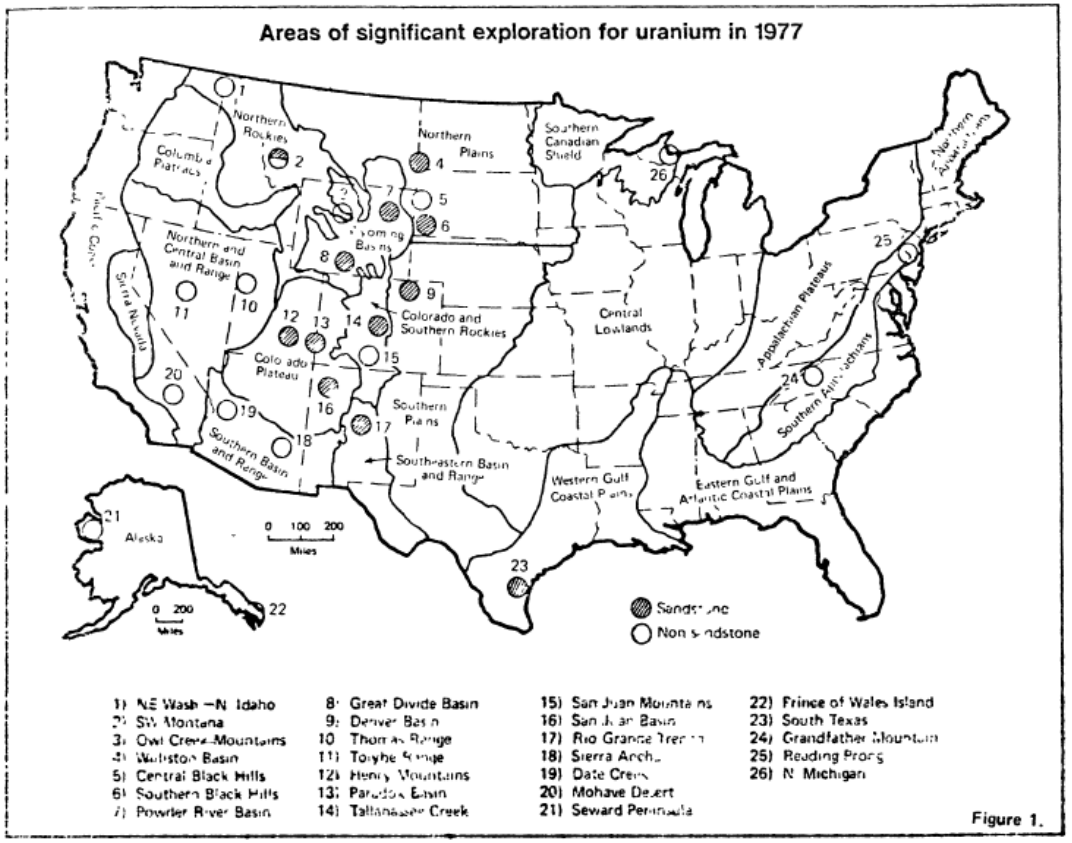
Uranium Issues in the Western US: Legacy, Current Production, Health Research and Resource Estimates

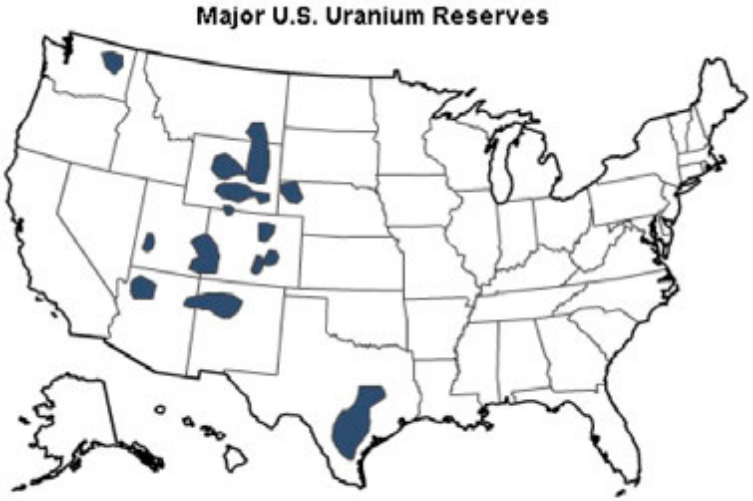
Compiled for
World Uranium Symposium
April 14 – 16, 2015
Quebec City, Canada

Paul Robinson, Research Director
sricpaul@earthlink.net

Southwest Research and Information Center
PO Box 4524
Albuquerque, NM 87196
www.sric.org



http://www.sric.org/uranium/1979_SRIC_URANIUM_PRIMER.pdf

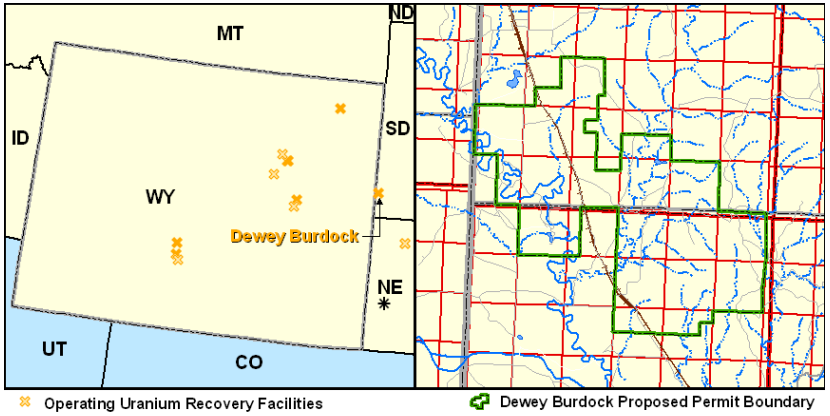


Sources: Based on U.S. Department of Energy, Grand Junction Project Office (GJPO). National Uranium Resources evaluation. Interim report (June 1979) Figure 3.2; and GJPO data files.

