

# UW School of Energy Resources

**In-Situ Recovery:**

## **Potential Production and Long Term Impacts on Wyoming**

**Presenter: Glenn Catchpole**

(10:40 a.m. Session)

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# Presentation Outline

- **Wyoming Uranium Reserves**
- **History of Uranium Mining in Wyoming**
- **Current Status of Industry in Wyoming**
- **Projections of Future Uranium Production in Wyoming**
- **Benefits of Uranium Mining to Wyoming**
- **Summary**

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# US Forward-Cost Reserves by State

Source: U.S. Energy Information Administration

STATE	\$50	\$100
	U3O8 (lbs)	U3O8 (lbs)
<b>Wyoming</b>	<b>220,000,000</b>	<b>446,000,000</b>
<b>New Mexico</b>	179,000,000	390,000,000
Arizona, CO, Utah	63,000,000	198,000,000
Texas	27,000,000	40,000,000
Other	50,000,000	154,000,000
<b>Total</b>	<b>539,000,000</b>	<b>1,227,000,000</b>

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- Wyoming Uranium Reserves
- **History of Uranium Mining in Wyoming**
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# Wyoming Uranium History

- First major discovery in state made in 1951 by Dr. John Love Near Pumpkin Buttes (central PRB).
- First commercial production began around 1953.
- Continuous U Production in Wyo Since 1957
- First commercial ISR production started 1968
- Wyoming has been leading uranium producer in U.S. since 1995 (all by ISR extraction method)
- Historically Produced About 221 Million Pounds (2<sup>nd</sup> only to New Mexico)



# Wyo Historic Uranium Production

- From 1968 to 1980 Annual Production Ramped Up from about 4 million pounds per year to a **maximum of 12 million pounds per year (in 1980)**
- In 1979 Spot Price Peaked at \$43.80 a Pound
- From 1980 to 1986 Annual Production Fell From the 12 million pounds a Year to less than 1 million pounds a year
- After 1986 Annual Production has been Bouncing Around at 1.5 to 2 million Pounds Per Year (1 to 2 ISR Mines)
- In 2009 Wyoming Uranium Production was 1.8 Million Pounds (1 mine); All by ISR Mining Method
- **Total Wyoming Production ~ 221 million pounds**

# History of ISR Uranium Extraction

- Late 1960's – Birth of ISR (in Wyoming – Shirley Basin)
  - Good grade, good permeability, relatively shallow
- 1970's – Decade of ISR development (Texas & Wyoming)
- ISR Today
  - 36% of world uranium comes from ISR
  - 83% of US production from ISR; 100% of Wyo Production
  - Commercial 2009 ISR production from US (approximate)

• Nebraska	600,000 lbs
• Texas	1,000,000 lbs
• <b>Wyoming</b>	<b><u>1,800,000 lbs</u></b>
• Total	3,400,000 lbs

# Why Only ISR Production Since 1986

So current spot price, \$46.00/lb., not too bad compared to 1979 price of ~\$44/lb., right?

wrong!!!

# Real Uranium Spot Price (inflation adjusted)

- Peak Uranium Price in 1979 - \$43.80/lb.
- In Equivalent Dollars Today (CPI) - \$131.63/lb.
- **Current Spot Price - \$46.00/lb.**
- **In Equivalent 1979 Dollars (CPI) - \$15.33/lb.**

