

IN-SITU URANIUM MINING IN THE WEST

- ✘ Addressing
- ✘ Regulation and
- ✘ Environmental and
- ✘ Public Health Concerns



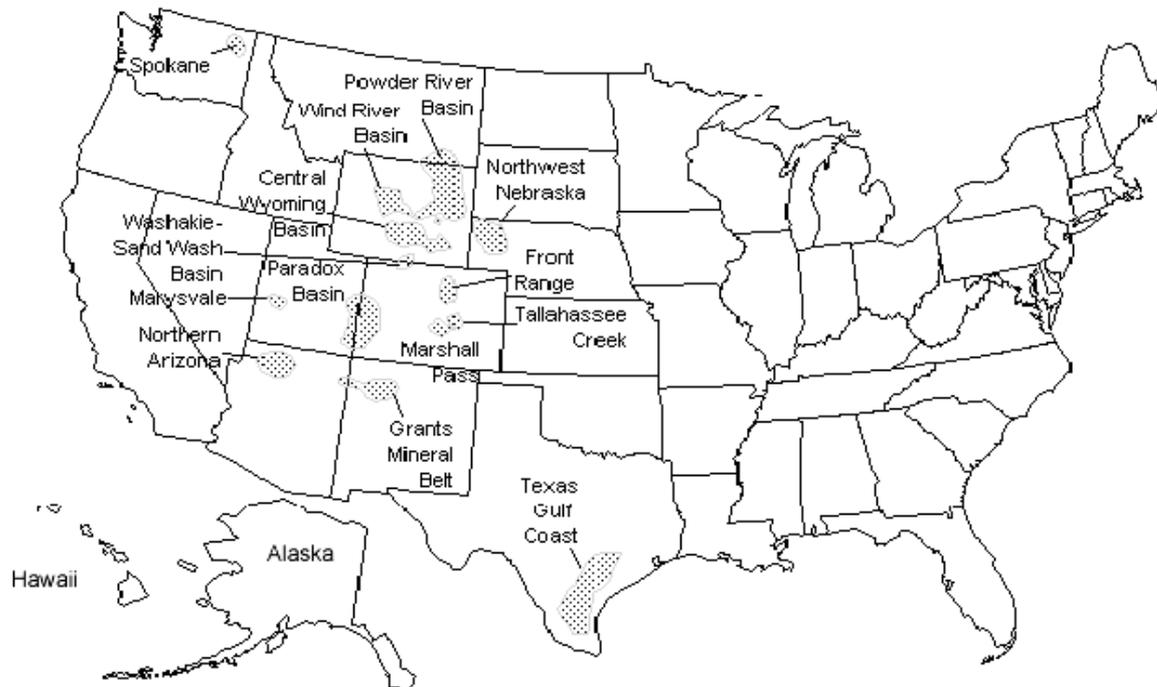
- ✘ Presented by Lisa Cox,
- ✘ University of Wyoming
- ✘ Department of Renewable Resources
- ✘ At the Mine Design, Operations & Closure Conference
- ✘ Fairmont Hot Springs Resort, MT
- ✘ May 2-6, 2010

✘

URANIUM MINING TODAY

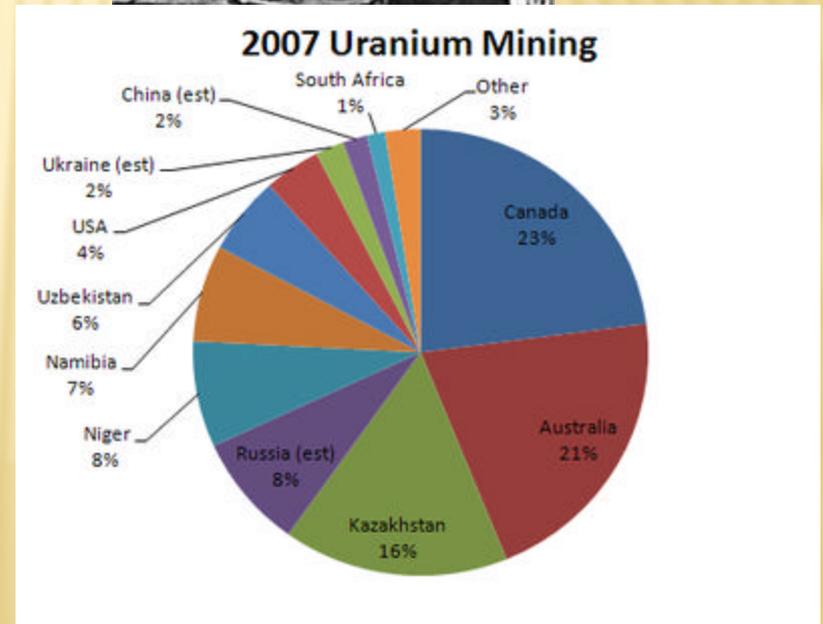
- ✘ Brief history
- ✘ ISR
- ✘ Regulation
 - + Federal
 - + State
- ✘ Environmental and public health concerns
 - + Radiation
 - + Ground water
- ✘ Summary and conclusion

