2			
<a href="#">Korea--Republic of</a>			2		1			
<a href="#">Netherlands</a>					1			
<a href="#">Norway</a>			1					
<a href="#">Romania</a>			1		1			

### SUMMARY: NUMBER OF FACILITIES PRODUCING ISOTOPES BY COUNTRY

Here you see a matrix that presents the number of facilities producing a given isotope in a given country.

Click on the number in any matrix cell to see a list of the citations in which a country's facilities are identified as producers of a given isotope. In that display, you might see multiple citations indicating that a given facility produces a given isotope.

Click on any country name to see a list of all yield citations for that country. In that display, you might see multiple citations indicating that a given facility produces a given isotope.

Click on any isotope name to see a list of all yield citations for that isotope. In that display, you might see multiple citations indicating that a given facility produces a given isotope.



# Findings & Problems

- Found evidence of at least 40 facilities that produce one or more of the 8 radionuclides in question
- Of the eight radionuclides, the most easily obtained source information is on Cobalt-60 and Iridium-192
- How much of each radionuclide was produced by whom?

# Recommendations For Future Database Development

- **Add new production facility types**
  - **Stockpiles**
  - **Waste Facilities (Strontium and Americium)**
  - **Future/planned Facilities**
- **Model conflicting data in cited works**
- **Maintain a local collection of cited works**