Consumer Price Index Inflation Factor – 3.005; Is it Relevant,  
Yes

# Real Uranium Spot Price (inflation adjusted)

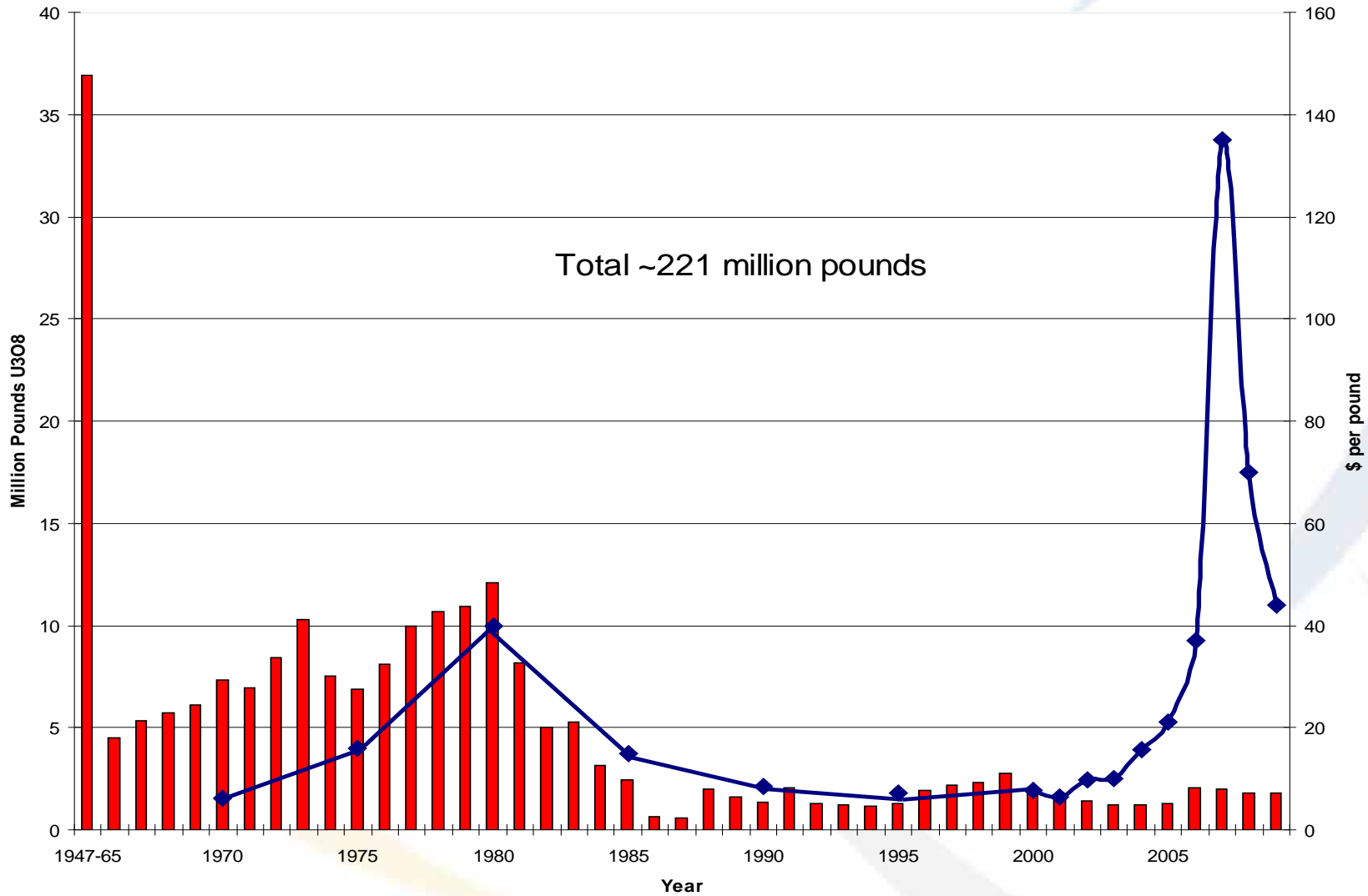
- In Equivalent 1979 Dollars (CPI) - Today's Spot Price is **\$15.33/lb.** [However not all U sold in the spot market]
- By the early 1990s the Spot Price had gone below \$15.33/lb. and All Open Pit & Underground Uranium Mines/Mills in Wyoming Had Shut Down and All But One Had Gone Into Decommissioning (Sweetwater Mill Placed on Standby)
- Four or Five ISR Uranium Mines in USA Remained in Operation; Two of them in Wyoming (lower Capex & Opex)

# Historic Uranium Spot Price

(all values approximate)

- 1970 – \$8/lb.
- 1980 - \$43/lb. (local high)
- 1985 - \$15/lb.
- 1990 to 2001 - \$7/lb. to \$8/lb.
- 2002 to 2003 - \$10/lb.
- 2004 - \$15/lb.
- 2005 - \$21/lb.
- 2006 - \$38/lb.
- 2007 - \$138/lb. (all time high)
- 2008 - \$70/lb. 2009 - \$46/lb (current)

# Wyoming Uranium Production & Spot Price





# Spot U Price vs. Wyo U Production

Historic Wyoming Uranium Production Correlates Closely  
with Selling Price of Uranium

Peak Annual Production in 1980 - 12 million Pounds

Peak Spot Price of Uranium 1979 (last boom) - \$43.78/lb.