Major U.S. Uranium Reserves

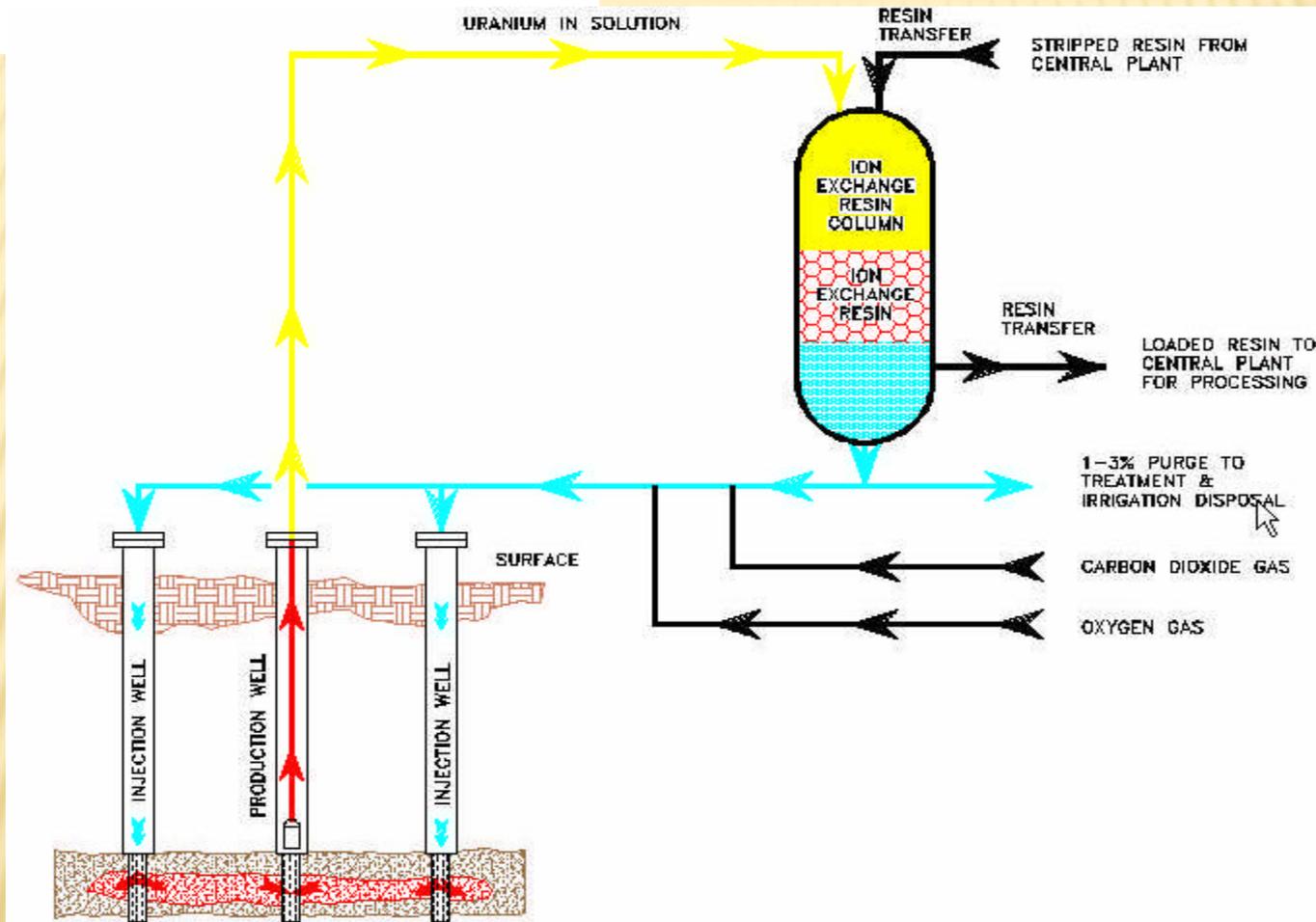


Sources: Based on U.S. Department of Energy, Grand Junction Project Office (GJPO), National Uranium Resources Evaluation, Interim Report (June 1979) Figure 3.2; and GJPO data files.

A BRIEF HISTORY OF MINING IN THE US



IN-SITU LEACHING



Acknowledgment: Bill Boberg, Ur-Energy Inc., Littleton, Colorado

REGULATION OF URANIUM EXPLORATION, MINING AND RECLAMATION

✘ Atomic Energy Act of 1954

- + Civilian aspect: "the development, use, and control of atomic energy shall be directed so as to promote world peace, improve the general welfare, increase the standard of living, and strengthen free competition in private enterprise."

✘ Energy Reorganization Act of 1974

+ Department of Energy (DOE)

- ✘ development and production of nuclear weapons, promotion of nuclear power, and other energy-related work

+ Nuclear Regulatory Commission (NRC)

- ✘ regulatory work, not including regulation of defense nuclear facilities

EPA: EXTRACTION AND RECLAMATION EPA: EXTRACTION AND RECLAMATION

Technologically Enhanced Naturally Occurring Radioactive Material (**TENORM**) is defined as: Naturally occurring radioactive materials that have been concentrated or exposed to the accessible environment as a result of human activities such as manufacturing, mineral extraction, or water processing.

The Science Advisory Board (SAB) agreed with EPA's intent to make TENORM documents useful to a broad audience, but also recommended that the whole life cycle of a TENORM source, in this case uranium extraction, be considered beyond regulatory or inter-agency considerations, and that the impacts of non-radiological contaminants also be examined.

EPA STATUTES AND REGULATIONS RE: URANIUM MINING FACILITIES

- **Safe Drinking Water Act** –EPA regulations for Underground Injection Control (UIC) wells: 40 CFR Parts 144 -146.
