



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

AUG 17 1984

MEMORANDUM

SUBJECT: Classification of the West Sak Pilot area, West Sak
Alaska

UIC Well Classification Advisory #5

FROM:

Thomas E. Belk, Chief
Ground Water Protection Agency

Thomas E. Belk

TO:

Jerry Opatz,
Region X

You have forwarded to us the Arco Alaska, Inc. letter of June 28, 1984, in which they identify the West Sak Pilot injection wells as Class V. At West Sak, Arco Alaska, Inc. will be operating the first hot waterflood in an arctic climate. There are a number of uncertainties that Arco must resolve before they begin commercial production. Arco is uncertain as to its success in sufficiently mobilizing the oil to allow for production. You have requested our review of this classification.

It seems clear that the project is experimental at least in terms of being economically viable. At such time as the project is demonstrated to be cost effective, and/or is converted to normal production, it will be reclassified as a Class II project.

Attachment

cc: Water Supply Branch Chiefs
Regions I-X

ARCO Alaska, Inc.
Post Office Box 100360
Anchorage, Alaska 99510
Telephone 907 276 1215

RECEIVED

JUL 2 1984

EPA-DWPB



June 28, 1984

Mr. Jerry Opatz
U.S. Environmental Protection
Agency, Region X
1200 Sixth Avenue
Seattle, WA 98101

Dear Mr. Opatz:

RE: West Sak Pilot

ARCO Alaska Inc. has reviewed the new UIC regulations and decided that we are operating the injection wells at the West Sak Pilot area as Class V, experimental technology wells. We are confident that the injection wells at the West Sak Pilot meet the criteria of "a technology which has not been proven feasible under the conditions in which it is being tested".

At West Sak, ARCO Alaska Inc. will be operating the first hot waterflood in an Arctic climate. We are hopeful, but uncertain as to its success in sufficiently mobilizing the oil to allow for production. As the majority of the information concerning West Sak is confidential to ARCO, I have enclosed only publicly available information. ARCO Alaska Inc. will submit the complete well inventory information requested by 40 CFR 144.26(a) prior to June 25, 1985. However, because a permit is not required for these Class V wells a permit application for the pilot project will not be made. It is planned to submit a permit application when the decision is made to make the formation a development for sustained commercial oil and gas production.

Please contact me at (907)265-6176 if you have any questions or if you disagree with our classification of the West Sak injection wells.

Sincerely,

Pete Hellstrom
Sr. Environmental Coordinator

PNH:skf

cc: Harold Scott, EPA Seattle
Chat Chatterton, AOGCC Anchorage

ARCO Alaska Inc. has outlined some details of the world's first thermal-heavy oil enhanced recovery project in an Arctic region, a pilot to exploit the West Sak sands of Alaska's North Slope.

If commercial, it would be the equivalent of finding another supergiant oil field in the Prudhoe Bay/Kuparuk River fields area. And that would mean another multibillion dollar project on the North Slope.

In addition, West Sak commerciality could indirectly enhance the economics of the long-dormant Milne Point unit because West Sak sands extend into that extension of the Kuparuk reservoir.

The Alaska Oil & Gas Conservation Commission last month granted ARCO approval to proceed with the \$58 million West Sak hot water injection pilot in Kuparuk River field.

Supergiant potential. ARCO is targeting a 25-30% recovery of the estimated 5-11 billion bbl of oil in place in the West Sak sands, a thin, shallow Cretaceous zone that overlies Kuparuk River pay over a broad area.

That could mean ultimate recovery of as much as 1.5-2 billion bbl of oil at peak production rates of 100,000-200,000 b/d, approaching Kuparuk output, according to ARCO West Sak Project Director Leland Tate.

Overlying West Sak sands is the Tertiary Ugnu, another heavy oil zone, which contains 6-11 billion bbl of oil in place. In addition, areal extent of the shallow heavy oil zones hasn't been determined. They could extend offshore to encompass perhaps 600 sq miles, containing an estimated 40 billion bbl of oil in place.

