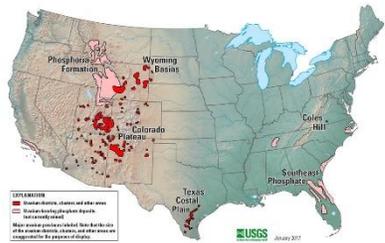


Library Research for Environmental Studies: Aspects of Uranium Mining and Nuclear Energy

GPO FDLP Webinar: September 15, 2021

Emily C. Wild, Chemistry, Geosciences and Environmental Studies Librarian
ewild@princeton.edu

Uranium Resources of the United States

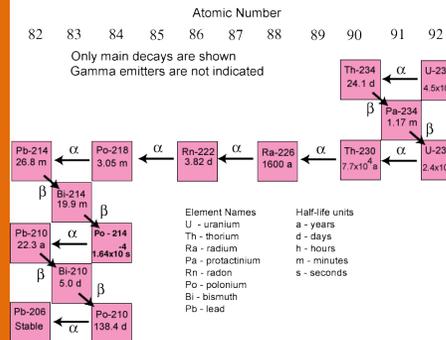


From USGS

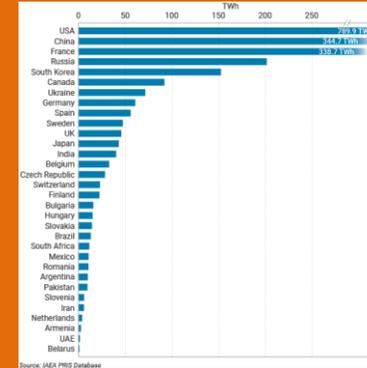


From USGS

The Uranium-238 Decay Chain

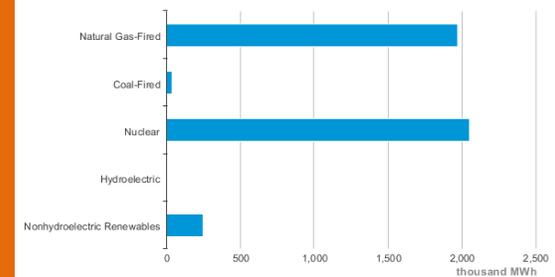


From USGS



From WNA

New Jersey Net Electricity Generation by Source, May, 2021



From EIA

Library User: "I spent two weeks searching for what you found in five minutes"

Upcoming and Past Webinars:

<https://libguides.princeton.edu/geo/librarianwebinars>

Princeton University Library <http://library.princeton.edu>

High Meadows Environmental Institute <http://environment.princeton.edu>

Princeton University, Chemistry <https://chemistry.princeton.edu/>

Andlinger Center for Energy and the Environment <https://acee.princeton.edu/>

Princeton School of Public and International Affairs <https://spia.princeton.edu/>

Center for Policy Research on Energy and the Environment (C-PREE)

<https://cpree.princeton.edu/>

Bendheim Center for Finance <https://bcf.princeton.edu/>

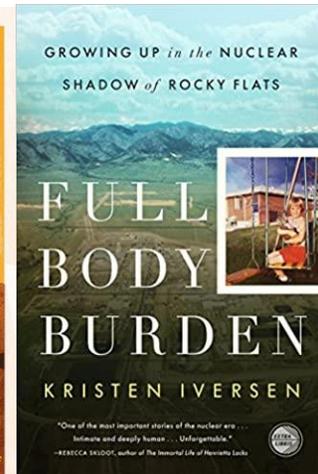
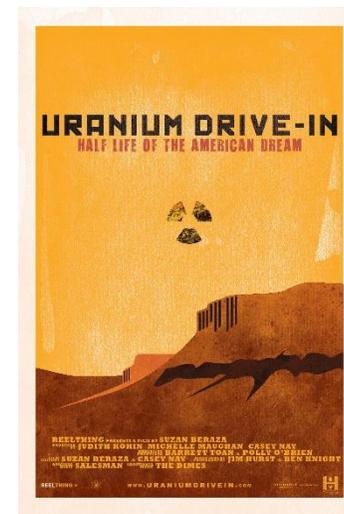
Operations Research and Financial Engineering (ORFE) <https://orfe.princeton.edu/>

Princeton Writing Program <https://writing.princeton.edu/undergraduates/writing-seminars>

Who Do I help the most?

**Scientists: Chemistry, Geosciences,
Environmental Studies**

**Non-scientists: Environmental Studies,
Policy, Law, Finance, Librarians**

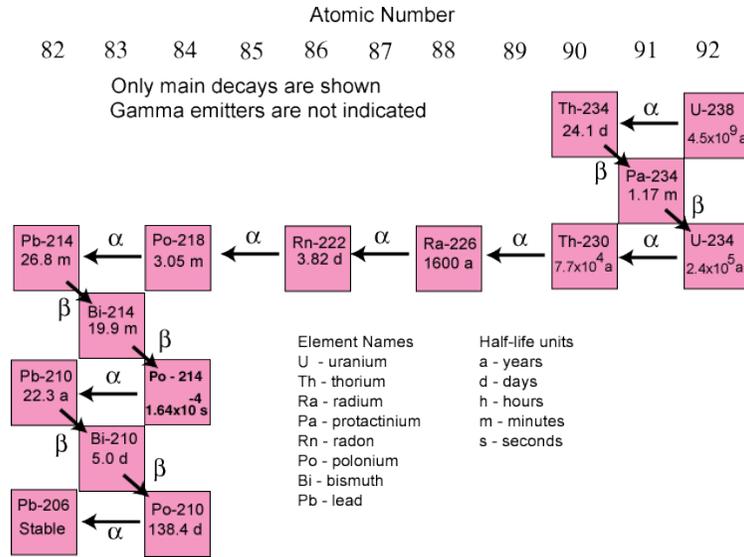


[Online for Free](#)

[Example, PUL](#)

Uranium Family

The Uranium-238 Decay Chain



Yellowcake = U_3O_8

<https://www.nrc.gov/materials/uranium-recovery.html>



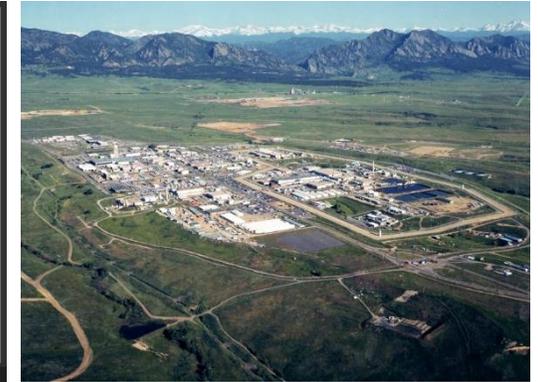
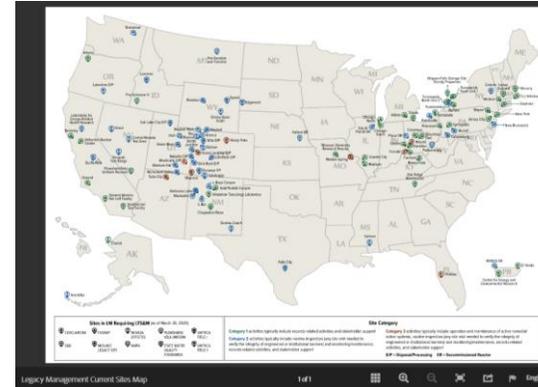
<https://www.grandcanyontrust.org/colorado-plateau-uranium>