- **Uranium Mill Tailings Radiation Control Act (UMTRCA)** --EPA established environmental protection standards (Part 192) for exposures to hazardous materials and radiation (including groundwater protection) that are applicable to inactive and active uranium mills and extraction facilities (ISL operations) –to the maximum extent possible they incorporate RCRA standards (Part 264). The Nuclear Regulatory Commission (NRC) and its Agreement States must utilize EPA’s standards developed under UMTRCA for facilities which they license, and DOE for closed mills which they will oversee in perpetuity. EPA must concur with any regulations developed by NRC or DOE for uranium extraction facilities.
- **Clean Water Act** --regulations in 40 CFR 440, Part C, are applicable to discharges from (a) mines either open-pit or underground, from which uranium, radium and vanadium ores are produced; and (b) mills and ISL operations using leaching processes for the extraction of uranium, radium and vanadium.
- **Clean Air Act** -regulates radon emissions for underground uranium mines in Part 61, Subpart B, and for uranium milling and impoundments in Part 61, Subpart W. Most recently, the Agency has determined that ISL evaporation ponds are also subject to Subpart W; accordingly, operators must apply to EPA for construction permits, limit the number and sizes of the ponds, and comply with Agency annual radon monitoring requirements.
- **EIS’s and EA’s** --EPA routinely reviews EIS’s and EA’s for uranium mine and mill facility approvals and operations on Federal lands, and for State lands as appropriate.
- **CERCLA**- EPA may take action for uranium mine and mill operations which create imminent endangerment under CERCLA. (*Comprehensive Environmental Response, Compensation, and Liability Act*), aka Superfund

AQUIFER PROTECTION

§146.10 Plugging and abandoning Class I, II, III, IV, and V wells.