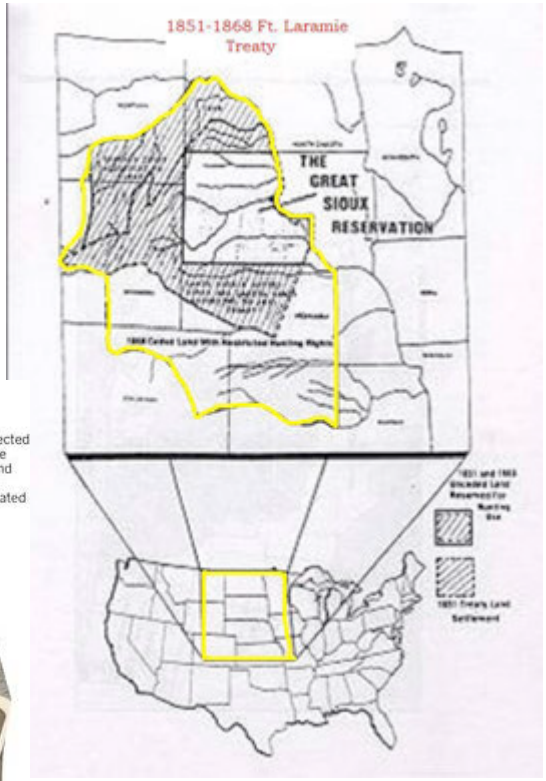
The Western USA has been a major uranium producing region since the 1940s. Few new deposits have been identified since the 1980s.
All proposed new mines in the USA seek to exploit deposits discovered decades ago

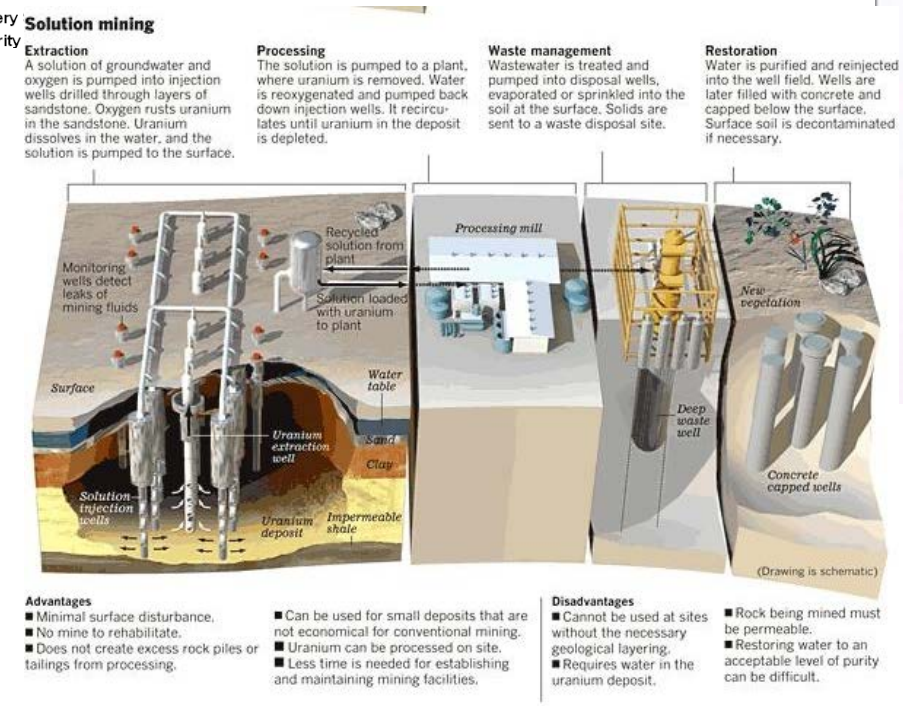
http://www.eia.gov/uranium/reserves/ures.pdf

The **Northern Plains** states of Wyoming and Nebraska host most of the currently licensed uranium production in the US currently that use in situ recovery. The Proposed Dewey-Burdock in situ mine in South Dakota and most ISR mines in Wyoming and Nebraska are on land designated as "the Great Sioux Reservation in the 1868 Fort Laramie Treaty.



http://www.nrc.gov/info-finder/materials/uranium/licensed-facilities/dewey-burdock.html

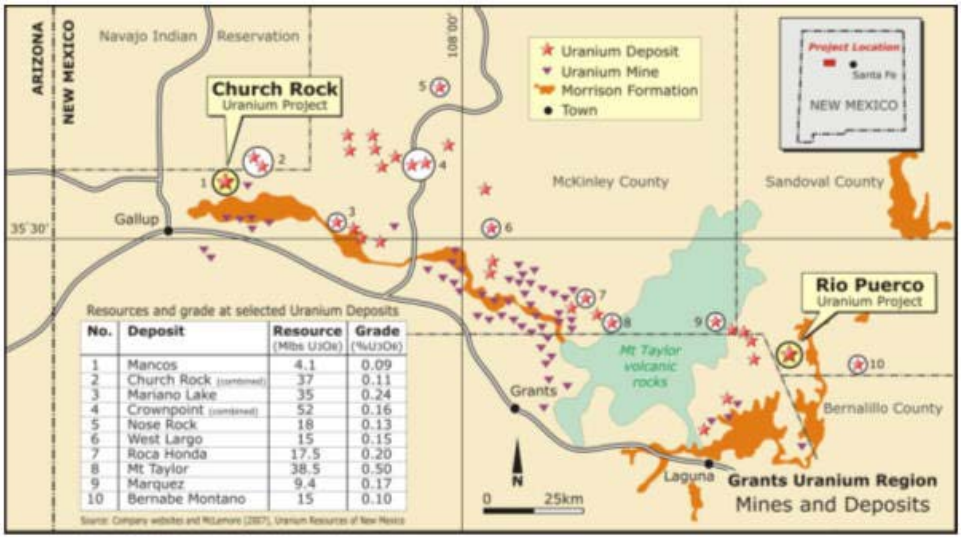




http://www.russellmeansfreedom.com/tag/cancer/

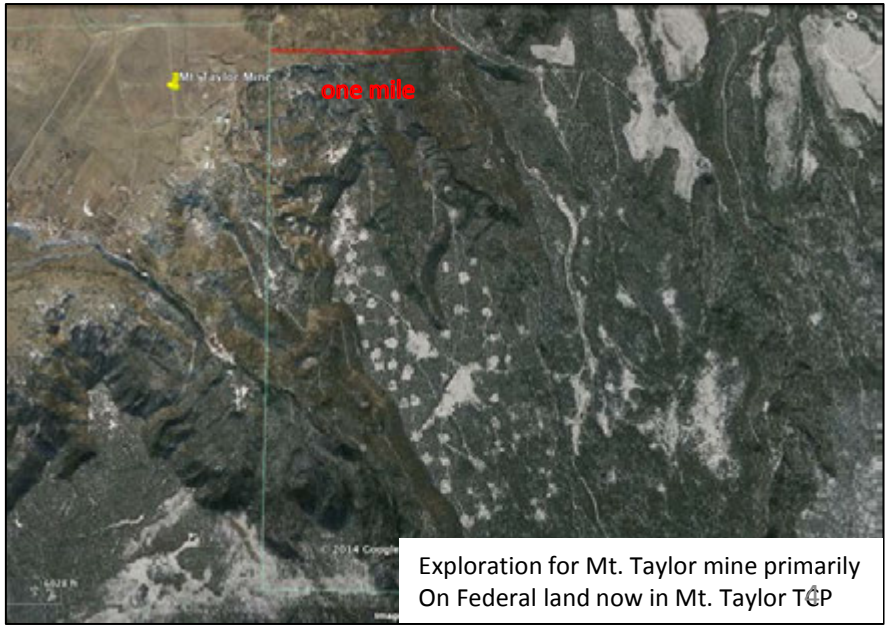
Cameco-Owned Crow Butte In Situ Uranium Mine, Nebraska