Yucca Mountain,
Nuclear Waste

Storage:
<https://pubs.er.usgs.gov/search?q=Yucca+Mountain+nuclear>

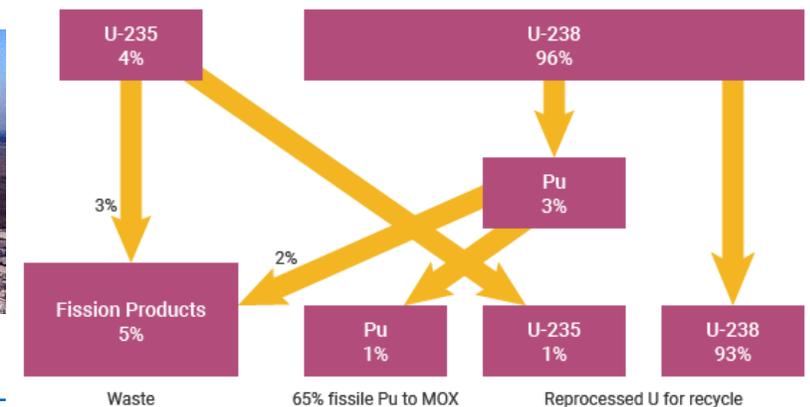
<https://www.energy.gov/lm/lm-sites>



Plutonium is formed in nuclear power reactors from uranium-238 by neutron capture. When operating, a typical 1000 MWe nuclear power reactor contains within its uranium fuel load several hundred kilograms of plutonium.
<https://world-nuclear.org/information-library/nuclear-fuel-cycle/fuel-recycling/plutonium.aspx>



<http://ready.nj.gov/plan-prepare/nuclear-generating-stations.shtml>



Basis: 45,000 MWD/t burn-up, ignores minor actinides



Emily C. Wild

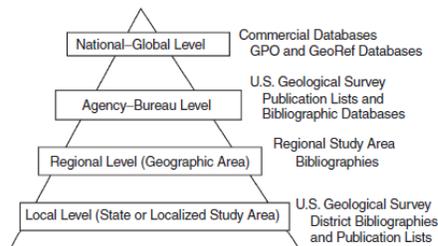
[Princeton University Library](https://library.princeton.edu)

ewild@princeton.edu

Schedule a Research Consultation : Mon – Fri

Meet Our Specialists – Emily Wild

FIGURE 2. Indexing and Availability Trends of U.S. Geological Survey Publications in Hydrology



“Online bibliographic sources in hydrology”

Science and Technology Libraries, 2001 <https://pubs.er.usgs.gov/publication/70023512>

**Princeton University Library, 2018-Present
Chemistry, Geosciences and Environmental Studies Librarian**

<https://library.princeton.edu/staff/ewild>

U.S. Geological Survey: <https://www.usgs.gov/staff-profiles/emily-wild>

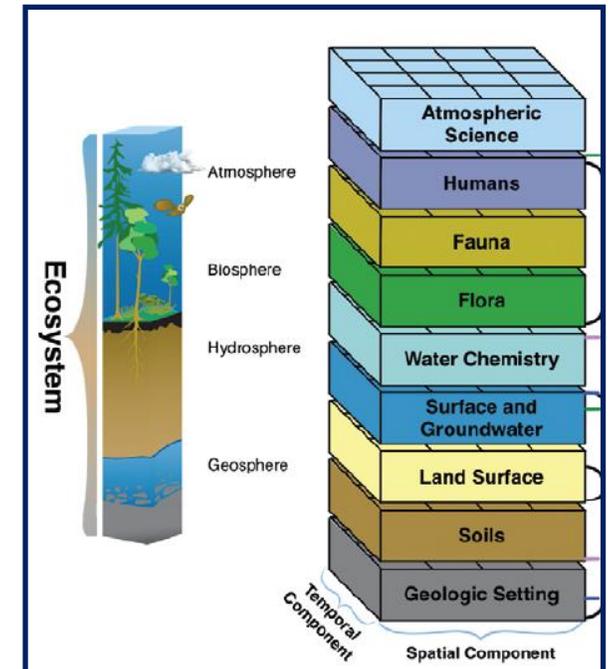
2008-2018 : Librarian (Physical Scientist): Denver, Colorado

1996-2008 : Hydrologist : [1998-2008 in Providence, Rhode Island]

2001: Master’s Library & Information Studies (MLIS), Univ. of Rhode Island

1995: BA Geology, Hartwick College

“Many people might be surprised to learn that drinking-water sources, especially groundwater, can contain radioactive elements (radionuclides). Radionuclides in water can be a concern for human health because several are toxic or carcinogenic.”



Upcoming and Past Webinars:

<https://libguides.princeton.edu/geo/librarianwebinars>

August 2020: Library Research for Energy, Minerals, and Uranium Resources <https://www.fdlp.gov/library-research-for-energy-mineral-and-uranium-resources>

USGS Library Materials for Earth's Age
<https://www.fdlp.gov/usgs-library-materials-for-earth-s-age>

USGS Library: Indexes, catalogs, and other bibliographic tools, a day in the life of a reference librarian <https://www.fdlp.gov/usgs-library-indexes-catalogs-and-other-bibliographic-tools-a-day-in-the-life-of-a-reference-librarian>

USGS Library: Oil, Gas, Coal, Uranium, and Minerals Maps and Data <https://www.fdlp.gov/usgs-library-oil-gas-coal-uranium-and-minerals-maps-and-data>

USGS Library: Using USGS Image, Map, and Data Products for Information Inquiries <https://www.fdlp.gov/usgs-library-using-usgs-image-map-and-data-products-for-information-inquiries>

Review and Interpretation of Previous Work and New Data on the Hydrogeology of the Schwartzwald Uranium Mine and Vicinity, Jefferson County, Colorado
<https://pubs.usgs.gov/of/2011/1092/>