Requirements for Class I, II and III wells. (1) Prior to abandoning Class I, II and III wells, the well shall be plugged with cement in a manner which will not allow the movement of fluids either into or between underground sources of drinking water.

The plugging and abandonment plan required in 40 CFR 144.51(o) and 144.52(a)(6) shall, in the case of a Class III project which underlies or is in an aquifer which has been exempted under §146.04, also demonstrate adequate protection of USDWs.

The Director shall prescribe aquifer cleanup and monitoring where he deems it necessary and feasible to insure adequate protection of USDWs.

AND THAT'S NOT ALL...

§144.4 Considerations under Federal law. Federal laws may apply to the issuance of permits. When any of these laws is applicable, its procedures must be followed:

- *The Wild and Scenic Rivers Act*
- *The National Historic Preservation Act of 1966*
- *The Endangered Species Act*
- *The Coastal Zone Management Act*
- *The Fish and Wildlife Coordination Act*
- *Executive orders.*

AQUIFER EXEMPTIONS

§ 146.4 Criteria for exempted aquifers. An aquifer or a portion thereof which meets the criteria for an ?underground source of drinking water? in § 146.3 may be determined under 40 CFR 144.8 to be an ?exempted aquifer? if it meets the following criteria:

–(a) It does not currently serve as a source of drinking water; and

–(b) It cannot now and will not in the future serve as a source of drinking water because:

- **(1) It is mineral, hydrocarbon or geothermal energy producing, or can be demonstrated by a permit applicant as part of a permit application for a Class II or III operation to contain minerals or hydrocarbons that considering their quantity and location are expected to be commercially producible.**

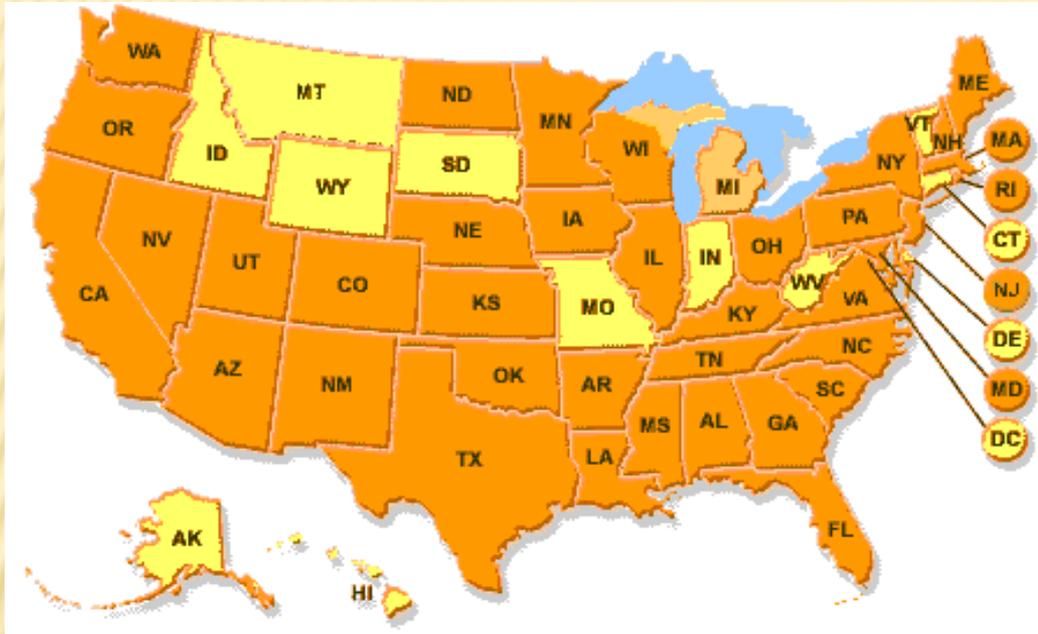
- (2) It is situated at a depth or location which makes recovery of water for drinking water purposes economically or technologically impractical;

- (3) It is so contaminated that it would be economically or technologically impractical to render that water fit for human consumption; or

- (4) It is located over a Class III well mining area subject to subsidence or catastrophic collapse; or

–(c) The total dissolved solids content of the ground water is more than 3,000 and less than 10,000 mg/l and it is not reasonably expected to supply a public water system.