New Mexico Uranium Resources are found near Mt. Taylor – a Sacred Site for Local Native Tribes - in the Grants Mineral Belt



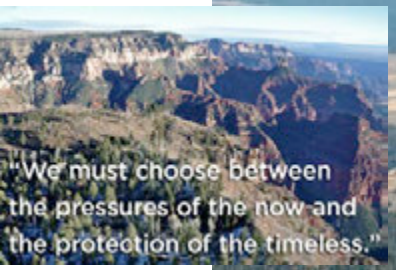
Mt. Taylor Traditional Cultural Property (TCP) designated by US Government after petition by Five Native Tribes – Acoma, Laguna, Zuni, Hopi and Navajo. Two uranium mines Roca Honda and La Jara Mesa are currently proposed in the Mt. Taylor TCP and the exploration area for the Mt. Taylor mine is within the TCP.

Roca Honda mine currently in comment period for 2500-4000 gallon per minute mine water discharge from dewatering of ore zone under US Forest Service environmental assessment.



The Grand Canyon region of Northern Arizona is a focus of uranium development and uranium challenges The US Government established a 20-year moratorium on new uranium exploration claims near Grand Canyon established and upheld against challenges. However, existing permitted mines including Energy Fuel's Pinenut mine north of Grand Canyon and Canyon mine near a significant Havasupai Cultural Site – Red Butte are not affected. The proposed restart of Canyon Mine focus of current campaigns.

http://www.pressenza.com/2013/04/call-for-a-worldwide-ban-on-uranium-mining-as-the-grand-canyon-comes-under-threat/

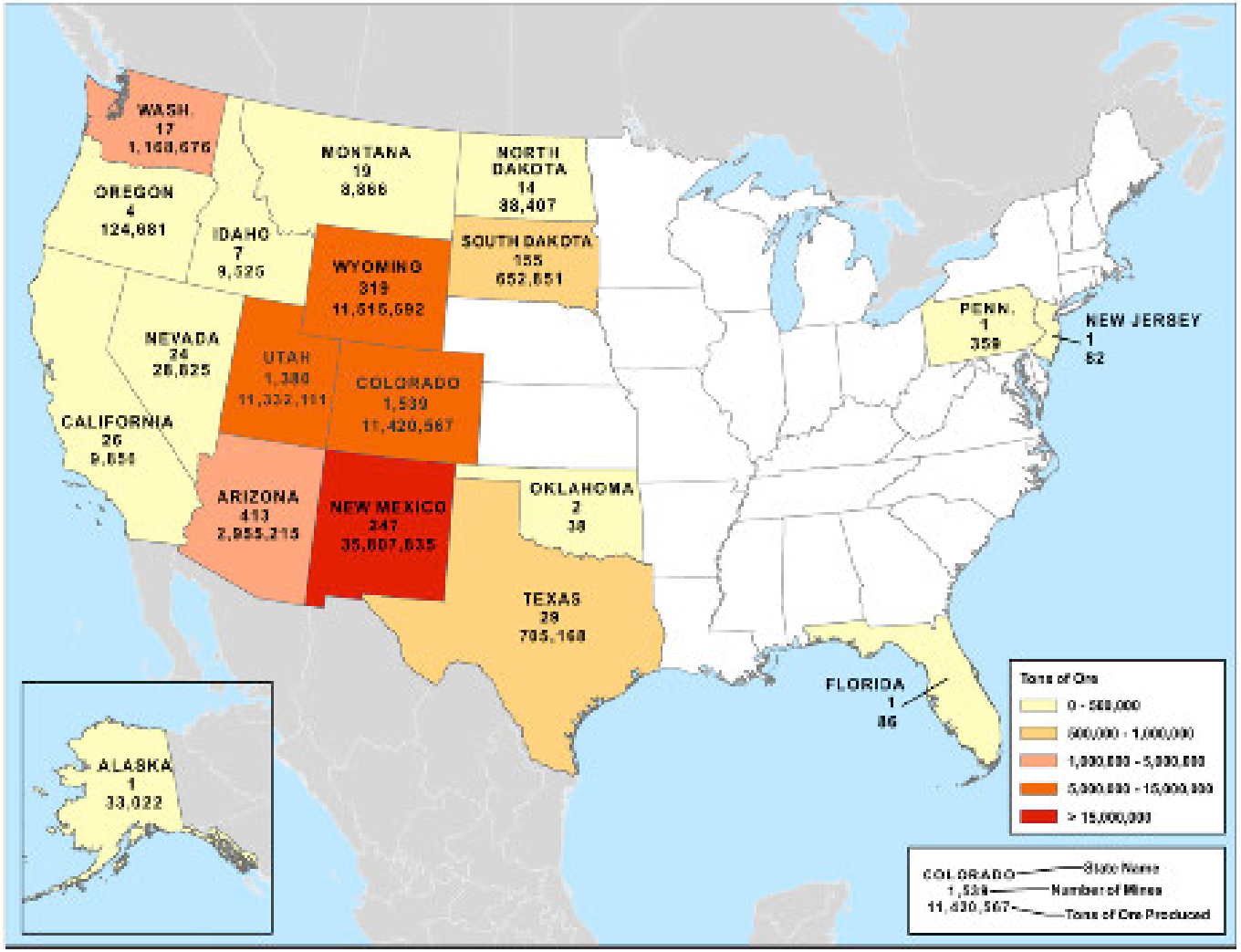


http://blog.preservationnation.org/wp-content/uploads/2012/01/grand-canyon.jpg

Canyon Mine

http://arizonageology.blogspot.com/2012/07development-of-northern-arizona-uranium.html

The legacy of environmental health and natural resources damage from from the first 50 Years of uranium mining in the US is still being addressed.