Geological Society of America conference (2013):
THE PAST IS THE KEY TO THE FUTURE: URANIUM RESEARCH AT THE USGS DENVER LIBRARY
<https://gsa.confex.com/gsa/2013AM/webprogram/Paper222073.html>

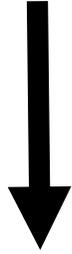
Geological Society of America conference (2013):
BACK TO THE FUTURE: URANIUM INFORMATION AT THE USGS DENVER LIBRARY
<https://gsa.confex.com/gsa/2013AM/webprogram/Paper225430.html>

GPO FDLP meeting (2020) poster session:
“Using U.S. Geological Survey (USGS) Uranium Research at the Princeton University Library” <https://www.fdlp.gov/2020-fdl-conference/2020-fdl-conference-virtual-poster-gallery>

“Online bibliographic sources in hydrology”

<https://pubs.er.usgs.gov/publication/70023512>

Scientist

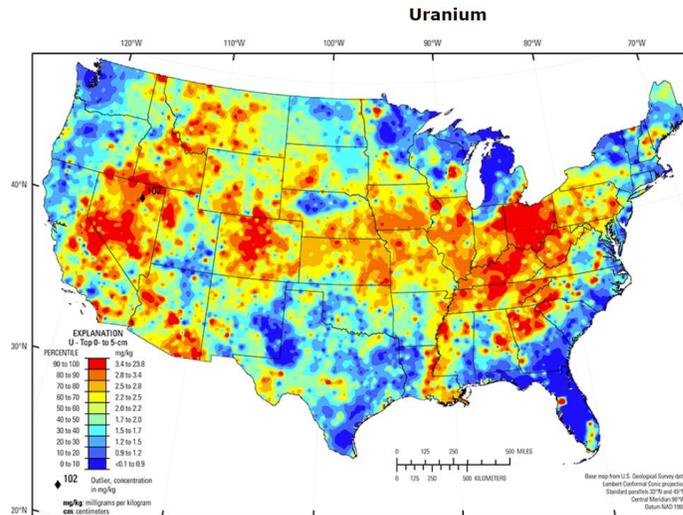


- **Raw Data:** Real-Time, Continuous, Recent Partial Records, Historical
- **Calculated Data:** Equations, Software Results, Lab Results, and Model Results
- **Map Data:** Specific Location Information by Geosciences Topic
- **Citation Data:** Bibliographic Information & Finding Publications

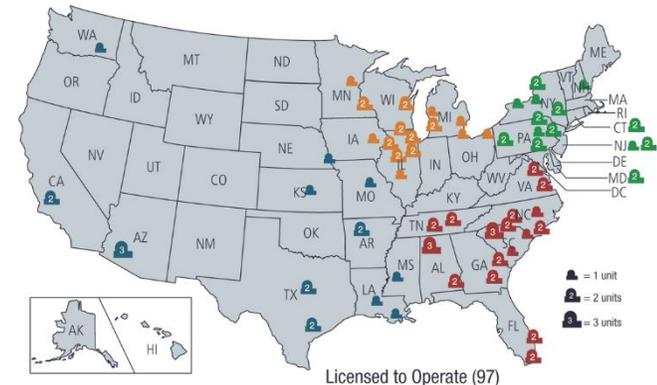


Non-Scientist

About 99.9% of the research inquiries I receive for the environmental aspects of uranium are answered via USGS data and publications



U.S. Operating Commercial Nuclear Power Reactors



USNRC
United States Nuclear Regulatory Commission
Protecting People and the Environment
As of August 2019

Environmental Studies

United States Uranium Provinces, Districts, and Important Deposits

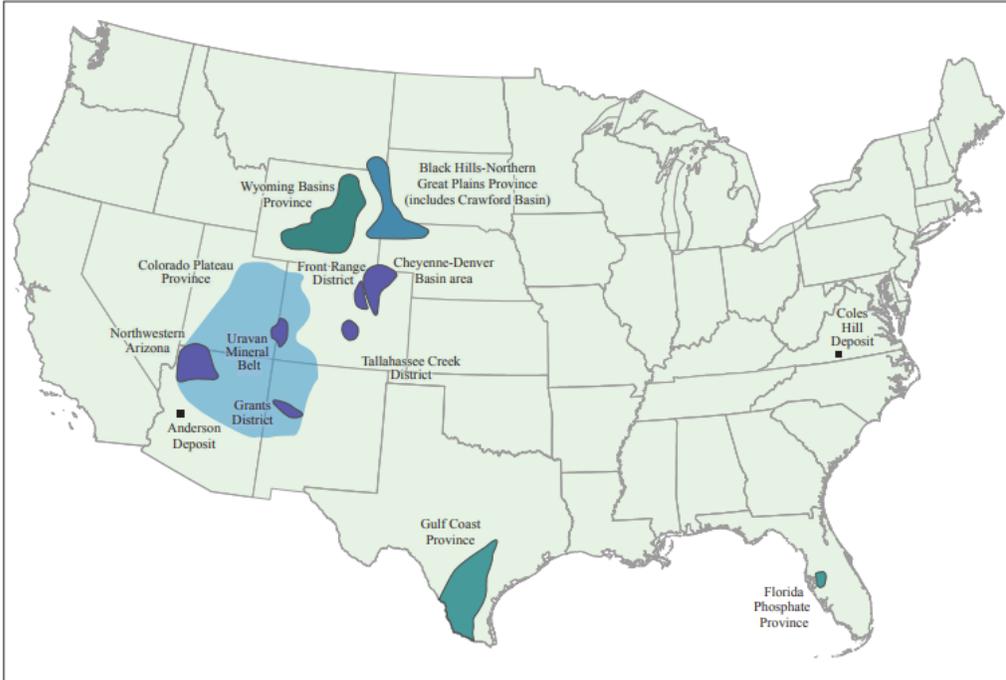


Figure 1-23. Uranium province map of the United States.