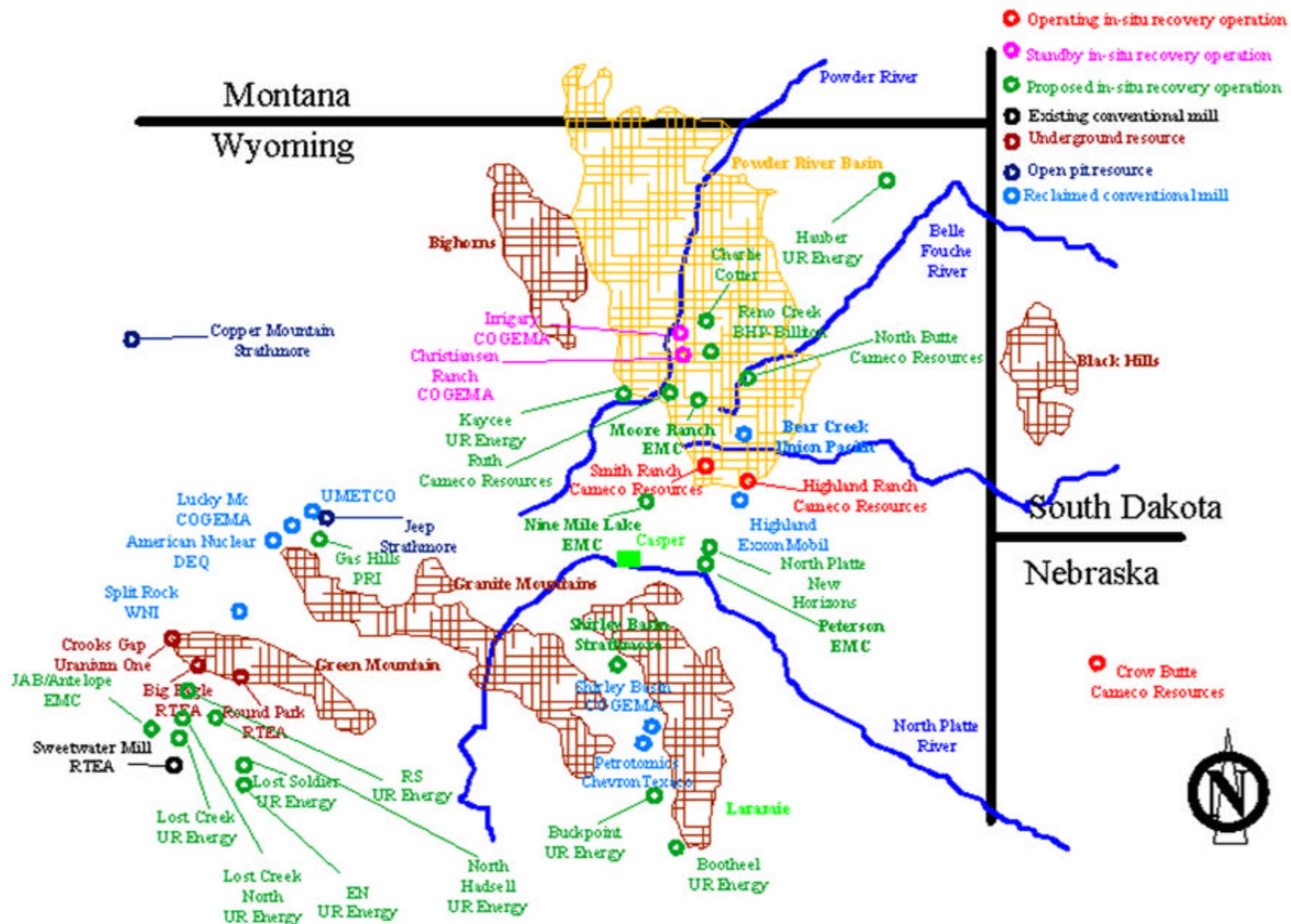
NRC:FSME - State Regulations and Legislation



orange: agreement state
yellow: non-agreement state
Michigan: pending letter of intent

Agreement States, have entered into agreements with NRC that give them the authority to license and inspect byproduct, source, or special nuclear materials used or possessed within their borders.