Today's Dollars (2010) - \$14.56/lb.

Future Spot Price ??? (RBC projects \$80/lb.)

BMO – current world average production cost \$31/lb.

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# Indicator of Interest in Wyoming Uranium Deposits

## Active Federal Mining Claims (Wyoming)\*

2001 – ~ 5,425

Today - ~ 39,518 ~790,000 Acres

\* As of July 2010

# Status of ISR Operations in Wyo

- Two Existing ISR Mines (Powder River Basin)
  - One in Production – Cameco’s Smith Ranch – Highland Facility
  - One on Standby – Uranium One’s Christensen Ranch Facility  
(planned restart in 2011)
- Two/Three ISR Mines ~ Licensed but Not Yet Built  
(two located in the Powder River Basin and the other in the Gas Hills)
- Five Planned ISR Mines in Permitting Stage (3 advanced)
- Three ISR Mines in Pre-Permitting Stage
- Two Conventional Mines in Pre-Permitting Stage

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# Primary Factors that Determine Production Levels

1. Quality of Deposits
  - For In-Situ Recovery Method to be economic need.....
    - Adequate Ore Grade & Thickness
    - Ore in Aquifer and with Good Permeability
    - Not too Deep
2. Regulatory Setting (N.M. Example)
3. Selling Price of Yellowcake

# Projections of Future Uranium Production in Wyoming

- **Therefore, to predict future uranium production in Wyoming and the number of mines that will be in operation, one must predict the future selling price yellowcake.**
- **As those individuals in this room who work for uranium companies know, there are many institutions who project future uranium prices but we also know that they are consistently wrong.**
- **The following is one such projection .....**



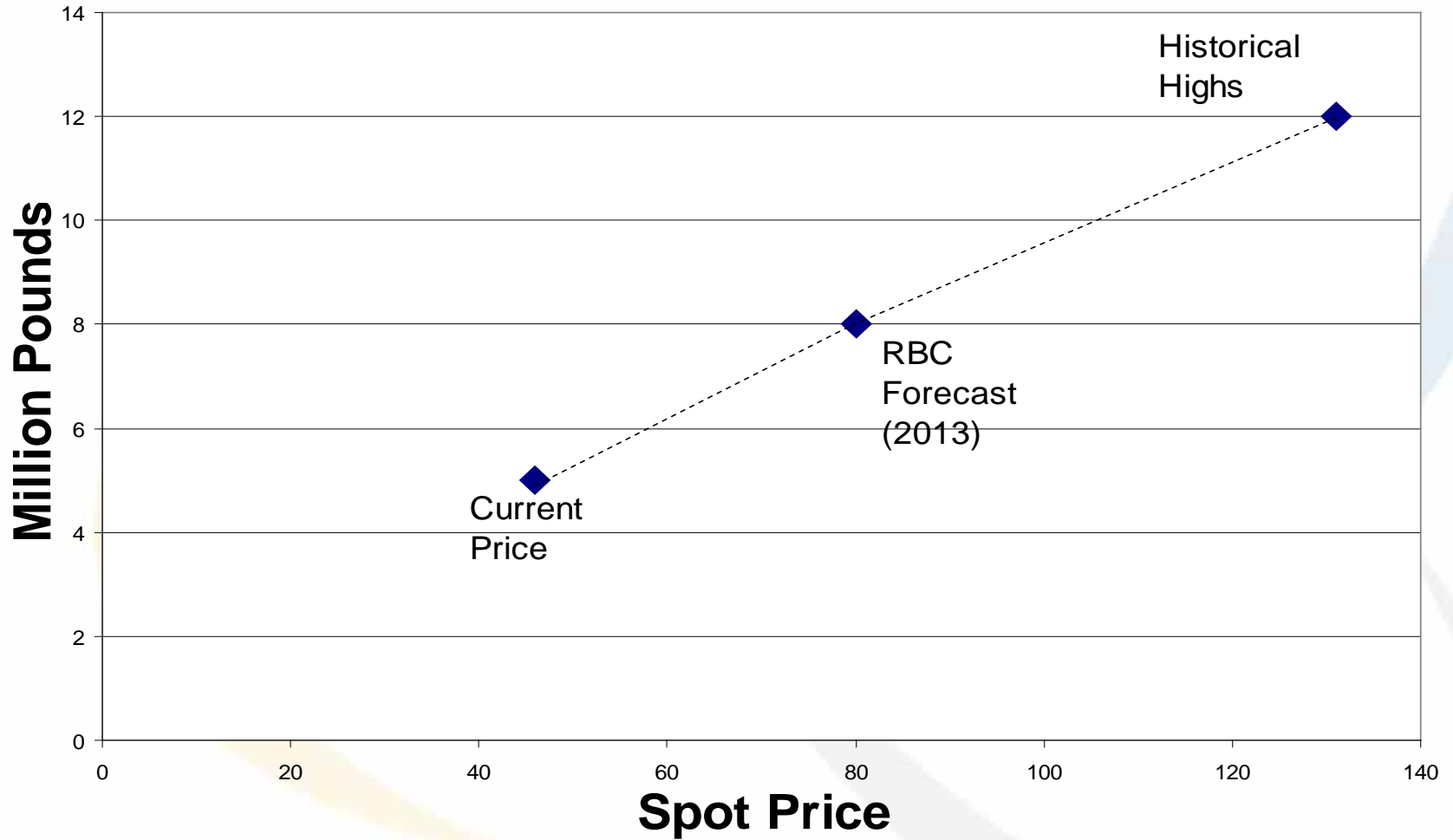
# Projections of Future Uranium Spot Prices