Critical Analysis of World Uranium Resources

USGS SIR 2012-5239

Prepared in cooperation with the U.S. Energy Information Administration

<https://pubs.usgs.gov/sir/2012/5239/>

Examples United States: Black Hills, Front Range Colorado, Uravan Mineral Belt, Grants District (Mineral Belt)

“Online bibliographic sources in hydrology” (2001)

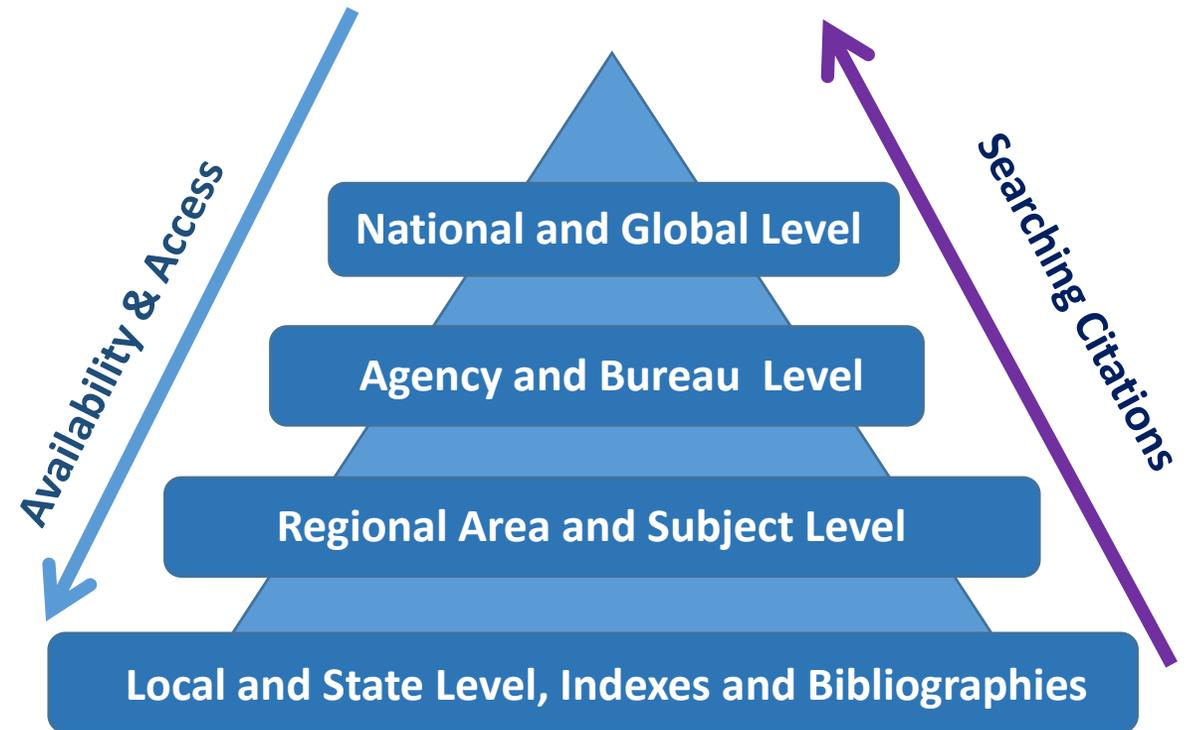
<https://pubs.er.usgs.gov/publication/70023512>

https://www.tandfonline.com/doi/abs/10.1300/J122v21n03_05

(online 2008)

Also published (2001) as a book chapter in *Information and the professional scientist and engineer*

<https://pubs.er.usgs.gov/publication/70176091>



World Uranium Mining Production

(Updated September 2021)

- Over two-thirds of the world's production of uranium from mines is from Kazakhstan, Canada and Australia
- An increasing amount of uranium, now over 50%, is produced by in situ leaching.

In 2020 Kazakhstan produced the largest share of uranium from mines (41% of world supply), followed by Australia (13%) and Canada (8%).

Production from mines (tonnes U)

Country	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Kazakhstan	19,451	21,317	22,451	23,127	23,607	24,689	23,321	21,705	22,808	19,477
Canada	9145	8999	9331	9134	13,325	14,039	13,116	7001	6938	3885
Australia	5983	6991	6350	5001	5654	6315	5882	6517	6613	6203
Namibia	3258	4495	4323	3255	2993	3654	4224	5525	5476	5413
Uzbekistan (est.)	2500	2400	2400	2400	2385	3325	3400	3450	3500	3500
Niger	4351	4667	4518	4057	4116	3479	3449	2911	2983	2991
Russia	2993	2872	3135	2990	3055	3004	2917	2904	2911	2846
China (est.)	885	1500	1500	1500	1616	1616	1692	1885	1885	1885
Ukraine	890	960	922	926	1200	808	707	790	800	400
USA	1537	1596	1792	1919	1256	1125	940	582	58	6
India (est.)	400	385	385	385	385	385	421	423	308	400
South Africa (est.)	582	465	531	573	393	490	308	346	346	250
Iran (est.)	0	0	0	0	38	0	40	71	71	71
Pakistan (est.)	45	45	45	45	45	45	45	45	45	45
Brazil	265	326	192	55	40	44	0	0	0	15
Czech Republic	229	228	215	193	155	138	0	0	0	0
Romania	77	90	77	77	77	50	0	0	0	0
France	6	3	5	3	2	0	0	0	0	0
Germany	51	50	27	33	0	0	0	0	0	0
Malawi	846	1101	1132	369	0	0	0	0	0	0
Total world	53,493	58,493	59,331	56,041	60,304	63,207	60,514	54,154	54,742	47,731
tonnes U ₃ O ₈	63,082	68,974	69,966	66,087	71,113	74,357	71,361	63,861	64,554	56,287
% of world demand	87%	94%	91%	85%	98%	96%	93%	80%	81%	74%

* Data from the World Nuclear Association. NB: the figures in this table are liable to change as new data becomes available.

<https://world-nuclear.org/information-library/nuclear-fuel-cycle/mining-of-uranium/world-uranium-mining-production.aspx>

Integrated Uranium Resource and Environmental Assessment

<https://www.usgs.gov/centers/cerc/science/integrated-uranium-resource-and-environmental-assessment>

Critical Analysis of World Uranium Resources, USGS SIR 2012-5239

Prepared in cooperation with the U.S. Energy Information Administration

<https://pubs.usgs.gov/sir/2012/5239/>

- USGS Mineral Resources on-line spatial data (<https://mrddata.usgs.gov>). Interactive maps and downloadable data for regional and global geology, geochemistry, and mineral resources including uranium.
- National Geochemical Database (<https://pubs.usgs.gov/of/1997/ofr-97-0492/>). Downloadable hydrogeochemical and stream sediment data from the Department of Energy's National Uranium Resource Evaluation program, reformatted and now administered by the USGS.
- US Environmental Protection Agency Uranium Mines and Mills Location Database (<https://www.epa.gov/radiation/uranium-mines-and-mills-location-database-0>) A compilation of uranium mine locations compiled by the EPA as part of an investigation into potential environmental hazards associated with abandoned uranium mines.
- US Energy Information Administration (<http://www.eia.gov/nuclear/>). Analysis and data describing the US domestic uranium and nuclear fuels industry.

