

SOME ASPECTS OF AND RESEARCH NEEDED FOR FUTURE DEVELOPMENT OF PICEANCE BASIN OIL SHALE

1. PICEANCE BASIN OIL SHALE

The “shale” is a kerogen-bearing lacustrine clastic/carbonate mudstone sequence, deposited in an Eocene closed saline lake basin. The eroded remnant of these deposits covers about 1200 square miles, ranges from ~100 feet thick on the basin rim to ~2,000 feet thick in mid-basin, probably averages 15–25 gallons per ton, and the total in-place resource is about 1.5 trillion bbl. The resource is 2–3 million bbl per acre in mid-basin. The 1.5 trillion bbl figure is about equal to eight Lake Powells full of oil, or 3 feet of oil over a “flat” state of Colorado. This volume would supply “current” U.S. crude needs for about 200 years, or perhaps a millennium for current aviation fuel and crude-supported petrochemical feed stocks. Several potential co-products (aluminum, cement, lithium, fertilizer, etc.) could equal or exceed the “oil” value in a ton of “ore.” Several shale oil retorting processes appear amenable to recovery of co-products.

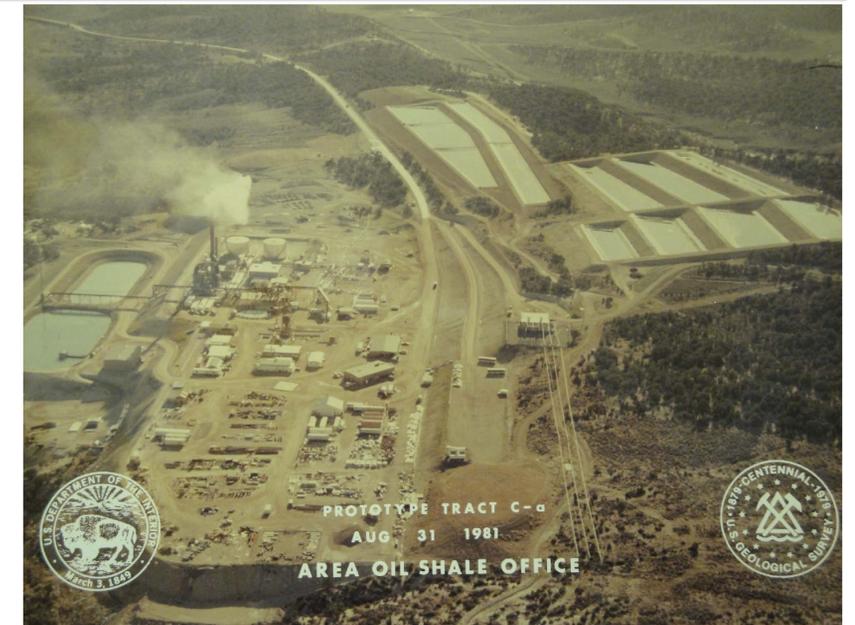
2. HISTORY

Interest began prior to 1900, with peaks in the late teens–twenties (USBOM and private development). Post WWII peaks (Anvil points and limited private sector), 1960–80's surge with several private efforts and USDOJ Prototype Leasing Program (Tracts C-a, C-b, see photos) produced a total of about 5 million bbl of oil. A basic problem is how to cope with wide ranges in oil prices, while operating a multi-billion dollar plant.

3. RESOURCE RECOVERY

The late Dr. Tell Ertl, a long-time researcher in oil shale, in viewing the future importance of the very large Piceance Basin resource, wrote:

“If our civilization has any conscience, and if it has any regard for posterity, it cannot give serious consideration to any method of production of shale oil from the center of the basin that does not result in substantially complete recovery. Our civilization has passed the stage in which it can kill the whole buffalo merely to consume the tongue and liver, as was done in this area less than a century ago.”



Modified In-Situ Retort Operating Tract C-a (1981)



Large Shaft Mine under construction Tract C-b (mid-1980's)

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This admonition is perhaps more fitting today than when written in 1965 (Note: The Ertl Collection at CSM).

The recovery issue, to many “newcomers” and “Spent Shalers,” overshadows all others. “Hi-grading” (Ertl’s concern) will leave a remaining resource of lower grade and in a difficult physical state for recovery, because of leaner average shale value and “bad ground” conditions (fractured rock, subsidence, etc.) We cannot afford to leave to future generations the equivalent of 50 or more “Prudhoe Bay” fields in such a state.

Projected resource recovery for current public and private projects in the Piceance Basin (all in-situ) are generally in the 10% – 50% range. This is unacceptable for the long-term national interest. The loss in value to our economy could be more than 100 trillion dollars along with many trillion dollars in lost royalties. These values could be much larger if potential co-products can be produced

4. CURRENT FEDERAL LEASING

There are five 160-acre Federal R & D leases in the basin. These could be converted to standard 5,120-acre leases, with about a “Prudhoe Bay” equivalent on each lease (~15 billion barrels.) All five leases plan to utilize some form of “In-situ” recovery, with only nahcolite noted as a potential co-product.

Known recovery methods and ranges in percent recovery are about as follows:

1. Room and pillar mining – less than 20% to more than 50%
2. In-Situ, several types – less than 10% to about 50%
3. Surface Mining – 80% to 100%, but requires a “basin-wide” approach.

Most co-products could only be produced by surface retorting from room and pillar and surface mining methods. Recovery of several co-products could more than double the “raw rock” value of a ton of oil shale.

5. FUTURE LEASING

1. The existing R & D leases in mid-basin should be allowed to “mature,” so as to gain knowledge about the industry, before any further similar leasing.
2. Any additional R & D leases should be restricted to using new methodology and should be located near the Basin rim, where shale is typically shallow, dry, and of adequate grade and volume.
3. “Pilot mine” areas on or near the rim would be of great value to future R&D projects (bulk shale samples, testing of methods and equipment, beneficiation, etc.).

These could include the Anvil Points mine and a surface mine area in the northwest part of the Basin where several hundred feet of oil shale is overlain by very thin overburden, and contains about 50 billion bbl both public and private shale. This is adequate enough for decades of valuable R & D, and could be a starting point for basin-wide development.