While Utah and Colorado had the most uranium mines
During the "US weapons-purchase" uranium period from the 1940-1971.
Most of the uranium mined during that period came from larger mines in New Mexico

Figure 2. Illustration of Total Uranium Ore Production by State

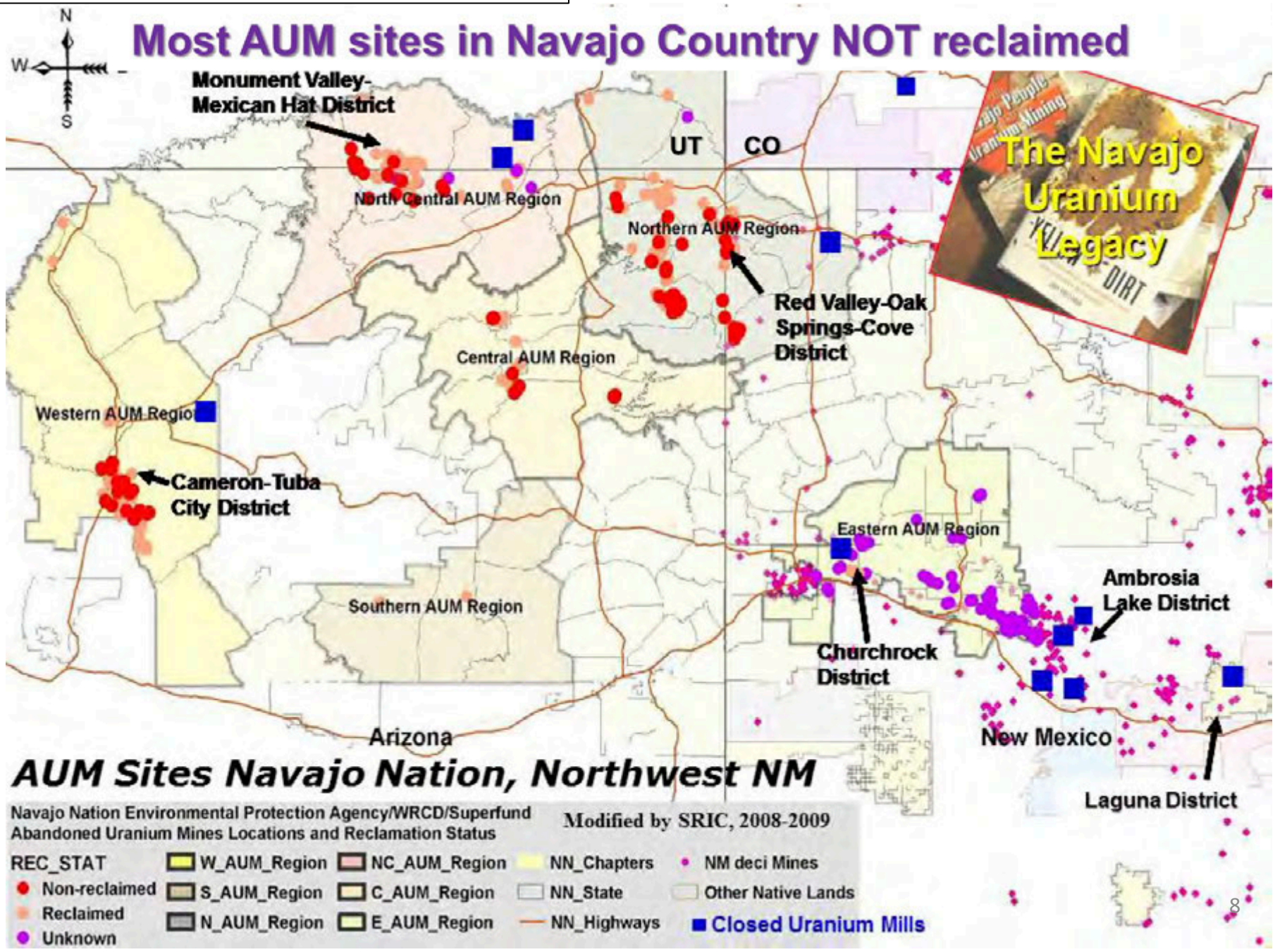
http://energy.gov/sites/prod/files/2014/09/f18/Defense-RelatedUraniumMinesReporttoCongress-FINAL.pdf

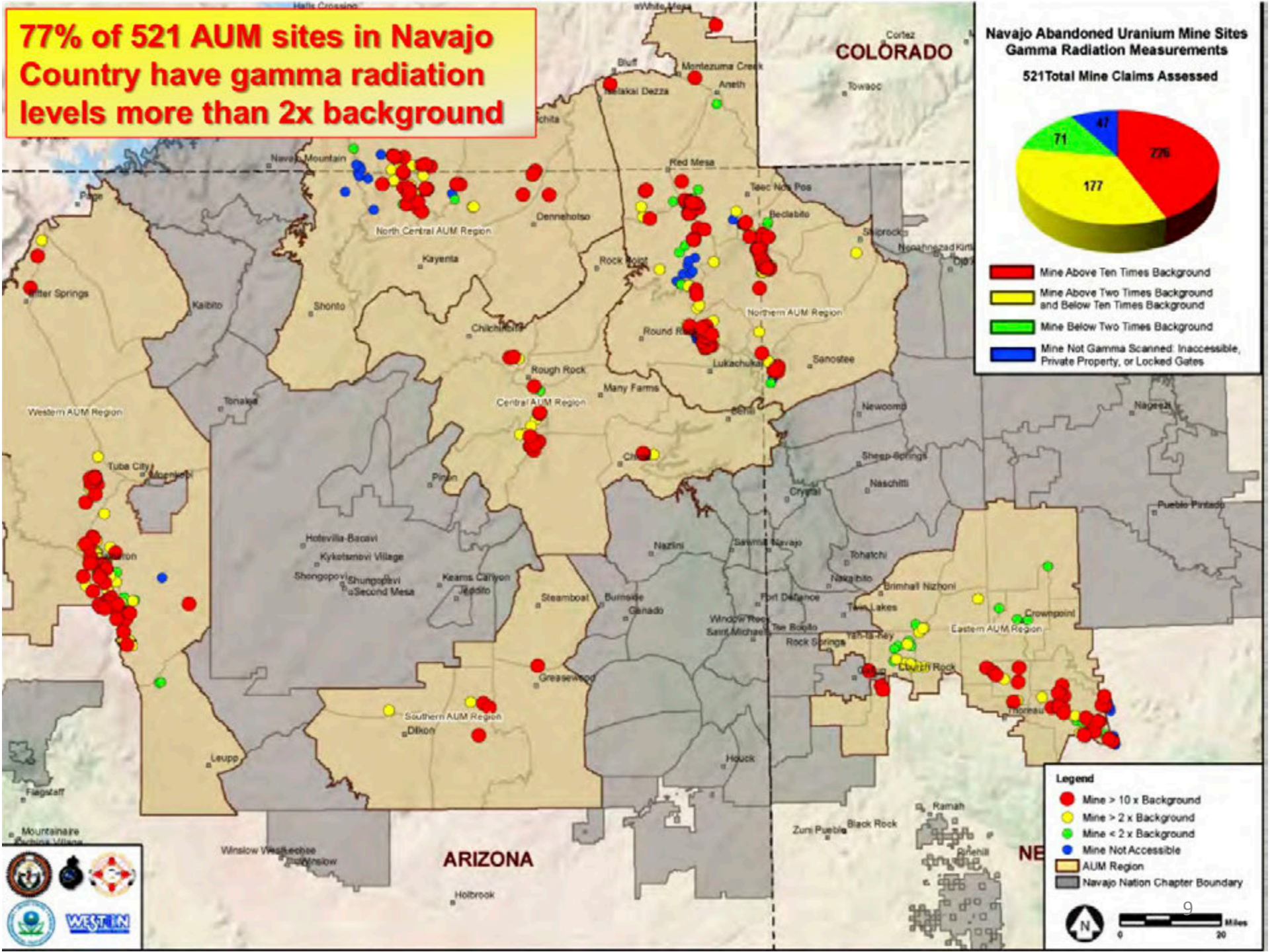
US Department of Energy, "Defense Related Uranium Mines , Report to Congress 2014