External Links

- World Nuclear Association (<http://www.world-nuclear.org>) Information on the nuclear fuel cycle.
- International Atomic Energy Agency – Nuclear Fuel Cycle (<https://www.iaea.org/topics/nuclear-fuel-cycle>). Information describing the nuclear fuel cycle including uranium production (<https://www.iaea.org/topics/nuclear-fuel-production>) and the world distribution of uranium deposits (UDEPO) database (<https://infcis.iaea.org/UDEPO/>).
- Organisation for Economic Cooperation and Development – Nuclear Energy Agency (<http://www.oecd-nea.org/>) Intergovernmental agency focused on the use of nuclear energy for peaceful purposes. Publishes the biennial "Redbook – Uranium resources, production and demand" <http://www.oecd-nea.org/ndd/pubs/2016/7301-uranium-2016.pdf>

Environmental Studies

Integrated Uranium Resource and Environmental Assessment

<https://www.usgs.gov/centers/cersc/science/integrated-uranium-resource-and-environmental-assessment>

Critical Analysis of World Uranium Resources, USGS SIR 2012-5239

Prepared in cooperation with the U.S. Energy Information Administration

<https://pubs.usgs.gov/sir/2012/5239/>

Search = Kazakhstan uranium

USGS MRDATA

<https://mrdata.usgs.gov/catalog/science.php?thcode=1&term=fKZ>

GeoScienceWorld

<https://pubs.geoscienceworld.org/search-results?page=1&quicknav=1&q=Kazakhstan%20uranium>



Home / Information Library / Country Profiles / Countries G-N / Kazakhstan

Uranium and Nuclear Power in Kazakhstan

(Updated February 2021)

- Kazakhstan has 12% of the world's uranium resources and in 2020 produced about 19,500 tU.
- In 2009 it became the world's leading uranium producer, with almost 28% of world production. In 2019, Kazakhstan produced 43% of the world's uranium.
- A single Russian nuclear power reactor operated from 1972 to 1999, generating electricity and desalinating water.
- Kazakhstan has a major plant making nuclear fuel pellets and aims eventually to sell value-added fuel rather than just uranium. A fuel fabrication plant is being built with 49% Chinese equity.

Kazakhstan has been an important source of uranium for more than 50 years. Over 2001 to 2013 production rose from 2022 to about 22,550 tonnes U per year, making Kazakhstan the world's leading uranium producer. Capacity is around 25,000 tU/yr. In 2019 production was 22,808 tU, up from 21,705 tU the year before. In 2020 Kazatomprom produced 19,477 tU, down from recent totals due to the impact of coronavirus. In August 2020, the company stated that it expected to produce 22,000-22,500 tU in both 2021 and 2022.

Of its 17 mine projects, five are wholly-owned by Kazatomprom and 12 are joint ventures with foreign equity holders, and some of these are producing under nominal capacity. In 2019, Kazatomprom's financial results show 13,291 tU – 25% of world production, putting it ahead of Orano, Cameco and Uranium One.

World Uranium Mining Production

(Updated September 2021)

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- An increasing amount of uranium, now over 50%, is produced by in situ leaching.

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Ukraine	890	960	922	926	1200	808	707	790	800	400
USA	1537	1596	1792	1919	1256	1125	940	582	58	6
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Pakistan (est.)	45	45	45	45	45	45	45	45	45	45
Brazil	265	326	192	55	40	44	0	0	0	15
Czech Republic	229	228	215	193	155	138	0	0	0	0
Romania	77	90	77	77	77	50	0	0	0	0
France	6	3	5	3	2	0	0	0	0	0
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Total world	53,493	58,493	59,331	56,041	60,304	63,207	60,514	54,154	54,742	47,731
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* Data from the World Nuclear Association. NB: the figures in this table are liable to change as new data becomes available.

<https://world-nuclear.org/information-library/nuclear-fuel-cycle/mining-of-uranium/world-uranium-mining-production.aspx>

Environmental Studies

United States Uranium Provinces, Districts, and Important Deposits

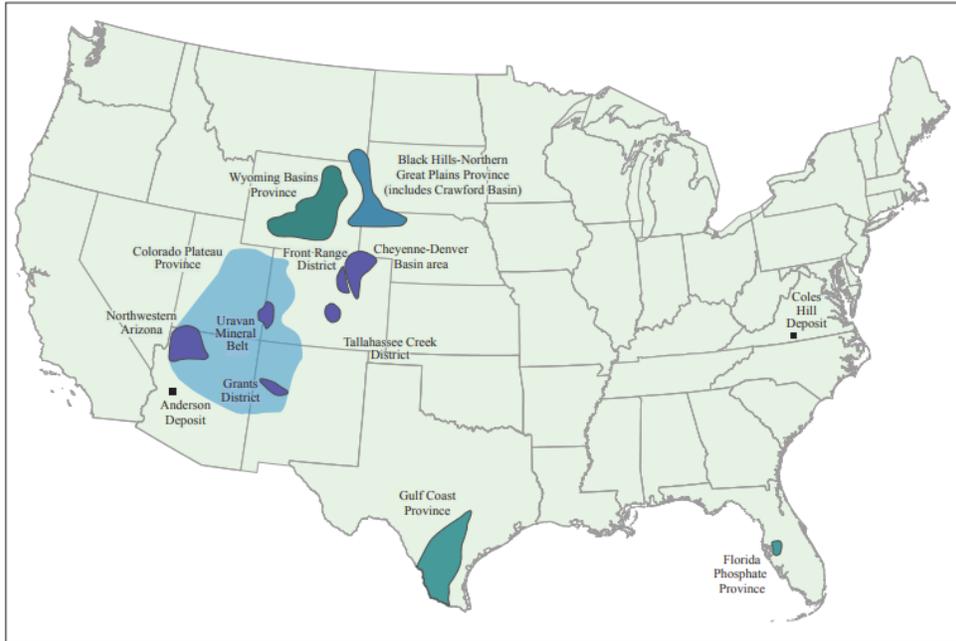


Figure 1-23. Uranium province map of the United States.

<https://pubs.usgs.gov/sir/2012/5239/>

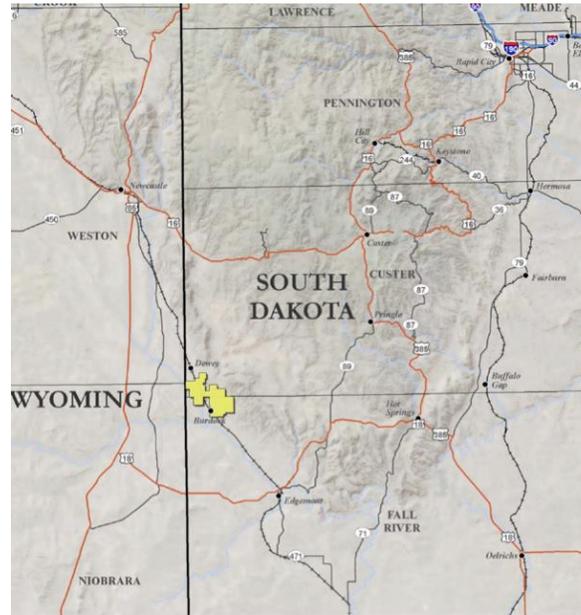
“The geology of the Jewel Cave SW quadrangle, South Dakota and its bearing on the origin of the uranium deposits in the southern Black Hills.”