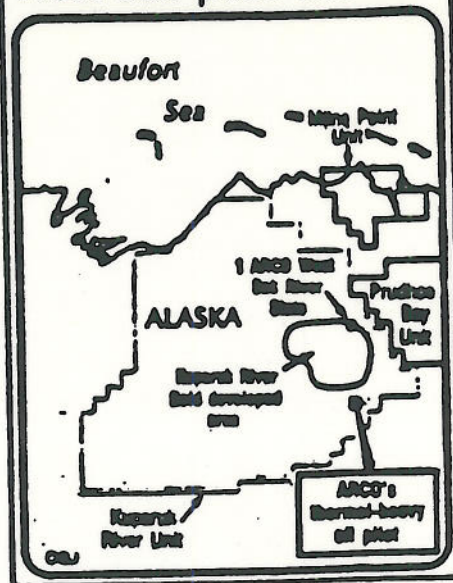
At present, ARCO is concentrating only on West Sak commerciality. Developing Ugnu pay is beyond industry's current technological capability, Tate says.

Reservoir features. The West Sak sands are part of the late Cretaceous deltaic system underlying Kuparuk River, Milne Point, and Prudhoe Bay units. In the 1971 zone discovery well, 1 ARCO West Sak River State, the West Sak sands occur in an interval at a measured depth of 3,744-4,040 ft.

West Sak sands entail very fine to fine-grained sand with interbedded mudstone and claystone, oil-bearing mainly in the Kuparuk and Milne Point units. The West Sak reservoir has porosity of less than 20% and permeability of 10-140 md. Oil is 16-22° gravity.

By comparison, the Ugnu reservoir

West Sak pilot site



is even shallower by about 500 ft—which means it's closer to the permafrost and thus has lower reservoir temperatures, entailing greater potential for heat loss. In addition, the Ugnu is a very unconsolidated sand. Oil is 10-11° gravity. Ugnu porosity is about 25%, and its permeability is extremely high.

Project details. ARCO has drilled the first well in the West Sak hot waterflood project.

It tentatively has scheduled a pilot flood start-up in January 1984. The flood is to continue through March. ARCO expects some sort of reservoir response within 1 year but could continue evaluations several years beyond that.

Object of the pilot is to prove commerciality and technical feasibility of hot water injection while maintaining reservoir pressure and heat energy. North Slope thermal enhanced oil recovery differs from that in the Lower 48 in cost and presence of permafrost, which leaves shallow reservoirs often cooler than room temperature.

The entire pilot will be conducted in 35-11n-10e, in the eastern portion of Kuparuk unit, covering less than 1 sq mile. For a commercial scale project, ARCO would extend West Sak EOR to 25 sections in the Kuparuk unit. The onshore portion of the reservoir is thought to cover about 250 sq miles.

Although ARCO has approval for as many as 30 wells, pilot plans call for 13 wells, involving eight producers and five injectors on an inverted nine-spot. Initial spacing would be 20 or 5 acres, then ultimately as much as 20 acres.

Plans call for initial hot water injection rate of about 1,000 b/d, increasing to about 2,500 b/d when the pilot is fully on stream. Peak oil output from the pilot would be about 2,500 b/d.