URANIUM PROJECTS IN WYOMING



REGULATION IN WYOMING

× DEQ, LQD and WQD

+ Active and inactive sites

- × Active: exploration, IS mining and processing, reclamation
- × Chapter 8 Noncoal Exploration by Drilling (includes bond)
- × Title I and Title II
- × Restoration: Return water to baseline quality.
- × Inactive: Open pit and underground mines, mills, storage, processing

+ In conjunction with NRC, DOE, and EPA

+ Construction and Operation Permits

- × "Permit Mine"- DEQ LQD
- × "Material License"- NRC
- × LQD and WQD review to meet EPA UIC Program reqs.

PUBLIC CONCERNS

Telluride group files legal challenge to Energy Fuels mill water

By Dick Kamp

Wick Communications Environmental Liaison

Published/Last Modified on Sunday, February 7, 2010 4:11 AM MST

TELLURIDE - A Telluride conservation nonprofit filed a legal challenge on January 26 in Montrose District Court to the proposed Energy Fuels (EF) Pinon Ridge yellowcake uranium mill, based on their belief that EF cannot prove they have the capacity to exploit and utilize water beneficially, and that they cannot avoid polluted water discharges from the mill.



Uranium: It's worse than you think

Op-Ed - [From the May 26, 2008 issue of High Country News](#)

by Jonathan Thompson

Take Monticello, Utah, where a uranium mill operated on the edge of town for many years and then sat idle for many more before it was finally cleaned up. Since the mid-1960s, when four young residents died of leukemia, various studies have shown that Monticello and surrounding San Juan County have higher cancer rates than the rest of the state.

CHEMICAL ANALYSES OF H₂O SAMPLES

SHIRLEY BASIN, WY, WELLS, SPRINGS AND DRILL HOLES

- × Silicon Dioxide- SiO₂
- × Aluminum- Al
- × Iron- Fe
- × Calcium- Ca
- × Magnesium- Mg
- × Sodium- Na
- × Potassium- K
- × Bicarbonate- HCO₃
- × Carbon Trioxide- CO₃
- × Sulfate- SO₄
- × Chlorine- Cl
- × Fluorine- F
- × Nitrate- NO₃
- × Phosphate- PO₄
- × Selenium- Se
- × Boron- B
- × Manganese- Mn (trace amts. in 1 sample)
- × Lithium- Li (trace amts. In 2 samples)
- × Arsenic- As (trace amts. In 1 sample)



(from Harshman, 1980, p. 98)

Chemical Data for In-situ Uranium Recovery Wastewater

Component	Sample 1	Sample 2
pH	7.4	8.3
Ca (mg/L)	344	138
Mg(mg/L)	60	53
Na(mg/L)	489	495
K(mg/L)	17.6	14.4
Se(mg/L)	2.79	2.95
As(mg/L)	0.02	0.008
SO ₄ (mg/L)	933	942



Maximum Contaminant Limits (MCLs) for Selenium and Arsenic

Water Use	Selenium (ug/L)	Arsenic (ug/L)
Human Drinking Water	10	10
Livestock Watering	50	200
Aquatic Life	50	50
Irrigation Water	20	100

Are we at war?