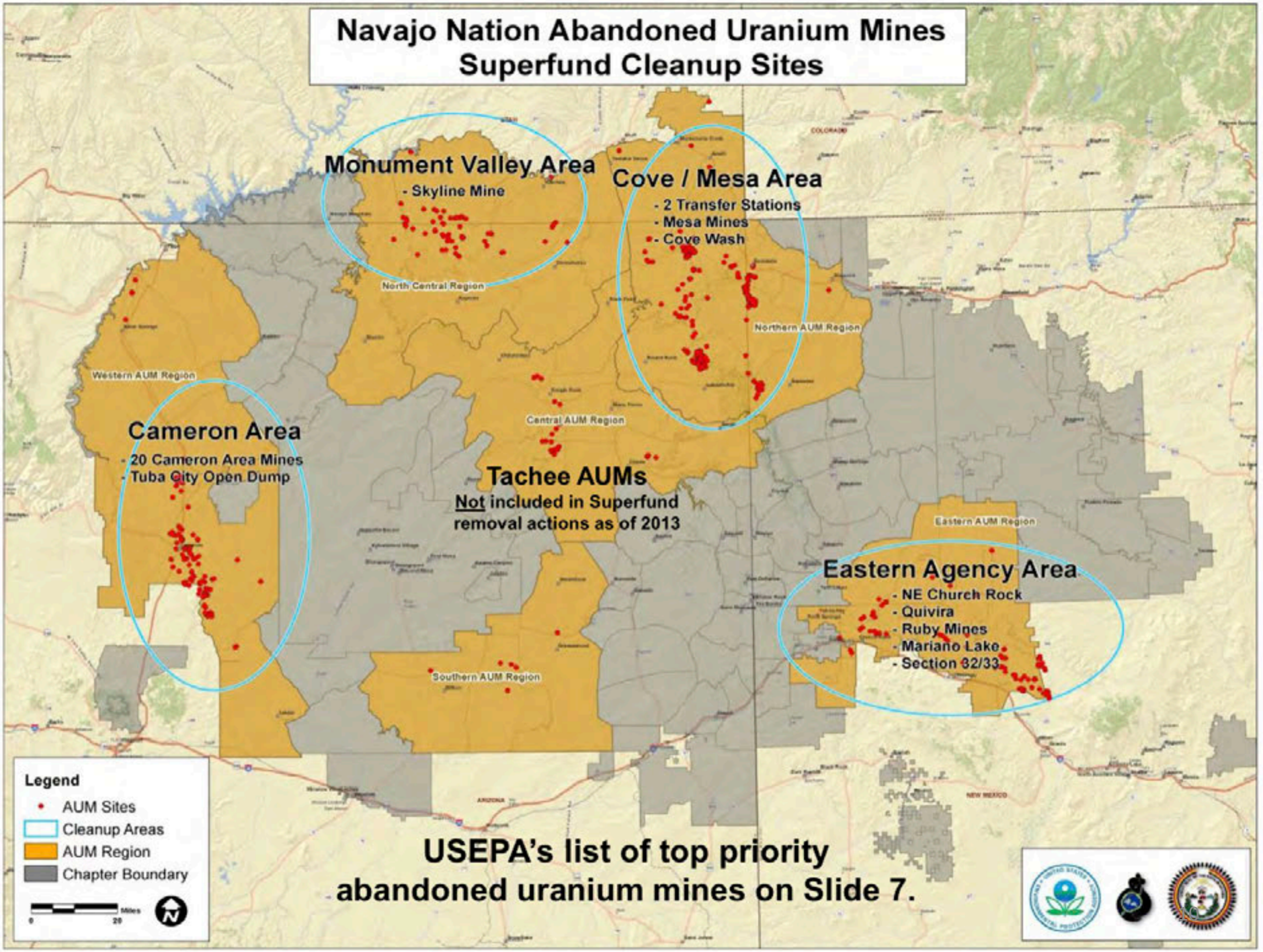
The US uranium legacy includes mines, mills, tailings piles and other government owned or managed sites across the country that are subject to remediation programs and permanent government oversight and monitoring

http://www.stoller.com/projects/legacy-management-support-services.php

The Uranium Legacy in the Navajo Nation




77% of 521 AUM sites in Navajo Country have gamma radiation levels more than 2x background
Navajo Abandoned Uranium Mine Sites
Gamma Radiation Measurements
521Total Mine Claims Assessed
47
71
177
226
Mine Above Ten Times Background
Mine Above Two Times Background and Below Ten Times Background
Mine Below Two Times Background
Mine Not Gamma Scanned: Inaccessible, Private Property, or Locked Gates
COLORADO
ARIZONA
North Central AUM Region
Northern AUM Region
Central AUM Region
Western AUM Region
Eastern AUM Region
Southern AUM Region
Legend
Mine > 10 x Background
Mine > 2 x Background
Mine < 2 x Background
Mine Not Accessible
AUM Region
Navajo Nation Chapter Boundary
Miles
0
20


Navajo Nation Abandoned Uranium Mines
Superfund Cleanup Sites
Monument Valley Area
- Skyline Mine
Cove / Mesa Area
- 2 Transfer Stations
- Mesa Mines
- Cove Wash
North Central Region
Northern AUM Region
Western AUM Region
Central AUM Region
Cameron Area
- 20 Cameron Area Mines
- Tuba City Open Dump
Tachee AUMs
Not included in Superfund
removal actions as of 2013
Eastern AUM Region
Eastern Agency Area
- NE Church Rock
- Quivira
- Ruby Mines
- Mariano Lake
- Section 32/33
Southern AUM Region
Legend
AUM Sites
Cleanup Areas
AUM Region
Chapter Boundary
Miles
0
20
USEPA's list of top priority
abandoned uranium mines on Slide 7.