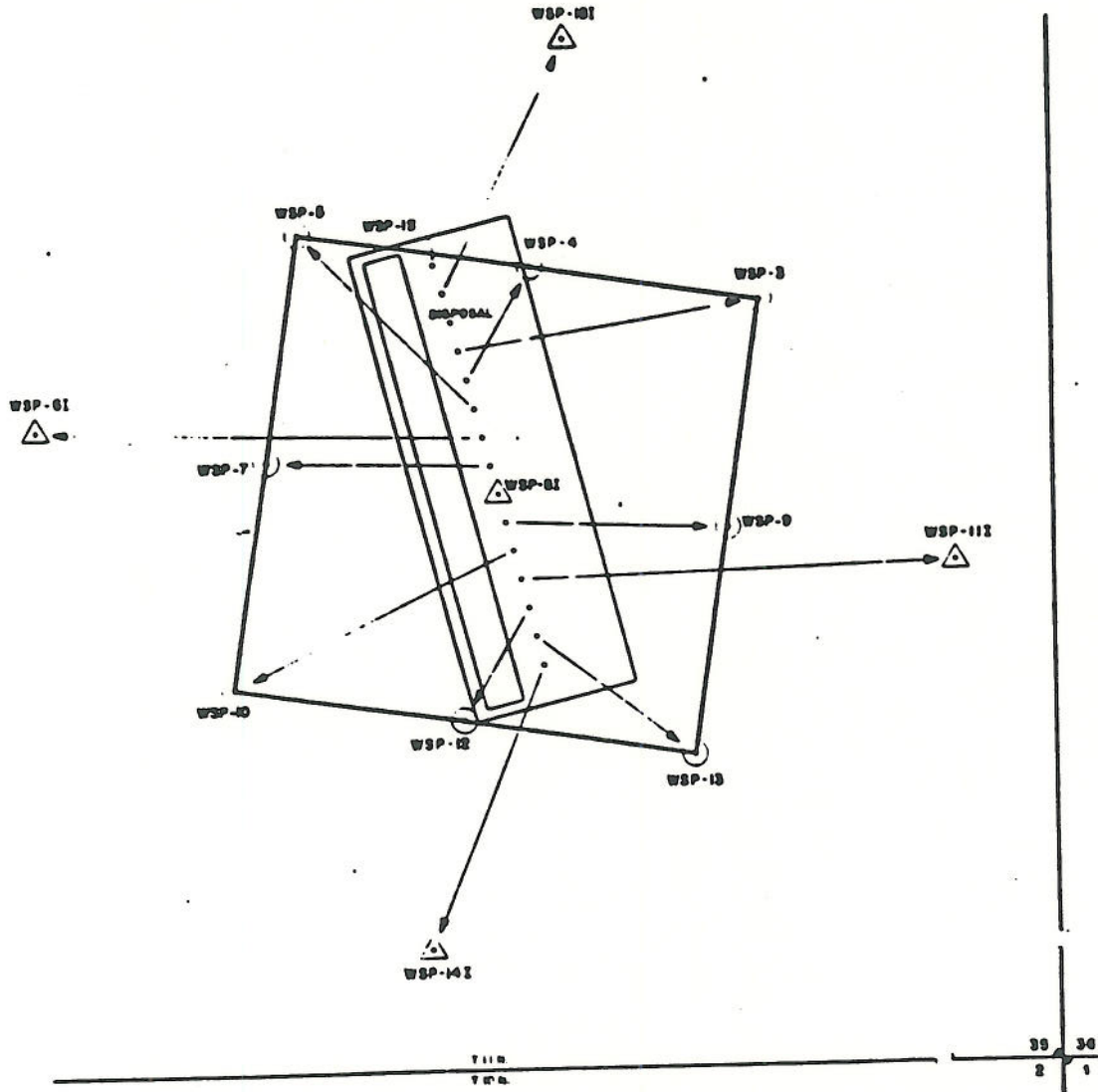
ARCO plans to tap the Sadlerochit aquifer for initial water injection, perhaps shifting to Beaufort Sea water later. Sadlerochit water tends to be highly corrosive and cause scaling problems.

Hot water surface temperatures during injection are expected to reach 200-250° F. at the wellhead. In addition to hot water injection, ARCO may try steaming near the wellbores and a continuous steam drive.

But the real key to West Sak commerciality, says Tate, is to reduce well costs while boosting productivity. Those well costs must drop below even those at Kuparuk.

That won't be easy, considering that Kuparuk, expected to become the second biggest U.S. oil producer in 1986, established a watershed in well economics on the North Slope. But ARCO, which expects Alaska to be its production base to 2000, thinks the prospect of developing another Kuparuk equivalent makes it worth the effort (OGJ, Oct. 10, p. 67).

Bob Williams
West Coast Editor



△ - INJECTOR

○ - PRODUCER

SUBJECT TO CHANGE AS TESTS CONTINUE

ARCO Alaska, Inc. Ⓞ	
WEST SAK PLOT PROJECT	
WATERFLOOD PATTERN & CONDUCTOR PLAN	
DATE: 0 8 83	
DRAWN BY: J. VANCE II	
CHECKED BY: J. VANCE II	
SCALE: 1" = 100'	
SHEET NO. 2 OF 2	