Princeton University, Geosciences, PhD :

<https://catalog.princeton.edu/catalog/9928436633506421>

USGS Open-File Report :

<https://pubs.er.usgs.gov/publication/ofr5910>



The Dewey Burdock Uranium Project is located in South Dakota and is a high-grade in-situ recovery deposit.

Azarga Uranium owns 100% of the Dewey Burdock Uranium Project.

Azarga Uranium

<https://azargauranium.com/projects/usa/dewey-burdock/>

Technical Reports:

<https://azargauranium.com/report-type/technical/>

EPA: [News release](#)

<https://www.theupa.org/>

Uranium Producers of America

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SUPPLY & DEMAND
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URANIUM TECHNOLOGY
ANNUAL REPORT

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Fax: 1 505 988 2987
Email: upa@cmrisantafe.com
Address:
141 East Palace Avenue
Santa Fe, New Mexico
United State of America
Post Office Box 669
87504 0669

UPA NEWS

UPA, WMA APPLAUD ANNOUNCEMENT OF TERRAPOWER ADVANCED NUCLEAR PLANT IN WYOMING
Jul 5, 2021
Today, Uranium Producers of America President and Executive Vice President of Uranium Energy Corp Scott Melbye and Wyoming Mining Associa...
READ MORE

UPA PRESIDENT TESTIFIES AT SENATE COMMITTEE ON ENERGY AND NATURAL RESOURCES
Mar 25, 2021
Today, Uranium Producers of America President and Executive Vice President of Uranium Energy Corp Scott Melbye testified before the U.S...
READ MORE

UPA ANNOUNCES ELECTION OF NEW OFFICERS
Feb 8, 2021
The Uranium Producers of America (UPA) is pleased to announce the election of its leadership positions at the organization's board meet...
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- [ConverDyn](#)
- [enCore Energy Corp.](#)
- [Energy Fuels Inc.](#)
- [Ur-Energy Inc.](#)
- [Laramide Resources Ltd.](#)
- [Rio Grande Resources](#)
- [Strata Energy - Peninsula Energy Ltd.](#)
- [Uranium Energy Corp](#)

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- [Laramide Resources Ltd.](#)
- [Rio Grande Resources](#)
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- [Uranium Energy Corp](#)

Environmental Studies

United States Uranium Provinces, Districts, and Important Deposits

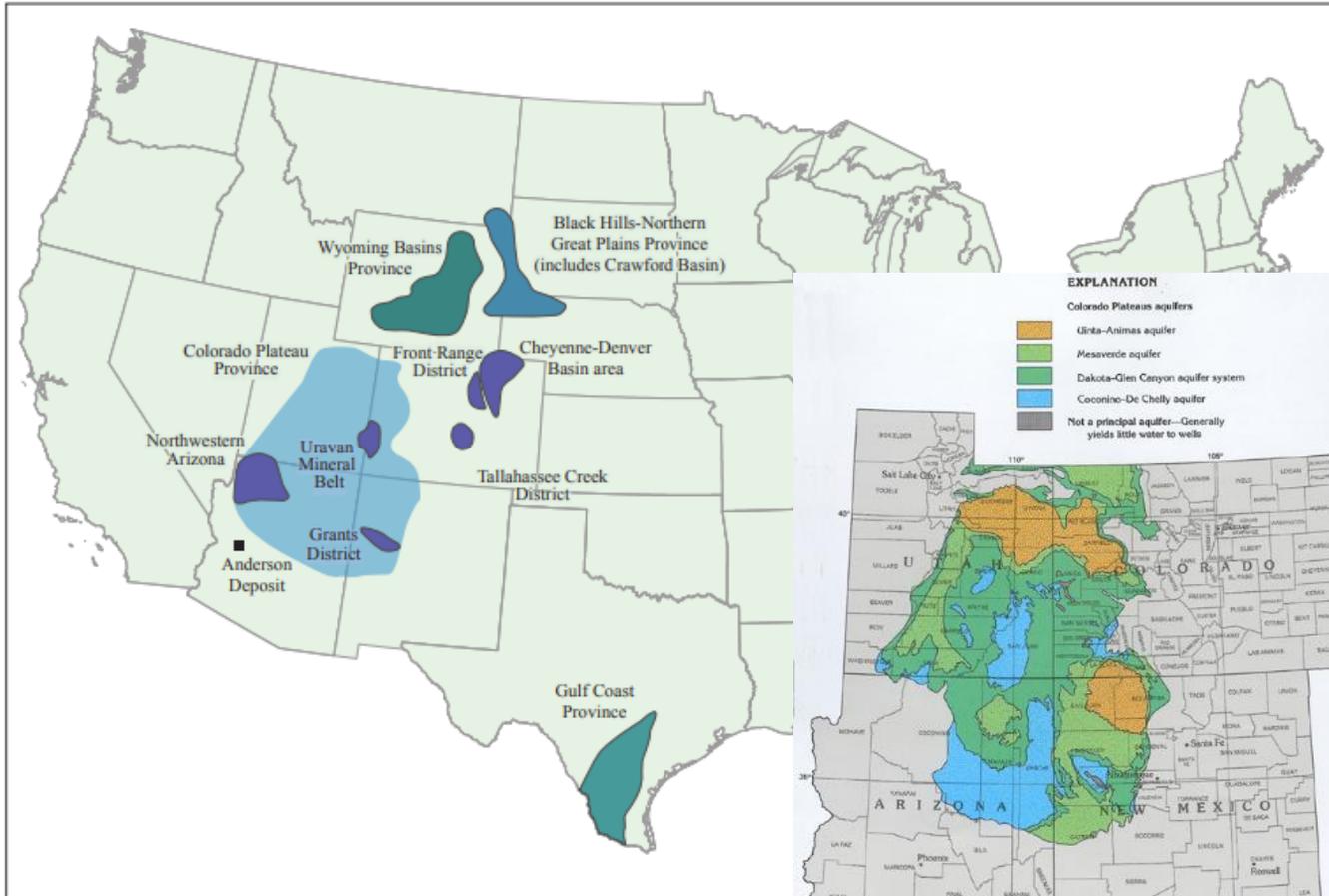


Figure 1-23. Uranium province map of the United States.