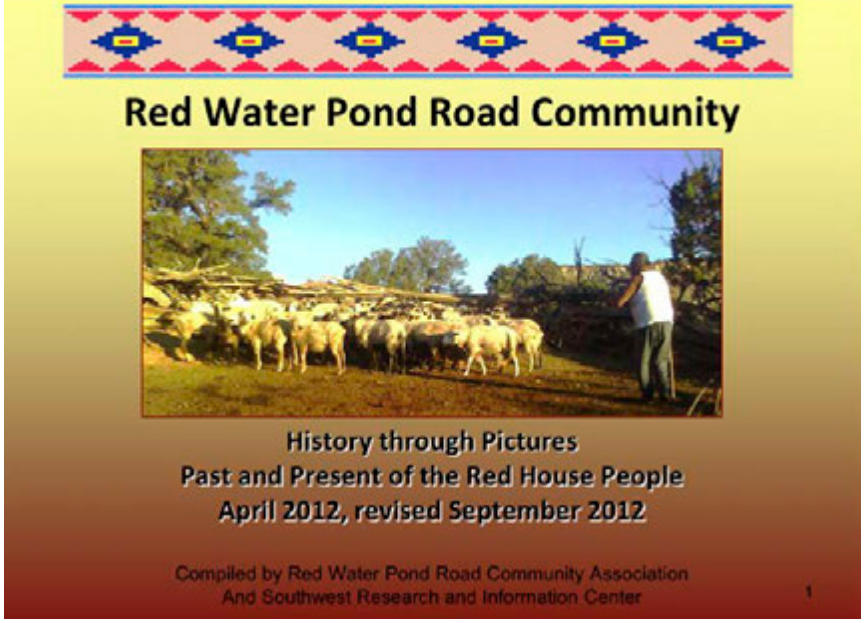
Several Occupied Residences Close to Claim 28 Mine

- 5 residences (20-25 people) within 1 mile of mine dump
- 3rd largest mine in terms of uranium ore production in Tachee Mining District
  - 4.2 million tons ore produced, 1957-1968
- NNAML placed dirt cover on waste dump in 1992 to stabilize materials
- NNEPA, USEPA, NNAML site assessments in 1990, 2009, 2011
- SRIC radiation survey 7/9/13:
  - Gamma radiation on waste dump slope 2 to 5 times greater than local background (i.e., 40-100 microRoengtens per hour)
  - Several "hot spots" (gamma rates at least 2x background) found in surrounding community
  - Area has higher background radiation than other places on Navajo Nation

Community Environmental Health Work

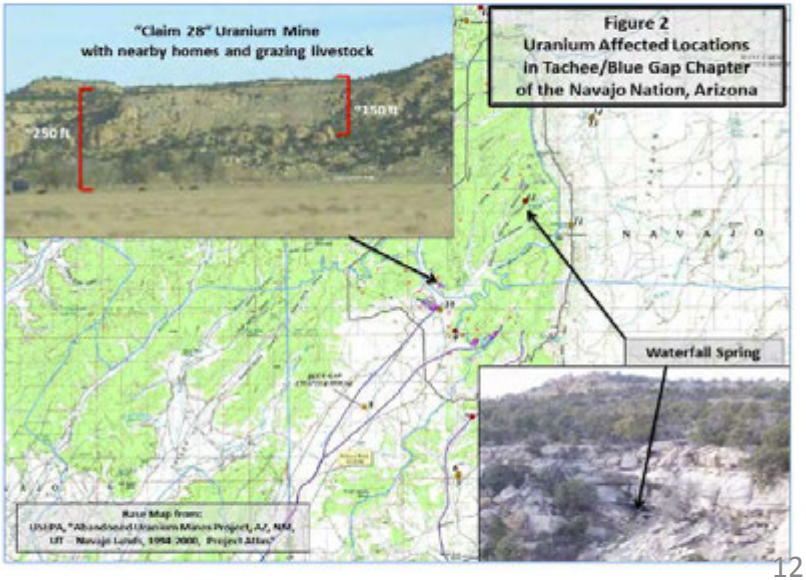
http://www.sric.org/nbcs/docs/NBCS_overview_063014.pdf

http://www.sric.org/russia_dialogue/docs/20140925/DiNEH_presentation_for_Russian_peer-to-peer_092314.pdf



http://www.sric.org/russia_dialogue/docs/2014_Russia_visitRWPR_History_Composite_042412_1.pdf

UNM METALS Monograph 1*Uranium in Soil, Mine Waste and Spring Water near Abandoned Uranium Mines, Tachee/Blue Gap and Black Mesa Chapters, Navajo Nation, Arizona



http://www.sric.org/uranium/docs/METALS_Monograph1_Final_040814a.pdf

DOE EIA data for 2013 vs. data for 2008

US Uranium Reserves - The amount of uranium mineable at a profit – reported by the Department of Energy (DOE) Energy Information Administration (EIA) have dropped by 73% since 2008.

Government estimates of US uranium reserves have fallen dramatically as the cost of uranium mining has increased , the price of uranium has decreased and projected demand has slowed significantly.

US uranium reserves, reported by DOE for the <$100/lb "forward cost" have fallen by 73% from: 1,227 million lbs in 2008 to 337 million lbs in 2013.

Table 10. Uranium reserve estimates at the end of 2012 and 2013

million pounds U_3O_8

Uranium Reserve Estimates[1] by Mine and Property Status, Mining Method, and State(s)	End of 2012 Forward Cost[2] $0 to $30 per pound	End of 2012 Forward Cost[2] $0 to $50 per pound	End of 2012 Forward Cost[2] $0 to $100 per pound	End of 2013 Forward Cost[2] $0 to $30 per pound	End of 2013 Forward Cost[2] $0 to $50 per pound	End of 2013 Forward Cost[2] $0 to $100 per pound
Properties with Exploration Completed, Exploration Continuing, and Only Assessment Work	W	W	102.0	W	W	130.7
Properties Under Development for Production and Development Drilling	W	W	W	W	31.8	W
Mines in Production	W	21.4	W	W	19.6	W
Mines Closed Temporarily, Closed Permanently, and Mined Out	W	W	133.1	W	W	135.2
In-Situ Leach Mining	W	W	128.6	W	W	124.1
Underground and Open Pit Mining	W	W	175.4	W	W	213.5
Arizona, New Mexico and Utah	0	W	164.7	0	W	189.1
Colorado, Nebraska and Texas	W	W	40.8	W	W	40.6
Wyoming	W	W	98.5	W	W	107.9
Total	**51.8**	**W**	**304.0**	**46.6**	**W**	**337.6**

W = Data withheld to avoid disclosure of individual company data.

http://www.eia.gov/uranium/production/annual/pdf/dupr.pdf

In Wyoming, <$50/lb "forward cost" uranium reserves has fallen by 56% from from 220 million lbs in 2008 to 98.5 million lbs in 2013 and <$100/lb uranium reserves has fallen 32% from 446 million lbs to 308 million lbs

In New Mexico (no longer reported separately by DOE), <$50/lb "forward cost" uranium reserves have fallen more from 179 million lbs in 2008 to 165 million lbs in 2013 from, for the southwestern states of New Mexico, Arizona and Utah. New Mexico's <$100/lb uranium reserves fell >52% from 390 million lbs in 2008 to 189.1 million lbs including New Mexico, Arizona, and Utah in 2013.