CURRENT ISSUES

- ✘ Regulation
- ✘ Operation
- ✘ Restoration

- ✘ Water, water, water

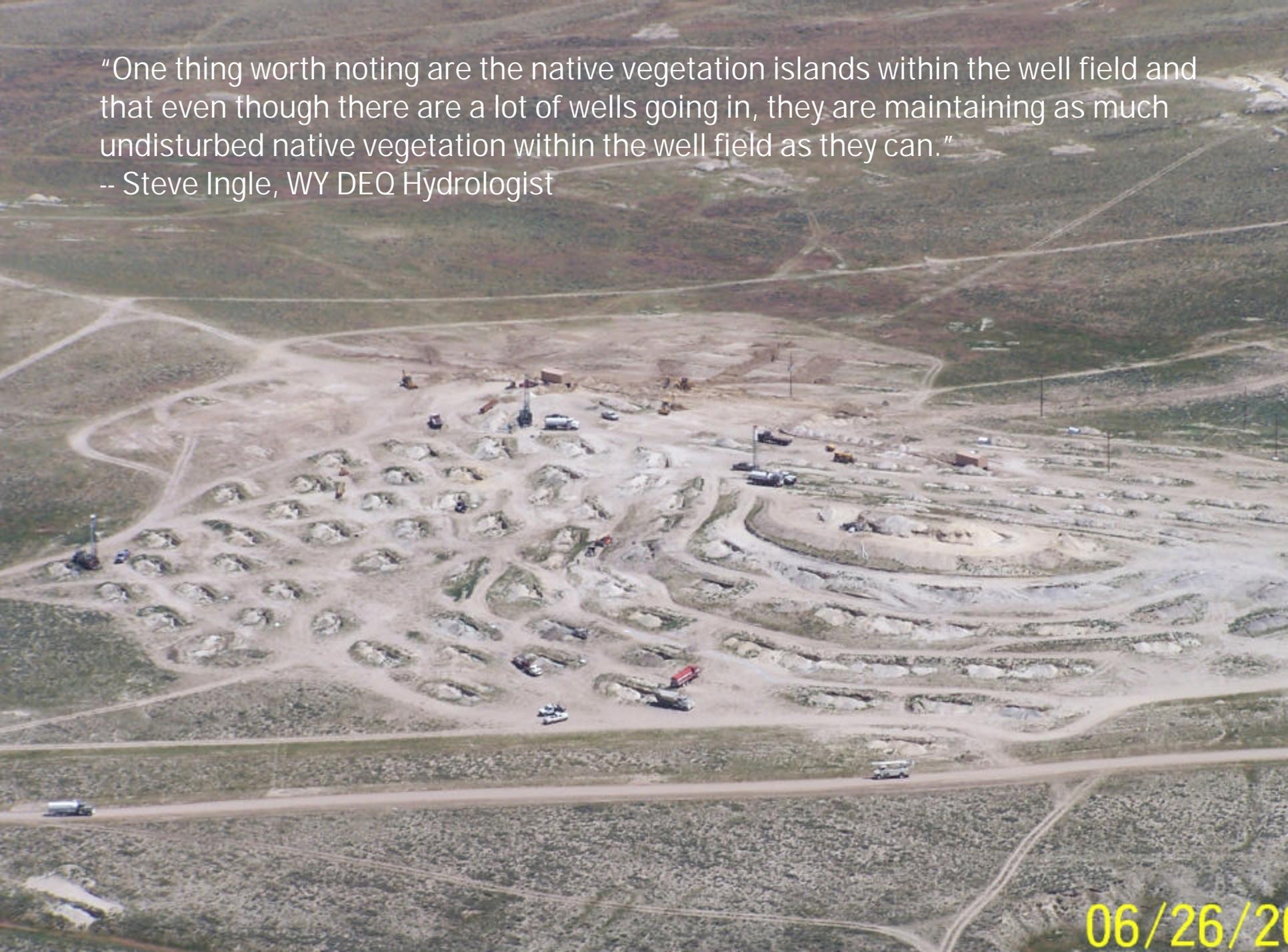
ONE BAD APPLE

ONE BAD APPLE



"One thing worth noting are the native vegetation islands within the well field and that even though there are a lot of wells going in, they are maintaining as much undisturbed native vegetation within the well field as they can."

-- Steve Ingle, WY DEQ Hydrologist



06/26/20

THE FUTURE OF URANIUM IN THE WEST?

✘ Some websites of interest:

- + UWyo School of Energy Resources Uranium Workshop Presentations: <http://www.uwyo.edu/ser/info.asp?p=15511>
- + Nuclear Regulatory Commission main page: <http://www.nrc.gov>
- + EPA Radiation Protection: Laws, Regulations and Guidance: <http://www.epa.gov/rpdweb00/mixed-waste/regs.html#nrcagree>
- + World Nuclear Association: <http://www.world-nuclear.org>
- + Uranium Producers of America: www.uraniumproducersamerica.com