	<u>RBC</u>
2010	\$44.50/lb.
2011	\$55/lb.
2012	\$75/lb.
<u>2013</u>	<u>\$80/lb.</u>
2014	\$80/lb.
2015	\$80/lb.

( as of 2n Qtr. 2010)

**Not All Uranium Sold on the Spot Market**

# Wyo Future Estimated Annual Uranium Production



# Graph Summary

- **Low Case – 5 million lbs./yr. (~5 mines)**
- **Mid Case - 8 million lbs./yr. (~8 mines)**
- **High Case – 12 million lbs./yr. (~12 mines)**

**[some future mines could be conventional if they have competitive cost structure]**

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# Benefits of ISR Mining to Wyoming

1. Significant Tax Revenue
2. Quality, Good Paying, Safe Jobs
3. Other Economic Benefits... Prof. Taylor

# Benefits of ISR Mining to Wyoming

## 1. Significant Tax Revenue

## 2. Quality, Good Paying, Safe Jobs

# Tax Revenue

- Uranium Mines Pay the following Taxes:
  - Property Taxes
  - Ad Valorem Taxes
  - Severance Taxes
  - Employee Payroll Taxes
  - Federal Corporate Income Tax
  - State Mineral Leases Royalties (to the State)
  - Sales Tax
  - Federal Land Fees (BLM)



# Potential Tax Revenue

- For a typical ISR Uranium mine in Wyoming, producing one million pounds per year of yellowcake, the total of all taxes paid is approximately \$4 to \$5 million per year.
- If we reach a point where there are twelve (12) ISR Uranium mines in production the annual tax revenue to the State could amount to roughly \$48 to \$60 million per year.

# Benefits of ISR Mining to Wyoming

1. Significant Tax Revenue
- 2. Quality, Good Paying, Safe Jobs**

# Careers and Opportunities

- Geologists
- Hydrologists
- Engineers / Environmental Specialists
- Health Physics
- Chemists
- Accountants / Human Resources
- Public and Government Relations
- GIS & Instrumentation Technicians
- Skilled Craftsmen

# Potential Employment

(typical number of employees)

- Employees per Mine (ISR) 80 - 120
- Contractors per Mine (ISR) 30 - 50
- Wyoming Office 15 - 30
- TOTAL (per ISR Mine) 125 - 200
- **If 12 ISR Mines in Operation; 1,500 – 2,400**  
**Quality Jobs for Wyoming Citizens**

(does not include vendor & service company jobs)

# Summary

- **Wyoming – Largest Reserves in US**
- **Historically – #2 Producing State**
- **Currently – 1 Mine Producing (#1 State) more in restart and licensing**
- **Projections – 5 to 12 m lbs./yr. (price?) for 20+ years, 220 million + Pounds?**
- **Benefits – jobs, taxes, economy**