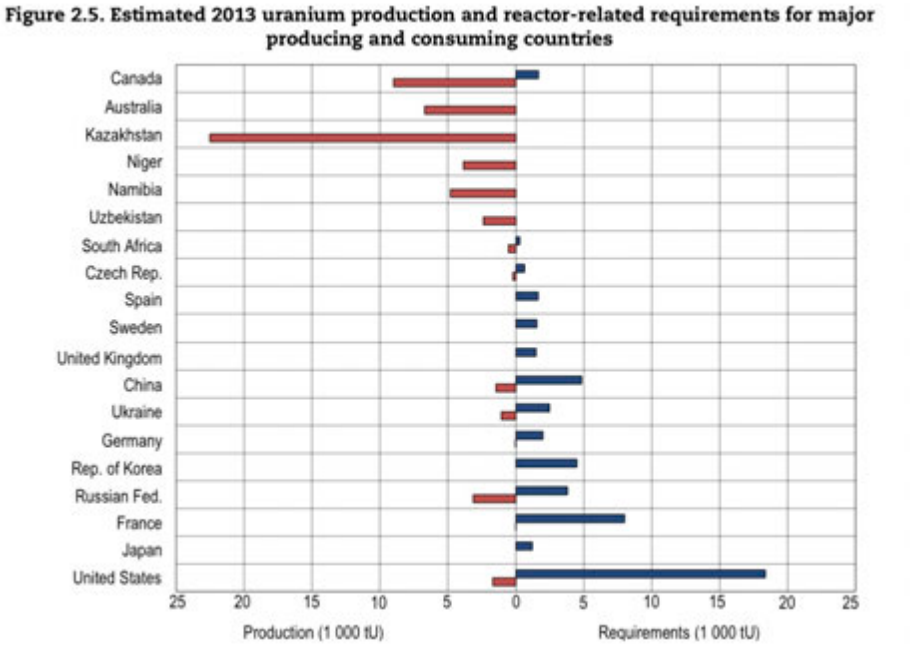
Table 1. U.S. Forward-Cost Uranium Reserves by State, Year-End 2008

State	$50/lb Ore (million tons)	$50/lb Grade[a] (%)	$50/lb U_3O_8 (million lbs)	$100/lb Ore (million tons)	$100/lb Grade[a] (%)	$100/lb U_3O_8 (million lbs)
Wyoming	145	0.076%	220	398	0.056%	446
New Mexico	64	0.140%	179	186	0.105%	390
Arizona, Colorado, Utah	22	0.145%	63	117	0.084%	198
Texas	15	0.089%	27	32	0.062%	40
Other[b]	28	0.090%	50	95	0.081%	154
Total	275	0.098%	539	828	0.074%	1,227

[a] Average percent U_3O_8 per ton of ore.

[b] Includes Alaska, California, Idaho, Montana, Nebraska, Nevada, North Dakota, Oregon, South Dakota, Virginia and Washington.

While DOE EIA "forward cost" reserves are not comparable to "reserves" as defined by Canadian NI 43-101 standards, "forward cost" reserves calculated by DOE reasonably for separate years of data developed with the same method.



Source: Uranium Red Book 2014

US 2013 uranium production of 4.7 million lbs represents only 18.9% of licensed production capacity

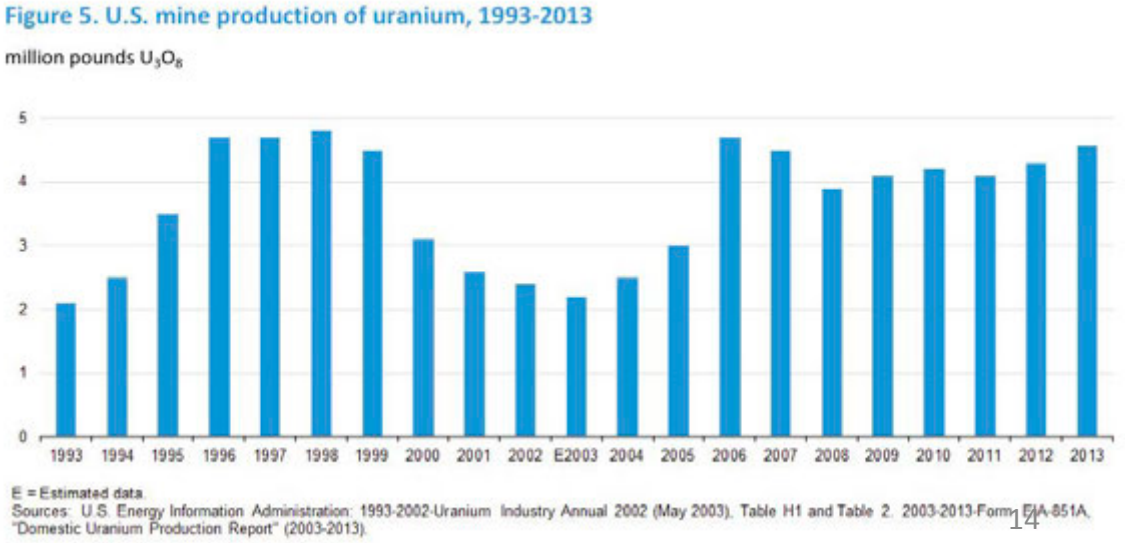
2013 US Production capacity –
16.4 million lbs. -In situ licensed production
8.0 million lbs. – licensed conventional production
24.8 million lbs. - US Operating Capacity

4.7/24.8 – 18.9% Operating Capacity

9.4 million lbs of additional in situ production in "permitting pipeline"

4.7 million lbs = 2,350 tons
24.8 million lbs = 12,400 tons
9.4 million lbs = 4,700 tons

US demand for uranium in 2013 was about 18,000 tons. The US Only produced 2,350 tons from Licensing capacity of 12,400 tons



US has one licensed conventional uranium mill with capable of producing 8,000,000 lbs (4,000 tons) per year at White Mesa in Utah. It owner Energy Fuels, Inc. reports total uranium production of 1,007,000 lbs.
(http://www.energyfuels.com/_resources/AIF-2013.pdf p. 21-22)