<https://pubs.usgs.gov/ha/ha730/gwa.html>

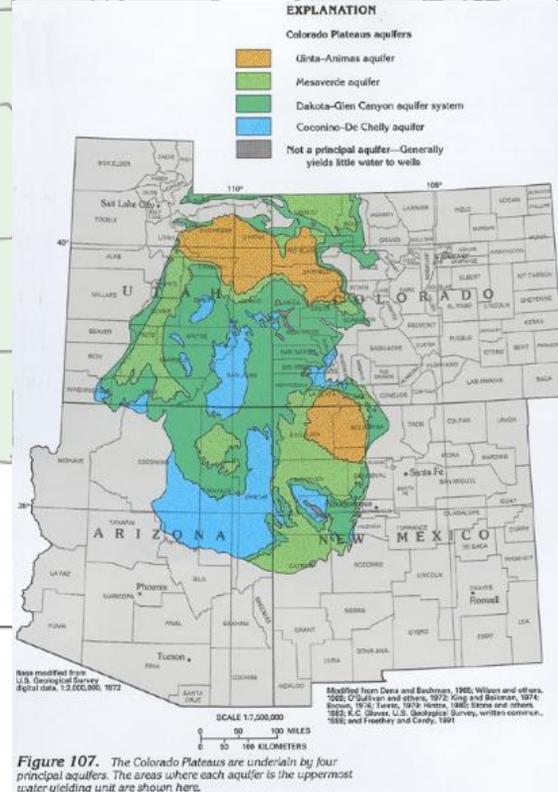
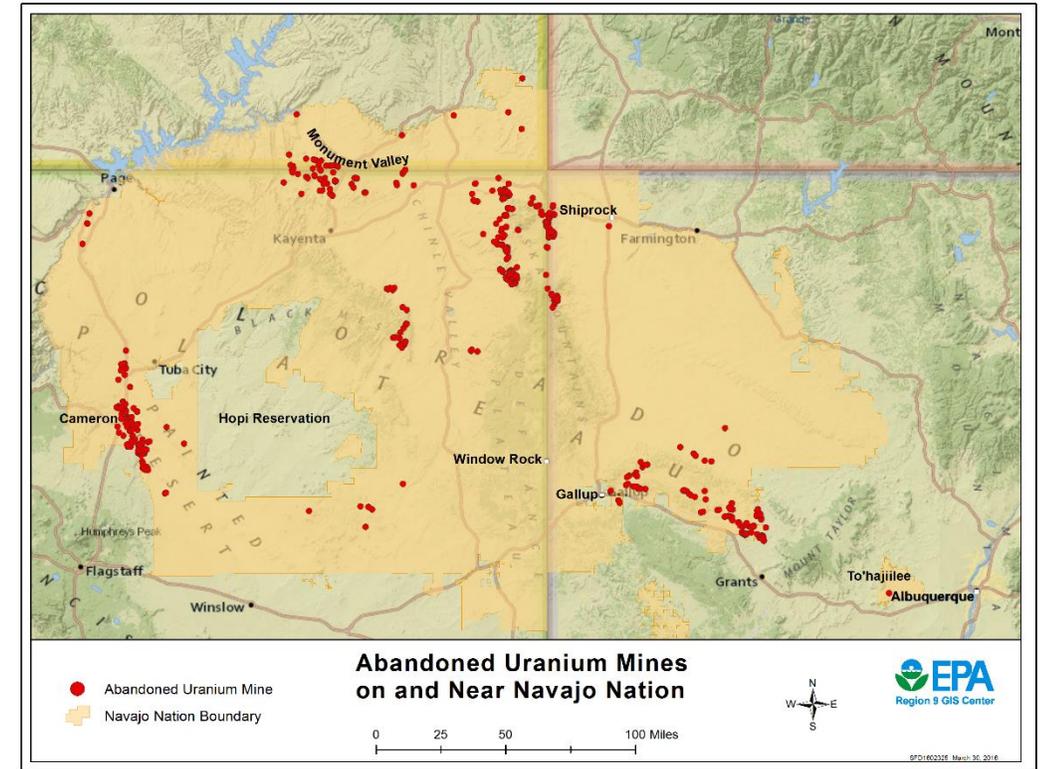


Figure 107. The Colorado Plateau is underlain by four principal aquifers. The areas where each aquifer is the uppermost water-yielding unit are shown here.



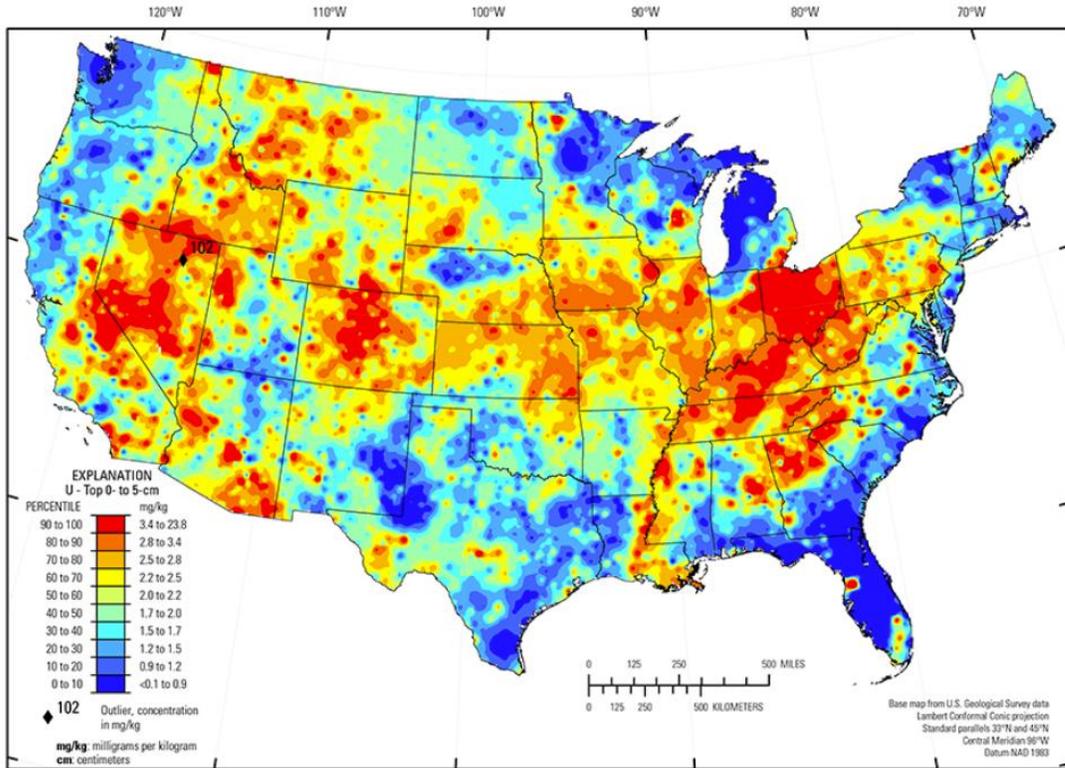
Navajo Nation: Cleaning Up Abandoned Uranium Mines