US In situ uranium mines hold licenses representing operating capacity of:
16.4 million lbs. DOE reports another
9.4 million lbs as developing, or partly licensed, mines

Table 4. U.S. uranium mills and heap leach facilities by owner, location, capacity, and operating status at end of the year, 2009-13

Owner	Mill and Heap Leach Facility Name	County, State (existing and planned locations)	Capacity (short tons of ore per day)	Operating Status at End of the Year 2009	2010	2011	2012	2013
Cotter Corporation	Canon City Mill	Fremont, Colorado	0	Standby	Standby	Reclamation	Demolished	Demolished
EFR White Mesa LLC	White Mesa Mill	San Juan, Utah	2,000	Operating	Operating	Operating	Operating	Operating; Processing Alternate Feed
Energy Fuels Resources Corporation	Piñon Ridge Mill	Montrose, Colorado	500	Developing	Developing	Permitted And Licensed	Partially Permitted And Licensed	Permitted And Licensed
Energy Fuels Wyoming Inc.	Sheep Mountain	Fremont, Wyoming	725	-	-	-	-	Undeveloped
Kennecott Uranium Company/Wyoming Coal Resource Company	Sweetwater Uranium Project	Sweetwater, Wyoming	3,000	Standby	Standby	Standby	Standby	Standby
Rosa Mendo Resources LLC	Pena Ranch	McKinley, New Mexico	2,000	-	-	-	-	Undeveloped
Strathmore Resources (US) Ltd	Gas Hills	Fremont, Wyoming	2,000	-	-	-	-	Undeveloped
Uranium One Americas, Inc.	Shootaring Canyon Uranium Mill	Garfield, Utah	750	Standby	Standby	Standby	Standby	Standby
Total Capacity:			11,175					

- = No data reported.

[1] Heap leach solutions: The separation, or dissolving out from mined rock, of the soluble uranium constituents by the natural action of percolating a prepared chemical solution through mounded (heaped) rock material. The mounded material usually contains low grade mineralized material and/or waste rock produced from open pit or underground mines. The solutions are collected after percolation is completed and processed to recover the valued components.

Notes: Capacity for 2013. An operating status of "Operating" indicates the mill was producing uranium concentrate at the end of the period.

Source: U.S. Energy Information Administration: Form EIA-851A, "Domestic Uranium Production Report" (2009-2013).

Table 5. U.S. uranium in-situ-leach plants by owner, location, capacity, and operating status at end of the year, 2009-13

In-Situ-Leach Plant Owner	In-Situ-Leach Plant Name	County, State (existing and planned locations)	Production Capacity (pounds U_3O_8 per year)	Operating Status at End of the Year 2009	2010	2011	2012	2013
AUC LLC	Reno Creek	Campbell, Wyoming	2,000,000	-	-	-	-	Developing
Cameco	Crow Butte Operation	Dawes, Nebraska	1,000,000	Operating	Operating	Operating	Operating	Operating
Hydro Resources, Inc.	Church Rock	McKinley, New Mexico	1,000,000	Partially Permitted And Licensed	Partially Permitted And Licensed	Partially Permitted And Licensed	Partially Permitted And Licensed	Partially Permitted And Licensed
Hydro Resources, Inc.	Crownpoint	McKinley, New Mexico	1,000,000	Partially Permitted And Licensed	Partially Permitted And Licensed	Partially Permitted And Licensed	Partially Permitted And Licensed	Partially Permitted And Licensed
Lost Creek ISR, LLC	Lost Creek Project	Sweetwater, Wyoming	2,000,000	Developing	Developing	Partially Permitted And Licensed	Under Construction	Operating
Mestena Uranium LLC	Alta Mesa Project	Brooks, Texas	1,500,000	Producing	Producing	Producing	Producing	Producing
Power Resources, Inc. dba Cameco Resources	Smith Ranch-Highland Operation	Converse, Wyoming	5,500,000	Operating	Operating	Operating	Operating	Operating
Powertech Uranium Corp	Dewey Burdock Project	Fall River and Custer, South Dakota	1,000,000	Undeveloped	Undeveloped	Undeveloped	Developing	Developing
South Texas Mining Venture	Hobson ISR Plant	Karnes, Texas	1,000,000	Permitted And Licensed	Operational	Operating	Operating	Operating
South Texas Mining Venture	La Palangana	Duval, Texas	1,000,000	Permitted And Licensed	Operating	Operating	Operating	Operating
Strata Energy Inc.	Ross	Crook, Wyoming	3,000,000	-	-	Developing	Partially Permitted And Licensed	Partially Permitted And Licensed
URI, Inc.	Kingsville Dome	Kleberg, Texas	1,000,000	Standby	Standby	Standby	Standby	Restoration
URI, Inc.	Rosita	Duval, Texas	1,000,000	Standby	Standby	Standby	Standby	Restoration
URI, Inc.	Vasquez	Duval, Texas	800,000	Restoration	Restoration	Restoration	Restoration	Restoration
Uranerz Energy Corporation	Nichols Ranch ISR Project	Johnson and Campbell, Wyoming	2,000,000	Developing	Partially Permitted And Licensed	Under Construction	Under Construction	Under Construction
Uranium Energy Corp.	Goliad ISR Uranium Project	Goliad, Texas	1,000,000	Partially Permitted And Licensed	Partially Permitted And Licensed	Partially Permitted And Licensed	Permitted And Licensed	Permitted And Licensed
Uranium One Americas, Inc.	Jab and Antelope	Sweetwater, Wyoming	2,000,000	Developing	Developing	Developing	Developing	Developing
Uranium One Americas, Inc.	Moore Ranch	Campbell, Wyoming	500,000	Partially Permitted And Licensed	Permitted And Licensed	Permitted And Licensed	Permitted And Licensed	Permitted And Licensed
Uranium One USA, Inc.	Willow Creek Project (Christensen Ranch and Irigaray)	Campbell and Johnson, Wyoming	1,300,000	Standby	Operational	Producing	Producing	Producing
Total Production Capacity:			29,600,000					

- = No data reported.

Notes: Production capacity for 2013. An operating status of "Operating" indicates the in-situ-leach plant usually was producing uranium concentrate at the end of the period. Hobson ISR Plant processed uranium concentrate that came from La Palangana. Hobson and La Palangana are part of the same project. ISR stands for in-situ recovery. Christensen Ranch and Irigaray are part of the Willow Creek Project.

Source: U.S. Energy Information Administration: Form EIA-851A, "Domestic Uranium Production Report" (2009-13).

The USA has enough uranium resources to power its reactors but domestic uranium is much more expensive to mine and process that other uranium available on the world market.

http://www.eia.gov/uranium/production/annual/pdf/dupr.pdf

Thank you for your time and attention