<https://www.epa.gov/navajo-nation-uranium-cleanup>

Navajo Nation: <https://www.navajo-nsn.gov/>

USGS research, Navajo uranium <https://pubs.er.usgs.gov/search?q=Navajo+uranium>

Uranium



Soils – Uranium

National Geochemical Database

<https://pubs.usgs.gov/of/1997/ofr-97-0492/>

Reformatted Data from the National Uranium Resource Evaluation (NURE) Hydrogeochemical and Stream Sediment Reconnaissance (HSSR) Program

<https://mrdata.usgs.gov/nure/water/>

USGS
science for a changing world

Mineral Resources / Online Spatial Data

Geochemistry of water samples in the US from the NURE-HSSR database

Geochemical analyses of water samples throughout the U.S. collected by the hydrogeochemical and stream sediment reconnaissance (HSSR) phase of the National Uranium Resource Evaluation (NURE) program. This database contains 335,547 records.

View

Show in a web browser window:

Continental US Alaska

Show in your GIS using OGC web services:

<https://mrdata.usgs.gov/services/nurewtr> (WMS, version 1.3.0)
<https://mrdata.usgs.gov/services/wfs/nurewtr> (WFS, version 1.1.0)

Trace Elements Investigations:

<https://pubs.er.usgs.gov/browse/Report/USGS%20Numbered%20Series/Trace%20Elements%20Investigations/>

Trace Elements Memorandums:

<https://pubs.er.usgs.gov/browse/Report/USGS%20Numbered%20Series/Trace%20Elements%20Memorandum/>

Environmental Studies

Fukushima Daiichi Status Updates

<https://www.iaea.org/newscenter/focus/fukushima/status-update>

Fukushima Nuclear Accident

<https://www.iaea.org/newscenter/focus/fukushima>

USGS research: <https://bqs.usgs.gov/fukushima/>
Fission Products in National Atmospheric Deposition Program Wet Deposition Samples Following the Fukushima Dai-Ichi Nuclear Power Station Incident, March 8 - April 5, 2011. <https://pubs.usgs.gov/of/2011/1277/>



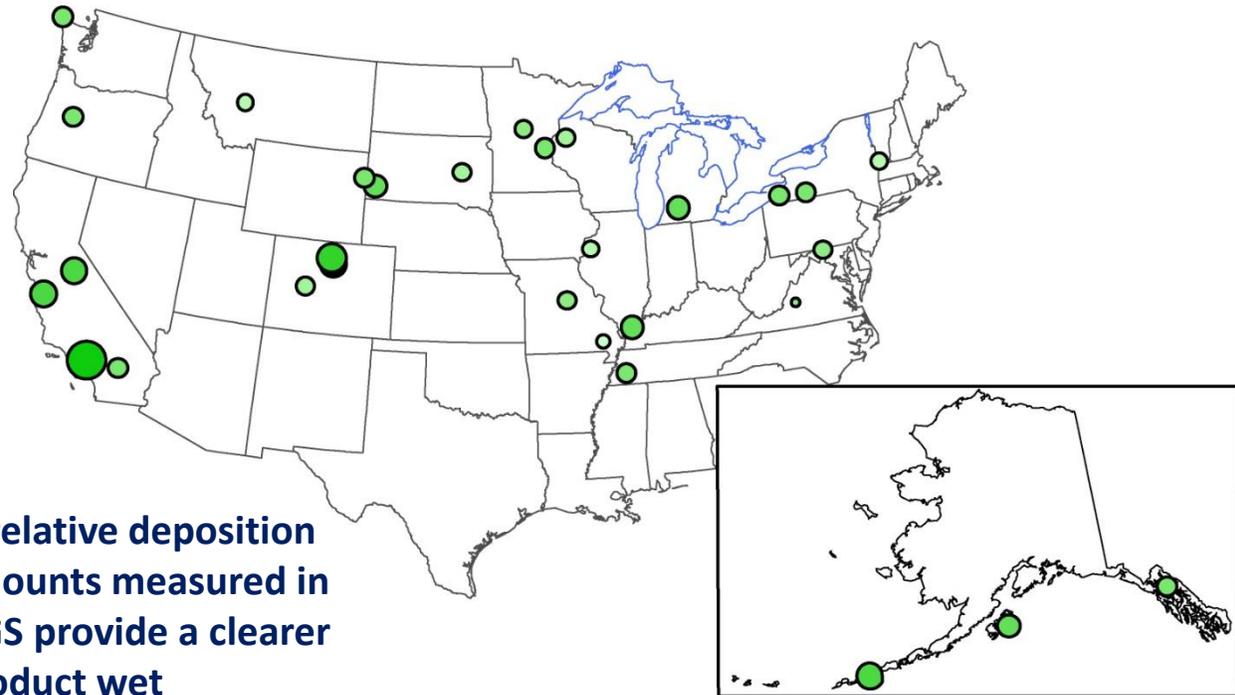
International Atomic Energy Agency

<https://www.iaea.org/>

65th IAEA General Conference

20 – 24 September 2021, Vienna International Centre, Vienna

<https://www.iaea.org/about/governance/general-conference/gc65/general-information>



Dot size represents relative deposition amounts. Fallout amounts measured in precipitation by USGS provide a clearer picture of fission-product wet deposition across the USA.

Environmental Studies : Reading List for Uranium

Critical Analysis of World Uranium Resources, USGS SIR 2012-5239

<https://pubs.usgs.gov/sir/2012/5239/>

Review and Interpretation of Previous Work and New Data on the Hydrogeology of the Schwartzwald Uranium Mine and Vicinity, Jefferson County, Colorado

<https://pubs.usgs.gov/of/2011/1092/>

Annotated Bibliography of Environmentally Relevant Investigations of Uranium Mining and Milling in the Grants Mineral Belt, Northwestern New Mexico

<https://pubs.usgs.gov/of/2011/1140/>

Uranium concentrations in groundwater, northeastern Washington

<https://pubs.er.usgs.gov/publication/sim3401>

Characterization of selected radionuclides in sediment and surface water in Standley Lake, Great Western Reservoir, and Mower Reservoir, Jefferson County, Colorado, 1992

<https://pubs.er.usgs.gov/publication/wri954126>

Thank You! Questions?

